TECHNICAL DATA

ALLISON 6TH GENERATION CONTROLS

Allison Transmission

SUBJECT: Datalink Communications for 2023 Software Releases

PRODUCT COVERAGE:

1000 and 2000 Series™
—B241 PC release, October 2023

3000 and 4000 Series™
—C/N241 PC release, October 2023

2000 Series 9-speed
—K232 PC release, March 2023

PUBLICATION DATE: October 12, 2023 (see Change History for revisions)

CONTENT LINKS:

Section A: General Information

Section B: SAE J1939

Section C: Proprietary Protocols

Section D: Network Assembly

QUICK LINKS:

TCM Network Configuration

J1939 Message & Parameter Broadcasts

J1939 Message & Parameter Reception

J1939-Based Functions

TABLE OF CONTENTS

SECTION A: GENERAL INFORMATION

A.1. INTRODUCTION

This section contains general information for all users of the Allison Transmission Datalink Technical Data package. Users should be familiar with this information before using the Technical Data.

A.1.1. DOCUMENT PURPOSE

This document explains Allison Transmission 6th Generation Controls support and utilization of serial communication links for <u>2023 software releases</u>. The exact products, software release levels and maturity (production vs. preliminary) are listed on the cover page.

Highlighted changes are relative to the October 7, 2022 publication of Allison 6th Generation Controls Datalink Tech Data.

The intent is to provide vehicle and control module manufacturers with the information necessary to be compatible with Allison 6th Generation Controls and properly implement datalink-based vehicle functions.

WARNING: This document describes information being sent by the transmission using serial communication data links. In addition, for the information that is being transmitted by other components on various serial communication links, it describes how that information is used by the transmission.

The Vehicle Builder (OEM) has overall system responsibility for proper implementation of these messages and appropriate use by other vehicle components in order to achieve a desired vehicle feature.

Allison Transmission <u>is not</u> responsible for improper or inappropriate use of the data and information that is sent from the transmission control module (TCM).

A.1.2. NOTICE OF ALLISON TRANSMISSION RESPONSIBILITY

This manual provides application and installation guidelines for operation of the transmission. These guidelines should be considered the minimum acceptable for transmission operation and durability under normal vocational usage.

Allison Transmission assumes responsibility only for the transmission products it provides and only in accordance with its standard limited warranty.

It is the responsibility of the vehicle manufacturer to integrate the transmission into the vehicle design so that it meets all applicable government regulations and customer requirements in all operating environments to which the vehicle will be subjected.

A.1.3. DESCRIPTION OF WARNING, CAUTION AND NOTE

WARNING is used when a procedure, practice, etc. could, if not correctly followed, result in personal injury or loss of life.

CAUTION is used when a procedure, practice, etc. could, if not strictly observed, result in damage to or destruction of equipment.

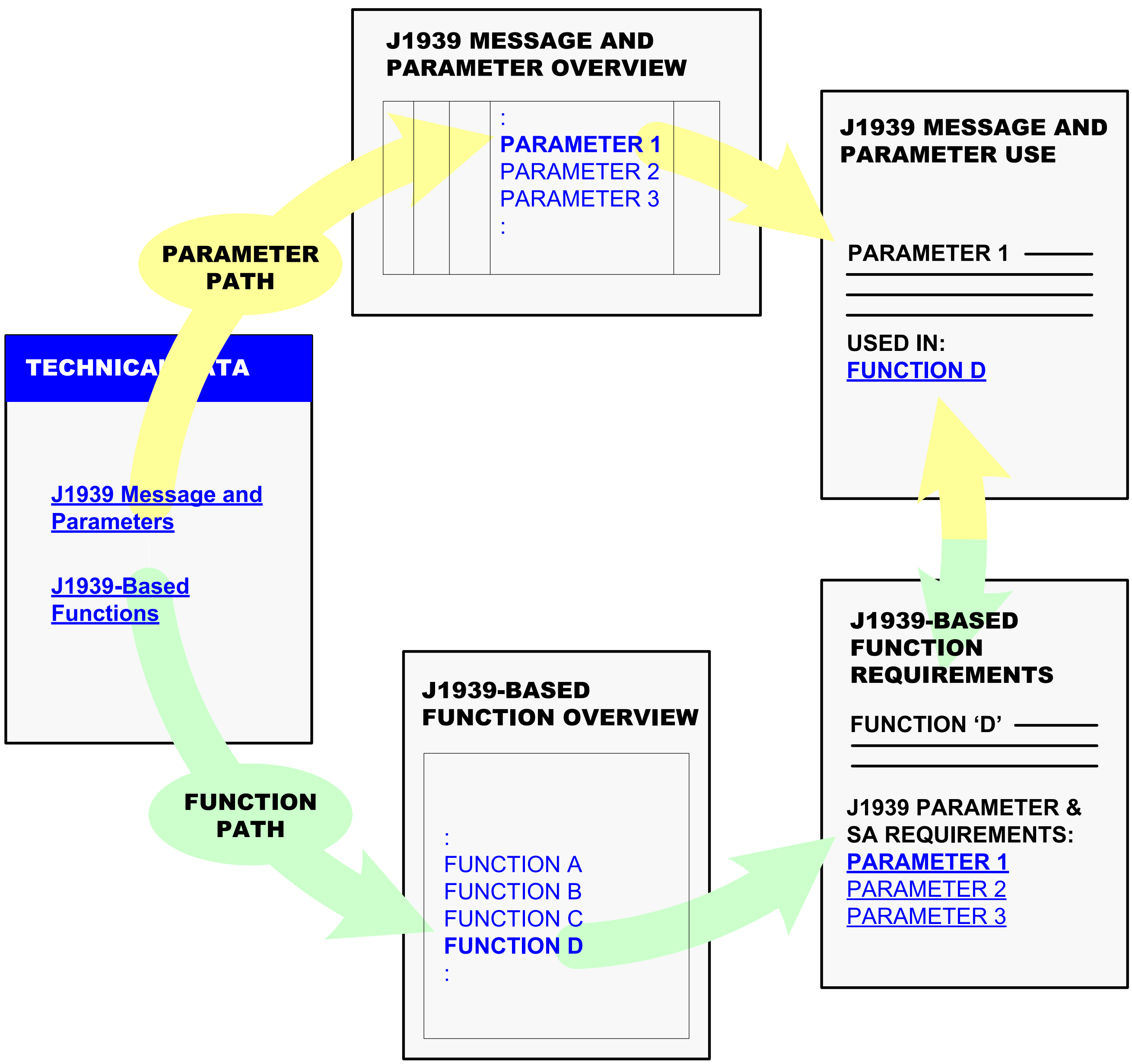
NOTE when a procedure, practice, etc. is essential to highlight.

A.1.4. TIPS ON USING THIS DOCUMENT

Every effort has been made to make this rather sizeable document as clear and easy-to-use as possible. If you have any feedback on how to make this document better, please forward your suggestions on to your Allison Customer Integration Engineer.

A.1.4.1. *NAVIGATION*

Most information can be found within several mouse-clicks by following the hyperlinks on the cover page. As shown below, information can be tracked down by either the J1939 parameter of interest (yellow path) or by the Allison Function (green path) in which the parameter is used:



TYPICAL NAVIGATION PATHS

A.1.4.2. *HIGHLIGHTED AREAS*

PRELIMINARY…
Blue highlights identify TCM functionality that is still under development, and may be subject to change in an upcoming publication.

OEMs who utilize the given parameter or function should monitor future publications for final revisions to the item.

NEW FOR…
Yellow highlights identify (a) new or improved TCM functionality for the given software release, or (b) a Datalink Tech Data documentation improvement that is new for the given publication.

OEMs who utilize the given parameter or function should review it thoroughly to verify that the changes will not negatively impact their system design.

A.1.4.3. *HEADINGS*

Parameter and SA Use
These sections describe parameters that must be broadcast or received by the Transmission Control Module (TCM) or other controller on the network.

Operator Interface
These sections convey specific content and / or physical implementation requirements necessary for the given function to work with the vehicle operator.

Other Requirements or Restrictions
These sections list other vehicle components, messaging, etc. that may interfere with the intended operation of the defined function.

Normal Operation
These sections define how the relevant controllers interact on the network and how various parameters are / should be used during normal operation of the given function.

Failure Modes and Responses
These sections reflect:

— how the Allison TCM will respond when it fails to receive required information or a required response from another controller or device on the vehicle network,

— how other controllers on the vehicle network should respond to situations where they are not receiving required information or response from the TCM, and

— typical responses that are seen due to more common implementation or system design errors.

SAE Excerpts
These areas state the J1939 Parameter and Parameter Group Number (PGN) assignments, and message update periods.

Text is lifted verbatim from the most current SAE source. This is the same information by which the Allison software has been structured. For complete information, refer to the appropriate SAE document.

In some cases, the excerpts will be from a balloted SAE document not yet readily available to the general public. This is necessary as Allison implementations often outpace the SAE publication process.

Allison Implementation
Component-specific implementation details for J1939 messages and parameters are found under headings:

— TCM and / or Selector Message Broadcast
— TCM and / or Selector Parameter Broadcast
— TCM and / or Selector Message Reception
— TCM and / or Selector Parameter Reception

These sections convey:

— how broadcast information is determined, and its' intended use,

— received information requirements, and how the information is utilized, and

— specific functions that use the given parameter.

A.1.4.4. *UNITS*
All numbers are assumed to be in decimal form unless noted otherwise.

A.2. COMMUNICATION INTERFACES & PROTOCOLS

Communication interfaces allow the digital exchange of information between Allison transmission control modules (TCMs) and other vehicle components or diagnostic tools. Common uses include:

- General information sharing for driver displays, instrument clusters, and vehicle management,
- Diagnostic information sharing with Allison or after-market diagnostic code readers, and
- Open and closed-loop powertrain control with other vehicle components including the engine and vehicle brake systems.

A.2.1. AVAILABLE INTERFACES & PROTOCOLS

Allison 6th Generation Control support the following datalink interfaces (physical connections) and protocols (message and data content):

A.2.1.1. *SAE J1939 INTERFACE & PROTOCOL*

SAE J1939 is a CAN-based, all-encompassing Recommended Practice which defines not only messages and data content, but the hardware, wiring and connector requirements as well. This high speed interface allows for open- and closed-loop control amongst vehicle engine, transmission, and brake systems, as well as off-vehicle tools communication. J1939 can be configured to operate at 250 kbps or 500 kbps depending on OEM needs.

Allison J1939 support is covered in SECTION B: SAE J1939.

A.2.1.2. *SAE J2284-3 INTERFACE*

The SAE J2284-3 Recommended Practice covers the physical and datalink layers for a CAN-based high speed 500 kbps interface. Note that J2284 does not define message content or format outside of being compatible with CAN 2.0b.

Allison supports the J2284-3 interface specifically for cases where a TCM CAN port is only wired to a diagnostic connector. See SAE J2284-3 WIRING REQUIREMENTS.

A.2.1.3. *SSF 14230 AND ISO 15765-3 (UDS) PROTOCOLS*

SSF 14230 is a Swedish refinement of the ISO 14230 (Keyword Protocol 2000) diagnostic protocol. ISO 15765-3 (UDS on CAN) is a successor of ISO 14230 and is used for diagnostic communication.

Both protocols use J1939 PGNs reserved for ISO use; see DIAGNOSTIC COMMUNICATION FOR OEM USE and UDS END-OF-LINE COMMUNICATION. These PGNs are fully J1939-compatible, while message content is defined by the given standard. Additional details can be found in the ALLISON TRANSMISSION OFF-VEHICLE COMMUNICATION SPECIFICATION.

A.2.1.4. *GMLAN PROTOCOL*

GMLAN combines General Motors version of the ISO 14230 (Keyword Protocol 2000) diagnostic protocol and their proprietary on-vehicle protocol. GMLAN applications may also support a limited amount of J1939 communication; see SECTION C: PROPRIETARY PROTOCOLS.

A.2.1.5. *IES-CAN AND PT-CAN PROTOCOLS*

IES-CAN and PT-CAN are proprietary Mercedes Benz protocols; see SECTION C: PROPRIETARY PROTOCOLS.

A.2.2. INTERFACES & PROTOCOLS NOT SUPPORTED

A.2.2.1. *RV-C PROTOCOL*

The Recreational Vehicle Industry Association (RVIA) has their own CAN-based communication protocol for interconnecting RV components. This protocol, dubbed "RV-C", is loosely structured on the J1939 Recommended Practice. However, it is not compatible with J1939, as some RV-C message and parameter locations overlap with those in J1939. As such, an Allison TCM cannot be connected to an RV-C network.

> **WARNING:** Connecting Allison transmission components to an RV-C network is strictly prohibited, as J1939 protocol conflicts may result in unintended vehicle or transmission operation.

A.2.3. APPLICABLE STANDARDS

In addition to the standards listed below, readers are strongly urged to review Allison Technical Data for the 1000 – 4000 Series product families. These documents have further information on the intended use and implementation of Allison features, and detail wiring and other requirements necessary in addition to the communication link information discussed here.

A.2.3.1. *SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)*

SAE J1939 Serial Control and Communications Vehicle Network – Top Level, published August 2018.

SAE J1939-01 On-Highway Equipment Control and Communication Network, published June 2018.

SAE J1939-11 Physical Layer, 250K bits/s, Twisted Shielded Pair, published December 2016.

SAE J1939-13 Off-Board Diagnostic Connector, published October 2016.

SAE J1939-14 Physical Layer, 500Kbps, published December 2016.

SAE J1939-15 Reduced Physical Layer, 250K bits/sec, Un-Shielded Twisted Pair (UTP), published December 2018.

SAE J1939-21 Data Link Layer, published October 2018.

SAE J1939-31 Network Layer, published September 2018.

SAE J1939-71 Vehicle Application Layer, published February 2020.

SAE J1939 Digital Annex, published October 2020.

SAE J1939-73 Application Layer – Diagnostics, published June 2020.

SAE J1939-76 Functional Safety Communications Protocol, published April 2020.

SAE J1939-81 Network Management, published March 2017.

SAE J1962 Diagnostic Connector, published July 2016. Technically equivalent to ISO/DIS 15031-3: December, 2016

SAE J2284-3 High Speed CAN (HSC) for Vehicle Applications at 500 KBPS, published November 2016.

SAE documents are available from:

SAE World Headquarters
400 Commonwealth Drive
Warrendale, PA 15096-0001 USA
Phone: 1-877-606-7323
Web: www.SAE.org

A.2.3.2. *INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)*

ISO 2575 Road vehicles — Symbols for controls, indicators and tell-tales, Sixth Edition, published 2010-07-01.

ISO 14229 Unified Diagnostic Services (UDS)

ISO 15765 Diagnostics on Controller Area Networks (CAN)

ISO documents are available from:

American National Standards Institute (ANSI)
25 West 43rd Street
New York, NY 10036-8002
Phone: 212-642-4900
Web: www.ansi.org

A.2.3.3. *ALLISON TRANSMISSION DATALINK COMMUNICATION TECHNICAL DATA*

Allison continually improves and expands datalink support; the latest Datalink Communication Tech Data release can be found on the Allison Transmission HUB website at hub.allisontransmission.com. The documents are located under ENGINEERING → TECH DATA BOOKS → DATALINK COMMUNICATIONS. Contact your Allison Transmission representative if you do not have access to the Allison Transmission HUB.

A.2.3.4. *ALLISON TRANSMISSION OFF-VEHICLE COMMUNICATION SPECIFICATION*

The Allison Off-Vehicle Communication Specification defines all J1939-73, SSF 14230 and ISO 15765-3 (UDS) tool modes supported by Allison, and is software release specific. Please contact your Allison Customer Integration Engineer for details.

A.2.3.5. *ALLISON TRANSMISSION FUNCTIONAL SAFETY MANUAL FOR 6TH GENERATION CONTROLS*

The Allison Transmission Functional Safety Manual for 6th Generation Controls (EM-101) contains information regarding ISO 26262 capabilities of the Allison 6th Generation Control System. Please contact your Allison Customer Integration Engineer for details.

A.3. FACTORS DETERMINING COMMUNICATION SUPPORT

Allison 6th Generation Controls offer a wide variety of serial communication options. Several factors determine if a given:

— Physical Datalink Connection,
— Communication Protocol,
— Message and / or Parameter, or
— Datalink-based Function

…is supported in a particular Allison transmission application. These factors include:

— Transmission Series or Family
— Transmission vocational model
— TCM model
— TCM software level
— TCM calibration configuration
— TCM readiness state
— TCM Auto-Detection logic
— FuelSense® packages

A.3.1. TRANSMISSION SERIES

— GMLAN is available on 1000/2000 Series 6-speed transmissions.

— IES-CAN is available on 1000/2000 Series 6-speed and 3000/4000 Series transmissions.

— PT-CAN is available on 1000 – 4000 Series transmissions.

— SAE J1939 is available on all products; however, message and parameter support varies between product families.

A.3.2. TCM MODEL

Allison 6th Generation Controls utilize several unique chassis-mount TCM models. While communication hardware and protocol support is identical, the TCMs have the following differences:

— C71M TCMs only support 12V, 6-speed applications without a driveline retarder.

— C72M TCMs add support for driveline retarder, 7-speed, 9-speed, and off-highway applications.

— C73M TCMs add 24V capability.

All TCM models support CAN baud rate auto-detect prior to baud rate configuration via VEPS.

A.3.3. FUELSENSE®

Certain fuel-saving functions (e.g. DynActive™ Shifting, Neutral at Stop, etc.) may only be available when ordered as part of a FuelSense® package. Refer to Allison Controls Installation Manual Section A-1: Controls System Familiarization for more details on function availability versus FuelSense® package.

A.3.4. TCM CALIBRATION CONFIGURATION (VEPS & ACCT)

Three methods are available to configure Allison 6th Generation TCM calibrations:

1. A **Vehicle Electronic Programming Station (VEPS)** can be used on vehicle OEM assembly lines to finish calibrating VEPS-Ready TCMs.

2. For Road-Ready TCMs to be fully programmed at the Allison factory, the web-based **Allison Calibration Configuration Tool (ACCT)** is used.

3. **Allison DOC®** can be used to configure TCMs at distributors or smaller OEMs, although a much smaller subset of options is available.

Each J1939-based function in this document has a section which explains the VEPS and ACCT options impacting that function.

NOTE: In this document, the term "VEPS" is used to denote questions and answers available through <u>either</u> VEPS or the ACCT.

Some VEPS / ACCT answers will flag a TCM calibration for Allison Customer Integration Engineering review. Such items are denoted in this document. Once reviewed and approved for a given vehicle OEM, the CIE review requirement may be removed for future calibration requests from that OEM.

Regardless of the calibration configuration method, an Allison "Calibration Summary Report" is the best way to understand the detailed datalink support for a given calibration.

A.3.5. TCM READINESS STATE & FACTORY MOBILITY MODE

A.3.5.1. *ROAD-READY TCMS*

Traditionally, Allison TCMs arrive at an OEM in a "Road-Ready" state; the TCM as received is ready to operate the transmission and related features once installed in the vehicle. This remains true for Allison 6th Generation TCMs that are configured at the Allison factory or local distributor.

A.3.5.2. *VEPS-READY TCMS*

Vehicle OEMs utilizing VEPS for TCM end of line programming will receive TCMs in a "VEPS-Ready" state. A VEPS-Ready TCM contains software and a Vocational Model base calibration loaded by Allison. TCM calibration must be completed via VEPS prior to being Road-Ready.

In a VEPS-Ready state, TCM CAN ports are only capable of communication with Allison service tools or VEPS stations equipped with the Allison Vendor Component Program (VCP).

All other CAN communication is disabled until VEPS programming is completed. This prevents TCM interference when connected to a network of unknown protocol, and eliminates all TCM bus loading contributions until programmed via VEPS.

VEPS programming can occur on any of the three TCM CAN ports at a baud rate of either 250 kbps or 500 kbps. The TCM automatically adapts to the baud rate of the VEPS station during the VEPS process. Baud rate auto-detection is not available once the TCM has advanced to the Road-Ready state.

A.3.5.3. *FACTORY MOBILITY MODE*

Factory Mobility Mode is an Allison feature closely tied to the TCM readiness state. It allows severely restricted vehicle operation with a VEPS-Ready (i.e. not fully programmed) TCM. This capability is useful for driving a partially completed vehicle chassis from one plant location to another.

Since the TCM does not support on-vehicle communication in a VEPS-Ready state, the OEM must either employ the dedicated-wire Neutral Start or provide a method to manually override J1939-based Neutral Start implementations. In addition, 3000/4000 Series and certain 2000 Series 9-speed applications rely solely on the Allison shift selector Direction Signal Wire input for desired direction input.

A.3.6. NETWORK CONFIGURATION

The TCM has three CAN ports whose protocol and network speed can be assigned via VEPS.

A.3.6.1. *ON-VEHICLE COMMUNICATION*

On-vehicle communication protocol support for each CAN port is set via these VEPS options:

[18010] ON-VEHICLE PROTOCOL: CAN1

— OFF
— SAE J1939 LIMITED FUNCTIONALITY
— SAE J1939 FULL FUNCTIONALITY (1)

[18020] ON-VEHICLE PROTOCOL: CAN2

— OFF
— SAE J1939 LIMITED FUNCTIONALITY
— SAE J1939 FULL FUNCTIONALITY (1)
— GMLAN (1, 2)

(1) This is a "Primary On-Vehicle Protocol"; only one may be used in a given application. If selected, the TCM will use this network's data for any Input, Output or Interface function configured to use the PRIMARY ON-VEHICLE PROTOCOL.

(2) Fixed value used in unique GMLAN VMCs.

Other Restrictions

Only one CAN port may be set to SAE J1939 FULL FUNCTIONALITY or SAE J1939 LIMITED FUNCTIONALITY.

J1939-based uses for a CAN port set to SAE J1939 LIMITED FUNCTIONALITY are restricted to:

— Allison shift selector communication,

— SAE J1939-73 diagnostic communication, and/or

— J1939 communication in GMLAN applications.

NOTE – Data processing associated with the CAN port set to SAE J1939 LIMITED FUNCTIONALITY:

Applications with no CAN port set to SAE J1939 FULL FUNCTIONALITY (as may occur with a non-electronic engine) should not have **[18000] THROTTLE AND LOAD SOURCE** set to PRIMARY ON-VEHICLE PROTOCOL.

If an application *were* configured in this manner, the TCM would still receive and process any J1939 throttle & load data that may appear on the CAN port set to SAE J1939 LIMITED FUNCTIONALITY.

This is not an intended use of the LIMITED link; OEMs should not rely on the TCM to process J1939 throttle & load information in this configuration, as it may be restricted in the future.

In GMLAN applications, CAN1 communication is either disabled or restricted to a unique subset of J1939 support; see J1939 MESSAGE AND PARAMETER SUPPORT IN GMLAN APPLICATIONS.

A.3.6.2. *NETWORK SPEED*

Communication baud rate and sample point for each CAN port is set via the VEPS options below. A 75% sample point option has been retained so Allison 4th Generation Controls settings can be duplicated. New applications are advised to use the 80% or 87.5% settings as recommended by J1939.

[18041] NETWORK: CAN1 CONFIGURATION

— CAN Port not used
— Classic CAN – 250 KPBS
— Classic CAN – 500 KBPS (FD TOLERANT)

[18045] NETWORK: CAN1 SAMPLE POINT

— 75.0%
— 80.0% (1)
— 87.5%

[18051] NETWORK: CAN2 CONFIGURATION

— CAN Port not used
— Classic CAN – 250 KPBS
— Classic CAN – 500 KBPS (FD TOLERANT)

[18055] NETWORK: CAN2 SAMPLE POINT

— 75.0%
— 80.0% (1)
— 87.5%

[18061] NETWORK: CAN3 CONFIGURATION

— CAN Port not used

— Classic CAN – 250 KPBS
— Classic CAN – 500 KBPS (FD TOLERANT)

[18065] NETWORK: CAN3 SAMPLE POINT

— 75.0% (1)
— 80.0%
— 87.5%

(1) Default answer.

A.3.6.3. *J1939-BASED SHIFT SELECTORS*

Shift selector communication must be directed to a specific CAN port.

[19020] SHIFT SELECTORS: J1939-Based Selector Connection

— CAN1 (1)
— CAN2

(1) Default answer.

Other Restrictions

The selected CAN port **ON-VEHICLE PROTOCOL** must be set to one of the SAE J1939 options.

Customer-supplied selectors using public J1939 data may only be connected to a CAN port where **ON-VEHICLE PROTOCOL** = SAE J1939 FULL FUNCTIONALITY.

When dual J1939-based shift selectors are used, both must connect to the same TCM CAN port.

A.3.6.4. *DIAGNOSTIC COMMUNICATION*

The VEPS / ACCT options below set the diagnostic protocol and CAN port for reading and clearing DTCs with non-Allison tools. They do not impact Allison DOC® communication.

Also, regardless of the options selected below, J1939 DM1 broadcast is supported on the CAN port set to SAE J1939 FULL FUNCTIONALITY. See DIAGNOSTIC COMMUNICATION FOR OEM USE for further details.

[18070] DIAGNOSTICS: Protocol

— SAE J1939-73
— UDS WITH SAE J2012 DTC FORMAT (1)
— SSF14230 WITH SAE J2012 DTC FORMAT

[18080] DIAGNOSTICS: J1939-73 Connection

— CAN1 (1)
— CAN2
— CAN3

(1) Default answer.

Other Restrictions

When SAE J1939-73 diagnostics are to be used, **[18080] DIAGNOSTICS: J1939-73 Connection** must specify a CAN port that uses a compatible **ON-VEHICLE PROTOCOL** (i.e. set to one of the J1939 answers, or NONE).

A.3.7. AUTO-DETECTION

Auto-detection reduces the number of customer modifiable parameters that the vehicle OEM must set. When the TCM is powered up after a vehicle is assembled, auto-detection logic looks for various input sources and locks onto the most preferred of those available for a given input.

A.3.7.1.1. Source Address (SA) Detection Process

Messages, Parameters and SAs Impacted

Where applicable, the J1939-based functions in this document list the acceptable multiplexed source addresses and their order of TCM preference.

Timing

Unless the OEM specifies an SA through VEPS (where available), the TCM looks for the most-preferred source address for approximately 50 engine start cycles.

SA Selection during Auto-Detect Period

During the SA auto-detect period, the TCM looks for multiplex-capable parameters from their calibrated lists of acceptable source addresses.

When a “more preferred” source is found for a given multiplexed parameter, the TCM will lock onto that source and ignore parameter instances coming from “less preferred” sources.

For example, if on the first key switch cycle the parameter CCVS1 *Brake Switch* is found coming from SA 00 -- and only SA 00 -- the TCM will use this parameter source. If, during a subsequent cycle within the SA auto-detect window, the CCVS1 *Brake Switch* is found coming from both SA 00 and SA 33, the TCM will lock onto SA 33 as the source, as it is higher in terms of calibrated source preference, per the SERVICE BRAKE STATUS function.

If the *most* preferred source is found for a given parameter, the auto-detect process for that parameter is stopped immediately, and all lesser sources are ignored for that parameter.

While the auto-detect process ignores parameters indicating “Not Available”, parameters indicating “Error” *are* included. Per SAE J1939, “Error” indicates that the broadcasting controller supports the parameter, but a temporary problem prevents a correct value from being broadcast.

When the SA auto-detect process is complete, the SA for each multiplexed parameter is locked in to the most preferred source seen during the auto-detect period.

SA Selection after Auto-Detect Period Expires

If a multiplexed parameter is not received from *any* acceptable SA during the auto-detect period, the TCM will lock onto the first acceptable SA it receives for that parameter, and use it for all subsequent key switch cycles.

TCM reception of ERC1 *Actual Retarder – Percent Torque* (used for the ENGINE BRAKE INTERFACE function), and TC1 *Transmission Requested Gear* (used for the shift selector interface) are exceptions. If the parameter(s) are not received from a valid SA within the auto-detect period, the parameter(s) are ignored, and the Engine Brake Interface or shift selector(s) will not function.

Resetting the SA Auto-Detect Process

The Allison DOC® service tool can reset the detection process by selecting the “Reset Auto-Detect” option and cycling the key switch. The auto-detect process is not reset until after the TCM goes through a power down / power up cycle.

A.3.7.1.2. Parameter Echoing

Echoing occurs when a parameter is sent out by one controller, received by another, and then re-broadcast in a second message instance. The source address most likely to echo a parameter is the source address that traditionally broadcast that parameter before a multiplexed system was implemented.

Per SAE J1939, parameter broadcasts should originate from the controller that receives or generates the physical input. For example, the controller connected to the accelerator pedal sensor input should likely be the one to broadcast EEC2 *Accelerator Pedal Position 1*.

Echoing is not recommended because:

- Echoed data may involve a time lag that could affect closed loop control in the vehicle system.
- Different network devices may utilize the same parameter from different sources, leading to interaction problems.
- Echoed parameters may not reflect all of the diagnostic capability of the originating device.

A.3.7.1.3. Failure Modes and Responses

Most source address detection problems stem from:

- vehicle controllers broadcasting inappropriate data (Error or Not Available),
- devices not connected to the J1939 network before the auto-detect process completes, or

— Devices whose source address is changed via a service tool either during or after completion of the auto-detect process.

In any case, a source may be incorrectly detected, and functions may not operate as desired.

A.3.8. J1939 NETWORK MANAGEMENT

All Allison 5th and 6th Generation TCMs and shift selectors support the J1939 address claim message.

All Allison 5th and 6th Generation components utilize fixed addressing, as is reflected in their address claims broadcast at power-up and on request. Source addresses used by the TCM are not alterable, while the source addresses (SA 05 and SA 06) used by Allison shift selectors are configured via a jumper wire.

Allison 6th Generation shift selectors do not respond to address claim messages sent from source addresses 254 and 255.

A.4. ACRONYMS, ABBREVIATIONS & DEFINITIONS

1K, 2K........1000 or 2000 Series

3K, 4K........3000 or 4000 Series

2WD...........Two-Wheel Drive

4WD...........Four-Wheel Drive

ABS ....Anti-Lock Brake System

ACC ....Adaptive Cruise Control, also known as Headway Control

ACCT ....Allison Calibration Configuration Tool used with Allison 5th and 6th Generation Controls

AETC ....SAE J1939 message; Advertised Engine Torque Curve

AFRI ....Auxiliary Function Range Input – Single Input; Allison input function

AGS ....Alternate Gear Start; Allison input function

ANDI ....Automatic Neutral – Dual Input; Allison input function

ANSI ....Automatic Neutral – Single Input; Allison input function

ANSISSO...Automatic Neutral – Single Input with Shift Selector Override; Allison input function

AP..............Accelerator Pedal

APP1 ....SAE J1939 parameter; Accelerator Pedal Position 1

ARM...........Acceleration Rate Management; Allison J1939-based function

ASCII ....American Standard Code for Information Interchange

ASR ....Anti-Slip Regulation or Acceleration Slip Regulation; Traction Control

ATA............American Trucking Association

ATC ....Automatic Traction Control

ATI ....Allison Transmission, Incorporated

B2 ....SAE J1939 message; Brakes 2

B2xx ....1000/2000 Series software release:
B221 PC = October 2021
B222 PC = January 2022
B223 PC = February 2022
B224 PC = May 2022
B231 PSC = April 2022
B231 PC = October 2022
B232 PC = November 2022
B240 PSC = April 2023
B241 PC = October 2023

BAM...........SAE J1939 Broadcast Announce Message

BBAN.........Brake-Based Auto Neutral; Allison input function

C2xx ....3000/4000 Series software release:
C221 PC = October 2021
C222 PC = January 2022
C223 PC = February 2022
C224 PC = May 2022
C231 PSC = April 2022
C231 PC = October 2022
C232 PC = November 2022
C240 PSC = April 2023
C241 PC = October 2023

CAN...........Controller Area Network

CAN1/2/3...The three physical CAN network connections or "ports" available on Allison 6th Generation TCMs

CCSS ....SAE J1939 message; Cruise Control/Vehicle Speed Setup

CCVS1 ......SAE J1939 message; Cruise Control / Vehicle Speed 1

CIC ....Customer Integration Calibration; Development release of ATI software

CIE ....Allison Customer Integration Engineering

CL..............SAE J1939 message; Cab Illumination Message

CM2...........SAE J1939 message; Cab Message 2

CRC...........Allison Calibration Review Committee

CSS...........Customer Specification Sheet

CTS ....Clear To Send

D................Drive

D-x.............“x” forward range positions lower than the Drive position on an Allison lever shift selector

DA ....SAE J1939 Destination Address

DCE .... Direction Change Enable; Allison input function

DDT .... SAE J1939 parameter; Driver's Demand Engine – Percent Torque

DOC® .... Allison DOC® for PC; the standard Allison service tool

DPF .... Diesel Particulate Filter

DPFC1 .... SAE J1939 message; Diesel Particulate Filter Control 1

DTC .... Diagnostic Trouble Code

DSC .... Downhill Speed Control

DSS .... Dynamic Shift Sensing

DSW .... Direction Signal Wire; input signal used with Allison shift selectors if J1939 communication fails

EBS .... Electronic Braking System

EC1 .... SAE J1939 message; Engine Configuration 1

EC3 .... SAE J1939 message; Engine Configuration 3

ECU .... Electronic Control Unit

ECM .... Engine or Electronic Control Module

EDT .... SAE J1939 parameter; Engine Demand – Percent Torque

EEC1 .... SAE J1939 message; Electronic Engine Controller 1

EEC2 .... SAE J1939 message; Electronic Engine Controller 2

EEC3 .... SAE J1939 message; Electronic Engine Controller 3

EM .... Engineering Memorandum

ENGSC ...... SAE J1939 message; Engine Start Control

ERC1 .... SAE J1939 message; Electronic Retarder Controller #1

ERC2 .... SAE J1939 message; Electronic Retarder Controller #2

ET1 .... SAE J1939 message; Engine Temperature

ETC1 .... SAE J1939 message; Electronic Transmission Controller 1

ETC2 .... SAE J1939 message; Electronic Transmission Controller 2

ETC7 .... SAE J1939 message; Electronic Transmission Controller 7

ETC8 .... SAE J1939 message; Electronic Transmission Controller 8

ETC12 .... SAE J1939 message; Electronic Transmission Controller 12

EVS .... Emergency Vehicle Series; Allison vocational model

FMI .... Failure Mode Identifier

FMVSS ...... Federal Motor Vehicle Safety Standard

GE .... SAE J1939 Group Extension

GEN .... Short for "Generation", e.g. 6th Gen controls

GMLAN ...... General Motors Local Area Network; proprietary communication protocol

GPI .... General Purpose Input; associated with the wired implementation of an input function

GPIO .... General Purpose Input / Output function; wired function that uses at least one input and one output

GPO .... General Purpose Output; associated with the wired implementation of an output function

IPGA .... SAE J1939 message; Impostor PG Alert

ISO .... International Organization for Standardization

K2xx .... 2000 Series 9-speed software release:
K231 PSC = November 2022
K232 PC = March 2023

Kbps .... Kilobits Per Second (baud rate)

Kph .... Kilometers Per Hour

LFE1 .... SAE J1939 message; Fuel Economy (Liquid)

LSB .... Least Significant Byte

LSG .... Limiting Speed Governor

LRTP .... Lower Range Torque Protection System; Allison feature

ms .... Milliseconds

MSB .... Most Significant Byte

MVS .... SAE J1939 message; Maximum Vehicle Speed Limit Status

N2xx .... Software release specific to 7 speed transmission models with fast reverse:
N221 PC = October 2021
N222 PC = January 2022
N223 PC = February 2022
N224 PC = May 2022
N231 PSC = April 2022
N231 PC = October 2022
N232 PC = November 2022
N240 PSC = April 2023
N241 PC = October 2023

N .... Neutral

NAS .... Neutral At Stop

N/V............. Ratio of engine RPM (N) to vehicle speed (V)

NA.............. Not Available

NIPTO........ Allison GPO function S, Neutral Indicator for PTO; not available via J1939

OD .... Overdrive

OEM .... Original Equipment Manufacturer

OFS .... Oil Field Series; Allison Vocational Model

OTL............ Output Torque Limiting; Allison Engine Management function

P .... Park

PDU .... SAE J1939 Protocol Data Unit

PF .... SAE J1939 PDU Format

PGN........... SAE J1939 Parameter Group Number; defines a J1939 message

PIEK .... European certification for commercial vehicles with reduced noise emissions

PS.............. SAE J1939 PDU Specific

PSI .... Parameter Specific Indicator

PSR .... Preselect Request; Allison function

PTL .... PTO Torque Limiting; Allison Engine Management function

PTODE ...... SAE J1939 message; Power Take-Off Drive Engagement

PWM.......... Pulse Width Modulated

R .... Reverse

RII .... Range Inhibit Indicator; Allison output function

RP.............. Recommended Practice, as in SAE

RC .... SAE J1939 message; Retarder Configuration

RIWSPR .... Reverse Inhibit with Preselect Request; Allison input function

RMR .... Retarder Modulation Request

RSG........... Road Speed Governor

RSM .... Range Selection Mode; Allison input function

RTS .... Ready To Send

RV-C.......... CAN-based protocol developed by RVIA; not compatible with J1939

RVIA .... Recreational Vehicle Industry Association

s................. Seconds

SA.............. SAE J1939 Source Address

SBS .... Service Brake Status; Allison input function

SAE .... Society of Automotive Engineers

SEM........... Shift Energy Management; Allison feature

SHM .... SAE J1939 message; Safety Header Message

SIP............. SAE J1939 parameter; Shift In Process

SOFT......... SAE J1939 message; Software Identification

SPN .... SAE J1939 Suspect Parameter Number

(V) .... Items marked by this symbol can be modified in some manner via VEPS and possibly ACCT

TC.............. Torque Converter

TC1............ SAE J1939 message; Transmission Control 1

TC2............ SAE J1939 message; Transmission Control 2

TCFG......... SAE J1939 message; Transmission Configuration

TCFG2....... SAE J1939 message; Transmission Configuration 2

TD.............. Technical Document

TES .... Technical Engineering Specification

TCM........... Transmission Control Module

TML .... SAE J1939 message; Transmission Mode Label

TSI .... Transmission Service Indicator; Allison output function

TP.CM .... SAE J1939 message; Transport Protocol – Connection Management

TP.DT .... SAE J1939 message; Transport Protocol – Data Transfer

TRF1.......... SAE J1939 message; Transmission Fluids 1

TRF2.......... SAE J1939 message; Transmission Fluids 2

TSC1 .... SAE J1939 message; Torque / Speed Control 1

UDS .... Unified Diagnostic Service

VAC .... Vehicle Acceleration Control; Allison J1939-based function. Beginning with B/C142 and D141 software releases, function is known as Acceleration Rate Management (ARM)

VEPS......... Vehicle Electronic Programming Station; Method by which Vocational Model Calibration are trimmed for a given application

VMC .... Vocational Model Calibration

VMRS........ Vehicle Maintenance Recording Standard, as specified by the American Trucking Association

VSG........... Variable Speed Governor

WATCH ..... Worldwide Allison Transmission Communication Hotline

A.5. DOCUMENT CHANGE HISTORY

For complete details on the changes or additions, refer to the appropriate heading listed here.

A.5.1. APRIL 11, 2023

Preliminary draft of Allison 6th Generation Control System Datalink Tech Data for:

— 1000/2000 Series B240 PSC software release, available in April 2023

— 3000/4000 Series C/N240 PSC software release, available in April 2023

— 2000 Series 9-speed K232 PC software release, available in March 2023

The changes listed are relative to the October 7, 2022 Allison 6th Generation Controls Datalink Tech Data for 2022 software releases. Some less significant changes may not be indicated.

A.5.1.1. *SECTION B: SAE J1939*

A.5.1.1.1. J1939-Based Function Requirements

AUTOMATIC NEUTRAL – BRAKE-BASED (BBAN) INPUT

<u>NEW FOR B/C/N240 PSC RELEASES:</u>
BBAN interaction with Neutral At Stop has been revised.

DIAGNOSTIC COMMUNICATION FOR OEM USE

<u>NEW FOR B/C/N240 PSC RELEASES:</u>
Any DTC or SPN / FMI content differences with the previous Allison 6th Generation Controls software releases are highlighted in yellow and discussed in the footnotes at the end of the DTC table.

DOWNHILL SPEED CONTROL

<u>NEW FOR B/C/N240 PSC RELEASES:</u>
The Downhill Speed Control functions have been consolidated and related VEPS configuration options have been revised.

Added optional use of signal EC3 *Engine Friction Percent Torque Points*.

Added VEPS parameters 29093, 29094, and 29095.

ENGINE BRAKE INTERFACE

<u>NEW FOR B/C/N240 PSC RELEASES:</u>
Added optional reception of RC *Retarder Configuration Map* to determine peak engine brake torque.

ENGINE STOP/START

<u>NEW FOR THE C240 PSC RELEASE:</u>
This function is new for C240 PSC.

HILL HOLD INTERFACE

<u>NEW FOR THIS PUBLICATION:</u>
Added requirement for compatible engine.

NEUTRAL AT STOP INPUT

<u>NEW FOR B/C/N240 PSC RELEASES:</u>
Expanded availability of Neutral At Stop Premium to 4000 Series 7-speed models.

Neutral At Stop interaction with GPI CA Automatic Neutral – Brake-Based (BBAN) has been revised.

Added VEPS trim 30121.

RANGE DISPLAY – REQUESTED RANGE

<u>NEW FOR THE B240 PSC RELEASE:</u>
Grade Braking Preselects are now reflected in ETC2 *Transmission Requested Range*.

SHIFT ACTUATOR SYSTEM WITH ALLISON SHIFT SELECTOR: 1000/2000 SERIES

<u>NEW FOR THIS PUBLICATION:</u>
Clarified available selector VEPS choices for this function.

SHIFT SELECTORS, ALLISON

<u>NEW FOR THIS PUBLICATION:</u>
Added VEPS trim 19075

Added value 0xEE in TC1 Transmission Requested Gear Value Table.

A.5.1.1.2. J1939 Message & Parameter Use

Only changes that are not directly associated with a J1939-based function described in section B.4 are indicated.

PGN 64743 – ENGINE CONFIGURATION 3 (EC3)

<u>NEW FOR B/C/N240 PSC RELEASES:</u>
Message reception is new for B/C/N240 PSC.

PGN 65218 – ELECTRONIC RETARDER CONTROLLER 2 (ERC2)

<u>NEW FOR THE C240 PSC RELEASE:</u>
Added optional broadcast of ERC2 *Retarder Road Speed Limit Enable*, *Retarder Road Speed Limit Active*, and *Retarder Road Speed Limit Set Speed*.

PGN 65249 – RETARDER CONFIGURATION (RC)

<u>NEW FOR B/C/N240 PSC RELEASES:</u>
Added reception of RC *Retarder Configuration Map*.

A.5.2. OCTOBER 12, 2023

Allison 6th Generation Control System Datalink Tech Data for:

— 1000/2000 Series B241 PC software release, available in October 2023

— 3000/4000 Series C/N241 PSC software release, available in October 2023

— 2000 Series 9-speed K232 PC software release, available in March 2023

The changes listed are relative to the April 11, 2023 Allison 6th Generation Controls Datalink Tech Data for 2023 software releases. Some less significant changes may not be indicated.

A.5.2.1. *SECTION B: SAE J1939*

A.5.2.1.1. J1939-Based Function Requirements

ALTERNATE GEAR START (AGS) INPUT
<u>NEW FOR C/N241 PC RELEASES:</u>
The Expanded automatic launch gear selection to 3000/4000 Series.

Added VEPS parameters 28100, 28105, and 28106.

DIAGNOSTIC COMMUNICATION FOR OEM USE
<u>NEW FOR B/C/N241 PC RELEASES:</u>
Any DTC or SPN / FMI content differences with the previous Allison 6th Generation Controls software releases are highlighted in yellow and discussed in the footnotes at the end of the DTC table.

ENGINE MANAGEMENT – NEUTRAL-TO-RANGE ASSIST (NRA)
<u>NEW FOR B/C/N241 PC RELEASES:</u>
The maximum NRA duration has been extended from 3 to 5 seconds.

RANGE DISPLAY – REQUESTED RANGE
<u>NEW FOR B/C/N241 PC RELEASES:</u>
The grace period for certain shift inhibits has been extended from 3 to 5 seconds.

A.5.2.1.2. J1939 Message & Parameter Use

Only changes that are not directly associated with a J1939-based function described in section B.4 are indicated.

PGN 0 – TORQUE / SPEED CONTROL 1 (TSC1)
<u>NEW FOR THIS PUBLICATION:</u>
Added VEPS trim 30560.

PGN 61445 – ELECTRONIC TRANSMISSION CONTROLLER 2 (ETC2)
<u>NEW FOR B/C/N241 PC RELEASES:</u>
The grace period for certain shift inhibits has been extended from 3 to 5 seconds.

SECTION B: SAE J1939

B.1. J1939 SYSTEM INTEGRATION APPROACH & RESPONSIBILITIES

B.1.1. ALLISON APPROACH AND EXPECTATIONS

Effective integration of the various systems using the datalink is important. In order to support the system integration process, Allison strives to adhere to the following principles:

- Maintain compliance with the SAE J1939 Recommended Practice and its intent.
- Avoid involvement with implementations that violate SAE J1939 and its intent.
- Avoid modifying Allison requirements in order to compensate for controllers that do not comply with SAE J1939.
- Test all TCM broadcast parameters, and TCM responses to all received parameters.
- Convey clear, detailed integration requirements.
- Strive to make all Allison products “transparent” at the J1939 interface for OEMs and customers.
- Inform vehicle OEMs and other integration partners of the development work schedule, including cut-off dates.
- Include datalink changes with other planned changes to Allison software.
- Minimize special implementations.

Allison engages in activities to improve the electronic integration process, and recommends that other datalink integration participants support these same activities:

- Specify primary and backup technical contacts for communication.
- Share documented J1939 message and parameter use. Provide timely updates on changes that will affect J1939 communication or response.
- Evaluate all changes that will affect J1939 communication or response.
- Coordinate software schedules by sharing vision and timing of future datalink plans.
- Have access to necessary facilities for change evaluation, including engines, transmissions, vehicles, and test cells. Use these facilities to test the changes.
- Provide support equipment and assistance for bench, test cell and vehicle operations to those doing change evaluation or system integration.
- Provide electronic control and software updates for development purposes to those doing change evaluation and / or system integration.
- Review system validation recommendations and jointly develop test requirements for change verification.
- Check interactions of electronic features and options for conflicts between the engine, vehicle and transmission.
- Provide understanding of datalink content and system response during failure modes.
- Identify configuration control methods.

B.1.2. FAILURE ANALYSIS

B.1.2.1. *OVERVIEW*

The system integrator is responsible for overall system operation and all vehicle component interactions. This responsibility includes the analysis of system failure modes. The system integrator has this responsibility because only they have access to all vehicle components and therefore all component interactions. Typically, the vehicle builder is the system integrator.

Each component manufacturer, including Allison, is responsible for providing the system integrator with an understanding of their component's datalink content and system response during failure modes.

This section is not intended as a substitute for any system integrator's own rigorous analysis. This section provides the following:

- Basic background for those new to datalink implementations.
- Minimum failure modes that every sender and receiver of datalink information should consider.

System failure modes must be considered differently for network-based inputs and outputs than for general purpose (wired) inputs and outputs.

B.1.2.1.1. Analog Wire Failure Modes

A key difference between GPIO wires and datalinks is the detection of signal corruption between the communicating devices.

An analog electrical signal generated properly by a sender may be corrupted during transmission to the receiver by such problems as electrical noise or shorts to ground or power. This corruption may or may not affect the value received.

B.1.2.1.2. CAN Datalink Failure Modes

CAN communication links are much more robust, as wiring integrity cannot change the values being sent. Wiring faults can only prevent messages from arriving at their destination. The CAN datalink layer protocol ensures that a message is accepted only -- and exactly -- as the sending node generated the message. CAN chips will reject messages affected by electrical noise or wire faults.

If the physical aspects of communication are working properly, the problems that occur in datalink-based systems typically fall into one of these categories:

- A sender broadcasts bad data.
- A receiver misinterprets or misuses good data.
- A receiver does not have a planned response for when it fails to receive valid data.

B.1.2.2. *FAILURE ANALYSIS REQUIREMENTS FOR RECEIVERS*

The CAN system virtually eliminates the possibility of a controller receiving a message containing data corrupted by the wiring integrity or environment. The remaining failure modes into one of two categories:

B.1.2.2.1. Error or Not Available Indications

These situations are usually an intentional choice by the sender. In one case, the sender is aware of a problem in the determination of its broadcast parameter, and instead of broadcasting potentially false or misleading data it chooses to send an "Error" indication. In the other case, a parameter in a message is not supported, so a "Not Available" indication is sent. In either case, the receiver does not obtain normal data and therefore must have a planned response.

B.1.2.2.2. Missing or intermittent J1939 messages

These situations are typically unintentional. The sender is broadcasting valid data, but the receiver doesn't get the data due to issues such as bus overloading, wiring integrity failures or electrical interference. Again, the receiver does not obtain normal data and therefore must have a planned response.

B.1.2.2.3. Receiving Device Responsibility

> **WARNING:** If an Allison datalink broadcast parameter is used as an input for a vehicle function or feature, the OEM is responsible for completing a Failure Mode and Effects Analysis. The OEM must evaluate the consequences of the failure response when any or all datalink information expected from Allison is not received.

B.1.2.3. *FAILURE ANALYSIS REQUIREMENTS FOR SENDERS*

System failures or unexpected vehicle operation can result if a network device broadcasts bad data or incorrect indications. As such, it is very important that all network devices broadcast correct data.

B.1.2.3.1. SAE Parameter Data States

SAE J1939 documents typically define normal, Not Available, and Error states for each parameter as follows:

- Unsupported broadcast parameters should indicate "Not Available" per their definition.

- When a broadcast parameter is supported and valid information is available, the parameter should be populated with that data.
- When a broadcast parameter is supported, but valid information is currently not available, that parameter should indicate “Error” per its definition.

B.1.2.3.2. “Error” versus “Not Available”

The difference between Not Available and Error is significant.

“Not Available” indicates that a parameter is not supported, while “Error” indicates that a parameter is supported, but the value is not known at the moment. Receivers often rely on correct support of these states during “hand shaking” sequences that may occur on the assembly line or during normal component power up when the vehicle is in service.

B.1.2.3.3. Default Algorithm Values

When a sensor component fails, it is not unusual for the controller involved to assume a default value (and possibly set a DTC) to continue vehicle operation.

The default value chosen might be suitable for that controller’s algorithms, but it may not be suitable for other controllers on the datalink. Senders should consider the implications of broadcasting these assumed default values. In most cases, the default value should not be broadcast. Instead, an Error indication should be sent.

B.1.2.3.4. Incorrect Data Broadcast

The most difficult failure mode to detect is the case where a device broadcasts incorrect data.

The sender is in the best position to determine the integrity of the information that it broadcasts over the datalink. The sender is the only device certain to have access to all of the inputs and logic used to generate its messages and parameters.

The receiver can determine message integrity only through redundant sensing and calculation. This redundancy may or may not be possible, and defeats the purpose of having a network of shared information.

In order to avoid broadcasting incorrect data, the sender must thoroughly understand its own failure modes.

Broadcast Data used to Shift from Neutral or Change Vehicle Direction

> **WARNING:** In 3000/4000 Series and certain 2000 Series 9-speed applications, TC1 *Transmission Requested Gear* is the primary transmission input that determines the range and vehicle direction desired by the operator.
>
> The TCM will make every effort to do what is asked of it via the J1939 TC1 Transmission Requested Gear parameter.
>
> Manufacturers and vehicle OEMs utilizing customer-supplied selectors assume sole and full responsibility of ensuring their design conveys no unintentional requests or parameter values to the TCM via J1939, during normal operation or any failure modes.

B.1.3. ALLISON ERROR INDICATION AND DTC TIMING

Per SAE J1939-71, parameter Error states allow the sender to *immediately* convey an issue:

> “…“error indicator” provides a means for a module to immediately indicate that valid parametric data is not currently available due to some type of error in the sensor, sub-system, or module.”

When a problem affecting broadcast parameter validity is detected, Allison strives to set the Error indication as soon as possible. This is important, as the TCM does not know how the receiver is using the data. Too much delay in setting the Error state may result in the receiver making a bad decision based on bad data.

Allison 4th Generation TCM capability was such that the TCM could not set an Error state until a fault was *confirmed*. The Error state broadcast would coincide very closely to the DTC set point and DM1 broadcast of that DTC.

Allison 5th Generation and newer TCMs are more capable, and may broadcast an Error indication as soon as a fault becomes *pending*. As a result, one of two things may happen:

1. The pending fault may clear on its own; normal parameter data broadcast resumes, and no DTC is set.
2. The Error indication may appear for up to 2 seconds before the fault is confirmed and a DTC is set. Once confirmed, the DTC will appear in the subsequent DM1 broadcast.

Receivers of Allison data should consider this timing when developing their diagnostic strategies.

B.1.4. DIAGNOSTIC GRACE PERIOD AT POWER UP

Several factors necessitate a longer communication “grace period” when a key switch is first turned on, or an engine is first started:

— **Controller initialization timing:** By design, different network nodes will “come on line” at different times after they first receive voltage.

— **Electrical power distribution:** Physical factors like node location, wiring length and variances in electrical relay operation can result in network nodes receiving power at slightly different times.

— **Controller resets during engine cranking:** Network nodes of different manufacturer will vary in the level of input voltage where their communication links will “drop out”, or their controllers will reset completely.

As such, Allison recommends other network nodes wait at least 5 seconds after power up before detecting the loss of any received Allison message. The goal is to wait long enough to avoid false indications of communication loss, while also avoiding unnecessary delay in detecting actual communication link problems.

Allison 6th Generation TCMs typically broadcast the first J1939 message within 300 ms of the TCM receiving key switch voltage. Not every J1939 message supported for broadcast by the TCM may be present within the first second.

B.1.5. USING A COMMUNICATION HEARTBEAT

Some Allison functions require an instrument cluster, engine or other J1939 device to monitor TCM communication integrity for diagnostic purposes. In other functions, such monitoring may be optional.

Receiving devices (“receivers”) can monitor Allison datalink presence by listening for a TCM “heartbeat” – a continuously broadcast J1939 message present whenever the TCM is powered up. Regular heartbeat reception tells the receiver that TCM communication is occurring properly.

Heartbeats are required with communication-critical functions, where unknown loss of communication between the TCM and another device may result in transmission component damage or unexpected vehicle operation. Heartbeats are also helpful with indicator functions, as they help assure that the given indicator is available to the operator.

Where applicable, the required or optional use of a heartbeat is noted for each function in the J1939-BASED FUNCTION REQUIREMENTS section.

B.1.5.1. *RECOMMENDED HEARTBEAT MESSAGES & TIMEOUT VALUES*

NOTE: Any specific heartbeat requirements listed under J1939-BASED FUNCTION REQUIREMENTS supersede the general recommendations listed here.

Receivers should consider TCM communication “lost” if a designated heartbeat has not been received from the TCM’s source address (SA 03) within a timeout period, which is dependent upon the message being used. Allison recommends:

Heartbeat Message	SAE J1939 Broadcast Rate	Multiplier “Cushion”	Timeout Value
ETC1	10 ms	10x	100 ms
ETC2	100 ms	10x	1 s
ETC7	100 ms	10x	1 s
DM1	1 s	5x	5 s

ETC1 is preferred, as it is in the group of fastest continuous broadcast TCM messages, meaning receivers can sense communication failures quickly. Also, most OEMs utilizing J1939 already receive ETC1 for other purposes, so its use as a heartbeat requires minimal additional software logic.

B.1.5.2. *OPERATOR NOTIFICATION*

If a receiver fails to see a heartbeat message for a period of time greater than or equal to its timeout value, that receiver may be required to or opt to notify the operator of a communication failure.

B.1.5.2.1. Physical Implementation

The physical “Communication Failure” indicator implementation is left to the discretion of the vehicle OEM. Acceptable examples include a lamp or text display with phrasing such as:

— “Communication Fault”
— “Vehicle Electrical Fault”
— “Vehicle Electronic Fault”

Exact wording is not specified, as Allison realizes vehicle OEMs may already have a method to convey such issues to the operator. Your Allison Customer Integration Engineer must review all implementations.

NOTE: Actuating the Check Trans Indicator is not an acceptable means to represent a communication problem with the TCM. If only the Check Trans Indicator is active, service technicians may assume there is a transmission problem, when it is most likely a vehicle network or wiring issue.

B.1.5.2.2. Length of Indication

The Communication Failure indication shall remain active until either a valid heartbeat message is received, or cycling the key switch resets the receiver and heartbeat reception returns. This logic informs the operator of a vehicle system issue that may not allow proper communication with the TCM.

B.1.6. GENERAL TIMEOUT RECOMMENDATIONS

Acceptable timeout behavior for signals received from the TCM is the responsibility of the receiving device. In general, Allison recommends timeout periods of 3x to 5x the broadcast rate, unless otherwise stated in the message, signal, or related function description.

B.1.7. NETWORK INTERCONNECTION

B.1.7.1. *OVERVIEW*

Per J1939-31, Network Interconnection ECUs (NIECUs) exist primarily for interconnecting networks or sub-networks. Specific implementations for “forwarding” messages:

- A **Repeater** regenerates the data signal to & from another segment of media.
- A **Bridge** stores and forwards messages between two or more network segments.
- A **Router** allows segments with independent address spaces, data rates, and media to exchange messages.
- A **Gateway** permits data transfer between two networks with different protocols or message sets.

NIECUs are also sometimes generically referred to as “datalink translators”.

B.1.7.2. *ALLISON POSITION*

General recommendations:

- Accomplishing Allison transmission functions with information traveling through an interconnection ECU is not recommended.
- It may be acceptable for an NIECU to “step down” TCM broadcast information from a high speed network (J1939) to a low-speed network (J1587) for instrument cluster or display use.
- Allison has not and does not evaluate NIECUs; determination of acceptable operation is the responsibility of the system integrator (vehicle OEM and / or body builder).

Specific requirements:

- In applications using Allison Engine Management functions, messages and parameters involved in these functions may not be conveyed through a NIECU, as they will likely interfere with the closed-loop control between the engine and transmission.
- Messages and parameters involved in Allison shift scheduling and modulation (such as throttle, engine load, engine torque, etc.) may not be conveyed through a NIECU, as their timing directly impacts transmission shift quality, performance, and durability.

B.1.8. REPROGRAMMING

B.1.8.1. *DATALINK CONTENT DURING TCM REPROGRAMMING*

During TCM reprogramming, normal message and parameter support ceases; the TCM only receives and broadcasts messages necessary for the reprogramming.

Devices which continually monitor TCM broadcasts may log fault codes during this period, as these devices have no way of knowing that TCM broadcasts have ceased due to reprogramming. As such, fault codes may need to be cleared from one or more devices on the vehicle after the TCM has been reprogrammed.

B.1.8.2. *TCM START / STOP BROADCAST SUPPORT*

Reducing unnecessary bus loading can significantly shorten the time required to reprogram engine or other ECUs. To assist the programming of other ECUs, Allison TCMs support reception of the DM13 Start / Stop Broadcast message.

Through use of this message, vehicle manufacturer download stations and other service tools can request that the TCM temporarily cease J1939 broadcasts and diagnostics.

For details on the required DM13 request content and TCM response, see PGN 57088 Stop / Start Broadcast (DM13) in the J1939 MESSAGE AND PARAMETER USE section of this document.

B.1.9. ATTEMPTS TO CONVERT ALLISON WIRE-BASED FUNCTIONS TO J1939 OPERATION

Allison understands that many OEMs are eager to transfer wire-based functions to the J1939 datalink, and intends to eventually offer equivalent or improved versions of all these functions via J1939. Currently the transition is still underway, but we continue to introduce more datalink-based functionality with each new software release.

As J1939 use has increased, Allison has fielded complaints that stem from a vehicle OEM or body builder attempting to *independently duplicate* an entire or partial Allison wire-based function over J1939 -- functions that Allison itself has not yet made available via J1939.

Such implementations are not approved for use with Allison products. As always, the only approved methods for implementing vehicle functions that interface with Allison products are found in:

…the “traditional” Allison Tech Data package, for wire-based IO functions, and

…this Allison Datalink Tech Data package, for J1939 or other CAN-based functions.

Each function in Datalink Tech Data states whether or not it can be directly substituted for a wire-based function. This information is summarized in the J1939 Function Overview table and listed at the beginning of each J1939-based function.

NOTE: If a desired J1939-based function is not found in Datalink Tech Data, then Allison currently does not offer that function via J1939.

Allison Tech Data function requirements are developed through significant engineering and testing to ensure the functions work as described.

WARNING: Mixing parts of Allison wire-based and J1939-based functions beyond what is published in Tech Data can result in damage to equipment or property, personal injury, or loss of life. Allison is not liable for the consequences of such implementations.

Depending on its complexity, converting a wire-based function to J1939 operation can be a significant engineering project. Beyond basic functionality, Allison must consider many other design factors:

— SAE J1939 message and / or parameter development for function robustness

— Protection of transmission hardware over a wide range of operation & circumstances

— Susceptibility to warranty issues or “false problem” reports

— Failure Mode differences between GPIO wires and the datalink (FMEA work)

— Compatibility with other existing Allison wire- & datalink-based functions, as well as those under development

— Compatibility with an extensive array of datalink devices (engines, ABS, etc.) and their functions

— Preservation of Allison standards for shift quality & vehicle operation as related to the transmission

— Interaction with existing diagnostics, or creation of new diagnostic trouble codes for the function

These steps and others are necessary to provide the high quality that our OEM partners and end customers expect of Allison products, and are especially critical for functions that may shift the transmission in and out of range or result in directional changes. Since much of the information required for this development is proprietary to Allison Transmission, it’s unfeasible for a company outside of Allison to *independently* develop a robust J1939-based function involving our transmission.

If Allison becomes aware of customer complaints or warranty issues on such vehicles already in service, we will advise the customer or OEM to implement the approved wire-based version of the function until such a time as Allison offers a fully-engineered equivalent function via the J1939 datalink.

As always, the preferred path for requesting new datalink-based functionality is through your Allison Customer Integration Engineer.

B.1.10. J1939 SOURCE ADDRESS (SA) MISUSE

Integrating electronic controllers in heavy-duty vehicles is a complex affair. Fortunately, SAE J1939 Recommended Practices help ensure that multiple components from various manufacturers can productively co-exist on a J1939 network. Per these recommended practices, Allison uses the following SAs to uniquely identify Allison controllers on J1939 networks:

- SA 03 (Transmission #1) identifies Allison TCMs.
- SA 05 (Shift Console #1) and SA 06 (Shift Console #2) identify Allison shift selectors.
- SA 16 (Retarder – Driveline) identifies retarder-related content from Allison TCMs.

Per SAE J1939-81, there are limitations on source address use:

"…a controller is made up of the software and the hardware within an Electronic Control Unit (ECU) that performs a particular control function. The software within a particular controller is the "Controller Application" (CA)."

"An address is a one-byte value identifying a particular CA in a network. The address of a CA is incorporated into the identifier of every message sent by that CA and is used to provide uniqueness to messages that are sent by the CA."

"Source addresses shall be unique within a particular vehicle or vehicle sub-network."

B.1.10.1. *EXAMPLES OF SA MISUSE*

Despite the SAE J1939-81 text, Allison is aware of devices that issue J1939 commands while posing as Allison components:

B.1.10.1.1. Impersonating an Allison TCM

In this case, an impostor issues commands from the Allison TCM source address in order to modify engine operation. Such activity may interfere with Allison Shift Energy Management and other engine integration functions, resulting in degraded transmission performance. In addition, transmission or other vehicle component damage may occur.

B.1.10.1.2. Impersonating an Allison Selector

In this case, an impostor issues commands from SA 05 or SA 06 in order to override commands coming from the actual Allison shift selector. This may cause the Allison selector to appear to malfunction, or cause unexpected vehicle operation. Again, transmission or other vehicle component damage may occur.

B.1.10.2. *ALLISON POSITION*

1. Allison strives to follow SAE J1939 Recommended Practices, and expects other manufacturers of J1939 devices to do the same.
2. Allison strictly prohibits other J1939 devices from using SAs claimed by Allison components unless specifically authorized in the Allison Datalink Tech Data package.
3. If a non-Allison device impersonates an Allison component on a J1939 network, Allison will not accept responsibility for damages incurred in these applications, and transmission warranty may be voided.
4. Allison considers the vehicle OEM and / or body builder to be the true vehicle system integrator. As such, it is their responsibility to avoid installation or recommendation of components that do not follow J1939 recommended practice, or may jeopardize J1939 network operation.
5. Companies that desire new, non-existing transmission integration functionality should contact Allison Customer Integration Engineering to submit a formal request. Allison is continually involved in ongoing integration development and standardization with the SAE J1939 committee and other heavy duty industry members.
6. Allison 6th Gen TCM and shift selector software include impostor detection mechanisms. Vehicle operation may be restricted until impostors are removed from the J1939 network.

B.1.11. RANGE DISPLAYS – GENERAL INFORMATION

All Allison-manufactured shift selectors have their own self-contained range displays. Vehicles utilizing mechanical shift selectors, OEM-exclusive J1939-based shift selectors, or auxiliary range displays may use J1939 to obtain range data for operator display.

OEM requirements for implementing range displays based on J1939 data, and the limitations associated with doing so, are defined in functions:

RANGE DISPLAY – REQUESTED RANGE

RANGE DISPLAY – RANGE ATTAINED

B.1.11.1. *INTENDED USE OF J1939 RANGE AND GEAR PARAMETERS*

The ETC2 byte definitions are as follows:

Byte	Content
1	*Transmission Selected Gear*
2,3	*Transmission Actual Gear Ratio*
4	*Transmission Current Gear*
5,6	*Transmission Requested Range*
7,8	*Transmission Current Range*

Bytes 1 through 4 are recommended for use in vehicle or control decisions. Caution should be exercised, particularly for functions occurring at vehicle key-on, as message latency may delay or otherwise affect the intended operation. It is the vehicle builder's responsibility to properly validate any functions based on this information.

The ASCII characters in bytes 5 through 8 are intended for display purposes only; no vehicle decisions are to be based on this information.

B.1.11.2. *DIFFERENCES BETWEEN RANGE AND GEAR PARAMETERS*

Interchangeability of seemingly identical parameter pairs such as *Transmission Requested Range* and *Transmission Selected Gear*, or *Transmission Current Range* and *Transmission Current Gear*, is often questioned. Content within these pairs is not the same, and systems receiving these parameters should not assume they are interchangeable. Consider the latter pair:

Transmission Current Range is an ASCII character that the transmission manufacturer associates with a particular range or ranges for operator display purposes. *Transmission Current Gear* defines a specific numeral for every transmission range. For example:

- A transmission in low range may simultaneously broadcast *Transmission Current Range* = 76 (ASCII "L") and *Transmission Current Gear* = 1.
- A transmission in neutral may simultaneously broadcast *Transmission Current Range* = 78 (ASCII "N") and *Transmission Current Gear* = 0.

These seemingly minor differences are significant; the ASCII character in *Transmission Current Range* relies on interpretation, while *Transmission Current Gear* does not.

By SAE definition, when *Transmission Current Gear* = 0, the transmission is in Neutral; there is no room for misinterpretation. In contrast, when *Transmission Current Range* = ASCII 78 ("N"), the person or component reading this letter has to make the association that "N" stands for Neutral.

Transmission Current Range gives the sender flexibility as to how the information is conveyed to the vehicle operator. *Transmission Current Gear* has rigid definitions that are more suitable for control system purposes, where misinterpretation of data could have unpleasant results.

For example: If a control system is designed around *Transmission Current Range* = ASCII 78 ("N"), that system may not respond identically (or acceptably) to reception of *Transmission Current Range* = ASCII 110 ("n"). Basing a control system on the definition "Current Gear = 0 = neutral" eliminates any chance for misunderstanding.

Beyond interpretation issues, "range" and "gear" parameter failure modes may differ among transmission manufacturers. Allison "range" parameter failure modes are tailored for displays – not for vehicle control. For these reasons, Allison strongly discourages use of *Transmission Requested Range* or *Transmission Current Range* for any use beyond driver displays.

B.1.11.3. *ALLISON VS. SAE TERMINOLOGY*

The table below lists commonly used Allison range terminology and the equivalent SAE parameter(s):

Allison Terminology	SAE Terminology
Range Selected	*Transmission Requested Range* (ASCII)
Range Commanded	*Transmission Selected Gear* (numeric)
Range Attained	*Transmission Current Gear* (numeric), *Transmission Current Range* (ASCII)

B.2. J1939 Message & Parameter Overview (2023)

Please see the table at the end of this section for a color key and footnote guide.

B.2.1. J1939 RECEPTION – ALLISON TCMS AND SHIFT SELECTORS

PGN	Message Received	Expected Rate	Byte	Bits	Parameters Received	Selector	1K–2K	3K–4K	Acceptable SAs (order of preference may differ vs. function or product family)
00000	TSC1	50 ms	--	--	See text for details	--	--	S	Any of 33 (V), 17 (V), 00 (V), 11 (V), 39 (V), 42 (V)
00256	TC1	50 ms or as needed (4)	1	8,7	*Transmission Reverse Gear Shift Inhibit Request* (F)	--	--	O	One of 49, 23, 05, 33 (V)
				2,1	*Transmission Gear Shift Inhibit Request* (F)	--	O(7)	O	Must specify via VEPS / ACCT
			3	--	*Transmission Requested Gear*	--	S(1)	S	05, 06, 42, 33, 23
			6	8,7	*Transmission Mode 4*	--	--	S(s)	05, 06
				6,5	*Transmission Mode 3* (F)	--	--	S(s)	05, 00, 33 (V)
				4,3	*Transmission Mode 2*	--	O	O	One of 49, 05, 33, 00 (V)
			7	8,7	*Trans. Shift Selector Display Mode Switch*	--	S	S	05, 06
				6-3	*Transmission Requested Launch Gear* (F)	--	--	S	One of 49, 23, 05, 33 (V)
03328	TC2	50 ms	1	8,7	*Transmission Output Shaft Brake Request* (F)	--	--	O	49 (V)
				6,5	*Transmission Pre-Defined Maximum Gear Activation Request* (F)	--	O	--	33 (V)
			2	2,1	*Transmission Requested Reverse Launch Gear* (F)	--	--	S(6)	One of 49, 23, 05, 33 (V)
03584	SHM	See J1939-76 for details				S(5)	O(5)	S(5)	Selectors: 03. TCM: 05, 06
7168	TC3	100 ms & on change, no faster than 10 ms	5	3,4	*Transmission Auto-Neutral (Auto-Return) Request* (F)	--	--	O	Must specify via VEPS / ACCT
				2,1	*Transmission Auto-Neutral (Auto-Return) Enable Switch* (F)	--	--	O	
34048	CM2	1 s & on change, no faster than 100 ms	7	6,5	*Active Shift Console Request* (F)	--	--	O	Must specify via VEPS / ACCT

PGN	Message Received	Expected Rate	Byte	Bits	Parameters Received	Selector	1K–2K	3K–4K	Acceptable SAs (order of preference may differ vs. function or product family)
53248	CL	5 s & on change, no faster than 100 ms	1	--	*Illumination Brightness Percentage* (V)	S	--	--	Must specify via VEPS / ACCT
56832	RESET	As needed	2	--	*Service Component Identification* (F)	--	S	S	Any, when sent to DA 03
57088	DM13	As needed	1	8,7	*Current Data Link*	--	S	S	Any
				2,1	*J1939 Network #1, Primary Vehicle Network*				
			4	8-5	*Hold Signal*				
				4-1	*Suspend Signal*				
59904	Request (PGN)	As needed	1-3	--	*PGN of Requested Message*	S	S(1)	S	Varies
61184	Proprietary A	100 ms	1-8	--	Proprietary shift selector information (F)	S	S(s)	S(s)	Selectors: 03. TCM: 05, 06
61440	ERC1	100 ms	1	6,5	*Retarder Enable – Brake Assist Switch* (V) (F)	--	O	O	One of 15, 41, 00 (V)
			2	--	*Actual Retarder – Percent Torque*	--	S	S	Any of 15, 41
			4	6,5	*Retarder Road Speed Limit Switch* (F)	--	--	O	39, 33
			7	--	*Retarder Selection, Non-Engine* (2)	--	--	S	One of 49, 23, 33, 39
61441	EBC1	100 ms	1	8,7	*EBS Brake Switch* (F)	--	O	O	11 (V)
				6,5	*Anti-Lock Braking (ABS) Active* (F)	--	S(1)	S	11
				4,3	*ASR Brake Control Active*	--	S	S	11
				2,1	*ASR Engine Control Active*	--	S	S	11
			2	--	*Brake Pedal Position* (F)	--	O	O	One of 45, 11 (V)
			5	--	*Engine Retarder Selection* (V) (F)	--	S	S	One of 49, 23, 33, 00 (V)

PGN	Message Received	Expected Rate	Byte	Bits	Parameters Received	Selector	1K– 2K	3K– 4K	Acceptable SAs (order of preference may differ vs. function or product family)
61443	EEC2	50 ms	1	6,5	*Road Speed Limit Status*	--	S	S	00
				4,3	*Accelerator Pedal Kickdown Switch* (F)	--	O	O	One of 17, 49, 33, 00 (V)
			2	--	*Accelerator Pedal Position 1*	--	S	S	One of 17, 49, 33, 00 (V)
			3	--	*Engine Percent Load at Current Speed*	--	S	S	00
			4	--	*Remote Accelerator Pedal Position* (F)	--	--	O	One of 49, 33, 00 (V)
			5	--	*Accelerator Pedal Position 2* (F)	--	--	O	One of 49, 00 (V)
			6	8,7	*SCR Thermal Management Active* (V)	--	S	S	00 (V)
				6,5	*DPF Thermal Management Active* (V)	--	S	S	00 (V)
				2,1	*Vehicle Acceleration Rate Limit Status* (V)	--	S	O	00 (V)
			7	--	*Actual Max. Available Engine – Percent Torque* (F)	--	O	O	00
61444	EEC1	Varies with engine speed	1	4-1	*Engine Torque Mode*	--	S	S	00
			2	--	*Driver's Demand Engine – Percent Torque* (F)	--	O	O	
			3	--	*Actual Engine – Percent Torque*	--	E	E	
			6	--	*SA of Controlling Device for Engine Control*	--	E	E	
			8	--	*Engine Demand – Percent Torque*	--	E	E	
61712	B2	1 s and on change but not faster than 20 ms	1-2	--	*Demanded Brake Application Pressure* (F)	--	--	--	One of 49, 33, 11 (V)
61839	IPGA	On detection of each attack event and, after the initial attack event detection, every 1 s for the remainder of the current ECU power cycle	1	--	*Impostor PG Event Detection Counter* (F)	--	O	O	Any of 05, 06
			2	--	*Impostor PG Source Address* (F)	--	O	O	Any of 05, 06
			3	--	*Impostor PG Destination Address* (F)	--	O	O	Any of 05, 06
			4-6	--	*Impostor PGN* (F)	--	O	O	Any of 05, 06
			7	--	*Time Since Last Imposter PG Detected* (F)	--	O	O	Any of 05, 06

PGN	Message Received	Expected Rate	Byte	Bits	Parameters Received	Selector	1K– 2K	3K– 4K	Acceptable SAs (order of preference may differ vs. function or product family)
64743	EC3	5 s and on change but not faster than 500 ms	Multi	--	Engine Friction Percent Torque Points (See text) (F)	--	O	O	00
64892	DPFC1	1 s and on change	2	4,3	Aftertreatment Diesel Particulate Filter Active (V)	--	S	S	One of 61, 00 (V)
64899	TCI	1 s and on change	1	3-1	Transfer Case Status	--	O	O	One of 04, 49, 33, 00 (V)
64912	AETC	On request	1	8-5	Number of AETC Data Points	--	E	E	00 (V)
				4-1	AETC Data Collection Standard				
			Multi	--	AETC Speed Value				
			Multi	--	AETC Torque Value				
64932	PTODE	100 ms	1	8,7	Enable Switch – Trans. Input Shaft PTO 1 (F)	--	O(1)	O	One of 49, 23, 33 (V)
				6,5	Enable Switch – Trans. Input Shaft PTO 2 (F)				
				4,3	Enable Switch – Trans. Output Shaft PTO (F)				
			5	4,3	Engagement Status – Transmission Output Shaft PTO (F)	--	--	O	One of 49, 23, 33 (V)
64997	MVS	1 s	8	--	Applied Vehicle Speed Limit (F)	--	O	O	One of 17, 49, 39, 33, 00 (V)
65098	ETC7	100 ms	1	4,3	Transmission Service Indicator	S(s)	--	--	03
			2	4,3	Active Shift Console Indicator				
			3	2,1	Transmission Mode 4 Indicator				
65228	DM3	On request	--	--	Not applicable (F)	--	O	O	Any
65235	DM11	On request	--	--	Not applicable (F)	--	O	O	Any
65242	SOFT	On request	1	--	Number of Software Identification Fields	--	S	S	Any of 05, 06
			2-N	--	Software Identification				
65247	EEC3	250 ms	1	--	Nominal Friction – Percent Torque	--	E	E	00
			5	--	Estimated Engine Parasitic Losses – % Torque	--	O	O	00, or up to five as specified via VEPS / ACCT

PGN	Message Received	Expected Rate	Byte	Bits	Parameters Received	Selector	1K– 2K	3K– 4K	Acceptable SAs (order of preference may differ vs. function or product family)
65249	RC	5 s & on change of torque/speed points of more than 10%, no faster than 500 ms	Multi	--	*Retarder Torque & Speed Map* (See text) (F)	--	O	O	Any of 15, 41
			17,18	--	*Retarder Reference Torque* (F)	--	S	S	
65251	EC1	5 s and on request	Multi	--	*Engine Percent Torque Points* (See text)	--	S	S	00
			Multi	--	*Engine Speed Points* (See text)	--	S	S	
			16,17	--	*Engine Speed At High Idle, Point 6* (F)	--	O	O	
			18,19	--	*Engine Gain (Kp) Of The Endspeed Governor* (F)	--	O	O	
			20,21	--	*Engine Reference Torque*	--	S	S	
			31,32	--	*Engine Moment of Inertia*	--	S	S	
			33,34	--	*Engine Default Torque Limit*	--	E	E	
65260	VI	On request	Multi	--	*Vehicle Identification Number*	--	S	S	00
65261	CCSS	On request	1	--	*Maximum Vehicle Speed Limit* (F)	--	O	O	One of 17, 49, 39, 33, 00 (V)
			4,5	--	*Maximum Vehicle Speed Limit (High Resolution)* (F)	--	O	O	
65262	ET1	1 s	1	--	*Engine Coolant Temperature* (F)	--	S	S	00
65265	CCVS1	100 ms	1	4,3	*Parking Brake Switch* (F)	--	O	O	One of 17, 49, 39, 23, 33, 00 (V)
				2,1	*Two Speed Axle Switch* (F)	--	--	O	33 (V)
			2,3	--	*Wheel-Based Vehicle Speed* (F)	--	S	S	One of 17, 33, 00 (V)
			4	6,5	*Brake Switch* (F)	--	O	O	One of 232, 23, 49, 17, 33, 00 (V)
				2,1	*Cruise Control Active* (V)	--	O	O	00 (V)
			6	--	*Cruise Control Set Speed*	--	O	O	One of 17, 49, 33, 00 (V)
			7	8-6	*Cruise Control States* (V)	--	S	S	One of 17, 49, 33, 23, 00 (V)
				5-1	*PTO Governor State*	--	S	S	One of 39, 17, 00

PGN	Message Received	Expected Rate	Byte	Bits	Parameters Received	Selector	1K– 2K	3K– 4K	Acceptable SAs (order of preference may differ vs. function or product family)
65266	LFE1	100 ms	1,2	--	*Engine Fuel Rate* (F)	--	O	O	One of 39, 00
			3,4	--	*Engine Instantaneous Fuel Economy* (F)	--	O	O	00
			5,6	--	*Engine Average Fuel Economy* (F)	--	O	O	00

B.2.2. J1939 BROADCASTS – ALLISON TCMS AND SHIFT SELECTORS

PGN	Message Broadcast	SA	Rate	Byte	Bits	Parameters Broadcast	Selector	1K–2K	3K–4K
00000	TSC1	03	10 ms to engine, 50 ms to retarders	--	--	See text for details [F]	--	S	S
00256	TC1	05 06	50 ms or as needed	3	--	*Transmission Requested Gear*	S	--	--
				6	8,7	*Transmission Mode 4*	S[s]	--	--
					6,5	*Transmission Mode 3*	S[s]	--	--
				7	8,7	*Transmission Shift Selector Display Mode Switch*	S[s]	--	--
03584	SHM	03 05 06	See J1939-76 for details				S[5]	O[5]	S[5]
59392	Acknowledgment	03	As req'd	--	--	See text for details	--	S	S
59904	Request (PGN)	03	As req'd	1-3	--	*Parameter Group Number Being Requested* [V]	--	S	S
60928	Address Claimed	All	As req'd	--	--	See text for details	S	S	S
61184	Proprietary A	03 05 06	100 ms	1-8	--	Proprietary shift selector information [F]	S[s]	S[s]	S[s]
61440	ERC1 [2]	16	100 ms	1	4-1	*Retarder Torque Mode* [V]	--	--	S
				2	--	*Actual Retarder – Percent Torque* [V]	--	--	S
				3	--	*Intended Retarder Percent Torque* [V]	--	--	S
				4	4,3	*Retarder Requesting Brake Light* [V]	--	--	S
					2,1	*Engine Coolant Load Increase* [V]	--	--	S
				5	--	*SA of Controlling Device for Retarder Control* [V]	--	--	S
				7	--	*Retarder Selection, Non-Engine* [V] [F]	--	--	S
				8	--	*Actual Maximum Available Retarder – Percent Torque* [V]	--	--	S

PGN	Message Broadcast	SA	Rate	Byte	Bits	Parameters Broadcast	Selector	1K–2K	3K–4K
61442	ETC1	03	10 ms	1	8,7	*Transmission TC Lock-Up Transition in Process* (V)	--	S(1)	S
					6,5	*Transmission Shift In Process* (V)	--	S(1)	S
					4,3	*Transmission Torque Converter Lock up Engaged* (F)	--	S(1)	S
					2,1	*Transmission Driveline Engaged* (V)	--	S(1)	S
				2,3	--	*Transmission Output Shaft Speed* (V)	--	S(1)	S
				5	4,3	*Progressive Shift Disable* (V)	--	S(1)	S
				6,7	--	*Transmission Input Shaft Speed* (V)	--	S(1)	S
				8	--	*SA of Controlling Device for Transmission Control* (V)	--	S(1)	S
61445	ETC2	03	100 ms	1	--	*Transmission Selected Gear* (V)	--	S(1)	S
				2,3	--	*Transmission Actual Gear Ratio* (V)	--	S(1)	S
				4	--	*Transmission Current Gear* (V)	--	S(1)	S
				5,6	--	*Transmission Requested Range* (V)	--	S(1)	S
				7,8	--	*Transmission Current Range* (V)	--	S(1)	S
61452	ETC8	03	Varies	1,2	--	*Transmission Torque Converter Ratio* (V)	--	S	S
				3,4	--	*Transmission Clutch / Converter Input Speed* (V)	--	S	S
				5	--	*Transmission Shift Inhibit Reason* (V)	--	S	S
61481	SSI2	03	10 ms	1-3	--	*Pitch Angle (Extended Range)* (V)	--	O(7)	O
61538	ETC12	03	10 ms	5,6	--	*Transmission Directional Output Shaft Speed* (V)	--	O	O
61677	ENGSC	03	20 ms	1	8-6	*Transmission Shift Selector Requested Vehicle Direction*	--	O(7)	O
61839	IPGA	03 05 06	On detection of each attack event and, after the initial attack event detection, every 1 s for the remainder of the current ECU power cycle	1	--	*Impostor PG Event Detection Counter* (F)	O	O	O
				2	--	*Impostor PG Source Address* (F)	O	O	O
				3	--	*Impostor PG Destination Address* (F)	O	O	O
				4-6	--	*Impostor PGN* (F)	O	O	O
				7	--	*Time Since Last Imposter PG Detected* (F)	O	O	O
64064	ETC15	03	100 ms	3	3-1	*Transmission Auto-Neutral (Auto-Return) Request Feedback* (F)	--	--	O
				4	4-1	*Transmission Auto-Neutral (Auto-Return) Function State* (F)	--	--	O

PGN	Message Broadcast	SA	Rate	Byte	Bits	Parameters Broadcast	Selector	1K–2K	3K–4K
64839	TML	03	On request	Varies	--	*Transmission Mode Label, Mode 1* (V)	--	O	O
					--	*Transmission Mode Label, Mode 2* (V)	--	O	O
					--	*Transmission Mode Label, Mode 4* (V)	--	O	O
64872	GCVW	03	Varies	1-3	--	*Gross Combination Weight* (V)	--	O(7)	O
64906	J2012	03	On request	1	--	*Number of SAE J2012 DTCs*	--	S(1)	S
				Varies	--	*SAE J2012 DTC*	--	S(1)	S
				Varies	--	*SAE J2012 DTC Status*	--	S(1)	S
				Varies	--	*J2012 DTC Occurrence Count*	--	S(1)	S
64917	TRF2	03	1 s	1	6,5	*Transmission Overheat Indicator* (V)	--	S	S
					2,1	*Transmission Oil Filter Restriction Switch* (V)	--	P	P
				4	--	*Transmission Oil Life Remaining* (V)	--	P(1)	P
64932	PTODE	03	100 ms	3	8,7	*Engagement Consent – Transmission Input Shaft PTO 1* (F)	--	O(1)	O
					6,5	*Engagement Consent – Transmission Input Shaft PTO 2* (F)	--	O(1)	O
					4,3	*Engagement Consent – Transmission Output Shaft PTO* (F)	--	O(1)	O
				7	8,7	*Operation Consent – Transmission Output Shaft PTO* (F)	--	--	O
64965	ECUID	03	On request	Multi	--	*ECU Part Number*	--	S(1)	S
				Multi	--	*ECU Serial Number*			

PGN	Message Broadcast	SA	Rate	Byte	Bits	Parameters Broadcast	Selector	1K–2K	3K–4K
65098	ETC7	03	100 ms	1	8,7	*Transmission Requested Range Display Flash State* (V)	--	S	S
					6,5	*Transmission Requested Range Display Blank State* (V)	--	S	S
					4,3	*Transmission Service Indicator* (F)	--	S(1)	S
				2	8,7	*Transmission Shift Inhibit Indicator* (F)	--	S(1)	S
					6,5	*Transmission Engine Crank Enable* (V)	--	S	S
					4,3	*Active Shift Console Indicator* (V)	--	--	S
					2,1	*Transmission Ready for Brake Release* (F)	--	O	O
				3	8,7	*Transmission Mode 1 Indicator* (F)	--	S	S
					6,5	*Transmission Mode 2 Indicator* (F)	--	S	S
					2,1	*Transmission Mode 4 Indicator* (V)	--	--	S(S)
				4	--	*Transmission Requested Gear Feedback* (V)	--	--	S
				6	8,7	*Transmission Mode 10 Indicator* (V)	--	S	S
					4,3	*Transmission Warning Indicator* (V)	--	S(1)	S
					2,1	*Transmission Reverse Gear Shift Inhibit Status* (F)	--	O	O
				7	8,7	*Transmission Manual Mode Indicator*	--	O(7)	O
				8	4,3	*Transmission Pre-Defined Range Limit Indicator* (F)	--	O	--
65099	TCFG2	03	Varies	1,2	--	*Transmission Torque Limit* (F) (V)	--	E	E
65218	ERC2 (2)	03	1 s and on change but not faster than 100 ms	1	6,5	Retarder Road Speed Limit Active (V)	--	O	O
					4,3	Retarder Road Speed Limit Enable (V)	--	O	O
				4,5	--	Retarder Road Speed Limit Set Speed (V)	--	O	O
65218	ERC2 (2)	16	1 s and on change but not faster than 100 ms	1	8,7	Transmission Retarder Enable Switch (V)	--	--	S
					2,1	Transmission Output Retarder (V)	--	--	S
65226	DM1 (M)	03 16	1 s	1	8,7	*Malfunction Indicator Lamp*	--	S(1)	S
					6,5	*Red Stop Lamp*			
					4,3	*Amber Warning Lamp*			
					2,1	*Protect Lamp*			
				Multi	--	*Suspect Parameter Number*			
				Multi	--	*Failure Mode Identifier*			
				Multi	--	*Occurrence Count*			

PGN	Message Broadcast	SA	Rate	Byte	Bits	Parameters Broadcast	Selector	1K–2K	3K–4K
65227	DM2 (M)	03 16	On request	1	8,7	Malfunction Indicator Lamp	--	S(1)	S
					6,5	Red Stop Lamp			
					4,3	Amber Warning Lamp			
					2,1	Protect Lamp			
				Multi	--	Suspect Parameter Number			
				Multi	--	Failure Mode Identifier			
				Multi	--	Occurrence Count			
65242	SOFT (M)	03 05 06	On request	1	--	Number of Software Identification Fields	S	S(1)	S
				2-N	--	Software Identification			
65249	RC (2)	16	5 s and on 10% map change	1	8-5	Retarder Location (V)	--	--	S
					4-1	Retarder Type (V)	--	--	S
				2	--	Retarder Control Method (V)	--	--	S
				Multi	--	Torque & Speed Map (See text for details) (V)	--	--	S
				17,18	--	Retarder Reference Torque (V)	--	--	S
65250	TCFG (M)	03	On request	1	--	Number of Reverse Gear Ratios	--	S	S
				2	--	Number of Forward Gear Ratios			
				Multi	--	Transmission Gear Ratio			
65259	CI (M)	03	On request	1-5	--	Make	--	S(1)	S
				Multi	--	Model			
65272	TRF1	03	1 s	5,6	--	Transmission Oil Temperature 1 (V)	--	S(1)	S
				7	--	Transmission Oil Level 1 High / Low (3) (V)	--	--	S
				8	8-5	Transmission Oil Level 1 Measurement Status (3) (V)	--	--	S
					4-1	Transmission Oil Level 1 Countdown Timer (3) (V)	--	--	S
65275	RF (2)	16	1 s	2	--	Hydraulic Retarder Oil Temperature (V)	--	--	S
				3	2,1	Driveline Retarder Overheat Indicator (V)	--	--	S
				4	--	Retarder Coolant Outlet Temperature (V)	--	--	O
65440	PropB_A0	03	On request	Multi	--	Proprietary TCM Information (V)	--	S(1)	S

B.2.3. J1939 MESSAGE AND PARAMETER OVERVIEW TABLE GUIDE

Footnotes

(1) In GMLAN applications, parameter broadcast or reception is supported on the CAN port set to SAE J1939 LIMITED FUNCTIONALITY.

(2) Only supported in applications equipped with an Allison driveline retarder.

(3) Only supported in applications equipped with an Allison oil level sensor.

(4) SAE J1939-71 allows intermittent message broadcast; Allison functions require it to be broadcast continuously.

(5) Only supported in applications equipped with an Allison 6th Gen shift selector.

(6) Only supported in 4000 Series 7-speed models with fast reverse.

(7) Not supported in 2000 Series 9-speed models.

(F) Parameter broadcast or reception is tied to the VEPS / ACCT answer for an Input, Output or Interface function.

(M) Message broadcast or reception is tied to a specific VEPS / ACCT question that controls its enabling or disabling.

(S) Support dependent on selector configuration.

(V) Parameter broadcast or reception is tied to a VEPS / ACCT Datalink Tailoring question. Source Addresses marked with this footnote may be set to an OEM-specified value via VEPS.

Message / Parameter Enabling

(S) Message / parameter broadcast or reception is standard with this product.

(O) Message / parameter broadcast or reception is optional with this product, and controlled by a VEPS / ACCT answer.

(R) Message / parameter reception is required by this transmission family in all applications.

(E) Message / parameter broadcast or reception is dependent on the ENGINE MAKE AND MODEL specified via VEPS / ACCT.

(P) Parameter broadcast is dependent on VEPS / ACCT answers that enable prognostics functionality.

Other

Yellow highlights indicate changes in availability. Refer to parameter definition sections or related functions.

B.2.4. J1939 SOURCE ADDRESS LISTING

While not a comprehensive list of all J1939 source addresses, the following is provided for reference; see the SAE J1939 Digital Annex for a full listing.

Allison does not use all SAs listed below; refer to each J1939-based function for specific source address use.

SA	Controller Application
00	Engine #1
03	Transmission #1
04	Transmission #2
05	Shift Console – Primary
06	Shift Console – Secondary
07	Power Take Off – Main or Rear
11	Brakes – System Controller
15	Retarder – Engine (Compression Brake)
16	Retarder – Driveline
17	Cruise Control
23	Instrument Cluster #1
24	Trip Recorder
33	Body Controller
39	Management Computer #1
40	Cab Display #1
41	Retarder, Exhaust, Engine #1
42	Headway Controller
43	On-Board Diagnostic Unit
45	Endurance Braking System
49	Cab Control – Primary
50	Cab Control – Secondary
61	Exhaust Emission Controller
90	Powertrain Control Module
232	Forward Road Image Processor
249	Off Board Diagnostic – Service Tool #1
250	Off Board Diagnostic – Service Tool #2
251	On-Board Data Logger
255	Global (All – Any Node)

B.3. J1939-Based Function Overview

Yellow highlights indicate changes in availability since the previous publication; click on the appropriate function name for more information. Additional footnotes are found at the bottom of the table.

2023 J1939-Based Input, Output or Interface Function	1K–2K	3K–4K	Equivalent GPIO Function or Dedicated Wire
ACCELERATOR PEDAL INPUT	S	S	TPS or PWM (1K–4K)
ACCELERATOR PEDAL INPUT – DUAL MODE OFS	--	O	TPS or PWM (3K–4K)
ALTERNATE GEAR START (AGS) INPUT	O(5)	S	Shift mask
ANTI-LOCK BRAKE SYSTEM (ABS) INPUT	S(1)	S	GPI Y
AUTOMATIC TRACTION CONTROL (ATC OR ASR)	S	S	None
AUTOMATIC NEUTRAL – BBAN INPUT (4)	O	O	GPI CA required
AUTOMATIC NEUTRAL – DUAL INPUT (ANDI) (8)	--	O	GPI AG, GPI AK
AUTOMATIC NEUTRAL – DUAL INPUT W/ARTR	O	O	GPI CN
AUTOMATIC NEUTRAL – SINGLE INPUT	O	O	GPI L, GPI CH
AUTOMATIC NEUTRAL – SINGLE INPUT W/SS OVERRIDE	O	O	GPI CD
AUXILIARY BOX TRANSITION	--	O	GPI BY
AUXILIARY FUNCTION RANGE INHIBIT (AFRI) – SI	O	O	GPI E
CHECK TRANS INDICATOR	S(1)	S	Dedicated TCM wire
CRUISE CONTROL, STANDARD	S	S	None
CRUISE CONTROL, ADAPTIVE	S	S	None
CRUISE CONTROL, VIA ENGINE PTO GOVERNOR	S	S	None
DIAGNOSTIC COMMUNICATION W/ALLISON TOOLS	R	R	None
DIAGNOSTIC COMMUNICATION FOR OEM USE	O	O	Allison selector display
DIRECT HOLD	--	O	GPI CE
DIRECTION CHANGE ENABLE INPUT	O	O	GPI W (3K–4K)
DOWNHILL SPEED CONTROL	O	O	None
DYNACTIVE™ SHIFTING	O/S(6)	O	None
DYNAMIC SHIFT SENSING (DSS)	O	O	None
ELECTRONIC BRAKING SYSTEMS (EBS) (4)	O	O	None
EMISSION CONTROL SYSTEMS (DPF / SCR)	S	S	None
ENGINE BRAKE INTERFACE	S	S	GPI H/I & GPO A (1K–4K)
ENGINE MANAGEMENT – ARM (4)	E	E	None
ENGINE MANAGEMENT – SEM (4)	E	E	None
ENGINE MANAGEMENT – LRTP (4)	E	E	None
ENGINE MANAGEMENT – NEUTRAL-TO-RANGE ASSIST	O	O	None
ENGINE MANAGEMENT – OUTPUT TORQUE LIMITING (4)	O	O	None
ENGINE MANAGEMENT – PTO TORQUE LIMITING (PTL)	O	O	None

Continued on next page

2023 J1939-Based Input, Output or Interface Function	1K–2K	3K–4K	Equivalent GPIO Function or Dedicated Wire
ENGINE STOP/START	--	O	None
FUELSENSE® INDICATOR	O	O	Allison selector display
HIGH N/V RATIO INPUT	O	O	GPI CC (1K-2K)
HILL HOLD INTERFACE (4)	O	O	None
IMPOSTOR DETECTION	S	S	None
KICKDOWN INPUT	O	O	GPI AH
LOCKUP INDICATOR	S(1)	S	GPO K
NEUTRAL AT STOP INPUT (4)	O	O	GPI AS
NEUTRAL INDICATOR	S(1)	S	None
NEUTRAL START	S	S	Dedicated TCM wire
OIL LEVEL DISPLAY (3)	--	S	Allison selector display
OVERDRIVE DISABLE	O	--	GPI AR
POWER DIVIDER INPUT (4)	--	O	None
PRESELECT REQUEST INPUT	S(1)	S	GPI AR, CB1 and CB2; 3-Position Hold Switch
PROGRESSIVE SHIFTING	--	O	None
PTO DRIVE INTERFACES 1 & 2	O	O	GPI C1/C2 & GPO G1/G2
PUMP MODE / FIRE TRUCK PUMP MODE	--	O	GPI AJ, GPI J
RANGE DISPLAY – RANGE ATTAINED	S(1)	S	Allison selector display
RANGE DISPLAY – REQUESTED RANGE	S(1)	S	Allison selector display
RANGE INHIBIT INDICATOR AND REASON (RII)	S(1)	S	Dedicated TCM wire (1K-2K)
RANGE SELECTION MODE (“TAP UP, TAP DOWN”)	O	--	None
RETARDER ACTIVE INDICATOR (2)	--	S	Part of GPO Q (3K–4K)
RETARDER CAPACITY REDUCTION (2)	--	O	Wire 135 (3K–4K)
RETARDER CONTROL (2)	--	S	GPI Z (3K–4K)
RETARDER TEMPERATURE INDICATOR (2)	--	S	GPO B (3K–4K)
REVERSE INHIBIT WITH PRESELECT REQUEST	O	O	GPI AM
REVERSE WARNING INDICATOR	S(1)	S	Dedicated TCM wire
ROAD SPEED LIMITING	S	S	None
SECONDARY MODE INDICATOR	S	S	GPO N
SECONDARY MODE INPUT	O	O	GPI A
SERVICE BRAKE STATUS INPUT	O	O	GPI AA
SHIFT ACTUATOR SYSTEM W/ALLISON SELECTOR	O(7)	--	None
SHIFT ACTUATOR SYSTEM W/NON-ALLISON SELECTOR	O	--	None
SHIFT SELECTOR, ALLISON	O(5)	S	None
SHIFT SELECTOR, NON-ALLISON BASIC (4)	--	O	None

Continued on next page

2023 J1939-Based Input, Output or Interface Function	1K–2K	3K–4K	Equivalent GPIO Function or Dedicated Wire
SHIFT SELECTOR, NON-ALLISON DIRECT SELECT [4]	--	O	None
SHIFT SELECTOR, NON-ALLISON STANDARD [4]	O[5]	O	None
SHIFT SELECTOR, NON-ALLISON STANDARD WITH ASSURANCE DATA VIA J1939-76 [4]	O[5]	O	None
SHIFT SELECTOR DIMMING	O	O	Dedicated selector wire
SHIFT SELECTOR TRANSITION	--	O	GPI D
SUMP TEMPERATURE INDICATOR	S[1]	S	GPO B (1K-4K)
TRANSMISSION SERVICE INDICATOR	S[1]	S	GPO O
TWO SPEED AXLE	--	O	GPI Q
UDS END-OF-LINE COMMUNICATION	S	S	None
VEHICLE ACCELERATION RATE LIMITING [4]	S	O	None

Function Overview Table Footnotes

(1) Available in GMLAN gas engine applications.

(2) Retarder-equipped applications only.

(3) OLS-equipped applications only.

(4) Customer Integration Engineering review required.

(5) 2000 Series 9-speed applications only.

(6) Standard in 2000 Series 9-speed applications.

(7) Not available in 2000 Series 9-speed applications.

(8) Function access is restricted. Contact your Allison Customer Integration Engineer for details.

J1939-Based Function Enabling

S = Standard with this product family.

O = J1939 option available with this product family.

R = J1939 support is required for this product family.

E = Dependent on ENGINE MAKE AND MODEL.

-- = J1939 option not applicable to this product family.

B.4. J1939-BASED FUNCTION REQUIREMENTS

This section lists requirements necessary to support certain vehicle or Allison functions via the J1939 datalink. Datalink parameters are shown in Italics; detailed descriptions of each are listed further in this document. Some functions may be accomplished by other methods; see each function for the alternative methods.

B.4.1. ACCELERATOR PEDAL INPUT

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.1.1. *OVERVIEW*

All installations require at least one source of Accelerator Pedal Position. See the Allison 6th Generation Controls Installation Manual for information on TPS or PWM implementations.

B.4.1.2. *AVAILABILITY*

J1939-based Accelerator Pedal input is standard in all 1000 – 4000 Series applications.

B.4.1.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be provided to the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[18000] THROTTLE AND LOAD SOURCE

Set answer to PRIMARY ON-VEHICLE PROTOCOL to enable TCM parameter reception.

B.4.1.4. *J1939 PARAMETER AND SA USE*

SAs marked (V) may be set to an OEM-specified value via VEPS. See AUTO-DETECTION for SA selection details.

B.4.1.4.1. Required Support

The J1939 network is required to provide EEC2 *Accelerator Pedal Position 1* from one of the following SAs, in order of TCM preference:

1. SA 17 (Cruise Control) (V)
2. SA 49 (Cab Controller)
3. SA 33 (Body Controller)
4. SA 00 (Engine #1)

B.4.1.5. *OTHER REQUIREMENTS / RESTRICTIONS*

B.4.1.5.1. Signal Filtering

Per SAE, accelerator pedal parameters should reflect the actual, physical position of the accelerator pedal. If an engine or other controller algorithm modifies the pedal input beyond normal A/D filtering, these modifications should be reflected in other parameters where appropriate, such as J1939 *Driver's Demand Engine – Percent Torque* or *Engine Demand – Percent Torque*.

B.4.1.5.2. Secondary or Remote Accelerator Pedals

In applications with more than one accelerator pedal installed -- such as with two driving stations -- it is critical that the TCM receive information from the pedal actively controlling vehicle movement.

Vehicle configuration must be such that switching of the throttle source occurs upstream of the single point of input into the Allison control system.

For example, if the TCM has been configured to receive throttle on the J1939 datalink, and an engine ECM receives two throttle pedal inputs, then the engine ECM must reflect the state of the active throttle pedal in the same *Accelerator Pedal Position 1* parameter.

There are two exceptions to the above requirement:

1. Implementations are acceptable where the secondary throttle control is implemented via the engine's PTO governor, and the *PTO Governor State* parameter is supported per CRUISE CONTROL, VIA ENGINE PTO GOVERNOR.

2. 3000/4000 Series Oil Field Service applications may utilize function ACCELERATOR PEDAL INPUT – DUAL MODE OFS.

B.4.1.5.3. Stationary Applications Controlling Engine Speed via TSC1 Speed Commands

Allison realizes stationary applications exist where engine operation is controlled completely via TSC1 speed commands. These commands are often issued from a Programmable Logic Controller (PLC) or other device. Even though there is no traditional accelerator pedal input connected to the engine or the

J1939 network, a valid accelerator pedal signal to the TCM is required:

Allison requires the PLC or controlling device to broadcast a simulated EEC2 *Accelerator Pedal Position 1* signal. It is recommended that a source address other than SA 00 (engine #1) is used, such as SA 33 (Body Controller).

Doing so avoids issues in the event the engine (SA 00) broadcasts invalid data (such as a constant 0%, regardless of engine operation) in EEC2 *Accelerator Pedal Position 1*. The TCM SA auto-detection logic will lock onto the more preferred (and in this case, correct) parameter from SA 33.

B.4.1.5.4. Applications with Road Speed Limiting and / or Cruise Control

If functions such as Road Speed Limiting or Cruise Control are employed, the necessary information must be supplied on the J1939 datalink per the function descriptions in this section of the document.

B.4.1.6. *TCM FAILURE MODES & RESPONSES*

If *Accelerator Pedal Position 1* reception is lost or indicates 255 (Not Available), the TCM logs a DTC and activates the Check Trans Indicator. A default value is assumed for accelerator pedal position, and shifting is restricted. The TCM diagnoses these conditions as the sender may not be aware of a network issue (causing communication loss) nor a sender configuration issue (parameter indicates Not Available).

If *Accelerator Pedal Position 1* indicates 254 (Error), the TCM does not log a DTC nor activate the Check Trans Indicator. A default value is assumed for accelerator pedal position, and shifting is restricted. In this case, the sender knows it has an issue, and therefore it should indicate the fault so that the problem can be resolved at the appropriate non-Allison repair center.

B.4.1.7. *INSTALLATION CHECKLIST: ACCELERATOR PEDAL*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer “yes” to the following questions:

- ☐ Is the TCM calibration configured properly?
- ☐ Is *Accelerator Pedal Position 1* broadcast from one of the acceptable source addresses?
- ☐ Is the parameter span at least 3 – 98% as the pedal is depressed & released? (0-100% range is ideal.)

B.4.2. ACCELERATOR PEDAL INPUT – DUAL MODE OFS

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.2.1. *OVERVIEW*

OFS (Oil Field Series) units may be used in either stationary or dual mode applications. Stationary units are often skid-mounted and have only a single accelerator pedal or hand throttle input to the power unit. Dual mode applications use the transmission to propel the vehicle in "Road Mode", and power a split-shaft PTO pump unit while in "Pump Mode".

Dual Mode OFS units use two shift selectors and up to two throttle controls. For dual throttle applications, use this function; for single throttle applications see function ACCELERATOR PEDAL INPUT.

Input combination options for Dual Mode OFS units:

Road Mode Accelerator Input	Pump Mode Accelerator or Throttle Input
EEC2 APP1 (1)	EEC2 APP2 (2)
EEC2 APP1	EEC2 RAPP (3)
EEC2 APP1	EEC2 APP1 with A/B Switch
EEC2 APP1	PTO switch control

(1) APP1 = EEC2 Accelerator Pedal Position 1

(2) APP2 = EEC2 Accelerator Pedal Position 2

(3) RAPP = EEC2 Remote Accelerator Position

B.4.2.2. *AVAILABILITY*

The J1939-based implementation is optional in 3000/4000 Series dual mode OFS applications.

B.4.2.3. *CONFIGURATION (VEPS / ACCT)*

[18000] THROTTLE AND LOAD SOURCE

Set answer to ON-VEHICLE PROTOCOL.

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be provided to the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[23000] OFS PUMP MODE: Throttle Input

Set answer to match the implementation used:

— SAME AS ROAD MODE THROTTLE SOURCE
— J1939 EEC2 Accelerator Pedal Position 2
— J1939 EEC2 Remote Accelerator Pedal Position

B.4.2.4. *J1939 PARAMETER AND SA USE – ROAD MODE REQUIREMENTS*

In Road Mode, the J1939 network is required to provide EEC2 *Accelerator Pedal Position 1* as described under ACCELERATOR PEDAL INPUT.

B.4.2.5. *J1939 PARAMETER AND SA USE – PUMP MODE REQUIREMENTS*

Pump Mode activation is controlled by GPI BZ (SHIFT SELECTOR TRANSITION AND OIL FIELD PUMPING). In Pump Mode, the TCM can receive the information necessary to modulate shifts via:

1. EEC2 Accelerator Pedal Position 2
2. EEC2 Remote Accelerator Pedal Position
3. EEC2 Accelerator Pedal Position 1 + A/B switch
4. PTO governor controls (not preferred)

SAs marked (V) may be set to an OEM-specified value via VEPS. See AUTO-DETECTION for SA selection details.

B.4.2.5.1. Engine Speed Control via TSC1 Speed Command

Some applications may control the engine via TSC1 speed commands during Pump Mode operation. Commands are often issued from a Programmable Logic Controller (PLC) or other device.

Even though the engine has no traditional accelerator pedal input, a TCM accelerator pedal signal is required during Pump Mode operation. Therefore, the controller must broadcast a simulated signal in one of the above EEC2 parameters.

A source address other than SA 00 (engine #1) is recommended, such as SA 33 (Body Controller). This avoids issues if SA 00 broadcasts invalid data (such as a constant 0%, regardless of operation) in EEC2 *Accelerator Pedal Position 1*. TCM SA auto-detection logic will lock onto the more preferred (and in this case, correct) parameter from SA 33.

B.4.2.5.2. PUMP MODE OPTION 1 – EEC2 Accelerator Pedal Position 2 (APP2)

As a second instance of an accelerator pedal, APP2 is typically associated with a second pedal located inside the cab used to the drive the vehicle, like those seen in "dual station" refuse vehicles. However, Allison realizes that some engines utilize this parameter to represent a second throttle source outside of the driver's cab.

J1939 Parameter and SA Requirements

In Pump Mode, the J1939 network is required to provide EEC2 *Accelerator Pedal Position 2* from one of the following SAs, in order of TCM preference:

1. SA 49 (Cab Controller) (V)
2. SA 00 (Engine #1)

Detroit Diesel Engine Requirements

NOTE: DDEC VI applications are required to use Pump Mode Option 2, as it only supports EEC2 *Remote Accelerator Pedal Position* (RAPP).

DDEC IV ECMs are required to use R40.0 or later software. DDEC V ECMs are required to used T2.03 or R3.0 or later software.

Per the DDEC Application and Installation Guide, the accelerator pedal used during Road Mode operation should be connected to the LSG ECM inputs, and the pump mode throttle should be connected to the VSG ECM inputs.

Normal Operation – Pump Mode

Shift scheduling and modulation are controlled by APP2. Parameters below are ignored by the TCM:

— EEC2 *Accelerator Pedal Position 1*
— EEC2 Remote Accelerator Pedal Position
— CCVS1 Cruise Control States
— CCVS1 PTO Governor State
— EEC2 Percent Load at Current Speed

B.4.2.5.3. PUMP MODE OPTION 2 – EEC2 Remote Accelerator Pedal Position (RAPP)

A "remote accelerator" is a pedal or hand throttle typically located outside of the cab used to drive the vehicle. By definition, this parameter is well suited to convey operator input from the pumping platform.

J1939 Parameter and SA Requirements

In Pump Mode, the J1939 network is required to provide EEC2 *Remote Accelerator Pedal Position* from one of the following SAs, in order of TCM preference:

1. SA 49 (Cab Controller) (V)
2. SA 33 (Body Controller)
3. SA 00 (Engine #1)

Caterpillar Engine Requirements

ADEM 4 support of EEC2 *Remote Accelerator Pedal Position* was released June 1, 2006 for the C15 435 OWS rating only. Contact Caterpillar for other ADEM 4 release dates.

Detroit Diesel Engine Requirements

NOTE: DDEC IV & V applications must use Pump Mode Option 1, as these software levels only support EEC2 *Accelerator Pedal Position 2* (APP2).

DDEC support of EEC2 *Remote Accelerator Pedal Position* was released with the introduction of their EPA 2007 engines, which coincides with the introduction of DDEC VI controls.

Normal Operation – Pump Mode

Shift scheduling and modulation are controlled by RAPP. Parameters below are ignored by the TCM:

— EEC2 *Accelerator Pedal Position 1*
— EEC2 Accelerator Pedal Position 2
— CCVS1 Cruise Control States
— CCVS1 PTO Governor State
— EEC2 Percent Load at Current Speed

B.4.2.5.4. PUMP MODE OPTION 3 – EEC2 *Accelerator Pedal Position 1* with an A/B Input Switch

If APP2 or RAPP cannot be supported as a Pump Mode throttle source, then the vehicle configuration must switch throttle sources upstream of the single point of input into the Allison control system. An A/B switch is required between the engine ECM and the Road Mode and Pump Mode throttle inputs.

J1939 Parameter and SA Requirements

During pump mode operation:

— EEC2 *Accelerator Pedal Position 1* must reflect the Pump Mode throttle position.

— If present, EEC2 *Road Speed Limit Status* must not indicate that road speed limiting is active; if it is not present, then EEC1 *Engine Torque Mode* must not indicate road speed limiting is active.

— If present, CCVS1 *Cruise Control States* must not indicate that cruise control is active; if it is not present, then EEC1 *Engine Torque Mode* must not indicate cruise control is active.

— If present, CCVS1 *PTO Governor State* must not indicate that PTO is active.

Cummins Customer Parameter Requirements

Set "Governor Type Switch" to enable variable speed, and wire the switch to be open in Road Mode and closed in Pump Mode. Leave "Governor Type" set to "Automotive", so the engine is variable speed governed in Pump Mode and automotive governed in Road Mode.

Caterpillar Engine Parameter Requirements

Set "Governor Style" to Full Range or Speed.

Normal Operation

In Road Mode, the A/B switch connects the normal ECM accelerator input to the cab throttle; in Pump Mode, the A/B switch connects the normal ECM accelerator input to the platform throttle. The TCM will ignore the following while in Pump Mode:

— EEC2 *Accelerator Pedal Position 2*
— EEC2 Remote Accelerator Pedal Position

B.4.2.5.5. PUMP MODE OPTION 4 – PTO Governor Operation

While less preferred, engine control during Pump Mode may be accomplished via the engine PTO governor controls. Engine speed is incremented or decremented through use of the engine's PTO / Cruise Control switches. To determine an acceptable communication method for a given engine / chassis combination, body builders must contact their chassis manufacturers.

> **WARNING:** During Pump Mode operation, the TCM only listens to ONE input conveying the engine control. If an accelerator pedal parameter is used as the TCM source during Pump Mode, the engine may not be controlled via the engine PTO governor (PTO / Cruise Control switches). Transmission damage may result.

J1939 Parameter and SA Requirements

In Pump Mode, the J1939 network is required to provide CCVS1 *PTO Governor State* (all bit states) from one of the following SAs, in order of TCM preference:

1. SA 39 (Management Computer #1)
2. SA 17 (Cruise Control)
3. SA 00 (Engine #1)

AND

EEC2 *Engine Percent Load at Current Speed* from SA 00 (Engine #1).

Normal Operation – Pump Mode

When CCVS1 *PTO Governor State* indicates PTO is active, the TCM uses EEC2 *Engine Percent Load at Current Speed* for shift scheduling and modulation.

B.4.2.6. *TCM FAILURE MODES AND RESPONSES*

B.4.2.6.1. Loss of Accelerator Input Signals

If Road Mode accelerator input reception is lost during Road Mode operation, or Pump Mode throttle input reception is lost during Pump Mode operation, then a DTC is logged and the Check Trans Indicator is activated. The TCM will use a default throttle value, and shifting will be restricted.

B.4.2.6.2. Incomplete Chassis with Only One Shift Selector Installed

If the vehicle chassis is initially built with only Road Mode controls, GPI BZ must be deactivated via Allison DOC® or DTCs and a Check Trans indication will be set. When equipment installation is completed by the body builder, GPI BZ must be re-enabled for the secondary selector to be functional.

B.4.2.7. *INSTALLATION CHECKLIST: ACCELERATOR INPUT – DUAL MODE OFS UNITS*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer "yes" to the following questions, as applicable:

B.4.2.7.1. General

- ☐ Is the TCM calibration configured properly?
- ☐ Is *Accelerator Pedal Position 1* broadcast from an acceptable SA?
- ☐ Does APP1 span at least 3-98% as the pedal is depressed and released? (0-100% is ideal.)

B.4.2.7.2. PUMP MODE OPTION 1 – APP2

- ☐ Is OFS PUMP MODE: Throttle Input = APP2?
- ☐ Is *Accelerator Pedal Position 2* broadcast from an acceptable source address?
- ☐ In Pump Mode, is APP2 span at least 3–98% as the platform throttle is increased and released? (0-100% is ideal.)

B.4.2.7.3. PUMP MODE OPTION 2 – RAPP

☐ Is OFS PUMP MODE: Throttle Input = RAPP?

☐ Is *Remote Accelerator Pedal Position* broadcast from an acceptable source address?

☐ In Pump Mode, is RAPP span at least 3–98% as the platform throttle is increased and released? (0-100% is ideal.)

B.4.2.7.4. PUMP MODE OPTION 3 – APP1 with an A/B Input Switch

☐ Is OFS PUMP MODE: Throttle Input = SAME AS ROAD MODE THROTTLE SOURCE?

☐ Is APP1 populated with valid data when in either Road or Pump Mode?

☐ In Pump Mode, is APP1 span at least 3–98% as the platform throttle is increased and released? (0-100% is ideal.)

☐ If present on the J1939 network, does EEC2 *Road Speed Limit Status* indicate that road speed limiting is not active while in Pump Mode?

☐ If EEC2 *Road Speed Limit Status* is not present on the J1939 network, does EEC1 *Engine Torque Mode* indicate a state other than road speed limiting?

☐ If present on the J1939 network, does CCVS1 *Cruise Control States* indicate that cruise control is not active while in Pump Mode?

☐ If CCVS1 *Cruise Control States* is not present on the J1939 network, does EEC1 *Engine Torque Mode* indicate a state other than cruise control?

☐ If present on the J1939 network, does CCVS1 *PTO Governor State* indicate PTO is not active?

B.4.2.7.5. PUMP MODE OPTION 4 – PTO Governor Operation

☐ Is OFS PUMP MODE: Throttle Input = SAME AS ROAD MODE THROTTLE SOURCE?

☐ Are CCVS1 *PTO Governor State* and EEC2 *Engine Percent Load at Current Speed* broadcast from acceptable source addresses?

☐ In Pump Mode, does CCVS1 *PTO Governor State* indicate an active state?

B.4.3. ALTERNATE GEAR START (AGS) INPUT

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.3.1. *OVERVIEW*

NEW FOR C/N241 PC RELEASES:

— Expanded automatic launch gear selection to 3000/4000 Series.

— Added VEPS parameters 28100, 28105, and 28106.

In most applications, 1st gear is used to launch the vehicle from a standing start. However, applications such as dock spotters -- or any application where the vehicle is run unloaded and has a high N/V ratio -- drivability can be improved by launching the vehicle in an alternate gear (e.g. 2nd).

There are 2 ways to implement an Alternate Gear Start (AGS) input:

Alternate Gear Start Shift Mask

Shift masks define the available operating ranges and the starting range for a given transmission mode. VEPS is used to assign an Alternate Gear Start shift mask to either primary or secondary mode.

The mode with the AGS shift mask is activated via the Secondary Mode Input function. This implementation associates a specific shift schedule with AGS operation.

Alternate Gear Start Input Function

Here, VEPS is used to assign a J1939 parameter as the AGS input. This implementation does not impact shift scheduling.

In addition to requesting a specific launch gear, the input can be used in 2000 Series 9-speed applications to indicate desire for the TCM to automatically select the optimal launch gear.

B.4.3.2. *AVAILABILITY*

J1939-based AGS for forward ranges is standard in 3000/4000 Series and 2000 Series 9-speed applications.

J1939-based AGS for reverse ranges is standard in 4000 Series 7-speed models with fast reverse and not available in other transmission models.

B.4.3.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be provided to the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[28090] ALTERNATE GEAR START (AGS) INPUT

Set to J1939 TC1 TRANSMISSION REQUESTED LAUNCH GEAR or J1939 TC1 TRANSMISSION REQUESTED LAUNCH GEAR & J1939 TC2 TRANSMISSION REQUESTED REVERSE LAUNCH GEAR to enable TCM parameter reception.

B.4.3.4. *VEPS / ACCT TRIMS*

Automatic launch gear determination may be customized via VEPS trims **[28100] ALTERNATE GEAR START: Custom Mass Breakpoint (kg), [28105] ALTERNATE GEAR START: Custom Grade Breakpoint (% grade), and [28106] ALTERNATE GEAR START: Automatic Configuration**.

2000 Series 9-speed applications have additional trims **[28093] ALTERNATE GEAR START: Automatic Selection Bias** and **[28094] ALTERNATE GEAR START: Allow Shift Selector Override** that influence function operation when automatic launch gear selection is active.

B.4.3.5. *J1939 PARAMETER AND SA USE*

SAs marked (V) may be set to an OEM-specified value via VEPS. See AUTO-DETECTION for SA selection details.

B.4.3.5.1. Required Support

For forward launch gear selection, the J1939 network is required to provide TC1 *Transmission Requested Launch Gear* every 50 ms to DA 03 (Transmission #1), from one of the following SAs in order of TCM preference:

1. SA 49 (Cab Controller) (V)
2. SA 23 (Instrument Cluster #1)
3. SA 05 (Shift Console, Primary) (1)
4. SA 33 (Body Controller)

For reverse launch gear selection, the J1939 network is required to provide TC2 *Transmission Requested Reverse Launch Gear* to DA 03 (Transmission #1), from one of the following SAs in order of TCM preference:

1. SA 49 (Cab Controller) (V)
2. SA 23 (Instrument Cluster #1)
3. SA 05 (Shift Console, Primary) (1)
4. SA 33 (Body Controller)

(1) SA may only be used if the application does not employ an Allison J1939-based selector.

B.4.3.6. *OTHER REQUIREMENTS / RESTRICTIONS*

Only one AGS implementation method (shift mask or J1939 input) may be used in a given application.

When the J1939 input is used, the TCM will only respond to the TC1 *Transmission Requested Launch Gear* and TC2 *Transmission Requested Reverse Launch Gear* values listed under NORMAL OPERATION; all other values are ignored.

B.4.3.7. *OPERATOR INTERFACE*

There are no specific interface requirements for the Alternate Gear Start function. For example, the command may be triggered directly from an operator input, or from a device sensing vehicle weight.

B.4.3.8. *NORMAL OPERATION*

Activation and deactivation depend on both the J1939 input and vehicle operating conditions. The TCM only supports the states discussed below.

B.4.3.8.1. Specific Launch Gear Selection

When use of a specific forward launch gear is desired, the transmitting device is required to send TC1 *Transmission Requested Launch Gear* with a value of either:

— 0010b (Launch the vehicle in 2nd gear; 2000 Series 9-speed, 3000/4000 Series 6-speed, and 4000 Series 7-speed applications with fast reverse)

— 0011b (Launch the vehicle in 3rd gear; 4000 Series 7-speed applications without fast reverse)

When use of a specific reverse launch gear is desired, the transmitting device is required to send TC2 *Transmission Requested Reverse Launch Gear* with a value of:

— 0010b (Launch the vehicle in Reverse 2; 4000 Series 7-speed applications with fast reverse)

If throttle position is ≤ 10%, transmission output shaft speed is ≤ 40 rpm, and the service brake pedal is depressed, the TCM will activate Alternate Gear Start operation based on the requested operator direction (Forward or Reverse).

The TCM may honor preselect requests below the alternate launch gear.

B.4.3.8.2. Automatic Launch Gear Selection

When it is desired that the TCM select the optimum launch gear, the transmitting device is required to send 1101b (Allow transmission to select the optimum launch gear). The TCM will then automatically select a launch gear based on engine and vehicle operating conditions.

B.4.3.8.3. 2000 Series 9-speed Shift Selector Override

The 2000 Series 9-speed Shift Selector Override capability allows the operator to (a) choose a desired starting range when AGS is not active, or (b) override the starting range requested through the AGS function.

The operator's requested override state will remain in effect until (a) Drive is re-selected while already in Drive, or (b) a key switch cycle occurs.

The override functionality is not available in applications with manual shift selector shaft.

B.4.3.8.4. Deactivating Alternate Gear Start

When forward Alternate Gear Start operation is no longer desired, the transmitting device is required to send TC1 *Transmission Requested Launch Gear* with a value of 0000b (No specific launch gear requested; use default launch gear).

When reverse Alternate Gear Start operation is no longer desired, the transmitting device is required to send TC2 *Transmission Requested Reverse Launch Gear* with a value of 0000b (No specific Reverse launch gear requested; use default Reverse launch gear).

If throttle position is ≤ 10% and transmission output shaft speed is ≤ 40 rpm, the TCM will deactivate Alternate Gear Start operation.

B.4.3.9. *TCM FAILURE MODES & RESPONSES*

If *Transmission Requested Launch Gear* reception is lost, indicates 1110b (Error) or 1111b (Not Available) while the forward Alternate Gear Start function is active, AGS will deactivate after a timeout period and the transmission will revert to the default starting range.

If *Transmission Requested Reverse Launch Gear* reception is lost, indicates 1110b (Error) or 1111b (Not Available) while the reverse Alternate Gear Start function is active, AGS will deactivate after a timeout period and the transmission will revert to the default starting range.

TCM failure to receive *Transmission Requested Launch Gear* and/or *Transmission Requested Reverse Launch Gear* may be the result of bus loading, wiring integrity failures, electrical noise, or improper function implementation. Vehicle OEMs should consider such failures during their design process.

B.4.3.10. *INSTALLATION CHECKLIST: ALTERNATE GEAR START*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer “yes” to the following questions where applicable:

- ☐ Is the TCM calibration configured properly?
- ☐ Is TC1 *Transmission Requested Launch Gear* being sent from one of the acceptable SAs?
- ☐ Is TC2 *Transmission Requested Reverse Launch Gear* being sent from one of the acceptable SAs?
- ☐ Does the transmitting device send appropriate state values when forward Alternate Gear Start operation is desired?
- ☐ Does the transmitting device send appropriate state values when reverse Alternate Gear Start operation is desired?
- ☐ Does the transmitting device send TC1 *Transmission Requested Launch* with a value of 0000b when forward Alternate Gear Start operation is no longer desired?
- ☐ Does the transmitting device send TC2 *Transmission Requested Reverse Launch* with a value of 0000b when reverse Alternate Gear Start operation is no longer desired?

B.4.4. ANTI-LOCK BRAKE SYSTEM (ABS) INPUT

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.4.1. *OVERVIEW*

ABS systems manage wheel skids through manipulation of service brakes and other retarding devices. If an application incorporates ABS, the TCM must be notified when ABS events occur.

B.4.4.2. *AVAILABILITY*

The J1939-based implementation is standard in all 1000 – 4000 Series applications.

B.4.4.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be provided to the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[25000] ANTI-LOCK BRAKE SYSTEM (ABS) INPUT

Set answer to EITHER GPI Y OR PRIMARY ON-VEHICLE PROTOCOL or ONLY PRIMARY ON-VEHICLE PROTOCOL to enable J1939 parameter reception.

[20100] RETARDER: Cancel Retarder when ABS Input is Active

When set to YES, retarder operation is canceled when the input defined by **[25000] ANTI-LOCK BRAKE SYSTEM (ABS) INPUT** indicates an ABS event is occurring. When set to NO, it is not.

WARNING: If retarder response to discrete ABS input(s) is disabled, the OEM is responsible for ensuring appropriate retarder deactivation (via TSC1 commands) during qualified ABS events.

B.4.4.4. *J1939 PARAMETER AND SA USE*

B.4.4.4.1. Required Support

The J1939 network is required to provide EBC1 *Anti-Lock Braking (ABS) Active* from SA 11 (Brakes – System Controller).

In Allison retarder applications, if **RETARDER: Cancel Retarder when ABS Input is Active** = NO, broadcast of proper TSC1 torque limits to the driveline retarder during ABS events is required**.**

B.4.4.4.2. Optional Support

Allison retarder applications also process TSC1 Torque Limits sent to DA 16 (Retarder – Driveline) from up to six configurable SAs. The following SAs are configured by default:

- SA 00 (Engine #1) (V)
- SA 11 (Brakes – System Controller) (V)
- SA 17 (Cruise Control) (V)
- SA 33 (Body Controller) (V)
- SA 39 (Management Computer #1) (V)
- SA 42 (Headway Controller) (V)

NOTE: TSC1 message reception is not a substitute for EBC1 *Anti-Lock Braking (ABS) Active*, as it does not invoke the full TCM ABS response.

B.4.4.5. *NORMAL OPERATION*

When the VEPS-defined discrete input indicates an ABS event is occurring:

- GPI Y is active and / or,
- EBC1 *Anti-Lock Braking (ABS) Active* indicates 01b (ABS active),

The TCM will:

- Disengage the torque converter lockup clutch. Disconnecting the engine from the driveline helps prevent engine stall, thereby helping the operator maintain vehicle control. It also reduces potential wheel skids caused by braking effects of the base engine.
- Modify downshift points, and inhibit shifts (except during hold override) to minimize torque disturbances in the driveline.
- Cancel Allison retarder operation (unless this capability is disabled via VEPS). This reduces wheel skid that could be caused by output retarder braking.

In Allison retarder applications, a properly formatted TSC1 Torque Limit or Torque Command of 0% will *also* cause the TCM to drop retarder operation. TSC1 messages may cause the retarder to drop out slightly sooner than *Anti-Lock Braking (ABS) Active*, as TSC1 messages to the retarder use a faster 50 ms rate versus the EBC1 100 ms broadcast rate.

TSC1 messages allow ABS to "stage" its control over the vehicle braking system(s) when the differential wheel slip is great enough to take action, but not enough to begin actively modulating the brake pressure. This situation may or may not precede an actual ABS event where *Anti-Lock Braking (ABS) Active* indicates "Active".

B.4.4.6. *TCM FAILURE MODES & RESPONSES*

Failure for Allison to receive J1939 information may be the result of – but not limited to – bus loading, wiring integrity failures, electrical noise, or improper function implementation. Vehicle OEMs should consider such failures during their design process.

B.4.4.6.1. Loss of Anti-Lock Braking ABS Active Reception

> **WARNING:** If the TCM fails to receive *Anti-Lock Braking (ABS) Active* state 01b during ABS events occurring under hard braking, the engine may stall.

If *Anti-Lock Braking (ABS) Active* reception is lost, the transmission will revert to normal operation after a timeout period expires.

B.4.4.6.2. Loss of TSC1 Reception (Allison Retarder Applications Only)

If the ABS system is only restricting or limiting retarder output torque via TSC1 commands, and the TCM loses TSC1 reception, the command will remain active until a timeout is reached. Subsequent TCM response is then dependent on the calibration configuration:

[20100] RETARDER: Cancel Retarder when ABS Input is Active = YES

The retarder will be disabled if the inputs defined by **[25000] ANTI-LOCK BRAKE SYSTEM (ABS) INPUT** indicate an active ABS event.

[20100] RETARDER: Cancel Retarder when ABS Input is Active = NO

The retarder will not disengage during ABS events unless its enable command signal (J1939 *Retarder Selection, Non-Engine*, or analog RMR input) is also no longer available.

B.4.4.7. *INSTALLATION CHECKLIST: ABS*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer "yes" to all of the following questions:

- ☐ Is the TCM calibration configured properly?
- ☐ Is the vehicle ABS system connected to J1939, and is EBC1 *Anti-Lock Braking (ABS) Active* supported?
- ☐ Does *Anti-Lock Braking (ABS) Active* indicate "active" during an ABS event?
- ☐ Does the ABS system support proper TSC1 control of the driveline retarder for installations where VEPS/ACCT option **RETARDER:** Cancel Retarder when **ABS Input is Active** = NO?

B.4.5. AUTOMATIC TRACTION CONTROL (ATC OR ASR)

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.5.1. *OVERVIEW*

Traction Control, also known as Automatic Slip Reduction, is sometimes incorporated in ABS or brake system controllers. When wheel spin is detected, the traction controller may reduce engine torque output via a series of TSC1 commands, and / or apply the foundation brakes to redirect power to the drive wheels with traction.

The TCM needs to be aware of ASR activity, as TSC1 commands sent to the engine will affect the relationship between engine output and throttle pedal position. In addition, the TSC1 commands may interact with those issued by the TCM.

B.4.5.2. *AVAILABILITY*

The J1939-based implementation is standard in all 1000 – 4000 Series applications.

B.4.5.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be provided to the CAN port set to SAE J1939 FULL FUNCTIONALITY.

B.4.5.4. *J1939 PARAMETER AND SA USE*

B.4.5.4.1. Required Support

The J1939 network is required to provide one of the following:

- EBC1 *ASR Engine Control Active* from SA 11 (Brakes – System Controller)
- EEC1 *Engine Torque Mode* (specifically state 0101b) from SA 00 (Engine #1)

EBC1 *ASR Engine Control Active* is the preferred data source. If it is present on the J1939 network, the TCM will ignore state 0101b (ASR Control) from EEC1 *Engine Torque Mode*.

B.4.5.4.2. Optional Support

While not required, the TCM will also respond to EBC1 *ASR Brake Control Active* when sent from SA 11 (Brakes – System Controller).

B.4.5.5. *OTHER REQUIREMENTS / RESTRICTIONS*

Allison controls are compatible with traction control systems as long as they utilize TSC1 torque limits with a TSC1 *Override Control Mode Priority* of 10b (Medium priority). TSC1 commands of differing priority may interfere with those issued by the TCM.

Allison only sends TSC1 commands to the engine with a TSC1 *Override Control Mode Priority* of 10b (Medium priority). Experience has shown that when multiple TSC1 torque limits are simultaneously sent to the engine, the components involved normally desire the lowest torque limit to be acted upon. Per the SAE-defined Engine Override Control Mode arbitration process, the only way to ensure this outcome is to use a common control mode and priority level.

B.4.5.6. *NORMAL OPERATION*

When any of the monitored parameter(s) indicate that an ASR event is occurring:

- EBC1 *ASR Engine Control Active* = 01b (ASR engine control active)
- EEC1 *Engine Torque Mode* = 0101b (ASR control)
- EBC1 *ASR Brake Control Active* = 01b (ASR brake control active)

…upshifts are inhibited for a period of time, or until engine speed exceeds the calibrated engine governed speed. Upshifts are allowed after the timer expires, or when engine speed rises above governed speed, even if the current ASR event remains active. This logic reduces shift cycling and minimizes driveline disturbance during traction control events.

The TCM does not adapt shifts while an active ASR event is indicated.

ASR events do not impact torque converter lockup clutch operation.

B.4.5.7. *TCM FAILURE MODES & RESPONSES*

Failure for Allison to receive this information may be the result of – but not limited to – bus loading, wiring integrity failures, electrical noise, or improper function implementation. Vehicle OEMs should consider such failures during their design process.

If an ASR indication is not provided during wheel spin, shift cycling may occur and the TCM will adapt to those shifts. Subsequent shifts under traction may flare, leading to excessive heat generation and premature clutch wear.

B.4.6. AUTOMATIC NEUTRAL – BRAKE-BASED (BBAN) INPUT

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.6.1. *OVERVIEW*

NEW FOR B/C/N240 PSC RELEASES: BBAN interaction with Neutral At Stop has been revised.

Brake-Based Auto-Neutral (BBAN) facilitates automatic shifts between Neutral and the forward starting range based on service brake input. BBAN uses GPI CA (AUTOMATIC NEUTRAL – BRAKE-BASED (BBAN) INPUT) and a J1939 Brake Switch input. See BBAN IMPLEMENTATION EXAMPLE for intended use.

B.4.6.2. *AVAILABILITY*

BBAN is optional with certain 1000 – 4000 Series vocational models. Customer Integration Engineering review is required.

B.4.6.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be provided to the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[24000] GENERAL PURPOSE INPUTS AND OUTPUTS (GPIO) PACKAGE

The selected package must assign GPI CA to a wire.

[25055] AUTOMATIC NEUTRAL BRAKE-BASED (BBAN) INPUT

Set to GPI CA AND SERVICE BRAKE STATUS IF DEFINED IN SELECTED GPIO PACKAGE.

[25300] SERVICE BRAKE STATUS INPUT

Set answer to J1939 CCVS1 BRAKE SWITCH or J1939 EBC1 EBS BRAKE SWITCH to enable TCM parameter reception.

B.4.6.3.1. VEPS / ACCT Trims

The following trims influence function operation:

- [25060] AUTOMATIC NEUTRAL: Brake-Based Auto-Neutral Preselect Range
- [25070] AUTOMATIC NEUTRAL: Maximum Output Speed for PTO
- [25065] AUTOMATIC NEUTRAL: Maximum Output Speed for Brake-Based Auto-Neutral

B.4.6.4. *J1939 PARAMETER AND SA USE*

B.4.6.4.1. Required Support

The J1939 network is required to provide one of the J1939 brake switch parameters as described under SERVICE BRAKE STATUS INPUT.

B.4.6.5. *OPERATOR INTERFACE*

B.4.6.5.1. Required Support – Wired Enable Switch

A wired enable switch (GPI CA) is required for this function, as described under BBAN in Allison 6th Generation Controls Installation Manual Section D: "Vehicle System Electrical Interface".

B.4.6.5.2. Optional Support

An optional signal may be used to inform the operator that BBAN is active. Since a "Range Inhibit" condition exists when BBAN is active, any Range Inhibit indication can be used, including:

- The Range Inhibit indication employed by Allison J1939-based shift selectors.
- The Range Inhibit indication employed by any customer-designed J1939-based shift selector.
- A separate Range Inhibit Indicator as described in function RANGE INHIBIT INDICATOR (RII).

B.4.6.6. *OTHER REQUIREMENTS / RESTRICTIONS*

B.4.6.6.1. GPIO Support

GPI CA implementation is required for BBAN. See GPI CA in Allison 6th Generation Controls Installation Manual Section E: "Using Input / Output (I/O) Functions, Packages, & Groups".

B.4.6.6.2. Anti-Rollback or "Hill Holder" Requirement

WARNING: The AUTOMATIC NEUTRAL – BRAKE-BASED (BBAN) INPUT function requires installation of an anti-rollback feature (or "hill holder") on the vehicle to prevent inadvertent rollback during Neutral states associated with the function.

It is the responsibility of the vehicle manufacturer to design and install the anti-rollback feature to ensure satisfactory operation during all BBAN operating modes, including:

- BBAN activation, where the TCM is automatically shifting the transmission into Neutral, or holding the transmission in Neutral.
- BBAN deactivation, where the TCM is automatically shifting the transmission from Neutral to Drive.
- BBAN deactivation during a failure mode response, where the TCM latches the transmission in Neutral and does not allow an automatic return to range.

To ensure the above requirement is met, Customer Integration Engineering review is required.

B.4.6.6.3. PTO Engagement

In applications using schematic CA1, the PTO drive is required to be engaged when Neutral is attained. This discourages the operator from driving the vehicle for long periods of time with the function active, and repeatedly generating high rpm Neutral to Drive shifts.

B.4.6.6.4. Diagnostics

For all BBAN implementations, the vehicle OEM is required to implement specific diagnostics and responses. See VEHICLE SYSTEM FAILURE MODES & RESPONSES.

B.4.6.6.5. Allison Function Compatibility

BBAN cannot be used in conjunction with the following Allison functions or their J1939 equivalents:

- GPI CF (AUTOMATIC NEUTRAL – IDLE START / STOP)
- GPI J (FIRE TRUCK PUMP MODE (4TH LOCKUP))
- GPI AG (AUTOMATIC NEUTRAL – DUAL INPUT)

— GPI AK (AUTOMATIC NEUTRAL – DUAL INPUT WITH SERVICE BRAKE STATUS)

B.4.6.7. *NORMAL OPERATION*

The preselect defined by **[25060] AUTOMATIC NEUTRAL: Brake-Based Auto-Neutral Preselect Range** is invoked whenever the GPI is active (on).

BBAN will activate when all of the following are true for a calibrated period of time:

— BBAN GPI CA is active (on)

— The J1939 brake switch input is active

— Throttle position and output shaft speed are below calibrated values

— A forward range has been selected, commanded or attained

— No ABS events are active or pending

— A shift is not currently in process

— Neither ANSI, ANSISSO nor ANDI w/ARTR are active

— There are no active DTCs pertaining to the J1939 brake switch input, output shaft speed sensor, turbine speed sensor or shift selector.

— The vehicle has moved (turbine speed has risen above a calibrated value) within the last 3 activations of the function.

When BBAN is activated, Neutral is commanded. Once Neutral is attained, the TCM will activate the applicable TCM Range Inhibit indications (e.g. flash the requested range display).

BBAN will deactivate and attempt a shift to the applicable forward range if any of the following become true:

— The J1939 brake switch input transitions from active to inactive

— BBAN GPI CA deactivates (is turned off)

— The operator manually re-selects a range

— Output shaft speed exceeds a customer-defined calibration value.

B.4.6.7.1. Allison Function Interactions

AFRI – Single Input

The J1939-based version of GPI E (AUXILIARY FUNCTION RANGE INHIBIT – SINGLE INPUT) is compatible with BBAN (the GPI version is compatible as well, but is currently not offered in any GPIO packages with BBAN).

Normally AFRI will not let the transmission go into range unless the brake pedal is depressed. This is true with BBAN, except when Neutral has been achieved due to BBAN activation. In that case, AFRI is overridden when the brake pedal is released, so the transmission can automatically return to range.

Neutral At Stop

BBAN can be used in conjunction with either Neutral At Stop Standard or Premium functions, subject to the following behavior:

Neutral At Stop will not activate while GPI CA is active.

If GPI CA is activated after Neutral At Stop has already become active, Neutral at Stop will be cancelled, and BBAN will activate when all other activation criteria are met.

If GPI CA is inactive, Neutral At Stop will activate when the vehicle comes to a stop and all other activation criteria are met.

Other Automatic Neutral Functions

If any of the following functions:

— GPI L (AUTOMATIC NEUTRAL – SINGLE INPUT)

— GPI CH (AUTOMATIC NEUTRAL – SINGLE INPUT, INVERTED)

— GPI CD (AUTOMATIC NEUTRAL – SINGLE INPUT WITH SHIFT SELECTOR OVERRIDE)

— GPI CN (AUTOMATIC NEUTRAL – DUAL INPUT WITH AUTOMATIC RETURN TO RANGE), or the J1939-based equivalent

…activate while BBAN is enabled, the automatic-return-to-range capability of BBAN is canceled. The operator must manually re-select range via the shift selector.

B.4.6.7.2. BBAN Implementation Example

1. As a refuse hauler pulls up to retrieve and empty a residential trash container, the operator turns on the BBAN enable switch.
2. The TCM invokes the BBAN preselect.
3. The service brakes are applied and the vehicle comes to a stop.
4. If all activation criteria are met, BBAN becomes active (typically as the vehicle passes through the

output speed threshold), the transmission shifts into Neutral, and the requested range display begins to flash (range inhibit indicator also comes on). The operator continues to apply the service brakes.

5. The vehicle system engages the PTO drive and increases engine rpm to assist in the hydraulic operation of the container arm.

6. Once the container has been retrieved, dumped, and replaced, the operator releases the brake pedal and depresses the accelerator to move to the next container. Transmission re-engagement begins when the brake pedal is released and engine speed drops to an acceptable level.

7. The vehicle OEM anti-rollback device prevents the vehicle from rolling while high idle is disengaged, engine rpm decreases, and the operator transitions from the service brakes to the accelerator pedal.

8. When shift criteria are met, the transmission shifts into Drive and the vehicle moves away.

B.4.6.8. *TCM FAILURE MODES & RESPONSES*

B.4.6.8.1. Invalid Brake Switch Data While BBAN is Active

If the service brake pedal is depressed and BBAN is active, and the J1939 Brake Switch signal then indicates 10b (Error), 11b (Not Available) or reception is lost, the TCM will latch the transmission in Neutral. PTO engagement and engine high idle operation are maintained. When the brake pedal is released, the operator will have to manually re-select range via the shift selector.

B.4.6.8.2. Brake Switch Rationality Check

The TCM continually evaluates the J1939 brake switch parameter. If several vehicle accelerations are detected while 01b (brake pedal depressed) is indicated, DTC P0703 is set and BBAN can no longer be activated. The Check Trans Indicator is not activated.

B.4.6.9. *VEHICLE SYSTEM FAILURE MODES & RESPONSES*

The vehicle system <u>is required</u> to detect any brake switch failures and indicate 10b (Error) in the appropriate J1939 brake switch parameter within 3 seconds of detection.

B.4.6.10. *INSTALLATION CHECKLIST: BBAN*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer “yes” to all questions in the following test sequences:

B.4.6.10.1. General

- ☐ Is the TCM calibration configured properly?

B.4.6.10.2. Inputs

- ☐ Is the brake switch information provided from an acceptable parameter and source address?
- ☐ Is GPI CA wired properly per the chosen schematic found in Sales Tech Data?

B.4.6.10.3. Normal Operation

- ☐ When the BBAN activation criteria are met, does the transmission shift to Neutral when the brake pedal is depressed?
- ☐ In applications using schematic CA1, does the PTO drive engage when the transmission goes to Neutral?
- ☐ Does the transmission return to range when the brake pedal is released?
- ☐ Does the vehicle OEM’s hill-holder maintain vehicle position during the time period between service brake release and driveline re-engagement?

B.4.6.10.4. Failure Modes

With BBAN active, disconnect the brake switch input from the component broadcasting the J1939 signal:

- ☐ Does the J1939 Brake Switch signal indicate 10b (Error) within 3 seconds of detection?
- ☐ Does the vehicle OEM’s hill-holder maintain vehicle position when the TCM latches Neutral?

B.4.7. AUTOMATIC NEUTRAL – DUAL INPUT (ANDI)

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.7.1. *OVERVIEW*

Automatic Neutral – Dual Input achieves Neutral when requested while the vehicle is at a stop. When requested to return to range (service brake required when configured), the transmission will automatically return to range.

In addition to the J1939 implementation discussed here, ANDI and ANDI with Service Brake Status can also be accomplished via a GPI AG or AK; see the Allison 6th Generation Controls Installation Manual.

B.4.7.2. *AVAILABILITY*

The J1939-based implementation is optional in 3000 – 4000 Series applications, but access is restricted. Please contact your Allison Customer Integration Engineering representative for details

B.4.7.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be provided to the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[25043] AUTOMATIC NEUTRAL – DUAL INPUT

Set answer to J1939 TRANSMISSION AUTO-NEUTRAL AUTO RETURN INTERFACE to enable TCM parameter reception.

[25046] AUTOMATIC NEUTRAL – DUAL INPUT WITH SERVICE BRAKE STATUS

Set answer to J1939 TRANSMISSION AUTO-NEUTRAL AUTO RETURN INTERFACE to enable TCM parameter reception.

[25300] SERVICE BRAKE STATUS INPUT

Set answer to J1939 CCVS1 BRAKE SWITCH or J1939 EBC1 EBS BRAKE SWITCH to enable TCM parameter reception when using AUTOMATIC NEUTRAL – DUAL INPUT WITH SERVICE BRAKE STATUS.

[29320] J1939 SA: TC3

Parameter is required to be set to the source address of the controller that is sending TC3 *Transmission Auto-Neutral (Auto-Return) Enable Switch* and TC3 *Transmission Auto-Neutral (Auto-Return) Request*. The TCM does not auto-detect the source addresses of these signals. Both signals must be sent by the same controller.

B.4.7.3.1. VEPS / ACCT Trims

Trim **[25050] AUTOMATIC NEUTRAL: Maximum Output Speed for Dual Input Functions** will influence PTO operation when ANDI is active.

B.4.7.4. *J1939 PARAMETER AND SA USE*

Items marked (V) can be modified via VEPS. Parameters may be enabled or disabled and SAs may be set to an OEM-specified value. See AUTO-DETECTION for SA selection details.

B.4.7.4.1. Required Broadcast Support

The J1939 network is required to provide TC3 *Transmission Auto-Neutral (Auto-Return) Enable Switch* and TC3 *Transmission Auto-Neutral (Auto-Return) Request* from the configured source address.

NOTE: The SAE J1939 TC3 checksum definition is flawed. Therefore, the TCM does not evaluate the TC3 counter or checksum values.

When using AUTOMATIC NEUTRAL – DUAL INPUT WITH SERVICE BRAKE STATUS, the J1939 network is also required to provide one of the J1939 brake switch parameters as described under SERVICE BRAKE STATUS INPUT.

B.4.7.4.2. Required Reception Support

The vehicle system is required to receive ETC15 *Transmission Auto-Neutral (Auto-Return) Function State* and ETC15 *Transmission Auto-Neutral (Auto-Return) Request Feedback* from SA 03 (Transmission #1).

B.4.7.5. *OTHER REQUIREMENTS / RESTRICTIONS*

WARNING: The TCM determines the response to all TC3 Transmission Auto-Neutral (Auto-Return) Request parameter values. The vehicle OEM assumes sole and full responsibility for ensuring the transmitting controller conveys no unintentional Transmission Auto-Neutral (Auto-Return) Request (SPN 21252) values to the TCM, during normal operation or any failure modes.

J1939-based ANDI may not be used in the same application with the following functions or their J1939 equivalents:

— GPI L AUTOMATIC NEUTRAL – SINGLE INPUT

— GPI CH (AUTOMATIC NEUTRAL – SINGLE INPUT, INVERTED)

— GPI CD AUTOMATIC NEUTRAL – SINGLE INPUT WITH SELECTOR OVERRIDE

— GPI CN (AUTOMATIC NEUTRAL – DUAL INPUT WITH AUTOMATIC RETURN TO RANGE)

— GPI CF (AUTOMATIC NEUTRAL – IDLE START / STOP)

— GPO S (NEUTRAL INDICATOR FOR PTO OUTPUT)

B.4.7.6. *NORMAL OPERATION*

If a forward or reverse range is selected and attained, output speed is below a calibrated speed threshold, and throttle is below a calibrated level, the function will activate and command the transmission to Neutral when:

— TC3 *Transmission Auto-Neutral (Auto-Return) Enable Switch* is received with a value of 01b (Transmission Auto-Neutral (Auto-Return) Function Enabled)

AND

— TC3 *Transmission Auto-Neutral (Auto-Return) Request* transitions from 00b (No request) to 01b (Request to shift to (or maintain) Auto-Neutral state).

While in this state, the RANGE INHIBIT INDICATOR function is active, and the Allison shift selector display flashes the requested range digit.

To return to the previously selected forward range,

— The function must not have been terminated or disabled

AND

— TC3 *Transmission Auto-Neutral (Auto-Return) Enable Switch* = 01b (Transmission Auto-Neutral (Auto-Return) Function Enabled

AND

— TC3 *Transmission Auto-Neutral (Auto-Return) Request* transitions from 01b (Request to shift to (or maintain) Auto-Neutral state) to 10b (Request to shift from Auto-Neutral state to previous direction)

This function does not allow automatic return to a reverse range. If AUTOMATIC NEUTRAL – DUAL INPUT is activated from a reverse range, the function is terminated and the transmission remains in Neutral until the operator reselects a forward or reverse range.

The operator can terminate this function by manually selecting a range (Drive, Neutral, Reverse) on the shift selector.

After the function is terminated, subsequent function activation requires cycling of TC3 *Transmission Auto-Neutral (Auto-Return) Request*.

AUTOMATIC NEUTRAL – DUAL INPUT is disabled when the TCM receives TC3 *Transmission Auto-Neutral (Auto-Return) Enable Switch* with a value of 00b (Transmission Auto-Neutral (Auto-Return) Function Disabled).

B.4.7.7. *SIGNAL INITIALIZATION*

Upon initialization, the J1939 device that controls the Automatic Neutral request shall initialize the TC3 *Transmission Auto-Neutral (Auto-Return) Request signal to a value of* 00b (No request).

B.4.7.8. *TCM FAILURE MODES & RESPONSES*

If reception of the TC3 message is lost, function operation is terminated.

B.4.7.9. *INSTALLATION CHECKLIST: ANDI*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer “yes” to all questions in the following test sequence:

☐ Is the TCM calibration configured properly?

☐ Are all parameter and SA requirements met?

B.4.8. AUTOMATIC NEUTRAL – DUAL INPUT W/AUTOMATIC RETURN TO RANGE

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.8.1. *OVERVIEW*

Automatic Neutral – Dual Input w/Automatic Return to Range (ANDI w/ARTR) achieves Neutral when the operator applies the parking brake while the vehicle is at a stop. When the service brake is applied and the parking brake then released, the transmission will automatically return to range.

In addition to the J1939 implementation discussed here, ANDI w/ARTR can also be accomplished via a GPI CN; see the Allison 6th Generation Controls Installation Manual.

B.4.8.2. *AVAILABILITY*

The J1939-based implementation is optional in 1000 – 4000 Series applications.

B.4.8.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be provided to the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[25045] AUTOMATIC NEUTRAL – DUAL INPUT WITH AUTOMATIC RETURN TO RANGE

Set answer to J1939 CCVS1 PARKING BRAKE SWITCH to enable TCM parameter reception.

[25300] SERVICE BRAKE STATUS INPUT

Set answer to J1939 CCVS1 BRAKE SWITCH or J1939 EBC1 EBS BRAKE SWITCH to enable TCM parameter reception.

B.4.8.3.1. VEPS / ACCT Trims

Trim **[25050] AUTOMATIC NEUTRAL: Maximum Output Speed for Dual Input Functions** will influence function operation.

B.4.8.4. *INTERACTION WITH OTHER ALLISON FUNCTIONS*

ANDI w/ARTR **may** be used in the same application as NEUTRAL AT STOP or AUTOMATIC NEUTRAL – BRAKE-BASED (BBAN) INPUT. In all cases, ANDI w/ARTR will take priority over the above functions.

B.4.8.5. *J1939 PARAMETER AND SA USE*

Items marked (V) can be modified via VEPS. Parameters may be enabled or disabled, and SAs may be set to an OEM-specified value. See AUTO-DETECTION for SA selection details.

B.4.8.5.1. Required Support

The J1939 network is required to provide *CCVS1 Parking Brake Switch* from one of the following SAs, in order of TCM preference:

1. SA 17 (Cruise Control) (V)
2. SA 49 (Cab Controller)
3. SA 39 (Management Computer #1)
4. SA 23 (Instrument Cluster #1)
5. SA 33 (Body Controller)
6. SA 00 (Engine #1)

The J1939 network is also required to provide one of the J1939 brake switch parameters as described under SERVICE BRAKE STATUS INPUT.

B.4.8.6. *OTHER REQUIREMENTS / RESTRICTIONS*

> **WARNING:** ANDI w/ARTR activation does not activate GPO S (NEUTRAL INDICATOR FOR PTO OUTPUT).

> **CAUTION:** When this function is enabled via VEPS, the transmission will shift into Neutral whenever the vehicle is stopped and the parking brake is applied. As such, the parking brake can no longer be used independent of the service brakes as a "hill holder" while driving.
>
> For example, if a vehicle stops on a grade and the parking brake is applied, the transmission will shift to Neutral. To resume driving, the operator must apply the service brakes before releasing the parking brake in order to prevent vehicle rollback.

J1939-based ANDI w/ARTR may not be used in the same application with the following functions or their J1939 equivalents:

— GPI L (AUTOMATIC NEUTRAL – SINGLE INPUT)

— GPI CH (AUTOMATIC NEUTRAL – SINGLE INPUT, INVERTED)

— GPI CD AUTOMATIC NEUTRAL – SINGLE INPUT WITH SELECTOR OVERRIDE

— GPI AG (AUTOMATIC NEUTRAL – DUAL INPUT)

— GPI AK (AUTOMATIC NEUTRAL – DUAL INPUT WITH SERVICE BRAKE STATUS)

— GPI CF (AUTOMATIC NEUTRAL – IDLE START / STOP)

— GPO S (NEUTRAL INDICATOR FOR PTO OUTPUT)

B.4.8.7. *NORMAL OPERATION*

For each key switch cycle, ANDI w/RTR logic must observe two brake switch input cycles before it will respond to a park brake request to go to Neutral.

After brake switch input operation is confirmed: If a forward range is selected and vehicle speed is below a calibrated speed limit, the function will activate and command the transmission to Neutral when *Parking Brake Switch* transitions from 00b (parking brake not set) to 01b (parking brake set).

While in this mode, the shift selector display will flash the requested range digit.

To resume operation in the selected drive range, the service brakes must first be applied, and then *Parking Brake Switch* must transition from 01b to 00b. The transmission will then automatically return to the previously selected range. In addition, the operator can override ANDI w/RTR by manually re-selecting a range on the shift selector.

Function activation is limited to three times within a given stop cycle. After the vehicle has moved, the function may be activated again.

B.4.8.8. *TCM FAILURE MODES & RESPONSES*

B.4.8.8.1. Loss of Communication

Prior to ANDI w/ARTR being active

If J1939-based service brake status input reception is lost or indicates 10b (error) or 11b (not available) while the function is inactive (transmission is in range), the transmission will still automatically shift to Neutral when the parking brake is applied. However, it will not automatically return to range when the parking brake is released; the operator must re-select range to exit the function. No DTCs are set.

If CCVS1 *Parking Brake Switch* reception is lost or indicates 10b (error) or 11b (not available) while the function is inactive, the transmission will not automatically shift to Neutral when the parking brake is physically applied. No DTCs are set.

After ANDI w/ARTR is active

If either the J1939-based service brake status input or *Parking Brake Switch* reception are lost or indicates 10b (error) or 11b (not available) while the function is active (transmission is in Neutral), the transmission will not automatically return to range. The operator must re-select range to exit the function. No DTCs are set.

B.4.8.8.2. Brake Switch Rationality Check

The TCM continually evaluates the J1939 brake switch parameter. If several vehicle accelerations are detected while 01b (brake pedal depressed) is indicated, DTC P0703 is set and ANDI w/ARTR automatic return-to-range capability is canceled. The operator must manually re-select a range to exit Neutral. The Check Trans Indicator is not activated.

B.4.8.9. *INSTALLATION CHECKLIST*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer “yes” to all questions in the following test sequence:

☐ Is the TCM calibration configured properly?

☐ While in Drive with the engine running, set the parking brake. Does a shift to Neutral occur?

☐ Apply the service brakes, and then release the parking brake. Does a Neutral-to-range shift occur?

B.4.9. AUTOMATIC NEUTRAL – SINGLE INPUT (ANSI)

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.9.1. *OVERVIEW*

Automatic Neutral – Single Input (ANSI) commands the transmission to neutral when the park brake is applied, regardless of range requested on the shift selector. To shift out of Neutral, the operator must release the park brake and re-select a range.

This function can also be accomplished via GPI L (AUTOMATIC NEUTRAL – SINGLE INPUT) or GPI CH (AUTOMATIC NEUTRAL – SINGLE INPUT, INVERTED). See the Allison 6th Generation Controls Installation Manual for details.

B.4.9.2. *AVAILABILITY*

The J1939-based implementation is optional in 1000 – 4000 Series applications, but not available with EVS and OFS vocational models.

B.4.9.3. *CONFIGURATION (VEPS / ACCT)*

[18000] THROTTLE AND LOAD SOURCE
Set to PRIMARY ON-VEHICLE PROTOCOL.

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2
Parameters must be provided to the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[25030] AUTOMATIC NEUTRAL – SINGLE INPUT
Set answer to J1939 CCVS1 PARKING BRAKE SWITCH OR PT-CAN to enable TCM parameter reception.

B.4.9.3.1. VEPS / ACCT Trims

Trim **[25070] AUTOMATIC NEUTRAL: Maximum Output Speed for PTO** will influence PTO operation when ANSI is active.

B.4.9.4. *J1939 PARAMETER AND SA USE*

Items marked (V) can be modified via VEPS. Parameters may be enabled or disabled and SAs may be set to an OEM-specified value. See AUTO-DETECTION for SA selection details.

B.4.9.4.1. Required Support

The J1939 network is required to provide CCVS1 *Parking Brake Switch* from one of the following SAs, in order of TCM preference:

1. SA 17 (Cruise Control) (V)
2. SA 49 (Cab Controller)
3. SA 39 (Management Computer #1)
4. SA 23 (Instrument Cluster #1)
5. SA 33 (Body Controller)
6. SA 00 (Engine #1)

B.4.9.5. *OTHER REQUIREMENTS / RESTRICTIONS*

WARNING: ANSI activation does not activate output function GPO S (NEUTRAL INDICATOR FOR PTO OUTPUT).

CAUTION: When this function is enabled via VEPS, the transmission will shift into Neutral whenever the vehicle is stopped and the parking brake is applied. As such, the parking brake can no longer be used independent of the service brakes as a “hill holder” while driving.

For example, if a vehicle stops on a grade and the parking brake is applied, the transmission will shift to Neutral. To resume driving, the operator must apply the service brakes before releasing the parking brake in order to prevent vehicle rollback.

J1939-based ANSI may not be used in the same application with the following functions or their J1939 equivalents:

— GPI CD AUTOMATIC NEUTRAL – SINGLE INPUT WITH SELECTOR OVERRIDE

— GPI AG1 (AUTOMATIC NEUTRAL – DUAL INPUT activated by park brake input)

— GPI AK (AUTOMATIC NEUTRAL – DUAL INPUT WITH SERVICE BRAKE STATUS) variation AK3 nor AK5 (activated by service brake and park brake)

— GPI CN (AUTOMATIC NEUTRAL – DUAL INPUT WITH AUTOMATIC RETURN TO RANGE)

— GPI CF (AUTOMATIC NEUTRAL – IDLE START / STOP)

— Functions that require the transmission to attain range while the parking brake is applied, for example, GPI AJ (PUMP MODE INPUT)

B.4.9.6. *NORMAL OPERATION*

When *Parking Brake Switch* indicates 01b (parking brake set) and both transmission output shaft speed and throttle input are below calibrated limits, the function will activate and command the transmission to Neutral regardless of shift selector position.

When active, the requested range digit on the shift selector display is flashed and/or the Range Inhibit Indicator is activated. To resume driving, the operator must release the parking brake (such that *Parking Brake Switch* = 00b) and re-select a drive range on the shift selector. Range selections are ignored while *Parking Brake Switch* = 01b.

B.4.9.7. *TCM FAILURE MODES & RESPONSES*

The ANSI function will not activate (i.e. shift the transmission to Neutral) if *Parking Brake Switch* indicates 10b (error) or 11b (not available).

If *Parking Brake Switch* reception is lost or indicates 10b (error) or 11b (not available) while the function is already active (the transmission is in Neutral), there is no impact to the function operation. The operator must re-select a range to exit the function, as normal. No DTCs are set.

B.4.9.8. *INSTALLATION CHECKLIST: ANSI*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer “yes” to all questions in the following test sequence:

- ☐ Is the TCM calibration configured properly?

- ☐ Clear any Allison DTCs. Start the engine, release the parking brake, and select Drive. Set the parking brake. Does the transmission shift to Neutral?

- ☐ Release the parking brake and re-select Drive. Does the transmission shift into range?

B.4.10. AUTOMATIC NEUTRAL – SINGLE INPUT WITH SHIFT SELECTOR OVERRIDE

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.10.1. *OVERVIEW*

Automatic Neutral – Single Input w/Shift Selector Override (ANSISSO) commands the transmission to neutral when the park brake is applied, regardless of range requested on the shift selector. To shift out of Neutral, the operator must re-select a range.

This function can also be accomplished via GPI CD (see the Allison 6th Generation Controls Installation Manual).

B.4.10.2. *AVAILABILITY*

The J1939-based implementation is optional in 1000 – 4000 Series applications.

B.4.10.3. *CONFIGURATION (VEPS / ACCT)*

[18000] THROTTLE AND LOAD SOURCE

Set to PRIMARY ON-VEHICLE PROTOCOL.

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be provided to the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[25036] AUTOMATIC NEUTRAL – SINGLE INPUT WITH SELECTOR OVERRIDE

Set answer to J1939 CCVS1 PARKING BRAKE SWITCH to enable TCM parameter reception.

B.4.10.3.1. VEPS / ACCT Trims

Trim **[25050] AUTOMATIC NEUTRAL: Maximum Output Speed for PTO** will influence PTO operation when ANSISSO is active.

B.4.10.4. *J1939 PARAMETER AND SA USE*

Items marked (V) can be modified via VEPS. Parameters may be enabled or disabled and SAs may be set to an OEM-specified value. See AUTO-DETECTION for SA selection details.

B.4.10.4.1. Required Support

The J1939 network is required to provide CCVS1 *Parking Brake Switch* from one of the following SAs, in order of TCM preference:

1. SA 17 (Cruise Control) (V)
2. SA 49 (Cab Controller)
3. SA 39 (Management Computer #1)
4. SA 23 (Instrument Cluster #1)
5. SA 33 (Body Controller)
6. SA 00 (Engine #1)

B.4.10.5. *OTHER REQUIREMENTS / RESTRICTIONS*

WARNING: ANSISSO activation does not activate output function GPO S (NEUTRAL INDICATOR FOR PTO OUTPUT).

CAUTION: When this function is enabled via VEPS, the transmission will shift into Neutral whenever the vehicle is stopped and the parking brake is applied. As such, the parking brake can no longer be used independent of the service brakes as a “hill holder” while driving.

For example, if a vehicle stops on a grade and the parking brake is applied, the transmission will shift to Neutral. To resume driving, the operator must apply the service brakes before releasing the parking brake in order to prevent vehicle rollback.

J1939-based ANSISSO may not be used in the same application with the following functions or their J1939 equivalents:

- GPI L2 AUTOMATIC NEUTRAL – SINGLE INPUT for park brake
- GPI CH (AUTOMATIC NEUTRAL – SINGLE INPUT, INVERTED) if it is activated by a park brake input
- GPI AG1 (AUTOMATIC NEUTRAL – DUAL INPUT activated by park brake input)
- GPI AK (AUTOMATIC NEUTRAL – DUAL INPUT WITH SERVICE BRAKE STATUS) variations AK3 or AK5 (activated by service brake and park brake)
- GPI CN (AUTOMATIC NEUTRAL – DUAL INPUT WITH AUTOMATIC RETURN TO RANGE)
- GPI CF (AUTOMATIC NEUTRAL – IDLE START / STOP)

> **WARNING:** ANSISSO activation does not activate output function GPO S (NEUTRAL INDICATOR FOR PTO OUTPUT).

B.4.10.6. *NORMAL OPERATION*

When *Parking Brake Switch* indicates 01b (parking brake set) and both transmission output shaft speed and throttle input are below calibrated limits, the function will activate and command the transmission to Neutral regardless of shift selector position.

When active, the requested range digit on the shift selector display is flashed and/or the Range Inhibit Indicator is activated. To resume driving, the operator must re-select a drive range on the shift selector. This may be done after *Parking Brake Switch* = 00b (parking brake not set), or as an override while *Parking Brake Switch* = 01b (parking brake set).

If the input is overridden, *Parking Brake Switch* must be toggled to 00b (parking brake not set) for at least one message broadcast before the function can be enabled again by setting it to 01b (parking brake set).

Function activation is limited to three times within a given stop cycle. After the vehicle has moved, the function may be activated again.

B.4.10.7. *TCM FAILURE MODES & RESPONSES*

If *Parking Brake Switch* reception is lost or indicates 10b (error) or 11b (not available) while the function is already active (the transmission is in Neutral), there is no impact to the function operation. The operator must re-select a range to exit the function, as normal. However, *Parking Brake Switch* must indicate 01b (parking brake set) before the function can activate again. No DTCs are set.

B.4.10.8. *INSTALLATION CHECKLIST: ANSISSO*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer “yes” to all questions in the following test sequence:

- ☐ Is the TCM calibration configured properly?
- ☐ Clear any Allison DTCs. Start the engine, release the parking brake, and select Drive. Set the parking brake. Does the transmission shift to Neutral?
- ☐ Release the parking brake and re-select Drive. Does the transmission shift into range?

B.4.11. AUXILIARY BOX TRANSITION

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.11.1. *OVERVIEW*

The Auxiliary Box Transition Input is used to assist in the transition of the transfer case by momentarily stopping the rotation of the output shaft.

This function can also be accomplished via GPI BY (See the Allison 6th Generation Controls Installation Manual).

B.4.11.2. *AVAILABILITY*

The J1939-based implementation is optional in 3000 – 4000 Series applications.

B.4.11.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be provided to the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[25080] AUX BOX TRANSITION INPUT

Set answer to J1939 TC2 TRANS OUTPUT SHAFT BRAKE REQUEST or J1939 TC2 TRANS OUTPUT SHAFT BRAKE REQUEST & CCVS1 PARKING BRAKE SWITCH to enable TCM parameter reception.

B.4.11.4. *J1939 PARAMETER AND SA USE*

Items marked (V) can be modified via VEPS. Parameters may be enabled or disabled and SAs may be set to an OEM-specified value. See AUTO-DETECTION for SA selection details.

B.4.11.4.1. Required Support

The J1939 network is required to provide TC2 *Transmission Output Shaft Brake Request* from SA 49 (Cab Controller) (V) to DA 03 (Transmission #1).

B.4.11.4.2. Optional Support

If AUXILIARY BOX TRANSITION is set to J1939 TC2 TRANS OUTPUT SHAFT BRAKE REQUEST & CCVS1 PARKING BRAKE SWITCH then the J1939 network is required to provide CCVS1 *Parking Brake Switch* from one of the following SAs, in order of TCM preference:

1. SA 17 (Cruise Control) (V)
2. SA 49 (Cab Controller)
3. SA 39 (Management Computer #1)
4. SA 23 (Instrument Cluster #1)
5. SA 33 (Body Controller)
6. SA 00 (Engine #1)

B.4.11.5. *NORMAL OPERATION*

When Auxiliary Box Transition is set to J1939 TC2 TRANS OUTPUT SHAFT BRAKE REQUEST, the function will only activate when:

- Transmission is in Neutral
- Output speed is low
- Throttle position is low
- J1939 TC2 *Transmission Output Shaft Brake Request* indicates 01b (Transmission output shaft braking is requested)

When Auxiliary Box Transition is set to J1939 TC2 TRANS OUTPUT SHAFT BRAKE REQUEST & CCVS1 PARKING BRAKE SWITCH, the function will only activate when:

- J1939 CCVS1 *Parking Brake Switch* indicates 01b (Parking brake set)
- Transmission is in Neutral
- Output speed is low
- Throttle position is low
- J1939 TC2 *Transmission Output Shaft Brake Request* indicates 01b (Transmission output shaft braking is requested)

When the Auxiliary Box Transition Function is active, the transmission periodically attempts to stop the output shaft for a short period of time. This function helps facilitate the meshing of gear teeth in an external transfer case.

B.4.11.6. *TCM FAILURE MODES & RESPONSES*

When J1939 TC2 *Transmission Output Shaft Brake Request* reception is lost or indicates 10b (Error) or 11b (Not available), the TCM will treat it the same as receiving *Transmission Output Shaft Brake Request* as 00b (Transmission output shaft braking is not requested).

When Auxiliary Box Transition is set to J1939 TC2 TRANS OUTPUT SHAFT BRAKE REQUEST & CCVS1 PARKING BRAKE SWITCH and J1939 CCVS1 *Parking Brake Switch* reception is lost or indicates 10b (Error) or 11b (Not available), the TCM will treat it the same as receiving *Parking Brake Switch* as 00b (Parking brake not set).

B.4.12. AUXILIARY FUNCTION RANGE INHIBIT – SINGLE INPUT

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.12.1. *OVERVIEW*

Auxiliary Function Range Inhibit (AFRI) is used to prevent inadvertent range selection when auxiliary equipment is operating, and to prevent transmission engagement unless the brake pedal is depressed.

AFRI input examples include a push-button, door status, or service brake switch. J1939 data may be substituted for a brake switch GPI. The GPI can then be used as an additional signal processed in series with the brake switch.

B.4.12.2. *AVAILABILITY*

The J1939-based implementation is optional in 1000 – 4000 Series applications. The PRIMARY ON-VEHICLE PROTOCOL GEAR SHIFT INHIBIT REQUEST SIGNAL option is not available in 2000 Series 9-speed applications.

The "Mission Critical" failure mode response under TCM FAILURE MODES AND RESPONSES is only available with certain VOCATIONAL USAGEs; see below.

B.4.12.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be provided to the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[25090] AUXILIARY FUNCTION RANGE INHIBIT – SINGLE INPUT

For AFRI via J1939 only, set to ONLY SERVICE BRAKE STATUS or PRIMARY ON-VEHICLE PROTOCOL GEAR SHIFT INHIBIT REQUEST SIGNAL. To use a J1939 brake input and the GPI in series, set to EITHER GPI E OR GPI AI, AND SERVICE BRAKE STATUS (IN SERIES).

[25094] AUXILIARY FUNCTION RANGE INHIBIT – SINGLE INPUT: Override When Secondary Selector is Active

This option is only available with 3000/4000 Series OFS models. Set to YES to disable the AFRI function when a secondary shift selector is active. This option is intended for dual selector applications where it is not feasible or desired to activate the AFRI input when the secondary selector is active. For example, in dual mode pumping applications where the secondary shift selector is located at a remote pump panel and AFRI is desired as a service brake interlock in drive mode only.

[25300] SERVICE BRAKE STATUS INPUT

Set answer to either J1939 CCVS1 BRAKE SWITCH or J1939 EBC1 EBS BRAKE SWITCH when Service Brake Status Input is used with this function.

[10010] VOCATIONAL USAGE

The "Mission Critical" failure mode responses under TCM FAILURE MODES AND RESPONSES will only be invoked if VOCATIONAL USAGE is set to one of:

- CRASH / RESCUE /MILITARY
- FIRE / EMERGENCY
- SPECIALTY / MILITARY

[24000] GENERAL PURPOSE INPUTS AND OUTPUTS (GPIO) PACKAGE

To use an AFRI GPI in series with the J1939 input, the GPIO package must contain GPI E or GPI AI.

[29222] J1939 SA: TC1 Transmission Gear Shift Inhibit Request

Parameter is required to be set to the source address of the controller that provides TC1 *Transmission Gear Shift Inhibit Request*. The TCM does not auto-detect the source address of TC1 *Transmission Gear Shift Inhibit Request*. If this parameter is not set to the desired source address when AUXILIARY FUNCTION RANGE INHIBIT – SINGLE INPUT is configured to PRIMARY ON-VEHICLE PROTOCOL GEAR SHIFT INHIBIT REQUEST SIGNAL, the function will not work.

B.4.12.4. *J1939 PARAMETER AND SA USE*

B.4.12.4.1. Required Support

When AUXILIARY FUNCTION RANGE INHIBIT – SINGLE INPUT is configured to one of the Service Brake Status Input options, the J1939 network is required to provide one of the J1939 brake switch parameters as described under SERVICE BRAKE STATUS INPUT.

When AUXILIARY FUNCTION RANGE INHIBIT – SINGLE INPUT is configured to PRIMARY ON-VEHICLE PROTOCOL GEAR SHIFT INHIBIT REQUEST SIGNAL, The J1939 network is required to provide TC1 *Transmission Gear Shift Inhibit Request* to destination address 03 (Transmission #1) from the configured source address.

B.4.12.5. *OTHER REQUIREMENTS / RESTRICTIONS*

Vehicle OEMs and body builders should consider potential operational differences when substituting a J1939 brake switch parameter for GPI E or GPI AI.

J1939 brake switch data does not indicate service brake *application*; it indicates operator *desire* for brake application. Systems designed for a brake pressure switch may use a high threshold to ensure brake *application*, and therefore may react differently when J1939 brake switch data is substituted.

NOTE: For applications that do not use a "Mission Critical" **VOCATIONAL USAGE**: If AFRI is enabled in calibration, its inputs must be connected & supported properly, otherwise shifts from Neutral cannot be made. To move the vehicle, AFRI will have to be disabled via service tool.

B.4.12.6. *NORMAL OPERATION*

When AFRI receives an active input as described in the implementations below, the TCM will recognize the request for a Neutral-to-range shift and, if all other operating conditions are acceptable, will command the requested shift.

Otherwise, all Neutral-to-range shifts are inhibited, and remain so until an active input signal is received or the output speed exceeds a preset value. Shifts which change vehicle direction (Drive-to-Reverse, Reverse-to-Drive) are permitted.

B.4.12.7. *OPERATION VS. VEPS OPTIONS*

Four implementations are available per **[25090] AUXILIARY FUNCTION RANGE INHIBIT INPUT**:

B.4.12.7.1. EITHER GPI E OR GPI AI IF DEFINED IN SELECTED GPIO PACKAGE

TCM J1939 reception does not affect the function. See the Allison 6th Generation Controls Installation Manual and GPIO schematics for more information.

B.4.12.7.2. ONLY SERVICE BRAKE STATUS

Below a calibrated speed limit, Neutral-to-range shifts are inhibited when the J1939 brake switch parameter indicates 00b (brake pedal released). 01b (brake pedal depressed) must be indicated to allow shifts from Neutral.

B.4.12.7.3. EITHER GPI E OR GPI AI, AND SERVICE BRAKE STATUS (IN SERIES)

Neutral-to-range shifts are inhibited unless permitted by the GPI circuit (GPI E closed, GPI AI open) and the J1939 brake switch parameter indicates 01b (brake pedal depressed).

B.4.12.7.4. PRIMARY ON-VEHICLE PROTOCOL GEAR SHIFT INHIBIT REQUEST SIGNAL

Below a calibrated speed limit, Neutral-to-range shifts are inhibited when the J1939 TC1 *Transmission Gear Shift Inhibit Request* parameter indicates 01b (gear shifts are inhibited). 00b (gear shifts are allowed) must be indicated to allow shifts from Neutral.

B.4.12.7.5. Interaction w/GPI Function AK – Automatic Neutral, Dual Input w/ Service Brake Status

The interaction is described by the scenario where the brake pedal is released and reapplied during Auto-Neutral operation. This applies to AUXILIARY FUNCTION RANGE INHIBIT – SINGLE INPUT configurations that utilize Service Brake Status:

1. With the selector in Drive, the vehicle is moving, and the Auto-Neutral cab switch is on.

2. The operator depresses the brake pedal and stops the vehicle.

3. The operator applies the work brake, activating the Auto-Neutral logic.

4. The transmission shifts into Neutral, and the Auto-Neutral inhibit is indicated by the flashing requested range digit on the selector and / or the Range Inhibit Indicator. Engine speed is often increased for PTO operation.

5. If the brake pedal is released while the Auto-Neutral inhibit is active, the AFRI inhibit goes active but does not latch on since it knows an Auto-Neutral inhibit is currently active. Again, this is transparent to the operator.

6. The operator is ready to move on; the brake pedal is depressed again, and the work brake is released.

7. The transmission exits Auto-Neutral and automatically returns to range after engine speed falls to an acceptable level. Per the intended use of the Auto-Neutral function, the operator does not have to re-select Drive.

B.4.12.8. *TCM FAILURE MODES & RESPONSES*

B.4.12.8.1. "Normal" Applications

In "Normal" applications, J1939 input failures will prevent Neutral-to-range shifts.

Invalid or Missing J1939 Signal Data

> **WARNING:** If the J1939 signal data indicates 10b (Error), 11b (Not Available), or reception is lost, the TCM inhibits shifts from Neutral.
>
> Body builders and vehicle OEMs are urged to consider this failure mode. If a more robust failure mode response is deemed necessary, GPI F (AUXILIARY FUNCTION RANGE INHIBIT – DUAL INPUT) should be considered.

No DTC is set, and the Check Trans Indicator is not activated. AFRI functionality will resume when the TCM receives valid J1939 signal data.

Brake Switch Rationality Failure

When AUXILIARY FUNCTION RANGE INHIBIT – SINGLE INPUT is configured to one of the Service Brake Status Input options, while J1939 brake switch data is valid, the TCM continually evaluates signal rationality. If several vehicle accelerations are detected while 01b (brake pedal depressed) is indicated, DTC P0703 is set. The Check Trans Indicator is not activated.

If Neutral is subsequently selected during the same key switch cycle where P0703 was set, AFRI cannot be deactivated and shifts out of Neutral are inhibited. Cycling the key switch will reset the acceleration counter, thus allowing the transmission to be shifted in and out of Neutral until DTC P0703 sets again.

B.4.12.8.2. "Mission Critical" Applications

In "Mission Critical" applications, inability to move the vehicle might have dire consequences. As such, the AFRI interlock is overridden during J1939 input failures; the vehicle may still be moved, even though J1939 signal data may be invalid, irrational or absent.

Invalid or MissingJ1939 Signal Data

DTC U0400 is set and the Transmission Service and Check Trans Indicators are activated; these alert the operator to a vehicle problem even though AFRI appears to operate normally.

> **NOTE:** The Transmission Service Indicator is the preferred indicator, since the issue does not warrant taking the vehicle out of service immediately. The transmission and vehicle are fully functional, but the interlock is no longer effective. Check Trans indications usually coincide with issues that restrict transmission operation.
>
> For this reason, Allison recommends that a Transmission Service Indicator be installed in "Mission Critical" applications with J1939-based AFRI.

Brake Switch Rationality Failure

When AUXILIARY FUNCTION RANGE INHIBIT – SINGLE INPUT is configured to one of the Service Brake Status Input options, if several vehicle accelerations are detected while 01b (brake pedal depressed) is indicated, DTC P0703 is set. The Transmission Service and Check Trans Indicators are activated.

B.4.12.9. *INSTALLATION CHECKLIST: AFRI*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer "yes" to all questions in the following test sequences:

B.4.12.9.1. General

- ☐ Is the TCM calibration configured properly?
- ☐ If GPI E or GPI AI is to be used, is it available in the active GPIO package?
- ☐ Are all parameter and SA requirements met?

B.4.12.9.2. Normal Operation – J1939 Service Brake Status Input Only

1. Clear any Allison DTCs. Start the engine.
2. With the brake pedal released, select Drive. Does the transmission remain in Neutral?
3. Move the selector back to Neutral.
4. Depress the brake pedal, and select Drive. Does the transmission shift to a forward range?

B.4.12.9.3. Normal Operation – GPI E and J1939 Input

1. Clear any Allison DTCs. Start the engine.

2. With the brake pedal released and the GPI open, select Drive. Does the transmission remain in Neutral?

3. Move the selector back to Neutral.

4. With the brake pedal released and the GPI closed, select Drive. Does the transmission remain in Neutral?

5. Move the selector back to Neutral.

6. With the brake pedal depressed and the GPI open, select Drive. Does the transmission remain in Neutral?

7. Move the selector back to Neutral.

8. With the brake pedal depressed and the GPI closed, select Drive. Does the transmission shift to a forward range?

B.4.12.9.4. Normal Operation – J1939 TC1 Transmission Gear Shift Inhibit Request

1. Clear any Allison DTCs. Start the engine.

2. With TC1 *Transmission Gear Shift Inhibit Request* = 01b, select Drive. Does the transmission remain in Neutral?

3. Move the selector back to Neutral.

4. Send TC1 *Transmission Gear Shift Inhibit Request* = 00b, and select Drive. Does the transmission shift to a forward range?

B.4.13. CHECK TRANS INDICATOR

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.13.1. *OVERVIEW*

All Allison installations require a Check Trans Indicator to inform the operator when transmission issues exist. Operator interface options for this function include a text display or a dedicated lamp w/text or icon. Available TCM outputs for this function include:

— TCM dedicated output wire
— J1939 DM1 message content
— J1939 ETC7 Transmission Warning Indicator

Allison recommends DM1-based implementation for text displays with generic lamps, and discrete parameter implementation for dedicated lamps. However, either output can be used to control either indication type.

B.4.13.2. *AVAILABILITY*

The J1939-based implementation is standard in all 1000 – 4000 Series applications.

B.4.13.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be received from the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[30000] J1939 BROADCAST: ETC7 Transmission Warning Indicator

Set to ENABLED if parameter is used to meet function requirements.

[30015] J1939 BROADCAST: DM1

Set to ENABLED if parameter is used to meet function requirements.

B.4.13.4. *J1939 MESSAGE, PARAMETER AND SA USE*

Regardless of implementation, the display controller is required to receive two distinct pieces of TCM information:

— A parameter or message to trigger activation of the indicator, and

— A heartbeat message to detect communication loss between the display controller and the TCM.

B.4.13.4.1. DM1 Trigger – Required Support

When triggering this indicator via DM1, the display controller is required to receive **ALL** of the following from SA 03 (Transmission #1):

— DM1 *Suspect Parameter Number*,
— DM1 *Amber Warning Lamp*, and
— DM1 *Failure Mode Identifier*

NOTE: Specific data values conveyed in these three parameters are directly tied to the J1939 activation of the Check Trans Indicator.

Amber Warning Lamp alone cannot be used to activate the Check Trans Indicator; the content of all three DM1 parameters must be considered.

Other *SPN*, *Amber Warning Lamp* and *FMI* combinations may define other Allison indications or fault conditions. Users should not assume that any other combinations of *SPN*, *Amber Warning Lamp*, and *FMI* values from SA 03 are indicative of a “Check Trans” indication.

B.4.13.4.2. ETC7 Trigger – Required Support

When triggering this indicator via the J1939 discrete parameter, the display controller is required to receive ETC7 *Transmission Warning Indicator* (V) as sent from SA 03 (Transmission #1).

NOTE: While the ETC7 trigger can be used to activate a generic AWL and text display, it is recommended for use with discrete lamp implementations.

B.4.13.4.3. Heartbeat Message

The importance of the Check Trans Indicator function dictates that communication integrity between the display controller and TCM must be monitored. If not, a situation could occur where critical diagnostics are not conveyed to the operator.

To do this, the display controller is required to listen for a TCM “heartbeat” – a continuously broadcast J1939 message present whenever the TCM is powered up. Continual, periodic heartbeat reception informs the display controller that communication is occurring properly with the TCM.

It is recommended that the message used (DM1 or ETC7) to activate the Check Trans Indicator also be used as the heartbeat signal. However, ETC1 or ETC2 may also be used.

B.4.13.5. *OPERATOR INTERFACE*

The indicator is supplied and installed by the vehicle builder, and is required to be:

…In the normal forward field of view of the vehicle operator (preferred), or readily viewable as part of the shift selector assembly.

…Clearly visible from both operator stations in dual selector applications (may require two indicators).

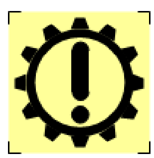
…Clearly visible under all vehicle lighting conditions, both daytime and nighttime.

Acceptable interface options are discussed below. For other potential implementations, please contact your Allison Customer Integration Engineer.

B.4.13.5.1. Dedicated Lamp with Text

Dedicated lamp text must read “CHECK TRANS”. Other wording may be acceptable upon review of an Allison Customer Integration Engineer. Yellow or amber color is strongly recommended, as “Check Trans” conditions do not warrant use of a red color.

B.4.13.5.2. Icon or Graphical Symbol



Per ISO 2575: “Road Vehicles – Symbols for Controls, Indicators, and Tell-Tales”, this symbol represents a transmission failure, and is acceptable for Allison Check Trans Indicator use. The preferred icon colors are yellow or amber.

B.4.13.5.3. Text Displays

While a dedicated lamp or icon is preferred, a driver text display used alone or in conjunction with generic warning and stop lamps is acceptable. In these implementations, the lamps convey issue severity to the operator, while the text display provides more specific information based on DM1 SPN and FMI data.

With dynamically configurable display systems, the visible content may change due to operating conditions or driver selection. In general, Allison requires that the Check Trans Indicator text is visible whenever active. However, there are three exceptions for installations with generic lamps and / or limited text display capacity:

Exception 1 – Text Prioritization during Simultaneous RSL and AWL Events

When multiple generic lamps are employed, it is possible for the RSL (Red Stop Lamp) and AWL (Amber Warning Lamp) to be illuminated at the same time. Per J1939-73, the RSL is higher priority:

- An RSL indicates a problem severe enough to warrant stopping the vehicle.
- An AWL indicates the presence of a problem, but the vehicle need not be immediately stopped.

When text display capacity is limited, it is acceptable that Check Trans Indicator text is not visible when the RSL is lit. The Check Trans Indicator text should be out-prioritized by text linked to the RSL. The display system is required to allow the operator to "scroll through" items associated with the lamps such that the Check Trans Indicator can be read.

Exception 2 – Text Prioritization during Simultaneous AWL Events

When a generic AWL is employed, multiple events may simultaneously cause it to illuminate.

When text display capacity is limited, it is acceptable that Check Trans Indicator text is not immediately visible when the AWL is lit due to these multiple situations. Again, the display system is required to allow the vehicle operator to "scroll through" items associated with the lamp such that the Check Trans Indicator can be read.

In this situation, the operator knows an issue exists, but may not know it is transmission-related until the text is scrolled through.

Exception 3 – Text Suppression

In some applications, Allison indicator text may appear in a display area normally used to convey other operator information. In these cases it is acceptable to employ an operator input (e.g. button push) to temporarily suppress the Check Trans Indicator so normal display operation may resume.

The suppression may only exist for the current key switch cycle; i.e. if the key switch is cycled, the Allison indicator text is required to reappear if active. The operator may then opt to suppress the text for that drive cycle.

The key points are that (a) the vehicle operator must recognize and take physical action to suppress the indicator, and (b) the operator is informed of any active indications again at the next key switch cycle.

B.4.13.5.4. Communication Failure Indication

If the controller detects TCM communication loss, operator notification is required; see FAILURE MODES AND DISPLAY CONTROLLER RESPONSES. The intent is to avoid unknowingly operating the vehicle when the TCM cannot properly indicate "Check Trans" conditions.

Physical implementation of this Communication Failure indication is left to the discretion of the vehicle OEM. Acceptable examples include a lamp or text display with phrasing such as "Vehicle Electrical Fault" or "Vehicle Electronic Fault". No specific wording is defined, as Allison realizes vehicle OEMs may already have a method to communicate such problems to the operator. Your Allison Customer Integration Engineer must review all implementations.

Check Trans Indicator actuation is not an acceptable means of representing a communication problem. If only the Check Trans Indicator is active, service technicians may assume there is a transmission problem, when in fact it is most likely a vehicle network or wiring issue.

B.4.13.5.5. Bulb Checks

The OEM must ensure that any inability to convey Allison indicators is made known to the operator. In a system with dedicated indicators (such as individual lamps), a bulb check at the beginning of each key switch cycle is required.

> **NOTE:** The TCM does not broadcast a DM1 "bulb check" message at power-up. There is no DM1 content that allows a receiver to distinguish a momentary "bulb check" from an actual diagnostic report.
>
> The TCM also does not send a "bulb check" in ETC7 *Transmission Warning Indicator* at power-up; it is set to 00b.

Allison recommends the lamp or indicator remain on for 2 seconds during the check. However, this not a requirement, and a slightly longer or shorter time period may be used.

B.4.13.6. *NORMAL OPERATION*

B.4.13.6.1. DM1 Trigger – Required Support

> **NOTE:** While the DM1 trigger can be used to activate a discrete Check Trans lamp, it is recommended for use with generic lamps and text displays.

DM1 may fluctuate between single and multi-frame formats, depending on how many fault indications are present. If only one indication is active, DM1 will be sent in a single frame. If two or more indications are active, DM1 will be sent via Transport Protocol.

Activating the Indicator

If the display controller is receiving the heartbeat message (DM1, ETC1, ETC7 or ETC2), and then receives DM1 from SA 03 (Transmission #1) with:

— *SPN* = 2003 (General Transmission Fault) **AND**
— Amber Warning Lamp = 01b (On) **AND**
— Failure Mode Indicator = Any value

…then the Check Trans Indicator is required to be activated. See DM1 under J1939 MESSAGE AND PARAMETER USE for sample data strings.

Deactivating the Indicator

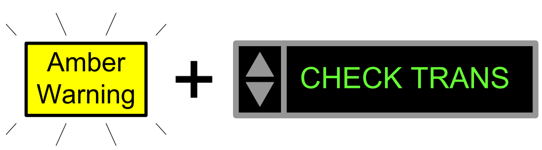
If the display controller receives DM1 from SA 03 where:

— *SPN* 2003 no longer appears, **OR**

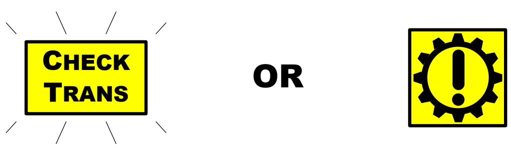
— No faults are indicated, i.e. *SPN* = 0 and *Amber Warning Lamp* = 00b (Off)

…then the display controller is required to deactivate the Check Trans Indicator. See DM1 under J1939 MESSAGE AND PARAMETER USE for sample data strings.

Generic lamps and text displays use DM1 *Amber Warning Lamp* to drive the lamp, and DM1 *SPN* to drive the text display:



Dedicated lamps must use the combination of DM1 *Amber Warning Lamp* and *SPN* for lamp activation:



RESPONSE TO DM1 CHECK TRANS INDICATOR TRIGGER

B.4.13.6.2. ETC7 Trigger – Required Support

Activating the Indicator

The display controller is required to continuously activate the Check Trans Indicator when receiving ETC7 *Transmission Warning Indicator* = 01b (Transmission Warning Indicator on continuously).

Deactivating the Indicator

The display controller is required to deactivate the Check Trans Indicator when receiving ETC7 *Transmission Warning Indicator* = 00b (Transmission Warning Indicator is off).

B.4.13.7. *DISPLAY CONTROLLER FAILURE MODES AND RESPONSES*

Fault logging, diagnostics and troubleshooting related to loss of the Check Trans Indicator trigger and / or heartbeat reception are the responsibility of the controller monitoring the parameter(s) and the vehicle OEM.

The following are minimum failure mode responses by the J1939 device controlling the indicator. These requirements help maintain operator awareness.

B.4.13.7.1. Initialization or Response to Resets

The display controller may be powered down intentionally (key switch turned off) or unintentionally (intermittent power source) while an active indication is present.

Regardless, Allison recommends that the display controller default the indicator to an inactive state when it reinitializes. If the issue is still active when power returns, TCM broadcast data will reflect this and only then should the display controller reactivate the indicator.

This recommendation is based on the fact that some Allison indications self-clear during a power cycle.

B.4.13.7.2. Loss of Heartbeat While Check Trans Indicator is Inactive

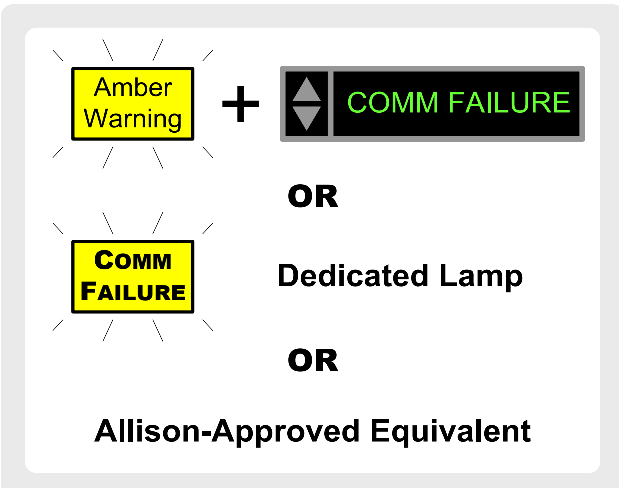
If a display controller fails to receive the designated TCM heartbeat for a period greater than or equal to:

Heartbeat Message	SAE J1939 Broadcast Rate	Multiplier Cushion	Timeout Value
ETC7	100 ms	10x	**1 s**
DM1	1 s	5x	**5 s**
ETC1	10 ms	10x	**100 ms**
ETC2	100 ms	10x	**1 s**

…then the display controller is required to activate a communication failure indication for the operator. For example, if ETC1 is the heartbeat, loss of ETC1 reception for 100 ms (10 x 10 ms SAE broadcast rate) should trigger the communication failure indication.

The indication is required to remain on until either a valid heartbeat message is received, **OR** the display controller is reset by cycling the key switch.

This logic informs the operator of a vehicle system problem that may not allow “Check Trans” indications to be communicated properly.



RESPONSE TO HEARTBEAT LOSS WHILE CHECK TRANS INDICATOR INACTIVE

B.4.13.7.3. Loss of Trigger during Active Check Trans Indicator

If the display controller has been receiving an active Check Trans indication and trigger reception ceases, it is required to activate the communication failure indication and continue to activate the Check Trans Indicator until either:

— The trigger returns and indicates the Check Trans Indicator has gone inactive, **OR**

— A key switch cycle resets the display controller, and the trigger indicates the Check Trans Indicator has gone inactive.

This logic maintains operator awareness of an active Check Trans Indicator in the event of complete communication loss after the TCM has begun to indicate a problem.

B.4.13.8. *INSTALLATION CHECKLIST: CHECK TRANS INDICATOR*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer “yes” to all questions in the following test sequences.

B.4.13.8.1. General

☐ Is the TCM calibration configured properly?

B.4.13.8.2. Vehicle Preparation and Test Setup

These tests require the ability to disconnect or unplug the TCM from the J1939 network. Possible methods include:

— a modified engineering vehicle wiring harness,
— a modified Allison service tool “T-Harness”, or
— a switch box between the TCM & vehicle harness.

B.4.13.8.3. Bulb Check / Text Display Check

1. Turn the key switch on; is a Check Trans Indicator bulb check or text display check performed at power up?

B.4.13.8.4. Normal Operation

1. Clear any Allison DTCs. Start engine.

2. Create a “Check Trans” situation by unplugging the transmission mating connector located on the transmission case or by unplugging the J1939-based shift selector (3000/4000 Series only).

3. If necessary, verify the fault via Allison DOC®. Does the Check Trans Indicator actuate?

4. Reconnect the mating connector (or selector); does the Check Trans Indicator deactivate when the fault clears?

B.4.13.8.5. Loss of Heartbeat While Check Trans Indicator is Inactive

1. Clear any Allison DTCs and begin this sequence with the key switch on and the engine not running.

2. Remove the heartbeat by disconnecting the TCM from the J1939 network; is a Communication Failure actuated?

3. Is the Communication Failure indicated **ONLY** by method(s) **OTHER** than the Check Trans Indicator?

4. Reconnect the TCM to the J1939 network; does the Communication Failure indication deactivate when TCM is reconnected?

B.4.13.8.6. "Check Trans" Situation Self-Clears During Key Switch Cycle

1. Clear any Allison DTCs. Start the engine.

2. Create a "Check Trans" situation by unplugging the transmission mating connector located on the transmission case or by unplugging the J1939-based shift selector (3000/4000 Series only).

3. Turn the key switch off and stop the engine. Reconnect the mating connector (or selector), eliminating the "Check Trans" cause.

4. Start the engine. When the bulb check is complete and the engine starts, does the Check Trans Indicator deactivate shortly afterwards?

B.4.13.8.7. Loss of Trigger AND Heartbeat While Check Trans Indicator is Active

1. Clear any Allison DTCs. Start engine.

2. Create a "Check Trans" situation by unplugging the transmission mating connector located on the transmission case or by unplugging the J1939-based shift selector (3000/4000 Series only).

3. Disconnect the TCM from the J1939 network by open circuiting its J1939 connection. Does the Communication Failure indication actuate in addition to the already active Check Trans Indicator?

4. Reconnect the TCM to the J1939 network. Does the Check Trans Indicator remain active while the Communication Failure indication deactivates?

B.4.14. CRUISE CONTROL, STANDARD

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.14.1. *OVERVIEW*

During cruise control operation, accelerator pedal data is no longer a valid source for shift modulation. In vehicle applications employing cruise control, the TCM must know when the cruise control is active.

B.4.14.2. *AVAILABILITY*

The J1939-based implementation is standard in all 1000 – 4000 Series applications.

B.4.14.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be provided to the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[18000] THROTTLE AND LOAD SOURCE

Set to PRIMARY ON-VEHICLE PROTOCOL to use EEC2 *Percent Load at Current Speed* and EEC1 *Engine Torque Mode* with this function.

[28010] J1939 RECEPTION: CCVS1 Cruise Control Active
[28020] J1939 RECEPTION: CCVS1 Cruise Control States

If a vehicle OEM intends to meet the requirements of this function with one of the above parameters, that parameter is required to be set to ENABLED via VEPS. Only one of the above parameters may be enabled for reception in a given TCM calibration. CCVS1 *Cruise Control States* is enabled by default.

[22080] CRUISE CONTROL: Override Cruise Active With High Accelerator Pedal

When CCVS1 Cruise Control Active is used for this function, set this parameter to ENABLED if it is desired for the TCM to ignore the cruise control active state when accelerator pedal is high.

[22090] CRUISE CONTROL: Filter Load Using Cruise Set Speed

When set to ENABLED, the TCM constructs a load signal based on the relationship between cruise set speed and measured vehicle speed. This artificial load signal supplements the load information received via EEC2 *Engine Percent Load at Current Speed*.

B.4.14.4. *J1939 PARAMETER AND SA USE*

Items marked (V) can be modified via VEPS. Parameters may be enabled or disabled and SAs may be set to an OEM-specified value. See AUTO-DETECTION for SA selection details.

B.4.14.4.1. Required Support

The J1939 network is required to provide EEC2 *Engine Percent Load at Current Speed* from SA 00 (Engine #1) **AND** one of either:

CCVS1 *Cruise Control States* (V) (all states) from one of the following SAs, in order of TCM preference:

1. SA 17 (Cruise Control) (V)
2. SA 49 (Cab Controller)
3. SA 33 (Body Controller)
4. SA 23 (Instrument Cluster #1)
5. SA 00 (Engine #1)

OR

CCVS1 *Cruise Control Active* (V) from SA 00 (Engine #1) (V)

OR

EEC1 *Engine Torque Mode* state 0010b (Cruise Control) from SA 00 (Engine #1)

If a CCVS1 parameter and EEC1 *Engine Torque Mode* are both present on the J1939 network, the TCM will utilize the CCVS1 parameter and ignore the cruise indication (state 0010b – Cruise Control) from *Engine Torque Mode*. The TCM will only make use of the *Engine Torque Mode* cruise indication if neither CCVS1 parameter is being received.

NOTE: CCVS1 *Cruise Control States* is the preferred parameter source for cruise control operation indication. New J1939 implementations are encouraged to support this parameter, as it is a more robust indication of cruise operation.

B.4.14.4.2. Optional Support

If available, the TCM will also utilize CCVS1 *Wheel-based Vehicle Speed* from one of the following SAs, in order of TCM preference:

1. SA 17 (Cruise Control) (V)
2. SA 33 (Body Controller)
3. SA 00 (Engine #1)

If available, the TCM may use CCVS1 *Cruise Control Set Speed* from one of the following SAs, in order of TCM preference:

1. SA 17 (Cruise Control) (V)
2. SA 49 (Cab Controller)
3. SA 33 (Body Controller)
4. SA 00 (Engine #1)

B.4.14.5. *OTHER REQUIREMENTS / RESTRICTIONS*

Specific parameter behavior is required to avoid shift cycling. See ALLISON IMPLEMENTATION under the EEC2 *Engine Percent Load at Current Speed* parameter definition for further information.

B.4.14.6. *NORMAL OPERATION*

When the input in use indicates cruise is active, the TCM uses *Engine Percent Load at Current Speed* for shift modulation instead of accelerator pedal data. Specific state support for *Cruise Control States* is:

Bit State	Cruise Control States	Modulation Source
000b	Off / Disabled	Pedal
001b	Hold	**Load**
010b	Accelerate	**Load**
011b	Decelerate / Coast	**Load**
100b	Resume	**Load**
101b	Set	**Load**
110b	Accelerator Override	Pedal
111b	Not Available	Pedal

In 1000/2000 Series applications, the differential between *Wheel-based Vehicle Speed* and *Cruise Control Set Speed* is used to prevent shift cycling.

B.4.14.7. *TCM FAILURE MODES & RESPONSES*

B.4.14.7.1. TCM Loss of Cruise Status Input

If the J1939-based cruise control input is lost during cruise operation, the TCM assumes cruise is inactive after a timeout period expires. No DTCs are logged.

WARNING: If a proper cruise control indication is not received during cruise control operation, clutch control will be incorrectly based on throttle position, leading to significant reductions in shift quality during cruise control operation, and premature transmission wear and / or damage.

Failure for Allison to receive this information may be the result of – but not limited to – bus loading, wiring integrity failures, electrical noise, or improper function implementation. Vehicle OEMs should consider such failures during their design process.

B.4.14.7.2. TCM Loss of Speed Information

In 1000/2000 Series applications, loss of either CCVS1 *Wheel-based Vehicle Speed* and / or *Cruise Control Set Speed* may result in increased shift cycling during cruise operation. No DTCs are logged.

B.4.15. CRUISE CONTROL, ADAPTIVE (ACC OR HEADWAY CONTROL)

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.15.1. *OVERVIEW*

Adaptive Cruise Control (ACC) systems or “headway control” automatically match the speed of their own vehicle to that of the traffic flow, and maintain a set distance to the vehicle ahead of it.

B.4.15.2. *AVAILABILITY*

The J1939-based implementation is standard in all 1000 – 4000 Series applications.

B.4.15.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be provided to the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[18000] THROTTLE AND LOAD SOURCE

Set to PRIMARY ON-VEHICLE PROTOCOL.

B.4.15.4. *OVERVIEW OF SYSTEM TYPES*

There are three basic ACC implementations, each using different means to control the engine and therefore vehicle speed: (a) J1939 TSC1 messages, (b) conventional cruise control parameters, and (c) Internal engine algorithms.

Some ACC systems also control engine braking (via J1939) and / or the vehicle service brakes to further optimize control of the set distance.

B.4.15.4.1. J1939 TSC1-based ACC Systems

These applications use external controllers to measure and maintain vehicle distance via J1939 TSC1 commands and limits to the engine and its brake system(s).

Eaton® VORAD® SmartCruise™

There are currently no known compatibility issues between Allison 6th Generation controls and VORAD® SmartCruise™. However, the system integrator still needs to ensure that operation of the end product is suitable to them. Failure to do so could result in shift cycling or harsh shifts, for example.

Other TSC1-based ACC Systems

Allison recognizes that several suppliers have or are working on TSC1-based ACC systems, including Bosch, Continental, Delphi, Siemens VDO, and Meritor WABCO (OnGuard™). However, as of this publication of Datalink Tech Data, Allison has not completed validation work with these systems.

B.4.15.4.2. “Conventional” Cruise Controls

Another approach to adaptive cruise control makes use of “traditional” cruise control system inputs. In these applications, an external controller measures and maintains vehicle distance by sending J1939-based ”Accel”, “Decel”, “Set Speed” and other inputs traditionally set or adjusted by the vehicle operator. This type of system does not control the engine with any type of TSC1 command or limit.

B.4.15.4.3. Internal Engine Algorithms

Here the distance-sensing device is a direct input into the engine controller. Internal algorithms then adjust engine operation and therefore vehicle speed. Again, TSC1 messages are not used.

B.4.15.5. *INTEGRATION REQUIREMENTS*

While Allison will support vehicle OEM validation of ACC systems, the system integrator is responsible for determining the acceptability of the end product.

B.4.15.5.1. TSC1-based ACC Systems

All Allison TSC1 engine commands have TSC1 *Override Control Mode Priority* 10b (Medium priority). Allison strongly recommends other components commanding the engine do the same.

Experience has shown that when multiple TSC1 torque limits are simultaneously sent to the engine, the components involved normally desire the lowest torque limit to be acted on. Per the SAE-defined TSC1 arbitration process, the only way to ensure this outcome is to use a common priority level.

B.4.15.5.2. ACC based on Conventional Cruise Controls or Internal Engine Algorithms

Allison is compatible with these implementations as long as the requirements are met as specified in function CRUISE CONTROL, STANDARD.

B.4.16. CRUISE CONTROL, VIA ENGINE PTO GOVERNOR

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.16.1. *OVERVIEW*

Certain jobs (e.g. spreading, pouring, road striping) may use an engine PTO governor to maintain a very slow vehicle speed. The operator toggles the PTO Set / Resume and Accel / Decel switches to control the vehicle speed. Occasionally this is referred to as "low speed cruise control".

If transmission shifting may occur during this mode of operation, support of this J1939-based function is required. There is no GPI equivalent to this function.

B.4.16.2. *AVAILABILITY*

The J1939-based implementation is standard in all 1000 – 4000 Series applications.

B.4.16.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be provided to the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[18000] THROTTLE AND LOAD SOURCE

Set to PRIMARY ON-VEHICLE PROTOCOL to enable use of EEC2 *Percent Load at Current Speed* and CCVS1 *PTO Governor State* with this function.

B.4.16.4. *J1939 PARAMETER AND SA USE*

See AUTO-DETECTION for SA selection details.

B.4.16.4.1. Required Support

If shifting may occur during PTO operation, the J1939 network is required to provide:

CCVS1 *PTO Governor State* (all bit states) from one of the following SAs, in order of TCM preference:

1. SA 39 (Management Computer #1)
2. SA 17 (Cruise Control)
3. SA 00 (Engine #1)

AND

EEC2 *Engine Percent Load at Current Speed* from SA 00 (Engine #1).

B.4.16.5. *OTHER REQUIREMENTS / RESTRICTIONS*

This function may not be used during Pump Mode operation in OFS applications utilizing EEC2 *Accelerator Pedal Position 2* or EEC2 *Remote Accelerator Pedal Position* in function ACCELERATOR PEDAL INPUT – DUAL MODE OFS.

B.4.16.6. *NORMAL OPERATION*

If the vehicle is moving and *PTO Governor State* indicates an active state, the TCM uses *Engine Percent Load at Current Speed* for shift modulation. One exception is if the TCM determines engine torque output is high due to parasitic load rather than driveline loads. See the *PTO Governor State* parameter definition for TCM response to the specific states.

B.4.16.7. *TCM FAILURE MODES & RESPONSES*

> **WARNING:** If *PTO Governor State* is not received in these applications, clutch control during 'low speed cruise control' shifts will be incorrectly based on throttle position, leading to significant reductions in shift quality during cruise control operation and premature transmission wear and / or damage.

Failure for Allison to receive this information may be the result of – but not limited to – bus loading, wiring integrity failures, electrical noise, or improper function implementation. Vehicle OEMs should consider such failures during their design process.

B.4.16.8. *INSTALLATION CHECKLIST: CRUISE CONTROL VIA PTO GOVERNOR*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer "yes" to all of the following questions:

- ☐ Is the TCM calibration configured properly?
- ☐ Is CCVS1 *PTO Governor State* provided from an acceptable source address?
- ☐ Does CCVS1 *PTO Governor State* reflect an "active" state during all applicable Set / Resume and Accel / Decal operation?

☐ Does CCVS1 *PTO Governor State* reflect “off” or an “inactive” state when disabled or turned off?

B.4.17. DIAGNOSTIC COMMUNICATION WITH ALLISON TOOLS

B.4.17.1. *OVERVIEW*

This section covers the communication used with Allison DOC® and Allison engineering tools. For communication options for vehicle OEM devices such as tools, recorders and displays, see DIAGNOSTIC COMMUNICATION FOR OEM USE.

B.4.17.2. *AVAILABILITY*

The J1939-based implementation is standard in all 1000 – 4000 Series applications.

B.4.17.3. *CONFIGURATION (VEPS / ACCT)*

There are no VEPS configuration requirements for this function.

B.4.17.4. *J1939 PARAMETER AND SA USE*

Allison 6th Generation service and engineering tools communicate with the TCM via J1939-compatible UDS messaging.

No parameter or source address requirements are placed on the vehicle builder; the information here is included for network user awareness.

B.4.17.4.1. Allison DOC®

Allison DOC® communication is accomplished via UDS messaging.

NOTE: Allison DOC® is the only service tool validated for use with Allison 6th Generation Controls. Universal tools such as Pro-Link or TransPro® are not recommended or approved.

SA 249 (Diagnostic Tool #1) is used for all communication with the TCM. UDS content is exchanged through PGN 55808 – Reserved for ISO 15765 using J1939-compatible 29-bit identifiers.

SA	DA	Priority	Identifier
249	03	6	0x18DA03F9
03	249	6	0x18DAF903

Bus loading typically ranges from 5% to 10%.

B.4.17.4.2. Allison Engineering Tools

Engineering tools include ACE, Read / Write (RW) and Datalog (DL), which are typically not used in the field for general service purposes. These tools may use SA 249 (Diagnostic Tool #1) and / or SA 250 (Diagnostic Tool #2).

In addition to PGN 55808 used by Allison DOC®, Allison engineering tools may use PGN 61184 – Proprietary "A", with the following source addresses and resulting CAN identifiers:

SA	DA	Priority	CAN Identifier
250	03	6	0x18EF03FA
03	250	6	0x18EFFA03
250	05	6	0x18EF05FA
250	06	6	0x18EF06FA

Again, all 29-bit identifiers are J1939 compatible.

Engineering tools typically involve large data transfers (e.g. loading software or a calibration) or reading real-time information from the TCM. In these situations, the tool and TCM utilize as much network bandwidth as is possible; bus loading can approach 95%.

B.4.17.5. *VEHICLE INTERFACE REQUIREMENTS*

All Allison transmission installations **require** a diagnostic connection for Allison DOC®. See ALLISON DOC® CONNECTIONS for details.

B.4.18. DIAGNOSTIC COMMUNICATION FOR OEM USE

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.18.1. *OVERVIEW*

This section describes diagnostic communication options available to the vehicle OEM. These options facilitate communication with on-vehicle devices (e.g. smart instrument clusters), and / or off-vehicle devices (e.g. diagnostic code readers) that plug into the vehicle diagnostic connector.

Allison 6th Generation Controls are capable of the following, depending on configuration:

- VEPS selection of diagnostic protocol.
- Full J1939 SPN / FMI support for all DTCs.
- UDS & SSF 14230 support w/J2012 DTC format.
- TCM code clearing with all diagnostic protocols.

J2012 DTC Display (PGN 64906) message support remains identical to Allison 4th and 5th Generation Controls.

B.4.18.2. *AVAILABILITY*

All communication options are available in all 1000 – 4000 Series applications.

B.4.18.3. *CONFIGURATION (VEPS / ACCT)*

NOTE: VEPS options discussed here have no impact on Allison DOC® communication.

B.4.18.3.1. Options Specific to J1939 On-Vehicle Communication

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

The J1939 DM1 (unless disabled via VEPS) and J1939 J2012 DTC Display messages are always supported on the CAN port set to SAE J1939 FULL FUNCTIONALITY. If a TCM CAN port is to be connected to a diagnostic-only network, its question should be answered OFF.

[30015] J1939 BROADCAST: DM1

Set to ENABLED if DM1 broadcasts are desired on the CAN port set to SAE J1939 FULL FUNCTIONALITY. OEMs not requiring this support may opt to answer DISABLED.

B.4.18.3.2. Options Associated with Diagnostic Protocol

[18070] DIAGNOSTICS: Protocol

The TCM must know the DTC format and method for off-vehicle tool communication. Possible answers:

— SAE J1939-73
— UDS WITH SAE J2012 DTC FORMAT (default)
— SSF 14230 WITH SAE J2012 DTC FORMAT

When a UDS- or SSF-based option is selected, that diagnostic protocol is available on all TCM CAN ports; CAN1, CAN2 and CAN3.

[18080] DIAGNOSTICS: J1939-73 Connection

If SAE J1939-73 diagnostic communication is to be used, the TCM must know the diagnostic connector location so it can replicate DM1 broadcasts and support J1939-73 requests on that CAN port. J1939-73 diagnostic messages other than DM1 are only available on this CAN port.

Default is CAN1, with CAN2 and CAN3 as options.

B.4.18.4. *J1939 DM1 SUPPORT*

B.4.18.4.1. DM1 CAN Port Availability

TCM DM1 broadcasts can appear on up to two CAN ports in a given application:

1. Unless **[30015] J1939 BROADCAST: DM1** = DISABLED, DM1 is always broadcast on the CAN port where **ON VEHICLE PROTOCOL** = SAE J1939 FULL FUNCTIONALITY.

2. If **[18070] DIAGNOSTICS: Protocol** = SAE J1939-73, DM1 is also broadcast on the CAN port designated by **[18080] DIAGNOSTICS: J1939-73 Connection**.

B.4.18.4.2. DM1 Operation

When enabled, DM1 is always broadcast from SA 03 (Transmission #1). Allison retarder applications will also broadcast DM1 from SA 16 (Retarder – Driveline).

DM1 is broadcast at a 1 S rate regardless of fault presence. All public Allison DTCs are supported.

B.4.18.5. *J1939 DM2 SUPPORT*

B.4.18.5.1. DM2 CAN Port Availability

DM2 is supported on the CAN port designated by **[18080] DIAGNOSTICS: J1939-73 Connection** when **[18070] DIAGNOSTICS: PROTOCOL** = SAE J1939-73.

B.4.18.5.2. DM2 Operation

DM2 is always broadcast from SA 03 (Transmission #1). Allison retarder applications will also broadcast DM2 from SA 16 (Retarder – Driveline).

DM2 is broadcast on request. All public Allison DTCs are supported.

B.4.18.6. *J1939 DM3 AND DM11 SUPPORT*

B.4.18.6.1. DM3 & DM11 CAN Port Availability

When **[18070] DIAGNOSTICS: PROTOCOL** = SAE J1939-73, DM3 and DM11 requests are supported on the CAN port designated by **[18080] DIAGNOSTICS: J1939-73 Connection**.

B.4.18.6.2. DM3 & DM11 Operation

To clear TCM or retarder DTCs, the vehicle system must send a Request for either DM3 (PGN 65228) or DM11 (PGN 65235) to either DA 03 (Transmission #1) or global address 255. The Request is received from any valid source address. The TCM does not accept requests directed to DA 16.

DTCs are only cleared if conditions are acceptable (e.g. vehicle stationary, transmission in Neutral). Regardless of a DM3 or DM11 request, all DTCs are cleared in the same manner as if requested via an Allison J1939-based shift selector. The TCM does not support selective DTC clearing.

B.4.18.7. *UDS AND SSF 14230 SUPPORT*

B.4.18.7.1. CAN Port Availability

When **[18070] DIAGNOSTICS: PROTOCOL** = UDS WITH SAE J2012 DTC FORMAT or SSF 14230 WITH SAE J2012 DTC FORMAT, the corresponding "request and response" support is available on any CAN port.

B.4.18.7.2. J1939 Identifier and SA Use

UDS and SSF 14230 support details are found in the Allison Off-Vehicle Communication Specification. Please contact your Allison Customer Integration Engineer.

The TCM (SA 03) will exchange UDS or SSF 14230 data with source addresses:

— SA 249 (Diagnostic Tool #1)
— SA 250 (Diagnostic Tool #2)
— SA 23 (Instrument Cluster #1)

UDS and SSF 14230 content are exchanged via ISO-reserved J1939 PGNs 56064 and 55808. All 29-bit identifiers used are J1939 compatible. Use of PGN 55808 – Reserved for ISO 15765 and physical addressing will result in CAN identifiers:

SA	DA	Priority	CAN Identifier
23	03	6	0x18DA0317
03	23	6	0x18DA1703
249	03	6	0x18DA03F9
03	249	6	0x18DAF903
250	03	6	0x18DA03FA
03	250	6	0x18DAFA03

Use of PGN 56064 – Reserved for ISO 15765 and functional addressing will result in CAN identifiers, all of which will be received by the TCM:

SA	DA	Priority	CAN Identifier
23	255	6	0x18DBFF17
249	255	6	0x18DBFFF9
250	255	6	0x18DBFFFA

NOTE: The priority of the TCM response reflects the priority of the request.

The examples above assume a request with priority 6.

B.4.18.7.3. Normal Operation

UDS and SSF communication flow is via tool request and TCM response. TCM codes can be cleared via the appropriate UDS and SSF modes.

B.4.18.8. *J1939 J2012 DTC DISPLAY MESSAGE*

B.4.18.8.1. CAN Port Availability

The TCM will respond to requests for PGN 64906 on the CAN port where **ON VEHICLE PROTOCOL** = SAE J1939 FULL FUNCTIONALITY.

B.4.18.8.2. J1939 Parameter and SA Use

To read DTCs via this method, the vehicle system must send a global Request for PGN 64906, and receive PGN 64906 – SAE J2012 DTC Display from SA 03 (Transmission #1).

Devices may wish to monitor TCM DM1 broadcasts, as J2012 DTCs will be present whenever the first DM1 SPN field has non-zero data.

B.4.18.8.3. Normal Operation

Upon request, PGN 64906 will convey active DTCs, and any DTCs that have gone inactive since the last code clear.

PGN 64906 may be broadcast in a single frame (≤ 1 DTCs present), or via Transport Protocol (2+ DTCs present). When no DTCs are present, *Number of J2012 DTCs* is set to zero. See PGN 64906 – SAE J2012 DTC Display for data content examples.

B.4.18.9. *VEHICLE INTERFACE REQUIREMENTS*

There are no Allison connector requirements for vehicle OEMs implementing their own diagnostic code readers. Refer to the respective hardware sections in this document for wiring and pin location information.

B.4.18.10. *SAE J2012 DTC AND J1939 SPN / FMI OVERVIEW: B241, C241 & N241 PC, K232 PC SOFTWARE*

NEW FOR B/C/N/241 PC and K232 PC RELEASES:
Any DTC or SPN / FMI content differences with the previous Allison 6th Generation Controls software releases are highlighted in yellow and discussed in the footnotes at the end of the DTC table.

NOTE: Allison regularly updates DMx SPN/FMI content as we add to and improve our diagnostic capabilities. As such, DMx SPN/FMI consumers should anticipate handling new "unexpected" SPN/FMI combinations. For example, if a display has no text string mapped to a new SPN/FMI combination, the display should still convey the SPN/FMI and associate it with the appropriate Allison source address. If the OEM associates a text string with each SPN/FMI, a default string such as "Unknown Fault" may need to be displayed.

NOTE: Product nomenclature:
B = 1000/2000 Series
C = 3000/4000 Series
N = 4000 Series 7-speed models with fast reverse
K = 2000 Series 9-speed models

Table key:

- A = Visual indication enabled. Check Transmission Indicator does not activate but DM1 *Amber Warning Lamp* = 01b.
- C = DTC enabled, and the Check Transmission Indicator activates when this DTC is active. As a result, DM1 *Amber Warning Lamp* = 01b when active.
- E = DTC enabled. No visual cues when active (i.e. DM1 *Amber Warning Lamp* = 00b).
- N = DTC enabled, but not reported in DM1. No visual cues when active.
- T = DTC enabled, Transmission Service Indicator activates when this DTC is active.

SAE J2012 DTC	SAE J1939 SPN	SAE J1939 FMI	Allison DTC Description	B241 PC	C241 PC	N241 PC	K232 PC
P0659	6822	3	Actuator Supply Circuit Voltage 1 High (HSD1)	C	C	C	C
P0658	6822	4	Actuator Supply Circuit Voltage 1 Low (HSD1)	C	C	C	C
P0657	6822	5	Actuator Supply Circuit Voltage 1 Open (HSD1)	C	C	C	C
P2671	6823	3	Actuator Supply Circuit Voltage 2 High (HSD2)	C	C	C	C
P2670	6823	4	Actuator Supply Circuit Voltage 2 Low (HSD2)	C	C	C	C
P2669	6823	5	Actuator Supply Circuit Voltage 2 Open (HSD2)	C	C	C	C
P2686	6824	3	Actuator Supply Circuit Voltage 3 High (HSD3)	C	C	C	C
P2685	6824	4	Actuator Supply Circuit Voltage 3 Low (HSD3)	C	C	C	C
P2684	6824	5	Actuator Supply Circuit Voltage 3 Open (HSD3)	C	C	C	C
P0703 (1)(4)	597	2	Brake Switch Circuit	E / C / C + T	E / C / C + T	E / C / C + T	E / C / C + T
U0073	6597	9	CAN Communication Bus 1 Off	C	C	C	C

SAE J2012 DTC	SAE J1939 SPN	SAE J1939 FMI	Allison DTC Description	B241 PC	C241 PC	N241 PC	K232 PC
U0074	6598	9	CAN Communication Bus 2 Off	C	C	C	C
P0607	2003	12	Control Module Performance	N	N	N	N
P0604	628	31	Control Module Random Access Memory (RAM) Error	E	E	E	E
P2185	110	3	Engine Coolant Temperature Sensor 2 Circuit High	--	N	N	--
P2184	110	4	Engine Coolant Temperature Sensor 2 Circuit Low	--	N	N	--
P0725 (4)	190	14	Engine Speed Sensor Circuit	E / C	E / C	E / C	E / C
P0727 (4)	190	21	Engine Speed Sensor Circuit No Signal	E / C	E / C	E / C	E / C
P0726 (4)	190	2	Engine Speed Sensor Circuit Performance	E / C	E / C	E / C	E / C
P0C2B	2046	11	Engine Stop-Start Electric Pump Fault	--	C	--	--
P2797	1762	1	Engine Stop-Start System Pressure Loss	--	C	--	--
P0837	2796	2	Four Wheel Drive (4WD) Switch Circuit Performance	C	C	C	C
P2793	751	8	Gear Shift Direction Circuit	--	C	C	C
P1790	751	13	Gear Shift Module 1 Calibration Invalid	C	C	C	C
P085D	751	11	Gear Shift Module 1 Direction Mismatch	--	C	C	C
U0304	751	31	Gear Shift Module 1 Incompatible	C	C	C	C
U0404	751	2	Gear Shift Module 1 Invalid Data	C	C	C	C
P1791	752	13	Gear Shift Module 2 Calibration Invalid	--	C	C	--
P085E	752	11	Gear Shift Module 2 Direction Mismatch	--	C	C	--
U0333	752	31	Gear Shift Module 2 Incompatible	--	C	C	--
U0592	752	2	Gear Shift Module 2 Invalid Data	--	C	C	--
P071D (2)	753	2	General Purpose Input Fault	--	E / T	E / T	--
P0731	5877	2	Incorrect 1st Gear Ratio	C	C	C	C
P0732	5878	2	Incorrect 2nd Gear Ratio	C	C	C	C
P0733	5879	2	Incorrect 3rd Gear Ratio	C	C	C	C
P0734	5880	2	Incorrect 4th Gear Ratio	C	C	C	C
P0735	5881	2	Incorrect 5th Gear Ratio	C	C	C	C
P0729	5882	2	Incorrect 6th Gear Ratio	C	C	C	C
P076F	5883	2	Incorrect 7th Gear Ratio	--	--	C	C
P07D9 (5)	5884	2	Incorrect 8th Gear Ratio	--	--	--	C
P07F6 (5)	5885	2	Incorrect 9th Gear Ratio	--	--	--	C
P1739	5876	2	Incorrect Low Gear Ratio	--	C	--	--
P077F	5888	2	Incorrect Reverse 2 Ratio	--	C	C	--
P0736	5887	2	Incorrect Reverse Ratio	C	C	C	C
P0603	8621	31	Internal Control Module Keep Alive Memory Error	E	E	E	E

SAE J2012 DTC	SAE J1939 SPN	SAE J1939 FMI	Allison DTC Description	B241 PC	C241 PC	N241 PC	K232 PC
P060C	2003	11	Internal Control Module Main Processor Performance	E	E	E	E
P27B2	20166	2	Internal Control Module Transmission Range Control Performance	C	C	C	C
P0600	9390	31	Internal SPI Diagnostics	C	C	C	C
U0400 (3)	597	9	Invalid CAN Communication	C + T	C + T	C + T	C + T
U2023	562	2	Invalid Data Received for EBC1 ASR Brake Control Active	E	E	E	--
U2022	561	2	Invalid Data Received for EBC1 ASR Engine Control Active	E	E	E	--
U2025	513	2	Invalid Data Received for EEC1 Actual Engine Percent Torque	E	E	E	--
U2026	514	2	Invalid Data Received for EEC3 Nominal Friction Percent Torque	E	E	E	--
U2024	1716	2	Invalid Data Received for ERC1 Retarder Selection Non-Engine	--	E	E	--
U2011	22247	2	Invalid Data Received from Retarder TSC1 SA Instance 1	--	E	E	--
U2012	22248	2	Invalid Data Received from Retarder TSC1 SA Instance 2	--	E	E	--
U2013	22249	2	Invalid Data Received from Retarder TSC1 SA Instance 3	--	E	E	--
U2014	22250	2	Invalid Data Received from Retarder TSC1 SA Instance 4	--	E	E	--
U2015	22251	2	Invalid Data Received from Retarder TSC1 SA Instance 5	--	E	E	--
U2016	22252	2	Invalid Data Received from Retarder TSC1 SA Instance 6	--	E	E	--
U0100	2000	9	Lost Communication with ECM A	C	C	C	C
U1407	22215	9	Lost Communication with Engine / Arbitrator	--	C	--	--
U0287	2046	9	Lost Communication with Engine Stop-Start Electric Pump	--	C	--	--
U0103	751	9	Lost Communication with Gear Shift Module 1	C	C	C	C
U0291	752	9	Lost Communication with Gear Shift Module 2	--	C	C	--
U2001	22247	9	Lost Communication from Retarder TSC1 SA Instance 1	--	E	E	--
U2002	22248	9	Lost Communication from Retarder TSC1 SA Instance 2	--	E	E	--
U2003	22249	9	Lost Communication from Retarder TSC1 SA Instance 3	--	E	E	--
U2004	22250	9	Lost Communication from Retarder TSC1 SA Instance 4	--	E	E	--
U2005	22251	9	Lost Communication from Retarder TSC1 SA Instance 5	--	E	E	--
U2006	22252	9	Lost Communication from Retarder TSC1 SA Instance 6	--	E	E	--
U2018	562	9	Lost Reception of EBC1 ASR Brake Control Active	E	E	E	--
U2017	561	9	Lost Reception of EBC1 ASR Engine Control Active	E	E	E	--
U2020	513	9	Lost Reception of EEC1 Actual Engine Percent Torque	E	E	E	--
U2021	514	9	Lost Reception of EEC3 Nominal Friction Percent Torque	E	E	E	--
U2019	1716	9	Lost Reception of ERC1 Retarder Selection Non-Engine	--	E	E	--
P0963	2908	3	Main Pressure Modulation Solenoid Control Circuit High	C	C	C	C
P0962	2908	4	Main Pressure Modulation Solenoid Control Circuit Low	C	C	C	C

SAE J2012 DTC	SAE J1939 SPN	SAE J1939 FMI	Allison DTC Description	B241 PC	C241 PC	N241 PC	K232 PC
P0960	2908	5	Main Pressure Modulation Solenoid Control Circuit Open	C	C	C	C
P0961	2908	2	Main Pressure Modulation Solenoid System Performance	C	C	C	C
P071A (4)	9391	2	Neutral At Stop Input Failed On	E / C	E / C	E / C	E / C
P27B4	6585	11	Output Shaft Direction Plausibility	C	C	C	C
P0720	191	14	Output Shaft Speed Sensor Circuit	C	C	C	C
P0722	191	21	Output Shaft Speed Sensor Circuit No Signal	C	C	C	C
P0721	191	2	Output Shaft Speed Sensor Circuit Performance	C	C	C	C
P27B6	191	11	Output Shaft Speed Sensor Plausibility	C	C	--	C
P0123	91	3	Pedal Position Sensor Circuit High Voltage	C	C	C	C
P0122	91	4	Pedal Position Sensor Circuit Low Voltage	C	C	C	C
P2730	5900	3	Pressure Control Solenoid (PCS) 1 Control Circuit High	C	C	C	C
P2729	5900	4	Pressure Control Solenoid (PCS) 1 Control Circuit Low	C	C	C	C
P2727	5900	5	Pressure Control Solenoid (PCS) 1 Control Circuit Open	C	C	C	C
P2728	5900	2	Pressure Control Solenoid (PCS) 1 Control Circuit Performance	C	C	--	C
P2723	5900	21	Pressure Control Solenoid (PCS) 1 Stuck Off	C	C	C	C
P2724	5900	20	Pressure Control Solenoid (PCS) 1 Stuck On	C	C	C	C
P0967	5901	3	Pressure Control Solenoid (PCS) 2 Control Circuit High	C	C	C	C
P0966	5901	4	Pressure Control Solenoid (PCS) 2 Control Circuit Low	C	C	C	C
P0964	5901	5	Pressure Control Solenoid (PCS) 2 Control Circuit Open	C	C	C	C
P0965	5901	2	Pressure Control Solenoid (PCS) 2 Control Circuit Performance	C	C	--	C
P0776	5901	21	Pressure Control Solenoid (PCS) 2 Stuck Off	C	C	C	C
P0777	5901	20	Pressure Control Solenoid (PCS) 2 Stuck On	C	C	C	C
P0971	5902	3	Pressure Control Solenoid (PCS) 3 Control Circuit High	C	C	C	C
P0970	5902	4	Pressure Control Solenoid (PCS) 3 Control Circuit Low	C	C	C	C
P0968	5902	5	Pressure Control Solenoid (PCS) 3 Control Circuit Open	C	C	C	C
P0969	5902	2	Pressure Control Solenoid (PCS) 3 Control Circuit Performance	C	C	--	C
P0796	5902	21	Pressure Control Solenoid (PCS) 3 Stuck Off	--	C	C	C
P0797	5902	20	Pressure Control Solenoid (PCS) 3 Stuck On	--	C	C	C
P2721	5903	3	Pressure Control Solenoid (PCS) 4 Control Circuit High	--	C	C	C
P2720	5903	4	Pressure Control Solenoid (PCS) 4 Control Circuit Low	--	C	C	C
P2718	5903	5	Pressure Control Solenoid (PCS) 4 Control Circuit Open	--	C	C	C
P2719	5903	2	Pressure Control Solenoid (PCS) 4 Control Circuit Performance	--	C	--	C
P2714	5903	21	Pressure Control Solenoid (PCS) 4 Stuck Off	--	C	C	C

SAE J2012 DTC	SAE J1939 SPN	SAE J1939 FMI	Allison DTC Description	B241 PC	C241 PC	N241 PC	K232 PC
P2715	5903	20	Pressure Control Solenoid (PCS) 4 Stuck On	--	C	C	C
P2739	5904	3	Pressure Control Solenoid (PCS) 5 Control Circuit High	--	C	C	C
P2738	5904	4	Pressure Control Solenoid (PCS) 5 Control Circuit Low	--	C	C	C
P2736	5904	5	Pressure Control Solenoid (PCS) 5 Control Circuit Open	--	C	C	C
P2737 (5)	5904	2	Pressure Control Solenoid (PCS) 5 Control Circuit Performance	--	--	--	C
P2732 (5)	5904	21	Pressure Control Solenoid (PCS) 5 Control Circuit Stuck Off	--	--	--	C
P2733 (5)	5904	20	Pressure Control Solenoid (PCS) 5 Control Circuit Stuck On	--	--	--	C
P2815	5905	3	Pressure Control Solenoid (PCS) 6 Control Circuit High	--	C	C	--
P2814	5905	4	Pressure Control Solenoid (PCS) 6 Control Circuit Low	--	C	C	--
P2812	5905	5	Pressure Control Solenoid (PCS) 6 Control Circuit Open	--	C	C	--
P2813	5905	2	Pressure Control Solenoid (PCS) 6 Control Circuit Performance	--	C	--	--
P2808	5905	21	Pressure Control Solenoid (PCS) 6 Stuck Off	--	C	C	--
P2809	5905	20	Pressure Control Solenoid (PCS) 6 Stuck On	--	C	C	--
P2743	120	3	Retarder Oil Temperature Sensor Circuit High	--	N	N	--
P2742	120	4	Retarder Oil Temperature Sensor Circuit Low	--	N	N	--
P273F (6)	120	15	Retarder Oil Temperature Sensor Over Temperature Condition	--	E + A	E + A	--
P0990	119	3	Retarder Pressure Circuit High	--	N	N	--
P0989	119	4	Retarder Pressure Circuit Low	--	N	N	--
C1313	1716	3	Retarder Request Sensor Circuit High	--	N	N	--
C1312	1716	4	Retarder Request Sensor Circuit Low	--	N	N	--
P0642	3509	2	Sensor Reference Voltage “A” Circuit Fault	C	C	C	C
P0652	3510	2	Sensor Reference Voltage “B” Circuit Fault	C	C	C	C
P0974	5908	3	Shift Solenoid 1 Control Circuit High	C	C	C	C
P0973	5908	4	Shift Solenoid 1 Control Circuit Low	C	C	C	C
P097A	5908	5	Shift Solenoid 1 Control Circuit Open	C	C	C	C
P0751	5908	21	Shift Solenoid 1 Valve Performance - Stuck Off	C	--	--	--
P0752	5908	20	Shift Solenoid 1 Valve Performance - Stuck On	C	C	C	--
P0977	5909	3	Shift Solenoid 2 Control Circuit High	C	C	C	C
P0976	5909	4	Shift Solenoid 2 Control Circuit Low	C	C	C	C
P097B	5909	5	Shift Solenoid 2 Control Circuit Open	C	C	C	C
P0756	5909	21	Shift Solenoid 2 Valve Performance - Stuck Off	C	--	--	--
P0757	5909	20	Shift Solenoid 2 Valve Performance - Stuck On	C	--	--	--
P0980	5910	3	Shift Solenoid 3 Control Circuit High	C	--	--	--

SAE J2012 DTC	SAE J1939 SPN	SAE J1939 FMI	Allison DTC Description	B241 PC	C241 PC	N241 PC	K232 PC
P0979	5910	4	Shift Solenoid 3 Control Circuit Low	C	--	--	--
P097C	5910	5	Shift Solenoid 3 Control Circuit Open	C	--	--	--
P0761	5910	21	Shift Solenoid 3 Valve Performance - Stuck Off	C	--	--	--
P0762	5910	20	Shift Solenoid 3 Valve Performance - Stuck On	C	--	--	--
P0562	158	4	System Voltage Low	--	C	--	--
P0634	5912	0	TCM Internal Temperature Too High	C	C	C	C
P0602	630	13	TCM Not Programmed	C	C	C	C
P0880	168	14	TCM Power Input Signal	N	N	N	N
P0883	168	3	TCM Power Input Signal High	C	C	C	C
P0882	168	4	TCM Power Input Signal Low	C	C	C	C
P0881	168	2	TCM Power Input Signal Performance	N	N	N	N
P1892	91	8	Throttle Position Sensor PWM Signal High	C	C	C	C
P1891	91	8	Throttle Position Sensor PWM Signal Low	C	C	C	C
P0614	747	31	Torque Control Data Mismatch - ECM/TCM	C	C	C	C
P2763	740	3	Torque Converter Clutch (TCC) Pressure Control Solenoid (PCS) Control Circuit High	C	C	C	C
P2764	740	4	Torque Converter Clutch (TCC) Pressure Control Solenoid (PCS) Control Circuit Low	C	C	C	C
P2761	740	5	Torque Converter Clutch (TCC) Pressure Control Solenoid (PCS) Control Circuit Open	C	C	C	C
P2762	740	2	Torque Converter Clutch (TCC) Pressure Control Solenoid (PCS) Control Circuit Performance	C	C	--	C
P0741	573	21	Torque Converter Clutch (TCC) System Stuck Off	C	C	C	C
P2637	9393	7	Torque Management Feedback Signal “A” (SEM)	C	C	C	C
P2641	9394	7	Torque Management Feedback Signal “B” (LRTP)	C	C	C	C
P2789	4178	1	Transmission Clutch Life Expired (Clutch Adaptive Learning at Limit)	C	C	C	--
P0701	785	14	Transmission Control System Performance	N	--	--	N
P088A	3359	18	Transmission Filter Maintenance Alert	--	E	--	--
P088B	3359	1	Transmission Filter Maintenance Required	C	C	C	C
P0897	4177	1	Transmission Fluid Deteriorated	C	C	C	C
P070D	3027	3	Transmission Fluid Level Sensor Circuit High	--	N	N	--
P070C	3027	4	Transmission Fluid Level Sensor Circuit Low	--	N	N	--
P0218 (6)	177	15	Transmission Fluid Over Temperature Condition	E + A	E + A	E + A	E + A
P0843	5891	3	Transmission Fluid Pressure Switch 1 Circuit High	C	C	C	C
P0842	5891	4	Transmission Fluid Pressure Switch 1 Circuit Low	C	C	C	C
P0848	5892	3	Transmission Fluid Pressure Switch 2 Circuit High	C	C	--	C
P0847	5892	4	Transmission Fluid Pressure Switch 2 Circuit Low	C	C	--	C

SAE J2012 DTC	SAE J1939 SPN	SAE J1939 FMI	Allison DTC Description	B241 PC	C241 PC	N241 PC	K232 PC
P0873	5893	3	Transmission Fluid Pressure Switch 3 Circuit High	C	--	--	C
P0872	5893	4	Transmission Fluid Pressure Switch 3 Circuit Low	C	--	--	C
P0878	5894	3	Transmission Fluid Pressure Switch 4 Circuit High	C	--	--	C
P0877	5894	4	Transmission Fluid Pressure Switch 4 Circuit Low	C	--	--	C
P0713 (4)	177	3	Transmission Fluid Temperature Sensor Circuit High	E / C	C	C	E / C
P0712 (4)	177	4	Transmission Fluid Temperature Sensor Circuit Low	E / C	C	C	E / C
P0711	177	2	Transmission Fluid Temperature Sensor Circuit Performance	C	C	C	C
P0708 (5)	20167	3	Transmission Range Sensor 1 Circuit High	--	--	--	C
P0707 (5)	20167	4	Transmission Range Sensor 1 Circuit Low	--	--	--	C
P0706 (5)	20167	2	Transmission Range Sensor 1 Circuit Performance	--	--	--	C
P2803 (5)	20168	3	Transmission Range Sensor 2 Circuit High	--	--	--	C
P2802 (5)	20168	4	Transmission Range Sensor 2 Circuit Low	--	--	--	C
P2801 (5)	20168	2	Transmission Range Sensor 2 Circuit Performance	--	--	--	C
P0708	751	14	Transmission Range Sensor Circuit High	C	--	--	--
P0706	2003	11	Transmission Range Sensor Circuit Performance	C	E	E	--
P2805 (5)	20167	11	Transmission Range Sensor Plausibility	--	--	--	C
U1402	12967	14	TSC1 C Brake Imposter Detection	N	N	N	N
U1403	12968	14	TSC1 E Brake Imposter Detection	N	N	N	N
U1401	12966	14	TSC1 Engine Imposter Detection	N	N	N	N
P0717	750	21	Turbine Shaft Speed Sensor Circuit No Activity	C	C	C	C
P0716	750	2	Turbine Shaft Speed Sensor Circuit Performance	C	C	C	C
P0715	750	14	Turbine Speed Sensor Circuit	C	C	C	C
P0894	36	7	Unexpected Mechanical Gear Disengagement	--	C	C	C
NA (6)	2003	31	Check Transmission Indicator	C	C	C	C
NA (6)	4177	17	Transmission Service Indicator - Oil Life Monitor	A	A	A	A
NA (6)	3359	31	Transmission Service Indicator - Filter Life Monitor	A	A	A	A
NA (6)	4178	31	Transmission Service Indicator - Transmission Health Monitor	A	A	A	A

(1) DTC P0703: This DTC is enabled for all vocations. Mission critical vocations also activate the Check Transmission Indicator and the Transmission Service Indicator when this DTC is set.

(2) DTC P071D: This DTC is enabled for all applicable product families. Certain applications also activate the Transmission Service Indicator when this DTC is set.

(3) DTC U0400: See discussion under functions AUXILIARY FUNCTION RANGE INHIBIT – SINGLE INPUT and DIRECTION CHANGE ENABLE. The Allison DTC Description was revised.

(4) These DTCs are enabled in all applicable product families. Certain applications also activate the Check Transmission Indicator.

(5) These DTCs are unique to 2000 Series 9-speed models.

(6) These SPN/FMI combinations are used for indicator functions via DM1. See DM1 under the J1939 MESSAGE AND PARAMETER USE section for details.

B.4.19. DIRECT HOLD

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.19.1. *OVERVIEW*

Direct Hold facilitates engagement of a direct drive transmission range directly from Neutral. This function can also be accomplished via GPI CE (see the Allison 6th Generation Controls Installation Manual).

B.4.19.2. *AVAILABILITY*

The J1939-based implementation is optional in 3000/4000 Series 6-speed and 7-speed applications with fast reverse.

B.4.19.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameter must be received from the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[25110] DIRECT HOLD INPUT

To enable Direct Hold set to:

- J1939 PTODE INTERFACE Transmission Output Shaft PTO
- J1939 CCVS1 Parking Brake Switch & J1939 PTODE INTERFACE Transmission Output Shaft PTO

B.4.19.3.1. VEPS / ACCT Trims

The following trims influence Direct Hold operation:

[25111] DIRECT HOLD INPUT: Range

This parameter specifies the transmission range used when Direct Hold Input is active.

[25117] DIRECT HOLD INPUT: Selectable Range

This parameter allows the operator to select between 4th and 5th range via the shift selector when the Direct Hold function is active. When set to DISABLED, no selector override is possible. When set to ENABLED, the shift selector may be used to select the range.

[25115] DIRECT HOLD INPUT: Custom Lockup Apply Speed

This parameter defines a specific lockup apply speed that is used during Direct Hold operation. When set to DISABLED, lockup will apply based on the selected shift schedule. Customer Integration Engineering review is required for application that utilize a custom lockup apply speed.

[25112] DIRECT HOLD INPUT: Output Speed Range Shift Inhibit Direct Drive to Single Overdrive
[25113] DIRECT HOLD INPUT: Output Speed Range Shift Inhibit Direct Drive to Single Overdrive

These parameters define the maximum output shaft speed at which shifts between the direct drive and single overdrive ranges may be requested via the shift selector. When set to DISABLED, the corresponding shift is not available while Direct Hold is active.

B.4.19.4. *J1939 PARAMETER AND SA USE*

B.4.19.4.1. Required Broadcast Support

The J1939 network is required to provide PTODE *Enable Switch – Transmission Output Shaft PTO* from one of the following SAs, in order of TCM preference:

1. SA 49 (Cab Controller) (V)
2. SA 23 (Instrument Cluster #1)
3. SA 33 (Body Controller)

B.4.19.4.2. Optional Broadcast Support

If DIRECT HOLD INPUT is set to J1939 CCVS1 Parking Brake Switch & J1939 PTODE INTERFACE Transmission Output Shaft PTO, the J1939 network is required to provide CCVS1 *Parking Brake Switch* from one of the following SAs, in order of TCM preference:

4. SA 17 (Cruise Control) (V)
5. SA 49 (Cab Controller)
6. SA 39 (Management Computer #1)
7. SA 23 (Instrument Cluster #1)
8. SA 33 (Body Controller)
9. SA 00 (Engine #1)

B.4.19.4.3. Required Reception Support

The vehicle system is required to receive PTODE *Operation Consent – Transmission Output Shaft PTO* from SA 03 (Transmission #1).

B.4.19.5. *OTHER REQUIREMENTS / RESTRICTIONS*

B.4.19.5.1. General Requirements

General function requirements as described in Allison 6th Generation Controls Tech Data for GPI Function CE must be followed.

B.4.19.5.2. Customer Integration Engineering Review

Due to the potential impacts on torsional vibration and hydraulic pressure capacity, Allison Customer Integration Engineering review is required before a custom lockup apply speed may be implemented for this function.

B.4.19.6. *NORMAL OPERATION*

The datalink implementation of Direct Hold mimics the behavior of the corresponding GPI function. A detailed function description is available in Allison 6th Generation Controls Tech Data for GPI Function CE.

PTODE *Enable Switch – Transmission Output Shaft PTO* takes the place of the Direct Hold Input wire.

Depending on the DIRECT HOLD INPUT configuration choice, parking brake state may be incorporated either as part of the PTODE *Enable Switch – Transmission Output Shaft PTO* signal, or separately via CCVS1 *Parking Brake Switch*.

PTODE *Operation Consent – Transmission Output Shaft PTO* takes the place of the Range Indicator wire and indicates when Direct Hold operation is active.

The transmission enters Direct Hold operation when the vehicle is stopped with the transmission in Neutral, the required inputs are activated, and subsequently Drive is selected on the shift selector. The transmission exits Direct Hold operation when any of the required inputs are deactivated or Neutral is selected on the shift selector.

B.4.19.7. *TCM FAILURE MODES & RESPONSES*

If PTODE *Enable Switch – Transmission Output Shaft PTO* reception is lost or indicates 10b (Error) or 11b (Not available), the transmission will treat it the same as receiving this signal as 00b (Enable switch off – PTO operation not desired).

If CCVS1 *Parking Brake Switch* reception is lost or indicates 10b (Error) or 11b (Not available), the transmission will treat it the same as receiving this signal as 00b (Parking brake not set).

B.4.19.7.1. PTO engaged without consent or not disengaged when consent revoked

> **WARNING:** Engaging a PTO drive or continuing drive engagement when consent is removed may result in damage to the transmission and / or the PTO drive mechanism.

B.4.20. DIRECTION CHANGE ENABLE

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.20.1. *OVERVIEW*

The Direction Change Enable (DCE) function prevents inadvertent shifts which would result in a change to the vehicle direction.

DCE input examples include a push-button, door status, or service brake switch. J1939 data may be substituted for a brake switch GPI. The GPI can then be used as an additional signal processed in series with the brake switch.

B.4.20.2. *AVAILABILITY*

The J1939-based implementation is optional in 1000 – 4000 Series applications.

The "Mission Critical" failure mode response under TCM FAILURE MODES AND RESPONSES is only available with certain **VOCATIONAL USAGE**s; see below.

Implementations using GPI W are only available in 3000/4000 Series applications.

B.4.20.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be provided to the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[25120] DIRECTION CHANGE ENABLE INPUT

For DCE via J1939 only, set the answer to ONLY SERVICE BRAKE STATUS. To use a J1939 brake input and GPI W in series, set the answer to BOTH GPI W & SERVICE BRAKE STATUS (IN SERIES).

[25300] SERVICE BRAKE STATUS INPUT

Set answer to either J1939 CCVS1 BRAKE SWITCH or J1939 EBC1 EBS BRAKE SWITCH.

[10010] VOCATIONAL USAGE

The "Mission Critical" failure mode responses under TCM FAILURE MODES AND RESPONSES will only be invoked if VOCATIONAL USAGE is set to one of:

- CRASH / RESCUE /MILITARY
- FIRE / EMERGENCY
- SPECIALTY / MILITARY

[24000] GENERAL PURPOSE INPUTS AND OUTPUTS (GPIO) PACKAGE

To use the DCE GPI in series with the J1939 input, the GPIO package must contain GPI W.

B.4.20.4. *J1939 PARAMETER AND SA USE*

B.4.20.4.1. Required Support

The J1939 network is required to provide one of the J1939 brake switch parameters as described under SERVICE BRAKE STATUS INPUT.

B.4.20.5. *OTHER REQUIREMENTS / RESTRICTIONS*

Vehicle OEMs and body builders should consider potential operational differences when substituting a J1939 brake switch parameter for GPI W.

J1939 brake switch data does not indicate service brake *application*; it indicates operator *desire* for brake application. Systems designed for a brake pressure switch may use a high threshold to ensure brake *application*, and therefore may react differently when J1939 brake switch data is substituted.

B.4.20.6. *NORMAL OPERATION*

Upon TCM power-up, the first Neutral-to-range shift is unaffected by DCE, as the TCM has no previous range selection or "direction" for reference.

B.4.20.6.1. After the First Shift out of Neutral

When DCE is active, direction-changing shift requests (Reverse-to-Drive or Drive-to-Reverse) are honored assuming all other operating conditions are acceptable.

When DCE is inactive, direction-changing shifts are inhibited and the TCM will command Neutral. Requests to shift from Neutral to the previously attained range are still honored.

B.4.20.7. *OPERATION VS. VEPS OPTIONS*

Three implementations are available per **[25120] DIRECTION CHANGE ENABLE INPUT**:

B.4.20.7.1. ONLY GPI W IF DEFINED IN SELECTED GPIO PACKAGE

Only available with 3000/4000 Series transmissions. TCM J1939 reception does not affect the function. See the Allison 6th Generation Controls Installation Manual and GPIO schematics for more information.

B.4.20.7.2. ONLY SERVICE BRAKE STATUS

Direction-changing shifts are inhibited when the J1939 brake switch parameter indicates 00b (brake pedal released), and allowed when it indicates 01b (brake pedal depressed).

B.4.20.7.3. BOTH GPI W & SERVICE BRAKE STATUS (IN SERIES)

Only available with 3000/4000 Series transmissions. Direction-changing shifts are inhibited unless the GPI W circuit is closed and the J1939 brake switch parameter indicates 01b (brake pedal depressed).

B.4.20.8. *TCM FAILURE MODES & RESPONSES*

B.4.20.8.1. "Normal" Applications

In "Normal" applications, J1939 input failures will prevent direction changes during the active key switch cycle. If the J1939 input has failed, cycling the key switch will allow one Neutral-to-range shift.

Invalid or Missing Brake Switch Data

WARNING: If J1939 brake switch data indicates 10b (Error), 11b (Not Available), or reception is lost, the TCM assumes the brake pedal is released; direction-changing shifts are continuously inhibited.

Body builders and vehicle OEMs are urged to consider this failure mode. If a more robust failure mode response is deemed necessary, GPI F (AUXILIARY FUNCTION RANGE INHIBIT – DUAL INPUT) should be considered.

No DTC is set, and the Check Trans Indicator is not activated. DCE functionality will resume when the TCM receives valid J1939 brake switch data.

Brake Switch Rationality Failure

While J1939 brake switch data is valid, the TCM continually evaluates signal rationality. If several vehicle accelerations are detected while 01b (brake pedal depressed) is indicated, DTC P0703 is set. The Check Trans Indicator is not activated.

Direction-changing shifts are not allowed during the key switch cycle where P0703 was set. Cycling the key switch will reset the acceleration counter, thus allowing direction-changing shifts until DTC P0703 sets again.

B.4.20.8.2. "Mission Critical" Applications

In "Mission Critical" applications, inability to move the vehicle might have dire consequences. As such, the DCE interlock is overridden during J1939 input failures; vehicle direction may still be changed, even though the J1939 brake switch data may be invalid, irrational or absent.

Invalid or Missing Brake Switch Data

In conjunction with the above response, DTC U0400 is logged and both the Check Trans Indicator and the Transmission Service Indicator are activated. These inform the operator that even though the DCE function appears to operate normally, there is actually something wrong with the vehicle.

NOTE: The Transmission Service Indicator is the preferred indicator, as the issue does not warrant taking the vehicle out of service immediately. The transmission and vehicle are fully functional, but the interlock is no longer effective. Check Trans indications usually coincide with issues that restrict transmission operation.

For this reason, Allison recommends that a Transmission Service Indicator be installed in "Mission Critical" applications using J1939-based DCE.

Brake Switch Rationality Failure

If several vehicle accelerations are detected while 01b (brake pedal depressed) is indicated, DTC P0703 is set. The Transmission Service and Check Trans Indicators are activated.

B.4.21. DOWNHILL SPEED CONTROL

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.21.1. *OVERVIEW*

NEW FOR B/C/N240 PSC RELEASES:

- The Downhill Speed Control functions have been consolidated and related VEPS configuration options have been revised.
- Added optional use of signal EC3 *Engine Friction Percent Torque Points.*
- Added VEPS parameters 29093, 29094, and 29095.

Downhill Speed Control activates and modulates the Engine Brake, Retarder, and/or Range Control to prevent the vehicle from exceeding certain vehicle speeds. Function options allow modulation to be triggered when vehicle speed exceeds:

- the cruise control set speed, or
- the road speed limit, or
- a vehicle speed learned at the moment the operator releases the accelerator pedal, or
- a vehicle speed learned at the moment the operator releases the service brake pedal, or
- a vehicle speed learned at the moment the operator releases the retarder lever.

B.4.21.2. *AVAILABILITY*

Downhill Speed Control is optional in all 1000 – 4000 Series applications. Downhill Speed Control via Retarder is limited to retarder applications. Customer Integration Engineering review is required.

B.4.21.3. *CONFIGURATION (VEPS / ACCT)*

B.4.21.3.1. Downhill Speed Control Configuration

[20260] DOWNHILL SPEED CONTROL
Answer must be set to ENABLED to use this feature.

[20261] DOWNHILL SPEED CONTROL: Speed Source
This parameter defines the input(s) used by Downhill Speed Control to determine the target speed.

[20262] DOWNHILL SPEED CONTROL: Torque Source
This parameter defines negative torque sources available to Downhill Speed Control to modulate speed. Possible choices include combinations of the driveline retarder (if equipped), engine brake, and preselect downshifts (Range Control).

[20264] DOWNHILL SPEED CONTROL: Speed Offset (Kph)
This parameter defines the speed difference between the set speed and the actual vehicle speed, beyond which the Downhill Speed Control function will attempt to control vehicle speed.

[20252] DOWNHILL SPEED CONTROL: Hold While Braking
Answer must be set to ENABLED to maintain negative torque through a service braking event when below the Downhill Speed Control set speed.

B.4.21.3.2. Downhill Speed Control Interface

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2
Parameter must be received from the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[20020] RETARDER INTERFACE
Answer must be set to one of:

- 0 = ONLY GPIO INTERFACE [ANALOG RMR OR GPI Z OR GPI BV WITH GPO Q IF DEFINED IN SELECTED GPIO PACKAGE]
- 1 = ONLY J1939 INTERFACE [INPUT VIA ERC1 RETARDER SELECTION – NON-ENGINE]
- 2 = BOTH GPIO AND J1939 INTERFACES

[16220] RETARDER: Downhill Speed Control Enable Input

Answer defines the operator input that will be used to enable any configured Downhill Speed Control via Retarder responses. Set to 1 = RETARDER INTERFACE to use the configured Retarder GPI. Set to 2 = J1939 ERC1 RETARDER ROAD SPEED LIMIT SWITCH to use [ERC1 *Retarder Road Speed Limit Switch*].

[20062] RETARDER: Use of GPI Interface

Answer specifies if the Retarder Enable GPI will be used for 1 = ANALOG RMR AND DOWNHILL SPEED CONTROL, or 2 = DOWNHILL SPEED CONTROL ONLY.

Setting of these parameters for Downhill Speed Control via Retarder depend on the type of retarder controls installed on the vehicle, and the desired method to convey the operator input to the TCM; refer to the table below for the various combinations of settings.

Retarder controls on vehicle	Retarder DSC enable source	VEPS/ACCT parameter		
		20020	16220	20062
Only GPIO	Retarder enable GPI	0	1	1
Only J1939	Retarder enable GPI	2	1	2
	J1939 ERC1	1	2	1
Both GPIO and J1939	Retarder enable GPI	2	1	1
	J1939 ERC1	2	2	1

Input Configuration Options for DSC via Retarder

[21401] ENGINE BRAKE: Downhill Speed Control Enable Input

Answer defines the operator input that will be used to enable any configured Downhill Speed Control via Engine Brake responses. To use Downhill Speed Control via Engine Brake, set this parameter to 1 = J1939 ERC1 Retarder Enable Brake Assist Switch from Tailored Source Address.

[29164] J1939 SA: ERC1 Retarder Enabled Brake Assist Switch

Answer defines the source address from which Downhill Speed Control will receive the ERC1 *Retarder Enable – Brake Assist Switch* signal.

[22021] ENGINE BRAKE: Minimum Required Speed

Answer defines the minimum engine speed required for engine brake operation.

[29093] J1939 BROADCAST: ERC2 Retarder Road Speed Limit Enable

Default answer is DISABLED. Set to ENABLED if broadcast of ERC2 *Retarder Road Speed Limit Enable* is desired.

[29094] J1939 BROADCAST: ERC2 Retarder Road Speed Limit Active

Default answer is DISABLED. Set to ENABLED if broadcast of ERC2 *Retarder Road Speed Limit Active* is desired.

[29095] J1939 BROADCAST: ERC2 Retarder Road Speed Limit Set Speed

Default answer is DISABLED. Set to ENABLED if broadcast of ERC2 *Retarder Road Speed Limit Set Speed* is desired.

B.4.21.3.3. Cruise Control and Road Speed Limit Options

[20050] RETARDER: Cancel Retarder when Cruise Control is Active

Answer must be set to NO to use the cruise control aspects of this function.

[20060] RETARDER: Cancel Cruise Control upon Rapid Modulation Request Increase

Answer must be set to NO to use the cruise control aspects of this function.

[20251] DOWNHILL SPEED CONTROL: Road Speed Limiter Set Speed Detection

Defines which signals are used by Downhill Speed Control to derive the speed that the road speed limiter is set to. See ROAD SPEED LIMITING for details.

B.4.21.4. *J1939 PARAMETER AND SA USE*

B.4.21.4.1. Required Support

Where J1939-based functions are referenced, see their respective functions for parameter and SA requirements:

To use cruise control to trigger this function, CRUISE CONTROL, STANDARD function support is required.

To use road speed limits to trigger this function, ROAD SPEED LIMITING function support is required.

To use the accelerator pedal to trigger this function, an accelerator pedal position input is required. If accomplished via J1939, then ACCELERATOR PEDAL INPUT function support is required.

To use the service brake pedal to trigger this function or to support Hold While Braking, a service brake status input is required. If accomplished via J1939, then SERVICE BRAKE STATUS INPUT function support is required.

To use the retarder lever to trigger this function, a retarder lever input is required. If accomplished via J1939, support for ERC1 *Retarder Selection, Non-Engine* as described in function RETARDER CONTROL is required.

If ERC1 *Retarder Road Speed Limit Switch* is specified as the Downhill Speed Control via Retarder enable input, the vehicle system must provide the parameter from one of the following SAs, in order of TCM preference:

1. SA 39 (Management Computer #1)
2. SA 33 (Body Controller)

B.4.21.4.2. Optional Support

Downhill Speed Control operation is further optimized when SA 00 (Engine #1) provides EC3 *Engine Friction Percent Torque Points*. Use of this signal requires a compatible **ENGINE MAKE AND MODEL** as validated by the Allison Engine Integration group.

The TCM can be configured to broadcast Downhill Speed Control related information in ERC2 *Retarder Road Speed Limit Enable*, ERC2 *Retarder Road Speed Limit Active*, and ERC2 *Retarder Road Speed Limit Set Speed* from SA 03 (Transmission #1).

B.4.21.5. *NORMAL OPERATION*

> **WARNING:** The operator always has overall responsibility for the speed of the vehicle. Use of the service brakes may be required at times when Downhill Speed Control is not able to hold the vehicle at the desired speed.

B.4.21.5.1. Enabling Downhill Speed Control via Retarder

All aspects of this part of the function are enabled or disabled based on the operator input specified in VEPS question **[16220] RETARDER: Downhill Speed Control Input Enable**.

B.4.21.5.2. Enabling Downhill Speed Control via Engine Brake

All aspects of this part of the function are enabled or disabled based on the operator input specified in VEPS question **[21401] ENGINE BRAKE: Downhill Speed Control Input Enable**.

B.4.21.5.3. Cruise Control and Road Speed Limit Triggers

When Downhill Speed Control is active and engine torque is being limited by the cruise control system or the road speed governor, the TCM automatically requests negative torque when all other activation conditions are met, and the vehicle speed has exceeded the associated cruise control set speed or road speed limit thresholds. Negative output torque is continuously adjusted in an attempt to maintain vehicle speed within the configured margins.

B.4.21.5.4. Operator Control Release Triggers

When the configured operator control (accelerator pedal, service brake pedal and / or retarder lever) is released and the associated vehicle speed offset is exceeded, the TCM will modulate the available negative output torque sources if all other activation criteria are met. If multiple operator controls are enabled, the TCM will react to the operator input that results in the lowest target speed.

In any case, the Downhill Speed Control event is deactivated and the learned set speed is reset when the accelerator pedal is applied.

When cruise control is active and a brief “tap” (short apply and release) is applied to the service brake pedal or retarder lever, the TCM assumes such “taps” are intended for canceling cruise control. As such, the TCM will not trigger the associated Downhill Speed Control responses.

B.4.21.5.5. Interactions with Other Retarder Inputs

Other retarder inputs requesting additional retarder torque will still be arbitrated and honored while any aspect of Downhill Speed Control via Retarder is active.

B.4.21.5.6. Interactions with Other Range Control

Other TCM preselect inputs will still be honored while any aspect of Downhill Speed Control via Range Control is active. The TCM always attempts to invoke the lowest preselect requested.

B.4.21.5.7. Interactions with Other Engine Brake Inputs

Other engine brake inputs will still be modulated and prioritized by the Engine while any aspect of Downhill Speed Control via Engine Brake is active. The resulting engine brake response may not match what the TCM is requesting.

B.4.21.6. *FAILURE MODES AND RESPONSES*

The TCM may disable Downhill Speed Control if the TCM fails to receive valid data for any of the required parameters, or the TCM detects faults in system.

B.4.22. DYNACTIVE™ SHIFTING

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.22.1. *OVERVIEW*

DynActive replaces traditional shift scheduling based on output speed and throttle with a set of equations designed to find the most fuel efficient means of implementing driver commands and specified performance. Although DynActive is a fuel efficiency optimizer, many find the shift scheduling to exhibit a more intuitive feel than the traditional approach.

DynActive may be used in Primary shift schedule only, Secondary shift schedule only, or both Primary and Secondary shift schedules.

B.4.22.2. *AVAILABILITY*

DynActive is optional in 1000 – 4000 Series applications. It is standard in 2000 Series 9-speed applications.

B.4.22.3. *CONFIGURATION (VEPS / ACCT)*

[17690] DYNACTIVE SHIFTING

Must be set to one of the ENABLED options.

[11020] ENGINE MAKE AND MODEL

DynActive can only be enabled for compatible electronic engines as certified by the Allison Engine Integration group.

[17010] PRIMARY MODE: Shift Schedule
[17050] SECONDARY MODE: Shift Schedule

May be set to any shift schedule.

[22000] ENGINE BRAKE INTERFACE

Must not be set to DISABLED

B.4.22.3.1. VEPS / ACCT Trims

The following trims influence DynActive operation:

[17705] DynActive: Maximum Converter Slip to allow LU Apply (RPM)

Maximum Converter Slip to allow LU Apply is used to lower the initial slip across the torque converter during the transition to lockup operation. This can be used to reduce noise and vibration but will increase time spent in converter operation and will result in increased engine speed before exiting converter mode.

[17926] DynActive: Engine Load Used In Downshift Selection

Engine Load Used In Downshift Selection allows DynActive to consider high engine percent load indications as a request for downshift power. Default is ENABLED. This parameter may be set to DISABLED for engines whose EEC2 *Engine Percent Load At Current Speed* broadcast causes shift cycling during cruise control operation.

[17610] PRIMARY MODE: DynActive: Flat Ground Economy Bias
[17620] SECONDARY MODE: DynActive: Flat Ground Economy Bias

Flat Ground Economy Bias adjusts the desired economy when the vehicle is operating on level ground. A setting of 100% provides maximum economy. A setting of 0% provides maximum acceleration.

[17670] PRIMARY MODE: DynActive: Grade Economy Bias
[17680] SECONDARY MODE: DynActive: Grade Economy Bias

Grade Economy Bias adjusts the desired economy when the vehicle is operating on grades. A setting of 100% provides maximum economy. A setting of 0% provides maximum performance.

[17673] PRIMARY MODE: DynActive: Lockup Range
[17683] SECONDARY MODE: DynActive: Lockup Range

Lockup Range specifies the lowest range for continuous operation with torque converter in the locked state.

[17674] PRIMARY MODE: DynActive: Maximum Converter Range
[17684] SECONDARY MODE: DynActive: Maximum Converter Range

Maximum Converter Range specifies the highest range for unlocked torque converter operation under normal conditions.

[17675] PRIMARY MODE: DynActive: Optional Lockup Range
[17685] SECONDARY MODE: DynActive: Optional Lockup Range

Optional Lockup Range specifies the lowest range for transient operation with torque converter in the locked state.

[17900] DynActive: Engine Torque Curve

Set to DEFINED to configure the engine torque curve via VEPS parameters 17901 through 17920 and 17941 through 17960. This is required if DynActive is used with non-LRTP / non-SEM engines. Leave at the default setting of LEARNED to let the TCM learn the torque curve.

[17925] DynActive: Engine Torque Curve Initialized Learn

Leave at the default setting of NO INITIALIZATION to let the TCM learn the engine torque curve without initial values. Set to INITIALIZATION WITH AETC to derive initial values from the J1939 AETC message. Set to INITIALIZE WITH DEFINED CURVE to derive initial values from the torque curve configured via VEPS parameters 17901 through 17920 and 17941 through 17960.

[17901] DynActive: Defined Engine Curve - Speed Point 1 (RPM) through [17901] DynActive: Defined Engine Curve - Speed Point 20 (RPM) [17921] DynActive: Defined Engine Curve - Torque Point 1 (NM) through [17901] DynActive: Defined Engine Curve - Torque Point 20 (NM)

Optional engine torque curve configuration.

[17982] DynActive: Downhill Lockup with Low Accelerator

Enables lockup operation when closed throttle vehicle acceleration is above a customizable threshold.

[17983] DynActive: Downhill Lockup with Low Accelerator Threshold (m/s2)

Customizable closed throttle vehicle acceleration threshold for lockup operation.

[28170] J1939 RECEPTION: EC1 Engine Map

DynActive uses the Engine Map as represented by EC1 Torque/Speed Points 1-6 to detect derated engine operation. Default is ENABLED. Increased shift cycling during engine derates may occur when this parameter is set to DISABLED.

[28180] J1939 RECEPTION: EC1 Engine Speed At High Idle Point 6

Default is DISABLED. Must be set to ENABLED for PIEK ("Quite Mode") vehicles.

Other DynActive VEPS Trims

See Programming Guides for additional VEPS trims not listed here.

B.4.22.3.2. Required Support

SAs marked (V) may be set to an OEM-specified value via VEPS. See AUTO-DETECTION for SA selection details.

The J1939 network is required to provide CCVS1 *Wheel-based Vehicle Speed* from one of the following SAs, in order of TCM preference:

1. SA 17 (Cruise Control) (V)
2. SA 33 (Body Controller)
3. SA 00 (Engine #1)

In addition, SA 00 (Engine #1) is required to provide:

— EEC1 *Actual Engine – Percent Torque*

— EEC3 *Nominal Friction – Percent Torque*

When **[28180] J1939 RECEPTION: EC1 Engine Speed At High Idle Point 6** is ENABLED, SA 00 (Engine #1) is required to provide:

— EC1 *Engine Speed At High Idle, Point 6*

— EC1 *Engine Gain (Kp) Of The Engine Endspeed Governor*

B.4.22.3.3. Optional Support

DynActive operation is further optimized when SA 00 (Engine #1) provides additional signals:

— EEC3 *Estimated Engine Parasitic Losses – Percent Torque*

— EEC1 *Engine Demand – Percent Torque*

— EEC1 *Driver's Demand Engine – Percent Torque*

— EEC2 *Engine Percent Load at Current Speed*

— EEC2 *Actual Maximum Available Engine – Percent Torque*

— CCVS1 *Cruise Control Set Speed*

— CCVS1 *Cruise Control Active*

— LFE1 *Engine Fuel Rate*

B.4.22.4. *OTHER REQUIREMENTS / RESTRICTIONS*

B.4.22.4.1. Engine Certification

Engines must undergo an Allison certification process to ensure compliance with the governor characteristics in APPENDIX A, and the response & torque accuracy requirements in APPENDIX B.

B.4.22.5. *NORMAL OPERATION*

DynActive requires knowledge of the engine torque curve for full operation. When initially installed, DynActive will inhibit upshifts in order to learn the engine torque curve at high speeds. Until the torque curve is learned, Acceleration Rate Management (ARM) will be disabled. The TCM remembers the torque curve so this procedure only occurs on initial installation or after reprogramming.

After learning the torque curve, the TCM continually examines vehicle operating conditions and selects the most fuel efficient gear that meets the specified performance requirements.

B.4.22.6. *TCM FAILURE MODES & RESPONSES*

B.4.22.6.1. TCM Fails to Receive CCVS1 Wheel-Based Vehicle Speed

This parameter is used to determine the overall driveline ratio (N/V) of the vehicle. DynActive will not be enabled by the TCM until N/V has been calculated. If N/V changes during loss of CCVS1 *Wheel-based Vehicle Speed*, increased shift cycling may occur. No DTCs are logged.

B.4.22.6.2. TCM Fails to Receive EC1 data

Increased shift cycling may occur during engine derates. No DTCs are logged.

B.4.22.6.3. Loss of Engine Communication

If the TCM loses reception of any of the following signals for a timeout period:

- EEC1 *Actual Engine – Percent Torque*
- EEC2 *Accelerator Pedal (AP) Position*
- EEC3 *Nominal Friction – Percent Torque*

…some shifts will be momentarily inhibited. A DTC may be set and the Check Trans Indicator may be actuated.

B.4.22.7. *INSTALLATION CHECKLIST: DYNACTIVE SHIFTING*

See Installation Checklist: Engine Management – LRTP or Installation Checklist: Engine Management – SEM

B.4.23. DYNAMIC SHIFT SENSING

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.23.1. *OVERVIEW*

Dynamic Shift Sensing (DSS) allows the TCM to automatically select between two VEPS-specified shift schedules based on current vehicle operating conditions; no operator interaction is necessary.

DSS can be accomplished by two different means:

1. For applications where the engine is known (through validation) to provide accurate J1939 torque data, VEPS will set up the TCM calibration to use J1939 information to control this function.

   This logic is described in this Datalink Tech Data function. On Calibration Summary Reports, this is noted as “Dynamic Shift Sensing Torque-Based”.

2. For applications where engine torque accuracy has not been validated, VEPS will set up the TCM calibration to use vehicle acceleration data to control this function. J1939 information is not used.

Within the Allison technical community this may be referred to as Accel-Based Shift Scheduling (ABSS) or Accel-Based MODE Selection (ABMS). On Calibration Summary Reports this is noted as “Dynamic Shift Sensing Accel-Based”.

The following implementation requirements apply to the J1939 torque-based version of DSS.

B.4.23.2. *AVAILABILITY*

The J1939-based implementation is optional in 1000 – 4000 Series applications.

Dynamic Shift Sensing availability may depend on the selected FuelSense® package.

B.4.23.3. *CONFIGURATION (VEPS / ACCT)*

[11020] ENGINE MAKE AND MODEL
DSS can only be enabled for compatible electronic engines as certified by the Allison Engine Integration group.

[11010] ENGINE COOLANT TEMPERATURE (ECT) SOURCE
Set to PRIMARY ON-VEHICLE PROTOCOL.

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2
Parameters are only supported on the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[16000] DYNAMIC SHIFT SENSING
Must be set to ENABLED.

[17000] PRIMARY MODE: Gears
[17030] SECONDARY MODE: Gears
The primary and secondary mode shift masks must be the same in order to use DSS.

[17020] PRIMARY MODE: Shift Speed
[17060] SECONDARY MODE: Shift Speed
The primary and secondary mode shift speeds are recommended to be within 200 rpm when DSS is configured.

[14000] TORQUE CONVERTER
Must be acceptable for DSS use.

[30390] J1939 BROADCAST: Request – EC1
May be set to DISABLED (NO REQUESTS SENT) if EC1 is periodically broadcast; otherwise, leave set to ENABLED (MAXIMUM OF 3 REQUESTS).

[30370] J1939 BROADCAST: Request – AETC
Default is ENABLED (MAXIMUM OF 3 REQUESTS). May be set to DISABLED (NO REQUESTS SENT) if EC1 is used to meet function requirements.

B.4.23.3.1. VEPS / ACCT Trims

The following trims influence DSS operation:

- **[16010] DYNAMIC SHIFT SENSING: Availability of Economy Shift Schedule**
- **[16020] DYNAMIC SHIFT SENSING: Economy Shift Schedule Designation**
- **[16022] DYNAMIC SHIFT SENSING: Performance Shift Schedule Override Time**
- **[16040] DYNAMIC SHIFT SENSING: Disable Super Economy Schedule**
- **[16050] DYNAMIC SHIFT SENSING: Mode Scheduling Capability**

The following trims also influence DSS operation:

- **[17010] PRIMARY MODE: Shift Schedule**
- **[17050] SECONDARY MODE: Shift Schedule**

B.4.23.4. *J1939 PARAMETER AND SA USE*

SAs marked (V) may be set to an OEM-specified value via VEPS. See AUTO-DETECTION for SA selection details.

B.4.23.4.1. Required Support

The J1939 network is required to provide EEC2 *Accelerator Pedal Position 1* as described under ACCELERATOR PEDAL INPUT.

The J1939 network is required to provide CCVS1 *Wheel-based Vehicle Speed* from one of the following SAs, in order of TCM preference:

1. SA 17 (Cruise Control) (V)
2. SA 33 (Body Controller)
3. SA 00 (Engine #1)

In addition, SA 00 (Engine #1) is required to provide:

- EEC2 *Engine Percent Load at Current Speed*
- EEC1 *Actual Engine – Percent Torque*
- EEC3 *Nominal Friction – Percent Torque*
- EC1 *Engine Reference Torque*
- EC1 Engine Speed and Percent Torque Points (1)

(1) Data is required to be in either EC1 Mode 1 or Mode 2 format. Regardless, Point 2 must contain valid engine speed and torque data.

B.4.23.4.2. Required Reception Support

SA 00 (Engine #1) is required to respond to Global Request (V) messages from SA 03 (Transmission #1) used to obtain EC1.

B.4.23.4.3. Optional Support

DSS operation is further optimized when the following signals are provided:

- EEC3 *Estimated Engine Parasitic Losses – Percent Torque*
- PGN 64912 – Advertised Engine Torque Curve
- ET1 *Engine Coolant Temperature*

In contrast to other J1939 parameters, EEC3 Estimated Engine Parasitic Losses – Percent Torque can be provided from up to 5 source addresses as configured via VEPS.

[29281] J1939 SA1: EEC3 Estimated Engine Parasitic Losses Percent Torque
If set to 254 (Default) then EEC3 Estimated Engine Parasitic Losses – Percent Torque will only be used from SA 00 (Engine #1) when a compatible engine is configured.

[29282] J1939 SA2: EEC3 Estimated Engine Parasitic Losses Percent Torque
[29283] J1939 SA3: EEC3 Estimated Engine Parasitic Losses Percent Torque
[29284] J1939 SA4: EEC3 Estimated Engine Parasitic Losses Percent Torque
[29285] J1939 SA5: EEC3 Estimated Engine Parasitic Losses Percent Torque

The TCM will add the *EEC3 Estimated Engine Parasitic Losses – Percent Torque* values received from all configured source addresses. If parameter reception from the engine is desired in combination with other SAs, one of the SAs must be set to 00 (Engine #1).

If available, the TCM will also use the SERVICE BRAKE STATUS INPUT.

B.4.23.5. *OTHER REQUIREMENTS / RESTRICTIONS*

B.4.23.5.1. Customer Integration Engineering Review

Due to the potential impacts on vehicle drivability and shift quality, Allison Customer Integration Engineering review is required before this function may be implemented.

B.4.23.5.2. Engine Certification

Engines must undergo an Allison certification process to ensure compliance with the governor characteristics in APPENDIX A, and the response & torque accuracy requirements in APPENDIX B.

B.4.23.6. *NORMAL OPERATION*

DSS is enabled after the TCM determines the vehicle driveline ratio (N/V) and peak engine torque.

After initialization, the TCM continually examines vehicle operating conditions, determines vehicle load, and selects an appropriate shift schedule based on these values and calibration settings.

The TCM will always revert to the performance shift schedule if any of the following are true:

— the transfer case is placed in low (if so equipped),
— engine de-rate conditions are detected,
— the TCM loses engine torque data reception, or
— the TCM is recalibrated

The operator can override Dynamic Shift Sensing by selecting secondary mode through a defined TCM input (Secondary Mode Input function). The transmission will then only operate in the shift schedule defined by **[17050] SECONDARY MODE: Shift Schedule**. DSS logic resumes when the secondary mode input is deactivated.

When **[16022] DYNAMIC SHIFT SENSING: Performance Shift Schedule Override Time** is set via VEPS / ACCT, operator overrides of DSS are restricted to the specified period of time.

See the SECONDARY MODE INDICATOR function for details on how it is impacted by DSS operation.

B.4.23.7. *TCM FAILURE MODES & RESPONSES*

B.4.23.7.1. TCM Fails to Receive CCVS1 Wheel-Based Vehicle Speed

This parameter is used to determine the overall driveline ratio (N/V) of the vehicle. DSS will not be enabled by the TCM until N/V has been calculated.

B.4.23.7.2. TCM Fails to Receive torque data

The TCM will revert to the primary shift schedule if it fails to receive EEC1 *Actual Engine – Percent Torque* or EEC3 *Nominal Friction – Percent Torque*. DSS will be disabled until the next drive cycle. No DTCs are logged.

B.4.23.7.3. Transmission component failures

DSS will be disabled if an output shaft speed sensor failure is detected. No DSS-specific DTCs are logged; however there are DTCs logged relative to the specific component issues.

B.4.23.8. *INSTALLATION CHECKLIST: DSS*

At this time, the installation checklist consists solely of confirmation that the necessary messages and parameters are supported as stated, and that all questions under CONFIGURATION have acceptable answers.

B.4.24. ELECTRONIC BRAKING SYSTEMS (EBS)

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.24.1. *OVERVIEW*

Electronic braking or "brake-by-wire" systems typically blend foundation brakes, engine brakes, and driveline retarding to provide an optimal brake combination to slow or stop a vehicle.

Due to the high level of electronic integration associated with this function, Allison Customer Integration Engineering review is required.

Most information provided by the 3000/4000 Series TCM and the requirements necessary to control the retarder via J1939 are covered under the function RETARDER CONTROL.

For EBS systems requiring a higher degree of *Actual Retarder – Percent Torque* broadcast accuracy, an optional retarder pressure sensor is available which provides TCM feedback during retarder operation.

B.4.24.2. *AVAILABILITY*

The J1939-based implementation is optional in 1000 – 4000 Series applications, pending Allison Customer Integration Engineering review.

B.4.24.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be received from the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[20040] RETARDER: Use Pressure Sensor for EBS

Default is NO; only enable if the sensor is installed. YES enables processing and diagnostics for the retarder pressure feedback sensor, which allows for higher accuracy ERC1 *Actual Retarder – Percent Torque* broadcast.

[30310] J1939 BROADCAST: ETC8 Transmission Torque Converter Ratio

Set to ENABLED if used by the EBS system.

B.4.24.4. *J1939 PARAMETER AND SA USE*

Parameters marked (V) can be enabled or disabled via VEPS.

B.4.24.4.1. Optional Support

In addition to items under RETARDER CONTROL, the TCM also broadcasts ETC8 *Transmission Torque Converter Ratio* (V) from SA 16 (Retarder – Driveline). This parameter may be used at the vehicle OEM's discretion.

B.4.24.5. *OTHER REQUIREMENTS AND RESTRICTIONS*

Allison Customer Integration Engineering review is required prior to integrating this function with an Allison transmission.

B.4.24.6. *TCM FAILURE MODES & RESPONSES*

B.4.24.6.1. Speed Sensor Failures

If an engine speed or turbine speed sensor error occurs, *Transmission Torque Converter Ratio* will indicate Error with the value $FEFF.

B.4.24.6.2. Retarder Pressure Sensor Failure

Enabling use of the retarder pressure sensor also enables its diagnostics. If the sensor fails, ERC1 *Actual Retarder – Percent Torque* accuracy cannot be held to the levels required; as a result, the parameter will indicate 254 (Error), and a DTC is set. "Check Trans" is not indicated.

B.4.25. EMISSION CONTROL SYSTEMS (DPF / SCR)

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.25.1. *OVERVIEW*

To meet heavy-duty emission requirements, many engines utilize Diesel Particulate Filter (DPF) and / or Selective Catalyst Reduction (SCR) systems.

The actual emission device operation is often of no significance to the TCM; however, if engine operation is modified to assist the emission device, the transmission may be impacted. Areas of concern include changes in:

…Engine idle speed,

…Engine torque output (including those caused by manipulating engine pumping losses, e.g. variable-geometry turbocharger manipulation), or

…Engine torque or speed de-rates.

To determine if the TCM needs to be made aware of changes in engine operation, engine OEMs are required to discuss their operation strategies with Allison Customer Integration Engineering.

Emission control system interfaces cannot be accomplished via GPI wiring; as such, systems which significantly impact engine operation are required to support this function via J1939.

B.4.25.1.1. DPF Systems

During DPF regeneration, exhaust temperatures are increased to remove particulate deposits from the filter substrate. This regeneration can be:

…Passive, where adequate exhaust temperatures are achieved through normal engine load and vehicle operation.

…Active, where DPF control systems manipulate vehicle components to achieve desired exhaust temperatures. These may include introduction of additional air or fuel to the catalyst (dosing) or altering the engine's speed, torque production, pumping efficiency and / or fueling strategy.

If deemed as such during Allison engine integration testing, DPF systems which significantly impact engine speed or torque production are required to support this function.

B.4.25.1.2. SCR Systems

Selective Catalyst Reduction systems reduce NOx emissions through a combination of catalyst and urea injection. The urea solution is sometimes referred to as Diesel Exhaust Fluid (DEF).

While SCR systems do not "regenerate" in order to clean themselves, exhaust temperatures are often manipulated (e.g. cold start situations) to keep the catalyst at peak efficiency. SCR systems also typically impose engine operation restrictions when faced with low or empty urea tanks. Both scenarios may impact transmission operation.

B.4.25.2. *AVAILABILITY*

The J1939-based implementation is standard in all 1000 – 4000 Series applications. Support of this function is required if deemed necessary by the Allison Engine Integration group.

B.4.25.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters are only supported on the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[28080] J1939 RECEPTION: DPFC1 Aftertreatment Diesel Particulate Filter Active

Default is ENABLED, RESPOND ONLY TO ACTIVE STATE. Answers ENABLED, RESPOND ONLY TO IMMINENT STATE and ENABLED, RESPOND TO EITHER ACTIVE OR IMMINENT STATES should only be chosen if deemed necessary by the Allison Engine Integration group.

[28050] J1939 RECEPTION: EEC2 DPF Thermal Management Active

Must be set to ENABLED if deemed necessary by the Allison Engine Integration group.

[28060] J1939 RECEPTION: EEC2 SCR Thermal Management Active

Must be set to ENABLED if deemed necessary by the Allison Engine Integration group.

[30390] J1939 BROADCAST: Request – EC1

Default answer is ENABLED (MAXIMUM OF 3 REQUESTS). May be set to DISABLED (NO REQUESTS SENT) if EC1 is periodically broadcast or EC1 is not needed to meet function requirements.

[30180] J1939 BROADCAST: ETC2 Transmission Current Gear
[30220] J1939 BROADCAST: ETC2 Transmission Selected Gear

Options can an only be set to DISABLED if the vehicle or engine OEM verifies the given parameter is not necessary for emission control system operation, or if GPO S – NEUTRAL INDICATOR FOR PTO is used to determine the transmission is in a non-Neutral state.

B.4.25.4. *J1939 PARAMETER AND SA USE*

Items marked (V) can be modified via VEPS. Parameters may be enabled or disabled and SAs may be set to an OEM-specified value. See AUTO-DETECTION for SA selection details.

B.4.25.4.1. Required Support

Unless specified, the following requirements apply to both DPF and SCR systems.

If Engine Pumping Losses are Modified to Manipulate Exhaust Temperatures

If an Allison Engine Integrator deems it necessary, engines that manipulate exhaust temperature via engine pumping losses (e.g. variable-geometry turbochargers) are required to include the pumping losses in *EEC3 Nominal Friction – Percent Torque* per its SAE definition.

The TCM does not receive or utilize the EEC2 *Pumping Losses – Percent Torque* parameter.

If Other Engine Operation is Modified to Manipulate Exhaust Temperatures

If an Allison Engine Integrator deems it necessary, engines that modify their behavior to elevate or maintain exhaust temperature may be required to support one or more of the following parameters:

EEC2 DPF Thermal Management Active (V) from SA 00 (Engine #1) (V),

AND / OR

EEC2 SCR Thermal Management Active (V) from SA 00 (Engine #1) (V),

AND / OR

DPFC1 *Aftertreatment Diesel Particulate Filter Active* (V) from one of the following SAs, in order of TCM preference:

1. SA 61 (Exhaust Emission Controller) (V)
2. SA 00 (Engine #1)

Per SAE, broadcast rate should be 1 s and on change of state, but no faster than every 100 ms.

If Engine Idle Speed is Manipulated to Assist the Emission Control System

Emission control systems which manipulate engine idle speed are required to update and provide EC1 *Engine Speed at Idle, Point 1* from SA 00 (Engine #1), **AND** either:

Receive and utilize both ETC2 *Transmission Selected Gear* (V) and ETC2 *Transmission Current Gear* (V) as broadcast from SA 03 (Transmission #1).

OR

Connect and use GPO S (NEUTRAL INDICATOR FOR PTO) for non-Neutral range detection.

If the Emission Control System De-Rates the Engine

Emission control systems which de-rate the engine based on low urea reserves or DPF regeneration are required to update and provide the speed & torque points of EC1 Engine Configuration and broadcast it from SA 00 (Engine #1).

Global Request (V) broadcasts for EC1 are sent at the beginning of each key switch cycle, and must be supported if EC1 is not broadcast on a regular basis. The requests cease upon EC1 reception or after a total of 3 Requests have been sent.

NOTE: EEC2 *DPF Thermal Management Active* and EEC2 *SCR Thermal Management Active* are the preferred parameters for indicating that engine operation has been modified for an emission control device such that it may impact transmission operation.

Some EPA 2007 engines used DPFC1 *Aftertreatment Diesel Particulate Filter Active* for this purpose; its reception is retained for backwards compatibility purposes.

Per SAE J1939 committee clarification in 2008, the DPFC1 parameter should only relate to DPF “dosing” (adding fuel or air to the catalyst) not the modification of engine operation. As such, this parameter is no longer of interest to the TCM.

B.4.25.5. *OTHER REQUIREMENTS / RESTRICTIONS*

B.4.25.5.1. Engine Management Function

Engines utilizing ENGINE MANAGEMENT – SEM are required to meet all SEM requirements regardless of emission control device operating state (e.g. DPF regeneration, SCR warm up, etc.). This includes all torque accuracy requirements and maintaining the ability to accept TSC1 torque limits.

B.4.25.5.2. Split Shaft PTO Applications

Allison realizes that some emission control systems may monitor ETC1 *Transmission Output Shaft Speed* as an enabler for stationary regeneration. DPF systems and vehicle OEMs need to be aware that *Transmission Output Shaft Speed* is exactly that, and in some applications does not necessarily reflect vehicle movement, e.g. in split-shaft PTO applications.

If a DPF system were to incorrectly initiate a non-stationary regeneration while a vehicle is stationary, the potential for issues exists, including:

— Excessive exhaust or tailpipe temperatures, and

— Engine torque and / or speed control anomalies, which can be critical in applications such as fire truck pumping units.

> **WARNING:** Emission Control Systems and vehicle OEMs must consider that *Transmission Output Shaft Speed* <u>does not directly correlate with vehicle motion in some applications</u>. DPF Systems must use additional inputs to determine if stationary or non-stationary regeneration activity should take place.

B.4.25.6. *NORMAL TCM OPERATION*

B.4.25.6.1. EC1 Reflects A New Idle Speed

The TCM makes adjustments to 2-1 closed throttle downshifts, and does not adapt certain shifts.

B.4.25.6.2. EC1 Reflects an Engine De-Rate Condition

The TCM makes adjustments to its shift scheduling and adaptive clutch control logic.

B.4.25.6.3. Engine Operation Has Been Modified to Assist an Emission Control Device

If any inputs indicate engine operation has been modified to assist an emission control device:

— EEC2 *DPF Thermal Management Active* = 01b (DPF Thermal Management is active), or

— EEC2 SCR *Thermal Management Active* = 01b (SCR Thermal Management is active), or

— DPFC1 *Aftertreatment Diesel Particulate Filter Active* = 01b (Active) or, depending on TCM configuration, 10b (Regeneration needed – automatically initiated active regeneration imminent)

…the TCM makes adjustments to clutch control and does not adapt shifts.

B.4.25.7. *REQUIRED ENGINE OPERATION*

To ensure compatibility, the TCM must be aware of instances where engine operation is modified to assist an emissions control device. These include:

1. Processes which impact engine idle speed, and

2. Processes which impact engine torque output while the transmission is in gear and the vehicle is moving.

B.4.25.7.1. Engine Idle Speed Modified to Assist Emission Control Device

If DPF regeneration or catalyst warm-up impacts the idle speed of the engine, EC1 *Engine Speed at Idle, Point 1* <u>is required</u> to be updated as specified in the SAE parameter definition.

Inhibiting Stationary Regeneration or SCR Warm-Up When Transmission Is In Gear

Per standard Allison Transmission Specifications, Allison products have the following maximum idle speed limitations when in a non-Neutral range:

— 820 rpm on 1000/2000 Series applications

— 800 rpm on 3000/4000 Series applications

Emission control systems must not violate these requirements. As such, emission control systems <u>are required</u> to prevent initiation of any stationary DPF regenerations or SCR warm-up modes <u>involving engine idle speeds at or above these limits</u> while the transmission is in gear, as indicated by any of the following:

ETC2 *Transmission Selected Gear* **OR** ETC2 *Transmission Current Gear* indicate a range other than Park (byte value 251) or Neutral (byte value 0),

OR

GPO S (NEUTRAL INDICATOR FOR PTO) indicates the transmission is in a non-Neutral range.

Exiting Stationary Regeneration or SCR Warm-Up: Transmission Transitions Out Of Neutral

If, during stationary DPF regeneration or SCR warm-up, engine speed is above:

— 1000 rpm on 1000/2000 Series applications, or

— 900 rpm on 3000/4000 Series applications,

…any attempts by the operator to shift into range will be inhibited by the TCM. To shift into range, the operator must manually cancel the regeneration cycle, and physically re-select the desired range.

Emission control systems may choose to aid this scenario by automatically canceling stationary DPF regeneration or SCR warm-up when either:

— ETC2 *Transmission Selected Gear* reflects a range other than Park (byte value 251) or Neutral (byte value 0), or

— GPO S (NEUTRAL INDICATOR FOR PTO) indicates the transmission is in a non-Neutral range.

As long as engine speed falls below the aforementioned values within 1.5 seconds of range selection (3 seconds for NIPTO), the TCM will engage the requested range. If engine speed does not meet these rpm and time criteria, the shift will be inhibited and the operator will have to physically re-select the desired range.

B.4.25.7.2. Engine Operation Modified To Assist Emission Control Device While Transmission Is In Gear and Vehicle Is Moving

If engine operation (torque production) is modified to assist the emissions control system while the transmission is in range (i.e. ETC2 *Transmission Selected Gear,* ETC2 *Transmission Current Gear* **OR** GPO S indicate the transmission is in a range other than other than Park or Neutral):

1. The engine <u>is required</u> to maintain gross torque output for the given accelerator pedal position and engine speed such that these values are within 7% of those seen when DPF active regeneration / SCR warm-up is not occurring.

2. If deemed necessary by the Allison Engine Integration group:

   — DPFC1 *Aftertreatment Diesel Particulate Filter Active* <u>is required</u> to indicate 01b (Active) **OR** 10b (Regeneration needed), and / or

   — EEC2 *DPF Thermal Management Active* <u>is required</u> to indicate 01b (Active), and / or

   — EEC2 *SCR Thermal Management Active* <u>is required</u> to indicate 01b (Active).

B.4.25.7.3. Engine Torque De-rate Operation

Emission control systems may de-rate the engine during failure modes or low urea levels in order to get the operator's attention and urge the operator to take action.

If any de-rate is imposed that reduces the engine torque curve by 10% or more, the engine <u>is required</u> to update the Engine Configuration torque curve values as specified in J1939-71.

As with applications without DPF or SCR systems, EEC2 *Engine Percent Load at Current Speed* calculation during de-rates should be based on the ratio of current <u>de-rated</u> indicated torque relative to the nominal <u>non-derated</u> indicated torque curve.

B.4.25.8. *FAILURE MODES & RESPONSES*

B.4.25.8.1. Emission Control System Fails To Notify TCM Of Modified Engine Operation

Shift quality and adaptive shift stability may suffer if the TCM is not notified when engine operation is modified to assist an emission control device (while the transmission is in gear and the vehicle is moving), or the data lags behind the actual events.

This includes errors or delays in the data contained in one or more of the following parameters:

— DPFC1 *Aftertreatment Diesel Particulate Filter Active*

— EEC2 *DPF Thermal Management Active*

— EEC2 *SCR Thermal Management Active*

B.4.25.8.2. Modified Pumping Losses Not Reflected in EEC3 Nominal Friction – Percent Torque

Failure to indicate intentional changes to engine pumping losses in EEC3 *Nominal Friction – Percent Torque* will result in poor shift quality.

B.4.25.8.3. Emission Control System Fails to React to ETC2 *Transmission Selected Gear*

If an emission control system does not recognize ETC2 *Transmission Selected Gear* and the parameter values indicating the vehicle operator's desire to shift the transmission into range, the operator may have to manually cancel regeneration before selecting a range and moving the vehicle.

B.4.25.8.4. Engine Fails To Set EC1 Idle Speed Correctly

Failure to update EC1 *Engine Speed at Idle, Point 1* correctly may result in adaptive de-calibration and poor shift quality of 2-1 closed throttle downshifts.

B.4.25.8.5. Emission Control System Fails To Inhibit Increased Idle Speed While Transmission Is In Range

If engine idle speed is increased above Allison limits with the transmission in gear, transmission and converter heat loading increase and transmission components may be damaged.

> **WARNING:** Significantly high engine speeds may over-power the vehicle service or park brake and result in unintended vehicle movement.

B.4.25.8.6. Engine Fails To Broadcast De-Rated Engine Torque in EC1

Failure to update the EC1 torque curve correctly during de-rates of 10% or more may result in poor shift quality, hanging shifts, reduced vehicle operation, and transmission adaptive de-calibration.

B.4.25.9. *INSTALLATION CHECKLIST: EMISSION CONTROL SYSTEMS (DPF / SCR)*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer “yes” to all questions in the following test sequences:

- ☐ Is the TCM calibration configured properly?
- ☐ Are parameters which indicate modified engine operation broadcast from acceptable SAs?
- ☐ If *Aftertreatment Diesel Particulate Filter Active* is used: When the parameter transitions from “inactive” to “active” or “regeneration needed”, is DPFC1 broadcast immediately (I.E. doesn’t wait for next 1 second broadcast to come along)?
- ☐ If idle speed changes during DPF regeneration and/or SCR warm-up, is the speed change reflected in EC1 *Engine Speed at Idle, Point 1*?
- ☐ Is stationary DPF regeneration and / or SCR warm-up prohibited if ETC2 *Transmission Selected Gear, ETC2 Transmission Current Gear*, or GPO S – NEUTRAL INDICATOR FOR PTO do not indicate Park or Neutral?
- ☐ If the emission control system may de-rate the engine, is EC1 broadcast from SA 00, and does it properly reflect de-rate conditions?

B.4.26. ENGINE BRAKE INTERFACE

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.26.1. *OVERVIEW*

> **NEW FOR B/C/N240 PSC RELEASES:** Added optional reception of RC *Retarder Configuration Map* to determine peak engine brake torque.

If an engine brake is incorporated in an installation, TCM knowledge of brake operation is required, and the transmission operating state must also be considered by the logic that determines when brake operation is allowed.

GPIO-based versions of this function use GPI H or I (ENGINE BRAKE AND PRESELECT REQUEST) to sense operator desire for engine braking, and GPO A (ENGINE BRAKE ENABLE OUTPUT) to indicate TCM consent for braking. GPIO implementations are covered in Allison 6th Generation Controls Installation Manual Section E: “Using Input / Output (I/O) Functions, Packages, & Groups”.

The J1939-based version of this function substitutes J1939 data for the GPIOs.

The J1939-based implementation can support up to two engine brakes in a given application; e.g. a compression brake and an exhaust brake. The TCM monitors both engine brakes and makes decisions based on the composite braking force being generated.

B.4.26.2. *AVAILABILITY*

The J1939-based implementation is standard in all 1000 – 4000 Series applications.

B.4.26.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be provided on the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[22000] ENGINE BRAKE INTERFACE
Set to PRIMARY ON-VEHICLE PROTOCOL to enable TCM reception of the associated J1939 parameters.

[22045] ENGINE BRAKE: Engagement Assistance
When set to ENABLED, the TCM will activate the engine brake shift schedule and (if configured) engine brake preselects in closed throttle conditions when operator desire for engine braking is indicated to the TCM, independent of actual engine brake engagement. Resulting downshifts may help the engine achieve the necessary minimum engine speed for engine brake engagement.

When set to DISABLED, the TCM will activate the engine brake shift schedule and (if configured) engine brake preselects only after the engine brake has engaged.

To avoid transmission damage, applications that tie engine brake engagement to additional operator inputs besides the typical engine brake enable switch (e.g. service brake pedal) are required to set this parameter to DISABLED.

[26030] LOCKUP INDICATOR
Set to BOTH GPO K AND J1939 PARAMETER or ONLY J1939 ETC1 TRANSMISSION TORQUE CONVERTER LOCKUP ENGAGED to enable the J1939 parameter broadcast.

[28040] J1939 RECEPTION: EBC1 Engine Retarder Selection
Set to ENABLED if parameter used to meet function requirements.

[28120] J1939 RECEPTION: ERC1 Retarder Enable – Brake Assist Switch
Should only be switched to ENABLED if parameter used to meet function requirements.

[30400] J1939 BROADCAST: Request – RC
May be set to DISABLED (NO REQUESTS SENT) if the RC message is not supported, not required, or is periodically broadcast; otherwise leave set to ENABLED (MAXIMUM OF 3 REQUESTS).

B.4.26.3.1. VEPS / ACCT Trims

The following trims influence transmission operation when engine brakes are active:

- **[22020] ENGINE BRAKE: Minimum Preselect Range**
- **[22030] ENGINE BRAKE: Alternate Minimum Preselect Range**

For details on operational impacts, see Allison Controls Installation Manual section A-2: Shift Calibration Familiarization.

B.4.26.4. *J1939 PARAMETER AND SA USE*

The Allison engine brake interface consists of up to three components:

- Exchange of basic torque and lockup data
- An indication of operator desire for engine braking
- Engine brake control via TCM TSC1 messages

Message and parameter support requirements vary versus transmission family, as not all families require support for all three components:

Allison Product Family	Basic Interface	Indication of Engine Braking Desire	Engine Brake TSC1 Control
1000/2000	**REQ'D**	**REQ'D**	Optional
3000/4000	**REQ'D**	Optional	**REQ'D** (some Engines)

Items marked (V) can be modified via VEPS. Parameters may be enabled or disabled and SAs may be set to an OEM-specified value. See AUTO-DETECTION for SA selection details.

While engine brake control may involve more than one on-board controller, the system that exchanges information and activates the engine brake is hereafter referred to as the "engine brake controller".

B.4.26.4.1. Basic Interface Support – Required for All Applications

The engine brake controller is required to provide ERC1 *Actual Retarder – Percent Torque* from up to two of the following SAs:

1. SA 41 (Retarder, Exhaust, Engine #1)
2. SA 15 (Retarder, Engine)

AND

Receive ETC1 *Transmission Torque Converter Lockup Engaged* from SA 03 (Transmission #1).

B.4.26.4.2. Indication of Engine Braking Desire (Required for 1000/2000 Series Applications)

1000/2000 Series applications require an indication of operator desire for engine braking. This indication is optional for 3000/4000 Series applications. The preferred source is EBC1 *Engine Retarder Selection* (V) from one of the following SAs, in order of TCM preference:

1. SA 49 (Cab Controller) (V)
2. SA 23 (Instrument Cluster #1)
3. SA 33 (Body Controller),
4. SA 00 (Engine #1)

If EBC1 *Engine Retarder Selection* is not supported, *ERC1 Retarder Enable – Brake Assist Switch* (V) reception may be enabled via VEPS in 1000/2000 Series applications. This signal is not supported for this purpose in 3000/4000 Series applications. When enabled, it will be received from one of the following SAs, in order of TCM preference:

1. SA 15 (Retarder, Engine) (V)
2. SA 41 (Retarder, Exhaust, Engine #1)
3. SA 00 (Engine #1)

If both parameters are enabled and received, the TCM will use EBC1 *Engine Retarder Selection* data.

NOTE: SAE J1939 is clear that ERC1 *Retarder Enable – Brake Assist Switch* should not be used to indicate desire for engine braking. Reception has been retained for legacy applications, but is now defaulted off and must be enabled via VEPS if it is to be used.

New engine brake implementations should support EBC1 *Engine Retarder Selection*.

B.4.26.4.3. TSC1 Control Support

1000/2000 Series and some 3000/4000 Series applications benefit from TSC1 support, as it allows the TCM to prevent or interrupt engine brake engagement, or limit engine brake torque during shifts under certain conditions.

TSC1 Control Support is required with certain engines to avoid transmission damage. Reference TD161 for engine requirements, and contact your Allison Customer Integration Engineer for more information.

To take advantage of the engine brake engagement prevention and interruption functionality, engine brakes must respond to TSC1 torque commands from SA 03 (Transmission #1).

To take advantage of the engine brake torque limiting functionality, engine brakes must respond to TSC1 torque limits from SA 03 (Transmission #1). This functionality is only available with certain engine models.

To minimize bus loading, TSC1 commands are only sent to brake SAs detected on the J1939 network.

B.4.26.4.4. Retarder Configuration

The TCM determines peak engine brake torque from information contained in the Retarder Configuration (RC) message.

To obtain RC *Retarder Reference Torque* and the RC *Retarder Configuration Map*, global Request (V) broadcasts for PGN 65249 (RC) are sent at the beginning of each key switch cycle. Requests cease upon PGN reception or after a total of 3 requests have been sent. A default values are assumed if RC *Retarder Reference Torque* or the RC *Retarder Configuration Map* is not supported.

B.4.26.5. *OTHER REQUIREMENTS / RESTRICTIONS*

NOTE: The engine brake interface to the TCM must be either fully GPIO-based or fully J1939-based. Mixing use of GPIO and J1939 signals is not allowed.

NOTE: Regardless of engine brake type (compression, exhaust) or combinations installed, maximum engine braking must not exceed the engine brake rating for the transmission model in use.

B.4.26.6. *OPERATOR INTERFACE*

B.4.26.6.1. Required Support – Communication Failure Indication

NOTE: Indication is only required if an OEM opts to allow on-going engine brake operation while communication problems exist between the engine brake controller and TCM. See OPTION 2 under FAILURE MODES AND REQUIRED RESPONSES: ENGINE BRAKE CONTROLLER.

Physical implementation of this Communication Failure indication is left to the discretion of the vehicle OEM. Acceptable examples include a lamp or text display with phrasing such as “Vehicle Electrical Fault” or “Vehicle Electronic Fault”. No specific wording is defined, as Allison realizes vehicle OEMs may already have a method to communicate such problems to the operator.

Check Trans Indicator actuation is not an acceptable means of representing a communication problem. If only the Check Trans Indicator is active, service technicians may assume there is a transmission problem, when in fact it is most likely a vehicle network or wiring issue.

B.4.26.7. *REFERENCE INFORMATION: GPIO VS. J1939 IMPLEMENTATION*

While both implementations function similarly from an operator perspective, the TCM role is significantly different. This section is intended to help OEMs understand these differences in the event other vehicle systems are tied into the engine brake actuation circuit.

GPIO Implementation (GPI H or I, plus GPO A)

- The TCM gives consent to engine brake operation via GPO A, based on internal criteria (accelerator position, torque converter lockup status, etc.).
- The TCM invokes engine brake preselects when its braking criteria are met and GPO A is active.

J1939 Implementation

- The TCM does not give consent to engine brake operation; it monitors J1939 data to decide when to activate its engine brake responses. The TCM invokes engine brake preselects only after it detects engine brake operation.
- The engine brake controller must monitor ETC1 *Transmission Torque Converter Lockup Engaged* and other vehicle inputs and decide when engine braking is acceptable.

B.4.26.8. *NORMAL J1939 OPERATION*

Engine Brake Activation

1. The operator turns on the engine brake switch, indicating a desire for engine braking. (This switch may be wired directly to the engine brake controller, or to another controller that forwards the request via J1939 to the engine brake controller.)
2. **[1000/2000 Series only]**: The TCM detects operator desire for engine braking when EBC1 *Engine Retarder Selection* > 0% or ERC1 *Retarder Enable – Brake Assist Switch* = 01b.

   [3000/4000 Series only]: The TCM detects operator desire for engine braking when EBC1 *Engine Retarder Selection* > 0%.
3. **[1000/2000 Series only]**: If the torque converter is not in lockup, the TCM attempts a downshift to increase engine speed (and therefore pump speed) to obtain enough flow for lockup clutch engagement.
4. If operator desire for engine braking is detected, Engine Brake Engagement Assistance is configured, and the converter lockup clutch is engaged, the TCM utilizes engine brake shift points and (if configured) invokes an engine brake preselect.
5. The engine brake controller enables the brake after verifying *Transmission Torque Converter Lockup Engaged* indicates 01b (Torque converter lockup engaged), and other vehicle inputs are acceptable.
6. The engine brake controller indicates engine brake activity via the ERC1 *Actual Retarder – Percent Torque* broadcast.
7. If not already active from step 4, the TCM utilizes engine brake shift points and invokes an engine brake preselect (if configured) when it detects engine brake activity.

Engine Brake Deactivation

The engine brake controller is required to deactivate the engine brake when *Transmission Torque Converter Lockup Engaged* = 00b (Torque converter lockup is not engaged).

B.4.26.9. *IMPLEMENTATION ERRORS AND IMPACTS*

B.4.26.9.1. Engine Brake Controller Fails to utilize Transmission Torque Converter Lockup Engaged

If the engine brake controller does not consider *Transmission Torque Converter Lock Engaged* in its activation logic, the engine brake may operate while lockup is disengaged. Engine braking will be less effective, and excessive transmission heat will be generated. No DTCs are logged.

B.4.26.9.2. Multi-Level Engine Brake Controller Indicates Incorrect Braking Level

Most engine compression brakes are capable of operating at multiple levels, e.g. “Low / High” or “Low / Medium / High”. Each level has a retarder curve associated with it.

If the ERC1 *Actual Retarder – Percent Torque* broadcast value is incorrectly based on the same curve for different engine braking levels, TCM adaptive clutch control cannot function properly. This will cause excessively harsh or soft shifts when switching between different engine brake levels. No DTCs are logged.

B.4.26.9.3. Engine Brake Controller Falsely Indicates Active Braking Or Falsely Indicates Operator Desire For Engine Braking

If:

- ERC1 *Actual Retarder – Percent Torque* indicates active braking when the brake isn't active (or perhaps not even installed), or

- The operator input indicates a desire for engine braking,

…the transmission will operate continuously in preselect mode when the accelerator pedal input is near zero. Shifts will adapt incorrectly, causing premature clutch wear when the brake actually becomes active. No DTCs are logged.

B.4.26.10. *FAILURE MODES AND RESPONSES: TCM*

The following failures may occur in service:

B.4.26.10.1. TCM Fails to Receive J1939 Operator Input (1000/2000 Only)

If the TCM does not detect operator desire for engine braking prior to activation, engine brake preselects will not be invoked and engine braking will be less effective. If an engine brake preselect is already active when the operator input is lost, it will remain active until ERC1 *Actual Retarder – Percent Torque* indicates the brake is not active.

B.4.26.10.2. TCM Fails to Receive ERC1 Actual Retarder – Percent Torque

If the TCM loses *Actual Retarder – Percent Torque* reception during engine braking, engine brake preselects will not occur, clutches may wear prematurely, and shifts will adapt incorrectly. No DTCs are logged.

B.4.26.11. *FAILURE MODES AND REQUIRED RESPONSES: ENGINE BRAKE CONTROLLER*

The following failure may occur in service:

B.4.26.11.1. Loss of Transmission Torque Converter Lockup Engaged Reception

Fault logging, diagnostics and troubleshooting related to the loss of *Transmission Torque Converter Lockup Engaged* reception are the responsibility of the vehicle OEM and the engine brake controller.

The engine brake controller <u>is required</u> to take action if ETC1 *Transmission Torque Converter Lockup Engaged* indicates 10b (Error), 11b (Not Available), or reception is lost. There are two response options:

Option 1: Disable Engine Brake Operation

If there is no means to convey a communication problem to the operator, the engine brake controller <u>is required</u> to disable engine braking during the communication failure. This prevents possible engine brake operation while lockup is disengaged.

Option 2: Alert the Operator and Continue to Allow Engine Brake Operation

If the vehicle OEM wishes to allow engine braking despite a communication failure with the TCM, the engine brake controller or vehicle system <u>is required</u> to alert the operator of the communication failure. The intent is to discourage engine brake operation on a regular basis when the engine brake controller is unaware of lockup status. See OPERATOR INTERFACE for the indication requirements.

The Communication Failure indication may only be deactivated when reception of valid *Transmission Torque Converter Lockup Engaged* data returns.

B.4.27. ENGINE MANAGEMENT – ACCELERATION RATE MANAGEMENT (ARM)

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.27.1. *OVERVIEW*

Acceleration Rate Management (ARM) is an Engine Management function where the TCM manages engine torque to limit vehicle acceleration to a calibrated profile. This function may be used to improve fuel efficiency, reduce tire wear, or reduce overall acceleration aggressiveness.

ARM can only be accomplished via J1939 datalink; there is no equivalent GPI function.

NOTE: Do not confuse ARM with VEHICLE ACCELERATION RATE LIMITING, where the engine controller restricts vehicle acceleration by its own internal logic.

B.4.27.2. *AVAILABILITY*

ARM can only be enabled in 1000 – 4000 Series applications when used with a compatible **ENGINE MAKE AND MODEL** as validated by the Allison Engine Integration group.

Acceleration Rate Management availability may depend on the selected FuelSense® package.

Allison Customer Integration Engineering review is required prior to implementing this function.

B.4.27.3. *CONFIGURATION (VEPS / ACCT)*

[11020] ENGINE MAKE AND MODEL

Acceleration Rate Management is only enabled for compatible electronic engines as validated by the Allison Engine Integration group.

[18000] THROTTLE AND LOAD SOURCE

Set to PRIMARY ON-VEHICLE PROTOCOL.

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters are only exchanged on the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[12000] ACCELERATION RATE MANAGEMENT

Set to ENABLED to use the function.

[12010] ACCELERATION RATE MANAGEMENT: Level of Acceleration Level

Sets the desired acceleration profile.

[30560] J1939 BROADCAST: TSC1 to Engine Continuous Broadcast

TSC1 broadcasts are intermittent (only sent during control sequences) by default. Heartbeat options of 10 ms or 100 ms are available.

B.4.27.4. *J1939 PARAMETER AND SA USE*

SAs marked (V) may be set to an OEM-specified value via VEPS. See AUTO-DETECTION for SA selection details.

B.4.27.4.1. Required Support

The J1939 network is required to provide EEC2 *Accelerator Pedal Position 1* as described under ACCELERATOR PEDAL INPUT.

The J1939 network is required to provide CCVS1 *Wheel-based Vehicle Speed* from one of the following SAs, in order of TCM preference:

1. SA 17 (Cruise Control) (V)
2. SA 33 (Body Controller)
3. SA 00 (Engine #1)

SA 00 (Engine #1) is required to broadcast:

— EEC2 *Engine Percent Load at Current Speed*

— EEC1 *Actual Engine – Percent Torque*

— EC1 *Engine Reference Torque*

— EC1 Engine Speed and Percent Torque Points [1]

— EEC3 *Nominal Friction – Percent Torque*

[1] Data is required to be in either EC1 Mode 1 or Mode 2 format. Regardless, Point 2 must contain valid engine speed and torque data.

B.4.27.4.2. Required Reception Support

SA 00 (Engine #1) is required to respond to the following messages from SA 03 (Transmission #1):

— Global Request (V) messages to obtain EC1
— TSC1 messages for engine control

B.4.27.4.3. Optional Support

ARM can be further optimized if *EEC3 Estimated Engine Parasitic Losses – Percent Torque* is provided.

In contrast to other J1939 parameters, EEC3 *Estimated Engine Parasitic Losses – Percent Torque* can be provided from up to 5 source addresses as configured via VEPS.

[29281] J1939 SA1: EEC3 Estimated Engine Parasitic Losses Percent Torque

If set to 254 (Default) then EEC3 *Estimated Engine Parasitic Losses – Percent Torque* will only be used from SA 00 (Engine #1) when a compatible engine is configured.

[29282] J1939 SA2: EEC3 Estimated Engine Parasitic Losses Percent Torque
[29283] J1939 SA3: EEC3 Estimated Engine Parasitic Losses Percent Torque
[29284] J1939 SA4: EEC3 Estimated Engine Parasitic Losses Percent Torque
[29285] J1939 SA5: EEC3 Estimated Engine Parasitic Losses Percent Torque

The TCM will add the EEC3 *Estimated Engine Parasitic Losses – Percent Torque* values received from all configured source addresses. If parameter reception from the engine is desired in combination with other SAs, one of the SAs must be set to 00 (Engine #1).

B.4.27.5. *OTHER REQUIREMENTS / RESTRICTIONS*

B.4.27.5.1. Vehicle Function Integration

If a vehicle is so equipped, all requirements for the following functions must be met:

CRUISE CONTROL, STANDARD

CRUISE CONTROL, ADAPTIVE

CRUISE CONTROL, VIA ENGINE PTO GOVERNOR

ROAD SPEED LIMITING

B.4.27.5.2. Engine Certification

Engines must undergo an Allison certification process to ensure compliance with the governor characteristics in APPENDIX A, and the response & torque accuracy requirements in APPENDIX B.

B.4.27.5.3. Vehicle Acceleration Rate Limiting

If EEC2 *Vehicle Acceleration Limit Status* reception is enabled and the TCM sees a value other than 11b (Not Available), ARM is permanently disabled to avoid conflicts with VEHICLE ACCELERATION RATE LIMITING.

B.4.27.5.4. Integration with TSC1 Commands from Other Components

ARM is compatible with traction control systems (i.e. ATC or ASR) as long as they utilize TSC1 torque limits with *TSC1 Override Control Mode Priority* 10b (Medium priority).

TSC1 engine commands sent from other devices with differing priority or control modes may interfere with those generated by ARM logic. The only sure way to avoid such interference is to install other devices that may modify engine torque via TSC1 messages. If such devices are installed, the system integrator (vehicle OEM) is responsible for verifying acceptable vehicle operation and device interaction.

All Allison TSC1 engine commands have *Override Control Mode Priority* 10b (Medium priority). Experience has shown that when multiple TSC1 torque limits are simultaneously sent to the engine, the devices involved normally desire the lowest torque limit to be honored. Per the SAE-defined TSC1 arbitration process, the only way to ensure this outcome is to use a common control mode and priority level.

Allison strongly recommends other devices only send medium-priority TSC1 limits to the engine, and avoid use of TSC1 torque and speed control.

B.4.27.5.5. Support of Parameter Error States

If a required broadcast parameter is inaccurate or unknown during a failure mode, J1939 convention must be followed in that the parameter must indicate an Error state or value.

B.4.27.5.6. Spark-Ignited Engines

Special instruction is necessary to use ARM with a spark-ignited (e.g. natural gas, propane, gasoline) engine. Reference TD161 for engine compatibility, and contact your Allison Customer Integration Engineer for more information.

B.4.27.5.7. Engine Accessory Loads

Though not required, it is recommended that the engine not allow changes in the ON / OFF state of engine accessory loads when shifts are in process.

B.4.27.6. *NORMAL OPERATION*

The TCM continuously monitors vehicle acceleration and broadcasts TSC1 torque limits to the engine as needed to maintain the selected acceleration profile.

B.4.27.7. *IMPLEMENTATION ERRORS AND IMPACTS*

The following are implementation errors that have been seen previously, and their impact:

B.4.27.7.1. Failure to Notify Allison of Major Engine Changes

Problems can occur if the **[11020] ENGINE MAKE AND MODEL** value remains unchanged when an engine undergoes a major mechanical redesign.

Changes such as a new fuel system or increased engine stroke can significantly alter engine response characteristics. As a result, Allison Customer Integration Engineering must review the engine to reaffirm ARM compatibility.

If the revised engine is significantly different from the existing model, but a new **[11020] ENGINE MAKE AND MODEL** value is not created, TCM ability to maintain the desired acceleration profile may be negatively impacted.

B.4.27.7.2. Poor Scaling of EC1 Engine Reference Torque

J1939-71 currently provides few guidelines on how to best set the EC1 *Engine Reference Torque* value. Experience has shown that reference torque is best set <u>as close as possible to the actual peak torque of the engine rating</u>. By doing so, the resolution of parameters expressed as a percentage of *Engine Reference Torque* is optimized.

If this is not possible, the next best approach is to set the reference torque equal to the maximum peak torque rating available *within a particular engine family*. Resolution of parameters expressed as a percentage of *Engine Reference Torque* will worsen as lower engine ratings are used.

Setting the reference torque artificially high, such as 10,000 Nm for an engine family that has a maximum peak torque rating of 1200 Nm, should be avoided. Resolution of parameters expressed as a percentage of *Engine Reference Torque* will be diminished to the point where shift quality will suffer.

Engine Reference Torque should not be set to a value of less than the engine's peak torque capability. Parameters expressed as a percentage of *Engine Reference Torque* will generate values of over +125%. Again, shift quality will suffer.

Remember that *Engine Reference Torque* is always expressed in terms of indicated torque, and should never change during a vehicle drive cycle.

B.4.27.8. *FAILURE MODES AND RESPONSES*

B.4.27.8.1. Engine Fails to Respond to Torque Limit from TCM

If the engine fails to respond to torque limits sent by the TCM, acceleration will not be held to the desired profile. No DTCs are logged.

B.4.27.8.2. Incorrect Input Values Received

No DTCs are set if incorrect values are received. However, incorrect data will negatively impact TCM ability to maintain the desired acceleration profile.

B.4.27.8.3. Loss of Engine Communication

If the TCM loses reception of any of the following for a time period longer than 5X their broadcast rates:

- EEC1 *Actual Engine – Percent Torque*
- EEC2 *Accelerator Pedal (AP) Position*
- EEC3 *Nominal Friction – Percent Torque*

…some shifts will be momentarily inhibited. If lost for a period of more than 5 seconds, a DTC is also set and the Check Trans Indicator is actuated.

B.4.27.9. *INSTALLATION CHECKLIST: ENGINE MANAGEMENT – ARM*

Allison Customer Integration Engineering will review new J1939-based implementations. The written test plan is available to assist vehicle and engine OEMs in development of Engine Management compatibility. Please contact your Allison Customer Integration Engineer.

B.4.28. ENGINE MANAGEMENT – SHIFT ENERGY MANAGEMENT (SEM)

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.28.1. *OVERVIEW*

Shift Energy Management (SEM) manages engine torque during shifts to increase shift quality and reduce clutch wear. Engine control is accomplished through the J1939 datalink.

B.4.28.2. *AVAILABILITY*

SEM is enabled in 1000 – 4000 Series applications when used with a compatible **ENGINE MAKE AND MODEL** as validated by the Allison Engine Integration group.

B.4.28.3. *CONFIGURATION (VEPS / ACCT)*

[11020] ENGINE MAKE AND MODEL

Shift Energy Management is only enabled for compatible electronic engines as validated by the Allison Engine Integration group.

[18000] THROTTLE AND LOAD SOURCE

Set to PRIMARY ON-VEHICLE PROTOCOL.

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters are only exchanged on the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[22000] ENGINE BRAKE INTERFACE

Set to PRIMARY ON-VEHICLE PROTOCOL, as Engine Management applications equipped with engine brakes are required to use the J1939-based interface.

[30390] J1939 BROADCAST: Request – EC1

May be set to DISABLED (NO REQUESTS SENT) if EC1 is periodically broadcast; otherwise, leave set to ENABLED (MAXIMUM OF 3 REQUESTS).

[30560] J1939 BROADCAST: TSC1 to Engine Continuous Broadcast

TSC1 broadcasts are intermittent (only sent during control sequences) by default. Heartbeat options of 10 ms or 100 ms are available.

B.4.28.4. *J1939 PARAMETER AND SA USE*

Items marked (V) can be modified via VEPS. See AUTO-DETECTION for SA selection details.

B.4.28.4.1. Required Support

The J1939 network is required to provide EEC2 *Accelerator Pedal Position 1* as described under ACCELERATOR PEDAL INPUT.

SA 00 (Engine #1) is required to provide:

- EEC2 *Engine Percent Load at Current Speed*
- EEC1 *Actual Engine – Percent Torque*
- EEC1 *Engine Demand – Percent Torque*
- EEC1 *SA for Controlling Device for Engine Control*
- EC1 *Engine Reference Torque*
- EC1 Engine Speed and Percent Torque Points (1)
- EC1 *Engine Moment of Inertia* (2)
- EEC3 *Nominal Friction – Percent Torque*

(1) Data is required to be in either EC1 Mode 1 or Mode 2 format. Regardless, Point 2 must contain valid engine speed and torque data.

(2) Parameter may not be required in all applications; see Allison TD161.

B.4.28.4.2. Required Reception Support

SA 00 (Engine #1) is required to respond to global Request (V) messages for EC1, and TSC1 messages for engine control. Both messages are sent from SA 03 (Transmission #1).

B.4.28.4.3. Optional Support

While not required, the TCM will use the following parameters if present:

RC *Retarder Reference Torque* as described under ENGINE BRAKE INTERFACE

CCVS1 *Wheel-based Vehicle Speed* from one of the following SAs, in order of TCM preference:

1. SA 17 (Cruise Control) (V)
2. SA 33 (Body Controller)
3. SA 00 (Engine #1)

EEC3 *Estimated Engine Parasitic Losses – Percent Torque* can be provided from up to 5 source addresses as configured via VEPS.

[29281] J1939 SA1: EEC3 Estimated Engine Parasitic Losses Percent Torque

If set to 254 (Default) then EEC3 Estimated Engine Parasitic Losses – Percent Torque will only be used from SA 00 (Engine #1) when a compatible engine is configured.

[29282] J1939 SA2: EEC3 Estimated Engine Parasitic Losses Percent Torque
[29283] J1939 SA3: EEC3 Estimated Engine Parasitic Losses Percent Torque
[29284] J1939 SA4: EEC3 Estimated Engine Parasitic Losses Percent Torque
[29285] J1939 SA5: EEC3 Estimated Engine Parasitic Losses Percent Torque

The TCM will add the EEC3 Estimated Engine Parasitic Losses – Percent Torque values received from all configured source addresses. If parameter reception from the engine is desired in combination with other SAs, one of the SAs must be set to 00 (Engine #1).

B.4.28.5. *OTHER REQUIREMENTS / RESTRICTIONS*

B.4.28.5.1. Engine and Adaption Inertia

WARNING: SEM requires each VEPS ENGINE MAKE AND MODEL answer be associated with a single inertia value. ANY change in this value requires evaluation by Allison.

For example, an engine approved for SEM use with a flywheel cannot be approved for SEM use with a flex plate unless a new ENGINE MAKE AND MODEL designation is created.

B.4.28.5.2. Integration with Other Vehicle Functions

If a vehicle is so equipped, all requirements for the following functions must be met:

AUTOMATIC TRACTION CONTROL

CRUISE CONTROL, STANDARD

CRUISE CONTROL, ADAPTIVE

CRUISE CONTROL, VIA ENGINE PTO GOVERNOR

ROAD SPEED LIMITING

ENGINE BRAKE INTERFACE

NOTE: Allison Engine Management functions are only compatible with the J1939-based Engine brake Interface; GPIO-based versions cannot be used.

B.4.28.5.3. Engine Certification

Engines must undergo an Allison certification process to ensure compliance with the governor characteristics in APPENDIX A, and the response & torque accuracy requirements in APPENDIX B.

B.4.28.5.4. Integration with TSC1 Commands from Other Components

SEM is compatible with traction control systems (i.e. ATC or ASR) as long as they utilize TSC1 torque limits with TSC1 *Override Control Mode Priority* 10b (Medium priority).

TSC1 engine commands sent from other devices with differing priority or control modes may interfere with those generated by SEM logic. The only sure way to avoid such interference is to not install other devices that may modify engine torque via TSC1 messages. If such devices are installed, the system integrator (vehicle OEM) is responsible for verifying acceptable vehicle operation and device interaction.

All Allison TSC1 engine commands have *Override Control Mode Priority* 10b (Medium priority). Experience has shown that when multiple TSC1 torque limits are simultaneously sent to the engine, the devices involved normally desire the lowest torque limit to be honored. Per the SAE-defined TSC1 arbitration process, the only way to ensure this outcome is to use a common control mode and priority level.

Allison strongly recommends other devices only send medium-priority TSC1 limits to the engine, and avoid using TSC1 torque & speed control.

B.4.28.5.5. Support of Parameter Error States

If a required broadcast parameter is inaccurate or unknown during a failure mode, J1939 convention must be followed in that the parameter must indicate an Error state or value.

B.4.28.5.6. Spark-Ignited Engines

Special instruction is necessary to use SEM with a spark-ignited (e.g. natural gas, propane, gasoline) engine. Reference TD161 for engine compatibility, and contact your Allison Customer Integration Engineer for more information.

B.4.28.5.7. Engine Accessory Loads

Though not required, it is recommended that the engine not allow changes in the ON / OFF state of engine accessory loads when shifts are in process.

B.4.28.6. *INITIAL OPERATION – TCM*

For a number of engine start cycles after a vehicle has been assembled, the TCM will set DTC P0614 and limit transmission ranges if any required parameters indicate Error, Not Available or are not present.

At the beginning of the first 5 engine start cycles, the TCM requests EC1 from the engine. The requests cease upon EC1 reception or after 3 attempts.

B.4.28.7. *NORMAL OPERATION – TCM*

During vehicle operation, the TCM evaluates powertrain operating conditions and briefly controls engine output when necessary through a series of TSC1 commands. See the TSC1 BROADCAST SUMMARY for more information on commands issued by the TCM.

In addition, the TCM will adjust operation if engine de-rates (e.g. due to high engine temperature) are detected in EC1 data.

B.4.28.8. *REQUIRED NORMAL OPERATION – ENGINE*

The engine must respond to TSC1 commands from the TCM as outlined in Appendix B.

B.4.28.9. *IMPLEMENTATION ERRORS AND IMPACTS*

The following are implementation errors that have been seen previously, and their impact:

B.4.28.9.1. Failure to Notify Allison of Major Engine Changes

Problems can occur if the **[11020] ENGINE MAKE AND MODEL** value remains unchanged when an engine undergoes a major mechanical redesign or uses a different transmission adaptation.

Changes such as a new fuel system or increased engine stroke can significantly alter engine inertia and response characteristics. As a result, Allison Customer Integration Engineering must review the engine to reaffirm SEM compatibility.

If the revised engine is significantly different from the existing model, but a new **[11020] ENGINE MAKE AND MODEL** value is not created, the proper TCM adjustments won't be used during SEM operation. Poor shift quality and / or transmission damage may result.

B.4.28.9.2. Poor Scaling of EC1 Engine Reference Torque

J1939-71 currently provides few guidelines on how to best set the EC1 *Engine Reference Torque* value. Experience has shown that reference torque is best set <u>as close as possible to the engine rating's actual indicated peak torque</u>. By doing so, the resolution of parameters expressed as a percentage of *Engine Reference Torque* is optimized.

If this is not possible, the next best approach is to set the reference torque equal to the maximum indicated peak torque rating available *within a particular engine family*. Resolution of parameters expressed as a percentage of *Engine Reference Torque* will worsen as lower engine ratings are used.

Setting the reference torque artificially high, such as 10,000 Nm for an engine family that has a maximum peak torque rating of 1200 Nm, should be avoided. Resolution of parameters expressed as a percentage of *Engine Reference Torque* will be diminished to the point where shift quality will suffer.

Last, *Engine Reference Torque* should not be set to a value of less than engine peak torque capability. Parameters expressed as a percentage of *Engine Reference Torque* will generate values over +125%. Again, shift quality will suffer.

Remember that *Engine Reference Torque* is always expressed in terms of indicated torque, and should never change during a vehicle drive cycle.

B.4.28.9.3. Incorrect Support of EEC1 SA of Controlling Device for Engine Control

This parameter is monitored and stored if the TCM detects improper engine response during SEM operation, as discussed in TCM FAILURE MODES AND RESPONSES DURING OPERATION.

If the engine controller does not properly support *Source Address for Controlling Device for Engine Control*, the TCM will implicate the engine SA (00) as the problem source. This can be misleading to technicians diagnosing the issue.

B.4.28.10. *TCM FAILURE MODES AND RESPONSES – NORMAL OPERATION*

B.4.28.10.1. Detection of Improper Engine Response during Shifts

If engine response to TSC1 commands during shifts is deemed unacceptable for a calibratible number of shifts, DTC P2637 is logged and the Check Trans Indicator actuated. As a result, clutch pressures are increased to provide protection to transmission components, which may lead to noticeably reduced shift quality. Some shifts may be inhibited.

Source Address for Controlling Device for Engine Control is logged so service technicians can see if TSC1 commands from another J1939 device may be pre-empting the SEM commands to the engine

Other possible causes of improper engine response are wiring integrity failures, electrical noise, or bus loading.

After a key cycle, the TCM will again attempt SEM operation where applicable, and self-clear the active fault if engine response returns to within acceptable criteria for a number of shifts.

B.4.28.10.2. Loss of Engine Demand – Percent Torque Input

In 1000 – 4000 Series applications, if the TCM fails to receive *Engine Demand – Percent Torque* for a given time period, or *Engine Demand – Percent Torque* indicates Error or Not Available:

— A DTC is logged and the Check Trans Indicator is actuated,

— Clutch pressures are increased for transmission component protection, and

— Shifts are not adapted.

When proper reception returns for a number of cycles without failure, the fault self-clears.

B.4.28.10.3. TCM Receives Incorrect Input Values

SEM inputs are used to determine what the engine will be doing before, during and after a shift. While no DTCs are set outside those mentioned above, incorrect input values – whether higher or lower than actual – will reduce shift quality.

B.4.28.10.4. Loss of Engine Communication

If the TCM loses reception of any of the following for a time period longer than 5X their broadcast rates:

— EEC1 *Actual Engine – Percent Torque*
— EEC2 *Accelerator Pedal (AP) Position*
— EEC3 *Nominal Friction – Percent Torque*

…some shifts may be inhibited. If lost for a period of more than 5 seconds, a DTC is also set and the Check Trans Indicator is actuated.

B.4.28.11. *INSTALLATION CHECKLIST: ENGINE MANAGEMENT – SEM*

Allison Customer Integration Engineering will review new J1939-based implementations. The written test plan is available to assist vehicle and engine OEMs in development of Engine Management compatibility. Please contact your Allison Customer Integration Engineer.

B.4.29. ENGINE MANAGEMENT – LOWER RANGE TORQUE PROTECTION (LRTP)

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.29.1. *OVERVIEW*

Lower Range Torque Protection (LRTP) is an Engine Management function that reduces engine torque when transmission input power, input torque, converter torque output, or converter speed ratio exceeds Allison-defined limits. These limits typically occur during torque converter mode or operation in lower gears, where stall or drivetrain torque may reach levels above gearbox capacity.

B.4.29.2. *AVAILABILITY*

LRTP is enabled in 1000 – 4000 Series applications when used with a compatible **ENGINE MAKE AND MODEL** as validated by the Allison Engine Integration group.

B.4.29.3. *CONFIGURATION (VEPS / ACCT)*

[11020] ENGINE MAKE AND MODEL
Lower Range Torque Protection is only enabled for compatible electronic engines as validated by the Allison Engine Integration group.

[18000] THROTTLE AND LOAD SOURCE
Set to PRIMARY ON-VEHICLE PROTOCOL.

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2
Parameters are only exchanged on the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[22000] ENGINE BRAKE INTERFACE
This answer is required to be set to PRIMARY ON-VEHICLE PROTOCOL when an engine brake is installed.

[30390] J1939 BROADCAST: Request – EC1
May be set to DISABLED (NO REQUESTS SENT) if EC1 is periodically broadcast; otherwise, leave set to ENABLED (MAXIMUM OF 3 REQUESTS).

[30440] J1939 BROADCAST: TCFG2 Transmission Torque Limit

Must be set to ENABLED unless Allison Customer Integration Engineering confirms that the vehicle OEM has a system in place to pre-program the torque limit value at the factory.

[30560] J1939 BROADCAST: TSC1 to Engine Continuous Broadcast

TSC1 broadcasts are intermittent (only sent during control sequences) by default. Heartbeat options of 10 ms or 100 ms are available.

B.4.29.4. *J1939 PARAMETER AND SA USE*

Items marked (V) can be modified via VEPS.

B.4.29.4.1. Required Support

The J1939 network is required to provide EEC2 *Accelerator Pedal Position 1* as described under ACCELERATOR PEDAL INPUT.

SA 00 (Engine #1) is required to broadcast:

- EEC2 *Engine Percent Load at Current Speed*
- EEC1 *Actual Engine – Percent Torque*
- EEC1 *SA for Controlling Device for Engine Control*
- EC1 *Engine Reference Torque*
- EC1 Engine Speed and Percent Torque Points (1)
- EC1 *Engine Default Torque Limit*
- EEC3 *Nominal Friction – Percent Torque*

(1) Data is required to be in either EC1 Mode 1 or Mode 2 format. Regardless, Point 2 must contain valid engine speed and torque data.

B.4.29.4.2. Required Reception Support

SA 00 (Engine #1) is required to respond to the following messages from SA 03 (Transmission #1):

- Global Request (V) messages to obtain EC1,
- TSC1 messages for engine control,
- TCFG2 *Transmission Torque Limit* (V), and
- ETC1 as a TCM heartbeat message.

B.4.29.4.3. Optional Support

The TCM will use the following parameters if present. However, they are not required, and LRTP will operate in their absence:

RC *Retarder Reference Torque* as described under ENGINE BRAKE INTERFACE, if installed.

CCVS1 *Wheel-based Vehicle Speed* from one of the following SAs, in order of TCM preference:

1. SA 17 (Cruise Control) (V)
2. SA 33 (Body Controller)
3. SA 00 (Engine #1)

EEC3 *Estimated Engine Parasitic Losses – Percent Torque* can be provided from up to 5 source addresses as configured via VEPS.

[29281] J1939 SA1: EEC3 Estimated Engine Parasitic Losses Percent Torque

If set to 254 (Default) then EEC3 Estimated Engine Parasitic Losses – Percent Torque will only be used from SA 00 (Engine #1) when a compatible engine is configured.

[29282] J1939 SA2: EEC3 Estimated Engine Parasitic Losses Percent Torque
[29283] J1939 SA3: EEC3 Estimated Engine Parasitic Losses Percent Torque
[29284] J1939 SA4: EEC3 Estimated Engine Parasitic Losses Percent Torque
[29285] J1939 SA5: EEC3 Estimated Engine Parasitic Losses Percent Torque

The TCM will add the EEC3 Estimated Engine Parasitic Losses – Percent Torque values received from all configured source addresses. If parameter reception from the engine is desired in combination with other SAs, one of the SAs must be set to 00 (Engine #1).

B.4.29.5. *OTHER REQUIREMENTS / RESTRICTIONS*

B.4.29.5.1. Vehicle Function Integration

If a vehicle is so equipped, all requirements for the following functions must be met:

CRUISE CONTROL, STANDARD

CRUISE CONTROL, ADAPTIVE

CRUISE CONTROL, VIA ENGINE PTO GOVERNOR

ROAD SPEED LIMITING

ENGINE BRAKE INTERFACE

NOTE: Allison Engine Management functions are only compatible with the J1939-based Engine brake Interface; GPIO-based versions cannot be used.

B.4.29.5.2. Engine Certification

Engines must undergo an Allison certification process to ensure compliance with the governor characteristics in APPENDIX A, and the response & torque accuracy requirements in APPENDIX B.

B.4.29.5.3. Integration with TSC1 Commands from Other Components

LRTP is compatible with traction control systems (i.e. ATC or ASR) as long as they utilize TSC1 torque limits with TSC1 *Override Control Mode Priority* 10b (Medium priority).

TSC1 engine commands sent from other devices with differing priority or control modes may interfere with those generated by LRTP logic. The only sure way to avoid such interference is to install other devices that may modify engine torque via TSC1 messages. If such devices are installed, the system integrator (vehicle OEM) is responsible for verifying acceptable vehicle operation and device interaction.

All Allison TSC1 engine commands have *Override Control Mode Priority* 10b (Medium priority). Experience has shown that when multiple TSC1 torque limits are simultaneously sent to the engine, the devices involved normally desire the lowest torque limit to be honored. Per the SAE-defined TSC1 arbitration process, the only way to ensure this outcome is to use a common control mode and priority level.

Allison strongly recommends other devices only send medium-priority TSC1 limits to the engine, and avoid use of TSC1 torque and speed control.

B.4.29.5.4. Support of Parameter Error States

If a required broadcast parameter is inaccurate or unknown during a failure mode, J1939 convention must be followed in that the parameter must indicate an Error state or value.

B.4.29.5.5. Spark-Ignited Engines

Special instruction is necessary to use LRTP with a spark-ignited (e.g. natural gas, propane, gasoline) engine. Reference TD161 for engine compatibility, and contact your Allison Customer Integration Engineer for more information.

B.4.29.5.6. Engine Accessory Loads

Though not required, it is recommended that the engine not allow changes in the ON / OFF state of engine accessory loads when shifts are in process.

B.4.29.6. *INITIAL OPERATION – TCM*

For a number of engine start cycles after a vehicle has been assembled, the TCM will set DTC P0614 and limit transmission ranges if any required parameters indicate Error, Not Available or are not present.

B.4.29.7. *NORMAL OPERATION – TCM*

At the beginning of each key switch cycle, the TCM broadcasts TCFG2 *Transmission Torque Limit* for a period of time (~1 minute) or until the engine echoes the same value back in EC1 *Engine Default Torque Limit.*

During vehicle operation, LRTP limits engine torque when transmission input power, input torque or torque converter output limits are close to values exceeding the transmission rating for the current gear and torque converter conditions. The TCM continually gauges engine response during these TSC1 commands.

B.4.29.8. *REQUIRED NORMAL OPERATION – ENGINE*

In addition to responding to TSC1 commands from the TCM as outlined in Appendix B, the engine is required to:

B.4.29.8.1. Update and Retain Engine Default Torque Limit

Engine Default Torque Limit is a companion parameter to *Transmission Torque Limit*. It provides confirmation to the TCM that the engine has received and will invoke the requested *Transmission Torque Limit* if J1939 communication is lost between the two devices.

The engine is required to monitor TCFG2 *Transmission Torque Limit* at the beginning of each engine start cycle. If the engine sees that the received value does not match its' stored value, it is required to update the *Engine Default Torque Limit* value it stores in non-volatile memory and uses during operation.

An *Engine Default Torque Limit* value of 0xFF00 to 0xFFFF indicates that no default engine torque limit has been received or set.

B.4.29.8.2. Monitor TCM Heartbeat Message

In LRTP applications, the engine is required to monitor ETC1 as a TCM heartbeat. See FAILURE MODES AND REQUIRED ENGINE RESPONSES for proper reaction to loss of the heartbeat.

B.4.29.9. *IMPLEMENTATION ERRORS AND IMPACTS*

The following are implementation errors that have been seen previously, and their impact:

B.4.29.9.1. Failure to Notify Allison of Major Engine Changes

Problems can occur if the **[11020] ENGINE MAKE AND MODEL** value remains unchanged when an engine undergoes a major mechanical redesign.

Changes such as a new fuel system or increased engine stroke can significantly alter engine response characteristics. As a result, Allison Customer Integration Engineering must review the engine to reaffirm LRTP compatibility.

If the revised engine is significantly different from the existing model, but a new **[11020] ENGINE MAKE AND MODEL** value is not created, the proper TCM adjustments won't be used during LRTP operation. Poor shift quality and / or transmission damage may result.

B.4.29.9.2. Poor Scaling of EC1 Engine Reference Torque

J1939-71 currently provides few guidelines on how to best set the EC1 *Engine Reference Torque* value. Experience has shown that reference torque is best set <u>as close as possible to the actual peak torque of the engine rating</u>. By doing so, the resolution of parameters expressed as a percentage of *Engine Reference Torque* is optimized.

If this is not possible, the next best approach is to set the reference torque equal to the maximum peak torque rating available *within a particular engine family*. Resolution of parameters expressed as a percentage of *Engine Reference Torque* will worsen as lower engine ratings are used.

Setting the reference torque artificially high, such as 10,000 Nm for an engine family that has a maximum peak torque rating of 1200 Nm, should be avoided. Resolution of parameters expressed as a percentage of *Engine Reference Torque* will be diminished to the point where shift quality will suffer.

Last, *Engine Reference Torque* should not be set to a value of less than the engine's peak torque capability. Parameters expressed as a percentage of *Engine Reference Torque* will generate values of over +125%. Again, shift quality will suffer.

Remember that *Engine Reference Torque* is always expressed in terms of indicated torque, and should never change during a vehicle drive cycle.

B.4.29.9.3. Incorrect Support of EEC1 SA of Controlling Device for Engine Control

This parameter is monitored and stored if the TCM detects improper engine response during LRTP operation, as discussed in TCM FAILURE MODES AND RESPONSES DURING OPERATION.

If the engine controller does not properly support *Source Address for Controlling Device for Engine Control*, the TCM will implicate the engine SA (00) as the problem source. This can be misleading to technicians diagnosing the issue.

B.4.29.10. *FAILURE MODES AND TCM RESPONSES*

These failure modes occur *after* LRTP capability is confirmed.

B.4.29.10.1. Detection of Improper Engine Response during LRTP Operation

If engine response is deemed unacceptable for a number of LRTP TSC1 commands, DTC P2641 is logged and the Check Trans Indicator is actuated.

Source Address for Controlling Device for Engine Control is logged so service technicians can see if TSC1 commands from another J1939 device may be pre-empting the LRTP commands to the engine.

Other possible causes of improper engine response include wiring integrity failures, electrical noise, or bus loading.

After a key cycle, the TCM will again attempt to use LRTP as needed, and self-clear the active DTC if engine response returns to within acceptable criteria for a number of TSC1 commands.

B.4.29.10.2. Incorrect Input Values Received

LRTP inputs are used to determine engine torque limits imposed during various aspects of transmission operation. No DTCs are set if incorrect values are received. However, if:

- EEC1 *Actual Engine – Percent Torque*
- EEC3 *Nominal Friction – Percent Torque*
- EEC3 *Estimated Engine Parasitic Losses – Percent Torque*

…are in error such that calculated (per Appendix B) gross torque is <u>lower</u> than actual, the LRTP limits may not adequately protect the transmission and damage may occur. Conversely, if errors in these parameters result in calculated gross torque that is higher than actual, excessively restrictive torque limits will be placed on the engine, and vehicle performance may be reduced.

B.4.29.10.3. Loss of Engine Communication

If the TCM loses reception of any of the following for a time period longer than 5X their broadcast rates:

- EEC1 *Actual Engine – Percent Torque*
- EEC2 *Accelerator Pedal (AP) Position*
- EEC3 *Nominal Friction – Percent Torque*

…some shifts will be momentarily inhibited. If lost for a period of more than 5 seconds, a DTC is also set and the Check Trans Indicator is actuated.

B.4.29.11. *FAILURE MODES AND REQUIRED ENGINE RESPONSES*

B.4.29.11.1. Engine Loses TCM Heartbeat

In the event the heartbeat message is not received in a time period of 5 times its broadcast rate (5 x 10 ms = 50 ms for ETC1), the engine is required to invoke a torque limit holding the engine to less than or equal to the value of *Transmission Torque Limit*. The engine may release the limit when engine-to-TCM communication is re-established.

The intention is to protect the transmission. LRTP may use torque limits during torque converter mode or operation in specific lower gears, where stall or drivetrain torque may reach levels higher than the gearbox capacity. If communication is lost during this torque-limited operation, unrestricted engine torque output could harm the transmission.

> **WARNING:** In applications that require LRTP, failure to invoke *Transmission Torque Limit* during communication loss between the engine and TCM WILL result in transmission damage.

B.4.29.12. *INSTALLATION CHECKLIST: ENGINE MANAGEMENT – LRTP*

Allison Customer Integration Engineering will review new J1939-based implementations. The written test plan is available to assist vehicle and engine OEMs in development of Engine Management compatibility. Please contact your Allison Customer Integration Engineer.

B.4.30. ENGINE MANAGEMENT – NEUTRAL-TO-RANGE ASSIST (NRA)

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.30.1. *OVERVIEW*

> **NEW FOR B/C/N241 PC Releases:** The maximum NRA duration has been extended from 3 to 5 seconds.

Neutral-to-Range Assist (NRA) is an Engine Management function where the TCM manages engine speed in order for the transmission to complete a Neutral-to-Range garage shift.

NRA can only be accomplished via J1939 datalink; there is no equivalent GPI function.

B.4.30.2. *AVAILABILITY*

NRA is optional in 1000 – 4000 Series applications when used with a compatible **ENGINE MAKE AND MODEL** as validated by the Allison Engine Integration group.

B.4.30.3. *CONFIGURATION (VEPS / ACCT)*

[11020] ENGINE MAKE AND MODEL

NRA will only enable when used with a compatible electronic engine as validated by the Allison Engine Integration group.

[18000] THROTTLE AND LOAD SOURCE

Set to PRIMARY ON-VEHICLE PROTOCOL.

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters are only exchanged on the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[12020] NEUTRAL-TO-RANGE ASSIST (NRA)

Must be set to ENABLED.

B.4.30.4. *J1939 PARAMETER AND SA USE*

There are no messages or parameters to support beyond those required by the functions listed under OTHER REQUIREMENTS / RESTRICTIONS.

B.4.30.5. *OTHER REQUIREMENTS / RESTRICTIONS*

B.4.30.5.1. Required Allison Function Support

To utilize Neutral-to-Range Assist (NRA), the vehicle is required to support these functions:

SERVICE BRAKE STATUS INPUT, and

ENGINE MANAGEMENT – SEM or

ENGINE MANAGEMENT – LRTP

B.4.30.5.2. Interaction with Other Vehicle Functions

CAUTION: When the garage shift is complete, the TCM ceases TSC1 engine control. The engine governor or control system is then free to resume the operational state active prior to NRA control.

Those using NRA should take this into consideration when analyzing its interaction with other vehicle functions such as PTO modes, etcetera.

B.4.30.6. *OPERATOR INTERFACE*

There are no specific operator interface requirements for this function.

B.4.30.7. *NORMAL OPERATION*

If the vehicle operator requests a Neutral-to-Range garage shift while engine speed is too high to initiate the shift, and within 5 seconds of the shift request the operator either:

— applies the service brakes, or

— depresses the accelerator pedal beyond a threshold (but less than 40%), or

— manipulates the shift selector,

…then the TCM will send a TSC1 torque limit to decrease engine speed so the shift can be initiated.

Once initiated, the NRA control will continue -- even if the service brakes or throttle pedal are released – until shift completion or for a maximum of 5 seconds.

If a garage shift is requested while engine speed is too high or accelerator pedal position is > 40%, engine speed will not be reduced and the shift will be inhibited. The Range Inhibited Indicator (RII) will be activated, and the operator will have to re-select the desired range.

B.4.30.8. *FAILURE MODES AND RESPONSES*

B.4.30.8.1. Engine Fails to Respond to Torque Limit from TCM

If engine speed fails to lower to an acceptable level within 5 seconds, the TCM will cease the TSC1 torque limit command and the transmission will remain in Neutral.

The Range Inhibited Indicator (RII) will be activated, and the operator will have to re-select the desired range. No DTCs are logged.

B.4.30.8.2. TCM loses throttle or service brake input reception

NRA logic will not execute if the TCM fails to receive either a valid J1939-based throttle input or a valid Service Brake Status input, or has an active fault related to either.

B.4.31. ENGINE MANAGEMENT – OUTPUT TORQUE LIMITING (OTL)

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.31.1. *OVERVIEW*

Output Torque Limiting (OTL) is an Engine Management function where the TCM limits engine torque output in order to keep transmission output torque below OEM-specified limits.

B.4.31.2. *AVAILABILITY*

Output Torque Limiting is optional in all 1000 through 4000 Series applications when used with a compatible **ENGINE MAKE AND MODEL** as validated by the Allison Engine Integration group. This feature is only available after successful Customer Integration Engineering review.

B.4.31.3. *CONFIGURATION (VEPS / ACCT)*

[11020] ENGINE MAKE AND MODEL

Output Torque Limiting will only enable when used with compatible electronic engines as validated by the Allison Engine Integration group.

[18000] THROTTLE AND LOAD SOURCE

Set to PRIMARY ON-VEHICLE PROTOCOL.

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters are only exchanged on the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[25130] HIGH N/V RATIO INPUT

Set answer to PRIMARY ON-VEHICLE PROTOCOL so the J1939 parameter will trigger the “transfer case low” output torque limit. GPI CC will not trigger the t-case output torque limit.

[12040] OUTPUT TORQUE LIMITING

Set answer to ENABLED to use the OTL function.

B.4.31.3.1. VEPS / ACCT Trims

The following trims influence function operation:

- **[12060] OUTPUT TORQUE LIMITING: T-Case Low Output Torque Limit**
- **[12070] OUTPUT TORQUE LIMITING: Reverse Output Torque Limit**
- **[12080] OUTPUT TORQUE LIMITING: General Output Torque Limit**

B.4.31.4. *OTHER REQUIREMENTS / RESTRICTIONS*

OTL requires that ENGINE MANAGEMENT – LRTP and all of its requirements be supported.

If OTL is desired during transfer case low operation, then HIGH N/V RATIO INPUT support is required.

B.4.31.5. *NORMAL OPERATION – TCM*

OTL operation is identical to LRTP except that engine limits are based on transmission output shaft torque. During vehicle operation, OTL limits engine torque when transmission output torque is close to exceeding the programmed torque limits. The TCM continually gauges engine response during these TSC1 commands.

The “transfer case low” output torque limit is invoked per the HIGH N/V RATIO INPUT function.

B.4.31.6. *FAILURE MODES ANDTCM RESPONSES*

All TCM failure modes and responses are identical to those listed for ENGINE MANAGEMENT – LRTP.

B.4.31.7. *FAILURE MODES AND REQUIRED ENGINE RESPONSES*

All failure modes and requirements are identical to those listed for ENGINE MANAGEMENT – LRTP.

B.4.31.8. *INSTALLATION CHECKLIST: ENGINE MANAGEMENT – OTL*

Allison Customer Integration Engineering will review new implementations. The written test plan is available to assist vehicle and engine OEMs in development of Engine Management compatibility. Please contact your Allison Customer Integration Engineer.

B.4.32. ENGINE MANAGEMENT – PTO TORQUE LIMITING (PTL)

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.32.1. *OVERVIEW*

PTO Torque Limiting (PTL) is an Engine Management function where the TCM restricts engine torque output in order to keep PTO drive output torques below OEM-specified limits.

B.4.32.2. *AVAILABILITY*

PTL is optional in 1000 – 4000 Series (except EVS and SP vocations) applications when used with a compatible **ENGINE MAKE AND MODEL** as validated by the Allison Engine Integration group.

B.4.32.3. *CONFIGURATION (VEPS / ACCT)*

[11020] ENGINE MAKE AND MODEL

PTL can only be enabled with LRTP-only electronic engines as validated by the Allison Engine Integration group.

[18000] THROTTLE AND LOAD SOURCE

Must remain set to default answer PRIMARY ON-VEHICLE PROTOCOL.

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters are only exchanged on the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[27082] PTO DRIVE INTERFACE 1: Torque Limiting

Default is DISABLED; must be set to ENABLED to invoke torque limiting when PTO Drive 1 is active.

[27142] PTO DRIVE INTERFACE 2: Torque Limiting

Default is DISABLED; must be set to ENABLED to invoke torque limiting when PTO Drive 2 is active.

[30390] J1939 BROADCAST: Request – EC1

Default answer is ENABLED (MAXIMUM OF 3 REQUESTS). May be set to DISABLED (NO REQUESTS SENT) if EC1 is periodically broadcast.

B.4.32.3.1. VEPS / ACCT Trims

The following trims influence function operation:

- **[27083] PTO DRIVE INTERFACE 1: Torque Limit**
- **[27084] PTO DRIVE INTERFACE 1: Drive Ratio (Percentage of Engine Speed)**
- **[27143] PTO DRIVE INTERFACE 2: Torque Limit**
- **[27144] PTO DRIVE INTERFACE 2: Drive Ratio (Percentage of Engine Speed)**

B.4.32.4. *J1939 PARAMETER AND SA USE*

See J1939 Parameter and SA use requirements for ENGINE MANAGEMENT – LRTP.

B.4.32.5. *OTHER REQUIREMENTS / RESTRICTIONS*

The PTO Torque Limiting function requires that ENGINE MANAGEMENT – LRTP and all of its requirements be supported.

PTL may not be used with output shaft PTOs.

The vehicle is required to support at least one of PTO Drive Interface 1 and / or PTO Drive Interface 2. These interfaces can be either J1939- or GPIO-based.

PTL may not be used in rolling PTO applications; it is restricted to stationary PTO applications only.

B.4.32.6. *NORMAL OPERATION – TCM*

For each PTO drive, while it is engaged and the transmission is in Park or Neutral, the TCM will limit engine torque to the OEM-defined torque rating for the given drive. In dual drive applications, if both drives are engaged, the TCM will limit the engine to the lower torque rating.

B.4.32.7. *FAILURE MODES ANDTCM RESPONSES*

B.4.32.7.1. TCM Detects Improper Engine Response during PTL Operation

If engine response is deemed unacceptable for a number of PTL TSC1 commands, DTC P2641 is logged and the Check Trans Indicator is actuated.

Source Address for Controlling Device for Engine Control is logged so service technicians can see if TSC1 commands from another J1939 device may be pre-empting the PTL commands to the engine.

Other possible causes of improper engine response include wiring integrity failures, electrical noise, or bus loading.

The TCM will continue attempting to use PTL as needed, and self-clear the active DTC if engine response returns to within acceptable criteria for a number of TSC1 commands.

B.4.32.7.2. TCM Receives Incorrect Input Values

PTL inputs are used to determine engine torque limits imposed while PTO Drive Interface 1 is engaged. No DTCs are set if incorrect values are received. However, if:

- EEC1 *Actual Engine – Percent Torque*
- EEC3 *Nominal Friction – Percent Torque*
- EEC3 *Estimated Engine Parasitic Losses – Percent Torque*

…are in error such that calculated (per Appendix B) gross torque is lower than actual, the PTL limits may not adequately protect the PTO-drive device and damage may occur. Conversely, if errors in these parameters result in calculated gross torque that is higher than actual, excessively restrictive torque limits will be placed on the engine, and PTO performance may be reduced.

B.4.32.7.3. TCM Loses Communication with Engine

If the TCM loses reception of any of the following for a time period longer than 5X their broadcast rates:

- EEC1 *Actual Engine – Percent Torque*
- EEC2 *Accelerator Pedal (AP) Position*
- EEC3 *Nominal Friction – Percent Torque*

…the TCM will revoke PTO engagement consent, and prohibit PTO operation until communication resumes. If lost for a period of more than 5 seconds, a DTC is also set and the Check Trans Indicator is actuated.

B.4.32.8. *FAILURE MODES AND REQUIRED ENGINE RESPONSES*

B.4.32.8.1. Engine Loses TCM Heartbeat

Like LRTP, if the heartbeat message is not received in a time period of 5 times its broadcast rate (5 x 10 ms = 50 ms for ETC1), the engine is required to invoke a torque limit holding the engine to less than or equal to the value of *Transmission Torque Limit*. The engine may release the limit when engine-to-TCM communication is re-established.

> **WARNING:** In applications that require PTO Torque Limiting, the *Transmission Torque Limit* value invoked during communication loss may not be low enough to sufficiently protect the driven PTO device.

B.4.32.9. *INSTALLATION CHECKLIST: ENGINE MANAGEMENT – PTL*

Allison Customer Integration Engineering will review new implementations. The written test plan is available to assist vehicle and engine OEMs in development of Engine Management compatibility. Please contact your Allison Customer Integration Engineer.

B.4.33. ENGINE STOP/START

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.33.1. *OVERVIEW*

NEW FOR THE C240 PSC RELEASE: This function is new for C240 PSC.

The Engine Stop/Start function allows the engine to shut down when the vehicle is stopped, and certain other conditions are met. The engine restarts when vehicle motion is desired.

B.4.33.2. *AVAILABILITY*

Engine Stop/Start is optional in 3000/4000 Series 6-speed applications. Additional hardware is required. Please contact your Allison Customer Integration Engineering representative for availability, and integration requirements.

B.4.34. FUELSENSE® INDICATOR

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.34.1. *OVERVIEW*

The Allison FuelSense® Indicator conveys that the TCM is configured with FuelSense®, to help optimize vehicle fuel economy. Activation only occurs briefly after TCM power-up. It does not reflect any dynamic changes in transmission operation. The following J1939 function allows indicator implementation on a vehicle OEM display in addition to the Allison shift selector display.

B.4.34.2. *AVAILABILITY*

The indicator is only available with certain 1000 – 4000 Series VMCs. For those VMCs, J1939-based implementation is optional.

B.4.34.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameter must be received from the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[16110] FUELSENSE® INDICATOR

Set to BOTH ALLISON SHIFT SELECTOR AND J1939 PARAMETER to enable TCM parameter broadcast.

B.4.34.4. *J1939 PARAMETER AND SA USE*

B.4.34.4.1. Required Support

The component controlling the FuelSense® Indicator is required to receive ETC7 *Transmission Mode 10 Indicator* (v) from SA 03 (Transmission #1).

B.4.34.5. *OPERATOR INTERFACE*

OEM FuelSense® Indicator implementations must be reviewed by Allison Transmission; please contact your Customer Integration Engineering representative.

B.4.34.5.1. Bulb Checks

The device that physically actuates the indicator is responsible for performing bulb and / or display checks at the beginning of each key switch cycle.

Allison recommends lamps or indicators remain on for 2 seconds during the check. Slightly longer or shorter time periods are acceptable.

B.4.34.6. *NORMAL OPERATION*

For vehicles configured with FuelSense®, when ETC7 *Transmission Mode 10 Indicator* = 01b (active), FuelSense® Indicator activation is required. When *Transmission Mode 10 Indicator* = 00b (inactive), FuelSense® Indicator deactivation is required. The indicator only activates briefly after TCM power-up.

For vehicles configured without FuelSense®, ETC7 *Transmission Mode 10 Indicator* is always set to 11b (not available).

B.4.34.7. *FUELSENSE® INDICATOR FAILURE MODES AND RESPONSES*

Any vehicle system response, fault logging, diagnostics or troubleshooting related to the loss of *Transmission Mode 10 Indicator* reception is the responsibility of the controller monitoring the parameter and the vehicle OEM.

B.4.34.7.1. Optional Heartbeat

Heartbeat monitoring and a Communication Failure indication are not required for this function, although vehicle OEMs may choose to implement such logic at their discretion. See USING A COMMUNICATION HEARTBEAT for recommendations on detecting and responding to J1939 communication failures.

B.4.34.8. *INSTALLATION CHECKLIST: FUELSENSE® INDICATOR*

Allison Customer Integration Engineering will review new J1939-based implementations for the following minimum functionality. While vehicle OEMs may use this list to help evaluate their implementation during development, it is not a substitute for the requirements described previously.

Acceptable implementations will answer "yes" to all of the questions in the following sequence:

- ☐ Is the TCM calibration configured properly?
- ☐ Observe the display while monitoring ETC7 *Transmission Mode 10 Indicator* from SA 03 in the Allison DOC® Data Bus Viewer. Turn on the vehicle key switch. Does the FuelSense® Indicator appear when the J1939 parameter value is 01b, and disappear when it is 00b?

B.4.35. HIGH N/V RATIO INPUT

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.35.1. *OVERVIEW*

High N/V operation results when driveline ratios result in high transmission output shaft speeds (N) while running at low vehicle speeds (V). Allison defines high N/V values as 43 to 93 rpm / kph (70 to 150 rpm / mph). In these situations, such as during two speed axle or transfer case operation, special TCM logic must be employed to optimize modulation and shift quality.

High N/V can be accomplished via J1939 or GPI CC (See the Allison 6th Generation Controls Installation Manual).

B.4.35.2. *AVAILABILITY*

The J1939-based implementation is optional in 1000 – 4000 Series applications.

B.4.35.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be provided to the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[25130] HIGH N/V RATIO INPUT

Set answer to PRIMARY ON-VEHICLE PROTOCOL to enable TCI *Transfer Case Status* reception.

B.4.35.4. *J1939 PARAMETER AND SA USE*

SAs marked (V) may be set to an OEM-specified value via VEPS. See AUTO-DETECTION for SA selection details.

B.4.35.4.1. Required Support

The J1939 network is required to provide TCI *Transfer Case Status* every 1 S and on change from one of the following SAs, in order of TCM preference:

1. SA 04 (Transmission #2) (V)
2. SA 49 (Cab Controller)
3. SA 33 (Body Controller)
4. SA 00 (Engine #1)

NOTE: TCI broadcast must be continuous. It may also be sent on change between the normal 1 second updates. If sent only on change, diagnostic responses will be generated by the TCM.

All 2WD and 4WD applications are required to support the applicable states as defined by SAE:

Bits	Meaning
000b	2WD high (normal or On Highway range)
001b	4WD high (normal or On Highway range)
010b	Neutral
011b	2WD low (or Off Highway range)
100b	4WD low (or Off Highway range)
101b	Shift in Progress or gear not confirmed
110b	Error
111b	Not Available

For example, a 2WD vehicle must support states 000b and 011b, while a 4WD vehicle must support states 001b and 100b. Transfer cases with a Neutral position must support state 010b. Regardless as to whether a vehicle is 2WD or 4WD, 110b (Error) support is required.

B.4.35.5. *OPERATOR INTERFACE*

B.4.35.5.1. Required Support – Communication Failure Indication During Sensor Failure

If the component broadcasting *Transfer Case Status* detects an input sensor or system failure, operator notification is required. The intent is to avoid unknowingly operating the vehicle when the TCM does not know the status of the transfer case.

Physical implementation of this Communication Failure indication is left to the discretion of the vehicle OEM. Acceptable examples include a lamp or text display with phrasing such as “Vehicle Electrical Fault” or “Vehicle Electronic Fault”. No specific wording is defined, as Allison realizes vehicle OEMs may already have a method to communicate such problems to the operator. Your Allison Customer Integration Engineer must review all implementations.

Check Trans Indicator actuation is not an acceptable means of representing a communication problem. If only the Check Trans Indicator is active, service technicians may assume there is a transmission problem, when in fact it is most likely a vehicle network or wiring issue.

B.4.35.5.2. Bulb Checks

The component that actuates the Communication Failure indication is required to perform a bulb check or functionality check on this indicator at the beginning of each key switch cycle.

Allison recommends the lamp or indicator remain on for 2 seconds during the check. However, there is no specific timing requirement, and a slightly longer or shorter time period may be used.

B.4.35.6. *OTHER REQUIREMENTS / RESTRICTIONS*

B.4.35.6.1. Park Brake

WARNING: If the transfer case is placed in Neutral while the transmission is in Park, the park pawl will be rendered useless, and the vehicle may roll or move unexpectedly.

Transfer cases or gearboxes downstream of the transmission are outside of TCM control and responsibility. However, Allison encourages vehicle manufacturers to alert the operator of this situation and / or implement their transfer case systems in such a manner that this situation cannot occur. If the transfer case is placed in Neutral while the transmission is in Park, the park pawl will be rendered useless, and the vehicle may roll or move unexpectedly.

ETC2 *Transmission Selected Gear* is available from the TCM to assist the transfer case system in determining if a 1000/2000 Series transmission is in Park.

B.4.35.7. *NORMAL OPERATION*

When TCI *Transfer Case Status* indicates either:

— 011b, 2WD low (or Off Highway range)
— 100b, 4WD low (or Off Highway range)

…torque converter lockup is disengaged, and the TCM adjusts to accommodate vehicle performance changes which result from the deeper gear ratio associated with the transfer case “low” position.

NOTE: Regardless of J1939 or GPI CC implementation, all operation is in converter mode when the function is active.

B.4.35.8. *FAILURE MODES AND RESPONSES*

B.4.35.8.1. Component Broadcasting *Transfer Case Status* Detects a Problem

The component broadcasting *Transfer Case Status* is required to diagnose its input sensor or system and indicate 110b (Error) in the event that transfer case status cannot be determined.

B.4.35.8.2. TCM receives invalid Transfer Case Status

When *Transfer Case Status* indicates 110b (Error), or the TCM fails to receive a valid *Transfer Case Status* value, the TCM will assume the transfer case is in high range. Adaptive shift quality will suffer, and converter lockup operation may stall the engine during rapid deceleration.

B.4.35.9. *INSTALLATION CHECKLIST: HIGH N/V*

Allison Customer Integration Engineering will review new J1939-based implementations for the following minimum functionality. While vehicle OEMs may use this list to help evaluate their implementation during development, it is not a substitute for the requirements described previously.

Acceptable implementations will answer "yes" to the following questions:

B.4.35.9.1. Basic Parameter and SAs

- ☐ Is the TCM calibration configured properly?
- ☐ Is the required parameter supported from an acceptable source address?

B.4.35.9.2. Bulb Check / Text Display Check

- ☐ Turn the key switch on. Is a Check Trans Indicator bulb check or text display check performed at power up?

B.4.35.9.3. Basic Operation

- ☐ Manipulate the transfer case controls. Does *Transfer Case Status* correctly reflect all applicable range indications?

B.4.35.9.4. Failure Modes

- ☐ Disconnect or disable the transfer case position input from the component which broadcasts TCI *Transfer Case Status*. Is 110b (Error) indicated?

B.4.36. HILL HOLD INTERFACE

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.36.1. *OVERVIEW*

> **NEW FOR THIS PUBLICATION:**
> Added requirement for compatible engine.

The Hill Hold Interface provides transmission status to Hill Hold controllers so they can determine whether or not to release the vehicle brakes. This interface is only available via J1939 communication.

B.4.36.2. *AVAILABILITY*

The Interface is available in 1000 – 4000 Series applications when used with a compatible **ENGINE MAKE AND MODEL**.

B.4.36.3. *CONFIGURATION (VEPS / ACCT)*

[11020] ENGINE MAKE AND MODEL

Hill Hold Interface requires a compatible electronic engines as validated by the Allison Engine Integration group.

[18000] THROTTLE AND LOAD SOURCE

Set answer to ON-VEHICLE PROTOCOL.

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be provided to the CAN port set to SAE J1939, FULL FUNCTIONALITY.

[30600] HILL HOLD INTERFACE

Answer must be set to ENABLED.

[14000] TORQUE CONVERTER

Answer must not be set to DEFAULT.

B.4.36.4. *J1939 PARAMETER AND SA USE*

B.4.36.4.1. Required Support

The Hill Hold controller is required to receive and utilize ETC7 *Transmission Ready for Brake Release* from SA 03 (Transmission #1).

B.4.36.5. *OTHER REQUIREMENTS / RESTRICTIONS*

B.4.36.5.1. Customer Integration Engineering Review

Allison Customer Integration Engineering review is required before this function may be implemented.

B.4.36.5.2. Compatibility with Neutral at Stop

Hill Hold Interface may only be used with Neutral at Stop implementations that do not activate the Neutral at Stop input to the TCM when the Hill Hold controller activates the vehicle brakes.

B.4.36.6. *NORMAL OPERATION: TCM*

> **WARNING:** The TCM indicates transmission consent with ETC7 *Transmission Ready for Brake Release* when operating conditions appear such that vehicle launch in the operator-selected direction is imminent. Vehicle movement in the opposite direction is minimized, but vehicle based factors (e.g. mass and road grade) may cause rollback. The system integrator (vehicle OEM) is responsible for verifying acceptable vehicle operation and device interaction.

The TCM will set ETC7 *Transmission Ready for Brake Release* = 01b (Transmission Ready for Brake Release) when:

— The transmission has commanded a forward or reverse range, and

— Sufficient torque is available to minimize vehicle movement in the opposite direction

The TCM will set ETC7 *Transmission Ready for Brake Release* = 00b (Transmission Not Ready for Brake Release) when any of the activation criteria are not met.

B.4.36.6.1. Neutral-to-Range Inhibit

After each key cycle, if not on near-level ground, the TCM will activate the Range Inhibit Indicator and inhibit the first Neutral-to-Range shift until it detects that the transmission has sufficient torque capacity, i.e. the transmission is able to transmit torque.

If, within 3 seconds of the operator range request, the TCM determines that transmission torque capacity is sufficient, the shift inhibit automatically clears and the requested range will engage.

If sufficient torque capacity is not achieved within the 3 second grace period (such as due to cold fluid), the shift inhibit remains in effect and the operator is required to re-select range. No indication is provided to the operator once the system has sufficient torque capacity.

B.4.36.7. *NORMAL OPERATION: HILL HOLD CONTROLLER*

The Hill Hold controller may release the brakes when ETC7 *Transmission Ready for Brake Release* = 01b (Transmission Ready for Brake Release).

The Hill Hold controller should not release brakes when ETC7 *Transmission Ready for Brake Release* indicates 00b (Transmission Not Ready for Brake Release). The vehicle may experience a greater amount of rollback on grade if the Hill Hold controller releases during this parameter state.

B.4.36.8. *FAILURE MODES & RESPONSES: TCM*

B.4.36.8.1. Function Input Failures

If the TCM detects Engine Speed or Turbine Speed sensor faults, the TCM will set ETC7 *Transmission Ready for Brake Release* = 10b (Error). No function-specific DTCs are set.

B.4.36.9. *FAILURE MODES & RESPONSES: HILL HOLD CONTROLLER*

B.4.36.9.1. Invalid ETC7 *Transmission Ready for Brake Release* data

If ETC7 *Transmission Ready for Brake Release* indicates 10b (Error), 11b (Not Available) or Hill Hold controller ETC7 reception is lost, the Hill Hold controller shall assume that the transmission is not able to transmit sufficient torque to minimize vehicle movement in the opposite direction.

B.4.36.10. *INSTALLATION CHECKLIST: TCM*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer “yes” to all of the following questions.

B.4.36.10.1. General

☐ Is the TCM calibration configured properly?

☐ Does the Hill Hold controller have defined behavior for all ETC7 *Transmission Ready for Brake Release* signal states?

B.4.36.10.2. Hill Hold controller releases brakes when TCM is ready

1. Clear any Allison DTCs, and begin this sequence in Neutral with the engine idling.

2. Select Drive, and increase throttle until the TCM broadcast of ETC7 *Transmission Ready for Brake Release* transitions from 00b to 01b (Transmission Ready for Break Release).

3. Verify that the Hill Hold controller releases the brakes after the parameter transition.

B.4.36.10.3. Hill Hold controller response to Error state

1. Clear any Allison DTCs, and begin this sequence in Neutral with the engine idling.

2. Select Drive and release the service brake pedal.

3. Verify the TCM broadcasts ETC7 *Transmission Ready for Brake Release* = 00b (Transmission not Ready for Brake Release).

4. Inject an Engine Speed sensor fault. Verify TCM broadcasts ETC7 *Transmission Ready for Brake Release* = 10b (Error).

5. Verify that the Hill Hold controller brake release is restricted (or at a minimum, delayed) due to the ETC7 *Transmission Ready for Brake Release* Error broadcast.

B.4.36.10.4. Hill Hold controller response to Not Available state

1. Using Allison DOC® or Allison engineering tools, disable Hill Hold Interface function.

2. Clear any Allison DTCs, and begin this sequence in Neutral with engine idling.

3. Verify the TCM broadcasts ETC7 *Transmission Ready for Brake Release* = 11b (Not Available).

4. Select Drive an release the service brake pedal.

5. Verify that the Hill Hold controller brake release is restricted (or at a minimum, delayed) due to the ETC7 *Transmission Ready for Brake Release* signal timeout.

B.4.36.10.5. Hill Hold controller response to TCM timeout

1. Clear any Allison DTCs, and begin this sequence in Neutral with engine idling.

2. Select Drive and release the service brake pedal.

3. Verify TCM broadcasts ETC7 *Transmission Ready for Brake Release* = 00b (Transmission not Ready for Brake Release).

4. Unplug TCM or disconnect the J1939 network between the TCM and the Hill Hold Controller.

5. Verify that the Hill Hold controller brake release is restricted (or at a minimum, delayed) due to ETC7 message timeout.

B.4.37. IMPOSTOR DETECTION

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.37.1. *OVERVIEW*

Allison 6th Generation TCM and shift selector are able to detect when other network devices send certain messages from a source address associated with either the TCM or shift selector (SA 03, SA 05, SA 06 SA 16). Allison does not allow other network devices to use source addresses claimed for use by Allison components on the same network. See J1939 Source Address (SA) Misuse.

B.4.37.2. *AVAILABILITY*

Impostor Detection is standard in 1000 – 4000 Series applications.

B.4.37.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameter must be received from the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[18130] DIAGNOSTICS: TCM J1939 TSC1 Impostor Reporting

Set to ENABLED, DTC REPORT ONLY to report detected impostors via DTC only. Set to ENABLED, DTC REPORT AND J1939 IPGA BROADCAST to report detected impostors via DTC and IPGA message broadcast.

B.4.37.4. *J1939 PARAMETER AND SA USE*

B.4.37.4.1. Optional Support

Any device that wants to be informed of detected impostors may monitor IPGA *Impostor PG Event Detection Counter*, IPGA *Impostor PG Source Address*, IPGA *Impostor PG Destination Address*, IPGA *Impostor PGN*, and IPGA *Time Since Last Imposter PG Detected* from SA 03 (Transmission #1), SA 05 (Shift Selector #1), and SA 06 (Shift Selector #2).

B.4.37.5. *NORMAL OPERATION*

B.4.37.5.1. Selector-Side Detection

When an Allison 6th Generation Shift Selector detects suspect TC1 messages on the J1939 network, the selector will start broadcasting IPGA messages with information pertinent to the impostor occurrence. No DTCs are logged.

For *Time Since Last Imposter PG Detected*, the selector only supports the parameter specific indicator values.

B.4.37.5.2. TCM-Side Detection

When an Allison 6th Generation TCM detects suspect TSC1 messages on the J1939 network, depending on the configured VEPS option, the TCM will:

- Set a U1401/U1402/U1403 DTC, and/or
- Start broadcasting IPGA messages with information pertinent to the impostor occurrence. The TCM will send a separate IPGA instance for each affected PGN.

For *Time Since Last Imposter PG Detected*, the TCM only supports the parameter specific indicator values.

B.4.38. KICKDOWN INPUT

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.38.1. *OVERVIEW*

The kickdown input function permits the operator to invoke Performance shift points when operating in an Economy shift schedule. The transition can be controlled by either the accelerator pedal or the MODE button, depending on TCM configuration.

The J1939 implementation described here is intended as a substitute for physical accelerator pedal kickdown switch.

B.4.38.2. *AVAILABILITY*

The J1939-based implementation associated with the accelerator pedal is optional in 1000 – 4000 Series applications.

B.4.38.3. *CONFIGURATION (VEPS / ACCT)*

[18000] THROTTLE AND LOAD SOURCE

Must remain set to default answer PRIMARY ON-VEHICLE PROTOCOL.

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be provided to the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[25010] KICKDOWN INPUT

Set to PRIMARY ON-VEHICLE PROTOCOL to enable TCM parameter reception.

B.4.38.4. *J1939 PARAMETER AND SA USE*

SAs marked (V) may be set to an OEM-specified value via VEPS. See AUTO-DETECTION for SA selection details.

B.4.38.4.1. Required Support

The J1939 network is required to provide EEC2 *Accelerator Pedal Kickdown Switch* from one of the following SAs, in order of TCM preference:

1. SA 17 (Cruise Control) (V)
2. SA 49 (Cab Controller)
3. SA 33 (Body Controller)
4. SA 00 (Engine #1)

B.4.38.5. *OPERATOR INTERFACE*

B.4.38.5.1. Required Support – Physical Detent

An acceptable mechanization is required for the engine controller to determine when to indicate a "kickdown active" state. The throttle pedal must be equipped with a detent indicating when full-throttle is achieved using the Economy shift points. When the operator "steps through" this detent, the function is activated and Performance shift points are achieved.

Many controllers set *Accelerator Pedal Kickdown Switch* based solely on pedal position information from the throttle pedal sensor. For example, an engine might set "Kickdown active" when throttle position is at 95% or higher.

Implementations without a physical detent or "break-over" point in the throttle travel to notify the operator that the throttle pedal is in the active kickdown zone are not acceptable. Without sensory feedback, operators may unknowingly operate a vehicle continuously in kickdown mode, resulting in poor fuel economy.

The figure below illustrates one possible operator feedback implementation in addition to the proper signal to the engine controller. The throttle position sensor may be used instead of the switch, as long as its kickdown point is properly synchronized with the throttle pedal detent or "break-over" point.

B.4.38.6. *NORMAL OPERATION*

When *Accelerator Pedal Kickdown Switch* = 01b (Kickdown Active), performance shift points are used at full throttle.

B.4.38.7. *TCM FAILURE MODES & RESPONSES*

If *Accelerator Pedal Kickdown Switch* reception is lost or indicates 10b (Error) or 11b (Not Available), the transmission defaults back to Economy mode after a timeout period expires.

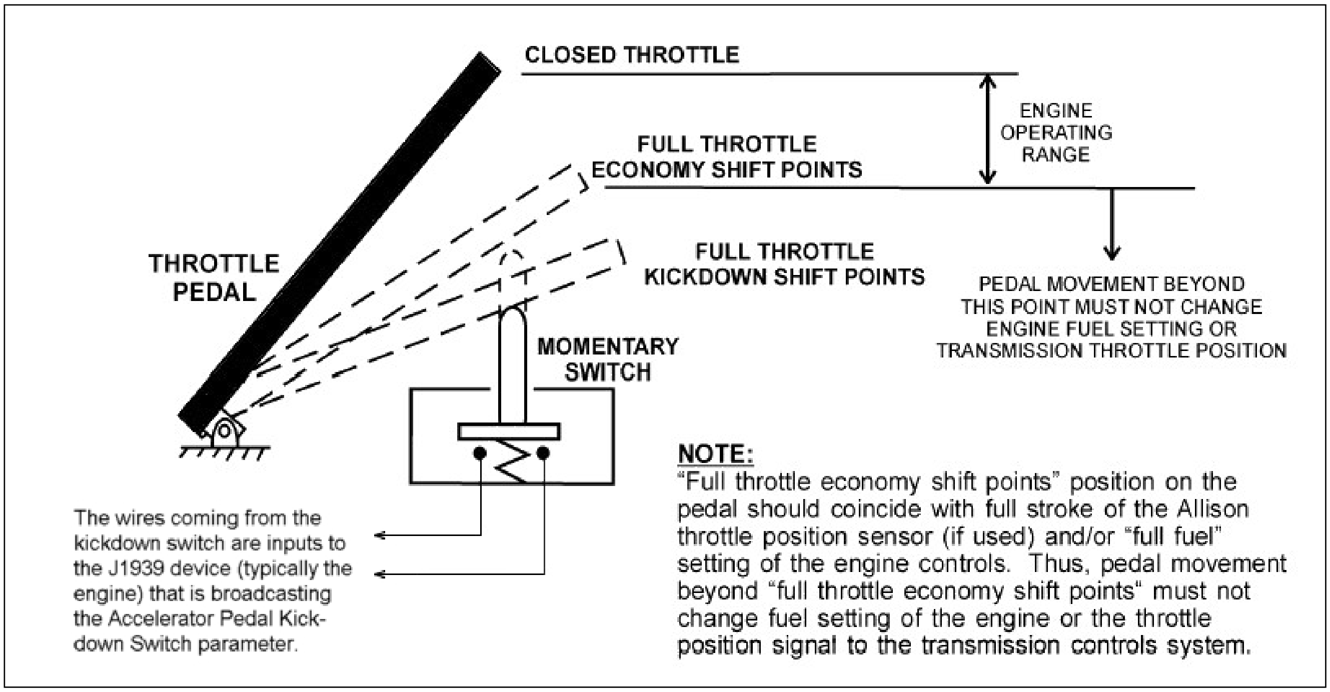
B.4.38.8. *INSTALLATION CHECKLIST: KICKDOWN INPUT*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer "yes" to all of the following questions:

- ☐ Is the TCM calibration configured properly?

- ☐ Is *Accelerator Pedal Kickdown Switch* being broadcast from an acceptable source address?
- ☐ Does the operator's accelerator pedal have a physical detent?
- ☐ Is *Accelerator Pedal Kickdown Switch* inactive with the pedal gently resting against the detent?
- ☐ Is the detent at 95% or greater accelerator pedal position?
- ☐ When the accelerator pedal is pressed through the detent, does *Accelerator Pedal Kickdown Switch* indicate 01b (Kickdown Active)?



MECHANIZATION OF KICKDOWN SWITCH

B.4.39. LOCKUP INDICATOR

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.39.1. *OVERVIEW*

The lockup indicator function gives auxiliary vehicle systems a means to acquire knowledge of torque converter lock-up clutch status. Status can be obtained through GPO K – LOCKUP INDICATOR or a J1939 parameter.

B.4.39.2. *AVAILABILITY*

The J1939-based implementation is standard in all 1000 – 4000 Series applications.

B.4.39.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameter must be received from the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[26030] LOCKUP INDICATOR

Set to BOTH GPO K AND J1939 PARAMETER or ONLY J1939 ETC1 TRANSMISSION TORQUE CONVERTER LOCKUP ENGAGED to enable TCM parameter broadcast.

B.4.39.4. *J1939 PARAMETER AND SA USE*

B.4.39.4.1. Required Reception Support

The component making decisions based on lock-up status is required to receive and utilize ETC1 *Transmission Torque Converter Lockup Engaged* from SA 03 (Transmission #1).

B.4.39.5. *OPERATOR INTERFACE*

There are no specific operator interface requirements for this function.

B.4.39.6. *NORMAL OPERATION*

When ETC1 *Transmission Torque Converter Lockup Engaged* = 01b (Torque converter lockup engaged), the torque converter lock-up clutch is engaged.

B.4.39.7. *FAILURE MODES AND RESPONSES*

If the TCM cannot determine the status of the lock-up clutch, 10b (Error) is broadcast.

B.4.40. NEUTRAL AT STOP INPUT

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.40.1. *OVERVIEW*

NEW FOR B/C/N240 PSC RELEASES:

- Expanded availability of Neutral At Stop Premium to 4000 Series 7-speed models.
- Neutral At Stop interaction with GPI CA Automatic Neutral – Brake-Based (BBAN) has been revised.
- Added VEPS trim 30121.

Neutral At Stop functions include Neutral At Stop Standard and Neutral At Stop Premium. Both functions save fuel by reducing load on the engine when the vehicle is at a full stop.

Neutral At Stop Standard may be activated by one of the following inputs:

— an analog brake pressure switch (via GPI AS)

— J1939 EBC1 *Brake Pedal Position*

— J1939 B2 *Demanded Brake Application Pressure*

— J1939 CCVS1 *Parking Brake Switch*.

Neutral At Stop Premium may be activated by one of the following inputs:

— an analog brake pressure switch (via GPI AS)

— any J1939 Service Brake Status input

— J1939 EBC1 *Brake Pedal Position*

— J1939 B2 *Demanded Brake Application Pressure*

— J1939 CCVS1 *Parking Brake Switch*

Neutral At Stop Premium may also be activated by a combination of the following inputs:

— any J1939 Service Brake Status input

— J1939 CCVS1 *Parking Brake Switch*

NOTE: The vehicle manufacturer is responsible for assuring that all applicable brake requirements are met. Allison Transmission assumes no responsibility for service brakes, park brakes, park brake apply systems, and other related components which are provided and installed by other parties.

This document only discusses the available J1939 inputs. For other input options, refer to GPI AS (NEUTRAL AT STOP INPUTS) documentation.

B.4.40.2. *AVAILABILITY*

Neutral At Stop is optional in 1000 – 4000 Series applications. Availability may depend on the selected FuelSense® package. Neutral At Stop Standard is not available on 2000 Series 9-speed and 4000 Series 7-speed models. 1000/2000 Series transmissions require specific controls hardware to use this function. Allison Customer Integration Engineering Review is required prior to VEPS / ACCT configuration.

B.4.40.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2
Parameters are only exchanged on the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[25267] NEUTRAL AT STOP TYPE
Set answer to STANDARD or PREMIUM, dependent on which variant of this function is desired.

[25261] NEUTRAL AT STOP INPUT
Defaults vary per product family and VMC. Currently the only answers that make use of J1939 inputs are:

— SERVICE BRAKE STATUS INPUT

— J1939 EBC1 BRAKE PEDAL POSITION

— BRAKE APPLICATION PRESSURE – PRIMARY ON-VEHICLE PROTOCOL

— CCVS1 PARKING BRAKE SWITCH

[25264] NEUTRAL AT STOP ALTERNATE INPUT
Set answer to CCVS1 PARKING BRAKE SWITCH and set [25261] NEUTRAL AT STOP INPUT to SERVICE BRAKE STATUS INPUT when a combination of Service Brake Status and Parking Brake inputs is desired.

NOTE: To use EBC1 *Brake Pedal Position* for Neutral At Stop, NEUTRAL AT STOP INPUT must be set to EBC1 BRAKE PEDAL POSITION. Neutral At Stop cannot be set to SERVICE BRAKE STATUS INPUT when SERVICE BRAKE STATUS INPUT is configured to use EBC1 *Brake Pedal Position*.

[25300] SERVICE BRAKE STATUS INPUT

Set answer to J1939 CCVS1 BRAKE SWITCH or J1939 EBC1 EBS BRAKE SWITCH to enable TCM parameter reception.

[25271] NEUTRAL AT STOP: Brake Pedal Position Activation Level
[25272] NEUTRAL AT STOP: Brake Pedal Position Deactivation Level

Answers to these two questions define the brake pedal position percentages at which Neutral At Stop will activate / deactivate for vehicles configured for NEUTRAL AT STOP INPUT = J1939 EBC1 BRAKE PEDAL POSITION.

The activation level value is required to be higher than the deactivation level value. Allison Customer Integration Engineering will assist in determination of the proper values.

[25273] NEUTRAL AT STOP: Brake Application Pressure Activation Level
[25274] NEUTRAL AT STOP: Brake Application Pressure Deactivation Level

Answers to these two questions define the brake application pressure at which Neutral At Stop will activate / deactivate for vehicles configured for NEUTRAL AT STOP INPUT = BRAKE APPLICATION PRESSURE – PRIMARY ON-VEHICLE PROTOCOL.

The activation level value is required to be higher than the deactivation level value. Allison Customer Integration Engineering will assist in determination of the proper values.

[30121] J1939 BROADCAST: ETC1 Transmission Driveline Engaged – Status During NAS

By default, the broadcast value of ETC1 Transmission Driveline Engaged during NAS is dependent on the selected **ENGINE MAKE AND MODEL**. The broadcast value during NAS for most engines is “Driveline engaged”. Set this VEPS parameter to DRIVELINE ENGAGED or DRIVELINE DISENGAGED to force the corresponding broadcast value during NAS.

B.4.40.4. *J1939 PARAMETER AND SA USE*

SAs marked (V) may be set to an OEM-specified value via VEPS. See AUTO-DETECTION for SA selection details.

B.4.40.4.1. Required Support – Neutral At Stop via J1939 EBC1 Brake Pedal Position

The J1939 network is required to provide EBC1 *Brake Pedal Position* from one of the following SAs, in order of TCM preference:

1. SA 45 (Endurance Braking System) (V)
2. SA 11 (Brakes – System Controller)

B.4.40.4.2. Required Support – Neutral At Stop via Service Brake Status Input

All applications require the J1939 network to provide one of the J1939 brake switch parameters defined under SERVICE BRAKE STATUS INPUT.

B.4.40.4.3. Required Support – Neutral At Stop via BRAKE APPLICATION PRESSURE - PRIMARY

B.4.40.4.4. ON-VEHICLE PROTOCOL

The J1939 network is required to provide B2 Demanded *Brake Application Pressure* from one of the following SAs, in order of TCM preference:

1. SA 49 (Cab Controller)
2. SA 33 (Body Controller)
3. SA 11 (Brakes – System Controller)

B.4.40.4.5. Required Support – Neutral At Stop via J1939 CCVS1 Parking Brake Switch

The J1939 network is required to provide CCVS1 *Parking Brake Switch* from one of the following SAs, in order of TCM preference:

1. SA 17 (Cruise Control) (V)
2. SA 49 (Cab Controller)
3. SA 39 (Management Computer #1)
4. SA 23 (Instrument Cluster #1)
5. SA 33 (Body Controller)
6. SA 00 (Engine #1)

B.4.40.4.6. Impact of Neutral At Stop Operation on other TCM Broadcasts

Except as determined by VEPS trim **[30121] J1939 BROADCAST: ETC1 Transmission Driveline Engaged – Status During NAS**, both Neutral At Stop functions are completely transparent are far as TCM broadcast parameters. For example, there are no ETC2 or ETC7 parameter broadcast content changes when a Neutral At Stop function activates or deactivates.

B.4.40.5. *OTHER REQUIREMENTS / RESTRICTIONS*

The Neutral At Stop Inputs are required to meet the timing and performance criteria specified under GPI AS.

B.4.40.6. *NORMAL OPERATION*

B.4.40.6.1. General

Neutral At Stop functions will activate when:

— normal sump operating temperature is achieved,
— the transmission is in 1st range (*),
— the vehicle is at a stop,
— the accelerator pedal is released,
— vehicle grade is not excessive,
— no ABS event is active,
— GPI CA (BBAN) is not active, and
— Neutral At Stop input is active.

Allison shift selectors convey no indication that Neutral At Stop is active, as function operation is intended to be transparent to the vehicle operator.

Neutral At Stop functions will deactivate when:

— the accelerator pedal is applied, or
— an ABS event occurs, or
— GPI CA (BBAN) becomes active, or
— its J1939 inputs go inactive.

(*) 1st or 2nd range for 2000 Series 9-speed models.

B.4.40.6.2. Neutral At Stop via Brake Pedal Position Input

In this configuration, the Neutral At Stop input is active when EBC1 *Brake Pedal Position* is greater than its configured activation value, and inactive when less than its configured deactivation value.

B.4.40.6.3. Neutral At Stop via Service Brake Status Input

In this configuration, the Neutral At Stop input is active when the J1939 brake switch parameter indicates 01b (brake pedal depressed), and inactive when it indicates 00b (brake pedal released).

B.4.40.6.4. Neutral At Stop via J1939 B2 Demanded Brake Application Pressure

In this configuration, the Neutral At Stop input is active when B2 *Demanded Brake Application Pressure* is greater than its configured activation value, and inactive when less than its configured deactivation value.

B.4.40.6.5. Neutral At Stop via Parking Brake Switch

In this configuration, the Neutral At Stop input is active when the J1939 parking brake switch parameter indicates 01b (parking brake set), and inactive when it indicates 00b (parking brake not set).

B.4.40.6.6. Neutral At Stop via Service Brake Status Input or Parking Brake Switch

In this configuration, the Neutral At Stop input is active when the J1939 brake switch parameter indicates 01b (brake pedal depressed), or when the J1939 parking brake switch parameter indicates 01b (parking brake set). It is inactive when the J1939 brake switch parameter indicates 00b (brake pedal released) and the J1939 parking brake switch parameter indicates 00b (parking brake not set).

B.4.40.7. *TCM FAILURE MODES AND RESPONSES*

B.4.40.7.1. Invalid Data or Loss of Communication

If the function is inactive and the TCM receives Error, Not Available or J1939 parameter reception is lost, the respective Neutral At Stop function will not activate. No DTCs are set.

If the function is already active due to a service brake input and the TCM receives Error, Not Available or J1939 parameter reception of the input is lost, the transmission will exit Neutral At Stop. No DTCs are set by the TCM.

B.4.40.7.2. Brake Switch Rationality Check – Neutral At Stop via Service Brake Status

The TCM continually evaluates the J1939 service brake switch parameter. If several vehicle accelerations are detected while 01b (brake pedal depressed) is indicated, DTC P0703 is set and Neutral At Stop will no longer function. The Check Trans Indicator is not activated.

B.4.40.8. *INSTALLATION CHECKLIST: NEUTRAL AT STOP INPUTS*

Allison Customer Integration Engineering will review all new J1939-based implementations. The GPI AS (NEUTRAL AT STOP INPUTS) documentation contains written test plans. Contact your Allison Customer Integration Engineer for assistance.

B.4.41. NEUTRAL INDICATOR

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.41.1. *OVERVIEW*

The neutral indicator function gives vehicle OEMs the means to interface with auxiliary vehicle systems that require neutral indication.

B.4.41.2. *AVAILABILITY*

The J1939-based implementation is standard in all 1000 – 4000 Series applications.

B.4.41.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be received from the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[30180] J1939 BROADCAST: ETC2 Transmission Current Gear
[30220] J1939 BROADCAST: ETC2 Transmission Selected Gear

Both answers must be set to ENABLED.

B.4.41.4. *J1939 PARAMETER AND SA USE*

Parameters marked (V) can be enabled or disabled via VEPS.

B.4.41.4.1. Required Reception Support

The component making decisions based on Neutral Indication is required to receive and utilize the following from SA 03 (Transmission #1):

— ETC2 *Transmission Current Gear* (V), and
— ETC2 *Transmission Selected Gear* (V)

Use of ETC2 *Transmission Current Range* and / or ETC2 *Transmission Requested Range* is not recommended for this function. These parameters were developed and validated for use by vehicle displays. As such, their failure modes were developed for display systems, and may not be acceptable for vehicle control situations.

B.4.41.5. *OPERATOR INTERFACE*

There are no specific operator interface requirements for this function.

B.4.41.6. *OTHER REQUIREMENTS / RESTRICTIONS*

> **WARNING:** The J1939 Neutral Indicator function is not an acceptable means of implementing 'neutral start' functionality. Refer to the NEUTRAL START function.

The J1939-based Neutral Indicator function cannot be substituted for GPO S – Neutral Indicator for PTO (NIPTO). The NIPTO function incorporates timer logic specifically required for PTO integration. There is no J1939 equivalent for NIPTO at this time.

B.4.41.7. *NORMAL OPERATION*

When both ETC2 *Transmission Current Gear* and *Transmission Selected Gear* indicate zero, the transmission is in Neutral. If either parameter does not indicate zero, the transmission is either engaged in a range or attempting to shift into a range.

B.4.41.8. *FAILURE MODES AND RESPONSES*

Fault logging, diagnostics, and troubleshooting related to the loss of any parameter reception are the responsibility of the controller monitoring the parameter(s) and the vehicle OEM.

B.4.41.9. *INSTALLATION CHECKLIST: NEUTRAL INDICATOR*

The vehicle OEM implementing vehicle functions utilizing the Neutral Indicator are responsible for all testing. Vehicle system responses to "Error" indications in any / all of the received parameters should be understood.

B.4.42. NEUTRAL START

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.42.1. *OVERVIEW*

The neutral start function prevents engine cranking while the transmission is in gear, and can be accomplished by either a dedicated TCM wire output or the J1939 datalink. See Allison 6th Generation Controls Installation Manual Section D: "Vehicle Electrical System Interface" for details on the dedicated wire implementation.

B.4.42.2. *AVAILABILITY*

The J1939-based implementation is standard in all 1000 – 4000 Series applications.

B.4.42.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameter must be received from the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[30240] J1939 BROADCAST: ETC7 Transmission Engine Crank Enable

Must be set to ENABLED.

B.4.42.4. *J1939 PARAMETER AND SA USE*

Parameters marked (V) can be enabled or disabled via VEPS.

B.4.42.4.1. Required Reception Support

The component controlling engine cranking, referred to as the starter controller, <u>is required</u> to receive ETC7 *Transmission Engine Crank Enable* (V) as sent from SA 03 (Transmission #1).

> **WARNING:** J1939 Neutral Start implementations that do not utilize ETC7 *Transmission Engine Crank Enable* are not acceptable.

Use of ETC2 *Transmission Selected Gear*, *Transmission Current Gear* and / or *Transmission Requested Range* <u>is not permitted</u> for this function:

- Any multi-parameter implementation relies on the vehicle OEM for proper interpretation, whereas the wire output and dedicated *Transmission Engine Crank Enable* parameter are simple yes-no indications.
- Allison's implementation of ETC2 *Transmission Requested Range* was developed and validated for use only by vehicle displays. As such, failure modes for this parameter were developed for display systems. These failure modes may not be acceptable for vehicle control situations.
- Future changes to the logic behind the three parameters (particularly those originally intended for display) might unintentionally change the neutral start functionality. A dedicated neutral start parameter prevents this, and allows for future changes behind its logic without forcing any change for the vehicle OEMs' software.

ETC7 *Transmission Engine Crank Enable* should not be used for interfacing with auxiliary vehicle systems that require neutral indication. ETC2 *Transmission Selected Gear* and *Transmission Current Gear* are available for fulfilling this need.

B.4.42.5. *OPERATOR INTERFACE*

B.4.42.5.1. Required Support – Communication Failure Indication

If the starter controller detects TCM communication loss, it <u>is required</u> to inform the operator. See STARTER CONTROLLER FAILURE MODES AND RESPONSES. The intent is to avoid situations where the engine fails to crank and the operator has no indication of a vehicle problem.

Actuating the Check Trans Indicator <u>is not</u> an acceptable means to represent a communication problem. If the Check Trans Indicator is active, service technicians may assume there is a transmission problem, when in fact, it is most likely a vehicle network or wiring issue.

B.4.42.6. *NORMAL OPERATION*

B.4.42.6.1. Timing

J1939-based neutral start has an inherent delay between the time when the key switch moves from the "off" to "crank" position and the activation of the TCM neutral start indication. The additional delay is the amount of time for the TCM to begin broadcasting on J1939 once it receives a key switch voltage signal.

The first ETC7 broadcast typically appears within 300 to 400 ms after the TCM receives key switch voltage.

B.4.42.6.2. Voltage & Latching Requirements

While the dedicated wire and J1939-based neutral start implementations provide similar behavior from the driver's perspective, their responses to voltage drop during cranking differ.

Dedicated Wire Implementation

The wire output provides a signal to energize the neutral start relay. Allison is responsible for keeping the wire output "latched" as long as possible during the cranking process, and has special TCM circuitry in place to do so. The wire will not "drop out" unless the TCM input voltage drops below 4.5 volts.

Vehicle OEMs are responsible for ensuring relay voltage doesn't drop out during cranking. If either voltage drops out, the starting circuit will cycle between being enabled and disabled.

J1939 Implementation

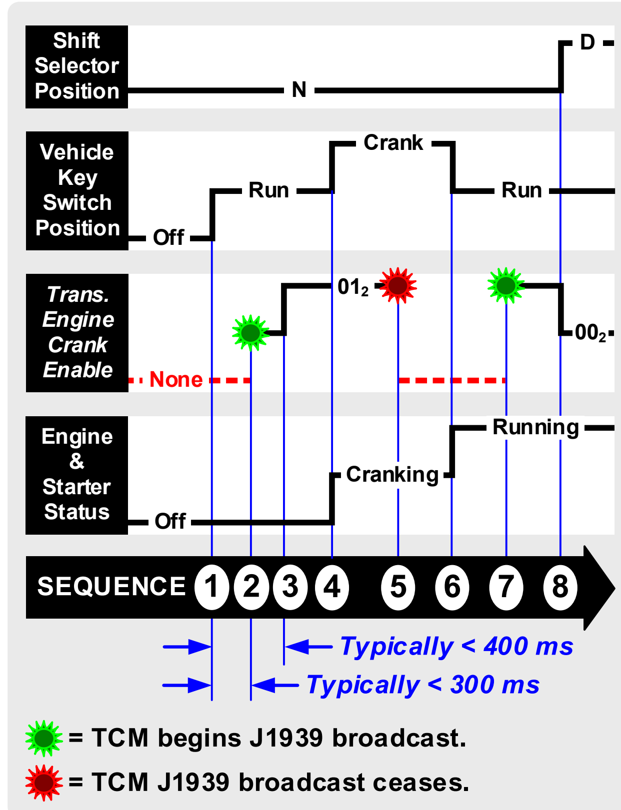
As long as TCM voltage remains above 7.5 volts, *Transmission Engine Crank Enable* directly follows the state of the wire output. When the wire output is energized, *Transmission Engine Crank Enable* will indicate 01b (Cranking Enabled).

When input voltage drops below 7.5 volts, J1939 communication ceases until the TCM receives sufficient voltage and subsequently reinitializes. There is no special circuitry that can keep the J1939 broadcast active during TCM resets.

In J1939 implementations, the starter controller <u>is required</u> to "latch" the state of *Transmission Engine Crank Enable* after cranking has initiated, and retain it as long as the key switch remains in the crank position for the given instance of cranking. The vehicle OEM is responsible for proper operation of the entire cranking circuit.

B.4.42.6.3. Cranking Sequence Example

The following illustrates the relationship between the key switch, TCM, and starter controller:



J1939-BASED NEUTRAL START SEQUENCE EXAMPLE

1. The operator turns the key switch to the "Run" position. The TCM is not yet broadcasting on J1939.

2. Within 300 ms after receiving the key switch signal, the TCM initializes and begins J1939 broadcasts. The first ETC7 *Transmission Engine Crank Enable* may indicate 00b (Cranking Disabled).

3. Within 400 ms after receiving the key switch signal, ETC7 *Transmission Engine Crank Enable* indicates 01b (Cranking Enabled).

4. The operator turns the key switch to the "Crank" position. The starter controller allows the starter to begin cranking the engine. At the onset of cranking, the starter controller latches onto the *Transmission Engine Crank Enable* state, and retains it as long as the key switch remains in the crank position.

5. During cranking, TCM voltage drops below 7.5 volts, and TCM J1939 broadcast ceases. However, the starter controller allows cranking to continue, based on the "latched" *Transmission Engine Crank Enable* value from the beginning of this cranking cycle.

6. The operator releases the key switch back to the "Run" position. Engine cranking ceases; the engine has started. The starter controller "unlatches" and resets the logic that determines if cranking is allowed.

7. TCM input voltage returns, the TCM reinitializes, and resumes J1939 broadcasts.

8. The operator selects Drive, and *Transmission Engine Crank Enable* indicates 00b (Cranking Disabled).

B.4.42.7. *STARTER CONTROLLER FAILURE MODES AND RESPONSES*

Fault logging, diagnostics, and troubleshooting related to the loss of *Transmission Engine Crank Enable* reception are the responsibility of the starter controller monitoring the parameter(s) and the vehicle OEM.

B.4.42.7.1. Starter Controller Doesn't Receive Transmission Engine Crank Enable

When a vehicle Neutral Start system is designed to utilize ETC7 *Transmission Engine Crank Enable*, and the parameter is not being received, the starter controller <u>is required</u> to assume that cranking is not allowed until a valid *Transmission Engine Crank Enable* is received, and <u>is required</u> to indicate a Communication Failure to the operator.

B.4.42.7.2. Starter Controller Loses *Transmission Engine Crank Enable* While Cranking

As discussed under "Normal Operation", this failure most likely occurs due to voltage loss during an engine-cranking event. However, this failure should not prevent engine cranking from continuing:

The starter controller <u>is required</u> to "latch" the state of *Transmission Engine Crank Enable* after cranking has initiated, and retain it as long as the key switch remains in the crank position for the given instance of cranking, or *Transmission Engine Crank Enable* indicates 00b.

B.4.42.7.3. Starter Controller Resets

The starter controller may be powered down intentionally (key switch turned off) or unintentionally (intermittent power source) while *Transmission Engine Crank Enable* reflects either 01b (Cranking Enabled) or 00b (Cranking Disabled).

In either case, it <u>is required</u> that the starter controller assume cranking is disabled / not allowed when it reinitializes. The starter controller should only allow the starter to engage when a positive indication (01b) of *Transmission Engine Crank Enable* is received.

B.4.42.8. *TCM FAILURE MODES AND RESPONSES*

B.4.42.8.1. TCM Broadcasts Error

The TCM does not support *Transmission Engine Crank Enable* state 10b (Error). If the TCM cannot determine the proper broadcast value, it will indicate 00b (Cranking Disabled). This avoids any chance for improper interpretation of Error by the starter controller.

B.4.42.8.2. TCM Broadcasts Not Available

Transmission Engine Crank Enable will only indicate 11b (Not Available) when TCM broadcast is disabled. A starter controller receiving 11b (Not Available) <u>is required</u> to prevent cranking from occurring.

B.4.42.9. *INSTALLATION CHECKLIST: NEUTRAL START*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously. A lever-style shift selector must be used for the following tests.

Acceptable implementations will answer "yes" for the following test sequences.

B.4.42.9.1. Vehicle Preparation and Test Setup

A protocol tool such as Vector CANalyzer is required to test the starter controller's response to "Error" and "Not Available" indications.

Regardless of tool use, testing requires the ability to disconnect or unplug the TCM from the J1939 network. Possible methods include:

— a modified engineering vehicle wiring harness,
— a modified Allison service tool "T-Harness", or
— a switch box between the TCM & vehicle harness.

B.4.42.9.2. General

☐ Is the TCM calibration configured properly?

B.4.42.9.3. Normal Operation

1. Clear any Allison DTCs, and begin this sequence with the key switch off.

2. Quickly turn the key through the "run" position to the "crank" position. Regardless of delay, does the engine eventually begin cranking?

3. Turn the key switch off. On lever selector applications, move the lever to "D"; on pushbutton selectors hold down the "D" button. Turn the key through the "run" position to the "crank" position.

Does the starter controller completely prevent engine cranking?

B.4.42.9.4. Starter Controller Doesn't Receive *Transmission Engine Crank Enable*

1. Clear any Allison DTCs and begin this sequence with the key switch on and the engine not running.

2. Disconnect the TCM from the J1939 network by open circuiting its J1939 connection. Is a Communication Failure indicated due to loss of ETC7 *Transmission Engine Crank Enable*?

3. Is the Communication Failure indicated **ONLY** by method(s) **OTHER** than the Check Trans Indicator?

4. Turn the key switch to the "crank" position. Does the starter controller prevent engine cranking?

5. Reconnect the TCM to the J1939 network. Is the Communication Failure indication turned off when the TCM is reconnected?

B.4.42.9.5. Starter Controller Latches *Transmission Engine Crank Enable* When Cranking Initiated

1. Clear any Allison DTCs, and begin this sequence with the key switch off.

2. Start to crank the engine.

3. As soon as the starter engages, IMMEDIATELY disconnect the TCM from the J1939 network by open circuiting its J1939 connection. Does engine cranking continue when the TCM is disconnected?

   Note: The engine may start; this is okay. If the engine starts, shut it off after the test is done.

B.4.42.9.6. Starter Controller Receives "Error" or "Not Available"

1. Begin this sequence with the key switch off.

2. Disconnect the TCM from the J1939 network by open circuiting its J1939 connection.

3. Turn the key switch on.

4. With a protocol tool such as CANalyzer, broadcast an ETC7 *Transmission Engine Crank Enable* value of 10b from SA 03.

5. Turn the key switch to the "crank" position. Does the starter controller prevent engine cranking?

6. Switch the ETC7 *Transmission Engine Crank Enable* broadcast value to 11b.

7. Turn the key switch to the "crank" position. Does the starter controller prevent engine cranking?

B.4.43. OIL LEVEL DISPLAY

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.43.1. *OVERVIEW*

When 3000/4000 Series transmissions are equipped with an oil level sensor, transmission oil level can be read out on Allison shift selectors with built-in displays. The Oil Level Display function allows vehicle OEMs to convey oil level to the operator through a customer-supplied shift selector or auxiliary display.

This function does not provide an oil level readout for continuous monitoring, but rather the equivalent of an "electronic dipstick".

B.4.43.2. *AVAILABILITY*

The J1939-based implementation is standard in all 3000/4000 Series applications equipped with an oil level sensor.

B.4.43.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be received from the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[15300] OIL LEVEL SENSOR

Answer must be set to AUTODETECTED or YES.

[30490] J1939 BROADCAST: TRF1 Transmission Oil Level 1 High / Low

Answer must be set to ENABLED.

[30510] J1939 BROADCAST: TRF1 Transmission Oil Level 1 Measurement Status

Answer must be set to ENABLED.

[30480] J1939 BROADCAST: TRF1 Transmission Oil Level 1 Countdown Timer

Answer must be set to ENABLED unless the vehicle OEM does not use this parameter.

[30500] J1939 BROADCAST: TRF1 Transmission Oil Level 1 High / Low – Enable Continuous Broadcast

The default answer is CONTINUOUS BROADCAST DISABLED; the shift selector must be in oil level display mode for the oil level broadcast parameters to be updated.

Answer CONTINUOUS BROADCAST ENABLED means oil level parameter data is updated regardless as to whether the shift selector is in oil level display mode. In this case, an operator interface is required to view the oil level data; see OPERATOR INTERFACE.

B.4.43.4. *J1939 PARAMETER AND SA USE*

Parameters marked (V) can be enabled or disabled via VEPS.

Required Support

The Oil Level Display controller is required to receive the following from SA 03 (Transmission #1):

— TRF1 *Transmission Oil Level 1 High / Low* (V)
— TRF1 Trans. Oil Level 1 Measurement Status (V).

If continuous updating of the oil level parameters is necessary, this must be specified via VEPS.

Display of *Transmission Oil Level 1 Measurement Status* is required. This keeps the operator aware of conditions which may prevent an oil level reading, and allows him or her to take corrective action as necessary.

Optional Support

Reception and use of TRF1 *Transmission Oil Level 1 Countdown Timer* (V) is optional.

B.4.43.5. *OPERATOR INTERFACE*

The vehicle must be on level ground for a valid oil level reading to be taken. Since the TCM cannot detect this, the operator interface is required to indicate when this criterion is met.

The oil level display may not be a continuous display; the customer-designed interface must require physical operator input before any oil level data is displayed. In addition, the vehicle OEM display and / or documentation is required to convey the need for parking the vehicle on level ground before attempting an oil level reading.

B.4.43.6. *NORMAL OPERATION*

The TCM continuously evaluates measurement conditions and updates the oil level parameters.

If measurement conditions are unacceptable, *Transmission Oil Level 1 High / Low* indicates 251

(Conditions not valid), and *Transmission Oil Level 1 Measurement Status* conveys the reason:

Transmission Oil Level 1 Measurement Status	**Bit Value**	**Allison Criteria**
Transmission in gear	0010b	<>Neutral
Transmission fluid Temperature too low	0011b	< 40°C
Transmission fluid temperature too high	0100b	> 104°C
Vehicle moving; output shaft speed too high	0101b	> 60 rpm
Engine speed too low	0111b	< 400 rpm
Engine speed too high	1000b	> 1000 rpm

When conditions are acceptable, the TCM initiates a settling timer. *Transmission Oil Level 1 Measurement Status* indicates 0001b (Settling timer still counting down), and *Transmission Oil Level 1 Countdown Timer* reflects the minutes remaining.

When the timer expires, *Transmission Oil Level 1 Measurement Status* indicates 0000b (Conditions valid for transmission oil level measurement), and *Transmission Oil Level 1 High / Low* is populated with oil level data.

B.4.43.7. *TCM FAILURE MODES & RESPONSES*

B.4.43.7.1. Oil Level Sensor Failure

If the oil lever sensor fails, a DTC is set and TRF1 *Transmission Oil Level 1 High / Low* indicates 254 (Error).

B.4.43.8. *INSTALLATION CHECKLIST: OIL LEVEL DISPLAY*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer “yes” to all of the following questions:

- ☐ Is the TCM calibration configured properly?
- ☐ Does the display interface require operator input before any oil level information is shown?
- ☐ Does the display stop displaying oil level data when Oil Level Display mode is exited?
- ☐ For each *Transmission Oil Level 1 Measurement Status* criteria listed, does the display correctly indicate that a reading cannot be taken when the Oil Level Display mode is entered?
- ☐ When all criteria are met, does the Oil Level Display indicate that the settling timer is counting down? (Display of the minutes remaining is optional.)

B.4.44. OVERDRIVE DISABLE

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.44.1. *OVERVIEW*

The Overdrive Disable Input is used to prevent the transmission from upshifting into overdrive.

B.4.44.2. *AVAILABILITY*

The J1939-based implementation is optional in certain 1000/2000 Series applications.

B.4.44.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be received from the CAN port set to SAE J1939 FULL FUNCTIONALITY

[25150] OVERDRIVE DISABLE INPUT

Set answer to J1939 TC2 TRANSMISSION PRE-DEFINED MAXIMUM GEAR ACTIVATION to enable TCM parameter reception and broadcast.

[17000] PRIMARY MODE: Gears

When used with a six-speed transmission and the shift control is programmed with:

- 6-4-2-1 shift mask, the enabled function creates the provision to hold the transmission in 5th range.
- 6-4-3-1 shift mask, the enabled function creates the provision to hold the transmission in 5th range.
- 6-4-3-2 shift mask, the enabled function creates the provision to hold the transmission in 5th range.
- 6-3-2-1 shift mask, the enabled function creates the provision to hold the transmission in 4th range.
- When used with a five-speed transmission and the shift control is programmed with:

  5-3-2-1 shift mask, the enabled function creates the provision to hold the transmission in 4th range – thus providing, for this combination, the capability to hold all forward ranges.

The function has no effect when used with 4-speed transmission configurations.

When used with a 2000 Series 9-speed transmission model, the enabled function creates the provision to hold the transmission in the 6th range.

B.4.44.4. *J1939 PARAMETER AND SA USE*

Items marked (V) can be modified via VEPS. Parameters may be enabled or disabled and SAs may be set to an OEM-specified value. See AUTO-DETECTION for SA selection details.

B.4.44.4.1. Required Support

The J1939 network is required to provide TC2 *Transmission Pre-Defined Maximum Gear Activation* from SA 33 (Body Controller) (V) to DA 03 (Transmission #1).

B.4.44.5. *OPERATOR INTERFACE REQUIREMENTS*

The vehicle OEM is required to provide the Overdrive Disable Input switch within easy access of the operator.

B.4.44.6. *NORMAL OPERATION*

The TCM prevents operation in the overdrive range when TC2 *Transmission Pre-Defined Maximum Gear Activation* is received with a value of 01b (Pre-defined range limit is in effect). The TCM reverts to normal operation when it receives a value of 00b (Pre-defined range limit is not in effect).

The TCM indicates Overdrive Disable status in ETC7 *Transmission Pre-Defined Range Limit Indicator* from SA 03 (Transmission #1). This indication is only available with the J1939-based implementation.

B.4.44.7. *TCM FAILURE MODES & RESPONSES*

B.4.44.7.1. Loss of Communication

Prior to Overdrive Disable being active

If TC2 *Transmission Pre-Defined Maximum Gear Activation* reception is lost or indicates 10b (Error) or 11b (Not Available) prior to function activation, the function will not activate. No DTCs are set.

While Overdrive Disable is active

If TC2 *Transmission Pre-Defined Maximum Gear Activation* reception is lost or indicates 10b (Error) or 11b (Not Available) while the function is active, the TCM may allow shifts into overdrive. The TCM may re-activate the function once the input is restored and indicates 01b (Pre-defined range limit is in effect). No DTCs are set.

B.4.45. POWER DIVIDER INPUT

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.45.1. *OVERVIEW*

A power divider is a gearbox located between the engine and transmission torque converter that splits engine power off to a pump or other driven device. The TCM must be aware of power divider operation to properly adjust for this type of operation.

B.4.45.2. *AVAILABILITY*

This function is optional in 3000/4000 Series non-OFS applications. Allison Customer Integration Engineering review is required.

B.4.45.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameter must be provided to the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[25360] POWER DIVIDER INPUT

Set answer to ENABLED for TCM TC1 *Transmission Mode 3* reception.

B.4.45.4. *J1939 PARAMETER AND SA USE*

B.4.45.4.1. Required Support

The J1939 network is required to provide TC1 *Transmission Mode 3* every 50 ms to DA 03 (Transmission #1) from one of the following SAs, in order of TCM preference:

1. SA 00 (Engine #1) (V)
2. SA 33 (Body Controller)

B.4.45.5. *OPERATOR INTERFACE*

There are no specific operator interface requirements for this function.

B.4.45.6. *OTHER REQUIREMENTS / RESTRICTIONS*

Allison Customer Integration Engineering review is required before this function may be implemented.

NOTE: SAE J1939 datalink etiquette dictates (and Allison requires) that unsupported broadcast parameters be set to their "Not Available" values. Failure to do so may result in unintended activation of other TC1-based Allison functions.

B.4.45.7. *NORMAL OPERATION*

When TC1 *Transmission Mode 3* is 01b, the TCM adapts operation for conditions where the torque converter is no longer driven directly by the engine.

B.4.45.8. *INSTALLATION CHECKLIST: POWER DIVIDER INPUT*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer "yes" to all of the following questions:

- ☐ Is the TCM calibration configured properly?
- ☐ Is TC1 sent every 50 ms to the proper DA, from one or more acceptable SAs?
- ☐ When the power divider is operating such that torque converter input speed does not equal engine speed, is TC1 *Transmission Mode 3* set to 01b?
- ☐ When the power divider is operating such that torque converter input speed equals engine speed, is TC1 *Transmission Mode 3* set to 00b?

B.4.46. PRESELECT REQUEST INPUT

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.46.1. *OVERVIEW*

Preselecting involves selecting any forward gear lower than "D" on the shift selector. When a range has been "preselected" in this manner, shift points to and from gear ranges above the preselected range are higher than the normal shift points. Shifts below the preselected range are not affected.

For a 1000/2000 Series transmission, this function also provides the capability to limit the transmission to forward ranges that may not have physical positions on the shift selector. For example, when used in conjunction with a shift selector with positions 5-3-2-1, this function creates the provision to limit the transmission to 4th range. The TCM initiates the preselect electronically, eliminating any required movement of the shift cable.

In 3000/4000 Series applications, this function is intended for requesting preselect ranges to improve engine brake operation.

In addition to the J1939 interface described here, preselect requests can be accomplished by the following GPI functions:

— AR (1000/2000 Series only)
— CB1 (1000 – 4000 Series)
— CB2 (3000 – 4000 Series)

GPI implementations are discussed in Allison 6th Generation Controls Installation Manual Section D: "Vehicle Electrical System Interface".

B.4.46.2. *AVAILABILITY*

The J1939-based implementation is standard in all 1000 – 4000 Series applications.

B.4.46.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be provided to the CAN port set to SAE J1939 FULL FUNCTIONALITY. There are no VEPS requirements beyond this; J1939-based Preselect Request logic and related J1939 parameter reception are enabled by default.

B.4.46.3.1. VEPS / ACCT Trims

[17130] PRESELECT STRATEGY

Determines when preselects will occur relative to engine speed. When set to STANDARD, downshifts will occur 300 rpm above engine governed speed. When set to LOW, downshifts will occur 150 rpm above engine governed speed.

OTHERS

The following trims impact function operation; see the NORMAL OPERATION section:

— **[17000] PRIMARY MODE: Gears**
— [17030] SECONDARY MODE: Gears

B.4.46.3.2. Relation to GPI-based Preselect Request Functions

J1939-based Preselect Requests may be used alone or in conjunction with GPI AR (OVERDRIVE DISABLE, 1000/2000 Series only), and / or GPIs CB1 and CB2 (PRESELECT REQUEST 1 and 2).

B.4.46.4. *J1939 PARAMETER AND SA USE*

B.4.46.4.1. Required Support

The J1939 network is required to provide TC1 *Transmission Requested Gear* every 50 ms to DA 03 (Transmission #1), from one or more of the following SAs:

1000/2000 Series 6-speed Models

1. SA 42 (Headway Controller)
2. SA 33 (Body Controller)
3. SA 05 (Shift Console, Primary) (1)
4. SA 23 (Instrument Cluster #1)

(1) SA may only be used if the application does not employ an Allison J1939-based selector.

1000/2000 Series 9-speed Models and 3000/4000 Series

1. SA 42 (Headway Controller)
2. SA 33 (Body Controller)
3. SA 23 (Instrument Cluster #1)

See NORMAL OPERATION for parameter values.

B.4.46.5. *OTHER REQUIREMENTS / RESTRICTIONS*

NOTE: SAE J1939 datalink etiquette dictates that any unsupported parameters broadcast in messages specifically be set to their "Not Available" values.

Unused TC1 parameters are required to be set to their appropriate "Not Available" values. Failure to do so may result in unintended activation of other TC1-based Allison functions.

J1939-based Preselect Requests **may not** be used in conjunction with the 1000/2000 Series J1939-based RANGE SELECTION MODE function.

B.4.46.6. *NORMAL OPERATION*

If activated while in a forward drive range that is higher than the desired preselect range, the TCM will invoke preselect downshifts until the specified gear range is attained. Function response is limited by various boundaries as discussed below.

J1939-based Preselect Request values are reflected in the requested range digit of 3000/4000 Series J1939-based Allison shift selectors and ETC2 *Transmission Requested Range*.

B.4.46.6.1. Accelerator Pedal Position

J1939-based preselect requests are honored regardless of accelerator pedal position. This is different than GPI-based preselects, where VEPS / ACCT options define the accelerator pedal positions where preselects are honored.

B.4.46.6.2. Preselect Shift Schedule

When a preselect request is active, the TCM commands downshifts at higher-than-normal engine speeds per **[17130] PRESELECT STRATEGY**.

The calibrated preselect shift schedule is invoked when the J1939-based Preselect Request function is active, regardless of other coinciding operations, e.g. active engine braking, the Reverse Inhibit with Preselect Request function, etcetera.

B.4.46.6.3. Preselect Request Values

Requests can only be made through "absolute" TC1 *Transmission Requested Gear* range values as shown below, i.e. ranges 1 through 9:

PSR Range	Unscaled Byte Value (Dec)	Unscaled Byte Value (Hex)
8	133	0x85
7	132	0x84
6	131	0x83
5	130	0x82
4	129	0x81
3	128	0x80
2	127	0x7F
1	126	0x7E

When a preselect is not desired, *Transmission Requested Gear* is required to indicate 0xE0 (Position unknown and / or no buttons pressed).

B.4.46.6.4. Shift Mask Boundaries

During operation, preselect range availability is dependent upon the active shift mask. Shift masks determine the forward ranges associated with the physical positions of the shift selector lever, or the bounds placed on the ranges when a pushbutton unit is in use.

[17000] PRIMARY MODE: Gears defines the primary mode shift mask, and is applicable to all transmissions. **[17030] SECONDARY MODE: Gears** defines the secondary mode shift mask, and is only applicable to 3000/4000 Series transmissions.

The maximum attainable preselect range is bounded by the top range of the active (primary / secondary) shift mask. In addition, 3000/4000 Series preselect requests are bounded by the bottom range of the active shift mask; there is no lower limit on 1000/2000 Series transmissions. Preselects requested beyond these boundaries are honored, but capped to the applicable shift mask boundary.

3000/4000 Series applications may be calibrated to have different shift masks in primary and secondary mode operation.

B.4.46.6.5. Allison Function Interactions

If other internal TCM logic or Allison functions are generating active preselect requests while a J1939-based preselect request is active, the TCM will invoke the lowest preselect range requested.

B.4.46.7. *TCM FAILURE MODES & RESPONSES*

During an active preselect, loss of *Transmission Requested Gear* reception or reception of a state outside those listed as acceptable will result in the transmission reverting to normal operation (no preselect) after a timeout period expires. No DTCs are logged.

B.4.46.8. *INSTALLATION CHECKLIST: PRESELECT REQUEST*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer "yes" to all of the following questions:

- ☐ Is the TCM calibration configured properly?
- ☐ Is TC1 sent every 50 ms to the proper DA, from one or more acceptable SAs?
- ☐ When a J1939-based preselect is desired, is TC1 *Transmission Requested Gear* set to one of the acceptable values?
- ☐ When a J1939-based preselect is not desired, is TC1 *Transmission Requested Gear* set to 0xE0?

B.4.47. PROGRESSIVE SHIFTING

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.47.1. *OVERVIEW*

Progressive shifting is an engine feature that limits engine speed versus transmission range. Such features are normally incompatible with automatic transmissions as they can prevent shift points from being achieved. However, the TCM may allow Progressive Shift activation under certain conditions.

B.4.47.2. *AVAILABILITY*

Progressive Shifting is only available for 3000/4000 Series transmissions. Customer Integration Engineering review is required.

B.4.47.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameter must be received from the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[30100] J1939 BROADCAST: ETC1 Progressive Shift Disable

Answer must be set to PARAMETER BROADCAST ENABLED - PROGRESSIVE SHIFTING CONDITIONALLY ALLOWED in order to use the progressive shifting function of the engine.

B.4.47.4. *J1939 PARAMETER AND SA USE*

B.4.47.4.1. Required Support

The engine is required to receive and honor ETC1 *Progressive Shift Disable* from the transmission if progressive shifting is enabled in the engine.

B.4.47.5. *NORMAL OPERATION*

Progressive Shifting is only allowed when the transmission has attained a manually-preselected forward range that is lower than the maximum forward range of the active shift mask, and no shift is in process. Under these conditions, ETC1 *Progressive Shift Disable* will indicate 00b (Progressive shift is not disabled). Otherwise, it will indicate 01b (Progressive shift is disabled).

B.4.47.5.1. Allison Function Interactions

Depending on the configured shift schedule and the engine's progressive shifting configuration, scenarios may be possible where transmission output shaft speed cannot reach the required threshold for applying the torque converter lockup clutch. It is the responsibility of the system integrator to ensure that lockup operation is not impacted by this function.

B.4.47.6. *TCM FAILURE MODES & RESPONSES*

In situations where the TCM is unable to determine that all required conditions for allowing progressive shifting are met, ETC1 *Progressive Shift Disable* will indicate 01b (Progressive shift is disabled).

B.4.47.7. *INSTALLATION CHECKLIST: PROGRESSIVE SHIFTING*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer "yes" to all of the following questions:

- ☐ Is the TCM calibration configured properly?
- ☐ Does the engine honor ETC1 *Progressive Shift Disable*?
- ☐ Is torque converter lockup engagement and operation possible while progressive shifting is active?
- ☐ Is vehicle performance acceptable while progressive shifting is active?

B.4.48. PTO DRIVE INTERFACE 1 & 2

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.48.1. *OVERVIEW*

PTO Drive Interface functions 1 & 2 allow vehicle OEMs to integrate transmission operation with up to two PTO drives. Either interface instance can be implemented via GPIO wires or J1939 parameters. Regardless of implementation, each instance has a unique set of programmable trims, allowing operation and protection to be optimized separately for each PTO drive.

To accomplish either instance via GPIO wires, refer to Allison 6th Generation Controls Installation Manual Section D: "Vehicle Electrical System Interface". The traditional GPIO-based functions have been renamed to reflect the availability of two instances: GPIs C1 / C2 (PTO Request 1 / 2) and GPOs G1 / G2 (PTO Enable 1 / 2).

B.4.48.2. *AVAILABILITY*

J1939-based PTO Drive Interface 1 & 2 implementations are optional in 1000 – 4000 Series applications.

Applications that utilize a transmission driven PTO are required to inform the TCM of PTO operation via one of the PTO DRIVE INTERFACE options.

B.4.48.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters are only exchanged on the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[27030] PTO DRIVE INTERFACE 1

The corresponding J1939 parameter pair is enabled for use when this option is set to J1939 PTODE INTERFACE – Transmission Input Shaft PTO #1.

[27090] PTO DRIVE INTERFACE 2

The corresponding J1939 parameter pair is enabled for use when this option is set to J1939 PTODE INTERFACE – Transmission Input Shaft PTO #2 or

J1939 PTODE INTERFACE – Transmission Output Shaft PTO.

B.4.48.3.1. VEPS / ACCT Trims

The following trims impact function operation:

- **[27040] PTO DRIVE INTERFACE 1: Maximum Engine Speed for Engagement**
- **[27050] PTO DRIVE INTERFACE 1: Maximum Engine Speed for Operation**
- **[27060] PTO DRIVE INTERFACE 1: Maximum Output Speed for Engagement**
- **[27070] PTO DRIVE INTERFACE 1: Maximum Output Speed for Operation**
- **[27080] PTO DRIVE INTERFACE 1: Lockup Engagement Speed (1K2K Series only)**
- **[27100] PTO DRIVE INTERFACE 2: Maximum Engine Speed for Engagement**
- **[27110] PTO DRIVE INTERFACE 2: Maximum Engine Speed for Operation**
- **[27120] PTO DRIVE INTERFACE 2: Maximum Output Speed for Engagement**
- **[27130] PTO DRIVE INTERFACE 2: Maximum Output Speed for Operation**
- **[27140] PTO DRIVE INTERFACE 2: Lockup Engagement Speed (1K2K Series only)**

B.4.48.4. *J1939 PARAMETER AND SA USE*

SAs marked (V) may be set to an OEM-specified value via VEPS. See AUTO-DETECTION for SA selection details.

B.4.48.4.1. Required Support

J1939 PTO Drive Engagement (PTODE) parameter pairs are location-specific. For troubleshooting ease, OEMs are required to use the correct set of PTODE parameters for a given PTO drive location.

The J1939 network is required to support the PTO Drive Engagement parameter pair(s) enabled for use in the VEPS options:

Broadcast PTODE *Enable Switch – Transmission Input Shaft PTO 1* and receive PTODE *Engagement Consent – Transmission Input Shaft PTO 1*.

AND / OR

Broadcast PTODE *Enable Switch – Transmission Input Shaft PTO 2* and receive PTODE *Engagement Consent – Transmission Input Shaft PTO 2*.

AND / OR

Broadcast PTODE *Enable Switch – Transmission Output Shaft PTO* and receive PTODE *Engagement Consent – Transmission Output Shaft PTO*.

Enable Switch parameters are required to be provided from one of the following SAs, in order of TCM preference:

1. SA 49 (Cab Controller) (V)
2. SA 23 (Instrument Cluster #1)
3. SA 33 (Body Controller)

All Consent parameters are broadcast from SA 03 (Transmission #1).

B.4.48.5. *OPERATOR INTERFACE*

A Communication Failure indication is optional; see FAILURE MODES AND RESPONSES – PTO CONTROLLER.

B.4.48.6. *OTHER REQUIREMENTS / RESTRICTIONS*

WARNING: If the PTO drives high inertia equipment (e.g. alternator, blower, chain-driven mechanical devices), then 'Maximum Engine Speed for PTO Engagement' should be set as close as possible to engine idle speed. PTO engagement at high speed may cause damage to the PTO system, whether at initial engagement or automatic re-engagement after an overspeed disengagement.

B.4.48.7. *NORMAL OPERATION: TCM*

B.4.48.7.1. Invoking Consent

When the Enable Switch parameter associated with any instance indicates 01b (enable switch on – PTO operation desired), the TCM ceases to modulate main pressure to provide maximum clutch apply pressures during the pending PTO operation.

For each instance where PTO operation is desired, the TCM evaluates operating conditions against the programmed limits for that instance:

- Throttle position must be low
- Engine speed must be acceptable
- Transmission output shaft speed must be acceptable.

Consent for an instance is given when its associated Engagement Consent parameter is set to 01b (consent given).

B.4.48.7.2. Revoking Consent

The TCM revokes consent for an instance by setting the associated Engagement Consent parameter to 00b (consent not given) when any programmed limits for that instance are exceeded, or its Enable Switch parameter indicates 00b (enable switch off – PTO operation not desired). Modulated main operation resumes when consent is revoked for both instances.

B.4.48.8. *NORMAL OPERATION: PTO CONTROLLER*

"PTO controller" refers to the device that is communicating with the TCM via J1939, and whose outputs control physical engagement of the drive(s).

For each PTO drive instance, the PTO controller <u>is required</u> to monitor the corresponding PTODE *Engagement Consent* parameter from the TCM, and only engage the drive when the parameter value is 01b (Consent given – PTO drive may be engaged).

If the *Engagement Consent* parameter from the TCM indicates 00b (Consent not given – PTO drive should not be engaged), the PTO controller <u>is required</u> to prevent PTO drive engagement, or if that PTO drive is already engaged, disengage the drive as soon as possible.

B.4.48.9. *FAILURE MODES & RESPONSES: TCM*

B.4.48.9.1. TCM does not receive *Enable Switch* parameter

If the TCM does not receive an *Enable Switch* parameter, or receives a value of 10b (Error) or 11b (Not Available), consent will be revoked. When reception of a valid value resumes, the appropriate consent parameter(s) will be reset based on the *Enable Switch* parameter value and current operating conditions. No DTCs are set.

B.4.48.9.2. TCM power interrupted

If TCM power is interrupted, J1939 broadcasts will stop, and the device controlling the PTO drive engagement should respond as discussed below.

When power is restored to the TCM, the appropriate *Engagement Consent* parameter(s) will be reset based on enable switch parameter state(s) and current operating conditions. No DTCs are set.

B.4.48.10. *FAILURE MODES & RESPONSES: PTO CONTROLLER*

B.4.48.10.1. PTO engaged without consent or not disengaged when consent revoked

WARNING: Engaging a PTO drive or continuing drive engagement when consent is removed may result in damage to the transmission and / or the PTO drive mechanism.

B.4.48.10.2. PTO controller does not receive *Engagement Consent* parameter

If the PTO controller fails to receive the applicable *Engagement Consent* parameter from the TCM, the device <u>is required</u> to disengage that PTO drive as soon as possible.

In addition, vehicle OEMs may choose at their discretion to inform the operator of communication loss between the TCM and the PTO controller. Methods of informing the operator are left to the vehicle OEM. However, actuating the Check Trans Indicator <u>is not</u> an acceptable means to represent a communication problem. If only the Check Trans Indicator is active, service technicians may assume there is a transmission problem, when in fact it is most likely a vehicle network or wiring issue.

B.4.48.11. *INSTALLATION CHECKLIST: PTO DRIVE INTERFACE*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer "yes" to all of the following questions.

B.4.48.11.1. General

☐ Is the TCM calibration configured properly?

☐ Are the *Enable Switch* parameter(s) sent every 100 ms from an acceptable SA?

B.4.48.11.2. Vehicle Preparation and Test Setup

Some testing below requires the ability to disconnect or unplug the TCM from the J1939 network. Possible methods include:

— a modified engineering vehicle wiring harness,
— a modified Allison service tool "T-Harness", or
— a switch box between the TCM & vehicle harness.

B.4.48.11.3. PTO Controller Disengages PTO Drive when TCM Consent Revoked

1. Clear any Allison DTCs, and begin this sequence with the key switch off.
2. Manipulate the vehicle inputs such that the PTO controller broadcasts an *Enable Switch* request (01b) to engage the PTO drive.
3. While TCM *Engagement Consent* is being given (01b) increase throttle to the point where the TCM revokes consent (00b).
4. Does the PTO controller disengage the PTO drive when the TCM revokes consent (00b)?

B.4.48.11.4. PTO Controller Disengages PTO Drive when TCM Consent Parameter Reception is Lost

1. Clear any Allison DTCs, and begin this sequence with the key switch off.
2. Manipulate the vehicle inputs such that the PTO controller broadcasts an *Enable Switch* request (01b) to engage the PTO drive.
3. While TCM *Engagement Consent* is being given (01b) and the PTO drive is engaged, disconnect the TCM from the J1939 network.
4. Does the PTO controller disengage the PTO drive when it loses reception of the *Engagement Consent* parameter from the TCM?

B.4.49. PUMP MODE / FIRE TRUCK PUMP MODE

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.49.1. *OVERVIEW*

> **WARNING:** This function may contain one or more potential single point faults that may lead to undesirable function behavior. The vehicle integrator is responsible for understanding the impact of these faults in their application.

Pump Mode facilitates operation of transmission output shaft driven pumps, fans, or other auxiliary equipment through a split-shaft PTO. During Pump Mode, the transmission operates in a direct drive range with the lockup clutch applied. Fire Truck Pump Mode is a variant of Pump Mode intended for use in emergency vehicles. Regular Pump Mode is not suitable for use in fire trucks or other emergency vehicles. Configuration and vehicle integration are similar for either function. Pump Mode and Fire Truck Pump Mode are also available via GPI AJ and GPI J (see the Allison 6th Generation Controls Installation Manual).

B.4.49.2. *AVAILABILITY*

Pump Mode and Fire Truck Pump Mode are only available for 3000/4000 Series transmissions in certain vocational models.

B.4.49.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameter must be received from the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[25240] PUMP MODE INPUT

To enable Pump Mode set to:

— PUMP MODE (4TH LOCKUP) with J1939 PTODE INTERFACE Transmission Output Shaft PTO
— PUMP MODE (4TH LOCKUP) with J1939 CCVS1 Parking Brake Switch & J1939 PTODE INTERFACE Transmission Output Shaft PTO

To enable Fire Truck Pump Mode set to:

- FIRE TRUCK PUMP MODE with J1939 PTODE INTERFACE Transmission Output Shaft PTO
- FIRE TRUCK PUMP MODE with J1939 CCVS1 Parking Brake Switch & J1939 PTODE INTERFACE Transmission Output Shaft PTO.

B.4.49.4. *J1939 PARAMETER AND SA USE*

B.4.49.4.1. Required Broadcast Support

The J1939 network is required to provide PTODE *Enable Switch – Transmission Output Shaft PTO* from one of the following SAs, in order of TCM preference:

1. SA 49 (Cab Controller) (V)
2. SA 23 (Instrument Cluster #1)
3. SA 33 (Body Controller)

AND

PTODE *Engagement Status – Transmission Output Shaft PTO* from one of the following SAs, in order of TCM preference:

1. SA 49 (Cab Controller) (V)
2. SA 23 (Instrument Cluster #1)
3. SA 33 (Body Controller)

B.4.49.4.2. Optional Broadcast Support

If PUMP MODE INPUT is set to an option that includes J1939 CCVS1 *Parking Brake Switch*, the J1939 network is required to provide CCVS1 *Parking Brake Switch* from one of the following SAs, in order of TCM preference:

1. SA 17 (Cruise Control) (V)
2. SA 49 (Cab Controller)
3. SA 39 (Management Computer #1)
4. SA 23 (Instrument Cluster #1)
5. SA 33 (Body Controller)
6. SA 00 (Engine #1)

B.4.49.4.3. Required Reception Support

The vehicle system is required to receive PTODE *Operation Consent – Transmission Output Shaft PTO* from SA 03 (Transmission #1).

B.4.49.5. *OTHER REQUIREMENTS / RESTRICTIONS*

B.4.49.5.1. General Requirements

The datalink implementation of Pump Mode and Fire Truck Pump Mode mimics the behavior of the corresponding GPI function. Detailed function descriptions and general requirements are available in Allison 6th Generation Controls Tech Data for GPI Function AJ and GPI Function J.

PTODE *Enable Switch – Transmission Output Shaft PTO* takes the place of the Pump Mode Request wire.

PTODE *Engagement Status – Transmission Output Shaft PTO* takes the place of the Pump Enable wire.

Depending on the PUMP MODE INPUT configuration choice, parking brake state is required to be incorporated either as part of the PTODE *Enable Switch – Transmission Output Shaft PTO* signal, or separately via CCVS1 *Parking Brake Switch*.

PTODE *Operation Consent – Transmission Output Shaft PTO* takes the place of the Range Indicator wire and indicates when Pump Mode / Fire Truck Pump Mode is requested and the TCM is actively commanding the direct drive range.

Refer to Allison 6th Generation Controls Tech Data for GPI Function AJ and GPI Function J for details on required indictor lamps. Indicators lamps may be implemented as dedicated lamps or as part of a datalink-connected display.

B.4.49.6. *NORMAL OPERATION*

The transmission enters Pump Mode / Fire Truck Pump Mode operation when the vehicle is stopped with the transmission in Neutral, the required inputs are activated, and subsequently Drive is selected on the shift selector. The transmission exits Pump Mode / Fire Truck Pump Mode when any of the required inputs are deactivated and Neutral is selected on the shift selector.

B.4.49.7. *TCM FAILURE MODES & RESPONSES*

If power to the TCM is interrupted while the transmission is operating in Pump Mode / Fire Truck Pump Mode and in the specified pump mode range, the TCM will restore transmission operation to the pump mode range with the lockup clutch exhausted when power is restored. This will occur if the signals for PTODE *Enable Switch – Transmission Output Shaft PTO*, PTODE *Engagement Status – Transmission Output Shaft PTO*, and/or CCVS1 *Parking Brake Switch* are still received when power is restored to the TCM.

If PTODE *Enable Switch – Transmission Output Shaft PTO* reception is lost or indicates 10b (Error) or 11b (Not available), the transmission will treat it the same as receiving this signal as 00b (Enable switch off – PTO operation not desired).

If PTODE *Engagement Status – Transmission Output Shaft PTO* reception is lost or indicates 10b (Error) or 11b (Not available), the transmission will treat it the same as receiving this signal as 00b (Drive not engaged).

If CCVS1 *Parking Brake Switch* reception is lost or indicates 10b (Error) or 11b (Not available), the transmission will treat it the same as receiving this signal as 00b (Parking brake not set).

B.4.49.7.1. PTO engaged without consent or not disengaged when consent revoked

WARNING: Engaging a PTO drive or continuing drive engagement when consent is removed may result in damage to the transmission and / or the PTO drive mechanism.

B.4.50. RANGE DISPLAY – RANGE ATTAINED

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.50.1. *OVERVIEW*

A Range Attained display indicates the current operating range of the transmission. Such displays are used with (but not limited to) functions SHIFT SELECTOR, NON-ALLISON BASIC, or SHIFT SELECTOR, NON-ALLISON STANDARD. This same functionality is referred to as the MONITOR display on Allison J1939-based shift selectors.

B.4.50.2. *AVAILABILITY*

Standard in all 1000 – 4000 Series applications.

B.4.50.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameter must be received from the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[30190] J1939 BROADCAST: ETC2 Transmission Current Range

Answer must be set to ENABLED.

[30210] J1939 BROADCAST: ETC2 Range Parameter Format

NOTE: Beginning with Allison 5th Generation Controls, the ETC2 *Transmission Current Range* format has been revised; see NORMAL OPERATION. This VEPS option allows for backward compatibility with 1000 – 4000 Series Allison 4th Generation Controls.

Default answer 1 [DEFAULT FORMAT FOR 5TH GEN AND NEWER PRODUCTS] may be changed to answer 0 [4TH GEN COMPATIBLE] in 1000 – 4000 Series applications if necessary for backward compatibility with existing customer-supplied shift selector or range attained displays. This VEPS answer does not impact Allison shift selector displays.

B.4.50.4. *J1939 PARAMETER AND SA USE*

Parameters marked (V) can be enabled or disabled via VEPS. The display controller is required to receive ETC2 *Transmission Current Range* (V) from SA 03 (Transmission #1).

B.4.50.5. *OTHER REQUIREMENTS / RESTRICTIONS*

ETC2 *Transmission Current Gear* **may not** be used for this display function as the data format does not match that of *Transmission Current Range*.

ETC2 transmission range and gear parameter intended use is explained further under RANGE DISPLAYS – GENERAL INFORMATION.

B.4.50.6. *OPERATOR INTERFACE*

B.4.50.6.1. Required Support

If Range Attained is to be displayed, a separate digit other than that used for the Requested Range display is required.

B.4.50.7. *NORMAL OPERATION*

Transmission Current Range is contained in ETC2 bytes 7 and 8, and reflects the range attained by the transmission. For 1000 – 4000 Series applications, two content formats are available via **[30210] J1939 BROADCAST: ETC2 Range Parameter Format**:

B.4.50.7.1. 4TH GEN COMPATIBLE FORMAT

Byte 7 conveys an ASCII value of the current range, while byte 8 conveys an ASCII value of the torque converter clutch lockup status ("C" or "L"). The information in byte 8 is not required to be displayed for this function.

B.4.50.7.2. DEFAULT FORMAT FOR 5TH GEN AND NEWER PRODUCTS

The Allison 4th Generation Controls byte order did not adhere to SAE J1939 recommended practice. With Allison 5th Generation Controls and beyond:

- Transmission lockup status is no longer conveyed in byte 8; vehicle OEMs seeking this information should refer to function LOCKUP INDICATOR.
- ETC2 content is now "right justified", with single digit ranges only appearing in byte 8. Dual-digit ranges use both bytes.

To properly implement a range display, both bytes must be utilized. Data examples are shown in the following table:

Option	Byte 7 Content	Byte 8 Content
Example 1: Transmission Current Range = 5th:		
4th Gen	ASCII 53 ("5")	ASCII 76 ("L")
5th Gen	ASCII 32 (space)	ASCII 53 ("5")
Example 2: Transmission Current Range = 10th:		
4th Gen	Not possible	Not possible
5th Gen	ASCII 49 ("1")	ASCII 48 ("0")

See ALLISON PARAMETER BROADCAST under the ETC2 *Transmission Current Range* definition for more details.

B.4.50.8. *RANGE DISPLAY FAILURE MODES AND RESPONSES*

Any vehicle system response, fault logging, diagnostics or troubleshooting related to the loss of *Transmission Current Range* reception is the responsibility of the controller monitoring the parameter and the vehicle OEM.

B.4.50.8.1. Loss of ETC2 Transmission Current Range

> **WARNING:** If an Error (either byte = 0) or Not Available indication (both bytes = 255) is received, or parameter reception is lost, the display controller must blank the display.
>
> The display may not continue to indicate the last valid value of *Transmission Current Range* received prior to encountering the communication problem.

This logic avoids display of misleading information during communication problems between the TCM and Range Attained display.

B.4.50.8.2. Heartbeat

Heartbeat monitoring and a Communication Failure indication are not required for this function, although vehicle OEMs may choose to implement such logic at their discretion. See USING A COMMUNICATION HEARTBEAT for recommendations on detecting and responding to J1939 communication failures.

B.4.50.9. *INSTALLATION CHECKLIST: RANGE ATTAINED DISPLAY*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer "yes" to all questions in the following test sequences:

B.4.50.9.1. General

- ☐ Is the TCM calibration configured properly?

B.4.50.9.2. Normal Operation

- ☐ With the selector in Neutral, start the engine; does the Range Attained display indicate Neutral?
- ☐ Drive the vehicle around such that the transmission shifts into all possible ranges, including reverse; does the Range Attained display track properly?

B.4.50.9.3. Loss of Transmission Current Range Reception

- ☐ With the engine running and the transmission in Neutral, disconnect the Range Attained display controller from the J1939 network. Does the display go blank, or at least not indicate a range? (For example, some displays may show asterisks or dashes under this condition.)
- ☐ Reconnect the Range Attained display controller to the J1939 network; does the display indicate Neutral?

B.4.51. RANGE DISPLAY – REQUESTED RANGE

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.51.1. *OVERVIEW*

NEW FOR THE B240 PSC RELEASE: Grade Braking Preselects are now reflected in ETC2 *Transmission Requested Range*.

NEW FOR B/C/N241 PC Releases: The grace period for certain shift inhibits has been extended from 3 to 5 seconds.

A Requested Range display reflects the range chosen by the vehicle operator via the shift selector, and signals if conditions exist such that the operator request may not be honored. Such displays are typically used with (but not limited to) functions RANGE SELECTION MODE, or SHIFT SELECTOR, NON-ALLISON BASIC, or SHIFT SELECTOR, NON-ALLISON STANDARD. This same functionality is referred to as the SELECT display on Allison J1939-based shift selectors.

B.4.51.2. *AVAILABILITY*

Standard in all 1000 – 4000 Series applications.

B.4.51.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be received from the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[30200] J1939 BROADCAST: ETC2 Transmission Requested Range

Answer must be set to ENABLED.

[30210] J1939 BROADCAST: ETC2 Range Parameter Format

> **NOTE:** Beginning with Allison 5th Gen Controls, the ETC2 *Transmission Requested Range* format has been revised; see NORMAL OPERATION. This VEPS option allows for backward compatibility with 1000 – 4000 Series Allison 4th Generation Controls.

Default answer 1 [DEFAULT FORMAT FOR 5TH GEN AND NEWER PRODUCTS] may be changed to answer 0 [4TH GEN COMPATIBLE] in 1000 – 4000 Series applications if necessary for backward compatibility with existing customer-supplied shift selector or range attained displays. This VEPS answer does not impact Allison shift selector displays or customer-supplied selectors that use the Allison Proprietary A message for display control.

[18032] ON-VEHICLE PROTOCOL: REQUESTED RANGE DISPLAY

In 3000/4000 Series applications, default answer NUMERIC FOR MAX RANGE may be changed to D FOR MAX RANGE to convey the letter D instead of the numeric requested range value in ETC2 *Transmission Requested Range* and on the Allison shift selector display. Preselects will still be reflected as numeric values.

[30280] J1939 BROADCAST: ETC7 Transmission Range Requested Display Flash State

Answer must be set to ENABLED if parameter used to meet function requirements.

[26223] RANGE INHIBIT INDICATOR

Must be set to ONLY ETC7 TRANSMISSION SHIFT INHIBIT INDICATOR or BOTH GPO AD AND J1939 TRANSMISSION SHIFT INHIBIT INDICATOR to use this function.

[30270] J1939 BROADCAST: ETC7 Transmission Range Requested Display Blank State

Answer must be set to ENABLED.

B.4.51.4. *J1939 PARAMETER AND SA USE*

Parameters marked (V) can be enabled or disabled via VEPS. The display controller is required to receive all of the following from SA 03 (Transmission #1):

— ETC2 *Transmission Requested Range* (V)

— ETC7 *Transmission Range Requested Display Flash State* (V) (preferred for displays) **OR** ETC7 *Transmission Shift Inhibit Indicator* (V)

— ETC7 *Transmission Range Requested Display Blank State* (V)

B.4.51.5. *OTHER REQUIREMENTS / RESTRICTIONS*

ETC2 transmission range and gear parameter intended use is explained further under RANGE DISPLAYS – GENERAL INFORMATION,

B.4.51.6. *OPERATOR INTERFACE*

B.4.51.6.1. Required Support

By choosing to implement their own Requested Range display, vehicles OEMs assume responsibility for meeting all associated FMVSS and other regulatory requirements.

To mimic Allison shift selector display operation, vehicle OEM displays are required to:

— Indicate range inhibit conditions, and
— Blank the display when requested to do so.

B.4.51.7. *NORMAL OPERATION*

Transmission Requested Range is contained in ETC2 bytes 5 and 6, and reflects the range chosen by the operator via the shift selector, as well as most operator-initiated preselect requests. For 1000 – 4000 Series applications, two content formats are available via **[30210] J1939 BROADCAST: ETC2 Range Parameter Format**:

B.4.51.7.1. 4TH GEN COMPATIBLE FORMAT

Byte 5 conveys an ASCII value of the requested range, while byte 6 is always ASCII 32 (space).

B.4.51.7.2. DEFAULT FORMAT FOR 5TH GEN AND NEWER PRODUCTS

The Allison 4th Generation Controls byte order did not adhere to SAE J1939 recommended practice. With Allison 5th Generation Controls and beyond, ETC2 content is “right justified”, with single digit ranges appearing in byte 6. Dual-digit ranges use both bytes.

To properly implement a range display, both bytes must be utilized. Data examples are shown in the following table:

Option	Byte 5 Content	Byte 6 Content
Example 1: Trans. Requested Range = 5th:		
4th Gen	ASCII 53 (“5”)	ASCII 32 (space)
5th Gen	ASCII 32 (space)	ASCII 53 (“5”)
Example 2: Trans. Requested Range = 10th:		
4th Gen	Not possible	Not possible
5th Gen	ASCII 49 (“1”)	ASCII 48 (“0”)

See ALLISON PARAMETER BROADCAST under ETC2 *Transmission Requested Range* definition for more details.

B.4.51.7.3. Reflection of Preselect Operation

Preselected ranges are reflected in ETC2 *Transmission Requested Range* per the table below:

Is Preselect Value Reflected in ETC2 *Transmission Requested Range*?

Function or TCM Logic Requesting a Preselect Range	1000 / 2000 Series	3000 / 4000 Series
PSR via shift selector	Yes	Yes
PSR via GPI CB1 or CB2	Yes	Yes
PSR via J1939	Yes	Yes
Engine Brake Preselects	Yes	Yes
Grade Braking Preselects (1)	Yes	Yes
Reverse Inhibit w/PSR	No	Yes
BBAN (GPI CA) Preselect	Yes	Yes
Transmission Sump Temp.	No	No
Engine Coolant Temp.	No	No
Overdrive Disable (GPI AR)	Yes	NA
Wired 6-5-4 selection	Yes	NA
Range Selection Mode	Yes	NA
Retarder operation	NA	No
Retarder Sump Temp.	NA	No
Retarder Coolant Temp.	NA	No
Direct Hold (GPI CE)	NA	No
D1 Selection (GPI B)	NA	Yes
Auto 2-1 Preselect (GPI BD)	NA	Yes
Auxiliary Hold (GPI G)	NA	Yes
Pump Mode operation	Yes	Yes

(1) Includes preselects associated with **[22050] PRESELECTS: Automatic Level of Preselect Range during Cruise Control** and **[17132] GRADE BRAKING / REGENERATION INPUT**.

B.4.51.7.4. Range Inhibit Indicator Options

Depending on the J1939 parameter used to meet the requirements of this function, either when:

— ETC7 *Transmission Requested Range Display Flash State* is 01b (Active; Transmission Requested Range display should be flashing)

OR

— ETC7 *Transmission Shift Inhibit Indicator* is 01b (Active; shift is inhibited)

…display controllers are required to blink and / or activate a range inhibit indicator (see function RANGE INHIBITED INDICATOR) to show that shifts are either temporarily or permanently inhibited. The inhibit may clear if its cause clears within up to 5 seconds of the shift request. Otherwise, the operator must re-select range.

B.4.51.7.5. Indicating Display Problems

When ETC7 *Transmission Requested Range Display Blank State* is 01b (Active; Transmission Requested Range display should be blanked), display controllers are required to turn off the Requested Range display. Depending on the failure, selectors may still operate in certain ranges.

B.4.51.8. *TCM FAILURE MODES & RESPONSES*

In 3000/4000 Series applications equipped with J1939-based shift selector(s), ETC2 *Transmission Requested Range* will indicate ASCII 0 (Error) if TC1 *Transmission Requested Gear* reception is not valid from the active shift selector.

B.4.51.9. *RANGE DISPLAY FAILURE MODES RESPONSES*

Any vehicle system response, fault logging, diagnostics or troubleshooting related to reception loss of any required display parameter is the responsibility of the display controller monitoring the parameters and the vehicle OEM.

B.4.51.9.1. Loss of Parameter Reception

WARNING: If an Error (either byte = 0) or Not Available indication (both bytes = 255) is received, or parameter reception is lost, the display controller must blank the display.

The display may not continue to indicate the last value of *Transmission Requested Range* received prior to encountering the communication problem.

This logic avoids display of misleading information during communication problems between the TCM and Requested Range display.

B.4.51.9.2. Heartbeat

Heartbeat monitoring and a Communication Failure indication are not required for this function, although vehicle OEMs may choose to implement such logic at their discretion. See USING A COMMUNICATION HEARTBEAT for recommendations on detecting and responding to J1939 communication failures.

B.4.51.10. *INSTALLATION CHECKLIST: REQUESTED RANGE DISPLAY*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer "yes" to all questions in the following test sequences:

B.4.51.10.1. General

- ☐ Is the TCM calibration configured properly?

B.4.51.10.2. Normal Operation

- ☐ With the selector in Neutral, start the engine; does the Requested Range display indicate Neutral?

- ☐ Apply the service brakes and systematically select all possible ranges (forward & reverse); does the Requested Range display track properly?

B.4.51.10.3. Indicate Inhibited Shifts

With the transmission in Neutral and the engine running, raise engine speed to above 1000 rpm.

- ☐ Apply the service brakes and place the selector in Drive. Is the inhibited shift indicated by either (1) the "Requested Range" digit blinking, or (2) the activation of a separate Range Inhibit Indicator?

- ☐ Return the selector to the Neutral position; does the "Range Inhibit" indication cease?

B.4.51.10.4. Blank Display on Command

- ☐ Using a protocol analyzer (e.g. CANalyzer), send ETC7 *Transmission Requested Range Display Blank State* = 01b; does the Requested Range display go blank?

B.4.51.10.5. Loss & Recovery of Transmission Requested Range Reception

Begin this test with the engine running and the transmission in Neutral.

- ☐ Disconnect the TCM from the J1939 network; does the Requested Range display go blank, or at least not indicate a range? (For example, some displays may show asterisks or dashes under this condition.)

- ☐ Reconnect the TCM to the J1939 network; does the Requested Range display indicate Neutral?

B.4.52. RANGE INHIBIT INDICATOR AND REASON (RII)

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.52.1. *OVERVIEW*

The Range Inhibit Indicator (RII) function alerts the operator that range shifts requested by the operator may not be honored. The RII will also activate in 1000/2000 Series applications if the TCM detects potentially damaging torque converter stall operation. Refer to Allison 6th Generation Controls Installation Manual Section B: "System Operation" for more information on these features.

All applications require an RII. This requirement is typically met with the built-in capability of Allison shift selectors. Separately, RII functionality is available either via J1939 or by dedicated wire 124 (see the Allison 6th Generation Controls Installation Manual). This allows consistency among Allison product families at a given vehicle OEM, and / or the ability to activate the RII in applications with customer-supplied shift selectors.

B.4.52.2. *AVAILABILITY*

J1939-based implementations are standard in all 1000 – 4000 Series applications.

B.4.52.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameter must be received from the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[26223] RANGE INHIBIT INDICATOR

Must be set to ONLY ETC7 TRANSMISSION SHIFT INHIBIT INDICATOR or BOTH GPO AD AND J1939 TRANSMISSION SHIFT INHIBIT INDICATOR to use this function.

[30290] J1939 BROADCAST: ETC8 Transmission Shift Inhibit Reason

Parameter must be set to ENABLED for Transmission Shift Inhibit Reason to be broadcast.

B.4.52.4. *J1939 PARAMETER AND SA USE*

Parameters marked (V) can be enabled or disabled via VEPS.

B.4.52.4.1. Required Support

The display controller is required to receive ETC7 *Transmission Shift Inhibit Indicator* (V) from SA 03 (Transmission #1).

B.4.52.4.2. Optional Support

In addition, displays have the option to receive ETC8 *Transmission Shift Inhibit Reason* (V) to obtain the reason for the transmission range inhibit.

B.4.52.5. *OPERATOR INTERFACE REQUIREMENTS*

The indicator is supplied and installed by the vehicle builder, and is required to be:

…In the normal forward field of view of the vehicle operator (preferred), or readily viewable as part of the shift selector assembly.

…Clearly visible from both operator stations in dual selector applications (may require two indicators).

…Clearly visible under all vehicle lighting conditions, both daytime and nighttime.

Acceptable interface options are discussed below. For other potential implementations, please contact your Allison Customer Integration Engineer.

B.4.52.5.1. Dedicated Lamp with Text

A lamp with appropriate wording for the country of vehicle operation is acceptable. Examples include:

Country or Region	Acceptable Wording
North America, United Kingdom, Netherlands, Sweden	RANGE INHIBIT or RANGE INHIBITED
Germany	GANG GESPERRT
Spain	RANGO INHIBIDO

Other wording may be acceptable upon review of an appropriately qualified Customer Integration Engineer.

The preferred lamp color is yellow or amber, which is consistent with ISO symbol color conventions.

B.4.52.5.2. Icon or Graphical Symbol

Per ISO 2575: "Road Vehicles – Symbols for Controls, Indicators, and Tell-Tales", this symbol represents a transmission gearshift, and is acceptable for Allison RII use. Preferred icon colors are yellow or amber.

B.4.52.5.3. Lamp or Icon Illumination

The lamp or icon may illuminate continuously or flash for the full duration of an active range inhibit condition. The vehicle OEM has full responsibility for implementing the mechanism(s) required to flash the lamp or icon if this indication method is chosen, since only an Active / Inactive signal is provided by the TCM over J1939. Typical flash rates are 1 to 3 Hz, with a 50% duty cycle.

B.4.52.5.4. Flashing Range Display Character

If a Transmission Range Selected / Range Attained dashboard display is used, the Transmission Range Selected character may be flashed in lieu of a dedicated lamp or Icon.

Typical flash rates are 1 to 3 Hz, with a 50% duty cycle. Flashing the Transmission Range Attained character is not allowed, as the Range Inhibit Indicator conveys an issue with what the vehicle operator is *asking for* (Range Selected) not the current state of the transmission (Range Attained).

Due to the many potential implementations of this function (flashing the character, flashing the character highlighting, alternating the color of the character, etc.), Allison Customer Integration Engineering must review the method and flash rate proposed to ensure that the "spirit and intent" of the Range Inhibit Indicator function are met.

B.4.52.5.5. Acceptable Additions

In addition to the above implementations, a tone may optionally accompany the RII visual indication.

NOTE: An audible tone cannot be substituted for the visual Range Inhibit indication.

The accompanying tone may sound continuously or beep for the full duration of an active Range Inhibit condition, and must be distinguishable from and heard in addition to all other required tones in the vehicle (Low Air Pressure alarm, Reverse Warning tone, etc.).

The vehicle OEM has full responsibility for implementing the mechanism(s) required to sound the accompanying tone if this method is chosen. Additionally, if a beeping tone and flashing lamp or icon is chosen, the tone and flash should be synchronized to maximize the association of the beeping tone with the flashing Lamp or Icon.

B.4.52.6. *BULB CHECKS*

The display controller is responsible for performing and bulb or display checks at the beginning of each key switch cycle.

Allison recommends lamps or indicators remain on for 2 seconds during the check. Slightly longer or shorter time periods are acceptable.

> **NOTE:** The TCM does not send any J1939-based “bulb check” when powered up; *Transmission Shift Inhibit Indicator* is set to 00b.

B.4.52.7. *NORMAL OPERATION*

When ETC7 *Transmission Shift Inhibit Indicator* = 01b (Active), the Range Inhibit Indicator should be activated. When this parameter is 00b (Inactive), the Range Inhibit Indicator should be deactivated.

On 1000/2000 Series applications, wire 124 will activate at the same time as the ETC7 parameter.

When the indicator is active, transmission operation is or will be inhibited in some fashion:

- Operator-requested range shifts may not occur.
- 1000/2000 Series with Engine Management will limit engine torque output if the TCM detects potentially damaging torque converter stall operation.

The RII is not activated during engine start / stop activity associated with the Auto-Neutral for Idle Start / Stop function.

> **WARNING:** When the RII is active, the transmission may not respond to shift selector requests, since operating limitations are being placed on the transmission. Direction changes may not occur.

B.4.52.8. *RANGE INHIBIT INDICATOR FAILURE MODES AND RESPONSES*

Vehicle system response, fault logging, diagnostics or troubleshooting related to *Transmission Shift Inhibit Indicator* reception loss is the responsibility of the controller monitoring the parameter and the vehicle OEM.

B.4.52.8.1. Initialization or Response to Resets

The display controller may be powered down intentionally (key switch turned off) or unintentionally (intermittent power source) while an active inhibit is present.

In either case, Allison recommends that the display controller default the indicator to an inactive state when it reinitializes -- If the inhibit is still present when power returns, TCM broadcast data will reflect this and only then should the display controller reactivate the indicator.

This recommendation is based on the fact that some Allison inhibits self-clear during a power cycle.

B.4.52.8.2. Loss of TCM Communication

If *Transmission Shift Inhibit Indicator* reception is lost, or 10b (Error) or 11b (Not Available) is received, display controller response is required as follows:

- If an active inhibit was the last valid indication received, the RII should remain **ON** until a new valid signal is received.
- If no inhibit was active when the last signal was received, the RII should remain **OFF** until a new valid signal is received.

This logic maintains operator awareness of an active shift inhibit if communication is lost after the TCM has begun to indicate an inhibit.

B.4.52.8.3. Heartbeat

This function does not require heartbeat monitoring or a Communication Failure indication, although vehicle OEMs may choose to implement such logic at their discretion. See USING A COMMUNICATION HEARTBEAT for recommendations on detecting and responding to J1939 communication failures.

B.4.52.9. *INSTALLATION CHECKLIST: RANGE INHIBIT INDICATOR*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer “yes” to all questions in the following test sequences:

B.4.52.9.1. General

- ☐ Is the TCM calibration configured properly?

B.4.52.9.2. Bulb Check / Text Display Check

- ☐ Turn the key switch on. Is an RII bulb check or text display check performed at power up?

B.4.52.9.3. Normal Operation

1. Clear any Allison DTCs. Start engine.
2. Increase engine speed to high idle. Move the shift selector to Drive. Is the RII actuated?

(Note some 1000/2000 Series applications use J1939 TSC1 commands to reduce engine speed such that the shift can be made; however, the RII should be active until engine speed lowers enough to make the shift.)

3. Move the selector back to Neutral. Does the RII deactivate?

B.4.52.9.4. Loss of Shift Inhibit Indicator Reception

1. With engine speed still above 1000 rpm, shift the selector to Drive. The RII should actuate.
2. Disconnect the RII controller from the J1939 network. Does the RII remain actuated?
3. Is the Check Trans Indicator <u>inactive</u>?
4. Let the engine return to idle, and move the selector to Neutral. Reconnect the RII controller to the J1939 network. Does the RII go inactive?
5. Disconnect the RII controller from the J1939 network. Does the RII remain inactive?
6. Is the Check Trans Indicator <u>inactive</u>?

B.4.52.9.5. Optional Tone Accompaniment

- ☐ When the RII is active, is the beep synchronized with the flashing?

B.4.53. RANGE SELECTION MODE ("TAP UP, TAP DOWN"')

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.53.1. *OVERVIEW*

To facilitate different driving, towing and hauling needs, a J1939-based Range Selection Mode feature is available to supplement the 1000/2000 Series mechanical shift linkage. This is sometimes referred to as "Tap Up, Tap Down" functionality.

By using momentary inputs provided by the vehicle OEM, the operator can select the range of gears they desire for current driving conditions. Range Selection Mode also allows control of engine and vehicle speed while going down a hill by enabling selection of a preferred range.

The required Requested Range display will show the range selected by the operator. This range is the highest attainable range, with all gears below accessible (i.e. when 4th is selected, ranges 1st through 4th are available).

B.4.53.2. *AVAILABILITY*

Function is optional in 1000/2000 Series applications with mechanical shift linkage.

B.4.53.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameter is only received on the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[17000] PRIMARY MODE: Gears

The selected shift mask must contain a manual position ("M", e.g. 6M1) to enable this function.

[19125] SHIFT SELECTORS: Express Preselects

When set to ENABLED AT ANY THROTTLE, the TCM will preselect to the currently attained range when the shift lever is moved to the manual position.

When set to ENABLED AT ZERO THROTTLE ONLY, the TCM will preselect to the currently attained range when the shift lever is moved to the manual position only at closed throttle.

B.4.53.4. *J1939 PARAMETER AND SA USE*

See AUTO-DETECTION for SA selection details.

B.4.53.4.1. Required Support

The J1939 network is required to provide TC1 *Transmission Requested Gear* every 50 ms to DA 03 (Transmission #1) from one of the following SAs, in order of TCM preference:

1. SA 33 (Body Controller)
2. SA 05 (Shift Console, Primary) (1)
3. SA 23 (Instrument Cluster #1)

(1) SA may only be used if the application does not employ an Allison J1939-based selector.

See NORMAL OPERATION for required parameter specific indicator support.

B.4.53.5. *OPERATOR INTERFACE REQUIREMENTS*

— The selector pattern or "shift mask" chosen in VEPS is required to contain a Manual position (M), such as PRNDM1. Regardless of the shift mask, the "M" position is always the next selector location beyond the normal Drive position.

— Momentary inputs are required to trigger the range commands in this function.

Response to sustained momentary inputs -- such as when the "tap down" button is depressed and held for a period of time -- is left to the discretion of the vehicle manufacturer. For example, an OEM may elect to broadcast a single "tap down" command sequence per depression / release cycle of the momentary input, or they may choose to issue a series of "tap down" command sequences if the input is depressed for some period of time. TCM response to a continuous sequence of "tap down" commands is illustrated under NORMAL OPERATION.

— A J1939-based display as described under RANGE DISPLAY – REQUESTED RANGE is required to convey the manually selected range to the vehicle operator.

B.4.53.6. *OTHER REQUIREMENTS / RESTRICTIONS*

— Range Selection Mode cannot be used in 1000/2000 Series applications with an Allison J1939-based shift selector.

— Range Selection Mode may not be used with function PRESELECT REQUEST INPUT.

— Range Selection Mode may not be used in conjunction with the wired "3-Position Hold Switch" as described in Allison 6th Generation Controls Installation Manual Section D: "Vehicle Electrical System Interface".

— Per SAE recommended practice, unsupported TC1 parameters must be set to Not Available.

— The TCM performs no diagnostics specific to the TC1 reception for this function. As such, Range Selection Mode cannot be used in OBD II applications below 14,000 lbs. GVW.

B.4.53.7. *NORMAL OPERATION*

The TCM only responds to Range Selection Mode requests while the selector is in the "M" position.

When a higher range is available, the TCM will increment to it when *Transmission Requested Gear* transitions from 0xE0 (224 decimal, Position unknown and / or no buttons pressed) to 0xF9 (249 decimal, Upshift 1 gear from current position).

When a lower range is available, the TCM will decrement to it when *Transmission Requested Gear* transitions from 0xE0 to 0xF7 (247 decimal, Downshift 1 gear from current position).

When Range Selection Mode is no longer desired, *Transmission Requested Gear* is required to indicate 0xE0 (Position unknown and / or no buttons pressed).

As shown in the figure below, the TCM will respond to *Transmission Requested Gear* transitions as quickly as they can be sent via TC1.

B.4.53.8. *TCM FAILURE MODES & RESPONSES*

If TC1 *Transmission Requested Gear* reception is lost while the TCM is in Range Selection Mode, the transmission will retain the current selected range until the selector is moved from the "M" position.

B.4.53.9. *INSTALLATION CHECKLIST: RANGE SELECTION MODE*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

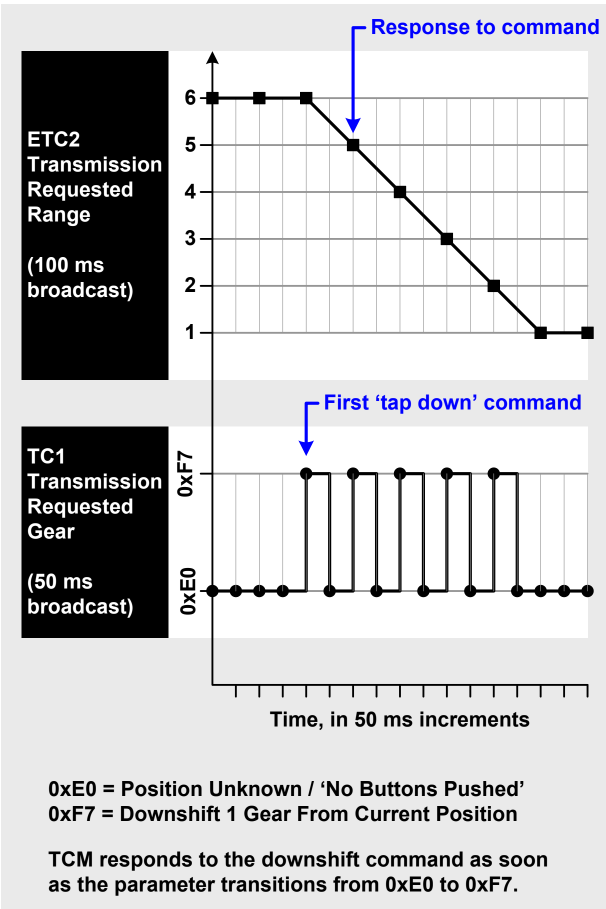
Acceptable implementations will answer "yes" to all of the following questions:

☐ Is the TCM calibration configured properly?

☐ Does the selector pattern have an "M" position?

☐ Does the Requested Range display show the selected range when the selector is in "M"?

- ☐ Is TC1 sent every 50 ms to the proper DA, from an acceptable SA?
- ☐ Does TC1 *Transmission Requested Gear* indicate 0xF9 when the increment or “tap up” input is activated?
- ☐ Does TC1 *Transmission Requested Gear* indicate 0xF7 when the decrement or “tap down” input is activated?
- ☐ When Range Selection Mode is not desired, is TC1 *Transmission Requested Gear* set to 0xE0?



TCM RESPONSE TO CONSECUTIVE TAP DOWN COMMANDS

B.4.54. RETARDER ACTIVE INDICATOR

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.54.1. *OVERVIEW*

All Allison driveline retarder installations are required to activate vehicle brake lights when the retarder is active. GPO Q – RETARDER ACTIVE INDICATOR is often used for this purpose (See Allison 6th Generation Controls Installation Manual).

While the J1939 implementation can replace the brake light activation functionality of GPO Q, it does not support all GPO Q functionality; see OTHER REQUIREMENTS / RESTRICTIONS below.

B.4.54.2. *AVAILABILITY*

The J1939-based implementation is standard in all 3000/4000 Series applications equipped with driveline retarders.

B.4.54.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be received from the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[20000] RETARDER

Answer must be set to AUTODETECTED or YES.

[30030] J1939 BROADCAST: ERC1 Actual Retarder – Percent Torque

Answer must be set to ENABLED if the parameter is used to meet function requirements.

[30060] J1939 BROADCAST: ERC1 Retarder Requesting Brake Light

Answer must be set to ENABLED if the parameter is used to meet function requirements.

B.4.54.4. *J1939 PARAMETER AND SA USE*

Parameter marked (V) can be enabled or disabled via VEPS.

B.4.54.4.1. Required Support

The component detecting retarder activation is required to receive either ERC1 *Actual Retarder – Percent Torque* (V) **OR** ERC1 *Retarder Requesting Brake Light* (V) from SA 16 (Retarder – Driveline).

B.4.54.5. *DRIVER & VEHICLE INTERFACES*

B.4.54.5.1. Required Support – Brake Light Activation

Activation of the vehicle brake lights is required during active retardation.

B.4.54.5.2. Optional Driver Indication

Installing a Retarder Active Indicator for the vehicle operator is left to the vehicle builder's discretion. Often a dash lamp is installed.

B.4.54.5.3. Optional Communication Failure Indication

See FAILURE MODES & OPTIONAL RESPONSES.

B.4.54.6. *OTHER REQUIREMENTS / RESTRICTIONS*

When **[20060] RETARDER: Cancel Cruise Control upon Rapid Modulation Request Increase** is enabled, GPO Q provides a short "flash" when requested retarder level is increased. Coupled with vehicle service brake wiring, it will cancel cruise control operation. See Allison 6th Generation Controls Section B: "System Operation" for more information.

NOTE: The "Retarder Cancel Cruise Control upon Rapid Modulation Request Increase" feature cannot be accomplished through the J1939 implementation of the Retarder Active Indicator.

B.4.54.7. *NORMAL OPERATION*

The receiver may assume the Allison retarder hardware is generating negative torque at any time ERC1 *Actual Retarder – Percent Torque* < 0% (a negative value) or ERC1 *Retarder Requesting Brake Light* = 01b.

Retarder Requesting Brake Light will indicate 01b whenever *Actual Retarder Percent Torque* is < 0%.

B.4.54.8. *FAILURE MODES AND OPTIONAL RESPONSES*

Fault logging, diagnostics, and troubleshooting related to the loss of ERC1 reception are the responsibility of the controller monitoring the parameter(s) and the vehicle OEM.

B.4.54.8.1. Loss of Parameter Reception

Failure to receive ERC1 *Actual Retarder – Percent Torque* or ERC1 *Retarder Requesting Brake Light* may be the result of bus loading, wiring integrity failures, electrical noise, or improper function implementation. Vehicle OEMs should consider such failures during their design process.

B.4.54.8.2. Heartbeat

Heartbeat monitoring and a Communication Failure indication are not required for this function, although vehicle OEMs may choose to implement such logic at their discretion. See USING A COMMUNICATION HEARTBEAT for recommendations on detecting and responding to J1939 communication failures.

B.4.54.9. *INSTALLATION CHECKLIST: RETARDER ACTIVE INDICATOR*

The vehicle OEM implementing the Retarder Active Indicator function is responsible for all testing.

B.4.55. RETARDER CAPACITY REDUCTION

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.55.1. *OVERVIEW*

Retarder capacity is automatically reduced if the transmission retarder or sump fluid temperatures exceed specified limits as detected by integral transmission temperature sensors.

Retarder capacity can also be reduced based on engine coolant temperature, as indicated by either:

- Analog sensor via wire 135 (see Allison 6th Generation Controls Installation Manual)
- J1939 ET1 *Engine Coolant Temperature*.

B.4.55.2. *AVAILABILITY*

The J1939-based implementation is optional in 3000/4000 Series applications equipped with driveline retarders.

B.4.55.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2
Parameter is only received on the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[20000] RETARDER
Answer must be set to AUTODETECTED or YES.

[20070] RETARDER: Engine Coolant Temperature (ECT) Based Capacity Reduction
Answer must be set to ENABLED for this function.

[11010] ENGINE COOLANT TEMPERATURE (ECT) SOURCE
Set to PRIMARY ON-VEHICLE PROTOCOL.

B.4.55.3.1. VEPS / ACCT Trims

The following trims influence function operation:

- **[20080] RETARDER: Engine Coolant Temperature (ECT) Based Capacity Threshold (Degrees C)**
- **[20090] RETARDER: Engine Coolant Temperature (ECT) Based Capacity Slope**
- **[20081] RETARDER: Retarder Temperature Based Capacity Reduction Threshold 1 (Degrees C)**
- **[20082] RETARDER: Retarder Temperature Based Capacity Reduction Threshold 2 (Degrees C)**
- **[20083] RETARDER: Sump Temperature Based Capacity Reduction Threshold 1 (Degrees C)**
- **[20084] RETARDER: Sump Temperature Based Capacity Reduction Threshold 2 (Degrees C)**
- **[20150] RETARDER: Override Capacity Reduction when Output Speed Increases**

B.4.55.4. *J1939 PARAMETER AND SA USE*

B.4.55.4.1. Required Support

The engine is required to provide ET1 *Engine Coolant Temperature* from SA 00 (Engine #1).

B.4.55.5. *NORMAL OPERATION*

Capacity reduction operation is described in Allison 6th Generation Controls Installation Manual Section B: "System Operation – 3000 & 4000 Product Families".

B.4.55.6. *TCM FAILURE MODES & RESPONSES*

Failure of inputs to reach the TCM may be the result of – but not limited to – bus loading, wiring integrity failures, electrical noise, or improper function implementation. Vehicle OEMs should consider such failures during their design process.

Regardless of ET1 *Engine Coolant Temperature* value or reception, the retarder may commence or continue capacity reduction based on transmission retarder and / or sump fluid temperature.

B.4.55.6.1. TCM Receives Engine Coolant Temperature Error Value

If retarder capacity reduction is active based on ET1 *Engine Coolant Temperature* and 254 (Error) is received, the TCM will immediately cease capacity reduction based on engine coolant temperature.

B.4.55.6.2. TCM Loss of Engine Coolant Temperature Reception

If retarder capacity reduction is active based on ET1 *Engine Coolant Temperature* and reception ceases, capacity reduction will cease after a 5 second time-out period. Capacity reduction will reactivate when a valid value indicating the need for capacity reduction is once again received.

B.4.56. RETARDER CONTROL

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.56.1. *OVERVIEW*

Allison driveline retarders can be controlled via:

— GPI Z, which includes a retarder enable switch and analog RMR input, or

— a J1939 parameter that reflects operator desire for retarding, or

— a combination of both.

In addition, the retarder will respond to J1939 TSC1 commands.

B.4.56.2. *AVAILABILITY*

The J1939-based implementation is standard in 3000/4000 Series applications equipped with driveline retarders.

B.4.56.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters are only supported on the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[20000] RETARDER

Answer must be set to AUTODETECTED or PRESENT.

[20020] RETARDER INTERFACE

Specifies the operator's retarder control interface:

> **NOTE:** VEPS options that use the GPIO interface <u>require</u> the analog RMR to be connected. If not connected, the TCM will log DTCs associated with the RMR input.

— ONLY GPIO INTERFACE [ANALOG RMR, GPI Z OR GPI BV, AND GPO Q IF DEFINED IN SELECTED GPIO PACKAGE] is intended for traditional analog installations where the TCM receives operator requests via the retarder enable switch and RMR lever.

— ONLY J1939 INTERFACE [INPUT VIA ERC1 Retarder Selection, Non-Engine] is intended for installations where the TCM only receives operator input via the dedicated J1939 parameter. This option should be selected when the analog inputs are not being used for retarder control. Diagnostics are not run on the analog RMR input, and the analog inputs are ignored by the TCM.

— BOTH GPIO AND J1939 INTERFACES (default) is intended for use with traditional analog installations, or EBS installations requiring both analog and J1939-based operator inputs.

J1939 BROADCAST Items

The following items are defaulted on, and must remain so unless they are not needed by the vehicle's retarder control system.

— **[30020] J1939 BROADCAST: ERC1 Actual Maximum Available Retarder - Percent Torque**

— **[30030] J1939 BROADCAST: ERC1 Actual Retarder - Percent Torque**

— **[30050] J1939 BROADCAST: ERC1 Intended Retarder Percent Torque**

— **[30060] J1939 BROADCAST: ERC1 Retarder Requesting Brake Light**

— **[30070] J1939 BROADCAST: ERC1 Retarder Selection, Non-Engine (Analog RMR)**

— **[30080] J1939 BROADCAST: ERC1 Retarder Torque Mode**

— **[30090] J1939 BROADCAST: ERC1 SA of Controlling Device for Retarder Control**

— **[30320] J1939 BROADCAST: RC Retarder Reference Torque**

— **[30330] J1939 BROADCAST: RC Retarder Control Method**

— **[30340] J1939 BROADCAST: RC Retarder Location**

— **[30350] J1939 BROADCAST: RC Retarder Type**

— **[30360] J1939 BROADCAST: RC Torque and Speed Map**

— **[29091] J1939 BROADCAST: ERC2 Transmission Output Retarder**

— **[29092] J1939 BROADCAST: ERC2 Transmission Retarder Enable Switch**

B.4.56.3.1. VEPS / ACCT Trims

The following trims will influence the J1939 interface:

[20010] RETARDER: Retarder Capacity Level

Determines the maximum retarding capability, and therefore impacts data broadcast in the retarder configuration message.

[20011] RETARDER: Retarder Capacity Level Custom Power Limit

Determines the maximum retarding capability, and therefore impacts data broadcast in the retarder configuration message.

[20012] RETARDER: Retarder Capacity Level Custom Torque Limit

Determines the maximum retarding capability, and therefore impacts data broadcast in the retarder configuration message.

[20040] RETARDER: Use Pressure Sensor for EBS

Default answer is NO. Only switch to YES if the sensor is installed, as this controls retarder pressure feedback sensor signal processing and diagnostics.

[20050] RETARDER: Cancel Retarder when Cruise Control is Active

Default answer is NO. When set to YES, retarder operation is prohibited / canceled when cruise control is active; see CRUISE CONTROL, STANDARD.

[20100] RETARDER: Cancel Retarder when ABS Input is Active

Default answer is YES. Retarder operation is prohibited / canceled when ABS is active. When answered NO, retarder operation is not canceled when ABS is active. See ANTI LOCK BRAKE SYSTEM (ABS) INPUT.

> **WARNING:** If retarder response to discrete ABS input(s) is disabled, the OEM is responsible for ensuring appropriate retarder deactivation (via TSC1 commands) during qualified ABS events.

Others

The following trims impact retarder operation:

— **[20110] RETARDER: Engine Coolant Temperature (ECT) Based Preselects**

— **[20080] RETARDER: Engine Coolant Temperature (ECT) Based Preselect Threshold**

— **[20060] RETARDER: Cancel Cruise Control upon Rapid Modulation Request Increase**

— **[20140] RETARDER: Accumulator**

In addition, all parameters listed under section OPTIONAL DATA PROVIDED BY THE TCM can be disabled via VEPS if desired.

B.4.56.4. *J1939 PARAMETER AND SA USE*

See AUTO-DETECTION for SA selection details.

B.4.56.4.1. Required Support

To request retarder activation via J1939, the TCM requires at least one of the following inputs from the J1939 component requesting retarder activation:

ERC1 Retarder Selection, Non-Engine

ERC1 *Retarder Selection, Non-Engine* is the preferred method of conveying desire for retarder activation to the TCM. If used, it is required to come from one of the following SAs, in order of TCM preference:

1. SA 49 (Cab Controller)
2. SA 23 (Instrument Cluster #1)
3. SA 33 (Body Controller)
4. SA 39 (Management Computer #1)

TSC1 Commands

TSC1 commands are preferred for conveying vehicle system desire for restricting retarder operation, and are expressed in terms of 0% to –100% of RC *Retarder Reference Torque*. The TCM will arbitrate and respond to TSC1 torque control and torque limit commands issued to DA 16 (Retarder – Driveline) from up to six configurable SAs. The following SAs are configured by default:

— SA 00 (Engine #1) (V)
— SA 11 (Brakes – System Controller) (V)
— SA 33 (Body Controller) (V)
— SA 17 (Cruise Control) (V)
— SA 39 (Management Computer #1) (V)
— SA 42 (Headway Controller) (V)

When a TSC1 transmitter is not controlling retarder operation, the transmitter is required to cease TSC1 broadcasts to DA 16. SAE requires that TSC1 control sequences be terminated with a single, final TSC1 message containing *Engine Override Control Mode* = 00b (Override Disabled).

> **NOTE:** Incorrect or lack of TSC1 command sequence termination can interfere with the SAE-defined TSC1 arbitration process.

When **[20100] RETARDER: Cancel Retarder when ABS input is Active** = NO, the ABS controller is required to support TSC1 torque limits to restrict and / or cancel driveline retarder operation during ABS events.

B.4.56.4.2. Optional Data Provided by the TCM

The TCM broadcasts the parameters below for discretionary use by the retarder control system. Parameters marked (V) can be enabled or disabled via VEPS:

— ERC1 *Actual Maximum Available Retarder – Percent Torque* (V)

— ERC1 *Actual Retarder – Percent Torque* (V)

— ERC1 *Engine Coolant Load Increase* (V)

— ERC1 *Intended Retarder Percent Torque* (V)

— ERC1 *Retarder Requesting Brake Light* (V)

— ERC1 *Retarder Selection, Non-Engine* (1) (V)

— ERC1 *Retarder Torque Mode* (V)

— ERC1 *SA of Controlling Device for Retarder Control* (V)

— ERC2 *Transmission Output Retarder* (2) (V)

— ERC2 *Transmission Retarder Enable Switch* (V)

— RC *Retarder Type* (V)

— RC *Retarder Location* (V)

— RC *Retarder Control Method* (V)

— RC *Retarder Reference Torque* (V)

— RC Full Retarder Configuration Map (V)

(1) Only broadcast when the TCM analog RMR input is connected and enabled. Parameter reflects status of both GPI Z and the analog RMR input.

(2) Only broadcast when the TCM GPI Z Retarder Enable Switch is connected and enabled. Parameter reflects the status of GPI Z.

B.4.56.5. *OPERATOR INTERFACE REQUIREMENTS*

The vehicle OEM is required to provide a retarder enable / disable switch for all Allison retarder installations, and must locate it within easy access of the operator.

> **WARNING:** Failure to provide a full authority retarder disable switch may result in retarder operation unexpected or undesired by the operator.

B.4.56.5.1. TCM GPI Z

When the analog RMR input is used, the retarder enable switch must be wired to the TCM. A jumper wire may not be substituted for the switch. The TCM will not respond to analog RMR requests without switch presence and activation. For more information on installation and operation, see Controls Installation Manual Section E: "Using Input / Output (I/O) Functions, Packages, & Groups".

> **NOTE:** GPI Z is only associated with the analog RMR signal; it has no impact on TCM response to ERC1 *Retarder Selection, Non-Engine* or TSC1 torque control commands.

B.4.56.5.2. J1939 Input(s)

When ERC1 *Retarder Selection, Non-Engine* and / or TSC1 commands are used to request retarder activation, a retarder enable switch does not need to be wired directly to the TCM. The switch input is now the responsibility of the vehicle OEM or components actuating the retarder via J1939:

— For any device that can activate the retarder via J1939, the vehicle OEM is required to provide a method by which the vehicle operator can override said device and disable operation of the Allison driveline retarder.

— This disable switch is required to function even during operator service brake application.

These requirements ensure the operator has final authority in whether or not the retarder is activated.

B.4.56.6. *RETARDER INPUT OPTIONS*

There are two methods of retarder control: (a) Retarder activation / deactivation requested by the vehicle operator, and (b) retarder activation and / or restriction by vehicle systems (e.g. ABS or ACC).

The 3 possible retarder activation inputs (TSC1 torque control command, ERC1 *Retarder Selection, Non-Engine*, and the traditional analog inputs) each have their own activation / deactivation hysteresis; see RETARDER INPUT PROCESSING.

If any J1939 inputs are used for retarder activation, the vehicle OEM and the device activating the retarder are responsible for enabling & modulation. See OPERATOR INTERFACE REQUIRMENTS.

B.4.56.6.1. J11939 TSC1 Inputs – All Implementations

The TCM processes TSC1 commands sent to the retarder regardless of the answer to VEPS option RETARDER REQUEST INPUTS.

> **NOTE:** In applications where the retarder may receive TSC1 commands from multiple devices, Allison recommends avoiding retarder activation via TSC1 torque control commands (*Engine Override Control Mode* = 10b).
>
> Per SAE-defined TSC1 arbitration logic, if a torque control command and torque limit command of the same priority are received, the control command is processed and the limit ignored. If the torque limit command has a higher priority than the torque control command, the control command is ignored; if this is the only input activating the retarder, retarder operation is effectively canceled.

B.4.56.6.2. RETARDER REQUEST INPUTS

[20020] RETARDER INTERFACE = ONLY GPIO INTERFACE [ANALOG RMR OR GPI Z OR GPI BV WITH GPO Q IF DEFINED IN SELECTED GPIO PACKAGE]

With this VEPS option, the retarder can be:

…Activated or deactivated via the traditional TCM analog RMR and Retarder Enable Switch inputs.

…Activated or limited by one or more J1939 TSC1 torque commands.

[20020] RETARDER INTERFACE = Only J1939 ERC1 Retarder Selection, Non-Engine

With this VEPS option, the retarder can be:

…Activated or deactivated via J1939 ERC1 Retarder Selection, Non-Engine.

…Activated or limited by one or more J1939 TSC1 torque commands.

[20020] RETARDER INTERFACE = Both Analog Inputs and ERC1 Retarder Selection, Non-Engine

With this VEPS option, the retarder can be:

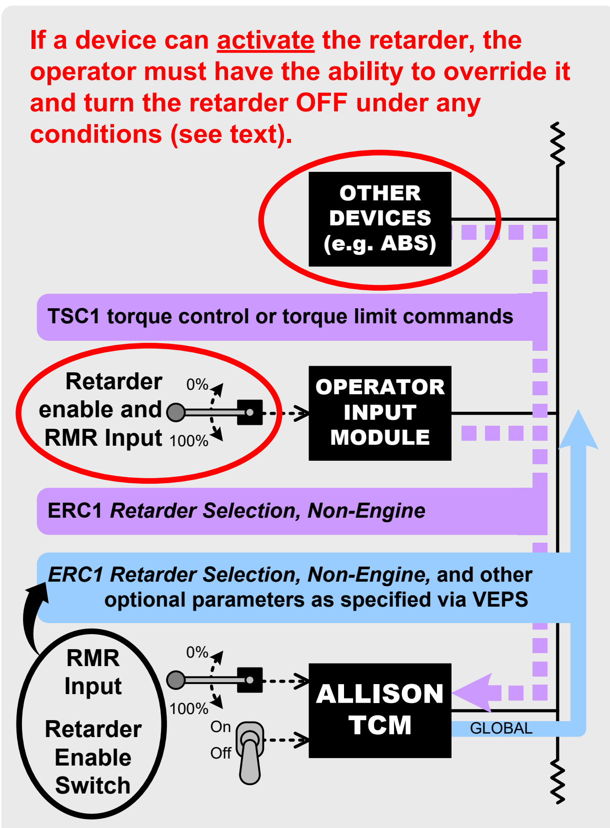
…Activated or deactivated via the traditional TCM analog RMR and Retarder Enable Switch inputs.

…Activated or deactivated via J1939 ERC1 *Retarder Selection, Non-Engine*.

…Activated or limited by one or more J1939 TSC1 torque commands.

B.4.56.6.3. Example Schematic

The figure below illustrates communication flow for all 3 types of retarder control inputs:



EXAMPLES OF RETARDER CONTROL INPUTS

B.4.56.7. *RETARDER INPUT PROCESSING*

WARNING: Regardless of retarder control input (analog or J1939), the retarder will not activate when Neutral or Reverse is selected or attained.

The retarder control inputs each have activation and deactivation hysteresis windows associated with them. In the absence of physical limitations, system faults or other restrictions, the retarder will activate when (where applicable based on the input configuration):

…Throttle input is below a threshold,

…analog RMR input > 9% **AND** the retarder enable switch is on, **OR**

…ERC1 *Retarder Selection, Non-Engine* > 9%, **OR**

…TSC1 torque control command less than or equal to between -8% and -22%, depending on configuration.

The retarder will deactivate when:

…Throttle input is above a threshold,

…analog RMR input < 7% **OR** the retarder enable switch is off, **AND**

…ERC1 *Retarder Selection, Non-Engine* < 7%, **AND**

…TSC1 torque control command greater than between -9% and -4%, depending on configuration.

When multiple TSC1 commands are sent to the retarder, the TCM determines the winning command (torque control or torque limit) via the TSC1 arbitration process defined in J1939-71.

Unless limited by a TSC1 torque limit, the retarder will act on the largest request.

B.4.56.8. *RETARDER ABS RESPONSE*

B.4.56.8.1. TSC1 vs. Anti-Lock Braking (ABS) Active

A properly formatted TSC1 Torque Limit or Torque Command of 0% will cause the TCM to drop retarder operation, provided a TSC1 command of equal priority is not already active. TSC1 messages may cause the retarder to drop out slightly sooner than *Anti-Lock Braking (ABS) Active*, as TSC1s to the retarder use a faster 50 ms rate versus the EBC1 100 ms broadcast rate.

TSC1 messages allow ABS to “stage” its control over the vehicle braking system(s) when wheel slip is great enough to take action, but not enough to begin actively modulating brake pressure. This situation may or may not precede an actual ABS event where *Anti-Lock Braking (ABS) Active* indicates “Active”.

B.4.56.8.2. [20100] RETARDER: Cancel Retarder when ABS Input is Active

When **[20100] RETARDER: Cancel Retarder when ABS Input is Active** = NO, retarder operation is not canceled when the TCM receives a discrete ABS Active indication. In this case, the ABS controller is required to support TSC1 messaging to restrict and / or cancel driveline retarder operation during ABS events.

> **WARNING:** If retarder response to discrete ABS input(s) is disabled, the OEM is responsible for ensuring appropriate retarder deactivation (via TSC1 commands) during qualified ABS events.

B.4.56.9. *IMPLEMENTATION ERRORS AND IMPACTS*

The following items pertain to the J1939 component requesting retarder activation (the transmitter):

B.4.56.9.1. Failure to send Override Disable at end of TSC1 sequence

The TCM relies on TSC1 time-outs to deactivate the retarder if an Override Disable command is not sent at the end of a TSC1 sequence. This may cause interaction problems and poor control transitions when multiple J1939 devices are sending TSC1 messages to the driveline retarder.

B.4.56.9.2. Failure to cease TSC1 broadcast when no operator request present

While not strictly forbidden by SAE, it is ill-advised to continually broadcast 0% TSC1 torque control messages to the retarder when no operator request is present. Other J1939 devices on the vehicle may not be able to control the retarder as needed. Also, this creates unnecessary bus loading.

B.4.56.10. *TCM FAILURE MODES & RESPONSES*

Failure of inputs to reach the TCM may be the result of -- but not limited to -- bus loading, wiring integrity failures, electrical noise, or improper function implementation. Vehicle OEMs should consider such failures during their design process.

B.4.56.10.1. Loss of TSC1 Reception

If a TSC1 sequence terminates unexpectedly during retarder torque control (i.e. a TSC1 Override Disable does not conclude the sequence), the last valid TSC1 value is honored until a timeout of approximately 150 ms is reached. The retarder will then remain off until a valid command from any valid source is received.

> **WARNING:** Loss of retarder-activating TSC1 messages during retarder operation may result in retarder deactivation after a time limit of approximately 150 ms is reached.

B.4.56.10.2. Loss of ERC1 Retarder Selection, Non-Engine Reception

If reception of *Retarder Selection, Non-Engine* is lost during active retarder control, the last valid value is honored until a timeout of approximately 500 ms is reached. The retarder then remains off until a valid input is received.

> **WARNING:** Loss of ERC1 *Retarder Selection, Non-Engine* during retarder operation may result in retarder deactivation after a time limit of approximately 500 ms is reached.

B.4.56.10.3. Retarder Solenoid Failure

If the retarder solenoid fails, DTC(s) are set and the retarder will not operate. The inability of the retarder to operate is also reflected in these parameters:

- ERC1 *Actual Retarder – Percent Torque* = 0%
- ERC1 *Actual Maximum Available Retarder – Percent Torque* = 0%
- ERC1 *Intended Retarder Percent Torque* = 0%
- ERC2 *Transmission Output Retarder* = Off
- The RC "retarder map" is broadcast as zero.

B.4.56.10.4. Retarder Enable Switch GPI Z or RMR Input Failure

When enabled for use via VEPS, electrical failures in the analog input circuits will set DTCs, and the retarder will no longer respond to the analog inputs. ERC1 *Retarder Selection, Non-Engine* will indicate 254 (Error). The retarder will still respond to J1939 inputs.

B.4.56.10.5. Accelerator Pedal Input Failure

If an accelerator pedal input failure is detected, the Service Brake Status input function will allow the operator to manually engage the retarder by depressing the brake pedal.

B.4.56.10.6. Retarder Pressure Sensor Failure (EBS only)

Enabling the retarder pressure sensor via VEPS also enables its diagnostics. If the sensor fails, ERC1 *Actual Retarder – Percent Torque* accuracy cannot be held to the levels required by EBS. As a result, *Actual Retarder – Percent Torque* indicates 254

(Error) and a DTC is set. The Check Trans Indicator is not activated.

B.4.56.11. *INSTALLATION CHECKLIST: RETARDER CONTROL*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer “yes” to the following questions:

B.4.56.11.1. General

- ☐ Is the TCM calibration configured properly?

B.4.56.11.2. Operator Interface

- ☐ Does the vehicle operator have a method by which the Allison retarder can be fully disabled?
- ☐ Bring the vehicle up to speed, release the accelerator pedal, activate the retarder at a very low setting, and then lightly apply the service brakes. Using the appropriate operator interface, disable the driveline retarder while continuing to apply the service brakes. Does the retarder deactivate completely?

B.4.56.11.3. TSC1 Operation (if applicable)

These tests require a protocol analyzer (such as CANalyzer) or the Allison DOC® Data Bus Viewer to monitor TSC1 messages.

- ☐ With the engine running, vehicle stationary, and no operator input requesting retarder activity, is there a total absence of TSC1 messages (to DA 16) from the component that conveys operator driveline retarder requests over J1939?
- ☐ Bring the vehicle up to speed, release the accelerator pedal, and activate the retarder at a very low setting. Now reduce the operator input such that no retarder operation is requested, and the retarder deactivates. Did the last TSC1 message in the retarder activation / deactivation sequence indicate “override disabled”?

If **RETARDER: Cancel Retarder when ABS Input is Active** = NO:

- ☐ When an ABS event occurs, does the ABS controller restrict retarder operation via TSC1 commands?

B.4.57. RETARDER TEMPERATURE INDICATOR

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.57.1. *OVERVIEW*

The Retarder Temperature Indicator notifies the operator that transmission temperatures are above the normal operating range. With the exception of transit buses, all Allison retarder applications are required to provide a Retarder Temperature Indicator. Operator interface options for this function include a text display or a dedicated lamp w/text or icon. Available TCM outputs for this function include:

- GPO B (SUMP / RETARDER TEMPERATURE INDICATOR); see Allison 6th Generation Controls Installation Manual for details.
- J1939 DM1 message content
- J1939 RF *Driveline Retarder Overheat Indicator*

Allison recommends DM1-based implementation for text displays with generic lamps, and discrete parameter implementation for dedicated lamps. However, either output can be used to control either indication type.

B.4.57.2. *DIFFERENCES BETWEEN GPO AND DATALINK IMPLEMENTATIONS*

Allison retarder applications encompass two indications in the single **GPO B** wire output.

The Sump Temperature and Retarder Temperature indications are two separate functions when implemented via J1939. One or both J1939-based indications may be used to activate a single temperature Indicator or alarm as with GPO B.

B.4.57.3. *AVAILABILITY*

The J1939-based implementation is standard in 3000/4000 Series applications equipped with driveline retarders.

B.4.57.4. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be received from the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[20000] RETARDER

Answer must be set to AUTODETECTED or PRESENT.

[26250] J1939 BROADCAST: RF DRIVELINE RETARDER OVERHEAT INDICATOR

Answer must be set to ENABLED IF HARDWARE PRESENT if parameter used to meet function requirements

[30015] J1939 BROADCAST: DM1

Answer must be set to ENABLED if DM1 is used to meet the function requirements.

B.4.57.5. *J1939 PARAMETER AND SA USE*

B.4.57.5.1. DM1 Trigger – Required Support

The display controller is required to receive **ALL** of the following from SA 16 (Retarder – Driveline):

— DM1 *Suspect Parameter Number*, and
— DM1 *Amber Warning Lamp*, and
— DM1 *Failure Mode Identifier*

> **NOTE: Specific data values** conveyed in these three parameters are directly tied to the J1939 activation of a Retarder Temperature indication.

Amber Warning Lamp alone cannot be used to activate the Retarder Temperature Indicator; the content of all three DM1 parameters must be considered.

Other *SPN*, *Amber Warning Lamp* and *FMI* combinations may define other Allison indications or fault conditions. Users should not assume that any other combinations of *SPN*, *Amber Warning Lamp*, and *FMI* values from SA 16 are indicative of a Retarder Temperature indication.

B.4.57.5.2. RF Trigger – Required Support

When triggering this indicator via the J1939 discrete parameter, the display controller is required to receive *RF Driveline Retarder Overheat Indicator* (V) from SA 16 (Retarder – Driveline). Support of all parameter states is required.

B.4.57.6. *OPERATOR INTERFACE RECOMMENDATIONS*

The indicator is supplied and installed by the vehicle builder. While there are no specific physical implementation requirements, Allison recommends the indicator be:

…In the normal forward field of view of the vehicle operator (preferred), or readily viewable as part of the shift selector assembly.

…Clearly visible from both operator stations in dual selector applications (may require two indicators).

…Clearly visible under all vehicle lighting conditions, both daytime and nighttime.

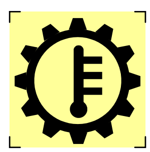
B.4.57.6.1. Dedicated Lamp with Text

When a dedicated lamp is used, recommended wording is “TRANS TEMP”. Yellow or amber lamp color is recommended, as retarder overheating does not warrant use of a red color.

B.4.57.6.2. Audible Alarm

An audible alarm may be used to signal the overheating condition. It is recommended that a lamp or text display be used in conjunction so the vehicle operator understands the cause of the alarm.

B.4.57.6.3. Icon or Graphical Symbol



Per ISO 2575: “Road Vehicles – Symbols for Controls, Indicators, and Tell-Tales”, this symbol represents a transmission fluid temperature condition, and is acceptable for Allison Retarder Temperature Indicator use. Preferred icon colors are yellow or amber.

B.4.57.6.4. Text Displays

While a dedicated lamp or icon is preferred, a driver text display used alone or in conjunction with generic warning and stop lamps is acceptable. In these implementations, the lamps convey issue severity to the operator, while the text display provides more specific information based on DM1 SPN and FMI data.

With dynamically configurable display systems, the visible content may change due to operating conditions or driver selection. In general, Allison requires that Retarder Temperature Indicator text is visible whenever active. However, there are three exceptions for installations with generic lamps and / or limited text display capacity:

Exception 1 – Text Prioritization during Simultaneous RSL and AWL Events

When multiple generic lamps are employed, it is possible for the RSL (Red Stop Lamp) and AWL

(Amber Warning Lamp) to be illuminated at the same time. Per J1939-73, the RSL is higher priority:

— An RSL indicates a problem severe enough to warrant stopping the vehicle.

— An AWL indicates the presence of a problem, but the vehicle need not be immediately stopped.

When text display capacity is limited, it is acceptable that Retarder Temperature Indicator text is not visible when the RSL is lit. The Retarder Temperature Indicator text should be out-prioritized by text linked to the RSL. The display system should allow the vehicle operator to scroll through the list of items associated with the lamps such that the Retarder Temperature Indicator can be read.

Exception 2 – Text Prioritization during Simultaneous AWL Events

When a generic AWL is employed, multiple events may simultaneously cause it to illuminate.

When text display capacity is limited, it is acceptable that Retarder Temperature Indicator text is not immediately visible when the AWL is lit due to these multiple situations. The display system should allow the vehicle operator to scroll through the list of items associated with the lamp such that the Retarder Temperature Indicator can be read.

In this situation, the operator knows a problem exists, but may not know it is transmission-related until the operator scrolls through the text.

Exception 3 – Text Suppression

In some applications, Allison indicator text may appear in a display area normally used to convey other operator information. In these cases it is acceptable to employ an operator input (e.g. button push) to <u>temporarily</u> suppress the Allison indicator text so normal display operation may resume.

The suppression may only exist for the current key switch cycle; i.e. if the key switch is cycled, the Allison indicator text <u>is required</u> to reappear if active. The operator may then opt to suppress the text for that drive cycle.

The key points are that (a) the vehicle operator must recognize and take physical action to suppress the indicator, and (b) the operator is informed of any active indications again at the next key switch cycle.

B.4.57.6.5. Bulb Checks

The device that physically actuates the indicator(s) is responsible for performing bulb and / or display checks at the beginning of each key switch cycle.

NOTE: The TCM does not broadcast a DM1 "bulb check" message at power-up. There is no DM1 content that allows a receiver to distinguish a momentary "bulb check" from an actual diagnostic report.

The TCM also does not send a "bulb check" in the discrete parameter at power up; RF *Driveline Retarder Overheat Indicator* is set to 00b.

Allison recommends lamps or indicators remain on for 2 seconds during the check. Slightly longer or shorter time periods are acceptable.

B.4.57.6.6. Optional Communication Failure Indication

See VEHICLE SYSTEM FAILURE MODES AND OPTIONAL RESPONSE.

B.4.57.7. *NORMAL OPERATION*

The DM1-based Retarder Temperature indication and RF *Driveline Retarder Overheat Indicator* are both triggered at the same time as the retarder portion of GPO B.

When the indication is triggered, the TCM may increase engine speeds associated with closed throttle downshift points by invoking a preselect downshift schedule. Downshifting at higher engine speeds increases fan speed and coolant flow through the transmission cooler and engine radiator.

B.4.57.7.1. DM1 Trigger – Required Support

DM1 may fluctuate between single and multi-frame formats, depending on how many fault indications are present. If only one indication is active, DM1 will be sent in a single frame. If two or more indications are active, DM1 will be sent via Transport Protocol.

Activating the Indicator

If the display controller receives DM1 from SA 16 (Retarder – Driveline) with:

— *SPN* = 120 (*Hydraulic Retarder Oil Temperature*), **AND**

— *Amber Warning Lamp* = 01b (On), **AND**

— *Failure Mode Identifier* = 15 (Data Valid but Above Normal Operating Range – Least Severe Level)

…then the Retarder Temperature Indicator <u>is required</u> to be activated.

Deactivating the Indicator

If the display controller receives DM1 from SA 16 where:

— *SPN* 120 no longer appears, **OR**

— *SPN* 120 appears **AND** the value of *Failure Mode Indicator* associated with this SPN is not 15, **OR**

— No faults are indicated, i.e. *SPN* = 0 and *Amber Warning Lamp* = 00b (Off)

…then the display controller is required to deactivate the Retarder Temperature Indicator. See DM1 under J1939 MESSAGE AND PARAMETER USE for data string examples.

B.4.57.7.2. RF Trigger – Required Support

Activating the Indicator

The display controller is required to steadily illuminate the Retarder Temperature Indicator when it receives RF *Driveline Retarder Overheat Indicator* = 01b (Driveline Overheat Indicator on continuously).

Deactivating the Indicator

If the display controller receives RF *Driveline Retarder Overheat Indicator* = 00b (Driveline Retarder Overheat Indicator is off), then the display controller is required to deactivate the Retarder Temperature Indicator.

B.4.57.8. *VEHICLE SYSTEM FAILURE MODES AND OPTIONAL RESPONSES*

B.4.57.8.1. Initialization or Response to Resets

The J1939 device that actuates the indicator may be powered down intentionally (key switch turned off) or unintentionally (intermittent power source) while an active indication is present.

In either case, Allison recommends that the display controller default the indicator to an inactive state when it reinitializes -- If the cause of the indication is still present when power returns, TCM broadcast data will reflect this and only then should the display controller reactivate the indicator.

This recommendation is based on the fact that some Allison indications self-clear during a power cycle.

B.4.57.8.2. Heartbeat

Heartbeat monitoring and a Communication Failure indication are not required for this function, although vehicle OEMs may choose to implement such logic at their discretion. See USING A COMMUNICATION HEARTBEAT for further information on detecting and responding to J1939 communication failures.

B.4.57.9. *TCM FAILURE MODES & RESPONSES*

In the event of a retarder temperature sensor failure, broadcast of the DM1-based Retarder Temperature Indicator will cease and RF *Driveline Retarder Overheat Indicator* will indicate 00b (Driveline Retarder Overheat Indicator is off).

In either case, a DTC will be set and a Check Trans Indicator will become active.

B.4.57.10. *INSTALLATION CHECKLIST: RETARDER TEMPERATURE INDICATOR*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer “yes” to the following questions, as applicable:

B.4.57.10.1. General

☐ Is the TCM calibration configured properly?

☐ Turn the key switch on. Is a Retarder Temperature Indicator bulb check or text display check performed at power up?

B.4.57.10.2. DM1-based Implementation

☐ Does the indicator only activate when all three activation criteria are met?

☐ Does the indicator deactivate when any of the deactivation criteria are met?

B.4.57.10.3. Discrete Parameter Implementation

☐ Does the indicator activate when RF *Driveline Retarder Overheat Indicator* = 01b?

☐ Does the indicator deactivate when RF *Driveline Retarder Overheat Indicator* = 00b?

B.4.58. REVERSE INHIBIT WITH PRESELECT REQUEST INTERFACE

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.58.1. *OVERVIEW*

This function is primarily used to meet European legislation for refuse vehicle operation, and can be accomplished by GPI AM, or J1939 as described here. GPI implementation is discussed in Controls Installation Manual Section D: "Vehicle Electrical System Interface".

When active, Reverse is inhibited when personnel ride at the rear of the vehicle. This function may also be used for other applications, such as a dump truck "hoist bed interlock" which restricts vehicle movement while the dump bed is in the raised position.

B.4.58.2. *AVAILABILITY*

The J1939-based implementation is optional in 1000 – 4000 Series applications.

B.4.58.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters are only exchanged on the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[27150] REVERSE INHIBIT WITH PRESELECT REQUEST INTERFACE

Answer must be set to J1939 INTERFACE to enable TCM J1939 parameter broadcast and reception for this function.

[27160] REVERSE INHIBIT WITH PRESELECT REQUEST: Preselect Range

Specifies the range preselected when the function is active. If set equal to the transmission's top range, the pre-select request portion of this function is effectively disabled.

B.4.58.4. *J1939 PARAMETER AND SA USE*

SAs marked (V) may be set to an OEM-specified value via VEPS. See AUTO-DETECTION for SA selection details.

B.4.58.4.1. Required Support

The J1939 network is required to provide *TC1 Transmission Reverse Gear Shift Inhibit Request* every 50 ms to DA 03 (Transmission #1), from one of the following SAs in order of TCM preference:

1. SA 49 (Cab Controller) (V)
2. SA 23 (Instrument Cluster #1)
3. SA 05 (Shift Console, Primary) (1)
4. SA 33 (Body Controller)

(1) SA may only be used if the application does not employ an Allison J1939-based selector.

B.4.58.4.2. Required Reception Support

The vehicle system is required to receive *ETC7 Transmission Reverse Gear Shift Inhibit Status* from SA 03 (Transmission #1).

B.4.58.5. *GPI VS. DATALINK IMPLEMENTATION*

B.4.58.5.1. Normal Operation

TC1 *Transmission Reverse Gear Shift Inhibit Request* is processed in the same manner as GPI AM. When a reverse inhibit request is received, the reverse inhibit is invoked, and the calibrated preselect range is invoked.

B.4.58.5.2. Failure Responses

TCM response to detectable system failures is the same in both implementations; the function will activate, prohibiting reverse operation. With J1939, additional requirements are in place such that the operator is also informed of a failure condition through an OEM-installed indication mechanism.

B.4.58.6. *OPERATOR INTERFACE*

B.4.58.6.1. Required Support – Communication Failure Indication

If the OEM controller or vehicle system detects a TCM communication problem, operator notification is required. See OEM CONTROLLER FAILURE MODES AND RESPONSES.

Physical implementation of this Communication Failure indication is left to the discretion of the vehicle OEM. Acceptable examples include a lamp or text display with phrasing such as "Vehicle Electrical Fault" or "Vehicle Electronic Fault". No specific wording is defined, as Allison realizes vehicle OEMs may already have a method to communicate these types of problems to the operator. Your Allison Customer Integration Engineer must review all implementations.

Check Trans Indicator actuation is not an acceptable means of representing the communication problem. If only the Check Trans Indicator is active, service technicians may assume there is a transmission problem, when in fact it is most likely a vehicle network or wiring issue.

B.4.58.7. *NORMAL OPERATION*

B.4.58.7.1. Activation and TCM Response

To activate the function, the OEM controller is required to set TC1 *Transmission Reverse Gear Shift Inhibit Request* = 01b (Inhibit shifts into Reverse gear, and shift transmission to Neutral if already in Reverse or attempting to shift to Reverse).

The TCM reflects function activation by setting *ETC7 Transmission Reverse Gear Shift Inhibit Status* = 01b (Reverse gear shifts are currently inhibited).

If the transmission is in Reverse or attempting to shift into Reverse at the moment the active inhibit request is received by the TCM, the transmission will shift to Neutral and remain there until commanded otherwise through the shift selector. An active range inhibit is conveyed as discussed under RANGE INHIBITED INDICATOR (RII).

While the function is active, the TCM ignores operator requests for Reverse, and invokes the calibrated preselect range. A calibrated preselect range of 1st will not be achieved if a 2nd gear start shift mask is active, or cold sump temperatures dictate use of a higher gear.

B.4.58.7.2. Deactivation and TCM Response

To deactivate the function, the OEM controller is required to set TC1 *Transmission Reverse Gear Shift Inhibit Request* = 00b (Allow shifts into Reverse gear).

The TCM revokes both the reverse inhibit and preselect request. Function deactivation is conveyed by setting *ETC7 Transmission Reverse Gear Shift Inhibit Status* = 00b (Reverse gear shifts are currently allowed).

B.4.58.8. *TCM FAILURE MODES & RESPONSES*

Like GPI AM, the J1939-based function failure modes are very conservative. Any failure detected by the TCM results in an active reverse inhibit and preselect request, so the vehicle cannot be driven in Reverse.

Loss of parameter reception, or reception of values 10b (Reserved) or 11b (Take no action) result in an active reverse inhibit and preselect request. This is true regardless as to whether or not the vehicle system was requesting an active Reverse Inhibit with Preselect Request at the time the TCM detected a communciation failure.

Once the failure response is invoked, the reverse inhibit and preselect request will both remain active until 00b (Allow shifts into Reverse gear) is received. No DTCs are logged.

The TCM will never indicate 10b (Error) in ETC7 *Transmission Reverse Gear Shift Inhibit Status*; it always knows the commanded state of the function.

B.4.58.9. *OEM CONTROLLER FAILURE MODES & RESPONSES*

Fault logging, diagnostics and troubleshooting related to the loss or incorrect reception of ETC7 *Transmission Reverse Gear Shift Inhibit Status* are the responsibility of the controller monitoring the parameter and the vehicle OEM.

The OEM controller is required to continuously monitor and compare the received value of ETC7 *Transmission Reverse Gear Shift Inhibit Status* against its own TC1 *Transmission Reverse Gear Shift Inhibit Request* broadcast.

If the parameter states fail to mirror each other for a period of > 10 seconds, the OEM controller is required to indicate the presence of a “vehicle electronic communication” failure to the operator.

If the OEM controller detects a problem within its own system and cannot determine the TC1 *Transmission Reverse Gear Shift Inhibit Request* state to broadcast, it is required to indicate 10b (Error) and indicate the presence of a “vehicle electronic communication” failure to the operator.

This indication is required to remain on until either the parameters once again mirror each other, **OR** cycling the key switch resets the OEM controller. This logic informs the operator of a vehicle system problem that may not allow the Reverse Inhibit with Preselect Request function to operate properly. The potential state combinations and required responses are summarized in the table below.

TC1 *Transmission Reverse Gear Shift Inhibit Request* Value	**ETC7 *Transmission Reverse Gear Shift Inhibit Status* Value**	**Must trigger a failure indication if states exist for > 10 sec?**
00b	00b	No
00b	01b	Yes
00b	10b (1)	Yes
00b	11b	Yes
00b	Signal Lost	Yes
01b	00b	Yes
01b	01b	No
01b	10b (1)	Yes
01b	11b	Yes
01b	Signal Lost	Yes
10b (2)	ANY	Yes
11b	00b	Yes
11b	01b	Yes
11b	10b (1)	Yes
11b	11b	No
11b	Signal Lost	Yes

(1) TCM currently does not support state 10b.

(2) OEM controller should only broadcast "Error" if it has a problem and must notify the vehicle operator that a problem exists when it does.

B.4.58.10. *INSTALLATION CHECKLIST: REVERSE INHIBIT WITH PRESELECT REQUEST*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer "yes" to all of the following questions:

- ☐ Is the TCM calibration configured properly?
- ☐ Is TC1 *Transmission Reverse Gear Shift Inhibit Request* sent every 50 ms to DA 03, from an acceptable SA?

B.4.58.10.1. OEM Controller Responses While Sending 00b

- ☐ When the OEM controller is sending TC1 *Transmission Reverse Gear Shift Inhibit Request* = 00b and the TCM is sending *Transmission Reverse Gear Shift Inhibit Status* = 01b, does the OEM controller indicate a communication problem within 10 seconds?
- ☐ After the above communication problem is indicated, does the indication self-clear when the TCM broadcast of ETC7 *Transmission Reverse Gear Shift Inhibit Status* switches to 00b (i.e. matches the request)?
- ☐ When the OEM controller is sending TC1 *Transmission Reverse Gear Shift Inhibit Request* = 00b and the TCM stops sending *Transmission Reverse Gear Shift Inhibit Status*, does the OEM controller indicate a communication problem within 10 seconds?
- ☐ After the above communication problem is indicated, does the indication self-clear when the TCM broadcast of ETC7 *Transmission Reverse Gear Shift Inhibit Status* returns with a value of 00b (i.e. matches the request)?
- ☐ When the OEM controller is sending TC1 *Transmission Reverse Gear Shift Inhibit Request* = 00b and the TCM is sending *Transmission Reverse Gear Shift Inhibit Status* = 11b, does the OEM controller indicate a communication problem within 10 seconds?

B.4.58.10.2. OEM Controller Responses While Sending 01b

- ☐ When the OEM controller is sending TC1 *Transmission Reverse Gear Shift Inhibit Request* = 01b and the TCM is sending ETC7 *Transmission Reverse Gear Shift Inhibit Status* = 00b, does the OEM controller indicate a communication problem within 10 seconds?
- ☐ After the above communication problem is indicated, does the indication self-clear when the TCM broadcast of ETC7 *Transmission Reverse Gear Shift Inhibit Status* switches to 01b (i.e. matches the request)?
- ☐ When the OEM controller is sending TC1 *Transmission Reverse Gear Shift Inhibit Request* = 01b and the TCM stops sending *Transmission Reverse Gear Shift Inhibit Status*, does the OEM controller indicate a communication problem within 10 seconds?
- ☐ After the above communication problem is indicated, does the indication self-clear when the TCM broadcast of ETC7 *Transmission Reverse Gear Shift Inhibit Status* returns with a value of 01b (i.e. matches the request)?
- ☐ When the OEM controller is sending TC1 *Transmission Reverse Gear Shift Inhibit Request* = 01b and the TCM is sending *Transmission Reverse Gear Shift Inhibit Status* = 11b, does the OEM controller indicate a communication problem within 10 seconds?

B.4.58.10.3. OEM Controller Responses While Sending 10b and 11b

- ☐ If the OEM controller supports the 10b (Error) state of TC1 *Transmission Reverse Gear Shift Inhibit Request*, is the presence of a problem indicated to the vehicle operator whenever Error is indicated?
- ☐ If the OEM controller supports TC1 *Transmission Reverse Gear Shift Inhibit Request* state 11b (Take no action) is the presence of a problem indicated to the vehicle operator whenever 11b is sent after the TCM has detected a valid signal (00b or 01b)?

B.4.59. REVERSE WARNING INDICATOR

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.59.1. *OVERVIEW*

If a reverse warning indicator (audible alarm, back up lights, etcetera) is incorporated into a vehicle, either a dedicated wire or J1939-based TCM output can be used to trigger the warning. Dedicated wire implementation is discussed in Controls Installation Manual Section D: “Vehicle Electrical System Interface”.

B.4.59.2. *AVAILABILITY*

The J1939-based implementation is standard in all 1000 – 4000 Series applications.

B.4.59.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameter must be received from the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[30220] J1939 BROADCAST: ETC2 Transmission Selected Gear

Answer must be set to ENABLED.

B.4.59.4. *J1939 PARAMETER AND SA USE*

B.4.59.4.1. Required Support

The component controlling the Reverse Warning Indicator is required to receive ETC2 *Transmission Selected Gear* (V) from SA 03 (Transmission #1).

B.4.59.5. *OPERATOR INTERFACE*

B.4.59.5.1. Optional Support

Allison does not require any operator indications for this function; however, the vehicle OEM may opt to provide an operator indication during certain failure modes. See FAILURE MODES AND RESPONSES.

B.4.59.6. *NORMAL OPERATION*

The receiving controller may assume Reverse is being commanded any time ETC2 *Transmission Selected Gear* indicates a negative range, or the raw byte value is 124 or less.

B.4.59.7. *FAILURE MODES AND RESPONSES*

Any vehicle system response, fault logging, diagnostics or troubleshooting related to the loss of ETC2 *Transmission Selected Gear* reception is the responsibility of the controller monitoring the parameter and the vehicle OEM.

B.4.59.7.1. Loss of ETC2 Transmission Selected Gear Reception

> **WARNING:** In the event 254 (Error) or 255 (Not Available) is received, or ETC2 *Transmission Selected Gear* reception is lost, the controller monitoring *Transmission Selected Gear* and the vehicle OEM utilizing this information must have planned, accepted responses.
>
> For example, if "Reverse" was the last valid indication received, the vehicle OEM may choose to leave the reverse warning device(s) on until a new valid direction or range is received.

B.4.59.7.2. Heartbeat

Heartbeat monitoring and a Communication Failure indication are not required for this function, although vehicle OEMs may choose to implement such logic at their discretion. See USING A COMMUNICATION HEARTBEAT for recommendations on detecting and responding to J1939 communication failures.

B.4.59.8. *INSTALLATION CHECKLIST: REVERSE WARNING INDICATOR*

The vehicle OEM implementing the Reverse Warning system is responsible for all testing. Vehicle system responses to the scenarios mentioned under FAILURE MODES AND RESPONSES above should be evaluated.

B.4.60. ROAD SPEED LIMITING

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.60.1. *OVERVIEW*

During "road speed limiting" or "road speed governor" operation, throttle pedal position is no longer representative of operator input or load on the engine. If a vehicle employs a road speed limiting function, the TCM **MUST** know when road speed limiting is active so it uses the correct information for shift modulation and clutch control. This function is only available via datalink; there is no wired equivalent.

B.4.60.2. *AVAILABILITY*

This function is standard in all 1000 – 4000 Series applications.

B.4.60.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be provided to the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[18000] THROTTLE AND LOAD SOURCE

Answer must be set to PRIMARY ON-VEHICLE PROTOCOL to enable use of J1939 EEC2 *Percent Load at Current Speed* and EEC1 *Engine Torque Mode* with this function.

[28190] J1939 RECEPTION: EEC2 Road Speed Limit Status Polarity

Defines the value representing the active state of EEC2 *Road Speed Limit Status*. Answer should remain at the default AUTODETECT choice, unless the signal behavior of the engine is known. An incorrect setting may lead to poor shifting behavior.

[20251] DOWNHILL SPEED CONTROL: Road Speed Limiter Set Speed Detection

Defines which signals are used by the TCM to derive the road speed limiter set speed. The set speed is only used by DOWNHILL SPEED CONTROL.

The following options are available:

— J1939 EEC1 ENGINE TORQUE MODE OR J1939 EEC2 ROAD SPEED LIMIT STATUS; The TCM determines the set speed by monitoring EEC1 *Engine Torque Mode* or EEC2 *Road Speed Limit Status*, CCVS1 *Wheel-Based Vehicle Speed* (if available), and EEC2 *Engine Percent Load at Current Speed*.

— J1939 CCSS MAXIMUM VEHICLE SPEED LIMIT; The TCM derives the set speed from either CCSS *Maximum Vehicle Speed Limit* or CCSS *Maximum Vehicle Speed Limit (High Resolution)*. The high resolution signal is used when available.

— J1939 MVS Applied Vehicle Speed Limit; The TCM derives the set speed from MVS *Applied Vehicle Speed Limit*.

— Lowest of J1939 CCSS Maximum Vehicle Speed Limit and J1939 MVS Applied Vehicle Speed Limit; The TCM chooses the lower of the speed limits received in a) CCSS *Maximum Vehicle Speed Limit / Maximum Vehicle Speed Limit (High Resolution)* and b) MVS *Applied Vehicle Speed Limit*.

— Lowest of J1939 EEC1 Engine Torque Mode or J1939 EEC2 Road Speed Limit Status and J1939 CCSS Maximum Vehicle Speed Limit; The TCM chooses the lower of the speed limits determined by a) monitoring EEC1 *Engine Torque Mode* or EEC2 *Road Speed Limit Status*, CCVS1 *Wheel-Based Vehicle Speed* (if available), and EEC2 *Engine Percent Load at Current Speed, and b)* the value received in CCSS *Maximum Vehicle Speed Limit / Maximum Vehicle Speed Limit (High Resolution)*.

B.4.60.4. *J1939 PARAMETER AND SA USE*

B.4.60.4.1. Detection of Road Speed Limiter Operation

If road speed limiting is employed and TCM accelerator pedal information is provided via J1939, then SA 00 (Engine #1) is required to provide:

— EEC2 *Engine Percent Load at Current Speed* **AND** either:

— EEC2 *Road Speed Limit Status* **OR** EEC1 *Engine Torque Mode* state 0100b (Road Speed Governor).

If both EEC2 *Road Speed Limit Status* and EEC1 *Engine Torque Mode* are present on the J1939 network, the TCM will use *Road Speed Limit Status* for this function and ignore state 0100b (Road Speed Governor) from *Engine Torque Mode*.

NOTE: EEC2 *Road Speed Limit Status* is the preferred source for road speed limit indications. New J1939 implementations are encouraged to support this parameter, as it is a more robust indication of road speed governor operation.

While SAE J1939 defines *Road Speed Limit Status* 00b as the "Active" state, this unorthodox definition has led to incorrect implementations in some vehicles. As a result, the TCM has auto-detection logic to determine the state combination used in a given vehicle:

— 00b = RSL active and 01b = RSL inactive, or
— 01b = RSL active and 00b = RSL inactive.

The parameter state is evaluated when the following criteria are met:

— A *Road Speed Limit Status* value other than 10b (Error) or 11b (Not Available) is being received.

— Engine is running, and below a calibrated speed (typically 1000 rpm),

— A forward range is attained,

— Transmission output shaft speed is below a calibrated threshold (typically 60 rpm), and

— A throttle signal is being received, and is below a calibrated level (typically 3.5%).

Until the evaluation criteria are met, the TCM will utilize the state definitions from the last key switch cycle where the criteria were met. If the active state cannot be determined, EEC2 *Road Speed Limit Status* is not used by the TCM in any algorithms.

B.4.60.4.2. Detection of the Road Speed Limiter Set Speed

NOTE: Detection of the road speed limiter set speed is always in addition to the detection of basic road speed limiter operation. The requirements for road speed limiter status indication as described in DETECTION OF ROAD SPEED LIMITER OPERATION continue to apply.

Detection of the road speed limiter set speed for use by DOWNHILL SPEED CONTROL requires the J1939 network to provide one or more additional signals, dependent on the setting of **[20251] DOWNHILL SPEED CONTROL: Road Speed Limiter Set Speed Detection**:

CCSS Maximum Vehicle Speed Limit or *CCSS Maximum Vehicle Speed Limit (High Resolution)* from one of the following SAs, in order of TCM preference:

1. SA 17 (Cruise Control) (V)
2. SA 49 (Cab Controller)
3. SA 39 (Management Computer #1)
4. SA 33 (Body Controller)
5. SA 00 (Engine #1)

MVS Applied Vehicle Speed Limit from one of the following SAs, in order of TCM preference:

1. SA 17 (Cruise Control) (V)
2. SA 49 (Cab Controller)
3. SA 39 (Management Computer #1)
4. SA 33 (Body Controller)
5. SA 00 (Engine #1)

If available, the TCM may also utilize CCVS1 *Wheel-Based Vehicle Speed* from one of the following SAs, in order of TCM preference:

1. SA 17 (Cruise Control) (V)
2. SA 33 (Body Controller)
3. SA 00 (Engine #1)

B.4.60.5. *NORMAL OPERATION*

When the input indicates active road speed limiting, the TCM substitutes EEC2 *Percent Load at Current Speed* for its accelerator pedal input and records the road speed limiter set speed for use by the Downhill Speed Control functions.

B.4.60.6. *TCM FAILURE MODES & RESPONSES*

If the Road Speed Limiting input is lost during Road Speed Limiting operation, the TCM assumes Road Speed Limiting is active until vehicle speed drops by a certain amount. Subsequent shifts may be harsh.

B.4.60.7. *INSTALLATION CHECKLIST: ROAD SPEED LIMITING*

Allison Customer Integration Engineering will review new J1939-based implementations.

B.4.61. SECONDARY MODE INDICATOR

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.61.1. *OVERVIEW*

This function provides indication that Secondary Mode is active, and can be accomplished by GPO function N and / or J1939 as discussed here. GPO implementation is discussed in Allison 6th Generation Controls Installation Manual Section E: "Using Input / Output (I/O) Functions, Packages, & Groups".

This function may be used in conjunction with (but is not restricted to) functions SHIFT SELECTOR, NON-ALLISON BASIC, or SHIFT SELECTOR, NON-ALLISON STANDARD.

B.4.61.2. *AVAILABILITY*

The J1939-based implementation is standard in all 1000 – 4000 Series applications.

B.4.61.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be received from the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[26230] SECONDARY MODE INDICATOR

Set to BOTH GPO N AND J1939 PARAMETERS or ONLY J1939 ETC7 TRANSMISSION MODE 1 AND 2 INDICATOR in order to use the J1939 function.

B.4.61.4. *VEPS / ACCT TRIMS*

[26232] SECONDARY MODE INDICATOR: Indicate Automatic Mode Selection

This trim impacts ETC7 parameter content during DSS operation, and is only available in special applications. Contact your Allison Transmission Customer Integration Engineer for more information.

B.4.61.5. *J1939 PARAMETER AND SA USE*

Parameters marked (V) can be enabled / disabled via VEPS.

B.4.61.5.1. Required Support

The component controlling the Secondary Mode Indicator <u>is required</u> to receive [ETC7 *Transmission Mode 2 Indicator*] from SA 03 (Transmission #1).

B.4.61.5.2. Optional Support

In addition, displays have the option to request [PGN 64839 – Transmission Mode Labels] (V) to obtain text strings identifying the functionality associated with Primary and Secondary Mode operation.

B.4.61.6. *OPERATOR INTERFACE*

There are no specific physical requirements for Secondary Mode Indicator implementation. It may be a lamp or alarm, for example.

B.4.61.6.1. Bulb Checks

The device that physically actuates the indicator is responsible for performing bulb and / or display checks at the beginning of each key switch cycle.

Allison recommends lamps or indicators remain on for 2 seconds during the check. Slightly longer or shorter time periods are acceptable.

NOTE: The TCM does <u>not</u> send any J1939-based "bulb check" when powered up; ETC7 *Transmission Mode 2 Indicator* is set to 00b.

B.4.61.7. *NORMAL OPERATION*

When ETC7 *Transmission Mode 2 Indicator* = 01b (active), the transmission is operating in Secondary Mode. Depending on the vocational package in use, this may indicate "Economy" mode, etc.

When *Transmission Mode 2 Indicator* = 00b (inactive), the transmission is not operating in Secondary shift mode.

DSS Interaction

In most applications, the Transmission Mode Indicator parameters only reflect secondary mode status changes initiated via the designated discrete Secondary Mode Input. This establishes a direct correlation between the operator or other discrete request and the indicator.

If **[26232] SECONDARY MODE INDICATOR: Indicate Automatic Mode Selection** is set to ENABLED, the Transmission Mode Parameters reflect true secondary mode status regardless of how it is set. In this case, if **[25290] SECONDARY MODE INPUT** is set to DISABLED, the Transmission Mode parameters become a direct indication of DSS activity.

B.4.61.8. *SECONDARY MODE INDICATOR FAILURE MODES AND RESPONSES*

Any vehicle system response, fault logging, diagnostics or troubleshooting related to the loss of *Transmission Mode 2 Indicator* reception is the responsibility of the controller monitoring the parameter and the vehicle OEM.

B.4.61.8.1. Optional Heartbeat

Heartbeat monitoring and a Communication Failure indication are not required for this function, although vehicle OEMs may choose to implement such logic at their discretion. See [USING A COMMUNICATION HEARTBEAT] for recommendations on detecting and responding to J1939 communication failures.

B.4.61.9. *INSTALLATION CHECKLIST: SECONDARY MODE INDICATOR*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer "yes" to all of the questions in the following sequence:

B.4.61.9.1. General

☐ Is the TCM calibration configured properly?

B.4.61.9.2. Indicator Test

1. Monitor ETC7 *Transmission Mode 2 Indicator* from SA 03 in the Allison DOC® Data Bus Viewer.
2. Activate the Secondary Mode Input.
3. Does the Secondary Mode Indicator activate when *Transmission Mode 2 Indicator* = 01b?
4. Deactivate the Secondary Mode Input.
5. Does the Secondary Mode Indicator deactivate when *Transmission Mode 2 Indicator* = 00b?

B.4.62. SECONDARY MODE INPUT

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.62.1. *OVERVIEW*

This function triggers transmission Secondary Mode operation, and can be accomplished by the MODE button, GPI A, or J1939. The MODE button and GPI implementations are discussed in Allison 6th Generation Controls Installation Manual Section E: "Using Input / Output (I/O) Functions, Packages, & Groups".

This function may be used in conjunction with (but is not restricted to) function SHIFT SELECTOR, NON-ALLISON BASIC, or SHIFT SELECTOR, NON-ALLISON STANDARD.

B.4.62.2. *AVAILABILITY*

The J1939-based implementation is optional in 1000 – 4000 Series applications.

B.4.62.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameter is only received on the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[25290] SECONDARY MODE INPUT

Set answer to J1939 TC1 TRANSMISSION MODE 2 to enable TCM parameter reception.

B.4.62.3.1. VEPS / ACCT Trims

The following trims will impact function operation:

- **[17030] SECONDARY MODE: Gears**
- [17050] SECONDARY MODE: Shift Schedule
- [17060] SECONDARY MODE: Shift Speed
- [17040] SECONDARY MODE: Starting Range Override

B.4.62.4. *J1939 PARAMETER AND SA USE*

SAs marked (V) may be set to an OEM-specified value via VEPS. See AUTO-DETECTION for SA selection details.

B.4.62.4.1. Required Support

The J1939 network is required to provide TC1 *Transmission Mode 2* every 50 ms to DA 03 (Transmission #1) from one of the following SAs, in order of TCM preference:

1. SA 49 (Cab Controller) (V)
2. SA 05 (Shift Console, Primary) (1)
3. SA 33 (Body Controller)
4. SA 00 (Engine #1)

(1) SA may only be used if the application does not employ an Allison J1939-based selector.

B.4.62.5. *OTHER REQUIREMENTS / RESTRICTIONS*

B.4.62.5.1. One Input Per Application

Only one secondary mode input is allowed in a given application. As such, the J1939-based Secondary Mode Input function may not be used if either of these VEPS options is set to ENABLED:

- **SHIFT SELECTOR TRANSITION AND SECONDARY SHIFT SCHEDULE INPUT**
- **SHIFT SELECTOR TRANSITION AND OIL FIELD PUMPING INPUT**

B.4.62.5.2. Unused TC1 Parameter Settings

SAE J1939 datalink etiquette dictates that any unsupported broadcast parameters be set to "Not Available".

TC1 messages that are only used for J1939-based Secondary Mode Input are required to set *Transmission Requested Gear* to 255 (Not Available). Failure to do so may result in unintended activation of other range-based functions such as Preselect Request or Range Selection Mode.

B.4.62.5.3. 3000/4000 Series Dual Selector System – Both Customer-Supplied

When a customer-supplied dual selector system is in use and TC1 *Transmission Mode 2* is sent by the selector system (not from SA 33), the TCM will only respond to TC1 *Transmission Mode 2* from SA 05 (Shift Console, Primary).

When the secondary selector is active, the primary selector is required to maintain TC1 *Transmission Mode 2* broadcast in order to control the Secondary Mode Input function. The TCM will not respond to TC1 *Transmission Mode 2* sent from SA 06 (Shift Console, Secondary).

If a vehicle OEM desires the ability to control Secondary Mode Input from both selector stations, the TC1 *Transmission Mode 4* (MODE button) interface must be used as described in SHIFT

SELECTOR, NON-ALLISON BASIC, or SHIFT SELECTOR, NON-ALLISON STANDARD.

B.4.62.5.4. 3000/4000 Series Dual Selector System – Mixed

A "mixed" dual selector system employs one Allison J1939-based selector and one Customer-supplied selector.

In these applications, if the Allison selector has secondary mode assigned to the MODE button, **AND** a Secondary Mode Input is desired from the customer-supplied selector, then the customer-supplied selector is required to implement the Secondary Mode Input via TC1 Transmission Mode 4, just like the Allison selector. The customer-supplied selector CANNOT use TC1 Transmission Mode 2. See function SHIFT SELECTOR, NON-ALLISON BASIC, or SHIFT SELECTOR, NON-ALLISON STANDARD.

B.4.62.6. *NORMAL OPERATION*

When *Transmission Mode 2* = 01b (Enable), the transmission will operate in Secondary Mode. Depending on the vocational package in use, this may indicate "Economy" mode, etc.

When *Transmission Mode 2* = 00b (Disable), primary mode operation resumes.

B.4.62.7. *TCM FAILURE MODES & RESPONSES*

If *Transmission Mode 2* reception is lost or indicates 10b (Error) or 11b (Not Available), the transmission will fail to the active mode. E.g. if reception is lost while secondary mode is active, the transmission will remain in secondary mode until another valid *Transmission Mode 2* value is received, or the key switch is cycled and the TCM reset.

Failure to receive *Transmission Mode 2* may be the result of bus loading, wiring integrity failures, electrical noise, or improper function implementation. Vehicle OEMs should consider such failures during their design process.

B.4.62.8. *INSTALLATION CHECKLIST: SECONDARY MODE INPUT*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer "yes" to the following questions:

- ☐ Is the TCM calibration configured properly?
- ☐ Is TC1 sent every 50 ms to the proper DA, from an acceptable SA?
- ☐ In applications using Allison shift selectors, is TC1 *Transmission Mode 2* being sent from a source address other than SA 05?
- ☐ In dual selector applications using customer-supplied shift selectors, is TC1 *Transmission Mode 2* continuously broadcast from SA 05, even when the secondary selector (SA 06) is active?
- ☐ When monitored with the Allison DOC® Data Bus Viewer, does *Transmission Mode 2 Indicator* goes to 01b when the secondary mode input is activated?

B.4.63. SERVICE BRAKE STATUS INPUT

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.63.1. *OVERVIEW*

The Service Brake Status input tells the TCM if the operator has depressed or released the brake pedal. This function can be accomplished either through GPI AA (SERVICE BRAKE STATUS) or the J1939 datalink. GPI implementation is discussed in Allison 6th Generation Controls Installation Manual Section E: "Using Input / Output (I/O) Functions, Packages, & Groups".

B.4.63.2. *AVAILABILITY*

The J1939-based implementations are optional in 1000 – 4000 Series applications.

B.4.63.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be provided to the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[25300] SERVICE BRAKE STATUS INPUT

Set answer to J1939 CCVS1 BRAKE SWITCH, J1939 EBC1 EBS BRAKE SWITCH, or J1939 EBC1 BRAKE PEDAL POSITION to enable TCM parameter reception.

[25305] SERVICE BRAKE STATUS INPUT: Brake Pedal Position Activation Level
[25307] SERVICE BRAKE STATUS INPUT: Brake Pedal Position Deactivation Level

Answers to these two questions define the brake pedal position percentages at which the Service Brake Status Input function will activate / deactivate for vehicles configured with SERVICE BRAKE STATUS INPUT = J1939 EBC1 BRAKE PEDAL POSITION.
The activation level value is required to be higher than the deactivation level value.

B.4.63.4. *J1939 PARAMETER AND SA USE*

SAs marked (V) may be set to an OEM-specified value via VEPS. See AUTO-DETECTION for SA selection details.

B.4.63.4.1. Required Support

The J1939 network is required to provide one of the following parameters, as specified through VEPS:

CCVS1 *Brake Switch* from **one** of the following SAs, in order of TCM preference:

1. SA 232 (Forward Road Image Processor) (V)
2. SA 23 (Instrument Cluster #1)
3. SA 49 (Cab Control – Primary)
4. SA 17 (Cruise Control)
5. SA 33 (Body Controller)
6. SA 00 (Engine #1)

OR

EBC1 EBS Brake Switch from SA 11 (Brakes – System Controller) (V)

OR

EBC1 Brake Pedal Position from **one** of the following SAs, in order of TCM preference:

1. SA 45 (Endurance Braking System) (V)
2. SA 11 (Brakes – System Controller)

B.4.63.5. *OTHER REQUIREMENTS / RESTRICTIONS*

Not all functions incorporating Service Brake Status may substitute a J1939-based input for the GPI:

Allison GPI Function	Allowable Service Brake Status Inputs
GPI E AUXILIARY FUNCTION RANGE INHIBIT – SINGLE INPUT (AFRI)	GPI or J1939
GPI W DIRECTION CHANGE ENABLE	GPI or J1939
GPI Z Retarder Enable (see RETARDER CONTROL)	GPI or J1939
GPI AA Service Brake Status Input	GPI or J1939
GPI AK Automatic Neutral – Dual Input with Service Brake Status	GPI or J1939
GPI AL Shift Selector Transition and Secondary Shift Schedule Input	**GPI ONLY**

Allison GPI Function	Allowable Service Brake Status Inputs
GPI CA AUTOMATIC NEUTRAL – BRAKE-BASED (BBAN) INPUT	**J1939 ONLY**
GPI CN AUTOMATIC NEUTRAL – DUAL INPUT W/ARTR	GPI or J1939
NEUTRAL AT STOP PREMIUM INPUT	GPI or J1939[1)]

1) To use EBC1 Brake Pedal Position for Neutral At Stop, the Neutral At Stop function must be configured for EBC1 Brake Pedal Position directly. Neutral at Stop cannot be configured to use Service Brake Status Input when the Service Brake Status Input function is configured to use EBC1 Brake Pedal Position.

Vehicle OEMs and body builders should be conscious of potential operational differences when substituting a J1939-based brake switch input in place of a traditional GPI.

J1939 brake switch parameters in no way indicate that any braking force is being generated; they merely indicate an operator's *desire* to apply the brakes. OEM systems designed for a brake pressure switch -- particularly where the switch threshold is intentionally high enough to ensure brake application -- may very likely react in a different fashion if a J1939-based brake switch input is substituted for the GPI and pressure switch.

B.4.63.6. *NORMAL OPERATION*

The TCM assumes the brake pedal is released when it receives a value of 00b (Brake pedal released), and depressed when it receives a value of 01b (Brake pedal depressed).

B.4.63.7. *TCM FAILURE MODES & RESPONSES*

B.4.63.7.1. TCM Fails to Receive Brake Switch Input

> **WARNING:** If the TCM fails to receive the J1939-based brake switch input, or receives 10b (Error) or 11b (Not Available), transmission operation will continue as if the brake pedal is released.

Failure to receive the brake switch parameter may be the result of bus loading, wiring integrity failures, electrical noise, or improper function implementation. Vehicle OEMs should consider such failures during their design process.

B.4.63.7.2. Brake Switch Rationality Check

The TCM continually evaluates the J1939 brake switch parameter. If several vehicle accelerations are detected while 01b (brake pedal depressed) is indicated, DTC P0703 is set and the TCM behaves as if the brake pedal is always released. The Check Trans Indicator is not activated.

B.4.63.8. *INSTALLATION CHECKLIST: SERVICE BRAKE STATUS*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer "yes" to all of the following questions:

- ☐ Is the TCM calibration configured properly?
- ☐ Is the brake switch parameter broadcast from an acceptable or OEM-specified source address?
- ☐ For discrete brake switch parameters, does the parameter indicate 00b when the pedal is released and 01b when the pedal is depressed?

B.4.64. SHIFT ACTUATOR SYSTEM WITH ALLISON SHIFT SELECTOR: 1000/2000 SERIES

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.64.1. *OVERVIEW*

NEW FOR THIS PUBLICATION
Clarified available selector VEPS choices for this function.

All Allison 1000/2000 Series 6-speed transmissions utilize a physical shift selector shaft. Traditionally, operator gear range selection is conveyed to this shaft via a mechanical linkage.

Several aftermarket suppliers produce J1939-based 1000/2000 Series shift actuator systems that utilize an Allison J1939-based shift selector. These systems, which are sourced and installed by the vehicle builder, eliminate the mechanical linkage between the shift selector and selector shaft. Systems are typically comprised of:

- An Allison 6th Generation pushbutton or Allison 5th Generation J1939-based strip **shift selector**,
- A **shift actuator**, either directly or remotely connected to the selector shaft, and
- A **shift controller** that receives shift selector and TCM information via J1939, and controls the shift actuator.

The shift controller and shift actuator may be contained in one physical device.

The TCM must be configured to support the Allison shift selector, as it populates the display with applicable range, mode, diagnostic and prognostic information.

NOTE: Integration requirements differ for shift actuator systems that use a J1939-based Non-Allison (e.g. Arens) shift selector; see SHIFT ACTUATOR SYSTEM WITH NON-ALLISON SHIFT SELECTOR: 1000/2000 SERIES.

Only TCM and shift selector communication are discussed here; for shift selector installation and operation details, see ALLISON SHIFT SELECTOR CONNECTIONS and the Allison 6th Generation Controls Installation Manual.

B.4.64.2. *AVAILABILITY*

Only available with 1000/2000 Series 6-speed transmissions. See OTHER REQUIREMENTS / RESTRICTIONS for additional hardware limitations.

B.4.64.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2
The shift controller is required to connect to the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[19000] SHIFT SELECTOR 1
Answer must match the Allison selector installed:

- 15 [ACTUATOR WITH ALLISON 5TH GEN J1939-BASED 3- OR 6-BUTTON STRIP SELECTOR]
- 16 [ACTUATOR WITH ALLISON 6TH GEN J1939-BASED STANDARD OR COMMON PUSHBUTTON SELECTOR
- 17 [ACTUATOR WITH ALLISON 6TH GEN J1939-BASED COMPACT PUSHBUTTON SELECTOR]

[19150] SHIFT SELECTOR 1: Functional Safety Interface
Answer 3 [ALLISON NOT RESPONSIBLE FOR SELECTOR SYSTEM FAILURE RESPONSES] is required.

[19020] SHIFT SELECTORS: J1939-Based Selector Connection
The default answer is CAN1; CAN2 is optional. This answer is required to align with the CAN port whose **ON-VEHICLE PROTOCOL** is set to SAE J1939 FULL FUNCTIONALITY.

[19050] SHIFT SELECTORS: Language
Default answer is ENGLISH; FRENCH is optional.

[19070] SHIFT SELECTORS: Mode Label
Default answer is "MODE". Other answers specify different text to display when the function assigned to the MODE button is active.

[17000] PRIMARY MODE: Gears
The answer is required to be set to a shift mask that does not include a "manual" position.

[24000] GENERAL PURPOSE INPUTS AND OUTPUTS (GPIO) PACKAGE
MODE button use requires a GPIO package with the MODE button assigned to the desired function. As of publication time, no 1000/2000 Series packages exist with a MODE button assignment.

[26260] TRANSMISSION SERVICE INDICATOR
To use the selector wrench icon to convey prognostic conditions, this question must be set to default answer BOTH GPO O AND J1939 ETC7 TRANSMISSION SERVICE INDICATOR or to ONLY J1939 ETC7 TRANSMISSION SERVICE INDICATOR.

B.4.64.4. *J1939 PARAMETER AND SA USE*

The shift controller is required to receive TC1 *Transmission Requested Gear* as sent from SA 05 (Shift Console, Primary) to DA 03 (Transmission #1). Required parameter state responses are listed under OPERATION REQUIREMENTS – SHIFT ACTUATOR SYSTEM.

> **NOTE:** Allison is aware that the above SA use does not conform to the SAE J1939 Recommended Practice. However, the destination address of the shift selector TC1 broadcast is not configurable.

Shift selector display control is handled by the TCM; no additional communication is necessary from the shift actuator system. The display control requires a Proprietary A (V) broadcast from the TCM (SA 03); this message may not be disabled via VEPS.

Shift controllers that require additional TCM J1939 communication should refer to the appropriate sections in this document, based on the functionality and/or communication required.

B.4.64.5. *OPERATOR INTERFACE*

Please refer to the Allison 6th Generation Controls Installation Manual for requirements.

B.4.64.6. *OTHER REQUIREMENTS / RESTRICTIONS*

B.4.64.6.1. Bus Loading and Network Message Content

> **WARNING:** Other network traffic can interfere with communication between the shift selector, TCM and shift controller. The vehicle system integrator must ensure their bus loading and message content do not interfere with communication between these devices.

B.4.64.6.2. Dual Selector Configurations

1000/2000 Series TCM software does not support a shift selector transition input, and is not capable of supporting dual Allison selectors.

B.4.64.6.3. Transmission Hardware

Use is restricted to Allison transmission models that do not have an internal park pawl. The function is not compatible with park pawl units.

B.4.64.6.4. Shift Selector Hardware

Use of an Allison 6th Generation pushbutton or Allison 5th Generation J1939-based strip shift selector is required; other Allison shift selectors are not compatible.

B.4.64.6.5. Range Inhibit Indication

The vehicle OEM is required to install a separate RANGE INHIBIT INDICATOR (RII) as in all 1000/2000 Series applications. While the shift selector SELECT digit will flash when most inhibits exist, 1000/2000 Series Converter Stall Abuse Protection activity is not conveyed in the SELECT digit.

B.4.64.6.6. Function Interactions

— An Allison selector may not be used with function RANGE SELECTION MODE.

— When an Allison selector is used, messages from SA 05 may not be used to accomplish functions:

PRESELECT REQUEST INPUT

REVERSE INHIBIT W/PRESELECT REQUEST

SECONDARY MODE INPUT

B.4.64.7. *NORMAL OPERATION – ALLISON SELECTOR*

The following Allison shift selector aspects operate as described under function SHIFT SELECTOR, ALLISON:

— TCM-Initiated Selector Calibration (TISC)

— MODE Button Interface
— MODE Label Interface
— Display Control

The TCM controls the shift selector display based on selector shaft position and selector display mode. TC1 *Transmission Requested Gear* data is only used in support of certain display modes, e.g. to maneuver up and down through DTCs while in diagnostic display mode.

Operator direction requests are always driven by selector shaft position; the TCM does not process the shift selector Direction Signal Wire (DSW) output during any communication failures.

B.4.64.8. *OPERATION REQUIREMENTS – SHIFT ACTUATOR SYSTEM*

> **WARNING:** Interpretation of Allison shift selector TC1 *Transmission Requested Gear* commands, and subsequent correct movement of the transmission selector shaft, are the responsibility of the vehicle OEM and the selector actuator system manufacturer.

The shift controller commands the shift actuator based on TC1 *Transmission Requested Gear* data received from the Allison shift selector. Shift actuator responses to the following selector commands are required:

0xDF (Reverse Selector Position)
The shift actuator shall move the selector shaft to the Reverse position.

0x7D (Neutral)
The shift actuator shall move the selector shaft to the Neutral position.

0xFC (Forward Drive Position)
The shift actuator shall move the selector shaft to the Drive position.

0xF9 (Upshift 1 gear from current position)
0xF7 (Downshift 1 gear from current position)

— The shift controller and shift actuator shall only respond to these states if the selector shaft is in a forward range position.

— Selector shaft movements in response to the 0xF9 and 0xF7 states shall be bounded by the selector shaft Drive and Low positions.

0xE0 (Position unknown and / or no buttons pressed)
The shift actuator shall not move the selector shaft.

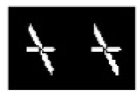
0xE1 (Press of momentary button to reselect current position)
The shift actuator shall not move the selector shaft.

B.4.64.9. *FAILURE MODES AND RESPONSES*

Communication failures may be the result of bus loading, wiring integrity failures, electrical noise, or improper function implementation. Vehicle OEMs should consider such failures during their system design process.

B.4.64.9.1. Allison Components

Communication Loss from TCM to Shift Selector



If the Allison shift selector does not receive communication from the TCM, the display will go blank for approximately 12 seconds before showing “double cat-eyes” as illustrated above.

Communication Loss from Shift Selector to TCM
If the TCM does not receive the TC1 message from the shift selector, no DTCs are logged, as the TCM does not use TC1 data for direction control. The operator will not be able to access or maneuver within the stationary display modes.

B.4.64.9.2. Shift Actuator System Requirements

Communication Loss with Allison Components

> **WARNING:** Shift actuator systems that receive Allison TCM and shift selector J1939 data are responsible for determining and executing appropriate responses in the event they lose reception of Allison shift selector and / or TCM communication.

Shift actuator system manufacturers interested in using the Allison shift selector Direction Signal Wire (DSW) output should contact Allison Customer Integration Engineering.

B.4.65. SHIFT ACTUATOR SYSTEM WITH NON-ALLISON SELECTOR: 1000/2000 SERIES

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.65.1. *OVERVIEW*

All Allison 1000/2000 Series 6-speed and certain 2000 Series 9-speed transmissions utilize a physical shift selector shaft. Traditionally, operator gear range selection is conveyed to the selector shaft via a mechanical linkage.

Several aftermarket suppliers (e.g. Arens Controls) produce J1939-based shift selector systems for the 1000/2000 Series that utilize a Non-Allison J1939-based shift selector. These systems, which are sourced and installed by the vehicle builder, eliminate the mechanical linkage between the shift selector and selector shaft. Systems are typically comprised of:

- A Non-Allison (aftermarket) J1939-based **shift selector**,
- A **shift actuator**, either directly or remotely connected to the selector shaft, and
- a **shift controller** that receives shift selector and TCM information via J1939, and controls the shift actuator.

The shift controller and shift actuator may be contained in one physical device.

The vehicle OEM assumes responsibility for all shift selector display operation, whether the display information is gathered from Allison TCM J1939 broadcast data or from actuator feedback.

NOTE: Integration requirements differ for shift actuator systems employing an Allison J1939-based shift selector; see SHIFT ACTUATOR SYSTEM W/ALLISON SELECTOR: 1000/2000 SERIES.

B.4.65.2. *AVAILABILITY*

May be used in any 1000/2000 Series 6-speed and 2000 Series 9-speed application with physical shift selector shaft.

B.4.65.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

The shift controller is required to connect to the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[19000] SHIFT SELECTOR 1

Must be set to answer 7 [ACTUATOR WITH ALLISON J1939-BASED SELECTOR].

[19020] SHIFT SELECTORS: J1939-Based Selector Connection

The default answer is CAN1; CAN2 is optional. This answer is required to align with the CAN port whose **ON-VEHICLE PROTOCOL** is set to SAE J1939 FULL FUNCTIONALITY.

[30210] J1939 BROADCAST: ETC2 RANGE PARAMETER FORMAT

Default answer 1 [DEFAULT FORMAT FOR 5TH GEN AND NEWER PRODUCTS] may need to be changed to answer 0 [4TH GEN COMPATIBLE] depending on selector system needs. Inquiries must be directed to the shift actuator system manufacturer.

[17000] PRIMARY MODE: Gears

A specific shift mask selection (e.g. 6321 or 6M1) may be required for the selector system to access the desired forward ranges. Inquiries must be directed to the shift actuator system manufacturer.

Others

TCM configuration requirements may vary among the aftermarket shift actuator systems. Vehicle OEMs will need to work with:

- their Allison Applications Engineer,
- this document,
- the appropriate Allison Programming Guide, and
- the shift actuator system manufacturer

…to ensure all shift actuator system needs are met.

B.4.65.4. *J1939 PARAMETER AND SA USE*

Message and parameter requirements vary among shift actuator system manufacturers. Vehicle OEMs will need to work with this document and the shift actuator system manufacturer to ensure selector system needs are met.

Other J1939-based Allison functions that may be of use to the shift actuator system include:

RANGE DISPLAY – REQUESTED RANGE

RANGE DISPLAY – RANGE ATTAINED

RANGE INHIBITED INDICATOR (RII)

RANGE SELECTION MODE

SECONDARY MODE INPUT

SECONDARY MODE INDICATOR

TRANSMISSION SERVICE INDICATOR

B.4.65.5. *OPERATOR INTERFACE*

Please refer to the Allison 6th Generation Controls Installation Manual for requirements.

B.4.65.6. *OTHER REQUIREMENTS / RESTRICTIONS*

B.4.65.6.1. General

The shift actuator system is required to meet design requirements for shift selectors and cable apply systems as discussed in Technical Document 177 (TD-177): Requirements for Shift Selector and Cable System.

B.4.65.6.2. Bus Loading and Network Message Content

> **WARNING:** Other network traffic can interfere with communication between the shift actuator system and the TCM. The vehicle system integrator must ensure their bus loading and message content do not interfere with communication between these devices.

B.4.65.6.3. Dual Selector Configurations

If a dual selector system is desired, it must be mechanized by the aftermarket selector system, completely upstream from the selector shaft input.

B.4.65.7. *OPERATIONAL REQUIREMENTS – SHIFT ACTUATOR SYSTEM*

> **WARNING:** The transmission selector shaft is the sole input in determining the vehicle direction desired by the operator, and the primary input in determining the forward range desired by the operator.
>
> The transmission will make every effort to accommodate the direction and range requests made via selector shaft position.
>
> The shift actuator system manufacturer and vehicle OEM assume full responsibility for their design to properly translate operator desires into selector shaft positions, during normal operation or any failure modes.

Inquiries for additional information must be directed to the shift actuator system manufacturer.

B.4.65.8. *FAILURE MODES AND RESPONSES*

Communication failures may be the result of bus loading, wiring integrity failures, electrical noise, or improper function implementation. Vehicle OEMs and shift actuator system manufacturers should consider such failures during their system design process.

B.4.65.8.1. Communication Loss

> **WARNING:** Shift actuator systems that receive Allison TCM J1939 data are responsible for determining and executing appropriate responses in the event they lose reception of TCM communication.

B.4.66. SHIFT SELECTORS, ALLISON

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.66.1. *OVERVIEW*

NEW FOR THIS PUBLICATION:

— Added VEPS trim 19075.

— Added value 0xEE in TC1 *Transmission Requested Gear* Value Table.

Allison 5th and 6th Generation shift selectors use J1939 communication to directly control 3000/4000 Series and 2000 Series 9-speed transmissions without physical selector shaft. Only TCM and selector communication are discussed here; for installation and operation details, see ALLISON SHIFT SELECTOR CONNECTIONS and the Allison 6th Generation Controls Installation Manual.

NOTE: To interface Allison J1939-based shift selectors with 1000/2000 Series transmissions with physical selector shaft, see SHIFT ACTUATOR SYSTEM W/ALLISON SHIFT SELECTOR.

B.4.66.2. *AVAILABILITY*

Allison 4th Generation selectors are not compatible with Allison 6th Generation Controls.

Allison 5th Generation pushbutton shift selectors are not compatible with Allison 6th Generation Controls.

Allison 6th Generation pushbutton shift selectors may be used with Allison 6th Generation Controls in 3000/4000 Series and 2000 Series 9-speed applications without physical selector shaft.

Allison 5th Generation bump lever and J1939-based strip shift selectors may be used with Allison 6th Generation Controls in 3000/4000 Series and 2000 Series 9-speed applications without physical selector shaft.

B.4.66.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

The CAN port used for Allison selectors must be configured to one of the J1939 options; either SAE J1939 FULL FUNCTIONALITY, or SAE J1939 LIMITED FUNCTIONALITY.

[19000] SHIFT SELECTOR 1
[19010] SHIFT SELECTOR 2

Determines the TCM interface content and enabling of diagnostics. The configuration setting is required to match the actual selector type installed.

[19020] SHIFT SELECTORS: J1939-Based Selector Connection

Default answer is CAN1; CAN2 is optional. This tells the TCM where to look for selector inputs and broadcast proprietary messages required for Allison shift selector operation. This answer has no impact if J1939-based selectors are not used.

[19050] SHIFT SELECTORS: Language

Default is ENGLISH; FRENCH is optional.

[19060] SHIFT SELECTORS: Units

Default is U.S CUSTOMARY UNITS; METRIC is optional.

[19070] SHIFT SELECTORS: Mode Label

Default is "MODE". Other answers allow OEMs to specify a more informative text string for display when the MODE button is active.

[19075] SHIFT SELECTORS: Inactive Selector Display

Default is DISPLAY – INACTIVE SELECTOR TEXT. Setting this parameter to DISPLAY – ATTAINED RANGE will show the currently attained range on the display of the inactive selector.

[18032] ON-VEHICLE PROTOCOL: REQUESTED RANGE DISPLAY

In 3000/4000 Series applications, default answer NUMERIC FOR MAX RANGE may be changed to D FOR MAX RANGE to convey the letter D instead of the numeric requested range value in ETC2 *Transmission Requested Range* and on the Allison shift selector display. Preselects will still be reflected as numeric values.

[19150] SHIFT SELECTOR 1: Functional Safety Interface
[19160] SHIFT SELECTOR 2: Functional Safety Interface

Must be set to an answer other than 0 – NONE. See EM-101 ALLISON TRANSMISSION FUNCTIONAL

SAFETY MANUAL FOR 6TH GENERATION CONTROLS for details.

[26260] TRANSMISSION SERVICE INDICATOR

Answer must be set to BOTH GPO O AND J1939 ETC7 TRANSMISSION SERVICE INDICATOR or ONLY J1939 ETC7 TRANSMISSION SERVICE INDICATOR in order to control the wrench icon on Allison selectors.

[30230] J1939 BROADCAST: ETC7 Active Shift Console Indicator

Answer must be set to ENABLED for dual selector applications.

B.4.66.3.1. Dual Selector Configuration Support

Any combination of Allison J1939-based shift selector supported by Allison 6th Generation Controls can be installed (certain Allison 5th Gen, any Allison 6th Gen), as long as both are connected to the same TCM CAN port designated by **[19020] SHIFT SELECTORS: J1939-Based Selector Connection**.

For mixed-selector applications (one Allison selector, one Non-Allison selector), see SHIFT SELECTOR, NON-ALLISON BASIC, or SHIFT SELECTOR, NON-ALLISON STANDARD.

B.4.66.4. *J1939 PARAMETER AND SA USE*

There are no vehicle OEM J1939 messaging requirements for Allison selector operation. Everything is handled by the selector(s) and TCM. Parameter and SA usage are listed here for reference. Allison selectors may broadcast:

— TC1 *Transmission Requested Gear*

— TC1 *Transmission Mode 3* (1)

— TC1 *Transmission Mode 4* (2)

— TC1 *Trans. Shift Selector Display Mode Switch* (3)

— PGN 60928 – Address Claimed / Cannot Claim

— Proprietary A

— SOFT *Software Identification*

— J1939-76 Safety Header Messages (4)

(1) Only Allison 5th Gen Bump Lever selectors.

(2) Only Allison selectors with a MODE button.

(3) Only Allison selectors equipped with a display.

(4) Only Allison 6th Gen selectors.

Primary and secondary (when present) selectors broadcast from SA 05 (Shift Console, Primary) and SA 06 (Shift Console, Secondary) respectively. SAs are set via a jumper wire in the vehicle OEM wiring harness. TC1 broadcasts are directed to DA 03.

To prevent excessive bus loading in dual selector applications, the inactive selector slows its TC1 broadcast to 500 ms. The 50 ms broadcast rate resumes when the selector is made active.

All Allison selectors receive the following items from the TCM (SA 03), and items marked (V) may not be disabled via VEPS if an Allison selector is installed:

— Request (PGN)

— Proprietary A (5) (V)

— ETC7 *Active Shift Console Indicator* (V)

— ETC7 *Transmission Service Indicator* (V)

— J1939-76 Safety Header Messages (6)

(5) Only broadcast by TCM when at least one Allison selector is installed.

(6) Only Allison 6th Gen selectors.

B.4.66.5. *OPERATOR INTERFACE*

Please refer to the Allison 6th Generation Controls Installation manual for requirements.

B.4.66.6. *OTHER REQUIREMENTS / RESTRICTIONS*

B.4.66.6.1. Bus Loading and Network Message Content

WARNING: Other network traffic can interfere with communication between the shift selector(s) and TCM. The vehicle system integrator must ensure their bus loading and message content do not interfere with communication between the TCM and shift selector(s).

B.4.66.7. *TCM-INITIATED SELECTOR CALIBRATION (TISC)*

Depending on VEPS options and selector features, the TCM may need to adjust the selector calibration. The TCM will initiate a calibration (TISC) event if deemed necessary. Such events normally last only a few seconds, and normal selector operation resumes afterwards.

Allison 5th Gen Bump Lever selectors display “CONFIG START” prior to the TISC event, and their displays go blank during re-calibration. Allison 6th Gen pushbutton selectors display “UPDATING SELECTOR” during re-calibration, and reboot once complete.

TISC events only happen at vehicle assembly time, when a selector is replaced, or if certain selector-related features are enabled, disabled or modified through Allison DOC® after the vehicle is in service.

B.4.66.8. *TCM / SELECTOR HANDSHAKE*

When a TCM is configured to use an Allison selector, the correct Allison selector must be installed before shifts to range can be made.

The TCM confirms selector compatibility on every key cycle via a "handshake" process. If an incorrect selector is detected, a DTC is set and the TCM will ignore range requests from that selector.

Prior to the initial handshake (e.g. at vehicle assembly time, or when the TCM is replaced or reprogrammed), the TCM will ignore range requests from a selector. This handshake may take several seconds to complete. Normal selector operation ensues once compatibility is confirmed, and there are no delays on subsequent key cycles.

B.4.66.9. *NORMAL OPERATION – SINGLE SELECTOR*

B.4.66.9.1. Range Selection

All selectors broadcasts TC1 at a 50 ms periodic rate. The TCM uses TC1 *Transmission Requested Gear* to determine the vehicle operator's desired range. The table at the end of this function section lists *Transmission Requested Gear* values that may be sent by Allison selectors.

In Allison 6th Gen selector applications, the integrity of the TC1 content is further assured by use of the SAE J1939-76 Functional Safety Communication Protocol.

In applications with Allison Bump Lever selectors, the TCM also receives TC1 *Transmission Mode 3.* Parameter transitions from 00b (Disable) to 01b (Enable) convey operator desire to toggle between R1 and R2 in applications equipped with the 2nd Reverse feature.

B.4.66.9.2. MODE Button Interface

TC1 *Transmission Mode 4* is a manufacturer-defined parameter. For Allison selectors, it conveys the state of the momentary-contact MODE button input. When the button is depressed, 01b (Enable) is sent; when released, 00b (Disable) is sent. Depending on TCM calibration, this parameter may be tied to one of many TCM input options, including Secondary Mode Input.

B.4.66.9.3. MODE Label Interface

5th and 6th Gen selectors do not have a dedicated MODE light. Display of the default "MODE" text or the MODE label text string specified via VEPS is accomplished through Proprietary A communication.

B.4.66.9.4. Display Control

All information displayed is conveyed to the selector via a TCM Proprietary A message. In Allison 6th Gen selector applications, the integrity of the display content is further assured by use of the SAE J1939-76 Functional Safety Communication Protocol.

While the vehicle is stationary, toggling of TC1 *Transmission Shift Selector Display Mode Switch* cycles the TCM through a series of screens that convey DTCs and possibly more, such as oil level or prognostic data.

B.4.66.10. *NORMAL OPERATION – DUAL SELECTORS (3000/4000 SERIES ONLY)*

Range selection, MODE button, and display operation are the same as single selector applications. Differences in dual selector systems include:

- The selectors use PGN 60928 Address Claimed broadcasts to ensure correct jumper wire installation on the secondary shift selector.
- A "Shift Selector Transition" input function tells the TCM which selector is active; TCM broadcast of *Active Shift Console Indicator* tells the selectors which is active.
- When an Allison selector is inactive, its TC1 broadcast is slowed to 500 ms to minimize bus loading. No range information is displayed on the inactive selector.

B.4.66.11. *BUS LOADING*

Connecting selector(s) to a separate CAN port with **ON-VEHICLE PROTOCOL: CANx** = SAE J1939 LIMITED FUNCTIONALITY can slightly reduce bus loading on the network attached to the TCM CAN port with **ON-VEHICLE PROTOCOL: CANx** = SAE J1939 FULL FUNCTIONALITY.

B.4.66.12. *FAILURE MODES AND RESPONSES*

Failure of the TCM to receive selector information may be the result of bus loading, wiring integrity failures, electrical noise, or improper function implementation. Vehicle OEMs should consider such failures during their system design process.

Incompatible Selector

See TCM / SELECTOR HANDSHAKE.

Communication Loss – Allison 5th Gen Selectors

If J1939 communication is lost between the TCM and J1939-based shift selector(s), limited functionality is maintained through the Direction Signal Wire. DTCs are logged and "Check Trans" is indicated.

The Direction Signal Wire permits the operator to select the operating direction (Drive, Neutral, or Reverse) in order that the vehicle may be driven to a service location. Operator requests for range upshifts and downshifts will not be recognized and the selector display will not convey any range information.

Communication Loss – Allison 6th Gen Selectors

The Functional Safety Interface option determines TCM response. Contact your Allison representative for details.

Direction Signal Wire Failure – Allison 5th Gen Selectors

Allison 5th Gen selectors use the Direction Signal Wire solely for limp-home capability. If this TCM input has an issue, a DTC is set but selector and transmission operation are not affected.

Direction Signal Wire Failure – Allison 6th Gen Selectors

The Functional Safety Interface option determines TCM response. Contact your Allison representative for details.

B.4.66.13. *ALLISON SHIFT SELECTOR TC1 TRANSMISSION REQUESTED GEAR BROADCAST VALUES*

Raw Byte Value (Hexadecimal)	**Raw Byte Value** (Decimal)	**Scaled Value, or PSI**	**Parameter Specific Indicator (PSI) or Scaled Value Meaning**	**6G Pushbutton**	**5G Bump Lever**	**5G 3-Button Strip**	**5G 6-Button Strip**
0xFD	253	PSI	Hold current gear	--	●	--	--
0xFC	252	PSI	Forward Drive Position	●	●	●	●
0xFA	250	PSI	Forward Low Position	--	●	--	--
0xF9	249	PSI	Upshift 1 gear from current position	●	●	--	--
0xF7	247	PSI	Downshift 1 gear from current position	●	●	--	--
0xEC	236	PSI	Between two forward shift selector positions	--	●	--	--
0xE4	228	PSI	Between “Drive” & “Neutral” shift selector positions	--	●	--	--
0xE3	227	PSI	Between “Neutral” & “Reverse” shift selector positions	--	●	--	--
0xE0	224	PSI	Position unknown and / or no buttons pressed	●	--	●	●
0xE1	225	PSI	Press of momentary button to reselect current position	●	--	--	--
0xEE	238	PSI	Between two shift selector positions	●	--	--	--
0xDF	223	PSI	Reverse Selector Position	●	●	●	●
0x80	128	3	3rd	--	--	--	●
0x7F	127	2	2nd	--	--	--	●
0x7E	126	1	1st	--	--	--	●
0x7D	125	0	Neutral	●	●	●	●

B.4.67. SHIFT SELECTORS, NON-ALLISON BASIC

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.67.1. *OVERVIEW*

This function allows vehicle OEMs to develop their own 3000/4000 Series shift selector through use of standard, public J1939 communication.

Non-Allison Basic selectors must meet the requirements defined in Allison TES-616 (environmental requirements) and TES-646 (implementation requirements). This section of the 6th Gen Datalink Communications document only contains configuration information.

A signed agreement must be on file with Allison prior to receiving this document and commencing selector development. Contact your Allison Customer Integration Engineer for details.

B.4.67.2. *AVAILABILITY*

Non-Allison Basic shift selectors may be used in any 3000/4000 Series applications; however, compatible TCM calibrations can only be generated after the signed agreement is on file with Allison.

Non-Allison selectors for use with Allison 4th Gen controls developed per TES-340 that utilize public J1939 messages may be used as Non-Allison Basic selectors with Allison 6th Gen Controls.

B.4.67.3. *CONFIGURATION (VEPS / ACCT)*

[17040] SECONDARY MODE: Starting Range Override

Only applicable to 7-speed OFS models. Answer may be set to a range value (i.e. functionality enabled) as long as certain communication requirements are met; see OTHER REQUIREMENTS / RESTRICTIONS.

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Non-Allison Basic shift selectors using public J1939 data must be connected to the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[19000] SHIFT SELECTOR 1
[19010] SHIFT SELECTOR 2

Must be answered NON-ALLISON J1939-BASED - BASIC as applicable.

> **NOTE:** Answer NON-ALLISON J1939-BASED – BASIC is only available to vehicle OEMs who have contacted their Allison Customer Integration Engineer and have passed the CIE review process.

[19020] SHIFT SELECTORS: J1939-Based Selector Connection

Default is CAN1; CAN2 is optional. This answer is required to align with the CAN port where **ON-VEHICLE PROTOCOL** is set to SAE J1939, FULL FUNCTIONALITY.

[19150] SHIFT SELECTOR 1: Functional Safety Interface
[19160] SHIFT SELECTOR 2: Functional Safety Interface

Must be set to answer 0 [NONE].

[24000] GENERAL PURPOSE INPUTS AND OUTPUTS (GPIO) PACKAGE

If the customer-supplied selector makes use of the optional MODE button interface based on TC1 *Transmission Mode 4*, (1) a GPIO package must be selected that has the MODE button assigned to the desired function, and (2) the corresponding VEPS Function Input question must be set to an answer which points to using the MODE button.

[30210] J1939 BROADCAST: ETC2 RANGE PARAMETER FORMAT

Default answer is 1 [DEFAULT FORMAT FOR 5TH GEN AND NEWER PRODUCTS] but may be set to answer 0 [4TH GEN COMPATIBLE] for customer-supplied selectors that require the Allison 4th Generation Controls format. This option setting does not impact Allison Proprietary A data.

[30230] J1939 BROADCAST: ETC7 Active Shift Console Indicator

Default answer is ENABLED. May be switched to DISABLED if no Allison selectors are installed.

[30255] J1939 BROADCAST: ETC7 Transmission Mode 4 Indicator

Default answer is ENABLED. May be switched to DISABLED if (1) no Allison shift selectors are in use, and (2) the customer-supplied selector does not use the optional MODE button interface based on TC1 *Transmission Mode 4*.

[30260] J1939 BROADCAST: ETC7 Transmission Requested Gear Feedback

Default answer is ENABLED. May be switched to DISABLED if not used.

[30430] J1939 BROADCAST: TCFG

Default answer is ENABLED. May be set to DISABLED if none of its parameters are used.

B.4.67.4. *OTHER REQUIREMENTS / RESTRICTIONS*

B.4.67.4.1. Direction Signal Wire

The TCM Direction Signal Wire input and diagnostics are disabled for the Non-Allison Basic shift selector.

B.4.67.4.2. 3000/4000 Series Dual Selector Systems

Use of a Shift Selector Transition input is required for all dual selector applications.

B.4.67.4.3. Secondary Mode Inputs in a Mixed Dual Selector System

In mixed selector applications, if the Allison selector has secondary mode assigned to the MODE button, **AND** a Secondary Mode Input is desired from the customer-supplied selector, then the Non-Allison selector is required to implement the Secondary Mode Input using TC1 *Transmission Mode 4*, just like the Allison selector.

B.4.67.4.4. SECONDARY MODE: Starting Range Override

When this VEPS / ACCT option is configured to any value other than maximum starting range, the Non-Allison shift selector is required to use a momentary pushbutton-style communication interface.

B.4.67.5. *FAILURE MODES AND RESPONSES*

B.4.67.5.1. Incorrect TCM Calibration

If the TCM calibration is not configured for Non-Allison Basic selector use, the TCM will log DTC(s) and activate the Check Trans Indicator. Transmission operation may be restricted. The DTCs are:

- U0304 (Gear Shift Module 1 Incompatible)
- U0333 (Gear Shift Module 2 Incompatible)

B.4.67.6. *TESTING*

The vehicle OEM implementing the shift selector is responsible for testing that the Non-Allison Basic selector system design meets all criteria in TES-616 and TES-646.

B.4.68. SHIFT SELECTORS, NON-ALLISON DIRECT SELECT

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.68.1. *OVERVIEW*

This function allows vehicle OEMs to develop their own 3000/4000 Series shift selector through use of standard, public J1939 communication.

Non-Allison Direct Select selectors must meet the requirements defined in Allison TES-616 (environmental requirements) and TES-752 (implementation requirements). This section of the 6th Gen Datalink Communications document only contains configuration information.

A signed agreement must be on file with Allison prior to receiving this document and commencing selector development. Contact your Allison Customer Integration Engineer for details.

B.4.68.2. *AVAILABILITY*

Non-Allison Direct Select shift selectors may be used in any 3000/4000 Series applications that use an OFS POWER SHIFT shift schedule; however, compatible TCM calibrations can only be generated after the signed agreement is on file with Allison.

B.4.68.3. *CONFIGURATION (VEPS / ACCT)*

[17050] SECONDARY MODE: Shift Schedule

Must be set to OFS POWER SHIFT.

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Non-Allison Direct Select shift selectors using public J1939 data must be connected to the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[19000] SHIFT SELECTOR 1
[19010] SHIFT SELECTOR 2

Must be answered NON-ALLISON J1939-BASED – DIRECT SELECT as applicable. See OTHER REQUIREMENTS / RESTRICTIONS.

NOTE: Answer NON-ALLISON J1939-BASED – DIRECT SELECT is only available to vehicle OEMs who have contacted their Allison Customer Integration Engineer and have passed the CIE review process.

[19020] SHIFT SELECTORS: J1939-Based Selector Connection

Default is CAN1; CAN2 is optional. This answer is required to align with the CAN port where **ON-VEHICLE PROTOCOL** is set to SAE J1939, FULL FUNCTIONALITY.

[19050] SHIFT SELECTOR: Language

Default is ENGLISH. This answer affects the language sent in the TML *Transmission Mode Label, Mode 4* broadcast.

[15000] PROGNOSTICS

Must be DEFAULTED ON for broadcast of any prognostics-related DM1 indications, as well as TRF2 *Transmission Oil Filter Restriction Switch* and TRF2 *Transmission Oil Life Remaining* broadcasts.

[15090] PROGNOSTICS: Allow Reset via J1939 Command

Answer must be set to YES.

[24000] GENERAL PURPOSE INPUTS AND OUTPUTS (GPIO) PACKAGE

If the customer-supplied selector makes use of the optional MODE button interface based on TC1 *Transmission Mode 4*, (1) a GPIO package must be selected that has the MODE button assigned to the desired function, and (2) the corresponding VEPS Function Input question must be set to an answer which points to using the MODE button.

[30210] J1939 BROADCAST: ETC2 RANGE PARAMETER FORMAT

Must be set to default answer 1 [DEFAULT FORMAT FOR 5TH GEN AND NEWER PRODUCTS].

[30230] J1939 BROADCAST: ETC7 Active Shift Console Indicator

Default answer is ENABLED. May be switched to DISABLED if dual selectors are not installed.

[30255] J1939 BROADCAST: ETC7 Transmission Mode 4 Indicator

Must remain set to default answer of ENABLED.

[30260] J1939 BROADCAST: ETC7 Transmission Requested Gear Feedback

Default answer is ENABLED. May be switched to DISABLED if not used.

[30430] J1939 BROADCAST: TCFG

Default answer is ENABLED. May be switch to DISABLED if none of its parameters are used.

[30470] J1939 BROADCAST: TML Transmission Mode Label – Mode 4

Answer must be set to ENABLED for MODE button label to be broadcast.

[30500] J1939 BROADCAST: TRF1 Transmission Oil Level 1 High / Low – Enable Continuous Broadcast

Answer must be set to CONTINUOUS BROADCAST ENABLED.

B.4.68.4. *OTHER REQUIREMENTS / RESTRICTIONS*

B.4.68.4.1. Direction Signal Wire

The TCM Direction Signal Wire input is optional when a Non-Allison Direct Select selector is specified.

B.4.68.4.2. 3000/4000 Series Dual Selector Systems

Use of a Shift Selector Transition input is required for all dual selector applications.

B.4.68.5. *FAILURE MODES AND RESPONSES*

B.4.68.5.1. Incorrect TCM Calibration

If the TCM calibration is not configured for Non-Allison Direct Select selector use, the TCM will log DTC(s) and activate the Check Trans Indicator. Transmission operation may be restricted. The DTCs are:

- U0304 (Gear Shift Module 1 Incompatible)
- U0333 (Gear Shift Module 2 Incompatible)

B.4.68.6. *TESTING*

The vehicle OEM implementing the shift selector is responsible for testing that the Non-Allison Direct Select selector system design meets all criteria in TES-616 and TES-752.

B.4.69. SHIFT SELECTORS, NON-ALLISON STANDARD

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.69.1. *OVERVIEW*

This function allows vehicle OEMs to develop their own shift selector through use of standard, public J1939 communication.

Non-Allison Standard selectors must meet the requirements defined in Allison TES-616 (environmental requirements) and TES-640 (implementation requirements). This section of the 6th Gen Datalink Communications document only contains configuration information.

A signed agreement must be on file with Allison prior to receiving this document and commencing selector development. Contact your Allison Customer Integration Engineer for details.

B.4.69.2. *AVAILABILITY*

Non-Allison Standard shift selectors may be used in any 3000/4000 Series and 2000 Series 9-speed application without physical selector shaft; however, compatible TCM calibrations can only be generated after the signed agreement is on file with Allison.

B.4.69.3. *CONFIGURATION (VEPS / ACCT)*

[17040] SECONDARY MODE: Starting Range Override

Only applicable to 7-speed OFS models. Answer may be set to a range value (i.e. functionality enabled) as long as certain communication requirements are met; see OTHER REQUIREMENTS / RESTRICTIONS.

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Non-Allison Standard shift selectors using public J1939 data must be connected to the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[19000] SHIFT SELECTOR 1
[19010] SHIFT SELECTOR 2

Must be answered NON-ALLISON J1939-BASED - STANDARD as applicable. See OTHER REQUIREMENTS / RESTRICTIONS.

NOTE: Answer NON-ALLISON J1939-BASED – STANDARD is only available to vehicle OEMs who have contacted their Allison Customer Integration Engineer and have passed the CIE review process.

[19020] SHIFT SELECTORS: J1939-Based Selector Connection

Default is CAN1; CAN2 is optional. This answer is required to align with the CAN port where **ON-VEHICLE PROTOCOL** is set to SAE J1939, FULL FUNCTIONALITY.

[19150] SHIFT SELECTOR 1: Functional Safety Interface
[19160] SHIFT SELECTOR 2: Functional Safety Interface

Must be set to answer 0 [NONE].

[19050] SHIFT SELECTOR: Language

Default is ENGLISH. This answer affects the language sent in the TML *Transmission Mode Label, Mode 4* broadcast.

[15000] PROGNOSTICS

Must be DEFAULTED ON for broadcast of any prognostics-related DM1 indications, as well as TRF2 *Transmission Oil Filter Restriction Switch* and TRF2 *Transmission Oil Life Remaining* broadcasts.

[15090] PROGNOSTICS: Allow Reset via J1939 Command

Answer must be set to YES.

[24000] GENERAL PURPOSE INPUTS AND OUTPUTS (GPIO) PACKAGE

MODE button use requires (1) a GPIO package that has the MODE button assigned to the desired function, and (2) the corresponding VEPS Function Input question must be set to an answer which points to using the MODE button.

[30210] J1939 BROADCAST: ETC2 RANGE PARAMETER FORMAT

Must be set to default answer 1 [DEFAULT FORMAT FOR 5TH GEN AND NEWER PRODUCTS].

[30230] J1939 BROADCAST: ETC7 Active Shift Console Indicator

Default answer is ENABLED. May be switched to DISABLED if dual selectors are not installed.

[30255] J1939 BROADCAST: ETC7 Transmission Mode 4 Indicator

Must remain set to default answer of ENABLED.

[30260] J1939 BROADCAST: ETC7 Transmission Requested Gear Feedback

Default answer is ENABLED. May be switched to DISABLED if not used.

[30430] J1939 BROADCAST: TCFG

Default answer is ENABLED. May be switch to DISABLED if none of its parameters are used.

[30470] J1939 BROADCAST: TML Transmission Mode Label – Mode 4

Answer must be set to ENABLED for MODE button label to be broadcast.

[30500] J1939 BROADCAST: TRF1 Transmission Oil Level 1 High / Low – Enable Continuous Broadcast

Answer must be set to CONTINUOUS BROADCAST ENABLED for transmission models equipped with an oil level sensor.

B.4.69.4. *NORMAL OPERATION*

B.4.69.4.1. Second Reverse Selection

The TC1 *Transmission Requested Range* value of "Reverse Selector Position" always requests the model-specific default reverse gear. Depending on the transmission configuration, selection of a different reverse gear is accomplished by sending TC1 *Transmission Requested Gear* = "Upshift 1 gear from current position" or "Downshift 1 gear from current position" after the default reverse gear has been requested.

Selector systems that continuously broadcast the requested gear selection <u>are required</u> to broadcast a TC1 *Transmission Requested Gear* value of "Hold current gear" while selection of the alternate reverse gear is desired. The TCM will revert to the default reverse gear when it receives another instance of TC1 *Transmission Requested Gear* = "Reverse Selector Position".

B.4.69.4.2. Alternate Gear Start with Shift Selector Override

Applications that utilize Alternate Gear Start with Shift Selector Override utilize TC1 *Transmission Requested Gear* values "Upshift 1 gear from current position" and "Downshift 1 gear from current position" to toggle between regular and alternate starting ranges while the vehicle is stationary and certain other criteria are met.

Selector systems that continuously broadcast the requested gear selection <u>are required</u> to support TC1 *Transmission Requested Gear transitions from "Forward Drive Position" to* "Hold current gear" to "Forward Drive Position" to allow exit of Shift Selector Override operation.

B.4.69.5. *OTHER REQUIREMENTS / RESTRICTIONS*

B.4.69.5.1. Direction Signal Wire

The TCM Direction Signal Wire input is required when a Non-Allison Standard selector is specified. If the Direction Signal Wire input is not supplied correctly, DTC P2793 will be logged and the Check Trans indicator will become active. Transmission operation may be restricted.

B.4.69.5.2. 3000/4000 Series Dual Selector Systems

Use of a Shift Selector Transition input <u>is required</u> for all dual selector applications.

B.4.69.5.3. SECONDARY MODE: Starting Range Override

When this VEPS / ACCT option is configured to any value other than maximum starting range, the Non-Allison shift selector <u>is required</u> to use a momentary pushbutton-style communication interface.

B.4.69.6. *FAILURE MODES AND RESPONSES*

B.4.69.6.1. Incorrect TCM Calibration

If the TCM calibration is not configured for Non-Allison Standard selector use, the TCM will log DTC(s) and activate the Check Trans Indicator. Transmission operation may be restricted. The DTCs are:

- U0304 (Gear Shift Module 1 Incompatible)
- U0333 (Gear Shift Module 2 Incompatible)

B.4.69.7. *TESTING*

The vehicle OEM implementing the shift selector is responsible for testing that the Non-Allison Standard selector system design meets all criteria in TES-616 and TES-640.

B.4.70. SHIFT SELECTORS, NON-ALLISON STANDARD WITH ASSURANCE DATA VIA J1939-76

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.70.1. *OVERVIEW*

This function allows vehicle OEMs to develop their own shift selector through use of standard, public J1939 communication.

Non-Allison Standard selectors with Assurance Data via J1939-76 must meet the requirements defined in Allison TES-616 (environmental requirements) and TES-741 (implementation requirements). This section of the 6th Gen Datalink Communications document only contains configuration information.

A signed agreement must be on file with Allison prior to receiving this document and commencing selector development. Contact your Allison Customer Integration Engineer for details.

B.4.70.2. *AVAILABILITY*

Non-Allison Standard shift selectors with Assurance Data via J1939-76 may be used in any 3000/4000 Series and 2000 Series 9-speed application without physical selector shaft; however, compatible TCM calibrations can only be generated after the signed agreement is on file with Allison.

B.4.70.3. *CONFIGURATION (VEPS / ACCT)*

[17040] SECONDARY MODE: Starting Range Override

Only applicable to 7-speed OFS models. Answer may be set to a range value (i.e. functionality enabled) as long as certain communication requirements are met; see OTHER REQUIREMENTS / RESTRICTIONS.

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Non-Allison Standard shift selectors using public J1939 data must be connected to the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[19000] SHIFT SELECTOR 1
[19010] SHIFT SELECTOR 2

Must be answered NON-ALLISON J1939-BASED - STANDARD WITH ASSURANCE DATA as applicable. See OTHER REQUIREMENTS / RESTRICTIONS.

> **NOTE:** Answer NON-ALLISON J1939-BASED - STANDARD WITH ASSURANCE DATA is only available to vehicle OEMs who have contacted their Allison Customer Integration Engineer and have passed the CIE review process.

[19020] SHIFT SELECTORS: J1939-Based Selector Connection

Default is CAN1; CAN2 is optional. This answer is required to align with the CAN port where **ON-VEHICLE PROTOCOL** is set to SAE J1939, FULL FUNCTIONALITY.

[19050] SHIFT SELECTOR: Language

Default is ENGLISH. This answer affects the language sent in the TML *Transmission Mode Label, Mode 4* broadcast.

[19150] SHIFT SELECTOR 1: Functional Safety Interface
[19160] SHIFT SELECTOR 2: Functional Safety Interface

Must be set to an answer other than 0 – NONE. See EM-101 ALLISON TRANSMISSION FUNCTIONAL SAFETY MANUAL FOR 6TH GENERATION CONTROLS for details.

[15000] PROGNOSTICS

Must be DEFAULTED ON for broadcast of any prognostics-related DM1 indications, as well as TRF2 *Transmission Oil Filter Restriction Switch* and TRF2 *Transmission Oil Life Remaining* broadcasts.

[15090] PROGNOSTICS: Allow Reset via J1939 Command

Answer must be set to YES.

[24000] GENERAL PURPOSE INPUTS AND OUTPUTS (GPIO) PACKAGE

MODE button use requires (1) a GPIO package that has the MODE button assigned to the desired function, and (2) the corresponding VEPS Function Input question must be set to an answer which points to using the MODE button.

[30210] J1939 BROADCAST: ETC2 RANGE PARAMETER FORMAT

Must be set to default answer 1 [DEFAULT FORMAT FOR 5TH GEN AND NEWER PRODUCTS].

[30230] J1939 BROADCAST: ETC7 Active Shift Console Indicator

Default answer is ENABLED. May be switched to DISABLED if dual selectors are not installed.

[30255] J1939 BROADCAST: ETC7 Transmission Mode 4 Indicator

Must remain set to default answer of ENABLED.

[30260] J1939 BROADCAST: ETC7 Transmission Requested Gear Feedback

Default answer is ENABLED. May be switched to DISABLED if not used.

[30430] J1939 BROADCAST: TCFG

Default answer is ENABLED. May be switch to DISABLED if none of its parameters are used.

[30470] J1939 BROADCAST: TML Transmission Mode Label – Mode 4

Answer must be set to ENABLED for MODE button label to be broadcast.

[30500] J1939 BROADCAST: TRF1 Transmission Oil Level 1 High / Low – Enable Continuous Broadcast

Answer must be set to CONTINUOUS BROADCAST ENABLED.

B.4.70.4. *NORMAL OPERATION*

B.4.70.4.1. Second Reverse Selection

The TC1 *Transmission Requested Range* value of “Reverse Selector Position” always requests the model-specific default reverse gear. Depending on the transmission configuration, selection of a different reverse gear is accomplished by sending TC1 *Transmission Requested Gear* = “Upshift 1 gear from current position” or “Downshift 1 gear from current position” after the default reverse gear has been requested.

The selector system is required to broadcast a TC1 *Transmission Requested Gear* value of “Hold current gear” while selection of the alternate reverse gear is desired. The TCM will revert to the default reverse gear when it receives another instance of TC1 *Transmission Requested Gear* = “Reverse Selector Position”.

B.4.70.4.2. Alternate Gear Start with Shift Selector Override

Applications that utilize Alternate Gear Start with Shift Selector Override utilize TC1 *Transmission Requested Gear* values “Upshift 1 gear from current position” and “Downshift 1 gear from current position” to toggle between regular and alternate starting ranges while the vehicle is stationary and certain other criteria are met.

The selector system is required to support TC1 *Transmission Requested Gear transitions from “Forward Drive Position” to* “Hold current gear” to “Forward Drive Position” to allow exit of Shift Selector Override operation.

B.4.70.5. *OTHER REQUIREMENTS / RESTRICTIONS*

B.4.70.5.1. Direction Signal Wire

The TCM Direction Signal Wire input is required when a Non-Allison Standard selector is specified.

B.4.70.5.2. 3000/4000 Series Dual Selector Systems

Use of a Shift Selector Transition input is required for all dual selector applications.

B.4.70.5.3. SECONDARY MODE: Starting Range Override

When this VEPS / ACCT option is configured to any value other than maximum starting range, the Non-Allison shift selector is required to use a momentary pushbutton-style communication interface.

B.4.70.6. *FAILURE MODES AND RESPONSES*

B.4.70.6.1. Incorrect TCM Calibration

If the TCM is incorrectly configured for an Allison selector and a Non-Allison selector is installed, the TCM will log DTC(s) and activate the Check Trans Indicator. Transmission operation may be restricted. The DTCs are:

- U0304 (Gear Shift Module 1 Incompatible)
- U0333 (Gear Shift Module 2 Incompatible)

B.4.70.6.2. Direction Signal Wire Failure

If the Direction Signal Wire input fails or indicates an invalid signal, DTC P2793 will be logged and the Check Trans indicator will become active. Transmission operation may be restricted based on the selected Functional Safety Interface option; see TES-741.

B.4.70.6.3. TC1 Transmission Requested Gear Failure

If the TC1 *Transmission Requested Gear* input is lost, indicates Error, Not Available or an invalid request, the TCM will log DTC(s) and activate the Check Trans Indicator. Transmission operation may be restricted based on the selected Functional Safety Interface option; see TES-741. The DTCs are:

- U0103 (Gear Shift Module 1 Loss of Comm)
- U0291 (Gear Shift Module 2 Loss of Comm)

- U0404 (Gear Shift Module 1 Invalid CAN Data)
- U0592 (Gear Shift Module 2 Invalid CAN Data)

B.4.70.7. *TESTING*

The vehicle OEM implementing the shift selector is responsible for testing that the Non-Allison Standard selector system design meets all criteria in TES-616 and TES-741.

B.4.71. SHIFT SELECTOR DIMMING

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.71.1. *OVERVIEW*

Allison 5th Generation and newer selectors support J1939-based dimming control.

B.4.71.2. *AVAILABILITY*

J1939-based dimming is optional in applications equipped Allison 5th Generation and newer shift selectors.

B.4.71.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

The CAN port where the dimming commands are provided must be configured to one of the J1939 options.

[19030] SHIFT SELECTOR 1: Dimming Input
[19040] SHIFT SELECTOR 2: Dimming Input

These options set the dimming input source for each selector. When set to 254 (default), the traditional analog input is used. When a SA of 0 – 253 is specified, the given selector will respond to CL *Illumination Brightness Percent* from that SA.

Since the inputs are specified per selector, dual selector applications may use any combination of analog vs. J1939 input.

B.4.71.4. *J1939 PARAMETER AND SA USE*

The dimming controller is required to provide CL *Illumination Brightness Percentage* from the SAs as specified in the VEPS options, to either DA 05 (Shift Console, Primary) or DA 06 (Shift Console, Secondary) as applicable. Allison 5th Gen selectors require a message priority of 6.

The CL message is destination-specific; in dual selector applications, the dimming controller must broadcast a separate message to each selector.

B.4.71.5. *OPERATOR INTERFACE*

If a vehicle OEM wishes to match selector brightness with other components (e.g. instrument cluster), they must build in any necessary command offsets into the values being broadcast.

B.4.71.6. *NORMAL OPERATION*

The vacuum fluorescent display and backlighting brightness are both controlled by the single 0 – 100% J1939 input, in a manner analogous to the traditional voltage input.

If the dimming controller is connected to the same CAN port as the selectors, the selectors receive CL messages directly from the source address specified via **SHIFT SELECTOR 1 / 2: Dimming Input**.

If the dimming controller is connected to a different CAN port than the selectors, the TCM will gateway the CL messages to the appropriate CAN port.

Each selector stores its current dimming level at power-down, and resumes that level upon power-up, until a new valid value is received.

B.4.71.7. *FAILURE MODES AND RESPONSES*

B.4.71.7.1. Selector Fails to Receive J1939 Input

In the event that a shift selector no longer receives a valid CL *Illumination Brightness Percentage* value (Error, Not Available, or timed out), the selector will default to maximum display and backlighting levels.

B.4.72. SHIFT SELECTOR TRANSITION

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.72.1. *OVERVIEW*

The Shift Selector Transition function is used in dual selector configurations to determine which shift selector is the active selector.

This function can also be accomplished via GPI D (See the Allison 6th Generation Controls Installation Manual).

B.4.72.2. *AVAILABILITY*

J1939-based implementation is optional in 3000/4000 Series applications.

B.4.72.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be provided to the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[25320] SHIFT SELECTOR TRANSITION INPUT

For SHIFT SELECTOR TRANSITION via J1939, set answer to J1939 CM2 ACTIVE SHIFT CONSOLE REQUEST.

[29049] J1939 SA: CM2 Active Shift Console Request

Parameter is required to be set to the source address of the controller that provides *CM2 Active Shift Console Request*. The TCM does not auto-detect CM2 *Active Shift Console Request*. If this parameter is not set to the desired source address, the SHIFT SELECTOR TRANSITION function will not work.

B.4.72.4. *J1939 PARAMETER AND SA USE*

The J1939 network is required to provide CM2 *Active Shift Console Request* to destination address 03 (Transmission #1) from the configured source address.

B.4.72.5. *NORMAL OPERATION*

The shift selector that was active at the end of the previous key cycle will be the active selector at the beginning of the current key cycle until conditions to transition have been met.

Transition to the secondary selector will only occur when both selectors are in the neutral position, the vehicle is stopped, the transmission is in neutral, and the TCM receives CM2 *Active Shift Console Request* with a value of 01b (Use Secondary Shift Console).

Transition to the primary selector will only occur when both selectors are in the neutral position, the vehicle is stopped, the transmission is in neutral, and the TCM receives CM2 *Active Shift Console Request* with a value of 00b (Use Primary Shift Console).

B.4.72.6. *FAILURE MODES AND RESPONSES*

B.4.72.6.1. Selector Fails to Receive J1939 Input

If CM2 *Active Shift Console Request* indicates 10b (Reserved), 11b (Don't Care / Take No Action), or reception is lost, the TCM will latch the shift selector to the currently active selector.

Failure for the TCM to receive this information may be the result of – but not limited to – bus loading, wiring integrity failures, electrical noise, or improper function implementation. Vehicle OEMs should consider such failures during their design process.

B.4.73. SUMP TEMPERATURE INDICATOR

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.73.1. *OVERVIEW*

The Sump Temperature Indicator notifies the operator that transmission temperatures are above normal operating range, or that a torque converter stall abuse condition exists that may cause severe overheating or torque converter damage. Operator interface options for this function include a text display or dedicated lamp w/text or icon. Available TCM outputs for this function include:

- GPO B (SUMP / RETARDER TEMPERATURE INDICATOR); see Allison 6th Generation Controls Installation Manual for details
- J1939 DM1 message content
- J1939 TRF2 Transmission Overheat Indicator

Allison recommends DM1-based implementation for text displays with generic lamps, and discrete parameter implementation for dedicated lamps. However, either output can be used to control either indication type.

B.4.73.2. *DIFFERENCES BETWEEN GPO AND DATALINK IMPLEMENTATIONS*

Allison retarder applications encompass <u>two</u> indications in the <u>single</u> GPO B wire output.

The Sump Temperature and Retarder Temperature indications are <u>two separate functions</u> when implemented via J1939. One or both J1939-based indications may be used to activate a single temperature indicator or alarm as with GPO B.

B.4.73.3. *AVAILABILITY*

The J1939-based implementation is standard in all 1000 – 4000 Series applications.

B.4.73.4. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be received from the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[26240] J1939 BROADCAST: TRF2 Transmission Overheat Indicator

Answer must be set to ENABLED if parameter used to meet function requirements.

[30015] J1939 BROADCAST: DM1

Answer must be set to EANBLED if DM1 is used to meet function the requirements.

B.4.73.5. *J1939 PARAMETER AND SA USE*

B.4.73.5.1. DM1 Trigger – Required Support

The display controller is required to receive **ALL** of the following from SA 03 (Transmission #1):

- DM1 *Suspect Parameter Number*,
- DM1 *Amber Warning Lamp*, and
- DM1 *Failure Mode Identifier*

NOTE: Specific data values conveyed in these three parameters are directly tied to the J1939 activation of a Sump Temperature Indicator.

Amber Warning Lamp alone cannot be used to activate the Sump Temperature Indicator; the content of all three DM1 parameters must be considered.

Other *SPN*, *Amber Warning Lamp* and *FMI* combinations may define other Allison indications or fault conditions. Users should not assume that any other combinations of *SPN*, *Amber Warning Lamp*, and *FMI* values from SA 03 are indicative of a Sump Temperature indication.

B.4.73.5.2. TRF2 Trigger – Required Support

When triggering this indicator via the J1939 discrete parameter, the display controller is required to receive TRF2 *Transmission Overheat Indicator* as sent from SA 03 (Transmission #1). The display controller is required to support all parameter states.

B.4.73.6. *OPERATOR INTERFACE RECOMMENDATIONS*

The indicator is supplied and installed by the vehicle builder. While there are no specific physical implementation requirements, Allison recommends the indicator be:

…In the normal forward field of view of the vehicle operator (preferred), or readily viewable as part of the shift selector assembly.

…Clearly visible from both operator stations in dual selector applications (may require two indicators).

…Clearly visible under all vehicle lighting conditions, both daytime and nighttime.

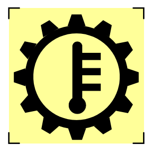
B.4.73.6.1. Dedicated Lamp with Text

When a dedicated lamp is used, recommended wording is "TRANS TEMP". Yellow or amber lamp color is recommended, as sump temperature overheating does not warrant use of a red color.

B.4.73.6.2. Audible Alarm

An audible alarm may be used to signal the overheating condition. It is recommended that a lamp or text display be used in conjunction so the vehicle operator understands the alarm cause.

B.4.73.6.3. Icon or Graphical Symbol



Per ISO 2575: "Road Vehicles – Symbols for Controls, Indicators, and Tell-Tales", this symbol represents a transmission fluid temperature condition, and is acceptable for Allison Sump Temperature Indicator use. Preferred icon colors are yellow or amber.

B.4.73.6.4. Text Displays

While a dedicated lamp or icon is preferred, a driver text display used alone or in conjunction with generic warning and stop lamps is acceptable. In these implementations, the lamps convey issue severity to the operator, while the text display provides more specific information based on DM1 SPN and FMI data.

With dynamically configurable display systems, the visible content may change due to operating conditions or driver selection. Since a Sump Temperature Indicator is not required by Allison, it is acceptable that the indication does not appear if other warnings or indications take precedence. If the indicator is implemented within a dynamic display, Allison recommendations are as follows:

Text Prioritization: Simultaneous RSL and AWL Events

When multiple generic lamps are employed, it is possible for the RSL (Red Stop Lamp) and AWL (Amber Warning Lamp) to be illuminated at the same time. Per J1939-73, the RSL is higher priority:

- An RSL indicates a problem severe enough to warrant stopping the vehicle.
- An AWL indicates the presence of a problem, but the vehicle need not be immediately stopped.

When text display capacity is limited, it is acceptable that Sump Temperature Indicator text is not visible when the RSL is lit. Sump Temperature Indicator text should be out-prioritized by text linked to the RSL. The display system should allow the vehicle operator to “scroll through” the list of items associated with the lamps such that the Sump Temperature Indicator can be read.

Text Prioritization: Simultaneous AWL Events

When a generic AWL is employed, multiple events may simultaneously cause it to illuminate.

When text display capacity is limited, it is acceptable that Sump Temperature Indicator text is not immediately visible when the AWL is lit due to these multiple situations. Again, the display system should allow the vehicle operator to “scroll through” the list of items associated with the lamp such that the Sump Temperature Indicator can be read.

In this situation, the operator knows a problem exists, but may not know it is transmission-related until the text is scrolled through.

Text Suppression

In some applications, Allison indicator text may appear in a display area normally used to convey other operator information. In these cases it is acceptable to employ an operator input (e.g. button push) to <u>temporarily</u> suppress the Allison indicator text so normal display operation may resume.

The suppression may only exist for the current key switch cycle; i.e. if the key switch is cycled, the Allison indicator text <u>is required</u> to reappear if active. The operator may then opt to suppress the text for that drive cycle.

The key points are that (a) the vehicle operator must recognize and take physical action to suppress the indicator, and (b) the operator is informed of any active indications again at the next key switch cycle.

B.4.73.6.5. Bulb Checks

The device that physically actuates the indicator(s) is responsible for performing bulb and / or display checks at the beginning of each key switch cycle.

> **NOTE:** The TCM does not broadcast a DM1 “bulb check” message at power-up. There is no DM1 content that allows a receiver to distinguish a momentary “bulb check” from an actual diagnostic report.
>
> The TCM also does not send a “bulb check” in the discrete parameter at power up; TRF2 *Transmission Overheat Indicator* is set to 00b.

Allison recommends lamps or indicators remain on for 2 seconds during the check. Slightly longer or shorter time periods are acceptable.

B.4.73.6.6. Optional Communication Failure Indication

See VEHICLE SYSTEM FAILURE MODES AND OPTIONAL RESPONSES.

B.4.73.7. *NORMAL OPERATION*

The DM1-based Sump Temperature Indicator and TRF2 *Transmission Overheat Indicator* are both triggered at the same time as the sump temperature portion of GPO B.

In addition, TRF2 *Transmission Overheat Indicator* and GPO B will activate when torque converter stall abuse conditions have been detected, and extreme temperatures and / or converter damage are eminent.

When elevated temperatures trigger the indicator, the TCM may increase engine speeds associated with closed throttle downshift points by invoking a preselect downshift schedule. Downshifting at higher engine speeds increases fan speed and coolant flow through the transmission cooler and engine radiator.

When converter stall abuse is detected, the TCM may also issue TSC1 torque limits to the engine to reduce or alleviate the stall condition.

B.4.73.7.1. DM1 Trigger – Required Support

DM1 may fluctuate between single and multi-frame formats, depending on how many fault indications are present. If only one indication is active, DM1 will be sent in a single frame. If two or more indications are active, DM1 will be sent via Transport Protocol.

Activating the Indicator

If the display controller receives DM1 from SA 03 (Transmission #1) with:

— *SPN* = 177 (*Transmission Oil Temperature 1*), **AND**

— *Amber Warning Lamp* = 01b (On), **AND**

— *Failure Mode Identifier* = 15 (Data Valid but Above Normal Operating Range – Least Severe Level)

…then the Sump Temperature Indicator is required to be activated.

Deactivating the Indicator

If the display controller receives DM1 from SA 03 where:

— *SPN* 177 no longer appears, **OR**

— *SPN* 177 appears **AND** the value of *Failure Mode Indicator* associated with this SPN is not 15, **OR**

— No faults are indicated, i.e. *SPN* = 0 and *Amber Warning Lamp* = 00b (Off)

…then the display controller is required to deactivate the Sump Temperature Indicator. See DM1 under J1939 MESSAGE AND PARAMETER USE for data string examples.

B.4.73.7.2. TRF2 Trigger – Required Support

Activating the Indicator

The display controller is required to steadily illuminate the Sump Temperature Indicator when it receives TRF2 *Transmission Overheat Indicator* = 01b (Transmission Overheat Indicator on continuously).

Deactivating the Indicator

If the display controller receives TRF2 *Transmission Overheat Indicator* = 00b (Transmission Overheat Indicator is off), the display controller is required to deactivate the Sump Temperature Indicator.

B.4.73.8. *VEHICLE SYSTEM FAILURE MODES AND OPTIONAL RESPONSES*

Since Allison does not require use of a Sump Temperature Indicator, there are no specific failure mode requirements around this function.

B.4.73.8.1. Initialization or Response to Resets

The device that actuates the indicator may be powered down intentionally (key switch turned off) or unintentionally (intermittent power source) while an active indication is present.

In either case, Allison recommends that the display controller default the indicator to an inactive state when it reinitializes; if the indication cause is still present when power returns, TCM broadcast data will reflect this and only then should the display controller reactivate the indicator.

This recommendation is based on the fact that some Allison indications self-clear during a power cycle.

B.4.73.8.2. Heartbeat

Heartbeat monitoring and a Communication Failure indication are not required for this function, although vehicle OEMs may choose to implement such logic at their discretion. See USING A COMMUNICATION HEARTBEAT for further information on detecting and responding to J1939 communication failures.

B.4.73.9. *TCM FAILURE MODES & RESPONSES*

In the event of a sump temperature sensor error, DM1 Sump Temperature Indicator broadcast will cease and TRF2 *Transmission Overheat Indicator* will indicate 00b (Transmission Overheat Indicator is off).

In either case, a DTC will be set and the Check Trans Indicator will become active.

B.4.73.10. *INSTALLATION CHECKLIST: SUMP TEMPERATURE INDICATOR*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer “yes” to the following questions, as applicable:

B.4.73.10.1. General

- ☐ Is the TCM calibration configured properly?
- ☐ Turn the key switch on. Is a Sump Temperature Indicator bulb check or text display check performed at power up?

B.4.73.10.2. DM1 Trigger

- ☐ Does the indicator activate when all three activation criteria are met?
- ☐ Does the indicator deactivate when any of the deactivation criteria are met?
- ☐ Does the Indicator activate and deactivate properly while the Check Trans Indicator is also active? (When both are active, DM1 is sent via Transport Protocol.)

B.4.73.10.3. TRF2 Trigger

- ☐ Does the indicator activate when TRF2 *Transmission Overheat Indicator* = 01b?
- ☐ Does the indicator deactivate when TRF2 *Transmission Overheat Indicator* = 00b?

B.4.74. TRANSMISSION SERVICE INDICATOR

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.74.1. *OVERVIEW*

The Transmission Service Indicator alerts the operator that either transmission maintenance is necessary, or a non-mission critical situation has been detected in the vehicle system. This function is also discussed in Allison 6th Generation Controls Installation Manual "Section B: System Operation".

Depending on TCM configuration and transmission hardware, this indicator may be activated by:

… Transmission prognostic functions; Oil Life, Filter Life and / or Transmission Health Monitor™.

Once maintenance is performed, most monitors can be reset via J1939 command or an Allison J1939-based shift selector. Monitors associated with consumable transmission components can only be reset via Allison DOC®.

… Input problems with J1939-based AFRI or DCE functions, or GPI F (AFRI – DUAL INPUT). In these cases, the Transmission Service Indicator will self-clear when the input problem is rectified.

Available TCM outputs for this function include:

— GPO O (TRANSMISSION SERVICE INDICATOR) as described in Allison 6th Controls Installation Manual Section D: "Vehicle Electrical System Interface".

— J1939 ETC7 *Transmission Service Indicator*. As with GPO O, the condition activating the indicator is conveyed by the status (on solid, or flashing) and duration of the lamp illumination.

— J1939 DM1 message content

Allison recommends DM1-based implementation for text displays with generic lamps, and discrete parameter implementation for dedicated lamps.

B.4.74.2. *AVAILABILITY*

The J1939-based implementation is standard in all 1000 – 4000 Series applications when prognostics and / or GPI F (AFRI – DUAL INPUT) are enabled in calibration.

B.4.74.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be received from the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[26260] TRANSMISSION SERVICE INDICATOR

Answer must be set to BOTH GPO O AND J1939 ETC7 TRANSMISSION SERVICE INDICATOR or ONLY J1939 ETC7 TRANSMISSION SERVICE INDICATOR if the ETC7 parameter is used to satisfy function requirements.

[15000] PROGNOSTICS

Must be DEFAULTED ON for broadcast of any prognostics-related DM1 indications, as well as TRF2 *Transmission Oil Filter Restriction Switch* and TRF2 *Transmission Oil Life Remaining* broadcasts.

Even if prognostics are disabled, the Transmission Service Indicator function may still be triggered by J1939-based AFRI or DCE functions, or GPI F (AUXILIARY FUNCTION RANGE INHIBIT – DUAL INPUT).

[15090] PROGNOSTICS: Allow Reset via J1939 Command

Answer must be set to YES if the OEM wants to reset any prognostics via J1939 RESET.

[30015] J1939 BROADCAST: DM1

Answer must be set to ENABLED if DM1 is used to satisfy function requirements.

[30530] J1939 BROADCAST: TRF2 Transmission Oil Filter Restriction Switch

Default answer is ENABLED. May be switched to DISABLED if the implementation does not need this information.

[30540] J1939 BROADCAST: TRF2 Transmission Oil Life Remaining

Default answer is ENABLED. May be switched to DISABLED if the implementation does not need this information.

B.4.74.3.1. VEPS / ACCT Trims

While not directly applicable to the J1939 Interface, other prognostics trims include:

— **[15020] PROGNOSTICS: Transmission Fluid Type**

— **[15060] PROGNOSTICS: Allow Enable/Disable via Shift Selector Sequence**

— **[15080] PROGNOSTICS: Allow Reset via Shift Selector Sequence**

— **[15100] PROGNOSTICS: Allow TES Oil Type Change via Shift Selector Sequence**

B.4.74.4. *J1939 PARAMETER AND SA USE*

Indicator control requirements vary based on the implementation method chosen. Commands used to reset the indications are independent of indicator control implementation. Parameters marked (V) can be enabled or disabled via VEPS.

B.4.74.4.1. ETC7 Trigger – Required Support

When triggering this indicator via J1939 discrete parameter, the lamp controller is required to receive ETC7 *Transmission Service Indicator* from SA 03 (Transmission #1).

NOTE: While the ETC7 trigger can be used to activate a generic AWL and text display, it is recommended for use with discrete lamp implementations.

B.4.74.4.2. DM1 Trigger – Required Support

When triggering this indicator via DM1, the display controller is required to receive **ALL** of the following from SA 03 (Transmission #1):

— DM1 *Suspect Parameter Number*,
— DM1 *Amber Warning Lamp*, and
— DM1 *Failure Mode Identifier*

NOTE: Specific data values conveyed in these three parameters are directly tied to the J1939 activation of the Transmission Service Indicator.

Amber Warning Lamp alone cannot be used to activate the Transmission Service Indicator; the content of all three DM1 parameters must be considered.

Other *SPN*, *Amber Warning Lamp* and *FMI* combinations may define other Allison indications or fault conditions. Users should not assume that any other combinations of *SPN*, *Amber Warning Lamp*, and *FMI* values from SA 03 are indicative of a Transmission Service indication.

B.4.74.4.3. Optional Data Available for Display

These optional parameters are available for display at the discretion of the vehicle manufacturer. For example, an interactive text display may allow the operator to check the remaining oil life. When their related prognostics logic is enabled, the TCM continually broadcasts the following:

TRF2 *Transmission Oil Filter Restriction Switch* (V) indicates if the transmission oil filter is clogged and in need of replacement. 3000/4000 Series 6 speed applications set this parameter based on a physical pressure switch, while 1000/2000 Series and 4000 Series 7 speed applications set this parameter based on a calculated filter life.

TRF2 *Transmission Oil Life Remaining* (V) indicates how much useful oil life remains, expressed as a percentage from 0 – 100%.

B.4.74.4.4. Options for Resetting Maintenance-Related Indications

Transmission service indications activated due to input function problems are self-clearing; they will deactivate when the input issue has been resolved. However, when transmission maintenance has been performed, TCM monitor logic must be reset. If not reset, the indicator will provide false indications.

NOTE: 3000/4000 Series 6 speed transmissions use a differential pressure sensor to determine when filter life has expired, while 1000/2000 Series & 4000 Series 7 speed filter life is based on transmission duty cycle.

The pressure sensor-based Filter Life Monitor does not require resetting; it resets itself when the pressure sensor determines that the restricted filter has been replaced.

All maintenance-related indications may be reset via Allison DOC®. If enabled via VEPS, the Oil Life Monitor (all products) and Filter Life Monitor (1000/2000 Series & 4000 Series 7 speed only) may also be reset via the J1939 RESET message or via an Allison shift selector sequence.

To use the J1939 reset capability, RESET *Service Component Identification* is required. The TCM will respond to reset requests with the Acknowledgment message. See RESETTING THE INDICATOR for parameter content requirements. RESET is accepted from any SA.

B.4.74.5. *OPERATOR INTERFACE*

The indicator is supplied and installed by the vehicle builder, and is required to be:

…In the normal forward field of view of the vehicle operator (preferred), or readily viewable as part of the shift selector assembly.

…Clearly visible from both operator stations in dual selector applications (may require two indicators).

…Clearly visible under all vehicle lighting conditions, both daytime and nighttime.

Acceptable interface options are discussed below. For other potential implementations, please contact your Allison Customer Integration Engineer.

B.4.74.5.1. Dedicated Lamp or Icon

Dedicated lamps may use a text designation, ISO symbol, or combination of both. Regardless, lamp color is highly recommended to be green, as this conveys a non-mission critical situation that does not require the vehicle to be put out of service.

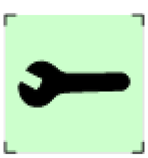
Approved Text

A plain lamp with appropriate wording for the country of vehicle operation is acceptable. For North America, “SERVICE TRANSMISSION” or “SERVICE TRANS” are suggested. Other wording may be acceptable upon review of an Allison Customer Integration Engineer.

ISO “Service Transmission” Symbol

The symbol design shown here is consistent with ISO conventions and is recognizable as being related to “transmission” and “service” indications. This symbol has been proposed for inclusion in ISO 2575: “Road vehicles – Symbols for controls, indicators and tell-tales”. Association with the transmission is implied, so no accompanying text is required.

ISO “Service” Symbol



As seen on Allison shift selectors with built-in displays, ISO symbol X.07 may also convey a “Service Transmission” condition. Due to its generic nature, its association with the transmission must be made either through placement (such as on the shift selector or shift console) or by description on an accompanying text display.

Lamp Control

The lamp controller <u>is required</u> to illuminate or flash the Transmission Service Indicator as directed by ETC7 *Transmission Service Indicator*. A flash rate of 1 to 3 Hz with a 50% duty cycle is recommended. See NORMAL OPERATION for specific activation and deactivation criteria.

B.4.74.5.2. Text Displays

While a dedicated lamp or icon is preferred, a driver text display used alone or in conjunction with generic warning and stop lamps is acceptable. In these implementations, the lamps convey issue severity to the operator, while the text display provides more specific information based on DM1 SPN and FMI data.

Dynamically configurable display systems may change visible information based on operating conditions or driver selection.

Text Content

Use of the text strings described under NORMAL OPERATION <u>is required</u> unless alternative text is approved by Allison Customer Integration Engineering.

Text Prioritization during Simultaneous Red Stop Lamp & Amber Warning Lamp Events

When multiple generic lamps are employed, it is possible for both the RLS (Red Stop Lamp) and AWL (Amber Warning Lamp) to be illuminated at the same time. Per SAE J1939-73, the RSL is higher priority:

— An RSL indicates a problem severe enough to warrant stopping the vehicle.

— An AWL indicates the presence of a problem, but the vehicle need not be immediately stopped.

When text display capacity is limited, it is acceptable that Transmission Service Indicator text is not visible when the RSL is lit. The Transmission Service Indicator text should be out-prioritized by text linked to the RSL. However, the display `system <u>is required</u> to allow the operator to “scroll through” items associated with the lamps such that the Transmission Service Indicator can be read.

Text Prioritization during Simultaneous Amber Warning Lamp Events

When a generic AWL is employed, multiple events may simultaneously cause it to illuminate.

When text display capacity is limited, it is acceptable that Transmission Service Indicator text is not immediately visible when the AWL is lit due to these multiple situations. Again, the display system <u>is required</u> to allow the operator to “scroll through” items associated with the lamp such that the Transmission Service Indicator can be read.

In this situation, the operator knows an issue exists, but may not know that it is transmission-related until the text is scrolled through.

Text Suppression

In some applications, Allison indicator text may appear in a display area normally used to convey other operator information. In these cases it is acceptable to employ an operator input (e.g. button push) to temporarily suppress the Allison indicator so normal display operation may resume.

The suppression may only exist for the current key switch cycle; i.e. if the key switch is cycled, the Allison indicator text is required to reappear if active. The operator may then opt to suppress the text for that drive cycle.

The key points are that (a) the vehicle operator must recognize and take physical action to suppress the indicator, and (b) the operator is informed of any active indications again at the next key switch cycle.

B.4.74.5.3. Bulb Checks

The display controller is responsible for performing any bulb or display checks at the beginning of each switch cycle.

Allison selectors illuminate the Transmission Service Indicator as part of their normal power-up sequence.

NOTE: The TCM does not broadcast a DM1 "bulb check" message at power-up. There is no DM1 content that allows a receiver to distinguish a momentary "bulb check" from an actual diagnostic report.

The TCM also does not send a "bulb check" in *Transmission Service Indicator* at power-up; it is set to 00b.

Allison recommends lamps or indicators remain on for 2 seconds during the check. Slightly longer or shorter time periods are acceptable.

B.4.74.5.4. Optional Communication Failure Indication

See VEHICLE SYSTEM FAILURE MODES AND OPTIONAL RESPONSES.

B.4.74.6. *OTHER REQUIREMENTS / RESTRICTIONS*

NOTE: Since the Transmission Service Indicator function can signal situations other than those for prognostics-related maintenance, reception of valid ETC7 *Transmission Service Indicator* data (00b or 01b) cannot be used to determine if prognostics are enabled in a given application.

B.4.74.7. *DIFFERENCES BETWEEEN ETC7 PARAMETER AND DM1 CONTENT*

DM1 simply indicates that transmission service condition(s) exist per the SPN / FMI combinations broadcast. ETC7 *Transmission Service Indicator* indicates:

…A transmission service condition exists, by activating for a period of time after Drive is first selected.

Short-duration activation signifies transmission oil life has expired or is near expiration, while continuous activation signifies that either a consumable transmission component (e.g. clutch plates) requires service, or a non-mission critical function input needs repair.

A flashing indication signifies that the transmission oil filter is restricted and needs to be replaced.

…A successful request to change oil type, via a brief activation after processing the request.

…A successful prognostic enable / disable request, via a brief activation after processing the request.

…A successful prognostic monitor reset request, via a brief activation after processing the request.

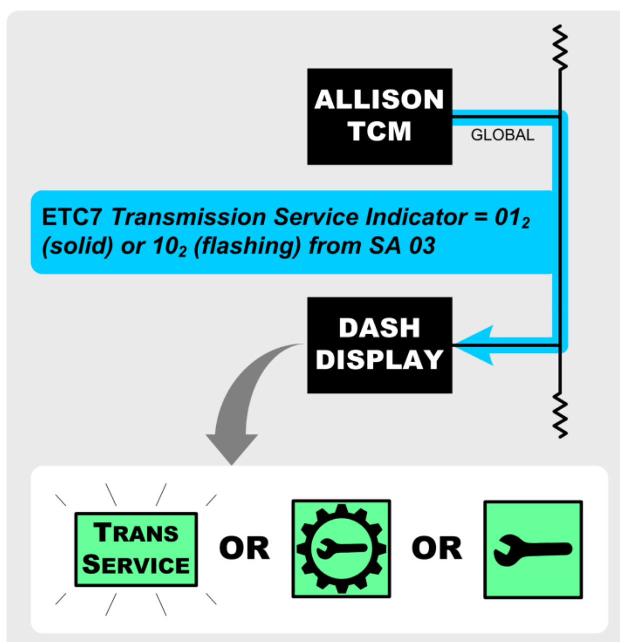
…That prognostics are enabled on a given vehicle, via a 2-second activation at each key-on event.

B.4.74.8. *NORMAL OPERATION*

B.4.74.8.1. ETC7 Trigger – Required Support

Activating the Indicator

The lamp controller is required to illuminate the Transmission Service Indicator when it receives an ETC7 *Transmission Service Indicator* value of 01b, and flash the indicator when it receives 10b.



RESPONSE TO ETC7 TRANSMISSION SERVICE INDICATOR TRIGGER

Deactivating the Indicator

If the lamp controller has been receiving an active indication as described above, and subsequently receives an ETC7 *Transmission Service Indicator* value of 00b, then the lamp controller can assume the Transmission Service Indicator is no longer active, and the indication shall be turned off.

B.4.74.8.2. DM1 Trigger – Required Support

In generic lamp and text display applications, DM1 *Amber Warning Lamp* driving the generic yellow lamp and DM1 *Suspect Parameter Number* drives the text display content. Allison does not use the DM1 RSL parameter.

While the dedicated lamp or icon implementation relies on the lamp state (solid or flashing) to convey service needs, the generic lamp implementation conveys this information via DM1 SPN.

AWL control requirements are only applicable to systems with a generic amber lamp. If the vehicle is only equipped with a text display, then only the Text Display Control requirements must be met.

AWL Control

Depending on the severity of the service need, the AWL may or may not be activated for any given Allison service indication.

In systems utilizing a generic amber lamp, the display controller is required to illuminate the AWL any time it receives DM1 from SA 03 (Transmission #1) with *Amber Warning Lamp* = 01b (On).

When *Amber Warning Lamp* = 00b (off), the TCM no longer requires the lamp to be illuminated. However, it may remain illuminated due to commands from other J1939 network devices.

Text Display Control

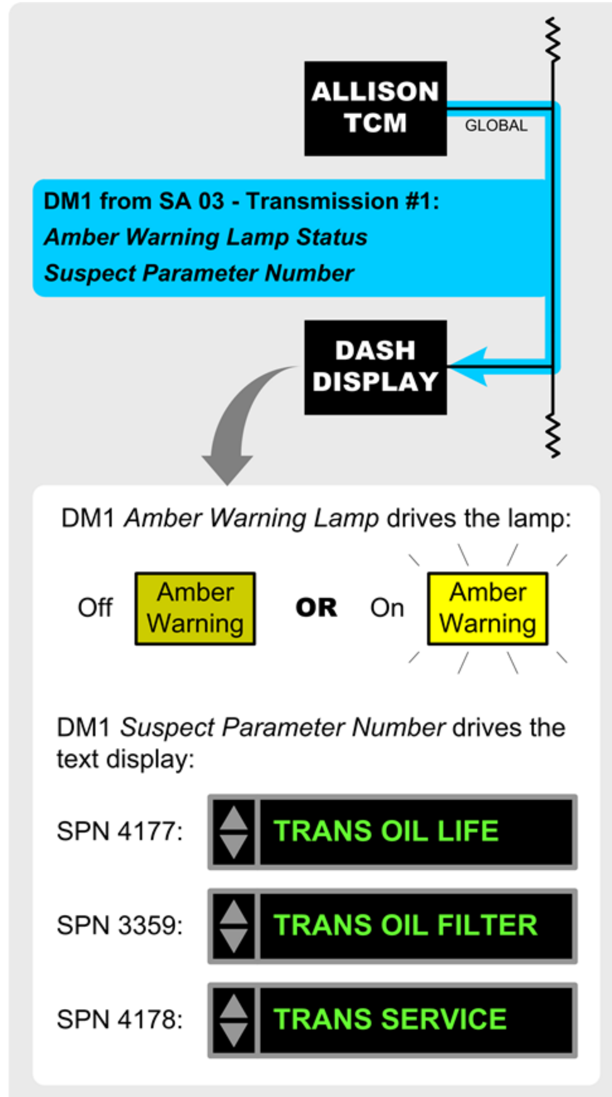
Per each DM1 *Suspect Parameter Number*, the text display is required to convey the following text:

SPN	Acceptable Text
4177	TRANS OIL LIFE
3359	TRANS OIL FILTER
4178	TRANS SERVICE

Other text may be acceptable upon review by Allison Customer Integration Engineering.

If the display controller has been receiving one of the above SPNs, and subsequently receives a DM1 from SA 03 without that SPN, the corresponding text shall be removed from the display.

In addition, the display may choose to show the corresponding SPN number and associated FMI value. See DM1 under the J1939 MESSAGE AND PARAMETER USE section for Examples of DM1 Content.



RESPONSE TO DM1 TRANSMISSION SERVICE INDICATIONS

B.4.74.8.3. Resetting the Indicator

To reset the Oil Life Monitor via J1939, a RESET *Service Component Identification* value of 37 is required to be sent to DA 03 (Transmission #1). The RESET message may use any source address.

To reset a 1000/2000 Series, 3000/4000 Series (7 speed models only) Filter Life Monitor via J1939, a RESET *Service Component Identification* value of 39 is required to be sent to DA 03 (Transmission #1).

The 3000/4000 Series (except 7 speed models) Filter Life Monitor will reset automatically when the control main fluid filter has been changed and the pressure drop across the filter no longer exceeds the threshold value.

When the TCM processes a request, positive acknowledgement is sent via PGN 59392 – Acknowledgment. If the TCM rejects a request, a negative acknowledgement is broadcast.

B.4.74.9. *VEHICLE SYSTEM FAILURE MODES AND OPTIONAL RESPONSES*

B.4.74.9.1. Initialization or Response to Resets

The display controller may be powered down intentionally (key switch turned off) or unintentionally (intermittent power source) while an active indication is present.

Regardless, Allison recommends that the display controller default the indicator to an inactive state when it reinitializes. If the issue is still active when power returns, TCM broadcast data will reflect this and only then should the display controller reactivate the indicator.

This recommendation is based on the fact that some Allison indications self-clear during a power cycle.

B.4.74.9.2. Heartbeat

Heartbeat monitoring and a Communication Failure indication are not required for this function, although vehicle OEMs may choose to implement such logic at their discretion. See USING A COMMUNICATION HEARTBEAT for recommendations on detecting and responding to J1939 communication failures.

B.4.74.10. *TCM FAILURE MODES AND RESPONSES*

B.4.74.10.1. Failure to Attend to a Service Condition

Failure to attend to the service condition and reset the Transmission Service Indicator within a defined operating period will result in a Check Trans indication. This conveys the increased probability of the service need developing into a more serious condition.

B.4.74.10.2. Premature Reset of Oil Life Monitor

If the Oil Life Monitor is attempted to be reset too soon after previously being reset, the TCM will NACK the J1939 RESET request.

B.4.75. TWO SPEED AXLE

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.75.1. *OVERVIEW*

This function is typically used with the axle shift actuator to permit axle shifts only when the conditions are valid. Use of this function should be considered for any vehicle with auxiliary gearing.

B.4.75.2. *AVAILABILITY*

The J1939-based implementation is optional in certain 3000/4000 Series applications.

B.4.75.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be received from the CAN port set to SAE J1939 FULL FUNCTIONALITY

[27010] TWO-SPEED AXLE INTERFACE

To enable J1939 parameter reception, set answer to one of the following, in accordance with the desired behavior described under NORMAL OPERATION:

- BOTH GPO J & J1939 CCVS TWO SPEED AXLE SWITCH
- ONLY CCVS TWO SPEED AXLE
- INPUT J1939 CCVS1 TWO SPEED AXLE SWITCH, UNCONDITIONAL TCM RESPONSE

[27020] TWO-SPEED AXLE INTERFACE: Maximum Output Speed Allowed for Shifting

Determines the maximum output speed allowed for shifting between axle ratios. The default value is set to 100 rpm.

B.4.75.4. *J1939 PARAMETER AND SA USE*

Items marked (V) can be modified via VEPS. Parameters may be enabled or disabled and SAs may be set to an OEM-specified value. See AUTO-DETECTION for SA selection details.

B.4.75.4.1. Required Support

The J1939 network is required to provide CCVS1 *Two Speed Axle Switch* from SA 33 (Body Controller) [V].

B.4.75.5. *OPERATOR INTERFACE REQUIREMENTS*

The vehicle OEM is required to provide the Two Speed Axle Input switch within easy access of the operator.

B.4.75.6. *NORMAL OPERATION*

The Two Speed Axle function provides an input signal to TCM indicating low/high ratio axle selection. The TCM makes certain adjustments to its internal logic based on this information. In addition, the optional wired output (GPO J) can be used by vehicle systems to provide protection to components, permitting shifts from high axle ratio to low axle ratio only when both output speed and throttle position are within acceptable ranges. This output may also be used as an input to the speedometer to enable scaling changes corresponding to the axle ratio.

The Two Speed Axle function is active when CCVS1 *Two Speed Axle Switch* is set to 00b "Low Speed Range" and the operating conditions are satisfied.

B.4.75.6.1. Both GPO J & J1939 CCVS Two Speed Axle Switch

When the Two Speed Axle function is configured to BOTH GPO J & J1939 CCVS TWO SPEED AXLE SWITCH, the TCM will only permit function activation when the following conditions are met:

- Output speed is below the maximum output speed allowed for shifting
- Throttle is near zero
- No shift is in process

The TCM activates GPO J while the Two Speed Axle function is active.

B.4.75.6.2. Only CCVS Two Speed Axle

When the Two Speed Axle function is configured to ONLY CCVS TWO SPEED AXLE, the TCM will only permit function activation when the following conditions are met:

- Output speed is below the maximum output speed allowed for shifting
- Throttle is near zero
- No shift is in process

B.4.75.6.3. INPUT J1939 CCVS1 Two Speed Axle Switch, Unconditional TCM Response

When the Two Speed Axle function is configured to INPUT J1939 CCVS1 TWO SPEED AXLE SWITCH, UNCONDITIONAL TCM RESPONSE, the TCM will allow function activation without further entry conditions. It is the responsibility of the system integrator to design and install controls logic to ensure satisfactory operation.

B.4.76. UDS END-OF-LINE COMMUNICATION

WARNING: The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

B.4.76.1. *OVERVIEW*

Allison TCMs support UDS services for End-of-Line communication, such as:

- Reading and clearing DTCs,
- Retrieving transmission model information,
- Retrieving TCM hardware information, and
- Retrieving software and calibration information.

Vehicle OEMs may use these services to perform quality checks after assembly, such as confirming the use of proper Allison hardware and software.

Users are assumed to be familiar with UDS, as this section is not intended to provide full explanation of sub-functions, masks, and other UDS terminology. UDS communication flow is via tool request and TCM response.

B.4.76.2. *AVAILABILITY*

Available in all 1000 – 4000 Series applications.

B.4.76.3. *CONFIGURATION (VEPS / ACCT)*

The UDS services described are always available on all TCM CAN ports; CAN1, CAN2 and CAN3. This is true regardless as to whether or not any J1939-based diagnostic message support is enabled.

B.4.76.4. *J1939 IDENTIFIER AND SA USE*

The TCM (SA 03) supports UDS data exchanges with these source addresses:

- SA 249 (Diagnostic Tool #1)
- SA 250 (Diagnostic Tool #2)
- SA 23 (Instrument Cluster #1)

UDS content is exchanged via ISO-reserved J1939 PGNs 56064 and 55808. All 29-bit identifiers used are J1939 compatible. Use of PGN 55808 – Reserved for ISO 15765 and physical addressing will result in CAN identifiers:

SA	DA	Priority	CAN Identifier
23	03	6	0x18DA0317
03	23	6	0x18DA1703
249	03	6	0x18DA03F9
03	249	6	0x18DAF903
250	03	6	0x18DA03FA
03	250	6	0x18DAFA03

Use of PGN 56064 – Reserved for ISO 15765 and functional addressing will result in CAN identifiers, all of which will be received by the TCM:

SA	DA	Priority	CAN Identifier
23	255	6	0x18DBFF17
249	255	6	0x18DBFFF9
250	255	6	0x18DBFFFA

NOTE: The TCM response priority reflects the request priority. The examples above assume a request with priority 6.

B.4.76.5. *UDS SERVICE 0x19 – READ DTC INFORMATION*

The TCM supports the following sub-functions and parameters:

B.4.76.5.1. Sub-Function 0x01: Retrieving the number of DTCs that match a client-defined status mask

The request string format is:

Data Byte	Parameter Name	Hex Value
1	Service ID	0x19
2	sub-function	0x01
3	DTCStatusMask	0x00 to 0xFF

A positive response from the TCM will look like:

Data Byte	Parameter Name	Hex Value
1	Service ID	0x59
2	reportType	0x01
3	DTCStatusAvailabilityMask	0x00 to 0xFF
4	DTCFormatIdentifier	0x00
5	DTCCountHighByte	0x00 to 0xFF
6	DTCCountLowByte	0x00 to 0xFF

A negative response from the TCM will look like:

Data Byte	Parameter Name	Hex Value
1	Negative Response	0x7F
2	ReadDTCInformation	0x19
3	NRC	0x12, 0x13 or 0x31

B.4.76.5.2. Sub-Function 0x02: Retrieving the list of DTCs that match a client-defined status mask

The request string format is:

Data Byte	Parameter Name	Hex Value
1	Service ID	0x19
2	sub-function	0x02
3	DTCStatusMask	0x00 to 0xFF

A positive response from the TCM will look like:

Data Byte	Parameter Name	Hex Value
1	Service ID	0x59
2	reportType	0x02
3	DTCStatusAvailabilityMask	0x00 to 0xFF
4	DTCHighByte#1	0x00 to 0xFF
5	DTCMiddleByte#1	0x00 to 0xFF
6	DTCLowByte#1	0x00 to 0xFF
7	statusOfDTC#1	0x00 to 0xFF
8	DTCHighByte#2	0x00 to 0xFF
9	DTCMiddleByte#2	0x00 to 0xFF
10	DTCLowByte#2	0x00 to 0xFF
11	statusOfDTC#1	0x00 to 0xFF
:	:	:
n-3	DTCHighByte#m	0x00 to 0xFF
n-2	DTCHighByte#m	0x00 to 0xFF
n-1	DTCHighByte#m	0x00 to 0xFF
n	statusOfDTC#m	0x00 to 0xFF

A negative response from the TCM will look like:

Data Byte	Parameter Name	Hex Value
1	Negative Response	0x7F
2	ReadDTCInformation	0x19
3	NRC	0x12, 0x13 or 0x31

B.4.76.6. *UDS SERVICE 0x14 – CLEAR DIAGNOSTIC INFORMATION*

Service implementation, request message structure and response message structure follow that of Section 11.2 of ISO14229-1:2006(E), and Section 9.4.2 of ISO15765-3:2004(E).

DTCs cannot be cleared individually nor in groups (e.g. the user cannot clear only active faults or only inactive faults). The groupOfDTC parameter must be set “All groups / All DTCs”. The request string must be:

Data Byte	Parameter Name	Hex Value
1	Service ID	0x14
2	groupOfDTCHighByte	0xFF
3	groupOfDTCMiddleByte	0xFF
4	groupOfDTCLowByte	0xFF

If DTCs are successfully cleared, the TCM will issue a positive response:

Data Byte	Parameter Name	Hex Value
1	ClearDiagnosticInformation Response Service ID	0x54

If DTCs cannot be cleared, the TCM will issue a negative response:

Data Byte	Parameter Name	Hex Value
1	Negative Response	0x7F
2	ClearDiagnosticInformation	0x14
3	NRC	0x13, 0x22 or 0x31

B.4.76.7. *UDS SERVICE 0x22 – READ DATA BY IDENTIFIER*

This service allows reading of various configuration information. Identifier support includes:

UDS DID	Content
0xF187	Customer Part Number
0xF18C	ECU Serial Number
0xF190	VIN Data
0xF192	ECU Hardware Number (TCM PN)
0xF1F8	Application S/W Level
0xF1FA	Calibration Identification Number
0xF1FD	Vocational Model (e.g. 3500 RDS)

B.4.76.7.1. Message Structure

Service implementation, request message structure and response message structure shall follow that of Section 10.2 of ISO14229-1:2006(E), and Section 9.3.1 of ISO15765-3:2004(E). The request string format is:

Data Byte	Parameter Name	Hex Value
1	Service ID	0x22
2	DID#1, byte#1(MSB)	0x00 to 0xFF
3	DID#1, byte#2	0x00 to 0xFF
:	:	:
n-1	DID#m, byte#1(MSB)	0x00 to 0xFF
n	DID#m, byte#2	0x00 to 0xFF

A positive response from the TCM will look like:

Data Byte	Parameter Name	Hex Value
1	Service ID	0x62
2	DID#1, byte#1(MSB)	0x00 to 0xFF
3	DID#1, byte#2	0x00 to 0xFF
4	DataRecord#1, data#1	0x00 to 0xFF
:	:	:
(k-1)+4	DataRecord#1, byte #k	0x00 to 0xFF
:	:	:
n-(o-1)-2	DID#m, byte#1(MSB)	0x00 to 0xFF
n-(o-1)-13	DID#m, byte#2	0x00 to 0xFF
n-(o-1)	DataRecord#m, data#1	0x00 to 0xFF
:	:	:
n	DataRecord#m, byte#o	0x00 to 0xFF

A negative response from the TCM will look like:

Data Byte	Parameter Name	Hex Value
1	Negative Response	0x7F
2	ReadDataByIdentifier	0x22
3	NRC	0x13, 0x22, 0x31 or 0x33

B.4.76.7.2. Data Formats

— DID 0xF187 [Customer Part Number] contains the 18-character customer part number in ASCII format, as entered during OEM VEPS programming.

— DID 0xF18C [ECU Serial Number] contains the 16-character TCM serial number in ASCII format, e.g. “BK6884A370980185”.

— DID 0xF190 [VIN Data] contains the Vehicle Identification Number as entered during OEM VEPS programming or through Allison DOC. It may be up to 17 characters in length.

— DID 0xF192 [ECU Hardware Number] contains the 8-digit TCM part number in ASCII format, e.g. “29556884”.

— DID 0xF1F8 [Application S/W Level] contains the 21-character TCM software level in ASCII format, e.g. “W19BCD_PC_~~8688~~~~~”. As shown, any unused characters are padded with tildes (~).

— DID 0xF1FA [Calibration Identification Number] contains the 13-digit CIN in ASCII format, e.g. “C19100084D88W”. The first character identifies the Allison product line, where “B” is the 1000/2000 Series, and “C” is the 3000/4000 Series. The next 3 characters identify the year and release instance, e.g. “191” is the first release of 2019.

— DID 0xF1FD [Vocational Model] contains the Allison Vocational model in ASCII characters, e.g. “3500 RDS”. ASCII spaces are used. Length is typically less than 10 characters, although up to 50 characters may be used.

B.4.76.8. *VEHICLE INTERFACE REQUIREMENTS*

There are no Allison connector requirements for vehicle OEMs implementing their own End-Of-Line tools. Refer to the respective hardware sections in this document for wiring and pin location information.

B.4.77. VEHICLE ACCELERATION RATE LIMITING

> **WARNING:** The following sections describe the intended use of a specific function which has been validated in the configuration(s) described. Implementations or use of this feature which differ from that described could result in damage to equipment or property, serious personal injury, or loss of life.
>
> **Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.**

B.4.77.1. *OVERVIEW*

The Vehicle Acceleration Rate Limiting function involves an engine controller restricting the vehicle acceleration rate to address end-user concerns such as fuel economy and tire life.

> **NOTE:** Do not confuse this function with the Allison ENGINE MANAGEMENT – ARM function, where the TCM restricts vehicle acceleration via TSC1 commands to the engine.

When the engine actively restricts acceleration, accelerator pedal position no longer represents operator input or engine load. If a vehicle employs acceleration rate limiting, the TCM **MUST** know when it is active for proper shift modulation and clutch control.

B.4.77.2. *AVAILABILITY*

The J1939-based implementation is standard in all 1000/2000 Series applications, and optional in 3000/4000 Series applications pending Allison Customer Integration Engineering review.

B.4.77.3. *CONFIGURATION (VEPS / ACCT)*

[18010] ON-VEHICLE PROTOCOL: CAN1
[18020] ON-VEHICLE PROTOCOL: CAN2

Parameters must be provided to the CAN port set to SAE J1939 FULL FUNCTIONALITY.

[28070] J1939 RECEPTION: EEC2 Vehicle Acceleration Rate Limit Status

1000/2000 Series default answer is ENABLED. 3000/4000 Series default answer is DISABLED; set answer to ENABLED to use this function.

[30160] J1939 BROADCAST: ETC1 Transmission Torque Converter Lock-Up Transition in Process

Set to ENABLED if parameter required by the vehicle acceleration controller (the engine).

B.4.77.4. *J1939 PARAMETER AND SA USE*

Items marked (V) can be modified via VEPS. Parameters may be enabled or disabled and SAs may be set to an OEM-specified value.

B.4.77.4.1. Required Support

The engine is required to provide:

- EEC2 *Vehicle Acceleration Rate Limit Status* (V) from SA 00 (Engine #1) (V), **AND**
- EEC2 *Engine Percent Load at Current Speed* from SA 00 (Engine #1).

Allison recommends *Vehicle Acceleration Limit Status* indicate 01b (Limit active) if the "vehicle acceleration limit – percent torque" (as calculated internally by the engine controller) is less than EEC1 *Drivers Demand Engine – Percent Torque*.

Per SAE, emission control limits should not be considered when calculating Vehicle Acceleration Limit Status. Also, no additional filtering or de-bouncing is desired in the calculation.

B.4.77.4.2. Optional Support

3000/4000 Series TCMs also broadcast ETC1 *Transmission Torque Converter Lock-Up Transition in Process* (V) from SA 03 (Transmission #1) for optional use by the acceleration rate limiting system.

B.4.77.5. *OTHER REQUIREMENTS / RESTRICTIONS*

Due to the potential impacts on vehicle drivability and shift quality, Allison Customer Integration Engineering review is required before this function may be implemented by an engine manufacturer.

B.4.77.6. *NORMAL OPERATION*

When *Vehicle Acceleration Limit Status* is 01b (Limit active), shift points are scheduled based on *EEC2 Engine Percent Load at Current Speed* rather than EEC2 *Accelerator Pedal Position*. Shift timing may be modified to prevent shift cycling when the TCM senses rapidly changing *Engine Percent Load at Current Speed*.

In non-SEM applications, *Engine Percent Load at Current Speed* will also be used in estimating torque for clutch control when *Vehicle Acceleration Limit Status* is active.

B.4.77.7. *FAILURE MODES AND RESPONSES*

If an engine is limiting acceleration rate but does not support EEC2 *Vehicle Acceleration Limit Status*, hanging shifts and poor shift quality may result. No DTCs are logged.

B.4.77.8. *INSTALLATION CHECKLIST: VEHICLE ACCELERATION RATE LIMITING*

Allison Customer Integration Engineering will review new implementations for the following minimum functionality. While vehicle OEMs may use this list to assist implementation development, it is not a substitute for requirements described previously.

Acceptable implementations will answer “yes” to the following questions:

- ☐ Is the TCM calibration configured properly?
- ☐ Are the required parameters supported from SA 00 or the SA specified via VEPS?
- ☐ When the engine controller is specifically limiting vehicle acceleration (as a customer-desired feature), is *Vehicle Acceleration Rate Limit Status* correctly set to 01b (Limit active)?
- ☐ Has an Allison Customer Integration Engineer successfully completed the “Transmission Integration with Vehicle Acceleration Rate Management” verification test plan?

B.5. J1939 MESSAGE & PARAMETER USE

Allison 6th Generation Controls may broadcast or receive the following J1939 messages (PGNs) and parameters (SPNs). Actual support is determined as discussed under FACTORS DETERMINING COMMUNICATION SUPPORT. For received parameters, see the individual functions for their source address requirements.

B.5.1. PGN 0 – TORQUE / SPEED CONTROL 1 (TSC1)

SAE Excerpt: Transmission Repetition Rate: To engine: Control purpose dependent or 10 ms. To retarder: 50 ms.

Data Length ....8 bytes
PDU Format..0
PDU Specific..DA
Default Priority 3
PGN 0 (0x0)

NOTE – Retarder may be disabled by commanding a torque limit of 0%. Use of the limit mode allows the use of the retarder only up to the limit specified in the request. This can be used to permit retarding of up to 50%, for example, if that limit is required by some device such as an EBS, or it can disable the use of the retarder by others, as when an ABS controller detects wheel slip.

Note that the 10 ms transmission repetition rate is intended for temporary powertrain control (P32 of SPN 3350). Slower transmission rates (for control purposes P1 through P31 of SPN 3350) may be supported for longer duration control.

Messages that are requesting control over the receiving device are transmitted at high rate only during the time when the control is active, but may be optionally sent at a slow rate as a "heartbeat."

It is expected that the transmitting device indicate to the receiving device that it no longer requests control by sending at least one broadcast with the override control modes set to 00b. In the absence of continued broadcasts from a requesting module, the receiving device shall default to an appropriate mode after a defined timeout.

Byte	Bit	Content
1	6,5	*Override Control Mode Priority* ● ♦
	4,3	*Engine Requested Speed Control Conditions* ●
	2,1	*Engine Override Control Mode* ● ♦
2-3		*Engine Requested Speed / Speed Limit* ●
4		*Engine Requested Torque / Torque Limit* ● ♦
5	8-4	*TSC1 Control Purpose*
	3-1	*TSC1 Transmission Rate*
6	8-5	Undefined
	4-1	*Engine Requested Torque (Fractional)* ●
7		Undefined
8	8-5	*Message Checksum* ●
	4-1	*Message Counter* ●

B.5.1.1. *TCM MESSAGE BROADCAST*

NEW FOR THIS PUBLICATION
Added VEPS trim 30560.

TSC1 messages and parameters marked ● may be broadcast from SA 03 and sent to:

— SA 00 (Engine #1)
— SA 41 (Retarder, Exhaust, Engine #1)
— SA 15 (Retarder, Engine)

See the TSC1 BROADCAST SUMMARY table for specific engine control uses. Garage Shift Abuse Protection and Engine Brake Interface TSC1 logic are always enabled; all other TSC1 functionality requires a compatible engine to be selected in **[11020] ENGINE MAKE AND MODEL**.

TSC1 *Engine Requested Speed / Speed Limit* and Engine *Requested Torque / Torque Limit* values vary as needed. All TSC1 commands are sent with *Override Control Mode Priority* = 10b (Medium).

See the TSC1 BROADCAST SUMMARY table for the TSC1 *Engine Override Control Mode* and *Engine Requested Speed Control Conditions* values used.

TSC1 broadcasts are intermittent (only sent during control sequences) by default. At the end of each TSC1 control sequence, a single TSC1 message is broadcast with Engine *Override Control Mode* = 00b (Override Disabled). For TSC1 messages sent to the engine (DA 00), heartbeat options of 10 ms or 100 ms are selectable via **[30560] J1939 BROADCAST: TSC1 to Engine Continuous Broadcast**.

B.5.1.2. *TCM MESSAGE RECEPTION*

The TCM receives TSC1 messages sent to DA 16 (Retarder – Driveline). Parameters marked ♦ may be used for RETARDER CONTROL. Multiple source addresses are supported.

B.5.1.4. *TSC1 BROADCAST SUMMARY (2023)*

TSC1 Functionality **The following functions will issue TSC1s from SA 03:**	**1K / 2K**	**3K / 4K**	**Destination Address**	**Control Mode [4]**	**Speed Ctrl Condition**	**TSC1 Event Duration**
Garage Shift Abuse Protection [1]	●	●	00	SL	10b	Typically 700 ms; maximum of 3 s.
ENGINE BRAKE INTERFACE						
Engine Brake Engagement Prevention/Interruption [1] [2]	●	●	15, 41	TC	10b	Typically 700 ms; maximum of 2 s.
Engine Brake Torque Limiting [3]		●	15, 41	TL	10b	Indefinite.
ENGINE MANAGEMENT – SHIFT ENERGY MANAGEMENT (SEM) [3]						
Closed-Throttle Downshifts	●	●	00	TL	10b	Ranges from 600 ms to 3 s.
Converter Stall Abuse Protection	●	●	00	TL	10b	Indefinite.
Garage Shift Abuse Protection	●	●	00	TL	10b	Typically 700 ms; maximum of 3 s.
Throttle Tip-In	●	●	00	TL,SL	10b	Typically 1 s; maximum of 3 s.
Component Over-Speed Protection	●	●	00	SL	10b	Indefinite.
Transmission Cooling Assistance	●	●	00	TL	10b	Typically 10-20 s, possibly longer.
Upshifts & Power Downshifts	●	●	00	TL	10b	Typically 700 ms; maximum of 2 s.
ENGINE MANAGEMENT – LOWER RANGE TORQUE PROTECTION (LRTP) [3]	●	●	00	TL	10b	Indefinite.
ENGINE MANAGEMENT – LOW SPEED GRADE ASSIST (LSGA) [V]	--	●	00	TL	10b	Typically 10-20 s, possibly longer.
ENGINE MANAGEMENT – NEUTRAL-TO-RANGE ASSIST (NRA) [V]	●	●	00	TL	10b	Maximum of 3 s.
ENGINE MANAGEMENT – OUTPUT TORQUE LIMITING (OTL) [V]	●	●	00	TL	10b	Indefinite.
ENGINE MANAGEMENT – PTO TORQUE LIMITING (PTL) [V]	●	●	00	TL	10b	Indefinite.
ENGINE MANAGEMENT – ACCELERATION RATE MANAGEMENT (ARM) [V]	●	●	00	TL	10b	Indefinite.

(1) Functionality enabled in applications, regardless of VEPS **ENGINE MAKE AND MODEL** selection.
(2) TSC1s are broadcast regardless as to whether engine brake implementation is via GPIO or datalink.
(3) Function is automatically enabled based on the **ENGINE MAKE AND MODEL** answer chosen in VEPS.
(4) SL = Speed Limit, SC = Speed Control, TL = Torque Limit, and TC = Torque Control.
(V) Function enabled via VEPS answer. Only available with compatible **ENGINE MAKE AND MODEL**.

B.5.1.5. *SPN 518 – ENGINE REQUESTED TORQUE / TORQUE LIMIT*

SAE Excerpt: Parameter provided to the engine or retarder in the torque/speed control message for controlling or limiting the output torque.

Requested torque to the engine is measured in indicated torque as a percentage of reference engine torque (see the engine configuration message, PGN 65251). This is the engine torque at which the engine is expected to operate if the torque control mode is active or the engine torque which the engine is not expected to exceed if the torque limit mode is active.

Zero torque can be requested which implies zero fuel and, according to Figures SPN512_A and SPN512_B, the engine will not be allowed to stall. The actual engine percent torque (SPN 513) should be zero and the engine should decelerate until the low idle governor kicks in, at which time the actual engine percent torque will be calculated as shown in Figures SPN512_A and SPN512_B and the engine torque mode bits (SPN 899) should be equal to 0000b – Low Idle Governor.

Requested torque to the retarder is measured in indicated torque as a percentage of Retarder Reference Torque (see the retarder configuration message, PGN 65249). The logic used in enabling or disabling the retarder is based on the override control mode priority bits (SPN 897).

A zero torque request to the retarder is a disable request, and is used by a J1939 node to prevent the retarder from being activated by other combinations of inputs outside of J1939 commands. The Torque Limit Mode is commonly used for this purpose.

Data Length:	1 byte
Resolution:	1% per bit gain, -125 offset
Data Range:	-125% to 125%
Operating Range:	0 to 125% engine torque requests, -125% to 0% for retarder torque requests

B.5.1.5.1. TCM Parameter Broadcast

See summary table above. TSC1 messages with an *Engine Override Control Mode* of 00b (Override Disabled) will have this parameter set to 125%.

B.5.1.5.2. TCM Parameter Reception

Allison retarder applications respond to both torque commands and torque limits.

B.5.1.6. *SPN 695 – ENGINE OVERRIDE CONTROL MODE*

SAE Excerpt: The override control mode defines which sort of control command is used.

00b Override disabled – Disable any existing control commanded by the source of this command.

01b Speed control – Govern speed to the included “desired speed” value.

10b Torque control – Control torque to the included “desired torque” value.

11b Speed/torque limit control – Limit speed and/or torque based on the included limit values. The speed limit governor is a droop governor where the speed limit value defines the speed at the maximum torque available during this operation.

If a device wants to know whether it has access to the engine, there are several possibilities:

a. Comparing its command with the actual engine broadcasts.

b. Looking at command modes from other devices.

c. Looking to the engine and retarder torque mode.

Remarks:

a. The realization of a torque limit (minimum selection) is possible by setting the speed limit to a high value (0xFAFF).

b. The realization of a speed limit (minimum selection) is possible by setting the torque limit to a high value (0xFA).

c. Limiting the retarder torque means to limit the magnitude of the torque request. As the brake torque is represented by negative torque values, the limitation must be done by a maximum selection of the requested torque and the retarder internal torque signals.

d. For torque increasing functions, time limits for the torque or speed value (command) and the direct modes are desirable.

e. The selection of which device has control of the engine's speed or torque depends on the override mode priority (see SPN 897) with the highest priority device gaining control. In the case of two devices with identical priority, the engine responds to speed/torque control commands over speed/torque limit commands and will act on the speed or torque commands on a first come, first served basis. The torque limit will be a "lowest wins" selection (e.g., if one device commands 60% limit and another 80% limit, then the engine will limit torque to 60%).

(See J1939-71 Figure SPN695_A for a flowchart of the torque/speed control priority selection logic.)

B.5.1.6.1. TCM Parameter Broadcast

All modes are used. See summary table above.

B.5.1.6.2. TCM Parameter Reception

Allison retarder applications use this parameter for TSC1 command arbitration. Modes 00b (Override Disabled), 10b (Torque Control), and 11b (Torque Limit) are supported.

B.5.1.7. *SPN 696 – ENGINE REQUESTED SPEED CONTROL CONDITIONS*

SAE Excerpt: This mode tells the engine control system the governor characteristics that are desired during speed control. The four characteristics defined are:

00b Transient optimized for driveline disengaged and non-lockup conditions

01b Stability optimized for driveline disengaged and non-lockup conditions

10b Stability optimized for driveline engaged and/or lockup condition 1 (e.g. vehicle driveline)

11b Stability optimized for driveline engaged and/or lockup condition 2 (e.g. PTO driveline)

00b – This speed governor gain selection is adjusted to provide rapid transition between speed set points. RPM overshoot and undershoot may be greater than what is seen when the "speed control characteristic" is set to be stability optimized.

01b – This control condition has been optimized to minimize rpm overshoot and undershoot given an expected plant consisting of the engine and its accessory loads. This gain adjustment is not intended to compensate for driveline characteristics. This characteristic is most appropriate when no driveline is connected.

10b – This control condition has been optimized to minimize rpm overshoot and undershoot given a more complex plant. For instance, the more complex plant would contain the engine, its accessory loads and the driveline characteristics. As an example, the driveline characteristics might include the effective spring mass relationship of pumps, tires, clutches, axles, driveshafts, and multiple gear ratios. This characteristic is most appropriate when a driveline is engaged.

11b – This speed control characteristic is available for applications requiring compensation for more than one driveline characteristic. It has been optimized to minimize rpm overshoot and undershoot given a more complex plant of the second variety. This more complex plant would again contain the engine, its accessory loads and a second driveline characteristic unique from the one described in speed control characteristic 10b.

B.5.1.7.1. TCM Parameter Broadcast

All TCM TSC1 broadcasts indicate 01b or 10b, depending on the driveline state when the message is issued. See summary table above.

B.5.1.7.2. TCM Parameter Reception

The TCM ignores the parameter value.

B.5.1.8. *SPN 897– OVERRIDE CONTROL MODE PRIORITY*

SAE Excerpt: This field is used as an input to the engine or retarder to determine the priority of the Override Control Mode received in the Torque / Speed Control message (see PGN 0). The default is 11 (Low priority). It is not required to use the same priority during the entire override function. For example, the transmission can use priority 01 (High priority) during a shift, but can set the priority to 11 (Low priority) at the end of the shift to allow traction control to also interact with the torque limit of the engine.

The four priority levels defined are:

00b Highest priority
01b High priority
10b Medium priority
11b Low priority

00b – Highest Priority = Used for situations that require immediate action by the receiving device in order to provide safe vehicle operation (i.e., braking systems). This level of priority should only be used in safety critical conditions.

01b – High Priority = Used for control situations that require prompt action in order to provide safe vehicle operation. An example is when the transmission is performing a shift and requires control of the engine in order to control driveline reengagement.

10b – Medium Priority = Used for powertrain control operations which are related to assuring that the vehicle is in a stable operating condition. An example is when the traction control system is commanding the engine in order to achieve traction stability.

11b – Low Priority = Used to indicate that the associated command desires powertrain control but is needed for function which improves the driver comfort which may be overridden by other devices. An example is cruise control or the non-critical part of a transmission shift to a new gear.

B.5.1.8.1. TCM Parameter Broadcast

All TCM TSC1 broadcasts use an *Engine Override Control Mode Priority* of 10b (Medium).

B.5.1.8.2. TCM Parameter Reception

Used by Allison retarder applications for TSC1 command arbitration.

B.5.1.9. *SPN 898 – ENGINE REQUESTED SPEED / SPEED LIMIT*

SAE Excerpt: Parameter provided to the engine from external sources in the torque / speed control message. This is the engine speed which the engine is expected to operate at if the speed control mode is active or the engine speed which the engine is not expected to exceed if the speed limit mode is active.

Data Length:	2 bytes
Resolution:	0.125 rpm per bit gain, 0 rpm offset
Data Range:	0 to 8031.875 rpm

B.5.1.9.1. TCM Parameter Broadcast

See summary table above.

B.5.1.9.2. TCM Parameter Reception

Allison retarders do not support requested speed or speed limits; parameter is ignored by the TCM.

B.5.1.10. *SPN 4206 – MESSAGE COUNTER*

B.5.1.10.1. TCM Parameter Broadcast

Counter is supported in all TSC1 broadcasts coming from the TCM.

B.5.1.10.2. TCM Parameter Reception

TCM parameter reception is not supported.

B.5.1.11. *SPN 4207 – MESSAGE CHECKSUM*

NOTE: The SAE-published checksum algorithm has been revised several times since 2007. The TCM follows the algorithm as defined in the January 2009 publication.

B.5.1.11.1. TCM Parameter Broadcast

Checksum is supported in all TSC1 broadcasts coming from the TCM.

B.5.1.11.2. TCM Parameter Reception

TCM parameter reception is not supported.

B.5.1.12. *SPN 4191 – ENGINE REQUESTED TORQUE (FRACTIONAL)*

SAE Excerpt: This parameter displays an additional torque in percent of the reference engine torque.

When the MSB is set to 1, this parameter is not available. When the MSB is set to 0, bits 1 to 3 indicate the desired torque with resolution of 0.125%/bit . Range is from 0 to 0.875% of reference torque.

The parameter is used in combination with SPN 518 Engine Requested Torque/Torque Limit. The resulting torque/torque limit will be calculated by adding these two parameters.

Validity of Engine Requested Torque High Res has no effect on SPN 518.

Additional torque representations:

0000 = +0.000%
0001 = +0.125%
:
0111 = +0.875%
1000 - 1111 = not available

For example, if SPN 518 = 150 (or 25%) and this parameter is 0100, the torque would be 25.5%.

If SPN 518 = 175 (or 50%) and this parameter is 0001, the torque would be 50.125%

If SPN 518 = 175 (or 50%) and this parameter is 1111, the torque would remain 50% (no high resolution available)

Data Length:	4 bits
Resolution:	0.125% per bit gain, 0 offset
Data Range:	0% to 1.875%
Operating Range:	0% to 0.875%

B.5.1.12.1. TCM Parameter Broadcast

Parameter is always populated during TCM TSC1 broadcasts. TSC1 messages with *Engine Override Control Mode* = 00b (Override Disabled) will have this parameter set to 1111b.

B.5.1.12.2. TCM Parameter Reception

Parameter is not supported.

B.5.2. PGN 256 – TRANSMISSION CONTROL 1 (TC1)

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables.

B.5.2.1. *SELECTOR MESSAGE BROADCAST*

Allison shift selector broadcasts result in CAN IDs:

SA	DA	Priority	CAN Identifier
05	03	3	0x0C010305
06	03	3	0x0C010306

In Allison dual selector applications, TC1 broadcast from the inactive selector is slowed to 500 ms for use as a heartbeat, and to reduce bus loading.

B.5.2.2. *TCM MESSAGE RECEPTION*

See the functions referenced by each parameter.

B.5.2.3. *SPN 681 – TRANSMISSION GEAR SHIFT INHIBIT REQUEST*

SAE Excerpt: Command signal to inhibit gear shifts.

00b Gear shifts are allowed (disable function)
01b Gear shifts are inhibited (enable function)
10b Reserved
11b Take no action (leave function as is).

B.5.2.3.1. TCM Parameter Reception

TCM receives parameter for use with function AUXILIARY FUNCTION RANGE INHIBIT – SINGLE INPUT.

B.5.2.4. *SPN 4242 – TRANSMISSION REVERSE GEAR SHIFT INHIBIT REQUEST*

SAE Excerpt: Allows devices external to the normal transmission shift selector system to request the transmission to inhibit shifts into to any Reverse gear and force the transmission into Neutral if it is currently in Reverse or attempting to shift to Reverse. These transmission responses occur regardless of shift selector (Forward, Neutral or Reverse) position at the time the request is received.

This request would typically come from a component wishing to override the vehicle operator's ability to shift or keep the transmission in Reverse. For example, the control system of a rear-loading refuse packer may wish to prevent shifts to reverse when it detects the presence of someone behind the vehicle.

Reverse gear shift inhibits include all "Neutral-to-Reverse" shifts and "Forward-to-Reverse" shifts; the ability of the transmission to complete "Neutral-to-Forward" or "Forward-to-Forward" gear shifts is not impacted.

If the transmission is in Reverse or attempting to shift to Reverse and receives an active Reverse gear shift inhibit request (01b), the transmission will shift to Neutral. When the request subsequently goes inactive (00b), the transmission will remain in Neutral until it receives a selector input from the vehicle operator requesting it to shift into a Non-Neutral gear. The transmission should not automatically return to the previous gear when this signal goes inactive.

Transmission response to this request can be monitored via SPN 4261 – *Transmission Reverse Gear Shift Inhibit Status*, SPN 523 *Transmission Current Gear*, and SPN 524 *Transmission Selected Gear*.

00b Allow shifts into Reverse gear
01b Inhibit shifts into Reverse gear, and shift transmission to Neutral if already in Reverse or attempting to shift to Reverse
10b Reserved
11b Take no action

B.5.2.4.1. TCM Parameter Reception

TCM receives parameter for use with function REVERSE INHIBIT WITH PRESELECT REQUEST.

B.5.2.5. *SPN 525 – TRANSMISSION REQUESTED GEAR*

SAE Excerpt: Gear requested by the operator, ABS, or engine.

Negative values are reverse gears, positive values are forward gears, zero is neutral, parameter specific indicators as listed below. Parameter specific values for this parameter are as follows: [See Allison functions for supported PSIs.]

Forward selector position from drive (0xF5 to 0xEF) – Indicates shift selector position in reference to the "Drive" position on the selector. It is possible that the shift selector software may not know the number of forward ranges. The shift selector may identify the position selected by the operator while the transmission ECU determines what range or gear that represents. If there is a digital display, the transmission ECU would communicate what is to be displayed via another message such as ETC2 or ETC7.

For example: Consider a vehicle with a 5-speed automatic transmission with the shift lever on the column. Suppose that shift selector has a limited number of positions, such that having positions for D-4-3-2-1 is not an option. For this example, assume there are only have enough lever positions for D-3-2-1. Pulling the lever into "D" will put the transmission in 5th (highest gear). It is desired that pulling the lever to the physical "3" position will limit the transmission to a maximum range of 3rd gear.

When the selector is pulled down into "3", the shifter selector itself has no way of correlating this physical lever position to the desired gear; it would have to be calibrated with software to tell it this information. If not calibrated, the shift selector cannot directly command the transmission to go to 3rd gear; it only knows it's one notch below drive.

However, if "D-1" (lever position, as opposed to desired gear) is broadcast by the selector, the transmission ECU can receive this and then make the determination of what range is desired. The benefit is that no specific calibration of the shift selector is required.

Between selector positions (0xEE to 0xE2) – Indicates the shift selector is not in an appropriate position. If a lever-type shift selector with a mechanical display is stuck between detents, it may appear to the operator that it is in the desired position when in fact it is not. The shift selector may be capable of reporting only that it is between positions or that it is between forward or reverse positions. If known, the transmission ECU may respond differently depending on which positions are involved.

Reselect current position (0xE1) – If the TC1 message continues to send the position last selected, then a capability to reselect the same position is required. For example: If a “Neutral to Drive” shift is selected and that shift is inhibited (say for high engine speed), it may be necessary for the operator to reselect “Drive” after the inhibit conditions pass in order for the transmission ECU to honor the request.

Position unknown and/or no buttons pressed (0xE0) – A push-button style shift selector with momentary contact buttons may send this indicator after initialization before any buttons are pressed, or before the transmission ECU determines and communicates the initial selection. This indicator could also be sent between button presses as an alternative to sending the last button press.

Data Length: 1 byte
Resolution: 1 gear value/bit, -125 Offset
Data Range: -125 to 125
Operational Range: -64 to 64

B.5.2.5.1. Parameter Broadcast & Reception

The TCM receives parameter from Allison and Non-Allison J1939-based shift selectors. For PSI and parameter value support, see functions:

SHIFT ACTUATOR SYSTEM W/ALLISON SELECTOR: 1000/2000 SERIES

SHIFT SELECTOR, ALLISON

In addition, the TCM receives this parameter for PRESELECT REQUEST INPUT and RANGE SELECTION MODE.

B.5.2.6. *SPN 1855 – TRANSMISSION MODE 4*

SAE Excerpt: Indicates whether transmission mode #4 is enabled. Modes are manufacturer specific and are not necessarily mutually exclusive. See also SPN 2539.

00b Disable
01b Enable
10b Reserved
11b Take no action

B.5.2.6.1. TCM and Selector Parameter Use

See functions:

SHIFT ACTUATOR SYSTEM W/ALLISON SELECTOR: 1000/2000 SERIES

SHIFT SELECTOR, ALLISON

SHIFT SELECTOR, NON-ALLISON BASIC

SHIFT SELECTOR, NON-ALLISON DIRECT SELECT

SHIFT SELECTOR, NON-ALLISON STANDARD

B.5.2.7. *SPN 1854 – TRANSMISSION MODE 3*

SAE Excerpt: Indicates whether transmission mode #3 is enabled. Modes are manufacturer specific and are not necessarily mutually exclusive. See also SPN 2538.

00b Disable
01b Enable
10b Reserved
11b Take no action

B.5.2.7.1. Parameter Broadcast & Reception

The TCM receives parameter from Allison 5th Generation Bump Lever shift selectors; see SHIFT SELECTOR, ALLISON.

TCM may also receive parameter from other sources for POWER DIVIDER INPUT.

B.5.2.8. *SPN 1853 – TRANSMISSION MODE 2*

SAE Excerpt: Indicates whether transmission mode #2 is enabled. Modes are manufacturer specific and are not necessarily mutually exclusive. See also SPN 2537.

00b Disable
01b Enable
10b Reserved
11b Take no action

B.5.2.8.1. TCM Parameter Reception

See function SECONDARY MODE INPUT.

B.5.2.9. *SPN 2985 – TRANSMISSION SHIFT SELECTOR DISPLAY MODE SWITCH*

SAE Excerpt: Status of the operator's switch used to "toggle" through multiple display modes of a shift selector display.

When a shift selector display is capable of displaying more than just range information, this switch is toggled by the operator to move through the different display modes. If the selector has only two display modes, this switch may behave as a typical SPST switch. If the selector has more than two display modes, the switch may be momentary, where each activation indicates that the selector has scrolled through to the next subsequent display mode.

00b Off
01b On
10b Error
11b Not available

B.5.2.9.1. Parameter Broadcast & Reception

TCM receives parameter from some J1939-based shift selectors for:

SHIFT ACTUATOR SYSTEM W/ALLISON SELECTOR: 1000/2000 SERIES

SHIFT SELECTOR, ALLISON

SHIFT SELECTOR, NON-ALLISON BASIC

SHIFT SELECTOR, NON-ALLISON DIRECT SELECT

SHIFT SELECTOR, NON-ALLISON STANDARD

OIL LEVEL DISPLAY

B.5.2.10. *SPN 4255 – TRANSMISSION REQUESTED LAUNCH GEAR*

SAE Excerpt: Initial gear for the transmission to start out in when the vehicle is launched from a standing stop, as specified by the vehicle operator or vehicle system. Automatic transmissions typically default to starting out in 1st gear. However, in applications such as those with very low gearing, it is desirable to launch the vehicle in a range higher than 1st. For example, when the vehicle has little or no payload, the operator may wish to launch from 2nd or 3rd gear to avoid stacked, unnecessary shifts in the lower ranges.

The intent of SPN 4255 is to request the initial starting range to be used when the vehicle gets underway from a stop; it does not request direction changes (forward / reverse). SPN 525 sets the direction requested by the operator. For example, if SPN 525 is requesting a Reverse range, any SPN 4255 value indicating a desired forward launch gear would be ignored by the transmission controller. The SPN 4255 value is only utilized by the transmission controller when its direction matches that of the current SPN 525 value.

0000b No specific launch gear requested; use default launch gear
0001b Launch the vehicle in 1st gear
0010b Launch the vehicle in 2nd gear
0011b Launch the vehicle in 3rd gear
0100b Launch the vehicle in 4th gear
0101b Launch the vehicle in 5th gear
0110b Launch the vehicle in 6th gear
0111b Launch the vehicle in 7th gear
1000b Launch the vehicle in 8th gear
1001b Launch the vehicle in Reverse 1
1010b Launch the vehicle in Reverse 2
1011b Launch the vehicle in Reverse 3
1100b Launch the vehicle in Reverse 4
1101b Allow transmission to select the optimum launch gear
1110b Error
1111b Not Available

B.5.2.10.1. TCM Parameter Reception

See function ALTERNATE GEAR START (AGS) INPUT.

B.5.3. PGN 3328 – TRANSMISSION CONTROL 2 (TC2)

SAE J1939-71 Excerpt: Used to communicate transmission control information

Transmission Repetition Rate:.....................50 ms
Data Length 8
PDU Format...13
PDU Specific...DA
Default Priority 3
Parameter Group Number 3328 (0x0D00)

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables.

B.5.3.1. *SPN 11753 – TRANSMISSION REQUESTED REVERSE LAUNCH GEAR*

SAE Excerpt: Initial Reverse gear for the transmission to start out in when the vehicle is launched from a standing stop, as specified by the vehicle operator or vehicle system. Automatic transmissions typically default to starting out in 1st Reverse. However, in applications such as those with very low gearing, it is desirable to launch the vehicle in a higher range. For example, when the vehicle has little or no payload, the operator may wish to launch from 2nd or 3rd Reverse to avoid stacked, unnecessary shifts in the lower ranges.

This SP does not request direction changes (forward vs. reverse); direction is requested by the operator either through SPN 525 or another shift selection method. The value in this SP is only utilized by the transmission controller when the operator has selected the Reverse direction.

This SP is similar to SPN 4255, whose definition contains states for both Forward and Reverse launch ranges. However, there are situations where both the Forward and Reverse launch gears need to be conveyed simultaneously; in these situations, SPN 4255 shall be used to specify the Forward launch gear, and this SP shall be used specify the Reverse launch gear. In the event both SPN 4255 and this SP are supported in a given application, the Reverse launch gear specified in this SP shall be given precedence over any Reverse launch gear specified in SPN 4255.

0000b No specific Reverse launch gear requested; use default Reverse launch gear
0001b Launch the vehicle in Reverse 1
0010b Launch the vehicle in Reverse 2
0011b Launch the vehicle in Reverse 3
0100b Launch the vehicle in Reverse 4
0101b Reserved
0110b Reserved
0111b Reserved
1000b Reserved
1001b Reserved
1010b Reserved
1011b Reserved
1100b Reserved
1101b Allow transmission to select the optimum Reverse launch gear
1110b Error
1111b Not Available

B.5.3.1.1. Parameter Reception

See function ALTERNATE GEAR START (AGS) INPUT.

B.5.3.2. *SPN 11751 – TRANSMISSION PRE-DEFINED MAXIMUM GEAR ACTIVATION REQUEST*

SAE Excerpt: This parameter requests that the transmission not operate in ranges above a pre-defined or calibrated range as configured in the transmission or other controller. For example, this parameter could be used to prevent operation in an overdrive range. Parameter SPN 11748 [Transmission Pre-Defined Maximum Gear Activation Indicator] reflects the current operating state of this functionality. Note that a transmission may not honor this request if doing so would create an undesired situation such as over-speeding the engine.

00b Pre-defined range limit is not requested
01b Pre-defined range limit is requested
10b Reserved
11b Don't Care / Take No Action

B.5.3.2.1. Parameter Reception

See function OVERDRIVE DISABLE.

B.5.3.3. *SPN 11752 – TRANSMISSION OUTPUT SHAFT BRAKE REQUEST*

SAE Excerpt: This parameter requests that the transmission apply either internal or external braking systems for the purpose of stopping output shaft rotation. Such action is typically used to facilitate engagement of split-shaft PTOs or other components downstream of the transmission output shaft. This parameter is not intended to generate vehicle braking. Typically used when the vehicle is stationary. Transmission manufacturers may have limitations on how long such a request will be honored.

00b Transmission output shaft braking is not requested
01b Transmission output shaft braking is requested
10b Reserved
11b Don't Care / Take No Action

B.5.3.3.1. Parameter Reception

See function AUXILIARY BOX TRANSITION.

B.5.4. PGN 3584 – SAFETY HEADER MESSAGE (SHM)

SAE J1939-71 Excerpt: See document J1939-76 for PG details.

PDU Format 14
PDU Specific .... DA
Parameter Group Number 3584 (0x0E00)

B.5.4.1.1. TCM and Selector Parameter Use

See functions:

SHIFT ACTUATOR SYSTEM W/ALLISON SELECTOR: 1000/2000 SERIES

SHIFT SELECTOR, ALLISON

SHIFT SELECTOR, NON-ALLISON STANDARD WITH ASSURANCE DATA VIA J1939-76

B.5.5. PGN 7168 – TRANSMISSION CONTROL 3 (TC3)

SAE J1939-71 Excerpt: This message is used to control the output speed and/or torque of a transmission.

For example, this message could be directed toward a continuously variable transmission (CVT) where output speed and torque are not directly dependent on input speed and torque. This message could also be directed toward a fixed range transmission, but only if it has a mechanism to manipulate its input speed and torque (e.g. TSC1 commands to the engine).

Note: This message is intended for single device control. It is understood that if future applications require multiple device control, then a standardized arbitration strategy will need to be approved by SAE.

The 100 ms transmission rate can be used for control limiting or as a heartbeat.

Transmission Repetition Rate: Every 100 ms and on change of state but no faster than every 10 ms.

Data Length 8
PDU Format...28
PDU Specific...DA
Default Priority 3
Parameter Group Number 7168 (0x1C00)

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables.

B.5.5.1. *SPN 21251 – TRANSMISSION AUTO-NEUTRAL (AUTO-RETURN) ENABLE SWITCH*

SAE Excerpt: This enable switch is required for use with interfaces using SPN 21252 [Transmission Auto-Neutral (Auto-Return) Request]. It allows the operator to prohibit the transmission from responding to temporary Auto-Neutral requests made via SPN 21252.

Note: See SPN 7694 Transmission Auto-Neutral (Manual Return) Enable Switch for functions that require operator input prior to the transmission returning to a specific direction.

00b Transmission Auto-Neutral (Auto-Return) Function Disabled
01b Transmission Auto-Neutral (Auto-Return) Function Enabled
10b Error
11b Not Available

B.5.5.1.1. Parameter Reception

See function AUTOMATIC NEUTRAL – DUAL INPUT.

B.5.5.2. *SPN 21252 – TRANSMISSION AUTO-NEUTRAL (AUTO-RETURN) REQUEST*

SAE Excerpt: This parameter conveys a vehicle system desire to (a) override the operator's current shift selector request (e.g. Drive, Reverse) and shift the transmission into Neutral, and then (b) exit the Neutral state and return to the previously selected direction. "Auto-Return" indicates the previously selected direction can be achieved without direct operator input via the shift selector. SPN 21253 [Transmission Auto-Neutral (Auto-Return) Request Feedback] reflects the request state currently being acted on by the transmission, while SPN 21254 [Transmission Auto-Neutral (Auto-Return) Function State] reflects the current state of the Auto-Neutral function. See Appendix D for implementation details.

Note: See SPN 7695 [Transmission Auto-Neutral (Manual Return) Request] for Auto-Neutral functionality that always requires operator shift selector input to exit the Auto-Neutral state.

00b No request
01b Request to shift to (or maintain) Auto-Neutral state
10b Request to shift from Auto-Neutral state to previous direction
11b Don’t Care / Take No Action

B.5.5.2.1. Parameter Reception

See function AUTOMATIC NEUTRAL – DUAL INPUT.

B.5.6. PGN 34048 – CAB MESSAGE 2 (CM2)

SAE J1939-71 Excerpt: Message containing parameters originating from the vehicle cab.

Transmission Repetition Rate: Every 1 s and on change but no faster than every 100 ms.

Data Length 8
PDU Format..133
PDU Specific..DA
Default Priority 6
Parameter Group Number 34048 (0x8500)

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables.

B.5.6.1. *SPN 8855 – ACTIVE SHIFT CONSOLE REQUEST*

SAE Excerpt: Requests the shift console or shift selector that the operator desires to be active. See SPN 2945 (Active Shift Console Indicator) for feedback on which shift console is currently active.

00b	Use Primary Shift Console
01b	Use Secondary Shift Console
10b	Reserved
11b	Don't Care / Take No Action

Note: In some applications such as refuse trucks, the transmission can be operated from two positions in the vehicle. The transmission control unit will accept changes in transmission requested gear (SPN 525) from the operator only from the active shift console. The transmission control unit determines which shift console is active based on an input (such as this SP) controlled by the operator and transmission system state criteria.

B.5.6.1.1. Parameter Reception

See function SHIFT SELECTOR TRANSITION.

B.5.7. PGN 53248 – CAB ILLUMINATION MESSAGE (CL)

SAE J1939-71 Excerpt: This message contains information that controls illumination devices inside the vehicle's cab.

Transmission Repetition Rate: Every 5 s and on change of state but no faster than every 100 ms.

Data Length 8
PDU Format..208
PDU Specific ....DA
Default Priority 6
Parameter Group Number...........53248 (0xD000)

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables.

B.5.7.1. *SPN 1487 – ILLUMINATION BRIGHTNESS PERCENT*

SAE Excerpt: Commanded backlight brightness level for all cab displays. Note: If a separate device is used to independently control the switch backlight brightness level, see SPN 5532.

Data Length:	1 byte
Resolution:	0.4 %/bit, 0 offset
Data Range:	0 to 100 %

B.5.7.1.1. Parameter Reception

Allison shift selectors will receive parameter for SHIFT SELECTOR DIMMING. In addition, the TCM will gateway the PGN to the necessary CAN port if the dimming controller and selector(s) are not connected to the same TCM CAN port.

B.5.8. PGN 55808 – RESERVED FOR ISO 15765 (KWP2)

Data Length	8
PDU Format	218
PDU Specific	DA
Default Priority	6
Parameter Group Number	55808 (0xDA00)

B.5.8.1. *ALLISON MESSAGE USE*

PGN is exchanged between the TCM and service tools for use in:

DIAGNOSTIC COMMUNICATION WITH ALLISON TOOLS

DIAGNOSTIC COMMUNICATION FOR OEM USE

B.5.9. PGN 56064 – RESERVED FOR ISO 15765 (KWP1)

Data Length	8
PDU Format	219
PDU Specific	DA
Default Priority	6
Parameter Group Number	56064 (0xDB00)

B.5.9.1. *ALLISON MESSAGE USE*

PGN is exchanged between the TCM and some vehicle OEM tools for DIAGNOSTIC COMMUNICATION FOR OEM USE.

B.5.10. PGN 56832 – RESET

SAE Excerpt: NOTE – This message requires an Acknowledgement response (See J1939-21, PGN 59392) from the receiving node.

Transmission Repetition Rate	When needed
Data Length	8
PDU Format	222
PDU Specific	DA
Default Priority	7
Parameter Group Number	56832 (0xDE00)

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables.

B.5.10.1. *TCM MESSAGE RECEPTION*

TCM receives this PGN from any SA when sent to DA 03 (Transmission #1).

B.5.10.2. *SPN 1584 – SERVICE COMPONENT IDENTIFICATION*

SAE J1939-71 Excerpt: Identification of component needing service.

Data Length:	1 byte
Resolution:	1 ID / bit, 0 offset
Data Range:	0 to 250 (See table below)

B.5.10.2.1. TCM Parameter Reception

Only the values shown below are supported. Other requests to SA 03 will result in a negative acknowledgement. See function TRANSMISSION SERVICE INDICATOR.

Byte Value	Service Component Identification Supported by Allison
37	Transmission Oil – Transmission #1
39	Transmission Oil Filter – Transmission #1

B.5.11. PGN 57088 – STOP / START BROADCAST (DM13)

SAE J1939-73 Excerpt: DM13 has two primary functions. It may be used as a **command**, from either a tool or an ECU, directed to a single controller or to all controllers to request the receiving controller(s) to **stop** or **start** broadcast messages. Additionally it may be used by an ECU to **inform** other nodes that the sender is about to **suspend** its normal broadcast due to commands other than a SAE J1939 DM13 command received on that same network segment. The broadcast messages stopped, started, or suspended may be on networks other than SAE J1939.

Transmission Rate: Sent whenever a Stop or Start broadcast event is necessary.

Data Length 8
PDU Format..223
PDU Specific..DA
Default Priority 6
Parameter Group Number 57088 (0xDF00)

See SAE J1939-73 for full message definition. For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables.

B.5.11.1. *TCM MESSAGE RECEPTION*

See DM13 IMPLEMENTATION REQUIREMENTS for full details. DM13 is only received on the TCM CAN port set to SAE J1939 FULL FUNCTIONALITY. Allison shift selectors do not support DM13.

B.5.11.2. *SPN 1230 – CURRENT DATA LINK*

SAE Excerpt: Identifies the action to be performed on the communications port that this parameter was received on.

00b Stop Broadcast
01b Start Broadcast
10b Reserved
11b Don’t Care/take no action (leave as is)

B.5.11.2.1. TCM Parameter Reception

TCM will respond to 00b (Stop Broadcast) and 01b (Start Broadcast); see the DM13 implementation requirements below.

B.5.11.3. *SPN 639 – SAE J1939 NETWORK #1, PRIMARY VEHICLE NETWORK*

SAE Excerpt: Identifies the action to be performed on the SAE J1939 Network #1, Primary Vehicle Network” communications port.

00b Stop Broadcast
01b Start Broadcast
10b Reserved
11b Don’t Care/take no action (leave as is)

B.5.11.3.1. TCM Parameter Reception

TCM will respond to 00b (Stop Broadcast) and 01b (Start Broadcast); see the DM13 implementation requirements below.

B.5.11.4. *SPN 1236 – HOLD SIGNAL*

SAE Excerpt: Indicator to all nodes that the communication ports that have been acted upon by the “Stop Start Broadcast” PGN are remaining in the modified state. Therefore all nodes should act accordingly. The Hold signal is required to be broadcast every 5 seconds plus or minus one second. A device requesting stop broadcast must send the hold signal every 5 seconds and if the message is not received for 6 seconds all applicable nodes revert back to their normal state.

Bit State	Devices to take action
0000b	All Devices
0001b	Devices whose broadcast state has been modified
0010b to 1110b	SAE Reserved
1111b	Not Available

B.5.11.4.1. TCM Parameter Reception

See the DM13 implementation requirements below.

B.5.11.5. *SPN 2618 – SUSPEND SIGNAL*

SAE Excerpt: Indicator to all nodes that broadcast messages on the current J1939 datalink are being suspended due to commands other than J1939 DM13. Therefore, the receiving nodes should suspend timeout diagnostics for all messages from the transmitting device. The suspend signal is to be broadcast once, but may be repeated at the option of the transmitting device (if it is capable of doing so) to increase the chances of proper reception by repeating one or two times within the first second of the suspension. If it is able, the transmitter may also send a DM13 message with the suspend signal set to “1110” to indicate that it is returning to full broadcast status.

Bit State	Devices to take action
0000b	Indefinite suspension of all broadcasts
0001b	Indefinite suspension of some messages
0010b	Temporary suspension of all broadcasts
0011b	Temporary suspension of some messages
0100b to 1101b	SAE Reserved
1110b	Resuming normal broadcast pattern
1111b	Not Available

B.5.11.5.1. TCM Parameter Reception

See the DM13 implementation requirements below.

B.5.11.6. *DM13 IMPLEMENTATION REQUIREMENTS*

The requirements necessary to initiate, maintain and exit a TCM "stopped broadcast" state are as follows:

B.5.11.6.1. Initiate a 'Stop Broadcast' State

To achieve a TCM "stopped broadcast" state, the requesting device must first send a DM13 to indicate that J1939 broadcasts are to be modified. This first DM13 can be sent to either DA 255 (Global) or DA 03 (Transmission #1) from any source address. The following parameter content <u>is required</u>:

— <u>Both</u> *Suspend Signal* and *Hold Signal* must be set to 1111b (Not Available), and

— Either *Current Data Link* or *SAE J1939 Network #1, Primary Vehicle Network* must be set to 00b (Stop Broadcast).

Per SAE, the TCM will not respond to this request if the engine is running or the vehicle is moving.

Upon receiving the initial DM13 request, the TCM immediately ceases all J1939 broadcasts, and disables all J1939 parameter reception diagnostics.

B.5.11.6.2. Maintain a "Stop Broadcast" State

Once a TCM "stopped broadcast" state has been initiated, the requesting device must send a global DM13 every 5 seconds to maintain this state. The following parameter content <u>is required</u>:

— *Suspend Signal* must be set to 1111b (Not Available), and

— *Hold Signal* must be set to either 0000b (All Devices) or 0001b (Devices whose broadcast state has been modified).

B.5.11.6.3. Exit the "Stop Broadcast" state

The TCM will exit the "stopped broadcast" state if:

— a "hold" request is not received for 6 seconds at any point after the "stop broadcast" state has been achieved, or

— the corresponding parameter initially used to stop TCM broadcast (either *Current Data Link* or *SAE J1939 Network #1, Primary Vehicle Network*) is set to 01b (Start Broadcast), or

— the TCM senses the engine has been started, or

— the TCM senses the vehicle is moving, or

— the vehicle key switch is cycled.

When the TCM exits the "stopped broadcast" state, J1939 broadcasts resume within approximately 100 ms. J1939 diagnostics will resume no sooner than 6 seconds after the broadcasts resume.

B.5.11.7. *DM13 SEQUENCE EXAMPLE*

The data below illustrates a DM13 sequence from a tool that initiates and holds a TCM "stop broadcast" state. In this example, the TCM "stop broadcast" state will end 6 seconds after the tool ceases DM13 broadcast.

Time	CAN Identifier	SA	DA	PGN	Name	Data Bytes 1	2	3	4	5	6	7	8
20.770	18DFFFFAx	250	255	57088	DM13	63	255	192	255	255	255	255	255
26.340	18DFFFFAx	250	255	57088	DM13	255	255	192	15	255	255	255	255
31.340	18DFFFFAx	250	255	57088	DM13	255	255	192	15	255	255	255	255
36.340	18DFFFFAx	250	255	57088	DM13	255	255	192	15	255	255	255	255
41.340	18DFFFFAx	250	255	57088	DM13	255	255	192	15	255	255	255	255
46.340	18DFFFFAx	250	255	57088	DM13	255	255	192	15	255	255	255	255

EXAMPLE OF DM13 "STOP BROADCAST" MESSAGE SEQUENCE

B.5.12. PGN 59392 – ACKNOWLEDGMENT

See SAE J1939-21 for full message definition. The TCM will broadcast this PGN to global destination address 255 in response to Destination-Specific requests. The TCM supports Control Byte values:

— 0 (Positive Acknowledgement)

— 1 (Negative Acknowledgment)

Global requests are not acknowledged. Used with TRANSMISSION SERVICE INDICATOR and DIAGNOSTIC COMMUNICATION FOR OEM USE.

B.5.13. PGN 59904 – REQUEST (PGN)

SAE J1939-21 Excerpt: Used to request a PGN from a network device or devices.

Transmission Repetition Rate: Per user requirements, generally recommended that requests occur no more than 2 or 3 times per second.

Data Length ....3 bytes
PDU Format 234
PDU Specific.........................Destination address (Global or specific)
Default Priority 6
PGN 59,904 (0xEA00)

Byte	Bit Content
1-3	*Parameter Group Number being requested*

B.5.13.1. *TCM MESSAGE BROADCAST*

Requests are only broadcast to global DA 255, resulting in CAN identifier 0x18EAFF03. Requests for parameters marked (V) below can be modified via VEPS by one of three possible settings:

— DISABLED (NO REQUESTS SENT) completely disables Request broadcast.

— ENABLED (MAXIMUM OF 3 REQUESTS) results in no more than 3 requests per key switch cycle,

— ENABLED (CONTINUOUS UNTIL PGN RECEIVED) can potentially result in an infinite number of requests per key switch cycle.

In any case, the Request broadcast for a given PGN ceases as soon as the TCM receives that PGN. Note that disabling a TCM PGN Request broadcast may not prevent TCM reception of the associated PGN if present on the J1939 network.

The TCM may request:

— PGN 65242 (SOFT) for SHIFT SELECTOR, ALLISON

— PGN 64912 (AETC) (V) for DYNAMIC SHIFT SENSING

— PGN 65249 (RC) (V) for ENGINE BRAKE INTERFACE

— PGN 65251 (EC1) (V) for:

EMISSION CONTROL SYSTEMS – DPF / SCR

ENGINE MANAGEMENT – ARM

ENGINE MANAGEMENT – SEM

ENGINE MANAGEMENT – LRTP

ENGINE MANAGEMENT – OTL

— PGN 65260 (VI)

— PGN 65261 (CCSS) (V) for ROAD SPEED LIMITING

B.5.13.2. *TCM MESSAGE RECEPTION*

The TCM will respond to global and destination-specific requests, and use the SAE J1939-21 RTS / CTS mechanism as required.

B.5.13.2.1. Information Request Support

Unless an item marked (V) is disabled via VEPS, the TCM will respond to requests for:

— PGN 64906 (SAE J2012 DTC Display)
— PGN 64965 (ECU Identification Information)
— PGN 65099 (Transmission Configuration #2) (V)
— PGN 65242 (Software Identification) (V)
— PGN 65250 (Transmission Configuration) (V)
— PGN 65259 (Component ID) (V)
— PGN 65440 (Prop_A0) (V)

B.5.13.2.2. Action Request Support

If VEPS **[18070] DIAGNOSTICS: Protocol** = SAE J1939-73, the TCM will respond to requests for:

— PGN 65228 (DM3)
— PGN 65235 (DM11)

See DIAGNOSTIC COMMUNICATION FOR OEM USE for details.

B.5.13.3. *SELECTOR MESSAGE RECEPTION*

Allison J1939-based shift selectors only respond to PGN 65242 (SOFT) requests sent to destination address 05 or 06 (if dual selectors installed) from SA 03. See SHIFT SELECTOR, ALLISON.

B.5.14. PGN 60160 – TRANSPORT PROTOCOL DATA TRANSFER MESSAGE (TP.DT)

SAE J1939-21 Excerpt: The TP.DT message is an individual packet of a multi-packet message transfer. For example, if a large message had to be divided into five packets in order to be communicated then there would be five TP.DT messages. [See SAE J1939-21 for more details.]

Transmission Repetition Rate: Per the PGN to be transferred

Data Length .... 8 bytes
PDU Format 235
PDU Specific .... 255 (Global) for TP.CM.BAM
Default Priority 7
PGN 60,160 (0xEB00)

Byte	Bit Content
1	Sequence Number
2-8	Packetized Data (7 bytes). Note the last packet of a multipacket Parameter Group may require less than 8 data bytes. The extra bytes should be filled with FF_{16}.

B.5.14.1. *TCM MESSAGE BROADCAST*

The TCM uses TP.DT to convey the following multi-packet messages from SA 03 (Transmission #1):

— PGN 65226 – Active Diagnostic Trouble Codes
— PGN 65242 – Software Identification
— PGN 65250 – Transmission Configuration
— PGN 65259 – Component ID
— PGN 64906 – SAE J2012 DTC Display
— PGN 64965 – ECU Identification Information
— PGN 64839 – Transmission Mode Labels

…and PGN 65249 – Retarder Configuration from SA 16 (Retarder – Driveline).

Sequence Number and *Packetized Data* values vary. See individual PGN descriptions for details. TCM packet broadcasts use the "parent" message priority, e.g. a multi-packet DM1 message would use Priority 6 in its message segments. This is not an uncommon industry practice.

B.5.14.2. *TCM MESSAGE RECEPTION*

The TCM uses TP.DT to receive:

— PGN 64912 – Advertised Engine Torque Curve
— PGN 65251 – Engine Configuration 1
— PGN 65249 – Retarder Configuration
— PGN 65260 – Vehicle Identification

B.5.15. PGN 60416 – TRANSPORT PROTOCOL CONNECTION MANAGEMENT (TP.CM) BAM

SAE J1939-21 Excerpt: This type of message is used to initiate and close connections and also to control flow. Transport protocol provides the following five transport protocol connection management messages: the Connection Mode Request To Send, the Connection Mode Clear To Send, the End of Message Acknowledgment, the Connection Abort, and the Broadcast Announce Message.

The RTS message informs a node that another node on the network wishes to open a virtual connection with it. The RTS is a message with the SA field set to that of the originating node, the DA field set to that of the intended recipient of a large message, and the remaining fields set appropriately for the PG being sent.

The CTS message is used to respond to the RTS message. The CTS message informs the originating node that the receiving node is ready for a certain amount of large message data. The amount of large message data cleared to send shall be no larger than the smaller of the two values in byte 4 and byte 5 of the originator's TP.CM_RTS message.

TP.CM_BAM (Transport Protocol Connection Management Broadcast Announce Message) is used to inform all network nodes that a large message is about to be broadcast. It defines the PGN and number of bytes to be sent. After TP.CM_BAM is sent, the Data Transfer Messages are sent containing the packetized broadcast data. TP.CM_BAM is only transmitted by the originator.

[See SAE J1939-21 for more details.]

Transmission Repetition Rate: Per the PGN to be transferred

Data Length .... 8 bytes
PDU Format 236
PDU Specific .... Destination address
Default Priority 7
PGN 60,416 (0xEC00)

Byte	Bit Content
1	Control Byte
2-5	Definition depends on the specific CM message type as indicated by the Control Byte value
6-8	PGN of Broadcast Message

The TCM uses TP.CM_BAM, TP.CM_RTS, and TP.CM_CTS for Transport Protocol connections according to J1939-21, Table 5.

B.5.15.1. *TCM MESSAGE BROADCAST*

The TCM uses TP.CM to announce broadcast of the following multi-packet messages from SA 03:

- PGN 65226 – Active Diagnostic Trouble Codes
- PGN 65242 – Software Identification
- PGN 65250 – Transmission Configuration
- PGN 65259 – Component ID
- PGN 64906 – SAE J2012 DTC Display
- PGN 64965 – ECU Identification Information
- PGN 64839 – Transmission Mode Labels

…and PGN 65249 – Retarder Configuration from SA 16 (Retarder – Driveline).

B.5.15.2. *TCM MESSAGE RECEPTION*

The TCM receives TP.CM in association with the following received messages:

- PGN 64912 – Advertised Engine Torque Curve
- PGN 65251 – Engine Configuration 1
- PGN 65249 – Retarder Configuration
- PGN 65260 – Vehicle Identification

B.5.16. PGN 60928 – ADDRESS CLAIMED / CANNOT CLAIM

SAE Excerpt:
Transmission Broadcast Rate............As Required
Data Length ....8 bytes
PDU Format..238
PDU Specific.........................255 (global address)
Default Priority 6
PGN 60,928 (0xEE00)
Source Address .... 0 to 253
(Address claimed for the Controller Application)

NAME of Controller Application:

Byte	Bit Content
1	Least significant byte of Identity Number
2	Second byte of Identity Number
3	8-6 Least significant 3 bits of Manufacturer Code 5-1 Most significant 5 bits of Identity Number
4	Most significant 8 bits of Manufacturer Code
5	8-4 Function Instance 3-1 ECU Instance
6	Function
7	8-2 Vehicle System 1 Reserved
8	8 Arbitrary Address Capable 7-5 Industry Group 4-1 Vehicle System Instance

B.5.16.1. *TCM MESSAGE BROADCAST*

TCMs respond to destination-specific or global PGN requests. Broadcast from SA 03 and SA 16 (when applicable).

Parameter	Possible Values
Identity Number	200 = 6G TCM
Manufacturer Code	2 = Allison Transmission
Function Instance	0 = Primary
ECU Instance	0
Function	3 = Transmission 13 = Retarder – Driveline
Vehicle System	1 = Tractor
Arbitrary SA Capable	0 = No
Industry Group	1 = On-Highway Equipment
Vehicle System Instance	0

B.5.16.2. *SELECTOR MESSAGE BROADCAST*

Allison selectors respond to destination-specific or global PGN requests. See SHIFT SELECTOR, ALLISON and SHIFT ACTUATOR SYSTEM W/ALLISON SELECTOR: 1000/2000 SERIES.

In dual selector applications, Address Claim prevents both selectors from using the same SA and sending conflicting information to the TCM.

Parameter	Possible Values
Identity Number	0 = 4G Pushbutton 1 = 4G Lever 2 = 5G Pushbutton 3 = 5G Compact PB 4 = 5G Bump Lever 5 = 5G 3-Button Strip 6 = 5G 6-Button Strip 16 = 6G Pushbutton 26 = 6G Compact PB
Manufacturer Code	2 = Allison Transmission
Function Instance	0 = Primary 1 = Secondary
ECU Instance	0
Function	5 = Shift Control / Console
Vehicle System	1 = Tractor
Arbitrary SA Capable	0 = No
Industry Group	1 = On-Highway Equipment
Vehicle System Instance	0

B.5.17. PGN 61184 – PROPRIETARY "A"

SAE J1939-21 Excerpt: This proprietary PG uses the Destination Specific PDU Format allowing manufacturers to direct their proprietary communications to a specific destination node. How the data field of this message is used is up to each manufacturer. Use of proprietary messages is at the manufacturer's discretion with the constraint that significant percentages (2% or more) of vehicle network utilization must be avoided.

Transmission Repetition Rate: Per user requirements

Data Length ....0 to 1785 bytes (multipacket supported)
PDU Format..239
PDU Specific......................... Destination Address
Default Priority 6
PGN 61,184 (0xEF00)

Byte	Bit Content
1-8	Manufacturer specific use

B.5.17.1. *ALLISON MESSAGE USE*

When PGN 61184 is enabled, the TCM broadcasts a single-frame message of selector display information every 100 ms. The TCM also sends single frame instances of PGN 61184 during TCM-initiated Selector Configuration (TISC). Broadcast rates during TISC may vary. The following CAN identifiers are used:

SA	DA	Priority	CAN Identifier
03	05	6	0x18EF0503
03	06	6	0x18EF0603

Used with functions:

SHIFT ACTUATOR SYSTEM W/ALLISON SELECTOR: 1000/2000 SERIES

SHIFT SELECTOR, ALLISON

In addition, Allison 5th and 6th Generation selectors may broadcast a single Proprietary A message to the TCM resulting in CAN identifiers:

SA	DA	Priority	CAN Identifier
05	03	6	0x18EF0305
06	03	6	0x18EF0306

B.5.18. PGN 61440 – ELECTRONIC RETARDER CONTROLLER 1 (ERC1)

SAE Excerpt:
Transmission Repetition Rate ....100 ms
Data Length ....8 bytes
PDU Format...240
PDU Specific 0
Default Priority 6
PGN 61,440 (0xF000)

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables.

B.5.18.1. *TCM MESSAGE BROADCAST*

PGN is broadcast from SA 16 (Retarder – Driveline) unless all parameters are disabled via VEPS.

In addition, *Retarder Selection, Non Engine* can only be broadcast in applications where the analog RMR and retarder enable switch GPI are wired directly to the TCM.

B.5.18.2. *TCM MESSAGE RECEPTION*

See the functions referenced by each parameter.

B.5.18.3. *SPN 571 – RETARDER ENABLE – BRAKE ASSIST SWITCH*

SAE Excerpt: Switch signal which indicates whether the operator wishes the retarder to be enabled for vehicle braking assist. The retarder does not check this switch, nor does the enabling of this switch engage the retarder. When this switch is "enabled" the devices constructing TSC1 – destination retarder messages may command retarder torque for braking. For example, the cruise control should not request retarder torque if this switch is not enabled. The switch exists to prevent the retarder from being asked to engage via TSC1 in a noise sensitive area. See also SPN 572.

00b Retarder – Brake assist disabled
01b Retarder – Brake assist enabled
10b Error
11b Not available

B.5.18.3.1. TCM Parameter Reception

See ENGINE BRAKE INTERFACE.

B.5.18.4. *SPN 520 – ACTUAL RETARDER – PERCENT TORQUE*

SAE Excerpt: Actual braking torque of the retarder as a percent of retarder configuration reference torque SPN 556.

Data Length: 1 byte
Resolution: 1% per bit gain, -125% offset
Data Range: -125% to 125%
Operating Range: -125% to 0%

B.5.18.4.1. TCM Parameter Broadcast

Only available for broadcast in Allison retarder applications.

The Allison driveline retarder is active whenever a negative value is being broadcast.

Since engine coolant is typically used to cool the transmission fluid, engine coolant temperature will increase when the retarder is active. This parameter may be used by the system to maintain acceptable coolant temperature (e.g., lowering the temperature set point at which the cooling fan is engaged).

In addition, this parameter is provided for use in the following vehicle functions:

RETARDER CONTROL

RETARDER ACTIVE INDICATOR

ELECTRONIC BRAKING SYSTEMS (EBS)

While unit-to-unit variations may be as high as +/- 30%, repeatability for a given unit should be within approximately +/- 5%.

0% is indicated if the Allison retarder solenoid fails. 0xFE (Error) is indicated if the optional retarder pressure sensor is installed and fails. 0xFF (Not Available) is indicated when broadcast is disabled.

B.5.18.4.2. TCM Parameter Reception

See ENGINE BRAKE INTERFACE.

B.5.18.5. *SPN 1085 – INTENDED RETARDER PERCENT TORQUE*

SAE Excerpt: Braking torque of retarder that the retarder is currently trying to achieve. This value takes into account all static limitations, but not the limitations due to the dynamic behavior of the retarder. This value, if unchanged over a certain time, can and will be reached by the actual retarder – percent torque (See SPN 520).

Data Length: 1 byte
Resolution: 1 %/bit, -125 % Offset
Data Range: -125 to 125 %
Operational Range: -125 to 0%

B.5.18.5.1. TCM Parameter Broadcast

See RETARDER CONTROL. Parameter reflects the percent torque value being acted on by the retarder, which is the result of:

- All operator and vehicle inputs, including analog RMR, TSC1 messages, and / or ERC1 Retarder Selection, Non-Engine.
- Operational limitations, such as output shaft speed, retarder and / or sump temperature, or negative output torque limits.
- Diagnostic limitations, such as a failed retarder solenoid.

0% is indicated if the Allison retarder solenoid fails. 0xFF (Not Available) is indicated when broadcast is disabled.

B.5.18.6. *SPN 1667 – RETARDER REQUESTING BRAKE LIGHT*

SAE Excerpt: Indicates that whether the retarder is requesting that the brake lights are illuminated.

00b Retarder is not requesting that the brake lights are illuminated
01b Retarder is requesting that the brake lights are illuminated
10b Reserved
11b Don't Care; take no action

B.5.18.6.1. TCM Parameter Broadcast

Provided for use in functions:

RETARDER ACTIVE INDICATOR

RETARDER CONTROL

00b (Retarder is not requesting that the brake lights are illuminated) is indicated when the retarder is inactive, or if the Allison retarder solenoid fails. 01b (Retarder is requesting that the brake lights are illuminated) is indicated when the retarder is active. 11b (Don't Care; Take No Action) is indicated when broadcast is disabled.

B.5.18.7. *SPN 900 – RETARDER TORQUE MODE*

SAE Excerpt: State signal which indicates which retarder torque mode is currently generating, limiting, or controlling the torque. Note that the modes are not in prioritized order. Not all modes may be relevant for a given device. Some devices may not implement all functions.

Mode 0000b means "No request": retarder torque = 0 (no braking).

Modes 0001b to 1110b indicate that there is either a torque request or the identified function is currently controlling the retarder: engine/retarder torque may range from 0 (no braking) to the upper limit.

B.5.18.7.1. TCM Parameter Broadcast

See RETARDER CONTROL. Modes shown in **bold** are supported by Allison 6th Generation Controls:

Bits	Retarder Torque Mode
0000b	**Low idle governor / no request**
0001b	**AP / operator selection**
0010b	**Cruise control**
0011b	PTO governor
0100b	Road speed governor
0101b	ASR control
0110b	Transmission control
0111b	**ABS control**
1000b	**Torque limiting**
1001b	High speed governor
1010b	**Braking system (Electronic)**
1011b	Remote accelerators
1100b	Not defined
1101b	Not defined
1110b	Other
1111b	Not Available

1111b (Not Available) is indicated when broadcast is disabled.

Modes 0001b through 1110b indicate that there is either a torque request or the identified function is currently controlling the driveline retarder; torque may range from 0 (no braking) to the upper limit.

Low Idle Governor / No request (Default mode) – For a driveline retarder, only "No Request" applies. Mode is indicated when there are no analog or J1939-based inputs attempting to activate the retarder. The retarder is producing no braking.

Accelerator pedal/operator selection – This mode may be indicated when:

— Retarder activation is requested, either by analog RMR input, or from a J1939 "gateway" device receiving operator input and broadcasting it to the retarder via TSC1 messages or ERC1 *Retarder Selection, Non-Engine*.

— Retarder deactivated due to accelerator pedal input above a specific threshold, or a transmission range other than forward is commanded.

Cruise Control – If retarder operation is requested via J1939 TSC1 messages from SA 17 (Cruise Control), this mode may be indicated. This mode may also be indicated if **[20050] RETARDER: Cancel Retarder when Cruise Control is Active** has been enabled and cruise control is active (therefore preventing retarder operation).

ASR Control – Not supported, as ASR controllers do not send commands to the retarder during positive wheel slip events.

Transmission Control – Not supported. The SAE definition for this mode states: "Indicates that the transmission command is active (Speed, Torque, or Speed/Torque Limit Control)." Since the TCM does not send TSC1 commands to its own retarder, this mode is not applicable.

ABS Control – Indicates that ABS is limiting the retarder torque output. This mode is indicated when the driveline retarder is being deactivated due to an ABS response, or while waiting for the retarder reactivation timer (in the TCM) to elapse after the ABS event is over. Allison's internal "wheel lock detection" algorithm will also cause this mode to be indicated. During a skid, the TCM wheel lock algorithm and the ABS controller will both be deactivating the retarder.

Torque Limiting – Indicated if the retarder is being limited or deactivated by any of the following factors:

— Diagnostic codes
— High retarder fluid temperatures
— Rapid vehicle decelerations
— Transmission downshifts
— Operating against the retarder torque curve
— Output shaft speed too low for retarder operation.

Brake System (Electronic) – Reflected when TSC1s from SA 11 (Brakes – System Controller) are controlling the retarder. Despite the SAE definition:

"This indicates that the brake pedal is controlling the torque. Note that this may include enabling of the retarder when the brake pedal is depressed (touched). Note that if there is a request to the retarder but operating conditions do not allow braking, this situation will be reflected by the Percent Retarder Torque = 0 when broadcast."

…this *Retarder Torque Mode* is not indicated when an analog connection between the brake pedal and TCM is activating the retarder. When the retarder is wired such that the brake pedal can activate it (See *TD175: Guidelines for Selecting Retarder Controls*), the TCM has no way of distinguishing whether the brake pedal or another operator-actuated RMR is the source for retarder activation; both arrangements use the same I/O wires. As a result, "Operator Selection" will be indicated in both arrangements.

Retarder Torque Mode Arbitration and Hierarchy

Per the individual mode logic described above, there are times when multiple modes may be indicated. In such cases, hierarchy for the *Retarder Torque Mode* broadcast value is as follows, with the higher mode in the list below always being the mode broadcast:

Modes, Starting with Highest	Value
ABS Control deactivating the retarder	0111b
Cruise Control *deactivating* the retarder	0010b
Accelerator Pedal deactivating the retarder	0001b
Torque Limiting deactivating or limiting the retarder	1000b
Cruise Control or Operator Selection *activating* the retarder	0010b or 0001b
Brake System controlling or activating the retarder	1010b
No Request	0000b

For example:

— If the operator is requesting retarder operation via the analog RMR lever, but an ABS event is occurring and deactivating the retarder, *Retarder Torque Mode* will reflect 0111b (ABS Control).

— If the retarder is being activated by a Cruise Control via J1939 TSC1 messages, and the retarder is operating at peak output (i.e., on the retarder torque curve for the given driveline speed), then *Retarder Torque Mode* will reflect 1000b (Torque Limiting).

B.5.18.8. *SPN 1082 – ENGINE COOLANT LOAD INCREASE*

SAE Excerpt: Status of an event, external to the engine, that may increase the nominal temperature of the engine coolant liquid.

00b No coolant load increase
01b Coolant load increase possible
10b Error
11b Not available

B.5.18.8.1. TCM Parameter Broadcast

See RETARDER CONTROL. Indicates 01b (Coolant load increase possible) when the retarder is active, and 00b (No coolant load increase) when the retarder is inactive. 10b (Error) is not supported; 00b is indicated if the Allison retarder solenoid fails. 11b (Not Available) is indicated when broadcast is disabled.

B.5.18.9. *SPN 1480 – SOURCE ADDRESS OF CONTROLLING DEVICE FOR RETARDER CONTROL*

SAE Excerpt: The source address of the SAE J1939 device currently controlling the retarder. It is used to expand the torque mode parameter in cases where control is in response to an ECU that is not listed in the Retarder Torque Modes. The value may be the source address of the ECU transmitting the message (which means that no external SAE J1939 message is providing the active command) or the source address of the SAE J1939 ECU that is currently providing the active command in a TSC1 or similar message. Note that if this parameter value is the same as the source address of the device transmitting it, the control may be due to a message on a non-SAE J1939 data link such as SAE J1922 or a proprietary link.

Data Length: 1 byte
Resolution: 1 source address / bit, 0 offset
Data Range: 0 to 255
Operational Range: 0 to 253

B.5.18.9.1. TCM Parameter Broadcast

See RETARDER CONTROL. The TCM will indicate one of the following as controlling the retarder:

— Any SA controlling the retarder via ERC1 *Retarder Selection, Non-Engine*, or

— Any SA controlling the retarder via winning TSC1 command or limit.

0xFF (Not Available) is indicated when broadcast is disabled.

B.5.18.10. *SPN 1716 – RETARDER SELECTION, NON-ENGINE*

SAE Excerpt: The "Retarder Selection, non-engine" is the position of the driver's selector for retarders that are not part of the engine system, expressed as percent and determined by the ratio of current position to the maximum possible position. The physical device may be a lever, rotary dial, combination of switches, or other device that the driver can use to select the type or amount of retardation needed.

Data Length: 1 byte
Resolution: 0.4 % / bit, 0 offset
Data Range: 0 to 100 %
Operational Range: Same as data range

B.5.18.10.1. TCM Parameter Broadcast

TCM may broadcast parameter in Allison retarder applications, depending on IO configuration; see RETARDER CONTROL. Parameter reflects the combined status of the analog RMR and enable switch. 0xFE (Error) is indicated when analog input circuit electrical failures are detected. 0xFF (Not Available) is indicated when broadcast is disabled.

B.5.18.10.2. TCM Parameter Reception

See RETARDER CONTROL.

B.5.18.11. *SPN 1717 – ACTUAL MAXIMUM AVAILABLE RETARDER – PERCENT TORQUE*

SAE Excerpt: This is the maximum amount of torque that the retarder can immediately deliver. It is the same as the maximum torque shown in the Retarder's Configuration message, but allows for a much faster rate of change than could be communicated by reissuing the configuration message.

Application Note: The purpose for this parameter is to allow a "Master" retarder controller to more accurately allocate the vehicle's retarder requirements among multiple retarders. Its value should be the same as the value in the Configuration message at the time that message is assembled for broadcast, but may vary between those broadcasts.

Data Length:	1 byte
Resolution:	1 % / bit, -125% Offset
Data Range:	-125 to 125%
Operational Range:	0 to -125%

B.5.18.11.1. TCM Parameter Broadcast

See RETARDER CONTROL. Conveys the percentage of RC *Retarder Reference Torque* the retarder is capable of producing at a given instant, based on applicable retarder operation boundaries:

- Current output shaft speed
- Sump temperature
- Retarder temperature
- Diagnostics
- Fire Truck Pump Mode
- Negative output torque limits

0% is indicated if the Allison retarder solenoid fails. 0xFF (Not Available) is indicated when broadcast is disabled.

B.5.18.12. *SPN 4233 – RETARDER ROAD SPEED LIMIT SWITCH*

SAE Excerpt: Retarder road speed limit switch states:

00b Road speed limiting by retarder is disabled
01b Road speed limiting by retarder is enabled. When the speed limit is not set by a network device, the road speed that the retarder will limit to may be determined when the switch transitions from 00 to 01.
10b Error Indicator
11b Not available

B.5.18.12.1. TCM Parameter Reception

See DOWNHILL SPEED CONTROL.

B.5.19. PGN 61441 – ELECTRONIC BRAKE CONTROLLER 1 (EBC1)

SAE Excerpt:
Transmission Repetition Rate....................100 ms
Data Length ....8 bytes
PDU Format...240
PDU Specific..1
Default Priority 6
PGN 61,441 (0xF001)

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables.

B.5.19.1. *SPN 521 – BRAKE PEDAL POSITION*

SAE Excerpt: Ratio of brake pedal position to maximum pedal position. Used for electric brake applications. 0% means no braking. Also when there are two brake pedals on the machine (Left Brake Pedal Position SPN 3033 and Right Brake Pedal Position SPN 3032) the maximum of the two should be transmitted for Brake Pedal Position.

Data Length: 1 byte
Resolution: 0.4 %/bit, 0 offset
Data Range: 0 to 100%
Operational Range: Same as data range

B.5.19.1.1. TCM Parameter Reception

TCM may receive parameter for functions:

NEUTRAL AT STOP INPUT

SERVICE BRAKE STATUS INPUT

B.5.19.2. *SPN 561 – ASR ENGINE CONTROL ACTIVE*

SAE Excerpt: State signal which indicates that ASR engine control has been commanded to be active. Active means that ASR actually tries to control the engine. This state signal is independent of other control commands to the engine (e.g., from the transmission) which may have higher priority.

00b ASR engine control passive but installed
01b ASR engine control active
10b Reserved
11b Not available

B.5.19.2.1. TCM Parameter Reception

See AUTOMATIC TRACTION CONTROL.

B.5.19.3. *SPN 562 – ASR BRAKE CONTROL ACTIVE*

SAE Excerpt: State signal which indicates that ASR brake control is active. Active means that ASR actually controls wheel brake pressure at one or more wheels of the driven axle(s).

00b ASR brake control passive but installed
01b ASR brake control active
10b Reserved
11b Not available

B.5.19.3.1. TCM Parameter Reception

See AUTOMATIC TRACTION CONTROL.

B.5.19.4. *SPN 563 – ANTI-LOCK BRAKING (ABS) ACTIVE*

SAE Excerpt: State signal which indicates that the ABS is active. The signal is set active when wheel brake pressure actually starts to be modulated by ABS and is reset to passive when all wheels are in a stable condition for a certain time. The signal can also be set active when driven wheels are in high slip (e.g., caused by retarder). Whenever the ABS system is not fully operational (due to a defect or during off-road ABS operation), this signal is only valid for that part of the system that is still working. When ABS is switched off completely, the flag is set to passive regardless of the current wheel slip conditions.

00b ABS passive but installed
01b ABS active
10b Reserved
11b Don't care / take no action

B.5.19.4.1. TCM Parameter Reception

See ANTI-LOCK BRAKE SYSTEM (ABS) INPUT.

B.5.19.5. *SPN 973 – ENGINE RETARDER SELECTION*

SAE Excerpt: The position of the operator controlled selector, expressed as a percentage and determined by the ratio of the current position of the selector to its maximum possible position. Zero percent means no braking torque is requested by the operator from the engine while 100% means maximum braking.

Data Length: 1 byte
Resolution: 0.4 %/bit, 0 offset
Data Range: 0 to 100%
Operational Range: Same as data range

B.5.19.5.1. TCM Parameter Reception

See ENGINE BRAKE INTERFACE.

B.5.19.6. *SPN 1121 – EBS BRAKE SWITCH*

SAE Excerpt: Switch signal which indicates that the brake pedal is being pressed. The EBS brake switch is independent of the brake light switch and has no provisions for external connections.

00b Brake pedal is not being pressed
01b Brake pedal is being pressed
10b Error
11b Not available

B.5.19.6.1. TCM Parameter Reception

TCM may receive parameter to supplement or replace a brake switch GPI in functions:

AUXILIARY FUNCTION RANGE INHIBIT – SINGLE INPUT

AUTOMATIC NEUTRAL – BRAKE-BASED (BBAN) INPUT

AUTOMATIC NEUTRAL – DUAL INPUT W/ARTR

DIRECTION CHANGE ENABLE INPUT

DYNAMIC SHIFT SENSING

ENGINE MANAGEMENT – NRA

SERVICE BRAKE STATUS INPUT

B.5.20. PGN 61442 – ELECTRONIC TRANSMISSION CONTROLLER 1 (ETC1)

SAE Excerpt:
Transmission Repetition Rate .... 10 ms
Data Length .... 8 bytes
PDU Format..240
PDU Specific 2
Default Priority 3
PGN 61,442 (0xF002)

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables. PGN is broadcast from SA 03 unless all parameters are disabled via VEPS.

B.5.20.1. *SPN 4816 – TRANSMISSION TORQUE CONVERTER LOCKUP TRANSITION IN PROCESS*

SAE Excerpt: State signal indicating whether or not the transmission torque converter lock up clutch is transitioning between being applied and being released. The broadcast value should be set to 01 as soon as an apply or release of the lockup clutch is initiated, and then set to 00 once the given transition is complete. This parameter is a companion to SPN 573 *Transmission Torque Converter Lockup Engaged*.

00b Transition is not in process
01b Transition is in process
10b Error
11b Not available

B.5.20.1.1. TCM Parameter Broadcast

Parameter indicates 01b (Transition is in process) during impending lockup clutch apply or release. However, during some disengagement events, the control event may be so short that a transition in process is not indicated. State 10b (Error) is not supported. 11b (Not Available) is indicated when broadcast is disabled.

See VEHICLE ACCELERATION RATE LIMITING.

B.5.20.2. *SPN 574 – TRANSMISSION SHIFT IN PROCESS*

SAE Excerpt: Indicates that the transmission is in process of shifting from the current gear to the selected gear. This state is generally ACTIVE during the entire time that the transmission controls the vehicle. This includes any transmission clutch control, all engine control sequences, pulling to transmission neutral, and engaging the destination gear (e.g., until it is no longer sending commands and/or limits to the engine). See also SPN 560. (See Figure SPN574_A)

This state is INACTIVE during other engine control such as torque limiting outside of a shift.

00b Shift is not in process
01b Shift is in process
10b Error
11b Not available

B.5.20.2.1. TCM Parameter Broadcast

Parameter is set to 01b (Shift is in process) prior to any clutch activity for an upcoming shift, and is set back to 00b (Shift is not in process) when all clutch activity of the previous shift has completed. 10b (Error) is not supported. 11b (Not Available) is indicated when broadcast is disabled.

This information is provided for the discretionary use of the system, such as maintaining proper fueling when a shift occurs during cruise control operation.

B.5.20.3. *SPN 573 – TRANSMISSION TORQUE CONVERTER LOCKUP ENGAGED*

SAE Excerpt: State signal which indicates whether the torque converter lockup is engaged.

00b Torque converter lockup disengaged
01b Torque converter lockup engaged
10b Error
11b Not Available

B.5.20.3.1. TCM Parameter Broadcast

See LOCKUP INDICATOR and ENGINE BRAKE INTERFACE. 10b (Error) is indicated if the TCM does not know lock-up status. 11b (Not Available) is indicated when broadcast is disabled.

B.5.20.4. *SPN 560 – TRANSMISSION DRIVELINE ENGAGED*

SAE Excerpt: Driveline engaged indicates the transmission-controlled portion of the driveline is engaged sufficiently to allow a transfer of torque through the transmission. Driveline engaged is ACTIVE whenever the transmission is in gear and the clutch (if controlled by the transmission controller) is less than 100% clutch slip (clutch able to transfer torque). This parameter should be used in conjunction with the parameter "Shift in Process" (SPN 574). While a shift is in process, the receiver should not assume that the driveline is either fully engaged or disengaged (i.e., cruise control).

00b Driveline disengaged
01b Driveline engaged
10b Error
11b Not available

B.5.20.4.1. TCM Parameter Broadcast

Indicates 00b (Driveline disengaged) during all Allison neutral states, including the "Neutral No Clutches" state that occurs with some diagnostic faults.

01b (Driveline Engaged) is indicated during Neutral-to-Range shifts, as soon as some amount of torque may be transferred to the driveline (prior to full clutch engagement). Once an initial range has been engaged, 01b remains indicated as long as *Transmission Current Range* is non-neutral. This includes Neutral At Stop operation, except for some engine applications with particular idle governor characteristics.

10b (Error) is indicated in rare diagnostic conditions where the current gear cannot be determined. 11b (Not Available) is indicated when broadcast is disabled, and during the "All Solenoids Off" state resulting from diagnostic procedures.

B.5.20.5. *SPN 191 – TRANSMISSION OUTPUT SHAFT SPEED*

SAE Excerpt: Calculated speed of the transmission output shaft.

Data Length:	2 bytes
Resolution:	0.125 rpm / bit, 0 RPM offset
Data Range:	0 to 8031.875 RPM
Operational Range:	Same as data range

B.5.20.5.1. TCM Parameter Broadcast

TCM minimum broadcast value thresholds are dependent on the transmission output shaft tone wheel in use; see Allison Controls Systems Data for the values. Broadcast values below 15 RPM may not be accurate. Depending on sensor gap and component variation, some applications may read and convey lower output shaft speeds. 0 rpm is broadcast when the sensor reading drops out.

Due to the high sensitivity of the output shaft speed sensors used in the Allison 6th Generation Controls system, certain driveline disturbances may be visible as short spikes in the output shaft speed signal. The receiving device may need to implement signal filtering provisions appropriate for the intended use.

Speeds are indicated as positive values even when the vehicle is moving backwards.

0xFEFF (Error) is indicated during output shaft speed sensor errors. 0xFFFF (Not Available) is indicated when broadcast is disabled.

B.5.20.6. *SPN 607 – PROGRESSIVE SHIFT DISABLE*

SAE Excerpt: Command signal used to indicate that progressive shifting by the engine should be disallowed.

00b Progressive shift is not disabled
01b Progressive shift is disabled
10b Error
11b Take no action

B.5.20.6.1. TCM Parameter Broadcast

See PROGRESSIVE SHIFTING.

10b (Error) is not supported. 11b (Take no action) is indicated when broadcast is disabled.

B.5.20.7. *SPN 161 –TRANSMISSION INPUT SHAFT SPEED*

SAE Excerpt: Rotational velocity of the primary shaft transferring power into the transmission. When a torque converter is present, it is the output of the torque converter.

Data Length: 2 bytes
Resolution: 0.125 rpm / bit, 0 rpm offset
Data Range: 0 to +8031.875 rpm
Operational Range: Same as data range

B.5.20.7.1. TCM Parameter Broadcast

0xFEFF (Error) is indicated during input shaft speed sensor faults. 0xFFFF (Not Available) is indicated when broadcast is disabled.

B.5.20.8. *SPN 1482 – SOURCE ADDRESS OF CONTROLLING DEVICE FOR TRANSMISSION CONTROL*

SAE Excerpt: The source address of the SAE J1939 device currently controlling the transmission. Its value may be the source address of the ECU transmitting the message (which means that no external SAE J1939 message is providing the active command) or the source address of the SAE J1939 ECU that is currently providing the active command in a TSC1 or similar message. Note that if this parameter value is the same as the source address of the device transmitting it, the control may be due to a message on a non-SAE J1939 data link such as SAE J1922 or a proprietary link.

Data Length: 1 byte
Resolution: 1 source address / bit, 0 offset
Data Range: 0 to 255
Operational Range: 0 to 253

B.5.20.8.1. TCM Parameter Broadcast

TCM parameter broadcast always indicates SA 03, as the TCM always retains transmission control. Only Allison driveline retarders respond to TSC1 commands. 0xFF (Not Available) is indicated when broadcast is disabled.

B.5.21. PGN 61443 – ELECTRONIC ENGINE CONTROLLER 2 (EEC2)

SAE Excerpt: Transmission Repetition Rate: 50 ms (preferred) or Engine Speed Dependent (if required by application)

Data Length .... 8 bytes
PDU Format 240
PDU Specific...3
Default Priority 3
PGN 61,443 (0xF003)

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables.

B.5.21.1. *SPN 1437 – ROAD SPEED LIMIT STATUS*

SAE Excerpt: Status (active or not active) of the system used to limit maximum vehicle velocity.

00b Active
01b Not Active
10b Error
11b Not Available

NOTE – While somewhat inconsistent with other J1939 status parameters, the states defining 00 = active and 01 = inactive for Road Speed Limit Status are NOT typographical errors, and should be implemented as stated.

B.5.21.1.1. TCM Parameter Reception

TCM receives parameter for use with ROAD SPEED LIMITING.

This parameter is one of several used to determine if shift modulation is based on EEC2 *Accelerator Pedal Position 1* or EEC2 *Engine Percent Load at Current Speed*. Other parameters that factor into modulation source determination include:

— CCVS1 *Cruise Control States*
— CCVS1 Cruise Control Active
— EEC2 Road Speed Limit Status
— EEC1 Engine Torque Mode

If any of these parameters indicate that pedal information may not be valid for shift modulation purposes, then load information is utilized.

B.5.21.2. *SPN 559 – ACCELERATOR PEDAL KICKDOWN SWITCH*

SAE Excerpt: Switch signal which indicates whether the accelerator pedal Kickdown switch is opened or closed. The kickdown switch is defined in SAE J1843.

00b Kickdown passive
01b Kickdown active
10b Error
11b Not available

B.5.21.2.1. TCM Parameter Reception

TCM may receive parameter for KICKDOWN INPUT.

B.5.21.3. *SPN 91 – ACCELERATOR PEDAL POSITION 1*

SAE Excerpt: The ratio of actual position of the analog engine speed/torque request input device (such as an accelerator pedal or throttle lever) to the maximum position of the input device. This parameter is intended for the primary accelerator control in an application. If an application has only one accelerator control, use SPN 91.

For on-highway vehicles, this will typically be the operator's accelerator pedal. Although it is used as an input to determine powertrain demand, it also provides anticipatory information to transmission and ASR algorithms about driver actions.

In marine applications, this will typically be the operator's throttle lever.

If a low idle validation switch is used in conjunction with accelerator pedal position 1, use Accelerator Pedal Low Idle Switch 1, SPN 558.

Data Length:	1 byte
Resolution:	0.4% per bit gain, 0% offset
Data Range:	0% to 100%
Operational Range:	Same as data range

B.5.21.3.1. TCM Parameter Reception

TCM receives parameter for use with:

ACCELERATOR PEDAL INPUT

ACCELERATOR PEDAL INPUT – DUAL MODE OFS

ENGINE MANAGEMENT – ARM

ENGINE MANAGEMENT – SEM

ENGINE MANAGEMENT – LRTP

ENGINE MANAGEMENT – OTL

Per SAE, actual, physical accelerator pedal position should be reflected. If the broadcasting controller modifies the signal beyond normal A/D filtering, such modifications should only be reflected in other parameters, e.g. *Driver's Demand Engine – Percent Torque* or *Engine Demand – Percent Torque*.

B.5.21.4. *SPN 92 – ENGINE PERCENT LOAD AT CURRENT SPEED*

SAE Excerpt: The ratio of the actual percent torque (indicated) to maximum indicated torque available at the current engine speed, clipped to zero torque during engine braking.

Data Length:	1 byte
Resolution:	1% per bit, 0% offset
Data Range:	0% to 250%
Operational Range:	0 to 125%

B.5.21.4.1. TCM Parameter Reception

TCM receives parameter for use in functions:

ACCELERATOR PEDAL INPUT – DUAL MODE OFS

CRUISE CONTROL, STANDARD

CRUISE CONTROL, ADAPTIVE

CRUISE CONTROL, VIA ENGINE PTO GOVERNOR

DYNACTIVE™ SHIFTING

ENGINE MANAGEMENT – ARM

ENGINE MANAGEMENT – SEM

ENGINE MANAGEMENT – LRTP

ENGINE MANAGEMENT – OTL

ROAD SPEED LIMITING

VEHICLE ACCELERATION RATE LIMITING

Behavior during Engine De-Rate Operation

The calculation of EEC2 *Engine Percent Load at Current Speed* during de-rated conditions should always be based on the ratio of current de-rated indicated torque relative to the nominal non-derated indicated torque curve.

Behavior during Cruise Control and Road Speed Governor Operation

To avoid shift cycling and potential transmission damage during cruise control or road speed governor operation, *Engine Percent Load at Current Speed* behavior is required to:

— Reflect actual engine conditions with minimal filtering, and

— Maintain relatively constant values during certain shift scenarios. Unless the engine is responding to external TSC1 commands, *Engine Percent Load at Current Speed* should not change significantly during shifts that occur while operating under an active cruise control or road speed governor.

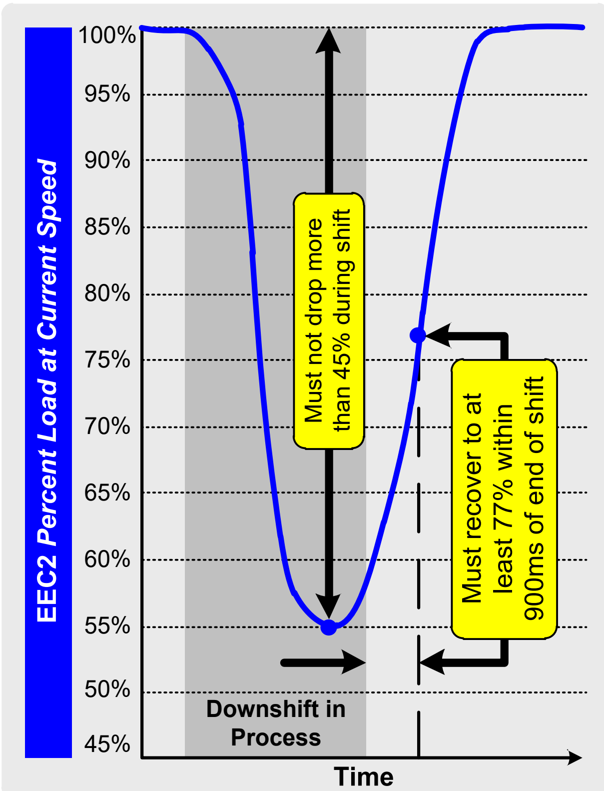
Typically, cruise and road speed governors using only vehicle speed and / or acceleration feedback do not exhibit significant changes in *Engine Percent Load at Current Speed*. The rapid changes described in the following two sections most often result from the use of engine speed and / or acceleration feedback in the controlling governor.

Full Power Downshifts during Cruise Control or Road Speed Governing

Cruise control maintains a set vehicle speed, and adjusts engine torque output as needed to do so. On steep grades, cruise governors will request maximum available engine torque to maintain the set speed. Still, the vehicle may slow to a point where a power downshift will occur.

It is understood that minor decreases in *Engine Percent Load at Current Speed* may occur during these downshifts, due to the combination of increased engine speed and negative slope on the engine torque curve. However, if *Engine Percent Load at Current Speed* drops significantly during this downshift, the transmission may upshift immediately afterwards. To avoid this cycling, the following requirements must be met:

For full power downshifts that occur while against an active cruise set speed or road speed governor, *Engine Percent Load at Current Speed* must not drop by more than 45% during the shift, and must recover to an absolute value of at least 77% within 900ms of the end of the shift. These requirements are illustrated below:



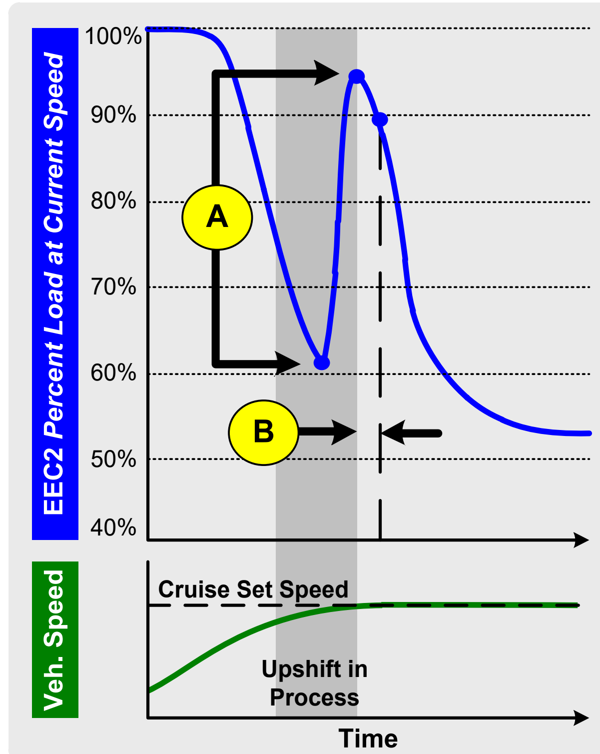
PERCENT LOAD BEHAVIOR DURING CC OR RSG FULL POWER DOWNSHIFTS

Upshifts as Cruise or Road Speed Governor Set Speed is Approached

As vehicle speed increases, an upshift may occur just as the cruise control or road speed governor set point is approached. Near the set point, the cruise or road speed governor tapers off the engine torque output, initiating the upshift.

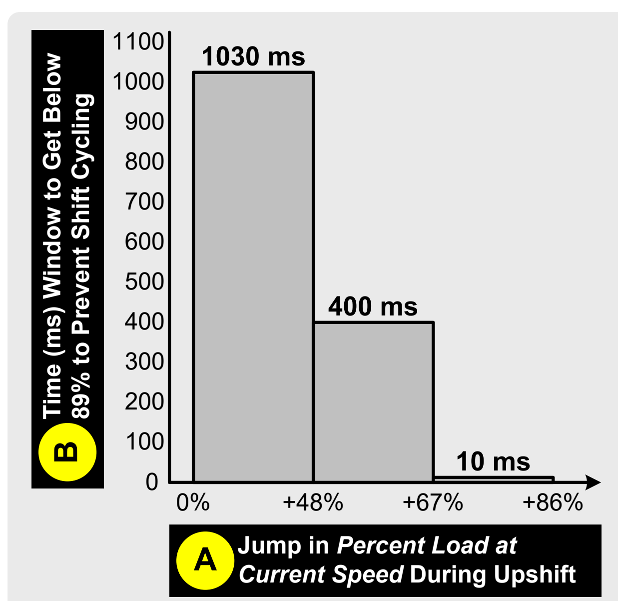
If *Engine Percent Load at Current Speed* jumps significantly during these upshifts, the transmission may downshift immediately afterwards. The increase in *Engine Percent Load at Current Speed* <u>during</u> the shift impacts the period of time available <u>after</u> the shift in which the value must drop below a threshold to avoid cycling. Requirements are illustrated in the two figures below.

The sequence in the figure below illustrates (A) the jump in *Engine Percent Load at Current Speed* value during the upshift, and (B) the time window after the shift in which *Engine Percent Load at Current Speed* must drop below an absolute value of 89% to prevent shift cycling. If the value does not peak above 89% during the upshift, shift cycling will not be a problem.



PERCENT LOAD BEHAVIOR DURING UPSHIFTS MADE NEAR CRUISE OR RSG SET POINT

The figure below defines the "recovery time" requirements associated with the *Engine Percent Load at Current Speed* increase during the upshift. For example, if *Engine Percent Load at Current Speed* jumped up by 55% during the upshift, it must drop below an absolute value of 89% within 400ms of the end of the shift to avoid a shift cycle.



PERCENT LOAD TIMING REQUIREMENTS FOR UPSHIFTS MADE NEAR CC OR RSG SET POINT

B.5.21.5. *SPN 974 – REMOTE ACCELERATOR PEDAL POSITION*

SAE Excerpt: The ratio of actual position of the remote analog engine speed/torque request input device (such as an accelerator pedal or throttle lever) to the maximum position of the input device.

For example, in on-highway vehicles this could be an accelerator control device that is external to the drivers cab or an accelerator that is controlled by a hand lever from the operator's seat.

The Remote Accelerator Enable Switch is SPN 969. This parameter enables the remote accelerator operation.

Data Length: 1 byte
Resolution: 0.4% per bit gain, 0% offset
Data Range: 0% to 100%
Operational Range: Same as data range.

B.5.21.5.1. TCM Parameter Reception

See ACCELERATOR PEDAL INPUT – DUAL MODE OFS.

B.5.21.6. *SPN 29 – ACCELERATOR PEDAL POSITION 2*

SAE Excerpt: The ratio of actual position of the second analog engine speed/torque request input device (such as an accelerator pedal or throttle lever) to the maximum position of the input device. This parameter is intended for secondary accelerator control in an application. If an application has only one accelerator control, use SPN 91.

In marine applications, this will typically be the operator's second throttle lever.

If a low idle validation switch is used in conjunction with accelerator pedal position 2, use Accelerator Pedal Low Idle Switch 2, SPN 2970.

NOTE – See SPNs 91, 28, and 974 for additional accelerator position parameters.

Data Length: 1 byte
Resolution: 0.4% per bit gain, 0% offset
Data Range: 0% to 100%
Operational Range: Same as data range.

B.5.21.6.1. TCM Parameter Reception

See ACCELERATOR PEDAL INPUT – DUAL MODE OFS.

B.5.21.7. *SPN 5399 – DPF THERMAL MANAGEMENT ACTIVE*

SAE Excerpt: Indicates that the exhaust temperatures have been elevated for regeneration of the diesel particulate filter aftertreatment system or in preparation of regeneration of the diesel particulate aftertreatment system.

00b DPF Thermal Management is not active
01b DPF Thermal Management is active
10b Reserved
11b Don't care

B.5.21.7.1. TCM Parameter Reception

See EMISSION CONTROL SYSTEMS – DPF/SCR.

B.5.21.8. *SPN 5400 – SCR THERMAL MANAGEMENT ACTIVE*

SAE Excerpt: Indicates that the exhaust temperatures have been elevated for regeneration of the SCR aftertreatment system or in preparation of regeneration of the SCR aftertreatment system.

00b SCR Thermal Management is not active
01b SCR Thermal Management is active
10b Reserved
11b Don't care

B.5.21.8.1. TCM Parameter Reception

See EMISSION CONTROL SYSTEMS – DPF/SCR.

B.5.21.9. *SPN 2979 – VEHICLE ACCELERATION RATE LIMIT STATUS*

SAE Excerpt: Status (active or not active) of the system used to limit maximum forward vehicle acceleration.

00b Limit not active
01b Limit active
10b Error
11b Not available

NOTE: The effect of emission control limits, such as engine exhaust smoke control, are specifically excluded; they are not considered to be part of a function to limit vehicle acceleration.

B.5.21.9.1. TCM Parameter Reception

See VEHICLE ACCELERATION RATE LIMITING.

B.5.21.10. *SPN 3357 – ACTUAL MAXIMUM AVAILABLE ENGINE – PERCENT TORQUE*

SAE Excerpt: This is the maximum amount of torque that the engine can immediately deliver as a percentage of the reference engine torque (SPN 544). The Actual Maximum Available Engine - Percent Torque shall take into consideration all engine torque derates (e.g. air fuel ratio control (AFC), noise control, etc.) that could potentially be active in the system. This parameter differentiates itself from the engine percent torque points 1 through 5 of the engine configuration map because it takes into account all dynamic internal inputs such as AFC and that it is updated on a 50ms basis.

Data Length: 1 byte
Resolution: 0.4% per bit, 0% offset
Data Range: 0 to 100%
Operational Range: Same as data range.

B.5.21.10.1. TCM Parameter Reception

See DYNACTIVE™ SHIFTING.

B.5.22. PGN 61444 – ELECTRONIC ENGINE CONTROLLER 1 (EEC1)

SAE Excerpt: Transmission Repetition Rate: Engine Speed Dependent

Data Length .... 8 bytes
PDU Format 240
PDU Specific 4
Default Priority 3
PGN: 61,444 (0xF004)

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables.

B.5.22.1. *SPN 899 – ENGINE TORQUE MODE*

SAE Excerpt: State signal which indicates which engine torque mode is currently generating, limiting, or controlling the torque. Note that the modes are not in prioritized order. Not all modes may be relevant for a given device. Some devices may not implement all functions. For typical priorities refer to Figures SPN512_A and SPN512_B for engine control and Tables SPN518_A to SPN518_B for retarder control. The data type of this parameter is measured.

Mode 0000b means "No request": engine torque may range from 0 to full load only due to low idle governor output.

Modes 0001b to 1110b indicate that there is either a torque request or the identified function is currently controlling the engine. Engine torque may range from 0 (no fueling) to the upper limit.

B.5.22.1.1. TCM Parameter Reception

TCM may receive parameter for use in functions:

AUTOMATIC TRACTION CONTROL

CRUISE CONTROL, STANDARD

CRUISE CONTROL, ADAPTIVE

ROAD SPEED LIMITING

Support for states marked ♦ below is required if the vehicle is equipped with the related feature or option and *Engine Torque Mode* is used to meet the minimum given function requirements. Refer to the functions listed above for details.

The bit states map as follows:

Bit State	Engine Torque Mode
0000b	Low idle governor / no request (Default)
0001b	Accelerator Pedal / operator selection
0010b	Cruise control ♦
0011b	PTO governor
0100b	Road speed governor ♦
0101b	ASR control ♦
0110b	Transmission control
0111b	ABS control
1000b	Torque limiting
1001b	High speed governor
1010b	Braking system
1011b	Remote accelerator
1100b	Service Procedure
1101b	Not defined
1110b	Other
1111b	Not Available

This parameter is one of several used to determine if shift modulation is based on EEC2 *Accelerator Pedal Position 1* or EEC2 *Engine Percent Load at Current Speed*. Other parameters that factor into modulation source determination include:

- CCVS1 *Cruise Control States*
- CCVS1 Cruise Control Active
- CCVS1 PTO Governor State
- EEC2 Road Speed Limit Status

If any of these parameters indicate that pedal information may not be valid for shift modulation purposes, then load information is utilized.

B.5.22.2. *SPN 512 – DRIVER'S DEMAND ENGINE – PERCENT TORQUE*

SAE Excerpt: The requested torque output of the engine by the driver. It is based on input from the following requestors external to the powertrain: operator (via the accelerator pedal), cruise control and/or road speed limit governor. Dynamic commands from internal powertrain functions such as smoke control, low- and high-speed engine governing; ASR and shift control are excluded from this calculation. The data is transmitted in indicated torque as a percent of the reference engine torque. See PGN 65251 for the engine configuration message. Several status bits are defined separately to indicate the request which is currently being honored. This parameter may be used for shift scheduling.

Data Length: 1 byte
Resolution: 1% per bit, -125% offset
Data Range: -125% to +125%
Operational Range: 0 to 125%

B.5.22.2.1. TCM Parameter Reception

See DYNACTIVE™ SHIFTING.

B.5.22.3. *SPN 513 – ACTUAL ENGINE – PERCENT TORQUE*

SAE Excerpt: The calculated output torque of the engine. The data is transmitted in indicated torque as a percent of reference engine torque (see the Engine Configuration message, PGN 65251). The engine percent torque value will not be less than zero and it includes the torque developed in the cylinders required to overcome friction.

Data Length: 1 byte
Resolution: 1% per bit, -125% offset
Data Range: -125% to +125%
Operational Range: 0 to 125%

B.5.22.3.1. TCM Parameter Reception

TCM receives parameter for use in functions:

DYNACTIVE™ SHIFTING

DYNAMIC SHIFT SENSING

ENGINE MANAGEMENT – ARM

ENGINE MANAGEMENT – SEM

ENGINE MANAGEMENT – LRTP

ENGINE MANAGEMENT – OTL

B.5.22.4. *SPN 1483 – SOURCE ADDRESS OF CONTROLLING DEVICE FOR ENGINE CONTROL*

SAE Excerpt: The source address of the SAE J1939 device currently controlling the engine. It is used to expand the torque mode parameter in cases where controls in response to a TCM that is not listed. Its value may be the source address of the TCM transmitting the message (which means that no external SAE J1939 message is providing the active command) or the source address of the SAE J1939 TCM that is currently providing the active command in a TSC1 or similar message. Note that if this parameter value is the same as the source address of the device transmitting it, the control may be due to a message on a non-J1939 data link such as SAE J1922 or a proprietary link.

Data Length: 1 byte
Resolution: 1 source address/bit, 0 offset
Data Range: 0 to 255
Operational Range: 0 to 253

B.5.22.4.1. TCM Parameter Reception

TCM receives parameter for use in functions:

ENGINE MANAGEMENT – SEM

ENGINE MANAGEMENT – LRTP

ENGINE MANAGEMENT – OTL

If an engine fails to respond to LRTP torque limits, a DTC is logged; this parameter indicates what vehicle device may have interfered with the engine control. See function for details.

B.5.22.5. *SPN 2432 – ENGINE DEMAND – PERCENT TORQUE*

SAE Excerpt: The requested torque output of the engine by all dynamic internal inputs, including smoke control, noise control and low and high speed governing.

Data Length: 1 byte
Resolution: 1%/bit, -125% offset
Data Range: -125 to 125%
Operational Range: -125% to 125%

Background:

During periods of TSC#1 engine control, other devices on the J1939 network may wish to know where the engine wants to go once it is released from TSC#1 control. In order for option transitions of driveline torque between different devices, it becomes necessary to understand the *engine's* desired torque for all phases of a TSC#1 control sequence.

Driver's Demand Engine – Percent Torque (SPN 512) provides a partial prediction of the torque the engine wishes to produce after a TSC#1 command is removed. Included in Driver's Demand Torque are external requestors to the powertrain such as accelerator pedal, cruise control, and road speed limit governors. However, *excluded* from DDT are (1) dynamic commands within the powertrain such as smoke control, noise control, and low and high speed engine governing, and (2) external TSC#1 commands to the engine such as those generated by traction control, unless SPN 3350 in the received TSC1 message is equal to P1 (Accelerator Pedal / Operator Selection), P2 (Cruise Control), P3 (PTO Governor), or P4 (Road Speed Governor). Since those control purposes originate from the driver, they shall be included in the calculation of DDT.

For a controller to properly determine the engine's desired output torque during a TSC#1 sequence, it needs knowledge of the torque being scheduled by all active controls within the engine. Since DDT excludes many of these active controllers from its calculation, it cannot be used to accurately predict the desired output torque. The effects of the external TSC#1 commands can be approximated by other devices by means of monitoring TSC#1 messages to the engine; however the effects of the engine's internal dynamic commands are completely unknown and cannot be estimated.

Actual Engine – Percent Torque (SPN 513) provides a window to the engine's desired torque output when no TSC#1 commands are actively controlling the engine. However, when the engine is responding to TSC#1 commands, the Actual Engine – Percent Torque parameter is no longer indicative of the torque that the engine will produce once those TSC#1 commands are removed.

In simplest terms, Engine Demand – Percent Torque (or "EDT") contains the engine's internal dynamic commands that are excluded from the Driver's Demand Engine – Percent Torque definition, including smoke control, noise control, and low and high speed governing. With this additional piece of information, devices on the network that are controlling the engine via TSC#1 messages can determine the torque direction of the engine once the current TSC#1 command is relinquished.

It is important to note that the proposed EDT parameter is used as information. The addition of the EDT parameter should in no way cause a change to the engine's actual torque command architecture.

EDT Calculation:

When no devices are controlling the engine via TSC#1 messages, the value of EDT is equal to the Actual Engine – Percent Torque parameter. When the engine is being controlled via a TSC#1 message, it is necessary for the engine controller to calculate what its' target torque *would be* if there were no external commands being received. This "runner up" in engine control will come from internal dynamic engine commands.

In the calculation of Actual Engine – Percent Torque, the output of the engine's idle governor must be considered, along with the impact of the engine's full load governor, smoke controls and other internal limiting logic. In the determination of the Engine Demand Torque parameter, these same engine logic components are needed, as indicated in Figure SPN 2432_A. However, there is a significant difference: These components only affect the Actual Engine – Percent Torque parameter determination if they are the component *actively* controlling the engine. In EDT, any of these components will be used to calculate EDT if they are the *"runner up"* for engine control. Even though these components may lose in the engine's internal control arbitration, the engine output torque that they would produce if in command needs to be found to determine EDT.

If speed governors are involved in determining these components of the EDT calculation, any of the following 3 special cases may need to be addressed:

Special Case #1: Speed Governors

If the engine governor referenced in Figure SPN 2432_A is a speed-based governor instead of a throttle table arrangement, a new challenge is presented in determining EDT. Since the speed governor output is directly influenced by the TSC#1 command in control (for example, integrator anti-windup logic), the speed governor's output during TSC#1 commands cannot be used to calculate EDT.

Instead, an *approximation* of the speed governor output without the effects of any TSC#1 commands is required for use in the EDT calculation. "Approximation" refers to removing the effects of integrator terms and any other dynamic components that result from the controlling TSC#1 commands. All elements affecting the speed governor reference should be included before the reference is translated into terms of torque.

All control algorithms with dynamic elements (e.g., speed governors) that execute during TSC#1 commands need to have their outputs replaced by "steady-state" approximations for use in the EDT calculation. Again note that these approximations are for use only in the EDT calculation; the actual engine control logic remains unchanged.

Figure SPN2432_B illustrates EDT and speed governor output during a typical control sequence. The output of the speed governor may tend to lag the engine's torque trace during and after the TSC#1 command sequence. Note however that the TSC#1's influence is not factored into EDT; only when the command sequence ends or is no longer winning in terms of engine control arbitration do the dynamic effects of the speed governor(s) appear in the EDT signal.

One method of converting the speed governor reference to torque is shown in Figure SPN2432_C. The inputs of current engine speed, accelerator pedal position and the shape of the governor droop curves can be used to find the equivalent torque output of the governor. A lookup table or calculation could be used.

Special Case #2: "Steep" or zero droop speed governors

Using a steady-state approximation with a "steep" or zero droop speed governor can cause large EDT changes over small speed changes. For example, if a cruise control governor has a zero droop and the vehicle speed is just below the cruise set speed, the steady-state torque approximation using the method described previously is very large. If vehicle speed increases a small amount to above the cruise set speed, the steady-state torque approximation becomes very small or zero.

As a result, a more accurate steady-state torque approximation is needed when steep droop governors are involved. A steep droop speed governor is defined as having a droop slope greater than 0.2% actual torque per rpm as seen below in Figure SPN2432_D.

The following method can be used to determine a steady-state torque approximation for steep or zero droop governors with fast responding integrator anti-windup / integrator resetting:

Upon a TSC#1 message actively controlling engine torque, save the last value of torque commanded by the speed governor (τ_{SGo}) and the last value of speed governor error (ε_{SGo}).

During this control sequence, calculate speed governor error (ε_{SGi})

Calculate an estimated torque for EDT determination use:

$$\tau_{SGestimated} = \tau_{SGo} + Kp_{SG} * (\varepsilon_{SGo} - \varepsilon_{SGi})$$

where Kp_{SG} is the speed governor proportional gain

Special Case #3: “Slow Response” Speed Governors

If the speed governor dynamic elements are slow to respond to a 1 second torque derate, then the speed governor can simply be executed during the TSC#1 event and the output used directly in determining EDT. This is an alternative for a speed governor which does not contain an integrator, or if the integrator anti-windup logic is slow to respond. A guideline for “slow response” is that the governor output after 1 second of torque limiting has only moved 1/3 of the way to the limit, as shown for example in Figure SPN2432_E.

B.5.22.5.1. TCM Parameter Reception

TCM receives parameter for use in functions:

DYNACTIVE™ SHIFTING

ENGINE MANAGEMENT – SEM

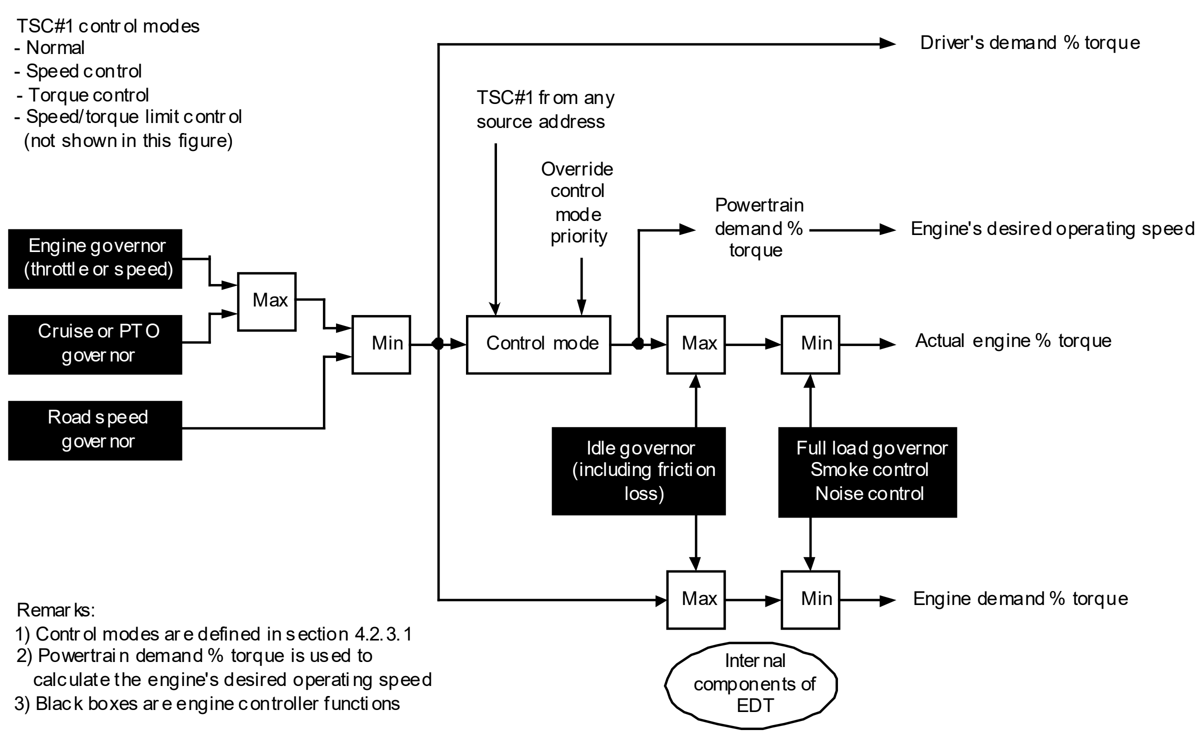


FIGURE SPN2432_A – TORQUE COMMANDS AND CALCULATIONS WHEN A “MAXIMUM LOW IDLE” TECHNIQUE IS USED

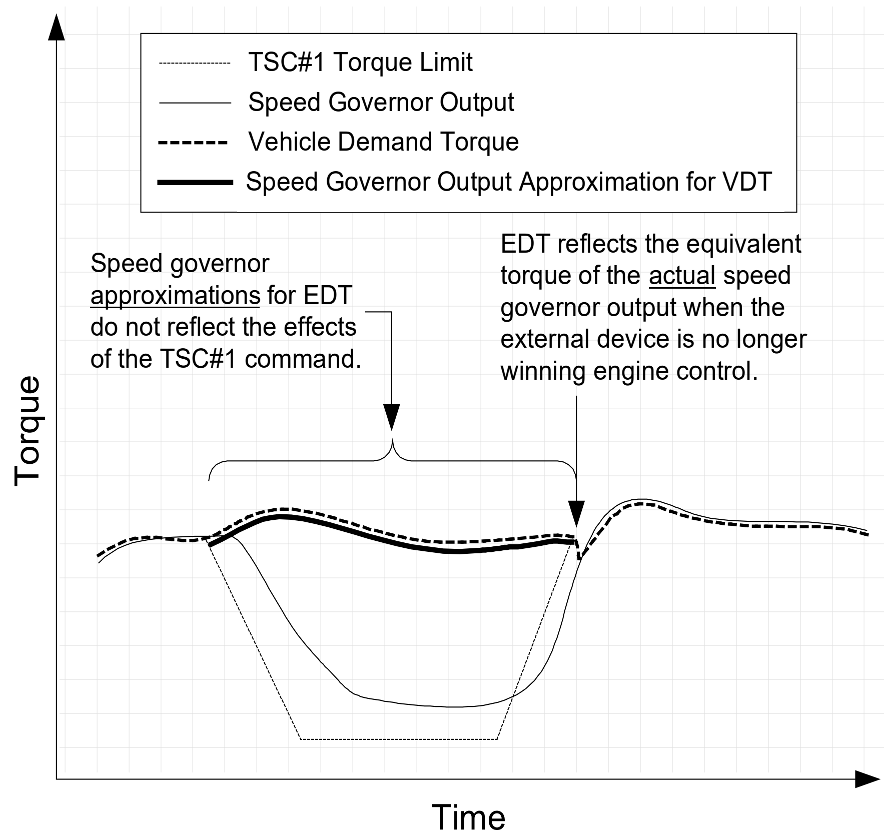


FIGURE SPN2432_B – EDT AND SPEED GOVERNOR OUTPUT RELATIONSHIP DURING A CONTROL SEQUENCE

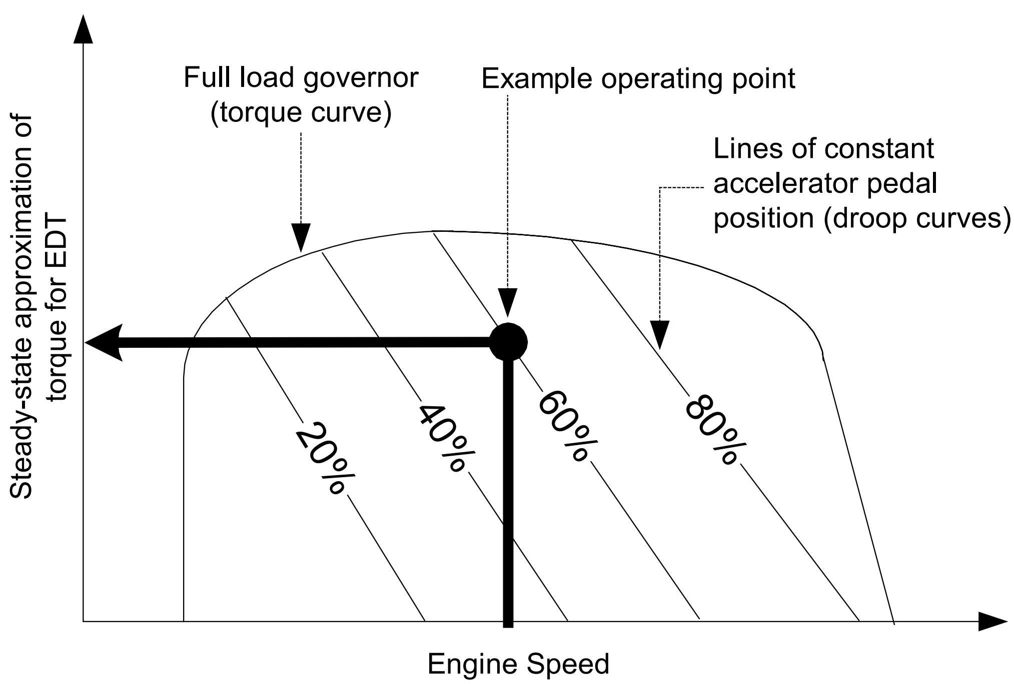


FIGURE SPN2432_C – FINDING EDT TORQUE APPROXIMATION FOR A SPEED GOVERNOR

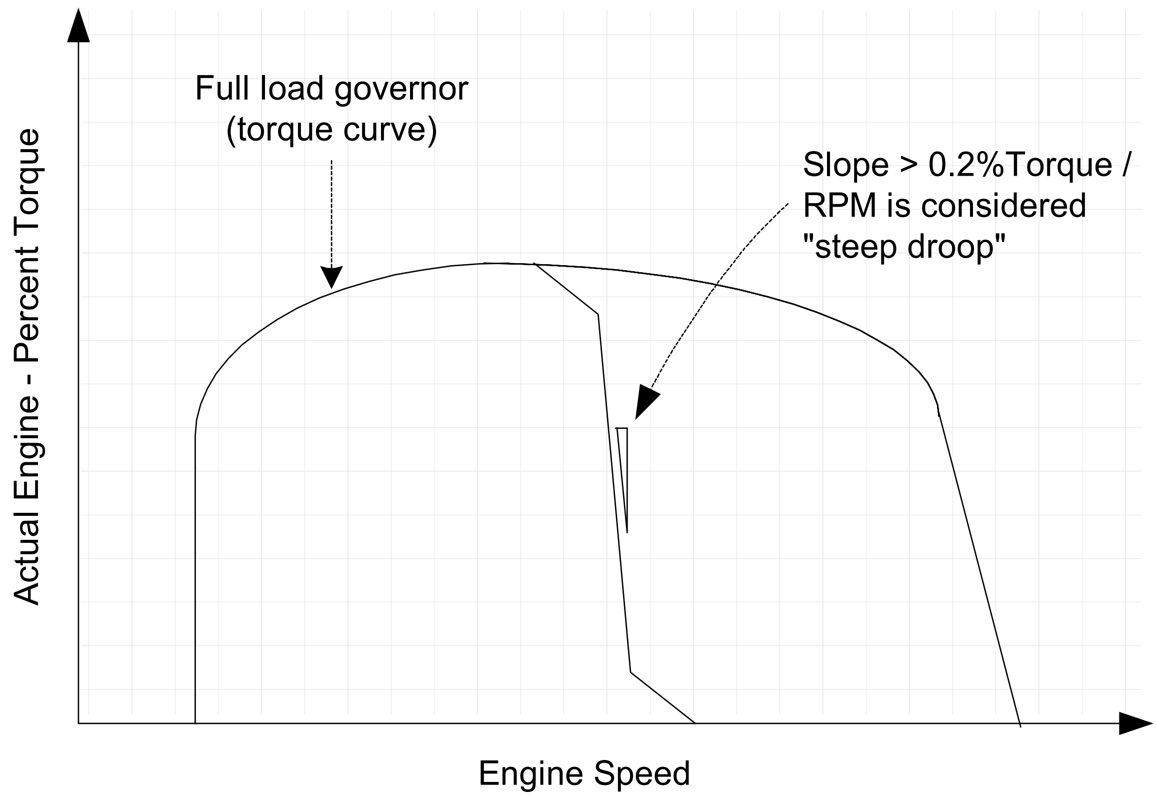


FIGURE SPN2432_D – EXAMPLE OF "STEEP DROOP" SPEED GOVERNOR

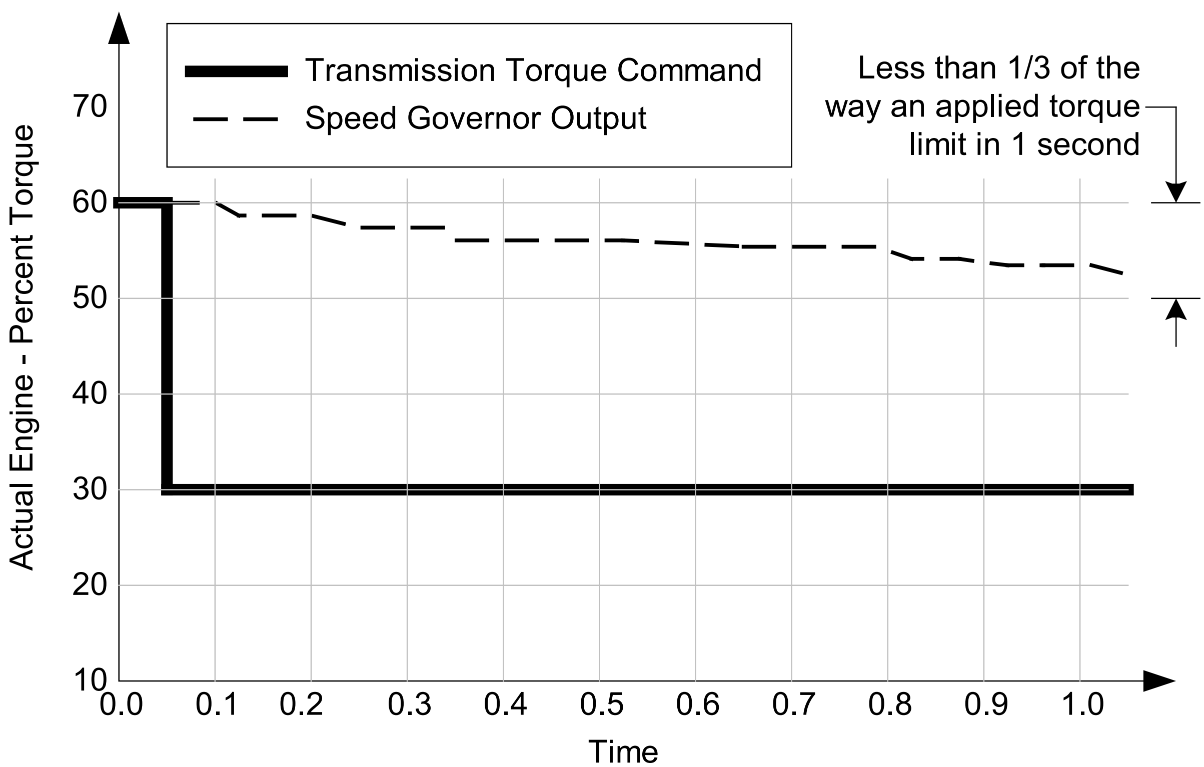


FIGURE SPN2432_E – EXAMPLE OF "SLOW TO RESPOND" SPEED GOVERNOR

B.5.23. PGN 61445 – ELECTRONIC TRANSMISSION CONTROLLER 2 (ETC2)

SAE Excerpt:
Transmission Repetition Rate....................100 ms
Data Length ....8 bytes
PDU Format 240
PDU Specific...5
Default Priority 6
PGN 61,445 (0xF005)

NEW FOR B/C/N241 PC Releases:
The grace period for certain shift inhibits has been extended from 3 to 5 seconds.

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables. PGN is broadcast from SA 03 unless all parameters are disabled via VEPS.

B.5.23.1. *SPN 524 – TRANSMISSION SELECTED GEAR*

SAE Excerpt: The gear that the transmission will attempt to achieve during the current shift if a shift is in progress, or the next shift if one is pending (i.e., waiting for torque reduction to initiate the shift).

Data Length:	1 byte
Resolution:	1 gear value / bit, -125 offset
Data Range:	-125 to 125
Operational Range:	-125 to +125, negative values are reverse gears, positive values are forward gears, zero is neutral. 251 (0xFB) is park.

B.5.23.1.1. TCM Parameter Broadcast

Used in:

EMISSION CONTROL SYSTEMS – DPF / SCR

NEUTRAL INDICATOR

REVERSE WARNING INDICATOR

0xFE (Error) may be broadcast when there are faults associated with the inputs used to derive this parameter. 0xFF (Not Available) is indicated when broadcast is disabled; other broadcast values are shown below. Differences between 3000/4000 Series 6-speed and 7-speed applications are highlighted in **bold** text.

Cross-section Variant	B/C/K 5/6/9-Spd	C 7-Spd	N 7-Spd
All Neutral states	125	125	125
Neutral At Stop active	126	NA	NA
Low	NA	**126**	NA
1st	126	**127**	126
2nd	127	**128**	127
3rd	128	**129**	128
4th	129	**130**	129
5th	130	**131**	130
6th	131	**132**	131
7th	132	NA	132
8th	133	NA	NA
9th	134	NA	NA
1st Reverse	124	124	124
2nd Reverse	NA	123	123
Park	251	NA	NA
Error State	254	254	254

Relationship with Shift Inhibits

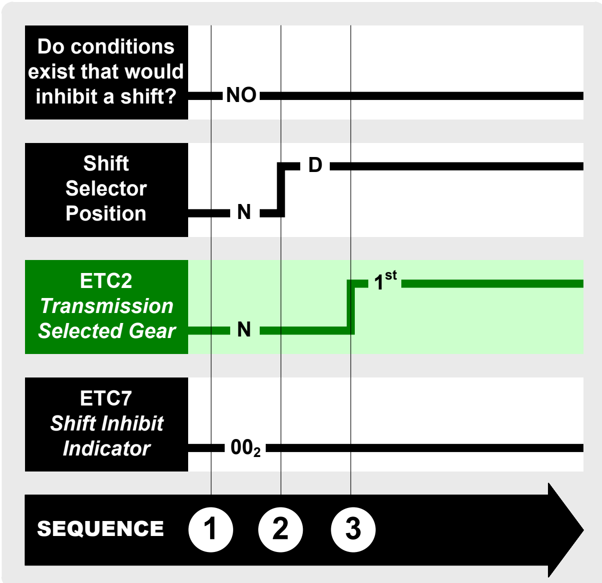
When the operator attempts a Neutral-to-Range shift while inhibit conditions exist, *Transmission Selected Gear* reflects the intended range during a “grace period” in which the transmission may make the shift – if the inhibit clears during this period. Once this grace period expires, *Transmission Selected Gear* reverts back to indicating Neutral. The driver must correct the condition and re-select the desired range before the transmission will attempt to shift out of Neutral. Depending on the inhibit, the grace period ranges from 0.5 to 5 seconds.

This functionality gives these engines the option to monitor *Transmission Selected Gear* and determine if stationary DPF regeneration should be aborted due to an operator’s desire to shift into range. Since stationary regeneration often involves increased engine speeds, the grace period gives engines time to decelerate to an acceptable rpm level such that the transmission will go ahead and shift into range.

The following examples illustrate *Transmission Requested Gear* content for three scenarios:

— A normal N-to-D shift with no inhibits present,
— A N-to-D shift attempt during an active inhibit, and
— A N-to-D shift where the initial inhibit clears during the grace period.

Normal N-to-D shift (No inhibit)

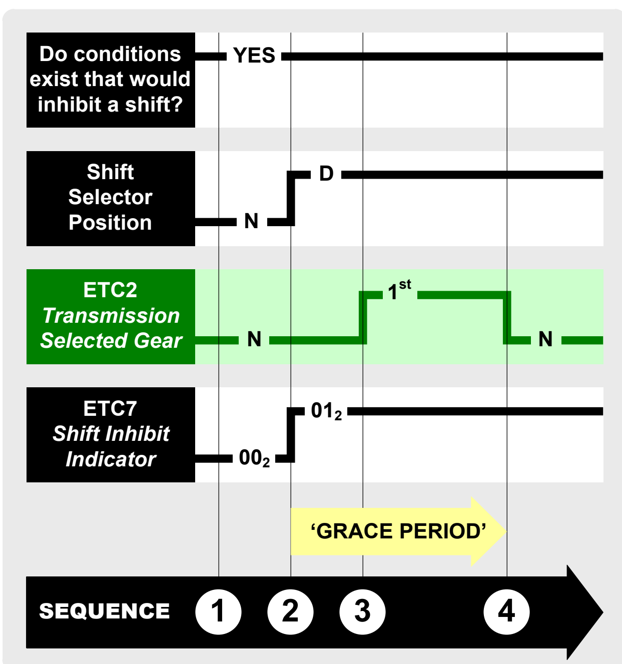


1. The shift selector is in Neutral, and no conditions exist that could inhibit a Neutral-to-Range shift.

2. The selector is put into Drive.

3. Shortly thereafter, *Transmission Selected Gear* reflects that the TCM is planning to go into 1st range when it makes its next shift.

N-to-D shift attempt while inhibit present



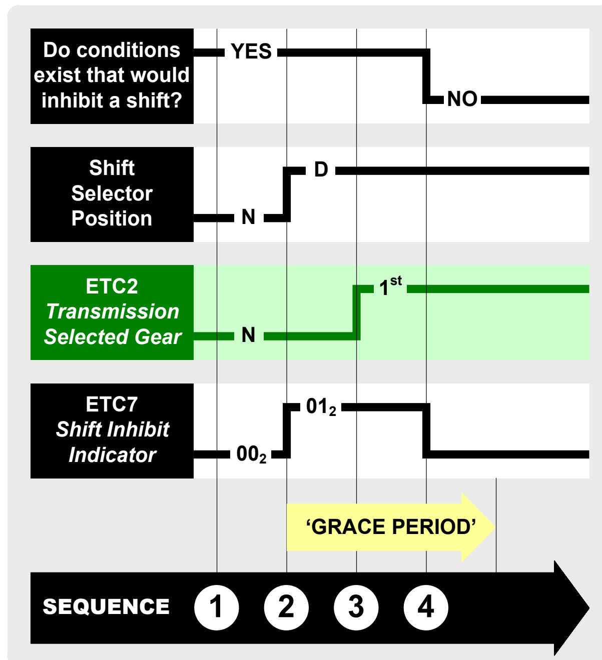
1. The selector is in Neutral, and conditions exist that will inhibit a Neutral-to-Range shift request.

2. The selector is put into Drive. A "grace period" is started, where the TCM will make the shift if the inhibit source clears within the grace period.

3. *Transmission Selected Gear* reflects that the TCM is planning to go into 1st range when it makes its next shift.

4. If the inhibit still exists when the grace period expires, the TCM activates the range inhibit indicator, and no shift occurs. The operator must correct the inhibit condition and re-select the range in order to get into gear. The TCM sets *Transmission Selected Gear* back to Neutral, indicating that it is no longer attempting to shift into range.

N-to-D shift, inhibit condition clears during 'grace period'



1. The selector is in Neutral, and conditions exist that will inhibit a Neutral-to-Range shift request.

2. The selector is put into Drive, and the grace period is started.

3. Shortly after the operator selects Drive, *Transmission Selected Gear* reflects that the TCM is planning to go into 1st range.

4. Since the inhibit clears during the grace period, the transmission proceeds to shift into 1st range.

Relationship with Automatic Neutral Functions

For automatic Neutral functions that require operator shift selector input to initiate the return to range (e.g. ANSI), *Transmission Selected Gear* will indicate 0 as soon as the shift to Neutral is made. This is because the TCM has no intention of shifting to a different range until commanded to do so by the operator.

For automatic Neutral functions where the return to range can occur without shift selector input, *Transmission Selected Gear* will indicate a non-Neutral range (e.g. 1) while the function is active. These include:

- GPI AG (AUTOMATIC NEUTRAL – DUAL INPUT)
- GPI AK (AUTOMATIC NEUTRAL – DUAL INPUT WITH SERVICE BRAKE STATUS)
- GPI CA (AUTOMATIC NEUTRAL – BRAKE-BASED (BBAN) INPUT)
- GPI CN (AUTOMATIC NEUTRAL – DUAL INPUT WITH AUTOMATIC RETURN TO RANGE), or the J1939-based equivalent

This is because the TCM does intend to initiate a shift as soon as operating conditions warrant. Maintaining the non-Neutral indication helps prevent operation of other vehicle functions (e.g. DPF regeneration) while the transmission is in a more "temporary" Neutral state.

B.5.23.2. *SPN 526 – TRANSMISSION ACTUAL GEAR RATIO*

SAE Excerpt: Actual ratio of input shaft speed to output shaft speed.

Data Length:	2 bytes
Resolution:	0.001 / bit, 0 offset
Data Range:	0 to 64.255
Operational Range:	Same as data range

B.5.23.2.1. TCM Parameter Broadcast

0xFEFF (Error) may be broadcast when there are faults associated with the inputs used to calculate this parameter. 0xFFFF (Not Available) is indicated when broadcast is disabled.

B.5.23.3. *SPN 523 – TRANSMISSION CURRENT GEAR*

SAE Excerpt: The gear currently engaged in the transmission or the last gear engaged while the transmission is in the process of shifting to the new or selected gear. Transitions toward a destination gear will not be indicated. Once the selected gear has been engaged then Transmission Current Gear (SPN 525) will reflect that gear.

Data Length:	1 byte
Resolution:	1 gear value / bit, -125 offset
Data Range:	-125 to +125,
Operational Range:	-125 to +125, negative values are reverse gears, positive values are forward gears, zero is neutral. 251 (0xFB) is park.

B.5.23.3.1. TCM Parameter Broadcast

Values are identical to those in SPN 524. Used in:

EMISSION CONTROL SYSTEMS – DPF / SCR

NEUTRAL INDICATOR

0xFE (Error) may be broadcast when there are faults associated with the inputs used to derive this parameter. 0xFF (Not Available) is indicated when broadcast is disabled.

B.5.23.4. *SPN 162 – TRANSMISSION REQUESTED RANGE*

SAE Excerpt: Range selected by the operator. Characters may include P, Rx, Rx-1...R2, R1, R, Nx, Nx-1...N2, N1, N, D, D1, D2..., Dx, L, L1, L2..., Lx-1, 1, 2, 3,... If only one character is required, the second character shall be used and the first character shall be a space (ASCII 32) or a control character (ASCII 0 to 31). If the first character is a control character, refer to the manufacturer's application document for definition.

Data Length:	2 bytes
Resolution:	ASCII, 0 offset
Data Range:	0 to 255 per byte
Operational Range:	Same as data range

B.5.23.4.1. TCM Parameter Broadcast

Used for RANGE DISPLAY – REQUESTED RANGE. 0xFFFF (Not Available) is indicated when broadcast is disabled.

Data format is set by VEPS [30210] ETC2 RANGE PARAMETER FORMAT:

DEFAULT FORMAT FOR 5TH GEN AND NEWER PRODUCTS

Characters in bytes 5 and 6 are "right justified".

For single digit ranges, byte 5 is ALWAYS an ASCII space (ASCII 32) and byte 6 contains the requested range ASCII equivalent (P, R, N, 9, 8, 7, 6, 5, 4, 3, 2, and 1). For two-digit ranges, both bytes contain characters. In applications using the 2nd Reverse feature, first reverse is conveyed as "R1", and second reverse is conveyed as "R2".

4TH GEN COMPATIBLE

The character in byte 5 is the requested range ASCII equivalent (P, R, r, N, 7, 6, 5, 4, 3, 2, 1). "r" indicates

2nd Reverse. Byte 6 is ALWAYS an ASCII space (ASCII 32).

Error State Support
3000/4000 Series applications with J1939-based shift selectors will indicate ASCII 0 (Error) if TC1 *Transmission Requested Gear* reception is not valid from the active shift selector.

Impact of Preselects on Parameter Content

Is Preselect Value Reflected in ETC2 *Transmission Requested Range*?

Function or TCM Logic Requesting a Preselect Range	1000 / 2000 Series	3000 / 4000 Series
PSR via shift selector	Yes	Yes
PSR via GPI CB	Yes	Yes
PSR via J1939	Yes	Yes
Engine Brake Preselect	Yes	Yes
Grade Braking Preselects (1)	Yes	Yes
PTO 1st Gear Preselect	NA	NA
Reverse Inhibit w/PSR	No	Yes
BBAN (GPI CA) Preselects	Yes	Yes
Transmission Sump Temp.	No	No
Engine Coolant Temp.	No	No
Overdrive Disable (GPI AR)	Yes	NA
Wired 6-5-4 selection	Yes	NA
Range Selection Mode	Yes	NA
Retarder operation	NA	No
Retarder Sump Temp.	NA	No
Retarder Coolant Temp.	NA	No
Direct Hold (GPI CE)	NA	No
D1 Selection (GPI B)	NA	Yes
Auto 2-1 Preselect (GPI BD)	NA	Yes
Auxiliary Hold (GPI G)	NA	Yes

(1) Includes preselects associated with **[22050] PRESELECTS: Automatic Level of Preselect Range during Cruise Control** and **[17132] GRADE BRAKING / REGENERATION INPUT**.

B.5.23.5. *SPN 163 – TRANSMISSION CURRENT RANGE*

SAE Excerpt: Range currently being commanded by the transmission control system. Characters may include P, Rx, Rx-1...R2, R1, R, Nx, Nx-1...N2, N1, N, D, D1, D2..., Dx, L, L1, L2..., Lx-1, 1, 2, 3,... If only one character is required, the second character shall be used and the first character shall be a space (ASCII 32) or a control character (ASCII 0 to 31). If the first character is a control character, refer to the manufacturer's application document for definition.

Data Length: 2 bytes
Resolution: ASCII, 0 offset
Data Range: 0 to 255 per byte
Operational Range: Same as data range

B.5.23.5.1. TCM Parameter Broadcast

Used for RANGE DISPLAY – RANGE ATTAINED. 0xFFFF (Not Available) is indicated when broadcast is disabled.

Data format is set by VEPS [30210] ETC2 RANGE PARAMETER FORMAT:

DEFAULT FORMAT FOR 5TH GEN AND NEWER PRODUCTS
The characters in bytes 7 and 8 are "right justified".

For single digit ranges, byte 7 is ALWAYS an ASCII space (ASCII 32) and byte 8 contains the attained range ASCII equivalent (P, R, N, 9, 8, 7, 6, 5, 4, 3, 2, and 1). For two-digit ranges, both bytes contain characters. In applications using the 2nd Reverse feature, first reverse is conveyed as "R1", and second reverse is conveyed as "R2".

4TH GEN COMPATIBLE
The character in byte 7 is the attained range ASCII equivalent (P, R, r, N, 7, 6, 5, 4, 3, 2, 1). "r" indicates 2nd Reverse. Byte 8 indicates torque converter lockup clutch status, where ASCII 67 ("C") indicates converter operation, and ASCII 76 ("L") indicates lockup operation.

B.5.24. PGN 61452 – ELECTRONIC TRANSMISSION CONTROLLER 8 (ETC8)

SAE Excerpt: Transmission Repetition Rate: 20 ms when torque converter unlocked, 100 ms when torque converter locked.

Data Length .... 8 bytes
PDU Format 240
PDU Specific 12
Default Priority 3
PGN 61,452 (0xF00C)

B.5.24.1. *TCM MESSAGE BROADCAST*

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables. PGN is broadcast from SA 03 unless all parameters are disabled via VEPS.

B.5.24.2. *SPN 3030 – TRANSMISSION TORQUE CONVERTER RATIO*

SAE Excerpt: Ratio of transmissions torque converter output torque to torque converter input torque at current speed. The ratio of 1.000 (03 E8 h) indicates torque converter lockup. If the ratio is less than 1 and the ratio cannot be properly determined it shall be set to a value of FB00 hex. Ratios above 1 indicate torque converter multiplication.

Data Length:	2 bytes
Resolution:	0.001 / bit, 0 offset
Data Range:	0 to 64.255
Operational Range:	Same as data range

B.5.24.2.1. TCM Parameter Broadcast

Parameter provided for ELECTRONIC BRAKING SYSTEMS (EBS) use. 0xFEFF (Error) is indicated if an engine speed or turbine speed sensor error occurs. 0xFFFF (Not Available) is indicated when broadcast is disabled.

B.5.24.3. *SPN 5052 – TRANSMISSION CLUTCH / CONVERTER INPUT SPEED*

SAE Excerpt: Rotational velocity of the input to a transmission's master clutch or torque converter. In most cases the rotational velocity will be the same as engine flywheel speed unless there is an intermediate device, such as a power divider, between the engine and the clutch / converter.

Data Length:	2 bytes
Resolution:	0.125 rpm / bit, 0 offset
Data Range:	0 to 8,031.875 rpm
Operational Range:	Same as data range

B.5.24.3.1. TCM Parameter Broadcast

0xFEFF is indicated during speed sensor errors. 0xFFFF (Not Available) is indicated when broadcast is disabled.

B.5.24.4. *SPN 10152 – TRANSMISSION SHIFT INHIBIT REASON*

SAE Excerpt: Parameter indicates the reason that the requested transmission range shift is being prevented. In most circumstances, the "Shift Inhibited" states will be enunciated after a shift request has been made that cannot be honored. At the manufacturer's discretion, certain states may be enunciated prior to a shift request being made. This can give the operator or receiving vehicle system advance knowledge that a shift attempt will not be honored. For example, if a transmission inhibits all shifts because the transmission fluid is deemed too cold, a manufacturer might set this parameter to state 1 at engine start up, and remain in that state until such a time as shifts would be allowed. When multiple inhibits are active, it is suggested that precedence be given to states which are less easily resolved, i.e. such as those due to a diagnostic being active.
NOTE: Any lack of shifting due to normal transmission shift scheduling is not considered to be an inhibit condition.

0	No active shift inhibits
1	Shift has not been requested
2	Shift Inhibited – Transmission fluid temperature is too low
3	Shift Inhibited – Engine speed is too high
4	Shift Inhibited – Transmission output shaft speed is too high
5	Shift Inhibited – Excessive transmission output shaft acceleration or deceleration
6	Shift Inhibited – Accelerator pedal position is too high
7	Shift Inhibited – Transmission input shaft speed limit
8	Shift Inhibited – Transmission converter fluid temperature is too low
9	Shift Inhibited – Incorrect transmission calibration installed
10	Shift Inhibited – Transmission main pressure is too low
11	Shift Inhibited – Transmission commanding Neutral, re-select of range required
12	Shift Inhibited – Shift Selector in "manual mode" position
13	Shift Inhibited – Direction change requires Neutral selection
14	Shift Inhibited – Diagnostic Active
15	Shift Inhibited – Torque converter not primed
16	Shift Inhibited – Torque converter stall test active
17	Shift Inhibited – Transmission Auto-Neutral (Manual Return) function is active

18 Shift Inhibited – Transmission Auto-Neutral (Automatic Return) function is active
19 Shift Inhibited – Neutral is required for PTO operation
20 Shift Inhibited – Output shaft PTO is not engaged
21 Shift Inhibited – Output shaft PTO is engaged
22 Shift Inhibited – External Reverse Enable input 1 is inactive
23 Shift Inhibited – External Reverse Enable input 2 is inactive
24 Shift Inhibited – Conditions not acceptable for other Reverse ranges
25 Shift Inhibited – External request via SPN 681 [Transmission Gear Shift Inhibit Request]
26 Shift Inhibited – External shift inhibit input is active
27 Shift Inhibited – External shift hold input (i.e. stay in current gear) is active
28 Shift Inhibited – External direction change inhibit input is active
29 Shift Inhibited – External function is forcing Neutral
30 Shift Inhibited – Engine Stop-Start Operation
31 Shift Inhibited – Service brake pedal is not applied
32 Shift Inhibited – Security interlock is active
33 Shift Inhibited – ABS, Traction Control or Stability Control event is active
34 Shift Inhibited – Shift cycle timer
35 Shift Inhibited – Unspecified test mode is active
36 – 224 SAE reserved
225 – 249 Shift Inhibited – Manufacturer-defined
250 Shift Inhibited – Other Reason
251 – 253 SAE reserved
254 Error
255 Not Available

Data Length: 1 byte
Resolution: 256 states / bit
Data Range: 0 to 255
Operational Range: Same as data range

B.5.24.4.1. TCM Parameter Broadcast

Parameter provided for: RANGE INHIBIT INDICATOR AND REASON (RII).

B.5.25. PGN 61481 – SLOPE SENSOR INFORMATION 2 (SSI2)

SAE Excerpt: The Slope Sensor Information 2 message shall provide a measurement of the vehicle's extended pitch angle and a measurement of the vehicle's extended roll angle. The vehicle dynamics measurements in this message shall be according to a Z-Down axis system as referenced in SAE J670.

Note 1) When this PG is used to transmit information from a device not attached to the vehicle, the components local frame of reference shall be used.

Note 2) The NAME of the source of the PG shall be used to associate to the frame of reference. (e.g, Machine control will report vehicle pitch and roll, blade control will report blade pitch and roll).

Transmission Repetition Rate .... 10 ms
Data Length .... 8 bytes
PDU Format 240
PDU Specific 41
Default Priority 3
PGN 61,481 (0xF029)

B.5.25.1. *TCM MESSAGE BROADCAST*

WARNING: The System Integrator (Vehicle OEM) is responsible for verifying acceptable vehicle operation and device interaction. The System Integrator is required to ensure the broadcast data accuracy meets the needs of the vehicle system via rigorous testing, filtering, etc.

SSI2 *Pitch Angle* data provided by the TCM shall not be used for implementations of vehicle safety critical functions.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

Availability of this message is restricted. Please contact your Allison Customer Integration Engineering representative for details. For byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables. PGN is broadcast from SA 03 unless all parameters are disabled via VEPS.

B.5.25.2. *SPN 4976 – PITCH ANGLE (EXTENDED RANGE)*

SAE Excerpt: The angle between the vehicle x-axis and the ground plane (i.e. rotation about the vehicle Y-axis). The pitch angle for an angle of ascent is reported with a positive value. This parameter is defined according to a Z-Down axis system and the sign of the value is in accordance to the right-hand rule, as specified in SAE J670. As specified in SAE J670, a Z-Down Axis System has positive X directed forward, positive Y to the right, and positive Z directed down. See SPN 3318 for an alternate range and resolution.

Data Length: 3 bytes
Resolution: 0.000 030 517 578 125 deg per bit
Data Range: -250 to 251.999 969 482 421 875 deg
Operational Range: Same as data range

Parameter Specific Indicator: A value of FB0000h indicates that the Pitch Angle cannot be determined due to environmental conditions.

B.5.25.2.1. TCM Parameter Broadcast

This parameter indicates 0xFB0000 when the TCM has not determined an estimated grade value. This may occur, for example, directly following programming events, such as updating TCM software.

0xFEFFFF (Error) is indicated during accelerometer faults.

B.5.26. PGN 61538 – ELECTRONIC TRANSMISSION CONTROLLER 12 (ETC12)

SAE Excerpt:

Transmission Repetition Rate .... 10 ms
Data Length .... 8 bytes
PDU Format... 240
PDU Specific 98
Default Priority 2
PGN 61,538 (0xF062)

B.5.26.1. *TCM MESSAGE BROADCAST*

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables. PGN is broadcast from SA 03 unless all parameters are disabled via VEPS.

B.5.26.2. *SPN 6585 – TRANSMISSION DIRECTIONAL OUTPUT SHAFT SPEED*

SAE Excerpt: The rotational velocity and direction of the output shaft. Positive values are used for forward vehicle motion, negative values for reverse vehicle motion.

SPN 191 should be used when direction is not used.

Data Length: 2 bytes
Resolution: 1 rpm per bit
Data Range: -32127 to 32128 rpm
Operational Range: Same as data range

Parameter Specific Indicator: A value of FB00h indicates that the speed cannot be reported because shaft direction is yet to be determined.

B.5.26.2.1. TCM Parameter Broadcast

TCM near-zero broadcast value thresholds are dependent on the transmission output shaft tone wheel in use; see Allison Control System Data. Depending on sensor gap and component variation, some applications may be able to read and convey output shaft speeds closer to zero, however, broadcast values between -15 and 15 RPM may not be accurate.

Due to the high sensitivity of the output shaft speed sensors used in the Allison 6th Generation Controls system, certain driveline disturbances may be visible as short spikes in the output shaft speed signal. The receiving device may need to implement signal filtering provisions appropriate for the intended use.

0xFB00 (Indeterminate) is indicated when the TCM cannot determine shaft direction, e.g. when the speed sensor is not registering any shaft rotation.

0xFEFF (Error) is indicated during output shaft speed sensor faults.

B.5.27. PGN 61677 – ENGINE START CONTROL (ENGSC)

SAE Excerpt:

Transmission Repetition Rate: Default broadcast rate of 20 ms unless the sending device has received Engine Start Control Message Rate (SPN 7752) from the engine start arbitrator indicating a switch to 250 ms and on change, but no faster than 20 ms.

Data Length .... 8 bytes
PDU Format...240
PDU Specific 237
Default Priority 4
PGN 61,677 (0xF0ED)

B.5.27.1. *TCM MESSAGE BROADCAST*

NOTE: ENGSC *Transmission Shift Selector Requested Vehicle Direction* is not a suitable substitute for ETC7 *Transmission Engine Crank Enable*..

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables. PGN is broadcast from SA 03 unless all parameters are disabled via VEPS.

B.5.27.2. *SPN 7788 – TRANSMISSION SHIFT SELECTOR REQUESTED VEHICLE DIRECTION*

SAE Excerpt: This parameter indicates the direction selected by the operator via the active transmission shift selector. Some regulations (e.g., Federal Motor Vehicle Safety Standards 102) require specific Engine Stop-Start behavior based on operator selected direction. This parameter provides the necessary direction information for this purpose. Neutral or range commands made by other vehicle functions (e.g., automatic neutral functions) will not be reflected in this parameter. For selectors that use momentary contacts, this parameter would not reflect the current state of the physical contacts, but rather the direction that the operator has selected. Where applicable, it conveys the transmission's de-bounced interpretation of the selector inputs.

000b No direction selected – Park
001b No direction selected – Neutral
010b Forward direction selected
011b Reverse direction selected
100b SAE Reserved
101b SAE Reserved
110b Error
111b Not supported

B.5.28. PGN 61712 – BRAKES 2 (B2)

SAE Excerpt: Contains information on brake control.

Transmission Repetition Rate: Every 1 s and on change but not faster than 20 ms.

Data Length .... 8 bytes
PDU Format 241
PDU Specific 16
Default Priority 2
PGN 61,712 (0xF110)

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables.

B.5.28.1. *SPN 8484 – DEMANDED BRAKE APPLICATION PRESSURE*

SAE Excerpt: Gage pressure of the compressed air or fluid in the vehicle braking system that is used to apply brake shoes (or pads) against the brake drums (or discs). This is the brake application pressure demanded by the vehicle operator and / or another vehicle system.

Data Length:	2 bytes
Resolution:	0.1 kPa / bit, 0 offset
Data Range:	0 to 6425.5 kPa
Operational Range:	Same as data range

B.5.28.1.1. TCM Parameter Reception

See NEUTRAL AT STOP INPUT.

B.5.29. PGN 61839 – IMPOSTOR PG ALERT (IPGA)

SAE Excerpt: An "impostor" is defined as a network component broadcasting messages from a source address that has already been successfully and rightfully claimed by an existing network component. The unexpected duplicate communication could be the result of numerous issues, e.g. a malicious attack on vehicle operation, the addition of an aftermarket network device, or a network configuration issue. Regardless of the cause, communication from the legitimate sender to its receiver(s) is not occurring as intended.

Legitimate senders can monitor the network for impostor messages ("attacks") emanating from their rightfully claimed source address. PGN 61839 allows senders that detect impostors to quickly inform their receivers that data in the reported PG is likely compromised. See SPN 10840 [Impostor PG Event Detection Counter] for details on how to sense the beginning and end of an attack event. Note that sender, receiver and system responses to an impostor alert are not specified; responses are left to their discretion. However, example responses might include:

* Reporting a DTC
* Changing to a different mode of operation
* Ignoring the questionable message and reacting as if its reception has been lost

The data in this message is for the current ECU power cycle (e.g. key switch cycle) only; all parameters, including the counter, should reset at the beginning of a new ECU power cycle. If a sender has detected no attack events in the current ECU power cycle, this message would only be sent on request. If a sender has detected multiple unique attacks, the response to a request for PGN 61839 will include multiple messages.

A unique impostor PG instance is defined by the combination of impostor source address, destination address and PG value. The same unique impostor PG instance may be used in multiple attack events. For example, each time an impostor transmits a series of TSC1 commands from SA 03 to DA 00, each series would be considered as an attack event. If an impostor continuously transmits a periodic message during a given ECU power cycle, that would be considered as one long attack event.

This message is transmitted on detection of each attack event and, after the initial attack event detection, every 1 s for the remainder of the current ECU power cycle. Since PGN 61839 only contains information on one impostor PG instance, multiple broadcasts will be needed to convey multiple unique impostor PG instances. In these cases, the sender will need to prioritize the transmit order of the imposter alerts. A minimum of 20ms spacing between message broadcasts is recommended so as to not preclude bus access to other messages.

On detection of each attack event and, after the initial attack event detection, every 1 s for the remainder of the current ECU power cycle.

Data Length .... 8 bytes
PDU Format 241
PDU Specific 143
Default Priority 2
PGN 61,839 (0xF18F)

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables.

B.5.29.1. *SPN 10840 – IMPOSTOR PG EVENT DETECTION COUNTER*

SAE Excerpt: For a given detected impostor PG being reported on, this parameter indicates the number of impostor message sequences that have been detected by the legitimate sender since the counter was last reset.

The counter increments on the first detection of a new impostor message series, i.e. when an attack begins. For example, if an impostor sends out a continuous series of 12 TSC1 commands, then ceases, and then sends out another continuous series 15 of TSC1 commands later during the same ECU power cycle, this would count as 2 events. The number of messages sent within an attack event is not counted.

The end of an attack event is determined by the timeout the sender would use if it were to receive that PG. For example, consider an impostor PG with a 100 ms broadcast rate, and a sender that would normally time out on such a message based on 5x its defined broadcast rate (500 ms). If the impostor PG is detected and then ceases to appear on the network for at least 500 ms, then that attack event would be considered as ended. The counter logic should then be rearmed such that it will increment upon detection of another attack event.

If a count of 250 is reached, the counter value shall remain at 250 until either the sender has its DTCs cleared or the sender goes through an ECU power cycle; then it shall reset to 0. If no impostor PG(s) have been detected during the current ECU power cycle, this parameter shall remain at 0.

Data Length: 1 byte
Resolution: 1 count / bit, 0 offset
Data Range: 0 to 250
Operational Range: Same as data range

B.5.29.1.1. TCM Parameter Reception

See IMPOSTOR DETECTION.

B.5.29.2. *SPN 10841 – IMPOSTOR PG SOURCE ADDRESS*

SAE Excerpt: Indicates the source address from which an impostor is broadcasting the detected PG. If no impostor PG(s) have been detected, this parameter shall be set to a value of 254.

Data Length: 1 byte
Resolution: 1 source address / bit, 0 offset
Data Range: 0 to 255
Operational Range: Same as data range

B.5.29.2.1. TCM Parameter Reception

See IMPOSTOR DETECTION.

B.5.29.3. *SPN 10842 – IMPOSTOR PG DESTINATION ADDRESS*

SAE Excerpt: Indicates the destination address to which the impostor is broadcasting the detected PG. If no impostor PG(s) have been detected, this parameter shall be set to a value of 254.

Data Length: 1 byte
Resolution: 1 source address / bit, 0 offset
Data Range: 0 to 255
Operational Range: Same as data range

B.5.29.3.1. TCM Parameter Reception

See IMPOSTOR DETECTION.

B.5.29.4. *SPN 10843 – IMPOSTOR PGN*

SAE Excerpt: This parameter identifies an unexpected duplicate PG (message) being broadcast from a source address that is already rightfully claimed. If no impostor PG(s) have been detected, each byte of this parameter shall be set to a value of 255.

Data Length: 3 bytes
Resolution: Binary
Data Range: 0 to 16,777,215
Operational Range: Same as data range

B.5.29.4.1. TCM Parameter Reception

See IMPOSTOR DETECTION.

B.5.29.5. *SPN 10844 – TIME SINCE LAST IMPOSTER PG DETECTED*

SAE Excerpt: For the given impostor PG being reported on, this parameter indicates how much time has elapsed since the impostor PG instance was last detected during the current ECU power cycle, i.e. when the last attack ended. See SPN 10840 for details on how to determine when an attack has ended.

Parameter Specific Indicator values are as follows:

251 = No impostor PG has been detected during the current ECU power cycle

252 = The Impostor PG is actively being detected

253 = The Impostor PG is not active, but has previously been detected during the current ECU power cycle. This Parameter Specific Indicator value shall also be indicated if, for the current ECU power cycle, the time elapsed since the last impostor PG detection exceeds 250 minutes.

Also note that for applications that do not support an actual timer, the sender may opt to support just the 3 Parameter Specific Indicator states.

Data Length:	1 byte
Resolution:	1 min / bit, 0 offset
Data Range:	0 to 250 min
Operational Range:	Same as data range

B.5.29.5.1. TCM Parameter Reception

See IMPOSTOR DETECTION.

B.5.30. PGN 64064 – ELECTRONIC TRANSMISSION CONTROLLER 15 (ETC15)

SAE Excerpt: Electronic Transmission Controller 15.

Transmission Repetition Rate	100 ms
Data Length	8 bytes
PDU Format	250
PDU Specific	64
Default Priority	3
PGN	64,064 (0xFA40)

B.5.30.1. *TCM MESSAGE BROADCAST*

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables. PGN is broadcast from SA 03 unless all parameters are disabled via VEPS.

B.5.30.2. *SPN 21253 – TRANSMISSION AUTO-NEUTRAL (AUTO-RETURN) REQUEST FEEDBACK*

SAE Excerpt: This parameter reflects the state of SPN 21252 [Transmission Auto-Neutral (Auto-Return) Request] that the transmission is currently acting upon.

000b	Responding to: No request
001b	Responding to: Request to shift to (or maintain) Auto-Neutral state
010b	Responding to: Request to shift from Auto-Neutral state to previous direction
011b	Responding to: Don’t Care / Take No Action
100b	Reserved
101b	Reserved
110b	Error
111b	Not Available

B.5.30.2.1. TCM Parameter Broadcast

See function AUTOMATIC NEUTRAL – DUAL INPUT.

B.5.30.3. *SPN 21254 – TRANSMISSION AUTO-NEUTRAL (AUTO-RETURN) FUNCTION STATE*

SAE Excerpt: Indicates the state of the Transmission Auto-Neutral (Auto-Return) function in relation to the state indicated in SPN 21253 [Transmission Auto-Neutral (Auto-Return) Request Feedback]. The applicability of the states and state transitions depend on transmission manufacturer options and implementation (e.g. function entry and exit criteria) of the Auto-Neutral (Auto-Return) function.

0000b	Function Aborted or Disabled. Indicated when SPN 21251 [Transmission Auto-Neutral (Auto-Return) Enable Switch] = 00b

[Disabled], or the normal Auto-Neutral functionality has been aborted, such as by operator input on the shift selector.

0001b Function Inactive; conditions are such that an Auto-Neutral request would be honored. Only indicated when SPN 21251 [Transmission Auto-Neutral (Auto-Return) Enable Switch] = 01b [Enabled] and SPN 21253 [Transmission Auto-Neutral (Auto-Return) Request Feedback] = 000b [No request]. Gives the requestor insight into how the transmission might respond to a request.

0010b Function Inactive; conditions are such that an Auto-Neutral request would NOT be honored. Only indicated when SPN 21251 [Transmission Auto-Neutral (Auto-Return) Enable Switch] = 01b [Enabled] and SPN 21253 [Transmission Auto-Neutral (Auto-Return) Request Feedback] = 000b [No request]. Gives the requestor insight into how the transmission might respond to a request. Note this state could result from a constraint (e.g. vehicle speed too high), or from a problem with an input required by the transmission Auto-Neutral function. If the function state cannot be determined, 1110b [Error] would be reported.

0011b Function Request Inhibited. Indicated when the transmission cannot achieve the desired state (01b, 10b) in SPN 21253 [Transmission Auto-Neutral (Auto-Return) Request Feedback].

0100b Function Request Pending. Transmission is in the process of shifting to the direction indicated in SPN 21253 [Transmission Auto-Neutral (Auto-Return) Request Feedback]. Similar to a "Shift in Process" indication.

0101b Function Request Achieved. Transmission direction matches the state indicated in SPN 21253 [Transmission Auto-Neutral (Auto-Return) Request Feedback].

0110b – 1110b Reserved

1110b Error

1111b Not Available

Note: While SPN 523 ETC2 Transmission Current Gear can be used to determine if the transmission has attained Neutral; SPN 21253 indicates if that Neutral state resulted from SPN 21252.

B.5.30.3.1. TCM Parameter Broadcast

See function AUTOMATIC NEUTRAL – DUAL INPUT.

B.5.31. PGN 64743 – ENGINE CONFIGURATION 3 (EC3)

SAE Excerpt: The EC3 message contains a static engine friction torque map consisting of torque points that correspond to the speed points in the EC1 message. A net brake torque map for the engine can be calculated by subtracting the static engine friction torque from the engine's corresponding indicated torque at each speed point. The static friction torque map is expected to change as engine temperature changes. It will also change when an engine speed derate is active.

For engine configuration map modes 1 and 2, points 1 through 6 correspond to the speed points in the torque map in the engine configuration message. For engine configuration map mode 3, points 1 through 5 correspond to the speed points, but point 6 corresponds to a speed point that is determined using Engine Gain (Kp) Of The Endspeed Governor (SPN 545). Refer to PGN 65251 in Supporting Information in J1939DA for a description of the modes.

Estimated Engine Parasitic Losses – Percent Torque (SPN 2978) are not accounted for in the EC3 static friction torque map. If the EC3 message is supported and parasitic losses are known, the parasitic losses must be included in Estimated Engine Parasitic Losses - Percent Torque (SPN 2978); the parasitic losses must NOT be included in Nominal Friction - Percent Torque (SPN 514).

Even though Estimated Pumping - Percent Torque (SPN 5398) is included in Nominal Friction - Percent Torque (SPN 514), Estimated Pumping - Percent Torque is not included in the computation of the static friction torque map. For a given engine speed, the relationship between the static friction torque map and Nominal Friction - Percent Torque can be determined by subtracting Estimated Pumping - Percent Torque from Nominal Friction - Percent Torque. The static friction torque map cannot include the effects of Estimated Pumping - Percent Torque because of the dynamic nature of the pumping losses.

The static friction torque at a given engine speed equals Nominal Friction - Percent Torque (SPN 514) minus Estimated Pumping - Percent Torque (SPN 5398).

Note: Refer to section 5.2.1 in SAE J1939-71.

Every 5 s and on change of torque/speed points of more than 10% since last transmission but no faster than every 500 ms

Data Length .... Variable
PDU Format 252
PDU Specific..231
Default Priority 6
PGN 64,743 (0xFCE7)

NEW FOR B/C/N240 PSC Releases: Message reception is new for B/C/N240 PSC.

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables.

B.5.31.1. *SPN 5471 – ENGINE FRICTION PERCENT TORQUE AT IDLE, POINT 1*

SAE Excerpt: The static portion of the friction torque at speed point 1 (SPN 188) of the engine torque map in the engine configuration message. This parameter does not include Estimated Pumping – Percent Torque (SPN 5398) and is expected to change with temperature. The data is transmitted as a percent of the reference engine torque (SPN 544).

Data Length: 1 byte
Resolution: 1 % / bit, -125% offset
Data Range: -125% to +125%
Operational Range: 0 to 125%

B.5.31.1.1. TCM Parameter Reception

See function DOWNHILL SPEED CONTROL.

B.5.31.2. *SPN 5472 – ENGINE FRICTION PERCENT TORQUE, POINT 2*

SAE Excerpt: The static portion of the friction torque at speed point 2 (SPN 528) of the engine torque map in the engine configuration message. This parameter does not include Estimated Pumping – Percent Torque (SPN 5398) and is expected to change with temperature. The data is transmitted as a percent of the reference engine torque (SPN 544).

Data Length: 1 byte
Resolution: 1 % / bit, -125% offset
Data Range: -125% to +125%
Operational Range: 0 to 125%

B.5.31.2.1. TCM Parameter Reception

See function DOWNHILL SPEED CONTROL.

B.5.31.3. *SPN 5473 – ENGINE FRICTION PERCENT TORQUE, POINT 3*

SAE Excerpt: The static portion of the friction torque at speed point 3 (SPN 529) of the engine torque map in the engine configuration message. This parameter does not include Estimated Pumping – Percent Torque (SPN 5398) and is expected to change with temperature. The data is transmitted as a percent of the reference engine torque (SPN 544).

Data Length: 1 byte
Resolution: 1 % / bit, -125% offset
Data Range: -125% to +125%
Operational Range: 0 to 125%

B.5.31.3.1. TCM Parameter Reception

See function DOWNHILL SPEED CONTROL.

B.5.31.4. *SPN 5474 – ENGINE FRICTION PERCENT TORQUE, POINT 4*

SAE Excerpt: The static portion of the friction torque at speed point 4 (SPN 530) of the engine torque map in the engine configuration message. This parameter does not include Estimated Pumping – Percent Torque (SPN 5398) and is expected to change with temperature. The data is transmitted as a percent of the reference engine torque (SPN 544).

Data Length: 1 byte
Resolution: 1 % / bit, -125% offset
Data Range: -125% to +125%
Operational Range: 0 to 125%

B.5.31.4.1. TCM Parameter Reception

See function DOWNHILL SPEED CONTROL.

B.5.31.5. *SPN 5475 – ENGINE FRICTION PERCENT TORQUE, POINT 5*

SAE Excerpt: The static portion of the friction torque at speed point 5 (SPN 531) of the engine torque map in the engine configuration message. This parameter does not include Estimated Pumping – Percent Torque (SPN 5398) and is expected to change with temperature. The data is transmitted as a percent of the reference engine torque (SPN 544).

Data Length: 1 byte
Resolution: 1 % / bit, -125% offset
Data Range: -125% to +125%
Operational Range: 0 to 125%

B.5.31.5.1. TCM Parameter Reception

See function DOWNHILL SPEED CONTROL.

B.5.31.6. *SPN 5476 – ENGINE FRICTION PERCENT TORQUE, POINT 6*

SAE Excerpt: For engine configuration map modes 1 and 2, this is the static portion of the friction torque at speed point 6 (SPN 532) of the engine torque map. For engine configuration map mode 3, this parameter is the static portion of the friction torque at the engine speed calculated by using Engine Gain (Kp) Of The Endspeed Governor (SPN 545) where torque is 0. This parameter does not include Estimated Pumping – Percent Torque (SPN 5398) and is expected to change with temperature. The data is transmitted as a percent of the reference engine torque (SPN 544).

Data Length: 1 byte
Resolution: 1 % / bit, -125% offset
Data Range: -125% to +125%
Operational Range: 0 to 125%

B.5.31.6.1. TCM Parameter Reception

See function DOWNHILL SPEED CONTROL.

B.5.31.7. *SPN 5477 – ENGINE FRICTION PERCENT TORQUE, POINT 7*

SAE Excerpt: The static portion of the friction torque at speed point 7 (SPN 533) of the engine torque map in the engine configuration message. This parameter does not include Estimated Pumping – Percent Torque (SPN 5398) and is expected to change with temperature. The data is transmitted as a percent of the reference engine torque (SPN 544).

Data Length: 1 byte
Resolution: 1 % / bit, -125% offset
Data Range: -125% to +125%
Operational Range: 0 to 125%

B.5.31.7.1. TCM Parameter Reception

See function DOWNHILL SPEED CONTROL.

B.5.32. PGN 64839 – TRANSMISSION MODE LABELS (TML)

SAE Excerpt: ASCII text string describing a manufacturer-specific Transmission Mode. This PGN may contain up to 8 instances of the Transmission Mode Label field (for Transmission Mode 1 through Transmission Mode 8) with each separated by the asterisk (*) delimiter character. The Mode Labels are placed in increasing order of the mode number (i.e. Mode 1 label is first, followed by Mode 2 label, etc). It is not necessary to include text for each mode; however, the delimiter is always required for each, i.e. the data field must include all 8 asterisk delimiters even if the application does not provide label data for each of the modes.

NOTE – The ASCII character "*" is reserved as the delimiter

Transmission Repetition Rate ....On request
Data length .... Variable
PDU format 253
PDU specific 71
Default priority 7
Parameter Group Number...........64839 (0xFD47)

SAE Excerpt (J1939-71 Appendix D): Conveys ASCII "labels" for each of the manufacturer-specified TC1 Transmission Mode "x" / ETC7 Transmission Mode Indicator "x" pairs. Intended for use with on-board or service tool displays. There are up to 8 fields (for Transmission Mode 1 through Transmission Mode 8), and each is separated by an ASCII asterisk delimiter "*". It is not necessary to include all fields; however, the delimiter is always required.

Data byte arrangement:

$a_1 \ldots a_x$ * $a_1 \ldots b_x$ * $c_1 \ldots c_x$ * $d_1 \ldots d_x$ * $e_1 \ldots e_x$ * $f_1 \ldots f_x$ * $g_1 \ldots g_x$ * $h_1 \ldots h_x$

…where, if applicable:

Byte	Byte Contents
$a_1 \rightarrow a_x$	*Transmission Mode Label, Mode 1* ●
ASCII *	Delimiter
$b_1 \rightarrow b_x$	*Transmission Mode Label, Mode 2* ●
ASCII *	Delimiter
$c_1 \rightarrow c_x$	*Transmission Mode Label, Mode 3*
ASCII *	Delimiter
$d_1 \rightarrow d_x$	*Transmission Mode Label, Mode 4* ●
ASCII *	Delimiter

$e_1 \rightarrow e_x$	*Transmission Mode Label, Mode 5*
ASCII *	Delimiter
$f_1 \rightarrow f_x$	*Transmission Mode Label, Mode 6*
ASCII *	Delimiter
$g_1 \rightarrow g_x$	*Transmission Mode Label, Mode 7*
ASCII *	Delimiter
$h_1 \rightarrow h_x$	*Transmission Mode Label, Mode 8*

EXAMPLE – Delimiter use when label support varies:

aaaaaaaa*bbbbbbbbbbb******	(Modes 1 & 2)
*bbbbbbbb******	(Mode 2 only)
*bbbbbbbb**dddd****	(Modes 2 & 4 only)

EXAMPLE – A transmission supporting a "NORMAL" operating mode in Transmission Mode 1, and a "PLOW" mode in Transmission Mode 2 might send:

Data Byte	Dec Value	ASCII Value	Data Byte	Dec Value	ASCII Value
1	78	"N"	10	79	"O"
2	79	"O"	11	87	"W"
3	82	"R"	12	42	*
4	77	"M"	13	42	*
5	65	"A"	14	42	*
6	76	"L"	15	42	*
7	42	*	16	42	*
8	80	"P"	17	42	*
9	76	"L"			

B.5.32.1. *TCM MESSAGE BROADCAST*

Parameters marked ● may be broadcast from SA 03 (Transmission #1). Broadcast support is defaulted off. The TCM only responds to TML requests if one or more TML parameters are enabled via VEPS.

TML broadcast length is always > 8 bytes, therefore destination-specific requests result in destination-specific responses via RTS / CTS, and global requests result in global responses via BAM.

B.5.32.2. *SPN 4254 – TRANSMISSION MODE LABEL*

SAE Excerpt: Conveys ASCII "labels" for each of the manufacturer-specified TC1 Transmission Mode "x" / ETC7 Transmission Mode Indicator "x" pairs. Intended for use with on-board or service tool displays.

NOTE – Non-printable or non-graphic ASCII characters are not allowed, and the ASCII character "*" is reserved as a delimiter.

Data Length:	Variable – up to 25 bytes followed by an "*" delimiter
Resolution:	ASCII, 0 offset
Data Range:	0 to 255 per byte
Operating Range:	Same as data range

B.5.32.2.1. TCM Parameter Broadcast

NOTE: OEMs currently using the TML message or considering its use should contact their Allison Customer Integration Engineer. Allison is considering discontinuing TML support at some point in the future.

Parameters are disabled in all calibrations unless the Mode 1, Mode 2, and/or Mode 4 Transmission Mode Label broadcasts are individually enabled via VEPS. Mode 1, Mode 2, and Mode 4 are only available in 3000 and 4000 Series applications.

Transmission Mode Label, Mode 1 expresses the shift schedule associated with Primary Mode operation. The text string "PRIMARY SHIFT SCHED" is always conveyed.

Transmission Mode Label, Mode 2 expresses the shift schedule or functionality associated with Secondary Mode operation. The text string "2ND SHIFT SCHED" is always conveyed.

Transmission Mode Label, Mode 4 expresses the functionality associated with the MODE button on Allison shift selectors. This may be Secondary Mode operation, or a GPI function input. The content of this label is specified via VEPS / ACCT parameter [19070] SHIFT SELECTORS: MODE LABEL.

B.5.33. PGN 64872 – GROSS COMBINATION VEHICLE WEIGHT (GCVW)

SAE Excerpt: Gross Combination Vehicle Weight

See Appendix D - PGN 64872 for details and an example of the transmission rate.

In systems developed to the standard published before March 2017, this message might not be transmitted at the 10 s repetition rate, but would be transmitted on request.

Data Length 8
PDU Format 253
PDU Specific...104
Default Priority 5
Parameter Group Number 64872 (0xFD68)

B.5.33.1. *TCM MESSAGE BROADCAST*

WARNING: The System Integrator (Vehicle OEM) is responsible for verifying acceptable vehicle operation and device interaction. The System Integrator is required to ensure the broadcast data accuracy meets the needs of the vehicle system via rigorous testing, filtering, etc.

GCVW *Gross Combination Weight* data provided by the TCM shall not be used for implementations of vehicle safety critical functions.

Allison Transmission is not liable for consequences associated with incorrect implementation or unintended use of this feature.

Availability of this message is restricted. Please contact your Allison Customer Integration Engineering representative for details. For byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables. PGN is broadcast from SA 03 unless all parameters are disabled via VEPS.

B.5.33.2. *SPN 417 – GROSS COMBINATION WEIGHT*

SAE Excerpt: Total weight of the truck and all the trailers as determined via on-board scales or performance based calculation.

Data Length: 3 bytes
Resolution: 2 kg per bit
Data Range: 0 to 32 899 070 kg
Operational Range: Same as data range

Parameter Specific Indicator: A parameter specific indicator value of FB0000h indicates that this parameter is supported, but conditions are such that a value cannot be derived.

B.5.33.2.1. TCM Parameter Reception

This parameter indicates 0xFB0000 when the TCM has not determined an estimated mass value. This may occur, for example, directly following programming events, such as updating TCM software.

0xFEFFFF (Error) is indicated during accelerometer faults.

B.5.34. PGN 64892 – DIESEL PARTICULATE FILTER CONTROL 1 (DPFC1)

SAE Excerpt: This PGN contains information about the particulate filter regeneration control. If there are aftertreatment systems on two banks, this PGN represents the composite information from both banks.

NOTE: This message will be transmitted by the engine or aftertreatment system controller.

Transmission Repetition Rate: Every 1 s and on change of state but no faster than every 100 ms. Grandfathered definition for systems that implemented this message prior to July, 2010: 1 s and on change

Data Length 8
PDU Format..253
PDU Specific...124
Default Priority 6
Parameter Group Number 64892 (0xFD7C)

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables.

B.5.34.1. *SPN 3700 – AFTERTREATMENT DIESEL PARTICULATE FILTER ACTIVE*

SAE Excerpt: Indicates the state of diesel particulate filter active regeneration.

00b Not active
01b Active
10b Regeneration needed – automatically initiated active regeneration imminent
11b Not available

B.5.34.1.1. TCM Parameter Reception

See EMISSION CONTROL SYSTEMS – DPF/SCR. By default, the TCM only reacts to 01b (Active); however, through VEPS, the TCM will also respond to 10b (Regeneration needed– automatically initiated active regeneration imminent). See the function for details.

B.5.35. PGN 64899 – TRANSFER CASE INFORMATION (TCI)

SAE Excerpt: Transmission Repetition Rate: Every 1 s and on change of state but no faster than every 100 ms. Grandfathered definition for systems that implemented this message prior to July, 2010: 1 s or on change.

Data Length .... 8 bytes
PDU Format..253
PDU Specific 131
Default Priority 6
PGN 64,899 (0xFD83)

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables.

B.5.35.1. *TCM MESSAGE RECEPTION*

NOTE: TCI broadcast must be continuous. It may also be sent on change between the normal 1 second updates. If sent only on change, diagnostic responses will be generated by the TCM.

B.5.35.2. *SPN 3645 – TRANSFER CASE STATUS*

SAE Excerpt: This parameter describes the feedback from the transfer case controller. Used by instrument clusters, tachographs, PTOs, etc.

000b 2 wheel high (normal or "On Highway" Range)
001b 4 wheel high (normal or "On Highway" Range)
010b Neutral
011b 2 wheel low (or "Off Highway" Range)
100b 4 wheel low (or "Off Highway" Range)
101b Shift in Progress or gear not confirmed
110b Error
111b Not Available

Data Length: 3 bits
Resolution: 8 states/3 bit, 0 offset
Data Range: 0 to 7
Operational Range: Same as data range

B.5.35.2.1. TCM Parameter Reception

See HIGH N/V RATIO INPUT.

B.5.36. PGN 64906 – SAE J2012 DTC DISPLAY (J2012)

SAE Excerpt: Conveys basic SAE J2012 DTC information for on-board or service tool displays.

Transmission Repetition Rate..............On request
Data length... Variable
PDU format 253
PDU specific 138
Default priority...7
Parameter Group Number 64906 (0xFD8A)

Data byte arrangement:
A $B1_1$ $B2_1$ $B3_1$ $B4_1$ $B5_1$ C_1 $B1_X$ $B2_X$ $B3_X$ $B4_X$ $B5_X$ C_X . . .

Where:

A	*Number of J2012 DTCs*	
$B1_X$	1st Character of J2012 DTC x	
$B2_X$	2nd Character of J2012 DTC x	
$B3_X$	3rd Character of J2012 DTC x	
$B4_X$	4th Character of J2012 DTC x	
$B5_X$	5th Character of J2012 DTC x	
C_X	Bit 8:	*J2012 DTC Status*
	Bits 7-1:	*J2012 DTC Occurrence Count*

If PGN 64906 is requested and a supporting device has no active or inactive J2012 DTCs, PGN 64906 shall be sent as a single frame message with the first data byte (*Number of J2012 DTCs*) set to zero. Any unused bytes in this PGN shall be set to 255. When two or more J2012 DTCs are indicated PGN 64906 must be sent via Transport Protocol (See J1939-21).

B.5.36.1. *TCM MESSAGE BROADCAST*

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables. PGN is broadcast in all applications.

Broadcast from SA 03 for use in function DIAGNOSTIC COMMUNICATION FOR OEM USE.

When TCM J2012 broadcast length is ≤ 8 bytes, destination-specific and global requests will both result in a global response.

When TCM J2012 broadcast length is > 8 bytes, a destination-specific request will result in a destination-specific response via RTS / CTS, while a global request will result in a global response via BAM.

B.5.36.2. *SPN 3619 – NUMBER OF SAE J2012 DTCS*

SAE Excerpt: The number J2012 DTCs being conveyed in PGN 64906. If the value of this parameter is zero, the device broadcasting PGN 64906 has no active or previously active J2012 DTCs.

Slot Length:	8 bits
Slot Scaling:	1 DTC per bit
Slot Range:	0 to 255
Operating Range:	0 to 250 DTCs

B.5.36.3. *SPN 3620 – SAE J2012 DTC*

SAE Excerpt: 5 character ASCII SAE J2012 DTC, sent Most Significant Byte first.

Slot Length:	5 bytes
Slot Scaling:	ASCII
Slot Range:	0 to 255

B.5.36.4. *SPN 3621 – SAE J2012 DTC STATUS*

SAE Excerpt: Indicates if the respective SAE J2012 DTC is active or previously active.

0b	DTC is previously active
1b	DTC is active

B.5.36.5. *SPN 3622 – SAE J2012 DTC OCCURRENCE COUNT*

SAE Excerpt: Number of occurrences of the respective SAE J2012 DTC being conveyed. If more than 126 occurrences happen the value shall be set to 126. If the occurrence count is not available to be sent then this value shall be set to 127.

B.5.36.6. *EXAMPLES OF PGN 64906 CONTENT*

B.5.36.6.1. No DTCs present

Byte:	1	2	3	4	5	6	7	8
Hex:	$00	$FF	$ FF	$ FF	$ FF	$ FF	$FF	$FF
Dec:	0	255	255	255	255	255	255	255

ASCII: Not applicable

Byte 1 indicates there are no J2012 DTCs present.

B.5.36.6.2. Multiple DTCs present

Byte:	1	2	3	4	5	6	7	8
Hex:	$02	$50	$30	$32	$31	$38	$7F	$50
Dec:	2	80	48	50	49	56	127	80
ASCII:	--	“P”	“0”	“2”	“1”	“8”	--	“P”

Byte:	9	10	11	12	13
Hex:	$30	$37	$33	$33	$FF
Dec:	48	55	51	51	255
ASCII:	“0”	“7”	“3”	“3”	--

Byte 1 indicates there are 2 DTCs present, Byte 7, bit 8 indicates the 1st DTC is inactive, and Byte 13, bit 8 indicates the 2nd DTC is active.

B.5.37. PGN 64912 – ADVERTISED ENGINE TORQUE CURVE (AETC)

SAE Excerpt: This map conveys the advertised torque curve for the engine, as typically seen on specification sheets available from most engine manufacturers. The collection conditions for the data conveyed are indicated by SPN 3558 – AETC Data Collection Standard.

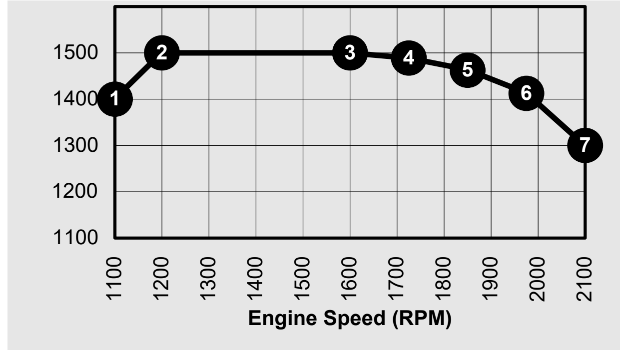
This map does not contain dynamic elements, and does not change during engine operation. For engines capable of dynamically switching between torque curves or ratings during operation, this map contains values for the highest (most powerful) rating. This map is not intended for use in real time engine control, but merely to indicate what engine rating is installed in the vehicle.

Data points on the curve are in order from left to right, and, at a minimum, must span from the lowest rpm where peak torque can be produced to the high speed governor breakpoint. SPN 3559 – Number of Data Points indicates the number of data points being sent. A minimum of 5 points must be supported, with up to 15 available as needed to properly convey the shape of the torque curve. As illustrated below, speed values need not be evenly incremented.

The pair of data points (a and b) are repeated in the PGN for the number of data points identified in byte 1.

Transmission Repetition Rate..............On request
Data Length .... Variable
PDU Format..253
PDU Specific...144
Default Priority 6
PGN 64,912 (0xFD90)

Byte	Bit	Content
1	8-5	*Number of AETC Data Points* ♦
	4-1	*AETC Data Collection Standard*
a		*AETC Speed Value* ♦
b		*AETC Torque Value* ♦



B.5.37.1. *TCM MESSAGE RECEPTION*

TCM reception and use is dependent upon use of a validated **ENGINE MAKE AND MODEL**.

Parameters marked ♦ are used by the TCM. AETC is used to ensure a correct ratings match between the engine and transmission model in use. If the engine rating exceeds that of the transmission, range availability will be restricted to prevent transmission damage. May be used with DYNAMIC SHIFT SENSING to predict vehicle performance.

B.5.37.2. *SPN 3558 – AETC DATA COLLECTION STANDARD*

SAE Excerpt: Indicates the standardized method by which torque data was obtained for the Advertised Engine Torque Curve. For example, in North America, heavy duty diesel engine specifications are typically based on SAE J1995. Other applicable SAE, ISO, or DIN standards may be added as necessary in the future.

Data Length: 4 bits
Type: Status

Bit States	Data Collection Standard
0000b	SAE J1995
0001b -1101b	Not Defined
1111b	Not Available

B.5.37.2.1. TCM Parameter Reception

Not used by the TCM; SAE J1995 data is assumed, as no other standards have been added to the SAE state definitions.

B.5.37.3. *SPN 3559 – NUMBER OF AETC DATA POINTS*

SAE Excerpt: Indicates the number of speed / torque data points contained in the Advertised Engine Torque Curve broadcast. A minimum of 5 points is required, with a maximum of 15 points available as needed to accurately convey the curve.

Slot Length:	4 bits
Slot Scaling:	16 states / 4 bit, 0 offset
Slot Range:	0 to 15
Operational Range:	5 to 15

B.5.37.3.1. TCM Parameter Reception

TCM reception and use is dependent upon use of a validated **ENGINE MAKE AND MODEL**.

B.5.37.4. *SPN 3560 – AETC SPEED VALUE*

SAE Excerpt: Engine speed value of the data points in PGN 64912 – Advertised Engine Torque Curve.

Slot Length:	2 bytes
Slot Scaling:	0.125 rpm/bit, 0 rpm offset
Slot Range:	0 to 8031.875 rpm
Operating Range:	Same as slot

B.5.37.4.1. TCM Parameter Reception

TCM reception and use is dependent upon use of a validated **ENGINE MAKE AND MODEL**.

B.5.37.5. *SPN 3561 – AETC TORQUE VALUE*

SAE Excerpt: Engine torque value of the data points in PGN 64912 – Advertised Engine Torque Curve.

Slot Length:	2 bytes
Slot Scaling:	1 Nm per bit
Slot Range:	0 to 64255 Nm
Operating Range:	Same as slot

B.5.37.5.1. TCM Parameter Reception

TCM reception and use is dependent upon use of a validated **ENGINE MAKE AND MODEL**.

B.5.38. PGN 64917 – TRANSMISSION FLUIDS 2 (TRF2)

SAE Excerpt:
Transmission Repetition Rate..........................1 s
Data length...8 bytes
PDU format 253
PDU specific 149
Default priority..6
PGN 64,917 (0xFD95)

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables. PGN is broadcast from SA 03 unless all parameters are disabled via VEPS.

B.5.38.1. *SPN 3359 – TRANSMISSION OIL FILTER RESTRICTION SWITCH*

SAE Excerpt: This switch indicates whether the transmission oil filter is clogged.

00b No restriction
01b Restriction exists on oil filter
10b Error
11b Not available

B.5.38.1.1. TCM Parameter Broadcast

May be broadcast when Filter Life Monitor prognostic is enabled; see TRANSMISSION SERVICE INDICATOR. 11b (Not Available) is indicated when broadcast is disabled.

B.5.38.2. *SPN 4177 – TRANSMISSION OIL LIFE REMAINING*

SAE Excerpt: Signal which indicates the actual oil life remaining in percent. 100% means the transmission oil is brand new, and 0% means the transmission oil is at the end of its life.

Data Length:	1 byte
Resolution:	0.4 %/bit, 0 offset
Data Range:	0 to 100 %
Operational Range:	Same as data range

B.5.38.2.1. TCM Parameter Broadcast

May be broadcast when Oil Life Monitor prognostic is enabled; see TRANSMISSION SERVICE INDICATOR. 0xFF (Not Available) is indicated when broadcast is disabled.

B.5.38.3. *SPN 5345 – TRANSMISSION OVERHEAT INDICATOR*

SAE Excerpt: Signal from transmission indicating that its fluid temperature is above normal acceptable limits, and as a result, transmission operation may be altered or restricted. The indicator is typically a lamp. Distinctions in meaning between the continuous and flashing are left to the transmission manufacturer.

00b Transmission Overheat Indicator is off
01b Transmission Overheat Indicator is on continuously
10b Transmission Overheat Indicator is flashing
11b Not available

B.5.38.3.1. TCM Parameter Broadcast

See SUMP TEMPERATURE INDICATOR. 11b (Not Available) is indicated when broadcast when disabled.

B.5.39. PGN 64932 – PTO DRIVE ENGAGEMENT (PTODE)

SAE Excerpt: Information relating to the request for engagement, consent for engagement, and status of engagement of various specific physical PTO drives. This message may be broadcast by one or all controllers involved in the enabling of a given PTO drive.

Transmission Repetition Rate	100 ms
Data length	8 bytes
PDU format	253
PDU specific	164
Default priority	6
PGN	64,932 (0xFDA4)

B.5.39.1. *TCM MESSAGE SUPPORT*

PGN is broadcast when one or more parameters enabled for PTO DRIVE INTERFACE 1 & 2 use. Parameter support, product availability and byte/bit locations are listed in the J1939 MESSAGE & PARAMETER OVERVIEW table.

B.5.39.2. *SPN 3452 – ENABLE SWITCH – TRANSMISSION INPUT SHAFT PTO 1*

SAE Excerpt: Status of the operator's switch or other input which indicates the desire for engaging the first PTO drive mounted on the transmission case. There may be more than one PTO drive mounted on the transmission case.

00b Enable switch off – PTO operation not desired
01b Enable switch on – PTO operation desired
10b Error
11b Not available

B.5.39.2.1. TCM Parameter Reception

See PTO DRIVE INTERFACE 1 & 2.

B.5.39.3. *SPN 3453 – ENABLE SWITCH – TRANSMISSION INPUT SHAFT PTO 2*

SAE Excerpt: Status of the operator's switch or other input which indicates the desire for engaging the second PTO drive mounted on the transmission case. If there is only one PTO drive on the transmission case, use SPN 3452 Enable Switch – Transmission input shaft PTO 1.

00b Enable switch off – PTO operation not desired
01b Enable switch on – PTO operation desired
10b Error
11b Not available

B.5.39.3.1. TCM Parameter Reception

See PTO DRIVE INTERFACE 1 & 2.

B.5.39.4. *SPN 3454 – ENABLE SWITCH – TRANSMISSION OUTPUT SHAFT PTO*

SAE Excerpt: Status of the operator's switch or other input which indicates the desire for engaging the PTO drive mounted on the transmission output shaft.

00b Enable switch off – PTO operation not desired
01b Enable switch on – PTO operation desired
10b Error
11b Not available

B.5.39.4.1. TCM Parameter Reception

See functions:
DIRECT HOLD
PTO DRIVE INTERFACE 1 & 2
PUMP MODE / FIRE TRUCK PUMP MODE

B.5.39.5. *SPN 3456 – ENGAGEMENT CONSENT – TRANSMISSION INPUT SHAFT PTO 1*

SAE Excerpt: Status of the transmission controller's consent to engage the first or sole PTO drive mounted on the transmission case. The controller in charge of the PTO drive should monitor this parameter and only engage the drive when consent is given. If consent is removed, while the PTO drive is engaged, the drive controller should disengage the drive as soon as possible. Engaging the drive or continuing drive engagement when consent is removed may result in damage to the transmission and / or the PTO drive mechanism.

00b Consent not given – PTO drive should not be engaged
01b Consent given – PTO drive may be engaged
10b Error
11b Not available

B.5.39.5.1. TCM Parameter Broadcast

See PTO DRIVE INTERFACE 1 & 2. 11b (Not Available) is indicated when PGN is broadcast but TCM is not configured to use this particular PTO.

B.5.39.6. *SPN 3457 – ENGAGEMENT CONSENT – TRANSMISSION INPUT SHAFT PTO 2*

SAE Excerpt: Status of the transmission controller's consent to engage the second PTO drive mounted on the transmission case. The controller in charge of the PTO drive should monitor this parameter and only engage the drive when consent is given. If consent is removed while the PTO drive is engaged, the drive controller should disengage the drive as soon as possible. Engaging the drive or continuing drive engagement when consent is removed may result in damage to the transmission and / or the PTO drive mechanism. If there is only one PTO drive on the transmission case, use SPN 3456 Engagement Consent – Transmission input shaft PTO 1.

00b Consent not given – PTO drive should not be engaged
01b Consent given – PTO drive may be engaged
10b Error
11b Not available

B.5.39.6.1. TCM Parameter Broadcast

See PTO DRIVE INTERFACE 1 & 2. 11b (Not Available) is indicated when PGN is broadcast but TCM is not configured to use this particular PTO.

B.5.39.7. *SPN 3458 – ENGAGEMENT CONSENT – TRANSMISSION OUTPUT SHAFT PTO*

SAE Excerpt: Status of the transmission controller's consent to engage the PTO drive connected to the transmission output shaft. The controller in charge of the PTO drive should monitor this parameter and only engage the drive when consent is given. If consent is removed, while the PTO drive is engaged, the drive controller should disengage the drive as soon as possible. Engaging the drive or continuing drive engagement when consent is removed may result in damage to the transmission and / or the PTO drive mechanism.

00b Consent not given – PTO drive should not be engaged
01b Consent given – PTO drive may be engaged
10b Error
11b Not available

B.5.39.7.1. TCM Parameter Broadcast

See PTO DRIVE INTERFACE 1 & 2. 11b (Not Available) is indicated when PGN is broadcast but TCM is not configured to use this particular PTO.

B.5.39.8. *SPN 3462 – ENGAGEMENT STATUS – TRANSMISSION OUTPUT SHAFT PTO*

SAE Excerpt: Reports if this specific PTO drive is engaged. This parameter should be broadcast only by the controller(s) receiving feedback about the specific drive. For example, a pressure switch may be used to determine if a PTO-driven pump has been engaged. If the Body Controller (SA 33) were monitoring this feedback signal, it should be the node broadcasting this parameter.

00b Drive not engaged
01b Drive is engaged
10b Error
11b Not available

B.5.39.8.1. TCM Parameter Broadcast

See function PUMP MODE / FIRE TRUCK PUMP MODE.

B.5.39.9. *SPN 20790 – OPERATION CONSENT – TRANSMISSION OUTPUT SHAFT PTO*

SAE Excerpt: Conveys a controller's consent for operation of the PTO device connected to the transmission output shaft. The operator and/or PTO control system should monitor this parameter and only operate the PTO device (e.g. begin pumping) when all related systems grant consent. The state of this parameter is not a prerequisite to engage a PTO drive, but it is a prerequisite to use the device driven by the PTO drive. If a controller no longer consents to PTO operation, PTO operation should be stopped as soon as possible to avoid damage to the vehicle or driveline.

00b Consent not given – PTO drive should not be operated
01b Consent given – PTO drive may be operated
10b Error
11b Not available

B.5.39.9.1. TCM Parameter Broadcast

See functions:
DIRECT HOLD
PUMP MODE / FIRE TRUCK PUMP MODE

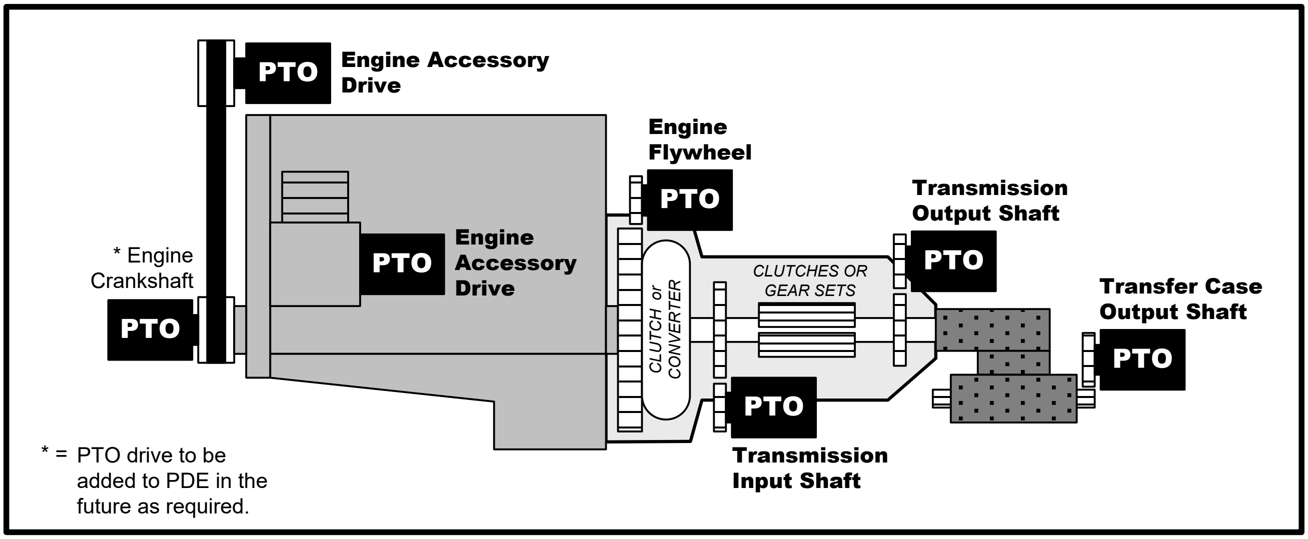


ILLUSTRATION OF PTO DRIVE LOCATIONS

B.5.40. PGN 64965 – ECU IDENTIFICATION INFORMATION (ECUID)

SAE Excerpt: Message for reporting identification and information about the physical ECU and its hardware, such as the ECU's part number, serial number, build date, etc. Information about the software within the ECU should be reported using the Software Identification PGN 65242 and/or DM19.

Transmission Repetition Rate............ On request
Data length...Variable
PDU format 253
PDU specific 197
Default priority.. 6
PGN 64,965 (0xFDC5)

Field	Content
a	*ECU Part Number* ●
	Delimiter (ASCII "*")
b	*ECU Serial Number* ●
	Delimiter (ASCII "*")
c	*ECU Location*
	Delimiter (ASCII "*")
d	*ECU Type*
	Delimiter (ASCII "*")
e	*ECU Manufacturer Name*
	Delimiter (ASCII "*")
f	*ECU Hardware ID*
	Delimiter (ASCII "*")

NOTE - The fields in this message are optional and separated by an ASCII "*". It is not necessary to include parametric data for all fields; however, the delimiter ("*") is always required. An ASCII "*" is required at the end of the last included field, even if there is only one ECU identification designator. Any additional ECU identification fields defined in the future will be appended at the end, each separated by an ASCII "*" as a delimiter.

B.5.40.1. *TCM MESSAGE SUPPORT*

Message and parameters marked ● are broadcast upon request from SA 03 in all applications, unless message broadcast is disabled via VEPS.

TCM ECUID broadcast length is always > 8 bytes, therefore a destination-specific request will result in a destination-specific response via RTS / CTS, and a global request will result in a global response via BAM.

B.5.40.2. *SPN 2901 – ECU PART NUMBER*

SAE Excerpt: The part number of the physical ECU.

Data Length:	Variable – up to 200 characters ("*" delimited)
Resolution:	ASCII, 0 offset
Data Range:	0 to 255 per byte

NOTE – The ASCII character "*" is reserved as a delimiter.

B.5.40.2.1. TCM Parameter Broadcast

Parameter contains the TCM part number.

B.5.40.3. *SPN 2902 – ECU SERIAL NUMBER*

SAE Excerpt: The serial number of the physical ECU.

Data Length:	Variable – up to 200 characters ("*" delimited)
Resolution:	ASCII, 0 offset
Data Range:	0 to 255 per byte

NOTE – The ASCII character "*" is reserved as a delimiter.

B.5.40.3.1. TCM Parameter Broadcast

Parameter contains the TCM serial number.

B.5.40.4. *EXAMPLE BROADCAST*

The data string below illustrates the ECUID response of an Allison A63 TCM.

Byte	Decimal	Hexadecimal	ASCII
1	32	0x20	**(space)**
2	32	0x20	**(space)**
3	50	0x32	**2**
4	57	0x39	**9**
5	53	0x35	**5**
6	53	0x35	**5**
7	54	0x36	**6**
8	56	0x38	**8**
9	56	0x38	**8**
10	52	0x34	**4**
11	42	0x2A	*****
12	66	0x42	**B**
13	75	0x4B	**K**
14	54	0x36	**6**
15	56	0x38	**8**
16	56	0x38	**8**
17	52	0x34	**4**
18	65	0x41	**A**
19	51	0x33	**3**
20	54	0x36	**6**
21	50	0x32	**2**
22	55	0x37	**7**
23	56	0x38	**8**
24	48	0x30	**0**
25	48	0x30	**0**
26	55	0x37	**7**
27	52	0x34	**4**
28	42	0x2A	*****
29	42	0x2A	*****
30	42	0x2A	*****
31	42	0x2A	*****
32	42	0x2A	*****

B.5.41. PGN 64997 – MAXIMUM VEHICLE SPEED LIMIT STATUS (MVS)

SAE Excerpt: Reports the possible maximum vehicle speed limits, one through seven, and the applied maximum vehicle speed limit.

Transmission Repetition Rate .... 1 s
Data length .... 8 bytes
PDU format 253
PDU specific 229
Default priority 6
PGN 64,997 (0xFDE5)

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables.

B.5.41.1. *SPN 2595 – APPLIED VEHICLE SPEED LIMIT*

SAE Excerpt: The vehicle speed limit in effect.

Data Length: 1 byte
Resolution: 1 kph per bit, 0 kph offset
Data Range: 0 to 250 kph
Operational Range: Same as data range

251 (FBh) is used to indicate that a maximum vehicle speed limit is not selected.

B.5.41.1.1. TCM Parameter Reception

See functions:

DOWNHILL SPEED CONTROL

ROAD SPEED LIMITING

B.5.42. PGN 65098 – ELECTRONIC TRANSMISSION CONTROLLER 7 (ETC7)

SAE Excerpt:
Transmission Repetition Rate .... 100 ms
Data length .... 8 bytes
PDU format 254
PDU specific 74
Default priority 6
PGN 65,098 (0xFE4A)

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables. PGN is broadcast from SA 03 unless all parameters are disabled via VEPS.

B.5.42.1. *SPN 1849 – TRANSMISSION REQUESTED RANGE DISPLAY FLASH STATE*

SAE Excerpt: State signal indicating a transmission request for the display of the Transmission Requested Range parameter (SPN 162) to flash or not to flash. The “Transmission Requested Range Display Flash State” indicator can be utilized by (but not limited to) the shift console, instrument cluster, or cab display. Definition of the cause of this state is at the discretion of the transmission manufacturer. The flash period shall be 700 ms @ 50% duty cycle.

Transmission manufacturers may want to flash the Transmission Requested Range display depending on certain events. It could be because a gear could not be attained, or because fluid is low, etc. Indicator should be on for 350 ms and off for 350 ms.

Transmissions supporting both this parameter and the Transmission Requested Range Display Blank State should treat the active states of these parameters as mutually exclusive; both parameters should not indicate "active" at the same time.

00b Inactive; Transmission Requested Range display should not be flashing
01b Active; Transmission Requested Range display should be flashing
10b Reserved
11b Take no action

B.5.42.1.1. TCM Parameter Broadcast

Indicates to OEM shift selector displays when the display digit should be flashing. Intended to reflect the display operation of Allison shift selectors; see function RANGE DISPLAY – REQUESTED RANGE. 11b (Not Available) is indicated when broadcast is disabled.

When flashing of the requested range display is used to convey the inhibited condition, *Transmission*

Requested Range Display Flash State is the preferred trigger. *Transmission Shift Inhibit Indicator* is the preferred method of conveying an inhibited shift condition when the indication method is not the flashing of the requested range display digit.

B.5.42.2. *SPN 1850 – TRANSMISSION REQUESTED RANGE DISPLAY BLANK STATE*

SAE Excerpt: State signal indicating a transmission request for the display of the Transmission Requested Range parameter (SPN162) to be blanked or not blanked. The "Transmission Requested Range Display Blank State" indicator can be utilized by (but not limited to) the shift console, instrument cluster, or cab display. Definition of the cause of this state is at the discretion of the transmission manufacturer

Transmission manufacturers may want to blank the Transmission Requested Range display depending on certain events. Typically it is an indication of a shift selector problem.

Transmissions supporting both this parameter and the Transmission Requested Range Display Flash State should treat the active states of these parameters as mutually exclusive; both parameters should not indicate "active" at the same time.

00b Inactive; Transmission Requested Range display should not be blanked
01b Active; Transmission Requested Range display should be blanked
10b Reserved
11b Take no action

B.5.42.2.1. TCM Parameter Broadcast

Parameter indicates to Non-Allison shift selector displays when the display digit should be blanked. See RANGE DISPLAY – REQUESTED RANGE. 11b (Not Available) is indicated when broadcast is disabled.

B.5.42.3. *SPN 4178 – TRANSMISSION SERVICE INDICATOR*

SAE Excerpt: Signal from transmission indicating that some aspect of the gearbox requires servicing, such as the oil, filter, clutch(es) or other component.

00b Transmission Service Indicator is off
01b Transmission Service Indicator is on continuously
10b Transmission Service Indicator is flashing
11b Not available

B.5.42.3.1. TCM Parameter Broadcast

See functions:

SHIFT ACTUATOR SYSTEM W/ALLISON SELECTOR: 1000/2000 SERIES

SHIFT SELECTOR, ALLISON

TRANSMISSION SERVICE INDICATOR

B.5.42.4. *SPN 1851 – TRANSMISSION SHIFT INHIBIT INDICATOR*

SAE Excerpt: State signal indicating a transmission request for the Shift Inhibit Indicator to be active or inactive. The shift inhibit indicator can be of lamp or text form, located on (but not limited to) the shift console, instrument cluster, or cab display. Definition of the cause of the "range inhibit" state is at the discretion of the transmission manufacturer.

Transmission manufacturers may want to indicate that they currently cannot make a requested shift. This could be due to inappropriate vehicle speed or other restrictions.

00b Inactive; shift is not inhibited
01b Active (on continuously); shift is inhibited
10b Active (flashing)
11b Take no action

B.5.42.4.1. TCM Parameter Broadcast

See functions:

RANGE INHIBITED INDICATOR (RII)

RANGE DISPLAY – REQUESTED RANGE

Transmission Shift Inhibit Indicator is the preferred method of conveying an inhibited shift condition when the indication method is not the flashing of the requested range display digit. When flashing of the requested range display is used to convey the inhibited condition, *Transmission Requested Range Display Flash State* is the preferred trigger.

During certain solenoid failures, *Transmission Shift Inhibit Indicator* will indicate 10b (Error). 11b (Not Available) is indicated when broadcast is disabled.

B.5.42.5. *SPN 2900 – TRANSMISSION ENGINE CRANK ENABLE*

SAE Excerpt: State signal from the transmission indicating if the transmission's status is such that engine cranking is allowed (i.e. at a minimum, transmission is in neutral and the driveline is disengaged). As sender of this information, the transmission is responsible for correct indication immediately upon first broadcast of this parameter.

As with dedicated wire neutral start implementations, those utilizing this parameter should consider the impact of the transmission or other controllers “resetting” due to voltage drops during the engine start sequence.

The vehicle system design should also consider the impact of timing latency in the engine starting sequence. For example, the turn of an key switch from “off” to “start” may happen more quickly than the transmission controller can boot up, determine its’ current state of being, and begin broadcasting information over the J1939 datalink.

00b Cranking disabled; engine cranking is prohibited by the transmission
01b Cranking enabled; engine cranking is allowed by the transmission
10b Error
11b Not Available

B.5.42.5.1. TCM Parameter Broadcast

See NEUTRAL START. 11b (Not Available) is indicated when broadcast is disabled.

B.5.42.6. *SPN 2945 – ACTIVE SHIFT CONSOLE INDICATOR*

SAE Excerpt: Signal from transmission control unit indicating which shift console (primary or secondary) it currently considers as the active shift selector input.

Note: In some applications such as refuse trucks, the transmission can be operated from two positions in the vehicle. The transmission control unit will accept changes in transmission requested gear (SPN 525) from the operator only from the active shift console. The transmission control unit determines which shift console is active based on a switch input controlled by the operator and transmission system state criteria.

00b Primary shift console is active
01b Secondary shift console is active
10b Reserved
11b Not available

B.5.42.6.1. TCM and Selector Parameter Use

See functions:

SHIFT SELECTOR, ALLISON

SHIFT SELECTOR, NON-ALLISON BASIC

SHIFT SELECTOR, NON-ALLISON DIRECT SELECT

SHIFT SELECTOR, NON-ALLISON STANDARD

11b (Not Available) is indicated when broadcast is disabled or the TCM is configured for a single shift selector.

B.5.42.7. *SPN 2536 – TRANSMISSION MODE 1 INDICATOR*

SAE Excerpt: This state signal is the transmission’s indication that it is operating under Transmission Mode 1 (SPN 1852) as commanded via the TC1 message (PGN 256). The definition of the shift mode is left to the discretion of the transmission manufacturer.

00b Transmission Mode 1 not active
01b Transmission Mode 1 Active
10b Error
11b Not available

B.5.42.7.1. TCM Parameter Broadcast

Parameter is linked with ETC7 *Transmission Mode 2 Indicator*; they are enabled / disabled as a pair.

Reflects the status of “primary mode” operation, which is typically associated with primary shift schedule operation. When *Transmission Mode 1 Indicator* is 01b, the transmission is operating in the primary mode. 11b (Not Available) is indicated when broadcast is disabled.

Transmission Mode 1 Indicator and *Transmission Mode 2 Indicator* will never be active at the same time. State 10b (Error) is not supported.

B.5.42.8. *SPN 2537 – TRANSMISSION MODE 2 INDICATOR*

SAE Excerpt: This state signal is the transmission’s indication that it is operating under Transmission Mode 2 (SPN 1853) as commanded via the TC1 message (PGN 256). The definition of the shift mode is left to the discretion of the transmission manufacturer.

00b Transmission Mode 2 not active
01b Transmission Mode 2 Active
10b Error
11b Not available

B.5.42.8.1. TCM Parameter Broadcast

See SECONDARY MODE INDICATOR. Parameter is linked with ETC7 *Transmission Mode 1 Indicator*; they are enabled / disabled as a pair.

10b (Error) is not supported. Unlike *Transmission Mode 4 Indicator* below, there is no “bulb check” functionality affiliated with this parameter. 11b (Not Available) is indicated when broadcast is disabled.

B.5.42.9. *SPN 2539 – TRANSMISSION MODE 4 INDICATOR*

SAE Excerpt: This state signal is the transmission's indication that it is operating under Transmission Mode 4 (SPN 1855) as commanded via the TC1 message (PGN 256). The definition of the shift mode is left to the discretion of the transmission manufacturer.

00b Transmission Mode 4 not active
01b Transmission Mode 4 Active
10b Error
11b Not available

B.5.42.9.1. TCM and Selector Parameter Use

Only broadcast from SA 03 (Transmission #1) with certain shift selector and / or VEPS configurations. 11b (Not Available) is indicated when broadcast is disabled. When broadcast, parameter reflects the TCM MODE state as it relates to the shift selector MODE Button. Set to 01b during bulb check. See functions:

SHIFT SELECTOR, NON-ALLISON BASIC

SHIFT SELECTOR, NON-ALLISON DIRECT SELECT

SHIFT SELECTOR, NON-ALLISON STANDARD

B.5.42.10. *SPN 6568 – TRANSMISSION MODE 10 INDICATOR*

SAE Excerpt: Indicates that the transmission is operating under transmission mode 10 (SPN 6570) as commanded via the TC2 message (PGN 3328). The definition of the transmission mode is left to the discretion of the transmission manufacturer.

00b Transmission Mode 10 not active
01b Transmission Mode 10 Active
10b Error
11b Not available

B.5.42.10.1. TCM Parameter Broadcast

See FUELSENSE® INDICATOR. 11b (Not Available) is indicated when broadcast is disabled.

B.5.42.11. *SPN 3289 – TRANSMISSION REQUESTED GEAR FEEDBACK*

SAE Excerpt: Feedback of the SPN 525 Transmission Requested Gear input as received from the shift selector, ABS or engine via PGN 256, Transmission Control 1 (TC1) or other transmission selector input. Scaling, values and parameter specific indicators are identical to those listed for SPN 525 Requested Gear.

This feedback from the transmission allows shift selectors and other TC1 input devices to determine if their Requested Gear command has been received by the transmission. (This parameter is not intended for driver display purposes.)

In systems with mechanical or electrical shift selectors which do not support J1939 communication, this parameter allows the transmission ECU to convey the requested gear as interpreted by the transmission from its mechanical or electrical shift selector.

Data Length:	1 byte
Resolution:	Same as TC1 Transmission Requested Gear
Data Range:	Same as TC1 Transmission Requested Gear

Parameter Specific Indicator: Same as TC1 Transmission Requested Gear

B.5.42.11.1. TCM Parameter Broadcast

Broadcast in 3000/4000 Series and 2000 Series 9-speed applications unless disabled via VEPS. Parameter only reflects the TC1 *Transmission Requested Gear* value being received by the TCM from the active shift selector.

0xFF (Not Available) is indicated when broadcast is disabled.

B.5.42.12. *SPN 5344 – TRANSMISSION WARNING INDICATOR*

SAE Excerpt: Signal from transmission indicating that some aspect of its operation is not functioning correctly, and as a result, Transmission operation may be altered or restricted. The indicator is typically a lamp. Distinctions in meaning between the continuous and flashing are left to the transmission manufacturer.

00b Transmission Warning Indicator is off
01b Transmission Warning Indicator is on continuously
10b Transmission Warning Indicator is flashing
11b Not available

B.5.42.12.1. TCM Parameter Broadcast

See CHECK TRANS INDICATOR. 11b (Not Available) is indicated when broadcast is disabled.

B.5.42.13. *SPN 3086 – TRANSMISSION READY FOR BRAKE RELEASE*

SAE Excerpt: This parameter indicates that enough torque / motive force is available at the transmission output shaft to release all the brakes without a risk of unintentional movement in the opposite direction.

00b Transmission Not Ready for Brake Release
01b Transmission Ready for Brake Release
10b Error
11b Not available

B.5.42.13.1. TCM Parameter Broadcast

See HILL HOLD INTERFACE. 11b (Not Available) is indicated when broadcast is disabled. 10b (Error) is indicated during certain fault conditions.

B.5.42.14. *SPN 4261 – TRANSMISSION REVERSE GEAR SHIFT INHIBIT STATUS*

SAE Excerpt: Reflects the status of transmission reverse inhibit activity in response to requests via SPN 4242 – Transmission Reverse Gear Shift Inhibit Request. Typically broadcast by the transmission controller.

00b Reverse gear shifts are currently allowed
01b Reverse gear shifts are currently inhibited
10b Error
11b Not available

B.5.42.14.1. TCM Parameter Broadcast

See REVERSE INHIBIT WITH PRESELECT REQUEST. 11b (Not Available) is indicated when broadcast is disabled.

B.5.42.15. *SPN 11748 – TRANSMISSION PRE-DEFINED RANGE LIMIT INDICATOR*

SAE Excerpt: This parameter indicates if the transmission is currently restricted to operation below a pre-defined range as requested by SPN 11751 [Transmission Pre-Defined Maximum Gear Activation Request].

00b Pre-defined range limit is not in effect
01b Pre-defined range limit is in effect
10b Error
11b Not available

B.5.42.15.1. TCM Parameter Broadcast

See OVERDRIVE DISABLE. 11b (Not Available) is indicated when broadcast is disabled.

B.5.42.16. *SPN 8291 – TRANSMISSION MANUAL MODE INDICATOR*

SAE Excerpt: This parameter indicates if the operator has selected a Manual Mode of the transmission. When a Manual Mode is active, the operator has directly and intentionally restricted the available transmission ranges for the given vehicle direction. A Manual Mode may require direct operator input before any shifts are initiated (e.g. "Upshift" or "Downshift" inputs), or may just prevent the transmission from achieving its maximum range in that direction (e.g. via selection of "Low" or another range below the maximum). When not in Manual Mode, the transmission always selects the optimum range for current operating conditions, and initiates any shifts as needed.

Manual Modes are typically associated with forward ranges. However, Manual Modes may also be available in applications where the transmission supports multiple reverse ranges.

Manual Mode should not be indicated when the transmission is in Park or Neutral, nor when another vehicle function (e.g. engine braking, adaptive cruise control) modifies the shift schedule or available transmission ranges.

00b Transmission is not in a Manual Mode
01b Transmission is in a Manual Mode
10b Reserved
11b Not available

B.5.42.16.1. TCM Parameter Broadcast

The TCM indicates that Manual Mode is active (01b) when the transmission is limited to a forward range lower than the maximum configured range in the currently active shift schedule due to operator input through the shift selector. In cases where a shift selector is in a manual position, but the maximum configured forward range in the currently active shift schedule is being requested, the TCM will indicate that Manual Mode is not active (00b). Other range limiting functions, except for OVERDRIVE DISABLE, do not activate Transmission Manual Mode Indicator. 11b (Not Available) is indicated when broadcast is disabled.

B.5.43. PGN 65099 – TRANSMISSION CONFIGURATION 2 (TCFG2)

SAE Excerpt: Transmission Repetition Rate: On request or sender may transmit every 5 seconds until acknowledged by reception of the engine configuration message PGN 65251 SPN 1846.

Data Length .... 8 bytes
PDU Format 254
PDU Specific...75
Default Priority 6
PGN 65099 (0xFE4B)

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables.

B.5.43.1. *SPN 1845 – TRANSMISSION TORQUE LIMIT*

SAE Excerpt: Parameter provided to the engine from the transmission as a torque limit to be invoked by the engine in the event that J1939 communication with the transmission is lost.

The intention is to protect transmissions that use a continuous torque limit during torque converter mode or operation in specific lower gears, where stall or drivetrain torque may reach levels higher than the gearbox capacity. If communication is lost during torque-limited operation, unrestricted engine torque output could harm the transmission.

It is recommended that engines use reception of the ETC1 message as a transmission "heartbeat". In the event that the ETC1 message is not received in a time period of 5 times its' broadcast rate (5 x 10 ms = 50 ms), the engine should invoke a torque limit holding the engine to less than or equal to the value of the Transmission Torque Limit parameter. The engine may release the limit when engine-to-transmission communication is re-established.

A value of FF00 to FFFF indicates that no transmission torque limit is desired.

It is expected that the engine will record this torque value in non-volatile memory and will include this in the engine configuration PGN as parameter Engine Default Torque Limit (SPN 1846).

If the engine observes change in this parameter value on power-up, the engine should record the new value.

Data Length:	2 bytes
Resolution:	1 Nm / bit, 0 offset
Data Range:	0 to 64255 Nm
Operational Range:	Same as data range

B.5.43.1.1. TCM Parameter Broadcast

See functions:

ENGINE MANAGEMENT – LRTP

ENGINE MANAGEMENT – OTL

While not clarified in the current SAE definition, this parameter is in terms of indicated torque – not gross torque.

B.5.44. PGN 65218 – ELECTRONIC RETARDER CONTROLLER 2 (ERC2)

SAE Excerpt: Transmission Repetition Rate: Every 1 s and on change of state but no faster than every 100 ms.

Data Length .... 8 bytes
PDU Format 254
PDU Specific 194
Default Priority 7
PGN 65218 (0xFEC2)

NEW FOR THE C240 PSC RELEASE: Added optional broadcast of ERC2 *Retarder Road Speed Limit Enable*, *Retarder Road Speed Limit Active*, and *Retarder Road Speed Limit Set Speed*.

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables.

B.5.44.1. *TCM MESSAGE BROADCAST*

PGN is broadcast with different parameter content from SA 03 (Transmission #1) and SA 16 (Retarder – Driveline), unless all applicable parameters are disabled via VEPS.

B.5.44.2. *SPN 748 – TRANSMISSION OUTPUT RETARDER*

SAE Excerpt: Identifies the status of the transmission output retarder.

00b = Off
01b = On
10b = Error
11b = Not available

B.5.44.2.1. TCM Parameter Broadcast

Provided from SA16 for use in function RETARDER CONTROL.

Off (00b) is indicated when the Allison driveline retarder is not active.

On (01b) is indicated when the Allison driveline retarder is active.

10b (Error) is indicated if the optional retarder pressure sensor is installed and fails. 11b (Not Available) is indicated when broadcast is disabled.

B.5.44.3. *SPN 4055 – TRANSMISSION RETARDER ENABLE SWITCH*

SAE Excerpt: The transmission retarder enable switch indicates whether the operator allows the transmission to engage its integral retarder when indicated by vehicle operating conditions.

00b = Retarder Enable Switch Off
01b = Retarder Enable Switch On
10b = Error
11b = Not Available

B.5.44.3.1. TCM Parameter Broadcast

Provided from SA16 for use in function RETARDER CONTROL.

This parameter is only broadcast in applications with the retarder enable switch directly wired to the TCM.

On (01b) is indicated when the Retarder Input GPI allows for retarder activation.

Off (00b) is indicated when the Retarder Input GPI does not allow for retarder activation.

Error (10b) is not supported by the TCM. Not Available (11b) is indicated when broadcast is disabled.

B.5.44.4. *SPN 12990 –RETARDER ROAD SPEED LIMIT ENABLE*

SAE Excerpt: This indicates that the system is capable of activating the retarder to limit the downhill vehicle speed which is possible when SPN 4233 is ON and the operator has set a downhill vehicle speed.

00b = Retarder Road Speed Limit is not enabled
01b = Retarder Road Speed Limit is enabled
10b = Error
11b = Not Available

B.5.44.4.1. TCM Parameter Broadcast

Provided from SA03 for use in function DOWNHILL SPEED CONTROL.

This parameter is available in applications with or without an Allison retarder.

Enabled (01b) is indicated when the operator has set the set speed via one of the enabled Downhill Speed Control activation methods (accelerator pedal, brake pedal, cruise, road speed limit, retarder lever – RMR)

Not Enabled (00b) is indicated when the operator has not set the set speed or is overriding the set speed via one of the enabled Downhill Speed Control activation methods (accelerator pedal, brake pedal, cruise, road speed limit, retarder lever – RMR).

Error (10b) is not supported by the TCM. Not Available (11b) is indicated when broadcast is disabled.

B.5.44.5. *SPN 12991 –RETARDER ROAD SPEED LIMIT ACTIVE*

SAE Excerpt: This indicates the retarder road speed limit system is actively engaged and retarder is limiting the downhill vehicle speed. This parameter can also be used as feedback indication for conventional cruise control system which supports downhill speed control capability.

00b = Retarder Road Speed Limit is not active
01b = Retarder Road Speed Limit is active
10b = Error
11b = Not Available

B.5.44.5.1. TCM Parameter Broadcast

Provided from SA03 for use in function DOWNHILL SPEED CONTROL.

This parameter is available in applications with or without an Allison retarder.

Active (01b) is indicated when the operator has set the set speed via one of the enabled Downhill Speed Control activation methods, and the TCM is actively limiting the vehicle speed via preselect shifts or the driveline retarder (if present and enabled).

Not Active (00b) is indicated when the operator has set the set speed via one of the enabled Downhill Speed Control activation methods and the TCM is not actively limiting the vehicle speed OR if the operator has not set the speed via one of the enabled Downhill Speed Control activation methods.

Error (10b) is not supported by the TCM. Not Available (11b) is indicated when broadcast is disabled.

B.5.44.6. *SPN 12992 –RETARDER ROAD SPEED LIMIT SET SPEED*

SAE Excerpt: Value of set (chosen) velocity of the retarder road speed limit system.

Data Length: 2 bytes
Resolution: 0.00390625 km/h per bit, 0 offset
Data Range: 0 to 250.99609375 km/h
Operational Range: Same as data range

B.5.44.6.1. TCM Parameter Broadcast

Provided from SA03 for use in function DOWNHILL SPEED CONTROL.

This parameter is available in applications with or without an Allison retarder.

This parameter indicates the currently active speed limit, which is determined by the combination of the speed chosen by the operator and the Downhill Speed Control Custom Speed Offset configured via VEPS.

The TCM indicates a value of 250.99609375 km/h when the operator has not yet chosen a set speed or is overriding the set speed via one of the enabled Downhill Speed Control activation methods.

B.5.45. PGN 65226 – ACTIVE DIAGNOSTIC TROUBLE CODES (DM1)

SAE Excerpt: The information communicated is limited to the currently active diagnostic trouble codes (DTCs). The active diagnostic codes are preceded by the diagnostic lamp status. Together they convey the diagnostic condition of the transmitting electronic component to other components on the network. Occurrence counts for currently active diagnostic trouble codes may be provided as described in J1939-73. DM1 should contain all active DTCs including the emissions-related DTCs.

The defined lamps (Malfunction Indicator Lamp, Red Stop Lamp, Amber Warning Lamp, and Protect Lamp) comprise a component's lamp status. Typically, they are associated with DTCs provided in DM1. If the transmitting electronic component does not have active DTCs, then the lamp status from that component will indicate that the lamps should be off. However, the component controlling the actual lamp illumination must consider the status from all components that provide these lamps before changing the display to the operator. The lamp information (Malfunction Indicator Lamp, Red Stop Lamp, Amber Warning Lamp, and Protect Lamp) should reflect the present state of the transmitting electronic component. DM1 shall not convey temporary signals to provide for lamp test illumination or DTC flashout. When there are multiple DTCs with different lamp command (for example SPN1213 is for the MIL) and lamp flash (for example SPN3038 is for the flash MIL) requirements then the DTC with the MIL and fast flash takes priority over, MIL with slow flash, which takes priority over the Short MIL, which takes priority over the class C.

There are uses for additional lamp definitions to accomplish specific functions (e.g., a lamp that indicates when cruise control is actively controlling would require a separate lamp in another PG).

Broadcast Rate:

A DM1 message shall be transmitted once every second and on state change. To prevent a high message rate due to intermittent faults that have a very high frequency, it is recommended that no more than one state change per DTC per second be transmitted. For example, if a fault has been active for 1 second or longer, and then becomes inactive, a DM1 message shall be transmitted to reflect this state change. If a different DTC changes state within the 1 second update period, a new DM1 message is transmitted to reflect this new DTC.

Thus a DTC that becomes active/inactive twice within a 1 second interval, such as shown in Example Case 1, would have one message identifying the DTC becoming active, and one at the next periodic transmission identifying it being inactive. This message shall be sent every second or in response to a request. Note that this Parameter Group will require using the "Multipacket Transport" Parameter Group (reference SAE J1939-21) when more than one active DTC exists.

DM1 shall be broadcast at 1.0 Hz Rate, even when there are no active faults. This permits instrumentation to detect the loss of the lamp information and take appropriate action. For example, MIL_Status Signal as required by OBD, and illuminate the MIL without querying providers.

Data Length .... Variable
PDU Format..254
PDU Specific 202
Default Priority 6
PGN 65226 (0xFECA)

Byte	Bit	Content
1	8,7	*Malfunction Indicator Lamp* ●
	6,5	*Red Stop Lamp* ●
	4,3	*Amber Warning Lamp* ●
	2,1	*Protect Lamp* ●
2	8,7	*Flash Malfunction Indicator Lamp*
	6,5	*Flash Red Stop Lamp*
	4,3	*Flash Amber Warning Lamp*
	2,1	*Flash Protect Lamp*
3	8-1	*SPN*, 8 least significant bits of SPN (most significant at bit 8) ●
4	8-1	*SPN*, second byte of SPN (most significant at bit 8) ●
5	8-6	*SPN*, 3 most significant bits (most significant at bit 8) ●
	5-1	*FMI* (most significant at bit 5) ●
6	8	*SPN Conversion Method* ●
	7-1	*Occurrence Count* ●
7-8		[ATI: J1939-73 doesn't define these bytes, however, examples show all bits set to 1.]

NOTE – When the occurrence count is not available it should be set to all ones which is a value of 127.

B.5.45.1. *TCM MESSAGE BROADCAST*

Message and parameters marked ● are broadcast from SA 03 (Transmission #1) in all applications, unless disabled via VEPS. Used for:

CHECK TRANS INDICATOR

DIAGNOSTIC COMMUNICATION FOR OEM USE

SUMP TEMPERATURE INDICATOR

TRANSMISSION SERVICE INDICATOR

Allison retarder applications will also send DM1 from SA 16 (Retarder – Driveline); see RETARDER TEMPERATURE INDICATOR.

If more than one indication is active at once, DM1 will be sent using Transport Protocol. While the SAE default priority for Transport Protocol data transfer packets is listed as 7, the TCM broadcasts with Priority 6 – that of the "parent" message being sent. This is not an uncommon industry practice.

Any unsupported *Lamp Status* parameters are set to 00b (Off).

See EXAMPLES OF DM1 CONTENT below for data string examples.

B.5.45.2. *SPN 623 – RED STOP LAMP*

SAE Excerpt: This lamp is used to relay trouble code information that is of a severe enough condition that it warrants stopping the vehicle.

00b Off
01b On
10b Error
11b Not available

B.5.45.2.1. TCM Parameter Broadcast

Parameter is always set to 11b (Not Available).

B.5.45.3. *SPN 624 – AMBER WARNING LAMP*

SAE Excerpt: This lamp is used to relay trouble code information that is reporting a problem with the vehicle system but the vehicle need not be immediately stopped.

00b Off
01b On
10b Error
11b Not available

B.5.45.4. *SPN 987 – PROTECT LAMP*

SAE Excerpt: This lamp is used to relay trouble code information that is reporting a problem with a vehicle system that is most probably not electronic subsystem related. For instance, engine coolant temperature is exceeding its prescribed temperature range.

00b Off
01b On
10b Error
11b Not available

B.5.45.4.1. TCM Parameter Broadcast

Parameter is always set to 11b (Not Available).

B.5.45.5. *SPN 1213 – MALFUNCTION INDICATOR LAMP*

SAE Excerpt: A lamp used to relay only emissions-related trouble code information. This lamp is only illuminated when there is an emission-related trouble code active.

00b Off
01b On
10b Error
11b Not available

B.5.45.5.1. TCM Parameter Broadcast

Parameter is always set to 11b (Not Available).

B.5.45.6. *SPN 1214 – SUSPECT PARAMETER NUMBER*

SAE Excerpt: This 19-bit number is used to identify the item for which diagnostics are being reported. The SPN is used for multiple purposes, some of those that are specific to diagnostics are: 1. to identify a least repairable subsystem that has failed; 2. to identify subsystems and or assemblies that may not have hard failures but may be exhibiting abnormal operating performance; 3. identifying a particular event or condition that will be reported; and 4. to report a component and non-standard failure mode. SPNs are assigned to each individual parameter in a Parameter Group and to items that are relevant to diagnostics but are not a parameter in a Parameter Group. SPNs are independent of the source address for the message. However, the source address may be necessary to determine which controller on the network performed the diagnosis.

Data Length: 19 bits
Resolution: 1 SPN / bit
Data Range: 0 to 524,287

B.5.45.7. *SPN 1215 – FAILURE MODE IDENTIFIER*

SAE Excerpt: The FMI defines the type of failure detected in the subsystem identified by an SPN. Note that the failure may not be an electrical failure but may instead be a subsystem failure or condition needing to be reported to the service technician and maybe also to the operator. Conditions can include system events or status that need to be reported. The FMI, SPN, SPN Conversion Method and Occurrence Count fields combine to form a given diagnostic trouble code.

Data Length:	5 bits
Resolution:	1 FMI / bit
Data Range:	0 to 31

B.5.45.8. *SPN 1706 – SPN CONVERSION METHOD*

SAE Excerpt: When this 1-bit field is equal to a zero, the SPN should be converted as it is defined in this document (see definition below for Version 4). The February 1996 version of J1939-73 contained inadequate definitions to assure consistent implementations. Products implementing to February 1996 version of the document will always have this bit set to a one. When this is the case, the SPN is in either Version 1, 2 or 3 format.

To clarify the ordering of bits and bytes within the SPN parameter (which is 19 bits long) and to keep that ordering consistent with other parameters in J1939-71 and J1939-73, the bit order has been respecified. See Version 4 below for the recommended formatting.

To reduce problems in interpretation of the SPNs the bit between the FMI field and the Occurrence Count field, previously reserved, will be cleared to zero to identify use of the currently specified SPN bit pattern. This bit now comprises an SPN Conversion Method for the purpose of maintaining usability of those implementations that are already in use.

Data Length:	1 bit
Resolution:	Not Applicable
Data Range:	0 means convert SPNs per the Version 4 definition below. 1 means convert SPNs per Version 1, 2 or 3 specified below.

The four versions of interpretation are:

— SPN assumed to be sent most significant bit first

— SPN represented as Intel format for most significant 16 bits with 3 least significant bits of 19 bits in with FMI value.

— SPN represented as Intel format for all 19 bits (least significant sent first)

— SPN represented as Intel format for all 19 bits with the SPN Conversion Method set to 0.

B.5.45.8.1. TCM Parameter Broadcast

Parameter is always set to 0, indicating version 4 interpretation is being used.

B.5.45.9. *SPN 1216 – OCCURRENCE COUNT*

SAE Excerpt: The 7-bit occurrence count field contains the number of times a fault has been independently detected. The occurrence count is reported as 1 the first time the DTC is detected. The occurrence count is not incremented again, until after the DTC has gone to the previously active state and then back active the DTC state when subsequently detected. At this point the occurrence count would be reported as 2. This continues until the DTC has been independently detected 126 times. The occurrence count shall not be incremented from 126 to 127 -- it shall remain at 126 until cleared by DM3 or DM11. If an occurrence count is not available, then this field should be set to all binary ones (127). The occurrence count is not incremented just due to an ignition key-off and ignition key-on. The diagnostic system shall have monitored the system or component (e.g. DTC) to see that it is no longer malfunctioning in order to declare it previously active.

Data Length:	7 bits
Resolution:	1 occurrence count/bit
Data Range:	0 to 126 (the value 127 is reserved for indicating not available)

B.5.45.9.1. TCM Parameter Broadcast

Parameter is always set to 127 for indicator functions implemented via DM1. Occurrence Count for DTCs is set to the appropriate value based on number of independent detections as defined by J1939-73.

B.5.45.10. *EXAMPLES OF DM1 CONTENT*

Allison 6th Gen controls support all TCM DTCs in the J1939 SPN / FMI format. The table below lists DM1 content <u>just for Allison indicator functions</u> when they are the only active DTCs being broadcast by the TCM. Bytes containing the SPN and FMI information are highlighted gray. If the data field contains more than 8 bytes (multiple SPNs are reported, i.e. multiple indications are active), DM1 is sent using Transport Protocol. In the table below:

SA 03 = Transmission #1
SA 16 = Retarder – Driveline
SPN 120 = Retarder Oil Temperature
SPN 177 = Transmission Oil Temperature 1
SPN 2003 = General Transmission Fault
SPN 3359 = Transmission Oil Filter Restriction Switch
SPN 4177 = Transmission Oil Life Remaining
SPN 4178 = Transmission Service
FMI 15 = Data valid but above normal data range – least severe level
FMI 17 = Data valid but below normal data range – least severe level
FMI 31 = Condition Exists

See DIAGNOSTIC COMMUNICATION FOR OEM USE for a list of SPN / FMI combination related to Allison diagnostic codes.

Active Indication from TCM	SA	Amber Warning Lamp	Byte 1 Lamp Control	Byte 2 Lamp Control	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8	SPN	FMI
Check Transmission	03	On	$04	$FF	$D3	$07	$1F	$7F	$FF	$FF	2003	31
			4	255	211	7	31	127	255	255		
Sump Temperature	03	On	$04	$FF	$B1	$00	$0F	$7F	$FF	$FF	177	15
			4	255	177	0	15	127	255	255		
Retarder Temperature	16	On	$04	$FF	$78	$00	$0F	$7F	$FF	$FF	120	15
			4	255	120	0	15	127	255	255		
Transmission Service (Oil Life Monitor)	03	Off	$00	$FF	$51	$10	$11	$7F	$FF	$FF	4177	17
			0	255	81	16	17	127	255	255		
Transmission Service (Filter Life Monitor)	03	Off	$00	$FF	$1F	$0D	$1F	$7F	$FF	$FF	3359	31
			0	255	31	13	31	127	255	255		
Transmission Service (Transmission Health Monitor ™)	03	Off	$00	$FF	$52	$10	$1F	$7F	$FF	$FF	4178	31
			0	255	82	16	31	127	255	255		
No DTCs or indication active	03	Off	$00	$FF	$0	$0	$0	$0	$FF	$FF	NA	NA
			0	255	0	0	0	0	255	255		

DM1 CONTENT ASSOCIATED WITH ALLISON INDICATOR FUNCTIONS

B.5.46. PGN 65227 – PREVIOUSLY ACTIVE DIAGNOSTIC TROUBLE CODES (DM2)

SAE Excerpt: When supported, DM2 provides a list of all previously active (previously detected) DTCs.

Transmission Rate..............................On request
Data Length .... Variable
PDU Format..254
PDU Specific...203
Default Priority 6
PGN 65227 (0xFECB)

Byte	Bit	Content
1	8,7	*Malfunction Indicator Lamp* ●
	6,5	*Red Stop Lamp* ●
	4,3	*Amber Warning Lamp* ●
	2,1	*Protect Lamp* ●
2	8,7	*Flash Malfunction Indicator Lamp*
	6,5	*Flash Red Stop Lamp*
	4,3	*Flash Amber Warning Lamp*
	2,1	*Flash Protect Lamp*
3	8-1	*SPN*, 8 least significant bits of SPN (most significant at bit 8) ●
4	8-1	*SPN*, second byte of SPN (most significant at bit 8) ●
5	8-6	*SPN*, 3 most significant bits (most significant at bit 8) ●
	5-1	*FMI* (most significant at bit 5) ●
6	8	*SPN Conversion Method* ●
	7-1	*Occurrence Count* ●
7-8		[ATI: J1939-73 doesn't define these bytes, however, examples show all bits set to 1.]

NOTE – When the occurrence count is not available it should be set to all ones which is a value of 127.

B.5.46.1. *TCM MESSAGE BROADCAST*

Message and parameters marked ● are broadcast from SA 03 (Transmission #1) in all applications, unless disabled via VEPS. Allison retarder applications will also send DM2 from SA 16 (Retarder – Driveline). Used for DIAGNOSTIC COMMUNICATION FOR OEM USE.

If more than one indication is active at once, DM2 will be sent using Transport Protocol. While the SAE default priority for Transport Protocol data transfer packets is listed as 7, the TCM broadcasts with Priority 6 – that of the "parent" message being sent. This is not an uncommon industry practice.

Any unsupported *Lamp Status* parameters are set to 00b (Off).

TCM Parameter Broadcast

For parameter definitions and support descriptions, refer to the corresponding definitions under PGN 65226 DM1. DM2 reports the 30 most recent DTCs that have gone inactive since the last DTC clearing.

B.5.47. PGN 65228 – DIAGNOSTIC DATA CLEAR / RESET OF PREVIOUSLY ACTIVE DTCS (DM3)

SAE Excerpt:

For Non-OBD Regulated Devices or Diagnostics

Products not subject to ARB 13 CCR 1971.1 may choose to support DM3. When supported, all diagnostic information pertaining to the previously active trouble codes should be erased when this PG is requested. The diagnostic data associated with active trouble codes will not be affected.

If the request is destination-specific (refer to SAE J1939-21 PGN 59392), upon completion of this operation or if there are no faults to clear, a positive acknowledgment shall be sent. If for some reason a device cannot perform the requested action when a destination-specific request is received, it is required to send a negative acknowledgement.

A positive or negative acknowledgement is not required in response to a global request.

Some applications may have a need to provide a positive or negative acknowledgement to indicate the success or failure of a global request. (This is an exception, as discussed in Note 4 of Table 5 in SAE J1939-21.)

ECUs shall clear the DTCs with ignition ON and with the engine not running. A manufacturer may allow DTC clearing with the engine running.

Broadcast Rate: On request using PGN 59904 (refer to SAE J1939-21 PGN 59904). A NACK is required if PG is not supported and it was a destination specific request (refer to SAE J1939-21 PGN 59392).

Data Length 0
PDU Format..254
PDU Specific...204
Default Priority 6
PGN 65228 (0xFECC)

B.5.47.1. *TCM MESSAGE RECEPTION*

When configured to do so (see DIAGNOSTIC COMMUNICATION FOR OEM USE), the TCM will respond to Global or Destination-Specific (SA 03) DM3 requests. DTCs are cleared in the same manner as if cleared by an Allison J1939-based shift selector.

B.5.48. PGN 65235 – DIAGNOSTIC DATA CLEAR / RESET FOR ACTIVE DTCS (DM11)

SAE Excerpt:

For Non-OBD Regulated Devices or Diagnostics

Use of the DM11 is to clear all of the diagnostic information pertaining to the active diagnostic trouble codes. A request for DM11 is sent whenever the service tool wishes to clear/reset diagnostic data for active DTCs. This is expected to occur once the problem has been corrected.

Upon completion of this operation, or if there are no faults to clear, a positive acknowledgment shall be sent if the request is destination specific (refer to SAE J1939-21 PGN 59392). If for some reason a device cannot perform the requested action, then it is required to send a negative acknowledgement (refer to SAE J1939-21 PGN 59392).

A positive or negative acknowledgement is not required in response to a global request.

Some applications may have a need to provide a positive or negative acknowledgement to indicate the success or failure of a global request. (This is an exception as discussed in Note 4 of Table 5 in SAE J1939-21.)

Tool suppliers should be aware that it may take as long as 5 seconds to complete the clearing action.

Broadcast Rate: On request using PGN 59904 (refer to SAE J1939-21). A NACK is required if PG is not supported (refer to SAE J1939-21 PGN 59392).

Data Length 0
PDU Format..254
PDU Specific 211
Default Priority 6
PGN 65235 (0xFED3)

B.5.48.1. *TCM MESSAGE RECEPTION*

When configured to do so (see DIAGNOSTIC COMMUNICATION FOR OEM USE), the TCM will respond to Global or Destination-Specific (SA 03) DM11 requests. DTCs are cleared in the same manner as if cleared by an Allison J1939-based shift selector.

B.5.49. PGN 65242 – SOFTWARE IDENTIFICATION (SOFT)

SAE Excerpt:
Transmission Repetition Rate..............On request
Data length... Variable
PDU format 254
PDU specific 218
Default priority...6
PGN 65,242 (0xFEDA)

Byte	Bit	Content
1		*Number of Software Identification Fields*
2-N		*Software Identification*

NOTE – The software identification field is variable in length and may contain up to 125 software identification designators. An ASCII "*" is used as a delimiter to separate multiple software identifications. Additional software identification fields may be added at the end, each separated by an ASCII "*" as a delimiter. An ASCII "*" is required at the end of the last software identification field, even if there is only one software identification designator.

B.5.49.1. *TCM MESSAGE BROADCAST*

PGN is broadcast on request from SA 03 unless disabled via VEPS. Individual parameter broadcasts cannot be modified via VEPS; this PGN and its parameters are enabled or disabled as a whole.

TCM SOFT broadcast length is always > 8 bytes, therefore a destination-specific request results in a destination-specific response via RTS / CTS, and a global request results in a global response via BAM.

B.5.49.2. *TCM MESSAGE RECEPTION*

The TCM receives this PGN when Allison shift selector(s) are installed. This PGN is only received from SA 05 (Shift Console, Primary) or SA 06 (Shift Console, Secondary).

B.5.49.3. *SELECTOR MESSAGE BROADCAST*

Allison shift selectors will broadcast this PGN from either SA 05 (Shift Console, Primary) or SA 06 (Shift Console, Secondary). A destination-specific request to either SA will result in a global response, as the data length is 8 bytes. The request is only accepted from SA 03.

Used with functions SHIFT ACTUATOR SYSTEM W/ALLISON SELECTOR: 1000/2000 SERIES and SHIFT SELECTOR, ALLISON.

B.5.49.4. *SPN 965 – NUMBER OF SOFTWARE IDENTIFICATION FIELDS*

SAE Excerpt: Number of software identification designators represented in the software identification parameter group.

Data Length: 1 byte
Resolution: 1 step / bit, 0 offset
Data Range: 0 to 250 steps
Operational Range: 0 to 125

B.5.49.4.1. TCM Parameter Broadcast

Two software identification fields are supported.

B.5.49.4.2. Selector Broadcast

One software identification field is supported.

B.5.49.5. *SPN 234 – SOFTWARE IDENTIFICATION*

SAE Excerpt: Software identification of an electronic module. As an example, this parameter may be represented with ASCII characters "MMDDYYaa" where "MM" is the month, "DD" is the day, "YY" is the year, and "aa" is the revision number.

NOTE: The ASCII character "*" is reserved as a delimiter.

Data Length: 1 byte
Resolution: ASCII, 0 offset
Data Range: 0 to 255 per byte
Operational Range: Same as data range

B.5.49.5.1. TCM Parameter Broadcast

The first field contains the Allison TCM software level. The second field contains the 14-character Allison Calibration Identification Number (CIN).

A TCM with software level "W13G5_KPC_2M7" and CIN "B1-131-000A3-754-K" would respond to a SOFT request as shown below. ASCII characters are highlighted in black.

Even though SAE J1939-21 lists TP.DT message priority as 7, Allison TCM TP.DT (packet) broadcasts use the "parent" message priority; this is not an uncommon industry practice. For SOFT broadcast, priority 6 is used.

B.5.49.5.2. Selector Broadcast

Supported by all Allison shift selectors; the content is proprietary.

B.5.49.5.3. TCM Parameter Reception

Parameter received by the TCM to verify usage of Allison J1939-based shift selectors.

Item	PGN	CAN ID (hex)	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
TP.CM BAM	60416	0x18ECFF03	32	30	0	5	255	218	254	0
			Control	Size of message		Packets	Reserv.	PGN being sent		
TP.DT Packet 1	60160	0x18EBFF03	1	2	87	49	51	71	53	95
			Packet	Fields	**W**	**1**	**3**	**G**	**5**	**_**
TP.DT Packet 2	60160	0x18EBFF03	2	75	80	67	95	50	77	55
			Packet	**K**	**P**	**C**	**_**	**2**	**M**	**7**
TP.DT Packet 3	60160	0x18EBFF03	3	42	66	49	49	51	49	48
			Packet	*****	**B**	**1**	**1**	**3**	**1**	**0**
TP.DT Packet 4	60160	0x18EBFF03	4	48	48	65	51	55	53	52
			Packet	**0**	**0**	**A**	**3**	**7**	**5**	**4**
TP.DT Packet 5	60160	0x18EBFF03	5	75	42	255	255	255	255	255
			Packet	**K**	*****					

EXAMPLE OF TCM PGN 65242 BROADCAST VIA J1939 TRANSPORT PROTOCOL

B.5.50. PGN 65247 – ENGINE CONTROLLER 3 (EEC3)

SAE Excerpt: Transmission Repetition Rate: 250 ms (preferred) or Engine Speed Dependent (if required by application).

Data Length ....8 bytes
PDU Format 254
PDU Specific.. 223
Default Priority 6
PGN 65,247 (0xFEDF)

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables.

B.5.50.1. *SPN 514 – NOMINAL FRICTION – PERCENT TORQUE*

SAE Excerpt: The calculated torque that indicates the amount of torque required by the basic engine itself added by the loss torque of accessories. It contains the frictional and thermodynamic loss of the engine itself, pumping torque loss (SPN 5398), and the losses of fuel, oil and cooling pumps. The data is transmitted in indicated torque as a percent of reference engine torque (see the engine configuration message, PGN 65251).

The realization can be done by a map dependent on engine speed and engine temperature and an offset value for additional loss torques.

See SPN 2978 for an indicator that describes the possible inclusion of engine parasitic losses such as cooling fan, etc. in this parameter value.

Data Length: 1 byte
Resolution: 1% per bit, -125% offset
Data Range: -125% to +125%
Operational Range: Same as data range

B.5.50.1.1. TCM Parameter Reception

Received in all applications for use in functions:

DYNACTIVE™ SHIFTING

DYNAMIC SHIFT SENSING

EMISSION CONTROL SYSTEMS – DPF / SCR

ENGINE MANAGEMENT – ARM

ENGINE MANAGEMENT – SEM

ENGINE MANAGEMENT – LRTP

ENGINE MANAGEMENT – OTL

It is recommended that engine accessory parasitic losses (such as cooling fan losses) not be included in EEC3 *Nominal Friction – Percent Torque*. In the event they are, EEC3 *Estimated Engine Parasitic Losses – Percent Torque* must be broadcast with value 0xFB as discussed below.

B.5.50.2. *SPN 2978 – ESTIMATED ENGINE PARASITIC LOSSES – PERCENT TORQUE*

SAE Excerpt: The calculated torque that indicates the estimated amount of torque loss due to engine parasitics, such as cooling fan, air compressor, air conditioning, etc. It is expressed as a percent of Engine Reference Torque.

If there are multiple devices on a network that provide this parameter, then users of this data shall add each of these values to determine the total torque loss due to engine parasitics. Devices other than the engine that provide this parameter shall use the value of Engine Reference Torque transmitted by the engine during the current key cycle to determine the percent torque loss as seen by the engine.

When the data value of this parameter is equal to FB it means that all parasitic losses calculated by the engine are included in the Engine's Nominal Friction Percent Torque (SPN 514).

Data Length: 1 byte
Resolution: 1 %/bit, -125 % offset
Data Range: -125 to 125 %
Operational Range: 0 to 125%

B.5.50.2.1. TCM Parameter Reception

Received in all applications. May be used with:

DYNACTIVE™ SHIFTING

DYNAMIC SHIFT SENSING

ENGINE MANAGEMENT – ARM

ENGINE MANAGEMENT – SEM

ENGINE MANAGEMENT – LRTP

If engine accessory parasitic losses are included in EEC3 *Nominal Friction – Percent Torque*, EEC3 *Estimated Engine Parasitic Losses – Percent Torque* must be broadcast as 0xFB per the SAE definition above.

B.5.51. PGN 65249 – RETARDER CONFIGURATION (RC)

SAE Excerpt: This map describes the stationary behavior of the retarder.

Note: Grandfathered definition for systems that implemented this message prior to July, 2010: On change of torque/speed points of more than 10% since last transmission, or every 5 s.

Transmission Broadcast Rate: Every 5 s and on change of torque/speed points of more than 10% since last transmission but no faster than every 500 ms.

Data Length .... 19 bytes
PDU Format 254
PDU Specific...225
Default Priority 6
PGN 65,249 (0xFEE1)

NEW FOR B/C/N240 PSC RELEASES: Added reception of RC *Retarder Configuration Map*.

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables.

B.5.51.1. *TCM MESSAGE BROADCAST*

PGN is broadcast via Transport Protocol from SA 16 (Retarder – Driveline) in Allison retarder applications unless all parameters are disabled via VEPS

B.5.51.2. *TCM MESSAGE RECEPTION*

See the functions referenced by each parameter.

B.5.51.3. *SPN 901 – RETARDER TYPE*

SAE Excerpt: A vehicle retarder is a supplementary device to the wheel brakes for the driver to better control the vehicle. The wheel brakes used in the vehicle are not designed for continuous retarding operation. In a prolonged period of braking, the brakes can be thermally over-stressed, causing the braking effect to be reduced or even lead to complete braking system failure. The vehicle retarder is designed for continuous operation for braking during downhill operation and is also used for braking the vehicle to comply with speed limits and traffic conditions.

This parameter provides some indication of the retarder dynamics. It is used in the retarder configuration message (See PGN 65249). The data type of this parameter is measured.

Data Length: 4 bits

Bit State	Retarder Type
0000b	Electric / Magnetic
0001b	Hydraulic
0010b	Cooled Friction
0011b	Compression Release
0100b	Exhaust
0101b – 1101b	Not defined
1110b	Other
1111b	Not Available

B.5.51.3.1. TCM Parameter Broadcast

0001b (Hydraulic) is always indicated when TCM broadcast is enabled. Provided to the vehicle system for RETARDER CONTROL use. 1111b (Not Available) is indicated when broadcast is disabled.

B.5.51.4. *SPN 902 – RETARDER LOCATION*

SAE Excerpt: This parameter defines whether the "torque/speed curve" defined by the retarder configuration message (PGN 65249) is dependent on engine rpm, output shaft rpm, or other parameter. The data type of this parameter is measured.

Data Length: 4 bits

Bit State	Retarder Location
0000b (Primary)	Engine Compression Release Brake (Exhaust pressure)
0001b (Primary)	Engine Exhaust Brake (Exhaust pressure)
0010b (Primary)	Transmission Input (Engine rpm)
0011b (Secondary)	Transmission Output (Output Shaft rpm)
0100b (Secondary)	Driveline (Output Shaft rpm)
0101b	Trailer (Vehicle speed)
0110b – 1101b	Not defined
1110b	Other
1111b	Not Available

B.5.51.4.1. TCM Parameter Broadcast

Provided for RETARDER CONTROL use. 0011b (Transmission Output) is always indicated when TCM broadcast is enabled. 1111b (Not Available) is indicated when broadcast is disabled.

B.5.51.5. *SPN 557 – RETARDER CONTROL METHOD*

SAE Excerpt: This parameter identifies the number of steps used by the retarder.

Data Length:	1 byte
Resolution:	1 step / bit, 0 offset
Data Range:	0 to 250 steps
Operational Range:	0: continuous control, 1 On/Off control, 2 to 250: Number of steps

B.5.51.5.1. TCM Parameter Broadcast

Provided for RETARDER CONTROL use. 0 (Continuous Control) is always indicated when TCM broadcast is enabled. 0xFF (Not Available) is indicated when broadcast is disabled.

B.5.51.6. *RETARDER CONFIGURATION MAP*

B.5.51.6.1. TCM Parameter Broadcast

Provided for RETARDER CONTROL use. All five speed & torque points are supported when TCM broadcast is enabled. If map broadcast is disabled, speed parameters will indicate 0xFFFF and torque parameters will indicate 0xFF. Scaling:

Speed Points	
Data Length:	2 bytes
Resolution:	0.125 rpm / bit, 0 offset
Data Range:	0 to 8,031.875 rpm

Torque Points	
Data Length:	1 byte
Resolution:	1 % / bit, -125% offset
Data Range:	-125 to 125 %
Operating Range:	-125 to 0%

Under normal conditions, the map will reflect the 100% retarding curve of the specified retarder capacity as set by VEPS. The map also reflects the reduced or completely inhibited capacity of the retarder during:

— High temperature conditions
— Fire Truck Pump Mode operation
— Diagnostic conditions
— Negative output torque limits

If a temperature sensor (e.g. sump temperature) fails while that temperature input is causing a derated condition, the map will return to indicating the normal 100% retarding curve. If the retarder solenoid fails, the configuration map will reflect 0% at all points.

Allison sets the 5 points as follows:

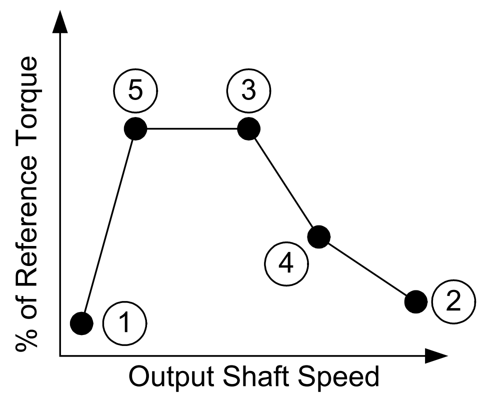
POINT 1 – *Retarder Speed At Idle* may vary with retarder operating temperature, as the minimum engagement speed of the retarder is increased with excess fluid temperature.

POINT 2 – By SAE definition, *Percent Torque at Maximum Speed* and *Maximum Retarder Speed* should equal the maximum output shaft speed where retarder operation is allowed. However, Allison retarders have no such definitive point. Therefore, Point 2 is calibrated to reflect the retarder operating speed beyond which the retarder does not produce higher retarding torque.

POINT 3 – Highest output shaft speed where our retarder can produce its maximum output torque.

POINT 4 – Best compromise of an “inflection point” between points 3 & 2 based on Allison retarder data.

POINT 5 – Lowest output shaft speed where our retarder can produce its maximum torque output.



B.5.51.6.2. TCM Parameter Reception

Used in function ENGINE BRAKE INTERFACE to determine peak engine brake torque.

B.5.51.7. *SPN 556 – RETARDER REFERENCE TORQUE*

SAE Excerpt: This parameter is the 100% reference value for all defined indicated retarder torque parameters. It is only defined once and doesn't change if a different retarder torque map becomes valid.

Data Length:	2 bytes
Resolution:	1 Nm / bit, 0 offset
Data Range:	0 to 64,255 Nm
Operational Range:	Same as data range

B.5.51.7.1. TCM Parameter Broadcast

The broadcast value is dependent on TCM calibration; see RETARDER CONTROL. 0xFFFF (Not Available) is indicated when broadcast is disabled.

B.5.51.7.2. TCM Parameter Reception

Used in function ENGINE BRAKE INTERFACE.

B.5.52. PGN 65250 – TRANSMISSION CONFIGURATION (TCFG)

SAE Excerpt:
Transmission Repetition Rate..............On request
Data length.. Variable
PDU format 254
PDU specific 226
Default priority...6
PGN 65,250 (0xFEE2)

Total message length depends on total number of forward and reverse gear ratios.

NOTE: The first gear ratio transmitted in bytes 3, 4 will be the highest reverse gear ratio. Additional 2-byte gear ratios will follow:

3,4 Highest reverse gear ratio
:
a,b Lowest reverse gear ratio
c,d Lowest forward gear ratio
:
e, f Highest forward gear ratio

Byte	Bit	Content
1		*Number of Reverse Gear Ratios*
2		*Number of Forward Gear Ratios*
3,4		*Transmission Gear Ratio*

B.5.52.1. *TCM MESSAGE BROADCAST*

PGN and all parameters are broadcast from SA 03 unless PGN broadcast is disabled via VEPS.

TCFG broadcast length is always > 8 bytes, therefore destination-specific requests result in destination-specific responses via RTS / CTS, and global requests result in global responses via BAM.

This PGN provides OEM shift selectors with the gear ranges available in the installed transmission, and may be used in functions SHIFT SELECTOR, NON-ALLISON BASIC, SHIFT SELECTOR, NON-ALLISON DIRECT SELECT, or SHIFT SELECTOR, NON-ALLISON STANDARD.

B.5.52.2. *SPN 958 – NUMBER OF REVERSE GEAR RATIOS*

SAE Excerpt: Number of reverse gear ratios in the transmission, provided as part of the transmission configuration.

Data Length:	1 byte
Resolution:	1 gear value / bit, 0 offset
Data Range:	0 to 250
Operational Range:	0 to 125 gear ratios

B.5.52.3. *SPN 957 – NUMBER OF FORWARD GEAR RATIOS*

SAE Excerpt: Number of forward gear ratios in the transmission, provided as part of the configuration.

Data Length:	1 byte
Resolution:	1 gear value / bit, 0 offset
Data Range:	0 to 250
Operational Range:	0 to 125 gear ratios

B.5.52.4. *SPN 581 – TRANSMISSION GEAR RATIO*

SAE Excerpt: The transmission configuration describes the number of forward gears, the number of reverse gears, and the ratio of each gear with the following resolution.

Data Length:	2 bytes
Resolution:	0.001 / bit, 0 offset
Data Range:	0 to 64.255
Operational Range:	Same as data range

B.5.52.5. *CONTENT EXAMPLE: 6-SPEED 3000 SERIES*

Parameter	Value
Number of Reverse Gear Ratios:	1
Number of Forward Gear Ratios:	6
Transmission Gear Ratio (Reverse):	5.03
Transmission Gear Ratio (1st):	3.49
Transmission Gear Ratio (2nd):	1.86
Transmission Gear Ratio (3rd):	1.41
Transmission Gear Ratio (4th):	1.00
Transmission Gear Ratio (5th):	0.75
Transmission Gear Ratio (6th):	0.65

B.5.53. PGN 65251 – ENGINE CONFIGURATION 1 (EC1)

SAE Excerpt: This map describes the stationary behavior of the engine and the speed dependent available indicated torque. This map should reflect the effect of changes due to barometric pressure, engine temperature, and any other stationary changes (sensor failures, etc.) which influence the engine torque curve more than 10%. This map is only valid for maximum boost pressure. At low boost pressures the torque limit may be much lower.

The engine configuration message must be sent at any time that the engine configuration map has changed by more than 10% of speed or torque (due to events other than boost pressure) since that last time the message was transmitted. As an alternative, it may be sent periodically, once every 5 s. It shall also be sent on response to a configuration request message.

The engine characteristic can be described in one of three modes. Mode 1 provides a complete curve of speed and torque points (see PGN65251_A). Mode 2 and 3 provide a partial curve of speed and torque points and a separate endspeed governor characteristic. In modes 2 and 3, the receiver of the engine configuration message has to calculate the minimum of the engine torque curve and the endspeed governor characteristic to get the final available engine torque.

Mode 2 provides a high idle point where torque equals zero (point 6) and the endspeed governor gain Kp (see Figure PGN 65251_B). Mode 3 provides the kick-in point of the endspeed governor (point 2) and the governor gain Kp (see Figure PGN 65251_C).

Transmission Repetition Rate........ Every 5 s and on change of torque/speed points of more than 10% since last transmission but no faster than every 500 ms

Data Length ....39 bytes
PDU Format...254
PDU Specific...227
Default Priority 6
PGN 65,251 (0xFEE3)

Byte	Bit Content
1-2	*Engine Speed at Idle- Point 1* ♦
3	*Engine Percent Torque at Idle- Point 1* ♦
4-5	*Engine Speed at Point 2* ♦
6	*Engine Percent Torque at Point 2* ♦
7-8	*Engine Speed at Point 3* ♦
9	*Engine Percent Torque at Point 3* ♦
10-11	*Engine Speed at Point 4* ♦
12	*Engine Percent Torque at Point 4* ♦
13-14	*Engine Speed at Point 5* ♦
15	*Engine Percent Torque at Point 5* ♦
16-17	*Engine Speed at High Idle- Point 6* ♦
18-19	*Engine Gain (KP) of The Endspeed Governor* ♦
20-21	*Engine Reference Torque* ♦
22-23	*Engine Maximum Momentary Override Speed- Point 7*
24	*Engine Maximum Momentary Override Time Limit*
25	*Engine Requested Speed Control Range Lower Limit*
26	*Engine Requested Speed Control Range Upper Limit*
27	*Engine Requested Torque Control Range Lower Limit*
28	*Engine Requested Torque Control Range Upper Limit*
29-30	*Engine Extended Range Requested Speed Control Range Upper Limit*
31-32	*Engine Moment of Inertia* ♦
33-34	*Engine Default Torque Limit* ♦
35	*Support Variable Rate TSC1 Message*
36	*Support TSC1 Control Purpose Group 1*
37	*Support TSC1 Control Purpose Group 2*
38	*Support TSC1 Control Purpose Group 3*
39	*Support TSC1 Control Purpose Group 4*

B.5.53.1. *TCM MESSAGE RECEPTION*

Parameters marked ♦ may be used by the TCM.

If *PGN Request* is not supported, EC1 must be sent via transport protocol at a periodic rate no slower than every 5 seconds. Regardless, EC1 should be sent on change of torque/speed points of more than 10% since the last broadcast.

EC1 data is required to be in either EC1 Mode 1 or Mode 2 format. Regardless, Point 2 must contain valid engine speed and torque data

B.5.53.2. *ENGINE SPEED POINTS*

EC1 engine speed data is formatted as follows:

Data Length: 2 bytes
Resolution: 0.125 rpm/bit, 0 offset
Data Range: 0 to 8,031.875 rpm
Operational Range: Same as data range

SPN 188 – Engine Speed at Idle, Point 1

SAE Excerpt: Stationary low idle speed of engine which includes influences due to engine temperature (after power up) and other stationary changes (calibration offsets, sensor failures, etc).

SPN 528 – Engine Speed at Point 2

SAE Excerpt: Engine speed of point 2 of the engine torque map. In engine configuration mode 1 and 3, point 2 is defined as the kick-in point from which torque is reduced to zero. In mode 2, there are no special requirements for the definition of this point.

SPN 529 – Engine Speed at Point 3,
SPN 530 – Engine Speed at Point 4,
SPN 531 – Engine Speed at Point 5

SAE Excerpt: Engine speed of point 3, 4, and 5 of the engine torque map. It is recommended that one of these points indicate the peak torque point for the current engine torque map. Points 3, 4, and 5 are optional and lie between idle and point 2.

SPN 532 – Engine Speed at High Idle, Point 6

SAE Excerpt: Engine speed of high idle (point 6) of the engine torque map. In engine configuration mode 3, point 6 is not defined by the engine torque map but by the governor characteristic and the zero torque line.

B.5.53.2.1. TCM Parameter Reception

Received in all applications for used in functions:

DYNACTIVE™ SHIFTING

ENGINE MANAGEMENT – ARM

ENGINE MANAGEMENT – SEM

ENGINE MANAGEMENT – LRTP

ENGINE MANAGEMENT – OTL

Engine Speed at Idle, Point 1 support is required in some applications; see EMISSION CONTROL SYSTEMS – DPF / SCR.

B.5.53.3. *ENGINE PERCENT TORQUE POINTS*

Engine percent torque data is formatted as follows:

Data Length: 1 byte
Resolution: 1% per bit, -125% offset
Data Range: -125% to 125%
Operational Range: 0 to 125%

SPN 539 – Engine Percent Torque at Idle, Point 1

SAE Excerpt: The torque limit that indicates the available engine torque which can be provided by the engine at idle speed. This parameter may be influenced by engine temperature (after power up) and other stationary changes (calibration offsets, sensor failures, etc.) See also SPN 188. The data is transmitted in indicated torque as a percent of the reference engine torque.

SPN 540 – Engine Percent Torque at Point 2

SAE Excerpt: The torque limit that indicates the available engine torque which can be provided by the engine at point 2 of the engine map. In engine configuration mode 1 and 3, point 2 is defined as the kick-in point from which torque is reduced to zero. In mode 2, there are no special requirements for the definition of this point. The data is transmitted in indicated torque as a percent of the reference engine torque.

SPN 541 – Engine Percent Torque at Point 3,
SPN 542 – Engine Percent Torque at Point 4,
SPN 543 – Engine Percent Torque at Point 5

SAE Excerpt: The torque limit that indicates the available engine torque which can be provided by the engine at point 3, 4, and 5 of the engine map (see PGN 65251 and supporting documents). It is required that one of these points indicate the peak torque point for the current engine torque map. Points 3, 4, and 5 lie between idle and point 2. The data is transmitted in indicated torque as a percent of the reference engine torque.

B.5.53.3.1. TCM Parameter Reception

Received in all applications. Used to determine engine maximum torque production capability in all 1000/2000 Series applications, and in functions:

ENGINE MANAGEMENT – ARM

ENGINE MANAGEMENT – SEM

ENGINE MANAGEMENT – LRTP

ENGINE MANAGEMENT – OTL

B.5.53.4. *SPN 545 – ENGINE GAIN (KP) OF THE ENDSPEED GOVERNOR*

SAE Excerpt: The endspeed governor is defined as a linear line with the following equations (Capital letters mean physical values, small letters mean normalized values).

The gain KP/kp is defined as a positive value. The factor 4096 is necessary for realizing flat curves with sufficient resolution as well as very steep curves.

KP = delta Torque / delta Speed
kp (normalized) = KP * 250/100% * 8031 rpm/64255 * 4096 = KP * 1280 rpm/%

B.5.53.4.1. TCM Parameter Reception

See DYNACTIVE™ SHIFTING.

B.5.53.5. *SPN 544 – ENGINE REFERENCE TORQUE*

SAE Excerpt: This parameter is the 100% reference value for all defined indicated engine torque parameters. It is only defined once and doesn't change if a different engine torque map becomes valid.

Data Length: 2 bytes
Resolution: 1 Nm per bit, 0 Nm offset
Data Range: 0 to 64,255 Nm
Operational Range: Same as data range

B.5.53.5.1. TCM Parameter Reception

Received in all applications for use in functions:

ENGINE MANAGEMENT – ARM

ENGINE MANAGEMENT – SEM

ENGINE MANAGEMENT – LRTP

ENGINE MANAGEMENT – OTL

…to estimate transmission net input torque. Also used by shift quality and transmission abuse algorithms to determine TSC1 command values. If not supported as required, shift feel will be degraded due to inaccurate net torque estimates. See the functions for how to best set this value.

B.5.53.6. *SPN 1794 – ENGINE MOMENT OF INERTIA*

SAE Excerpt: Moment of inertia for the engine, including items driven full-time by the engine such as fuel, oil and cooling pumps. The inertia from the following items are not included: flywheel, alternator, compressor and other engine-driven accessories.

Data Length: 2 bytes
Resolution: 0.004 kg-m^2 / bit, 0 offset
Data Range: 0 to 257.02 kg-m^2
Operational Range: Same as data range

B.5.53.6.1. TCM Parameter Reception

May be used by ENGINE MANAGEMENT – SEM.

NOTE: For engines approved for use with Allison Engine Management, any change in the value broadcast requires re-evaluation by Allison.

B.5.53.7. *SPN 1846 – ENGINE DEFAULT TORQUE LIMIT*

SAE Excerpt: Companion parameter to Transmission Torque Limit (SPN 1845). This "echo" parameter provides confirmation to the transmission that the engine has received and will invoke the requested Transmission Torque Limit in the event that J1939 communication is lost between the two devices.

If the engine supports this protection logic, the Engine Default Torque Limit parameter should be set equal to the Transmission Torque Limit parameter as received in the Transmission Configuration 2 message (PGN 65099). Otherwise, an Engine Default Torque Limit value of FF00 to FFFF indicates that no default engine torque limit has been received or set.

The intention is to protect transmissions that use a continuous torque limit during torque converter mode or operation in specific lower gears, where stall or drivetrain torque may reach levels higher than the gearbox capacity. If communication is lost during torque-limited operation, unrestricted engine torque output could harm the transmission.

It is recommended that engines use reception of the ETC1 message as a transmission "heartbeat". In the event that the ETC1 message is not received in a time period of 5 times its' broadcast rate (5 x 10 ms = 50 ms), the engine should invoke a torque limit holding the engine to less than or equal to the value of the Transmission Torque Limit parameter. The engine may release the limit when engine-to-transmission communication is re-established.

Data Length: 2 bytes
Resolution: 1 Nm per bit, 0 Nm offset
Data Range: 0 to 64,255 Nm
Operational Range: Same as data range

B.5.53.7.1. TCM Parameter Reception

Received in all applications for use in functions:

ENGINE MANAGEMENT – LRTP

ENGINE MANAGEMENT – OTL

While not clarified in the current SAE definition, this parameter is in terms of indicated torque – not gross torque. Also note that for the Engine Management functions listed above, an ETC1 heartbeat is required; not "recommended" as mentioned in the excerpt from the SAE definition.

B.5.54. PGN 65259 – COMPONENT ID (CI)

SAE Excerpt:
Transmission Repetition Rate ....On request
Data length .... Variable
PDU format 254
PDU specific 235
Default priority 6
PGN 65,259 (0xFEEB)

Field	Content
a	*Make* ●
	Delimiter (ASCII "*")
b	*Model* ●
	Delimiter (ASCII "*")
c	*Serial number*
	Delimiter (ASCII "*")
d	*Unit number (Power unit)*
	Delimiter (ASCII "*")

NOTE – The make, model, serial number and unit number fields in this message are optional and separated by an ASCII "*". It is not necessary to include all fields; however, the delimiter ("*") is always required.

B.5.54.1. *TCM MESSAGE BROADCAST*

Message and parameters marked ● are broadcast upon request from SA 03 in all applications, unless message broadcast is disabled via VEPS.

TCM CI broadcast length is always > 8 bytes, therefore a destination-specific request will result in a destination-specific response via RTS / CTS, and a global request will result in a global response via BAM.

B.5.54.2. *SPN 586 – MAKE*

SAE Excerpt: Make of the component corresponding to the codes defined in the American Trucking Association Vehicle Maintenance Reporting Standard (ATA/VMRS).

Data Length: 5 bytes
Resolution: ASCII, 0 offset
Data Range: 0 to 255 per byte

NOTE – The ASCII character "*" is reserved as a delimiter.

B.5.54.2.1. TCM Parameter Broadcast

Contains the standard Allison ATA / VMRS 5 character code "ALLSN". See example below.

B.5.54.3. *SPN 587 – MODEL*

SAE Excerpt: Model of the component.

Data Length:	Variable – up to 200 characters ("*" delimited)
Resolution:	ASCII, 0 offset
Data Range:	0 to 255 per byte

NOTE – The ASCII character "*" is reserved as a delimiter.

B.5.54.3.1. TCM Parameter Broadcast

Parameter contains the Allison vocational model name, which may vary in length up to a maximum of 50 characters. See example below.

B.5.54.4. *EXAMPLE BROADCAST*

The data string below illustrates the Component ID response of an Allison 3000 RDS transmission.

Byte	Decimal	Hexadecimal	ASCII
1	65	0x41	**A**
2	76	0x4C	**L**
3	76	0x4C	**L**
4	83	0x53	**S**
5	78	0x4E	**N**
6	42	0x2A	*
7	51	0x33	**3**
8	48	0x30	**0**
9	48	0x30	**0**
10	48	0x30	**0**
11	32	0x20	**(space)**
12	82	0x52	**R**
13	68	0x44	**D**
14	83	0x53	**S**
15	42	0x2A	*
16	42	0x2A	*
17	42	0x2A	*

B.5.55. PGN 65260 – VEHICLE IDENTIFICATION (VI)

SAE Excerpt:
Transmission Repetition Rate .... On request
Data length .... Variable
PDU format 254
PDU specific 236
Default priority 6
PGN 65,260 (0xFEEC)

Byte: 1-n Vehicle Identification Number ♦

Delimiter (ASCII "*")

B.5.55.1. *TCM MESSAGE RECEPTION*

Parameters marked ♦ may be used by the TCM.

If parameter is not received within a short time after key-on, the TCM will issue a series of up to 3 requests until it is received.

B.5.55.2. *SPN 237 – VEHICLE IDENTIFICATION NUMBER*

SAE Excerpt: Vehicle Identification Number (VIN) as assigned by the vehicle manufacturer.

Data Length:	Variable – up to 200 characters ("*" delimited)
Resolution:	ASCII, 0 offset
Data Range:	0 to 255 per byte

NOTE – The ASCII character "*" is reserved as a delimiter.

B.5.55.2.1. TCM Parameter Reception

Parameter is used to identify the TCM host vehicle.

B.5.56. PGN 65261 – CRUISE CONTROL/VEHICLE SPEED SETUP (CCSS)

SAE Excerpt: Reports the possible maximum vehicle speed limits, one through seven, and the applied maximum vehicle speed limit.

Transmission Repetition Rate..............On request
Data length..8 bytes
PDU format 254
PDU specific 237
Default priority...6
PGN 65,261 (0xFEED)

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables.

B.5.56.1. *SPN 74 – MAXIMUM VEHICLE SPEED LIMIT*

SAE Excerpt: Maximum vehicle velocity allowed.

Data Length: 1 byte
Resolution: 1 kph per bit, 0 kph offset
Data Range: 0 to 250 kph
Operational Range: Same as data range

See SPN 6808 for an alternate resolution.

B.5.56.1.1. TCM Parameter Reception

See functions:

ROAD SPEED LIMITING

B.5.56.2. *SPN 6808 – MAXIMUM VEHICLE SPEED LIMIT (HIGH RESOLUTION)*

SAE Excerpt: Maximum vehicle velocity allowed.

Data Length: 2 bytes
Resolution: 1/256 kph per bit, 0 kph offset
Data Range: 0 to 250.996 kph
Operational Range: Same as data range

See SPN 74 for an alternate resolution.

B.5.56.2.1. TCM Parameter Reception

See functions:

ROAD SPEED LIMITING

B.5.57. PGN 65262 – ENGINE TEMPERATURE (ET1)

SAE Excerpt:
Transmission Repetition Rate ....1 s
Data Length ....8 bytes
PDU Format..254
PDU Specific 238
Default Priority 6
PGN:...65,262 (0xFEEE)

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables.

B.5.57.1. *SPN 110 – ENGINE COOLANT TEMPERATURE*

SAE Excerpt: Temperature of the liquid found in the engine cooling system.

Data Length: 1 byte
Resolution: 1° C per bit, -40° C offset
Data Range: -40°C to +210°C (-40°F to +410°F)

B.5.57.1.1. TCM Parameter Reception

Received in all applications for use in functions:

DYNAMIC SHIFT SENSING

RETARDER CAPACITY REDUCTION

Also used by the TCM to:

— determine normal engine idle speed,
— aid in transmission oil temperature diagnostics,
— detect if the engine is warmed up or de-rated,
— adjust shift schedules.

B.5.58. PGN 65265 – CRUISE CONTROL / VEHICLE SPEED 1 (CCVS1)

SAE Excerpt:
Transmission Repetition Rate....................100 ms
Data Length ....8 bytes
PDU Format 254
PDU Specific...241
Default Priority 6
PGN 65,265 (0xFEF1)

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables.

B.5.58.1. *SPN 69 – TWO SPEED AXLE SWITCH*

SAE Excerpt: Switch signal which indicates the current axle range.

00b Low speed range
01b High speed range
10b Error
11b Not Available

B.5.58.1.1. TCM Parameter Reception

May be used by functions:

TWO SPEED AXLE

B.5.58.2. *SPN 70 – PARKING BRAKE SWITCH*

SAE Excerpt: Switch signal which indicates when the parking brake is set. In general the switch actuated by the operator's park brake control, whether a pedal, lever or other control mechanism.

00b Parking brake not set
01b Parking brake set
10b Error
11b Not Available

B.5.58.2.1. TCM Parameter Reception

May be used by functions:

AUTOMATIC NEUTRAL – SINGLE INPUT

AUTOMATIC NEUTRAL – SINGLE INPUT WITH SHIFT SELECTOR OVERRIDE

AUTOMATIC NEUTRAL – DUAL INPUT W/ARTR

AUXILIARY BOX TRANSITION

NEUTRAL AT STOP INPUT

B.5.58.3. *SPN 84 – WHEEL-BASED VEHICLE SPEED*

SAE Excerpt: Speed of the vehicle as calculated from wheel or tailshaft speed.

Data Length:	2 bytes
Resolution:	1/256 km/h per bit, 0 km/h offset
Data Range:	0 to 250.996 km/h
Operational Range:	Same as data range

B.5.58.3.1. TCM Parameter Reception

Received in all applications. Used in DYNACTIVE™ SHIFTING, DYNAMIC SHIFT SENSING, and may be used in:

CRUISE CONTROL, STANDARD

ENGINE MANAGEMENT – ARM

ENGINE MANAGEMENT – SEM

ENGINE MANAGEMENT – LRTP

ROAD SPEED LIMITING

B.5.58.4. *SPN 597 – BRAKE SWITCH*

SAE Excerpt: Switch signal which indicates that the driver operated brake foot pedal is being pressed. This brake foot pedal is controlling the vehicles' service brake (total vehicle braking application, not park brakes). It is necessary for safe drivetrain behavior that the switch activates before the physical braking components are activated (i.e. Disengage the cruise control function prior to the activation of friction brakes).

00b Brake pedal released
01b Brake pedal depressed
10b Error
11b Not Available

B.5.58.4.1. TCM Parameter Reception

May supplement or replace the brake switch GPI in:

AUXILIARY FUNCTION RANGE INHIBIT – SINGLE INPUT

AUTOMATIC NEUTRAL – BRAKE-BASED (BBAN) INPUT

AUTOMATIC NEUTRAL – DUAL INPUT W/ARTR

DIRECTION CHANGE ENABLE

DYNAMIC SHIFT SENSING

ENGINE MANAGEMENT – NRA

SERVICE BRAKE STATUS INPUT

B.5.58.5. *SPN 595 – CRUISE CONTROL ACTIVE*

SAE Excerpt: Cruise control is switched on. It is not ensured that the engine is controlled by cruise control, as in the case of a large driver's demand the engine is controlled by the driver while cruise control is active (maximum selection of cruise control and driver's demand). The cruise control is set to 0 if a switch off condition occurs.

00b Cruise control switched off
01b Cruise control switched on
10b Error
11b Not available

B.5.58.5.1. TCM Parameter Reception

Reception is defaulted off in all applications, and may only be enabled via VEPS. When enabled, used by functions:

DYNACTIVE™ SHIFTING

CRUISE CONTROL, STANDARD.

B.5.58.6. *SPN 86 – CRUISE CONTROL SET SPEED*

SAE Excerpt: Value of set (chosen) velocity of velocity control system.

Data Length:	1 byte
Resolution:	1 kph per bit, 0 kph offset
Data Range:	0 to 250 kph
Operational Range:	Same as data range

B.5.58.6.1. TCM Parameter Reception

May be used by functions:

DYNACTIVE™ SHIFTING

CRUISE CONTROL, STANDARD.

B.5.58.7. *SPN 527 – CRUISE CONTROL STATES*

SAE Excerpt: This parameter is used to indicate the current state or mode of operation by the cruise control device. This is a Status Parameter.

Data length:	3 bits
State values:	See function CRUISE CONTROL, STANDARD

B.5.58.7.1. TCM Parameter Reception

Received in all applications unless disabled via VEPS. Correct state support is required when used to meet the requirements of functions:

CRUISE CONTROL, STANDARD

CRUISE CONTROL, ADAPTIVE

B.5.58.8. *SPN 976 – PTO GOVERNOR STATE*

SAE Excerpt: This parameter is used to indicate the current state or mode of operation by the power takeoff (PTO) governor. In lieu of support for PTO Drive Engagement parameters, this parameter may represent the status of a PTO drive. The broadcasting device must ensure that each achieved state is conveyed in at least one message broadcast before a transition to another state is allowed.

Data length:	5 bits
State values:	See below

B.5.58.8.1. TCM Parameter Reception

Received in all applications. Correct state support is required when used to meet the requirements of:

ACCELERATOR PEDAL INPUT – DUAL MODE OFS

CRUISE CONTROL, VIA ENGINE PTO GOVERNOR

When the vehicle is moving, the bit states map as shown in the following table. The TCM ignores this parameter when the vehicle is stationary.

Bit State	PTO State	Mod. Source
00000b	Off / Disabled	Pedal
00001b	Hold	Load
00010b	Remote Hold	Load
00011b	Standby	Pedal
00100b	Remote Standby	Pedal
00101b	Set	Load
00110b	Decelerate / Coast	Load
00111b	Resume	Load
01000b	Accelerate	Load
01001b	Accelerator Override	Pedal
01010b	Pre-Program Set Speed 1	Load
01011b	Pre-Program Set Speed 2	Load
01100b	Pre-Program Set Speed 3	Load
01101b	Pre-Program Set Speed 4	Load
01110b	Pre-Program Set Speed 5	Load
01111b	Pre-Program Set Speed 6	Load
10000b	Pre-Program Set Speed 7	Load
10001b	Pre-Program Set Speed 8	Load
10010b	PTO Set Speed Memory 1	Load
10011b	PTO Set Speed Memory 2	Load
11111b	Not available	Pedal

Pedal position is used for all undefined states.

Per SAE, the states should convey the following:

Off / Disabled – The PTO governor enable switch is in the off position.

Hold – The PTO governor is active and currently maintaining a captured operating speed.

Remote Hold – The remote PTO governor is active and the PTO governor is currently maintaining a captured operating speed.

Standby – The PTO governor device enable switch is in the ON position and it is possible to manage the PTO governor.

Remote Standby – The remote PTO governor device enable switch is in the ON position and it is possible to manage the PTO governor.

Set – The PTO governor is establishing current speed as the operating speed (captured value).

Decelerate / Coast – The PTO governor is in the process of ramping down, or coasting, from the current operating speed.

Resume – The PTO governor is in the process of resuming the operating speed to a previously captured value.

Accelerate – The PTO governor is in the process of ramping up the operating speed.

Accelerator Override – The PTO governor is active but for the present time the engine is controlled by a large driver's demand.

Preprogrammed PTO Governor Set Speed 1 through 8 – The PTO device is establishing a preprogrammed governor set speed (user programmable) as the current operating speed.

PTO set speed memory 1 through 2 – A PTO set speed memory set state is active.

This parameter is one of several used to determine if shift modulation is based on EEC2 *Accelerator Pedal Position 1* or EEC2 *Engine Percent Load at Current Speed*. Other parameters that factor into modulation source determination include:

— CCVS1 *Cruise Control States*
— CCVS1 Cruise Control Active
— EEC2 Road Speed Limit Status
— EEC1 Engine Torque Mode

If any of these parameters indicate that pedal information may not be valid for shift modulation purposes, then load information is utilized.

B.5.59. PGN 65266 – FUEL ECONOMY (LIQUID) (LFE1)

SAE Excerpt:
Transmission Repetition Rate .... 100 ms
Data Length .... 8 bytes
PDU Format...254
PDU Specific 242
Default Priority 6
PGN 65,266 (0xFEF2)

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables.

B.5.59.1. *SPN 183 – ENGINE FUEL RATE*

SAE Excerpt: Amount of fuel consumed by engine per unit of time.

Data Length:	2 bytes
Resolution:	0.05 l/h / bit, 0 l/h offset
Data Range:	0 to 3212.75 l/h
Operational Range:	Same as data range

B.5.59.1.1. TCM Parameter Reception

See DYNACTIVE™ SHIFTING.

B.5.60. PGN 65272 – TRANSMISSION FLUIDS (TRF1)

SAE Excerpt:
Transmission Repetition Rate................1 second
Data Length ....8 bytes
PDU Format..254
PDU Specific...248
Default Priority 6
PGN 65,272 (0xFEF8)

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables. PGN is broadcast from SA 03 unless all parameters are disabled via VEPS.

B.5.60.1. *SPN 177 – TRANSMISSION OIL TEMPERATURE 1*

SAE Excerpt: First instance of transmission lubricant temperature.

Data Length: 2 bytes
Resolution: 0.03125°C / bit, -273°C offset
Data Range: -273°C to +1735.0°C
Operational Range: Same as data range

B.5.60.1.1. TCM Parameter Broadcast

0xFEFF (Error) is indicated when sensor failures occur. 0xFFFF (Not Available) is indicated when broadcast is disabled.

B.5.60.2. *SPN 3026 – TRANSMISSION OIL LEVEL 1 MEASUREMENT STATUS*

SAE Excerpt: Measurement status for the first instance of a transmission oil level indicator. Indicates if conditions are acceptable to obtain a valid transmission oil level measurement as conveyed in SPN 124 *Transmission Oil Level* or SPN 3027 *Transmission Oil Level High / Low*. If conditions are not acceptable, this parameter conveys to the operator what prevents conditions from being acceptable. Only one condition can be conveyed in this parameter at any given point in time. If multiple conditions exist, it is not important which condition is actually broadcast, as the driver must “correct” each and every condition as it is presented before a valid oil level reading can be made. If multiple conditions exist that prevent a valid reading, the sender should broadcast one of those conditions until it is corrected; then the next condition can be conveyed to the operator, and so on.

Data Length: 4 bits

Value	Meaning
0000b	Conditions valid for transmission oil level measurement
0001b	Conditions not valid – Settling timer still counting down
0010b	Conditions not valid – Trans. in gear
0011b	Conditions not valid – Transmission fluid temperature too low
0100b	Conditions not valid – Transmission fluid temperature too high
0101b	Conditions not valid – Vehicle moving; output shaft speed too high
0110b	Conditions not valid – Vehicle not level
0111b	Conditions not valid – Engine speed too low
1000b	Conditions not valid – Engine speed too high
1001b	Conditions not valid – No request for reading
1101b	Conditions not valid – Other
1110b	Error
1111b	Not available

B.5.60.2.1. TCM Parameter Broadcast

Parameter is only available for broadcast in applications equipped with an oil level sensor. Used with OIL LEVEL DISPLAY. 1111b (Not Available) is indicated when broadcast is disabled by VEPS, or an oil level sensor is not installed.

B.5.60.3. *SPN 3027 – TRANSMISSION OIL LEVEL 1 HIGH / LOW*

SAE Excerpt: First instance of a transmission oil level indicator. Conveys the amount of current volume of transmission sump oil compared to recommended volume. Positive values indicate overfill. Zero means the transmission fluid is filled to the recommended level.

Parameter Specific Indicator: A value of FB hex indicates conditions are not acceptable for a valid fluid level measurement.

Data Length: 1 byte
Resolution: 0.5 L / bit, -62.5 L Offset
Data Range: -62.5 L to +62.5 L
Operational Range: Same as data range

B.5.60.3.1. TCM Parameter Broadcast

Parameter is only available for broadcast in applications equipped with an oil level sensor. Used with OIL LEVEL DISPLAY. 0xFF (Not Available) is indicated when broadcast is disabled by VEPS, or an oil level sensor is not installed.

B.5.60.4. *SPN 3028 – TRANSMISSION OIL LEVEL 1 COUNTDOWN TIMER*

SAE Excerpt: Countdown timer for the first instance of a transmission oil level indicator. Once all vehicle conditions (such as vehicle stopped, etc) are met, some transmissions may require a “settling time” to allow the fluid level to normalize. This parameter indicates how much of the required settling time remains. When time reaches 0, a valid oil level measurement value will be broadcast in SPN 3027 Transmission Oil Level 1 High / Low.

Data Length: 4 bits
Resolution: 1 minute / bit
Data Range: 0 to 15
Operational Range: 0 to 13 minutes

Bit State	Transmission Oil Level 1 Countdown Timer
0000b	Less than 1 minute
0001b	1 minute
0010b	2 minutes
0011b	3 minutes
0100b	4 minutes
0101b	5 minutes
0110b	6 minutes
0111b	7 minutes
1000b	8 minutes
1001b	9 minutes
1010b	10 minutes
1011b	11 minutes
1100b	12 minutes
1101b	13 minutes
1110b	Error
1111b	Not available

B.5.60.4.1. TCM Parameter Broadcast

Parameter is only available for broadcast in applications equipped with an oil level sensor. Used with OIL LEVEL DISPLAY. 1111b (Not Available) is indicated when broadcast is disabled by VEPS, or an oil level sensor is not installed.

B.5.61. PGN 65275 – RETARDER FLUIDS (RF)

SAE Excerpt:
Transmission Repetition Rate .... 1 s
Data Length .... 8 bytes
PDU Format 254
PDU Specific 251
Default Priority 6
PGN 65,275 (0xFEFB)

For product availability and byte/bit locations, see the J1939 MESSAGE & PARAMETER OVERVIEW tables. PGN is broadcast from SA 16 (Retarder – Driveline) in Allison retarder applications unless all parameters are disabled via VEPS.

B.5.61.1. *SPN 120 – HYDRAULIC RETARDER OIL TEMPERATURE*

SAE Excerpt: Temperature of oil found in a hydraulic retarder.

Data Length: 1 byte
Resolution: 1° C / bit, -40° C offset
Data Range: -40°C to +210°C
Operational Range: Same as data range

B.5.61.1.1. TCM Parameter Broadcast

Parameter is only available for broadcast in Allison retarder applications. Provided for the discretionary use of the system, such as dashboard displays. 0xFF (Not Available) is indicated when broadcast is disabled.

In the event of retarder temperature sensor DTC P2742 or P2743, Error (0xFE) is indicated.

B.5.61.2. *SPN 5346 – DRIVELINE RETARDER OVERHEAT INDICATOR*

SAE Excerpt: Signal from the driveline retarder indicating that its fluid temperature is above normal acceptable limits, and as a result, retarder operation may be altered or restricted. The indicator is typically a lamp. Distinctions in meaning between the continuous and flashing are left to the transmission manufacturer.

00b Driveline Retarder Overheat Indicator is off
01b Driveline Retarder Overheat Indicator is on continuously
10b Driveline Retarder Overheat Indicator is flashing
11b Not available

B.5.61.2.1. TCM Parameter Broadcast

See RETARDER TEMPERATURE INDICATOR. 11b (Not Available) is indicated when broadcast is disabled.

B.5.61.3. *SPN 5656 –RETARDER COOLANT OUTLET TEMPERATURE*

SAE Excerpt: Temperature of liquid found in retarder cooling system.

Data Length:	1 byte
Resolution:	1° C / bit, -40° C offset
Data Range:	-40°C to +210°C
Operational Range:	Same as data range

B.5.61.3.1. TCM Parameter Broadcast

Parameter is only available for broadcast in Allison retarder applications where an analog temperature sensor is installed in the "cooler-out" circuit of the cooler for the driveline retarder. This broadcast represents the temperature of the engine coolant measured at the outlet of the driveline retarder cooling system. This sensor must be appropriately wired to the TCM for accurate parameter broadcast.

0xFF (Not Available) is indicated when broadcast is disabled. In the event of an invalid temperature sensor reading, Error (0xFE) is indicated.

For sensor wiring, refer to Allison 6th Generation Controls Installation Drawings.

For water temperature sensor location, refer to 3000 / 4000 Product Family Installation Drawings.

B.5.62. PGN 65280 TO 65535 – PROPRIETARY "B"

SAE J1939-21 Excerpt: This proprietary PG uses the PDU2 format message allowing manufacturers to define the PS (GE) field content as they desire. However, significant percentages (2 percent or more) of vehicle network utilization must be avoided. How the PS (GE) and data fields of this message are used is up to each manufacturer. The data length of these messages has been left up to each manufacturer. Therefore, two manufacturers, say of transmissions, may use the same GE value and it may very well have a different Data Length Code. Receivers of this information would need to differentiate between the two manufacturers.

Transmission Repetition Rate: Per user requirements

Data Length ....0 to 1785 bytes (multipacket supported)
PDU Format..255
PDU Specific .....Group Extension (mfg assigned)
Default Priority 6
PGN .... 65,280 to 65,535 (0xFFxx)

Byte	Bit	Content
1-n		Manufacturer specific use

B.5.62.1. *ALLISON MESSAGE USE*

The TCM may broadcast the following Proprietary B PGNs:

- PGN 65440 – Proprietary TCM Information (on request)

B.6. APPENDIX A: REQUIRED ENGINE GOVERNOR CHARACTERISTICS FOR ENGINE MANAGEMENT

While the following "Good" governor characteristics are required for ENGINE MANAGEMENT functions, they will also provide improved shift quality and drive-ability with all Allison transmissions.

B.6.1. FUNDAMENTAL DESIGN PREMISE OF AUTOMATIC TRANSMISSIONS

A fundamental premise in the design of automatic transmissions is that throttle position controls *engine torque*, as opposed to *engine speed*.

A "Good" governor with this characteristic is illustrated on the left side of Figure A1. Relatively flat throttle curves mean increasing the throttle input will increase engine torque output. In truck industry jargon, governors of this type are often referred to as "Min/Max" or "Limiting Speed" governors, or a "Power Throttle".

For a given throttle position, the vehicle will accelerate smoothly, and easily reach part throttle shift points. When a shift does occur, as shown on the left side of Figure A2, there is relatively little change in engine torque. This results in a smoother, quieter shift.

In contrast, a "less than optimal" governor arrangement is illustrated on the right side of Figure A1. With steep throttle curves, increases in throttle position will increase engine speed. Governors of this type are often referred to as "Variable Speed" or "All Speed" governors, or a "Speed Throttle".

Here, at a given throttle position, engine speed cannot reach the upshift point unless the driver adds more throttle. As shown on the right side of Figure A2, there is a large change in engine torque if a shift does occur. This results in noticeable vehicle surge, as well as increased engine noise and clutch slip.

B.6.2. OPTIMUM ENGINE GOVERNOR CHARACTERISTICS FOR AUTOMATIC TRANSMISSIONS

The optimum governor actually falls somewhere in between the pure limiting speed governor and the pure variable speed governor. Optimum governors produce constant engine horsepower versus engine speed for a given part throttle position.

To accomplish this, engine throttle progression must be such that a given throttle percentage produces nearly the same percentage of power, as shown in Figure A3.

This design yields constant torque and power at the transmission output *before* and *after* a shift, and therefore minimizes driveline disturbance *during* the shift. The constant output results in the best shift quality and smooth vehicle acceleration.

Approximately 200 – 300 rpm of high idle governor droop is required.

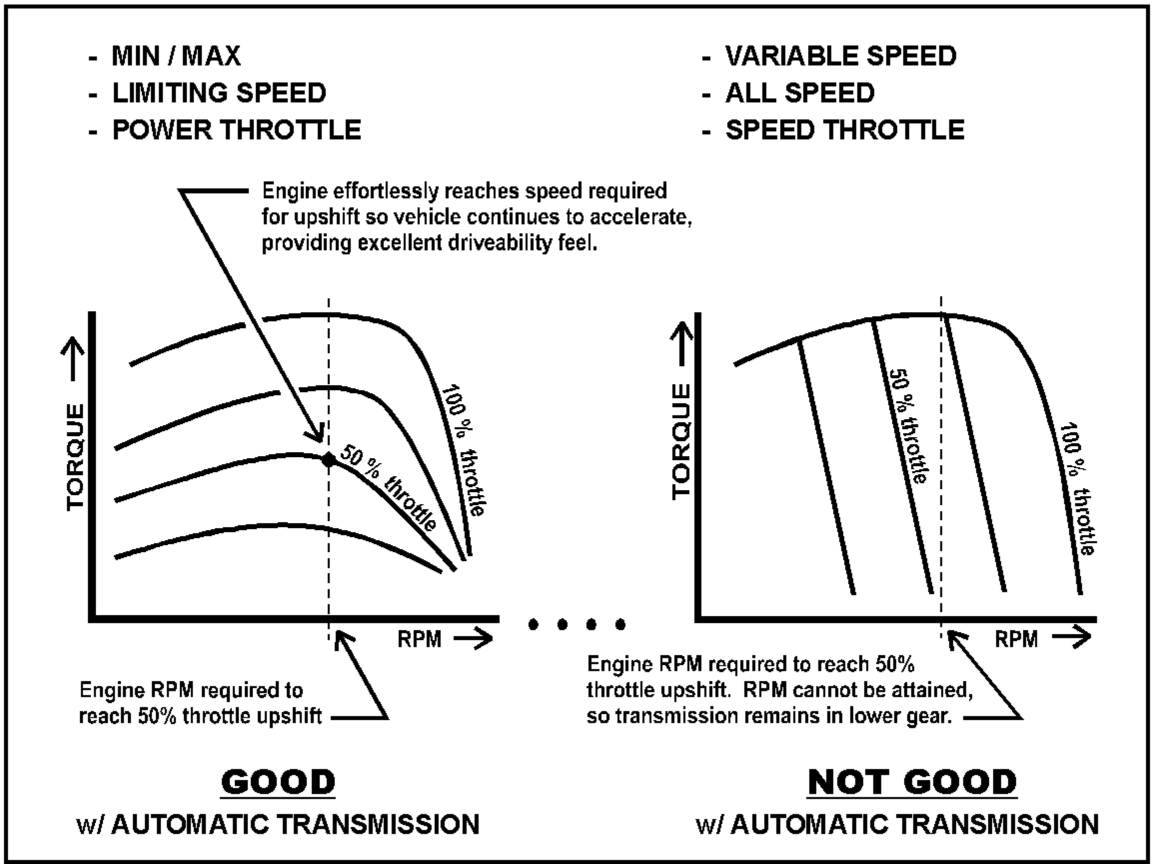


FIGURE A1 – DEFINITIONS OF GOVERNOR TYPES

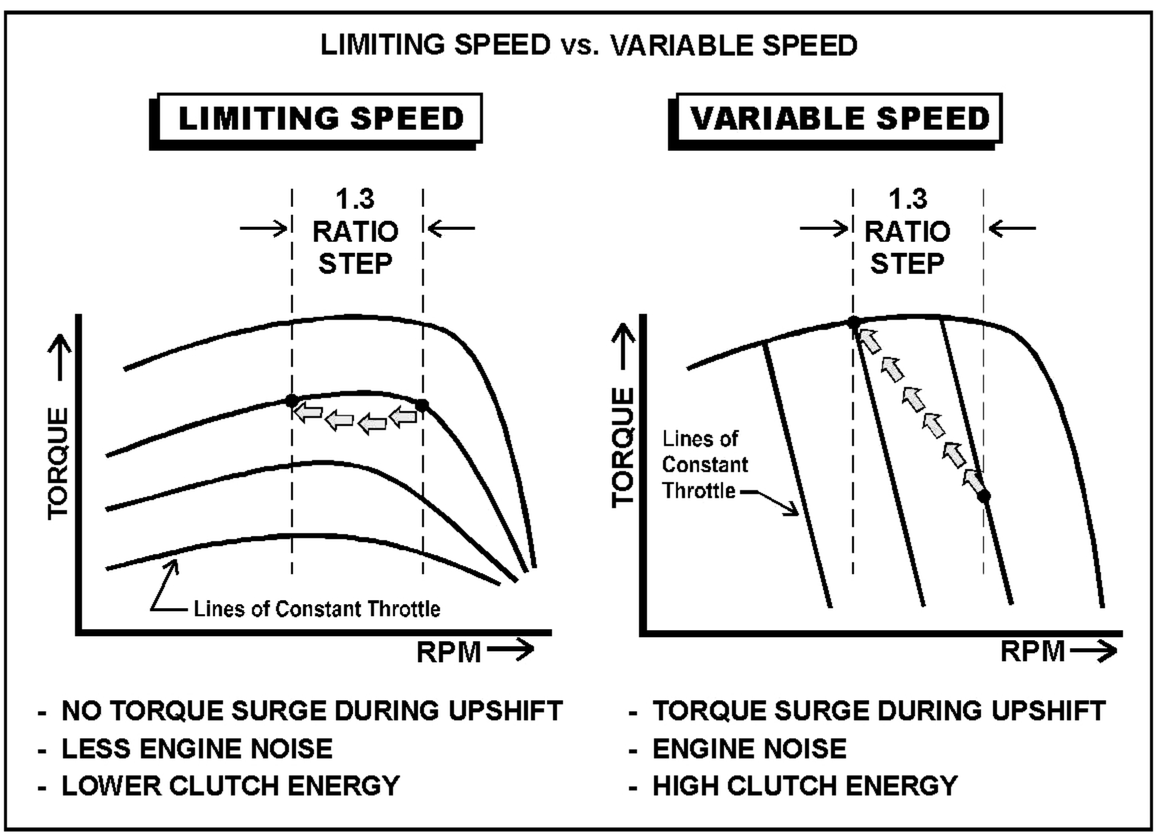


FIGURE A2 – PART THROTTLE UPSHIFT CHARACTERISTICS

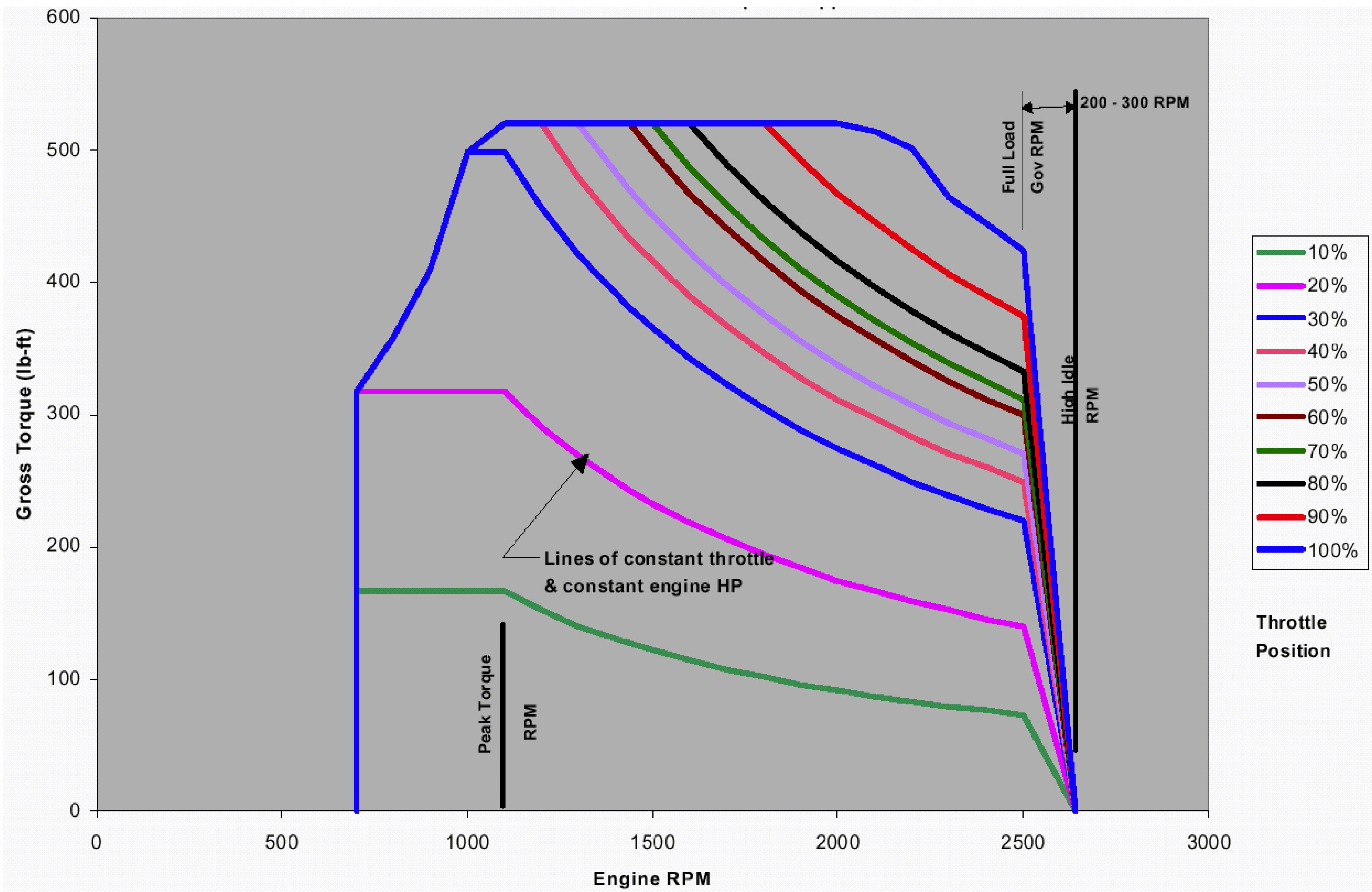


FIGURE A3 – EXAMPLE OF OPTIMUM GOVERNOR USING PART THROTTLE CONSTANT HORSEPOWER APPROACH

B.7. APPENDIX B: REQUIRED ENGINE RESPONSE CHARACTERISTICS FOR ENGINE MANAGEMENT

While the following characteristics are required for Allison ENGINE MANAGEMENT features, they will provide improved shift quality and drive-ability with any Allison transmission.

B.7.1. GENERAL TSC1 TORQUE LIMIT COMMAND RESPONSE

In general, engine TSC1 torque limit response is required to have the following 6 characteristics:

— Engine torque output at the flywheel must reach the commanded limit within 100 ms of Allison placing the command on the J1939 datalink.

— While Allison TSC1 torque limits are controlling the engine, the engine's *Actual Engine – Percent Torque* broadcast must be within 2% of the TSC1 commanded torque limit.

— The engine must respond quickly to the removal of torque limits:

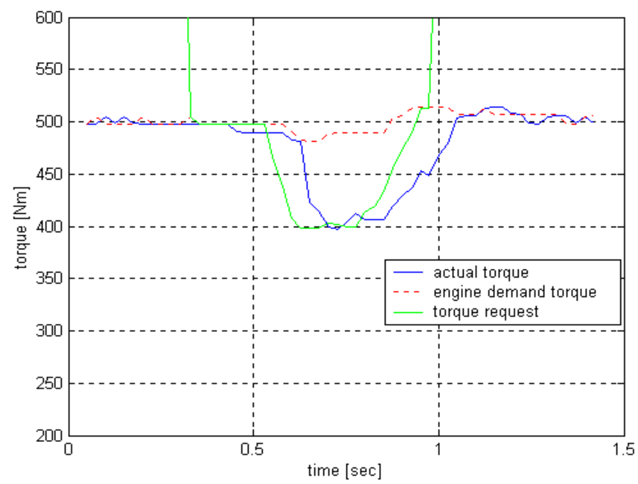
> When a torque limit is removed, the engine must – within 150 ms – produce the same torque output (for the given engine speed and accelerator pedal) as if the engine had not been torque limited by the TCM. For example, after a wide-open throttle (WOT) upshift, maximum torque output for the current engine speed must resume within 150 ms of the torque limit being removed or set greater than the 100% torque curve.
>
> Slow torque recovery can cause a noticeable drop in output torque and poor shift quality. Causes for slow recovery may include:
>
> … Improper resetting of an engine governor dynamic element such as an integrator,
>
> … Engine governor gains that provide too low of a system bandwidth, and/or
>
> … In turbocharged diesel applications, loss of boost pressure coupled with "air-fuel ratio" or "smoke" control limits.

— LRTP requires the engine to accept TSC1 torque **limits** for an unlimited amount of time (see stall test below).

— The engine must accept a full (0 – 100%) range of TSC1 torque limits at all engine operating temperatures.

— Under no circumstances should the engine stall due to TSC1 torque limit reception.

An example of acceptable engine torque response during an upshift is shown below. The values reflect Allison estimates of gross brake torque, not "indicated" or "measured" torque.



ACCEPTABLE ENGINE TORQUE RESPONSE TO ALLISON TORQUE LIMIT COMMAND

B.7.2. SPEED CONTROL CONDITIONS

Engine Management TSC1 commands will issue one of two *Requested Speed Control Conditions*:

01b Stability optimized for driveline disengaged and non-lockup conditions

10b Stability optimized for driveline engaged and/or lockup condition 1 (e.g. vehicle driveline)

Support of *Requested Speed Control Conditions* is more essential for engine fuel systems with slow response times. Multiple gain sets allow increased gains when inertia is high (driveline engaged), and decreased, more stable gains during lower inertia conditions (driveline disengaged or in Neutral).
If response is acceptable for both driveline engaged and disengaged situations, fuel systems with fast response times may not be required to have unique gain sets for each speed control condition.

B.7.3. TORQUE ACCURACY

There are three main components which factor into the torque at an engine's flywheel:

- Indicated torque generated in the cylinders. This data is conveyed via EEC1 *Actual Engine – Percent Torque*.
- Internal engine friction losses, as well as those due to normal engine equipment such as fuel, oil and water pumps. This data is conveyed via EEC3 *Nominal Friction – Percent Torque*.
- Parasitic losses due to engine accessories (e.g. air compressors, power steering pumps, air conditioning, engine-driven cooling fans). This data is conveyed via EEC3 *Estimated Engine Parasitic Losses – Percent Torque.*

This section discusses the impact of each on Allison Engine Management functions.

B.7.3.1. *TORQUE ACCURACY REQUIREMENTS*

First, two definitions:

- ACTUAL GROSS TORQUE – Power made in the cylinders (indicated torque) minus any losses required for the base engine to operate (friction torque), as measured through testing with cooling fans and other engine accessories turned off.
- J1939 GROSS TORQUE – The gross torque of the engine as calculated from J1939 parameters broadcast by the engine:

  (EEC1 *Actual Engine – Percent Torque* minus EEC3 *Nominal Friction – Percent Torque*) x EC1 *Engine Reference Torque*

Gross engine torque calculated from J1939 data <u>is required</u> to be within ±5% of actual measured gross engine torque. However, accuracy of ±10% may be conditionally acceptable.

B.7.3.2. *MEASURING TORQUE ACCURACY*

Since indicated torque is difficult to measure directly, tests typically measure actual steady-state gross torque at the flywheel, and compare this data to the "J1939 gross torque" determined from J1939 parameters broadcast by the engine.

Engine OEMs usually provide or at least summarize this data, often in terms of throttle progression.

To measure gross engine torque, the engine must be operated with minimal parasitic losses from any load-bearing engine accessories. This includes disabling any engine-driven fans and minimizing operation of other engine-driven accessories.

Tests are typically run on an engine dynamometer, although a well calibrated in-vehicle torque meter may also work as long as all accessory loads are disabled during testing. Regardless, the error must be evaluated across the entire engine operating range and expected environmental conditions, including temperature extremes and altitude.

B.7.3.3. *CONDITIONAL ±10% ACCURACY*

B.7.3.3.1. SEM

Tests show SEM shift quality is best when ±5% accuracy is maintained, particularly at higher load conditions. Adequate SEM shift quality can be obtained with accuracy as low as ±10%, <u>provided that a given engine's torque response is repeatable</u>.

"Repeatable" means that a given engine in a given vehicle consistently reports and controls (a) on the high side of actual torque, or (b) on the low side of actual torque. TCM adaptive logic can compensate for these consistent torque biases; however, it cannot address accuracy concerns during LRTP operation.

B.7.3.3.2. LRTP

LRTP applications must maintain ±5% accuracy for a variety of operating conditions, but most particularly near the full-load torque curve. For lower torque values, LRTP has no impact on the accuracy requirements; all requirements are driven by SEM shift quality. "Lower torque" in this case is approximately < 80% of the full-load torque curve, depending on the torque curve and the torque converter used in a given application.

B.7.3.4. *FANS & OTHER PARASITIC LOSSES*

Engine-driven fans (e.g. viscous driven units) and other accessory loads are often not directly controlled by the engine control module (ECM). As such, Allison accuracy requirements focus on what is known and controlled by the ECM: Indicated torque generated in cylinder and the friction of normally installed components. Lack of knowledge about any additional engine loading is in part what drives the tight (±5%) accuracy requirements.

If the ECM <u>does know</u> fan or accessory parasitic losses, it should broadcast this information in EEC3 *Estimated Engine Parasitic Losses – Percent Torque* so the TCM can make use of it.

While not typical -- and not recommended -- some engine OEMs choose to include these additional parasitic losses in their EEC3 *Nominal Friction – Percent Torque* broadcast. If so, EEC3 *Estimated Engine Parasitic Losses – Percent Torque* support <u>is required</u>, and must indicate 0xFB as defined by SAE. 0xFB indicates that additional information has been lumped in with the standard *Nominal Friction – Percent Torque* broadcast.

In either case, the ECM must control the fan or other accessory in order to impart its impact on the parameter broadcast values.

Bottom line: Allison does not require fan or other accessory losses to be included in any torque parameter; it is accepted that these fans and loads may not be controlled by the ECM. However, the TCM will use the additional information if provided.

B.7.3.5. *SUMMARY*

For Engine Management compatibility, any areas of operation lacking ±5% torque accuracy must be understood. If error up to ±10% occurs somewhere away from the full-load torque curve and the particular engine's torque response is repeatable, good shift quality and durability can still be had. If an error is not repeatable or occurs near the full-load torque curve, a more detailed analysis is necessary to determine the effects.

B.7.4. TORQUE RESPONSE DURING SHIFTS IN CRUISE CONTROL OR ROAD SPEED GOVERNING

In addition to the general TSC1 responses above, there are further SEM / LRTP requirements if cruise control or road speed governors are involved.

B.7.4.1. *BACKGROUND: NON-SEM SHIFTS*

Text in this section is repeated from "Allison Implementation" as stated under EEC2 *Engine Percent Load at Current Speed.*

To avoid shift cycling and potential transmission damage during cruise control or road speed governor operation, *Engine Percent Load at Current Speed* behavior is required to:

— Reflect actual engine conditions with minimal filtering, and

— Maintain relatively constant values during certain shift scenarios. Unless the engine is responding to external TSC1 commands, *Engine Percent Load at Current Speed* should not change significantly during shifts that occur while operating under an active cruise control or road speed governor.

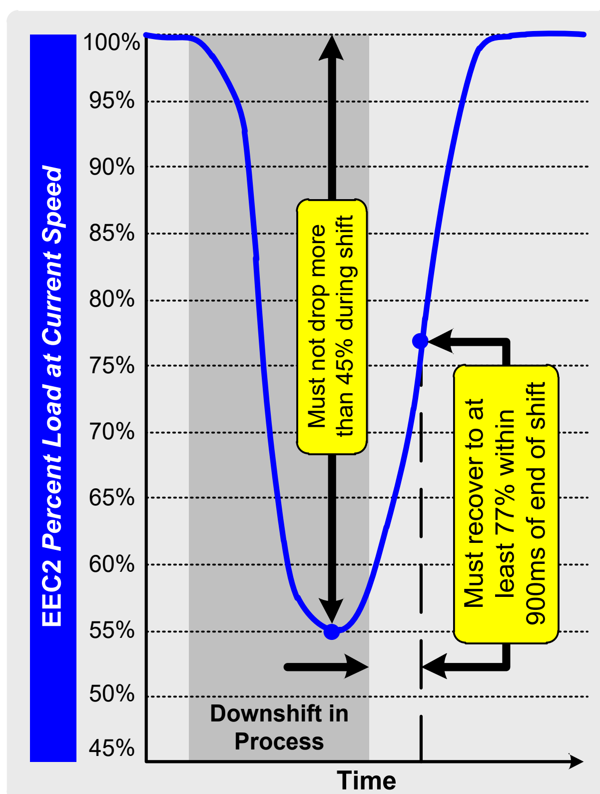
Typically, cruise and road speed governors using only vehicle speed and / or acceleration feedback do not exhibit significant changes in *Engine Percent Load at Current Speed*. The rapid changes described in the following two sections most often result from the use of engine speed and / or acceleration feedback in the controlling governor.

B.7.4.1.1. Full Power Downshifts during Cruise Control or Road Speed Governing

Cruise control maintains a set vehicle speed, and adjusts engine torque output as needed to do so. On steep grades, cruise governors will request maximum available engine torque to maintain the set speed. Still, the vehicle may slow to a point where a power downshift will occur.

It is understood that minor decreases in *Engine Percent Load at Current Speed* may occur during these downshifts, due to the combination of increased engine speed and negative slope on the engine torque curve. However, if *Engine Percent Load at Current Speed* drops significantly during this downshift, the transmission may upshift immediately afterwards. To avoid this cycling, the following requirements must be met:

For full power downshifts that occur while against an active cruise set speed or road speed governor, *Engine Percent Load at Current Speed* must not drop by more than 45% during the shift, and must recover to an absolute value of at least 77% within 900 ms of the end of the shift. These requirements are illustrated below:



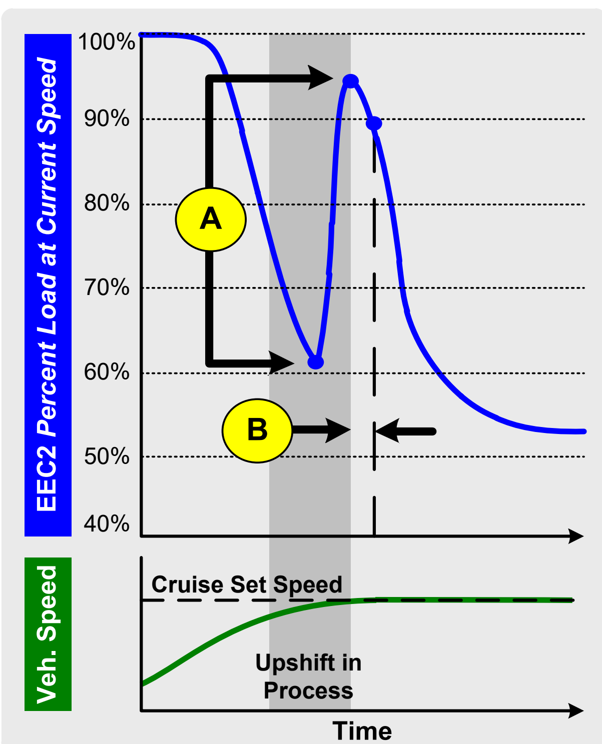
PERCENT LOAD BEHAVIOR DURING CC OR RSG FULL POWER DOWNSHIFTS

B.7.4.1.2. Upshifts as Cruise or Road Speed Governor Set Speed is Approached

As vehicle speed increases, an upshift may occur just as the cruise control or road speed governor set point is approached. Near the set point, the cruise or road speed governor tapers off the engine torque output, initiating the upshift.

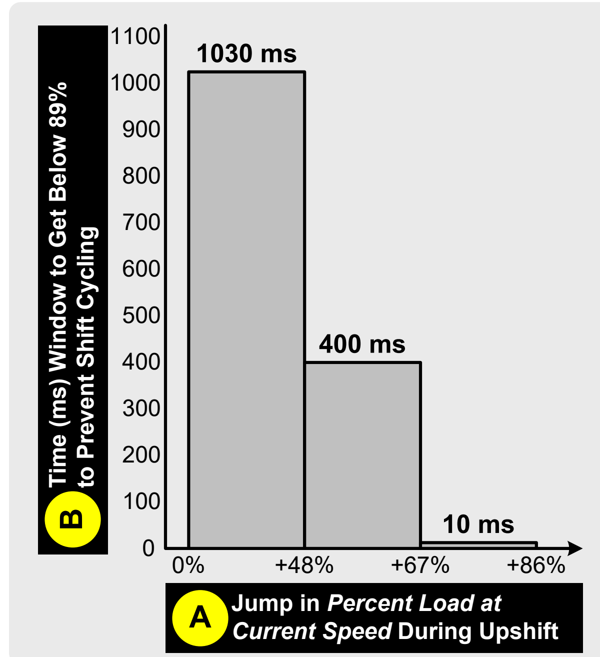
If *Engine Percent Load at Current Speed* jumps significantly during these upshifts, the transmission may downshift immediately afterwards. The increase in *Engine Percent Load at Current Speed* during the shift impacts the period of time available after the shift in which the value must drop below a threshold to avoid cycling. Requirements are illustrated in the two figures below.

The sequence in the figure below illustrates (A) the jump in *Engine Percent Load at Current Speed* value during the upshift, and (B) the time window after the shift in which *Engine Percent Load at Current Speed* must drop below 89% to prevent shift cycling. If the value does not peak above an absolute value of 89% during the upshift, shift cycling will not be a problem.



PERCENT LOAD BEHAVIOR DURING UPSHIFTS MADE NEAR CRUISE OR RSG SET POINT

The figure below defines "recovery time" requirements associated with the *Engine Percent Load at Current Speed* increase during the shift. For example, if *Engine Percent Load at Current Speed* jumped up by 55% during the upshift, it must drop below an absolute value of 89% within 400 ms of the end of the shift to avoid a shift cycle.



PERCENT LOAD TIMING REQUIREMENTS FOR UPSHIFTS MADE NEAR CC OR RSG SET POINT

B.7.4.2. *POWER DOWNSHIFTS WITH SEM (1000 – 4000 SERIES ONLY)*

With SEM, cruise control systems must still attempt to maintain torque during power downshifts, *except* when interrupted by Allison TSC1 torque reduction commands.

When honored, these torque reductions are correctly reflected in engine broadcast parameters such as *Engine Percent Load at Current Speed* and *Actual Engine – Percent Torque*. To understand the engine's desired torque output level sans external TSC1 influences, Allison torque limit commands are based on *Engine Demand – Percent Torque*.

In the case of a power downshift during cruise control operation, *Engine Demand – Percent Torque* should reflect the torque level requested by the cruise algorithm. If Allison commands result in improper engine torque reduction during cruise control, typically the cause is incorrect behavior of *Engine Demand – Percent Torque* during the shift.

B.7.4.3. *UPSHIFTS WITH SEM*

Torque response during SEM upshifts in cruise control should be very similar to that during throttle-controlled upshifts. For test purposes, "resuming" to a high cruise set speed while at a low vehicle speed can create these upshifts.

B.7.5. TORQUE RESPONSE

B.7.5.1. *DURING GARAGE SHIFTS*

The engine must accept TSC1 torque limits immediately after engine start and at all coolant and intake manifold temperatures, since TSC1 may be transmitted during garage shifts (shifts from Neutral). The engine should not stall if it receives a TSC1 torque limit during idle operation.

B.7.5.2. *DURING UPSHIFTS FROM ENGINE'S HIGH SPEED GOVERNOR*

Manual upshifts via the shift selector while the engine is operating against its' high speed governor are sometimes known as "hold override" upshifts in Allison terminology.

Regardless of throttle or cruise control operation, these upshifts should result in the engine attempting to increase torque throughout the shift. As a result, *Engine Demand – Percent Torque* should increase throughout the shift as well.

As with cruise control operation, decreases in engine torque output should only result from Allison torque limit commands.

B.7.5.3. *DURING THROTTLE TIP-IN*

During transitions from zero to any amount of throttle (small, part, or full), engine torque response <u>shall not</u> generate a large impulse on the driveline such that an oscillation or "ringing" results.

Regardless of whether shifting is involved, driveline ringing often results in customer dissatisfaction with the vehicle powertrain. This dissatisfaction may translate into improper blame on the transmission as well as unwarranted service time and expense.

B.7.6. SPEED RESPONSE

B.7.6.1. *LOW SPEED GOVERNOR RESPONSE*

When the vehicle driveline is under no load and the torque converter lockup clutch is released (such as while coasting), the engine will naturally fall to the low speed governor. For these situations, low speed governor response <u>is required</u> to be approximately critically damped; at a minimum, it should not be too under-damped (i.e., 2nd order system approximation damping ratio of 0.6 to 1.0).

The TCM releases the torque converter immediately preceding some shifts (such as a 2-1 downshift), and if engine speed is oscillating wildly at this point, the turbine response may lead to poor shift quality. The transmission may also adapt shifts incorrectly.

B.7.6.2. *HIGH SPEED GOVERNOR RESPONSE*

While the transmission is in gear (with or without torque converter clutch engaged) and the vehicle is accelerating, the engine high-speed governor response <u>is required</u> to be approximately slightly under-damped to critically damped (i.e., 2nd order system approximation damping ratio 0.7 to 1.0).

SECTION C: PROPRIETARY PROTOCOLS

C.1.1. IES-CAN AND PT-CAN

IES-CAN & PT-CAN are proprietary communication protocols used by Mercedes Benz trucks to communicate with the TCM and other vehicle components.

As proprietary protocols, their details cannot be discussed in this public document. This section describes what Allison functionality is supported by these interfaces. If further information is necessary, please contact your Allison Customer Integration Engineering representative.

C.1.1.1. *ALLISON FUNCTIONS SUPPORTED VIA IES-CAN AND PT-CAN*

The IES-CAN protocol supports equivalents to the following Allison J1939- or GPIO-based functions:

- Accelerator Pedal Input
- Anti-Lock Brake System (ABS) Input
- Automatic Traction Control (ATC or ASR)
- Auxiliary Function Range Inhibit – Single Input
- Cruise Control, Standard
- Engine Brake Interface
- Kickdown Input
- Neutral Start
- Preselect Request
- Range Inhibit Indicator (RII)
- Retarder Active Indicator
- Retarder Control
- Retarder Temperature Indicator
- Reverse Enable Input
- Reverse Inhibit Input
- Reverse Warning Indicator
- Road Speed Limiting
- Service Brake Status Input

In addition to the functions listed above, PT-CAN applications also support:

- Automatic Neutral – Single Input
- Automatic Neutral – Brake-Based (BBAN) Input
- Engine Management
- Dynamic Shift Sensing

C.1.2. GMLAN

GMLAN is a proprietary communication protocol used by certain General Motors gasoline engine to communicate with the TCM and other vehicle components.

As a proprietary protocol, its details cannot be discussed in this public document. This section describes Allison functions supported over GMLAN, and the limited subset of J1939 support available in GMLAN applications.

C.1.2.1. *CALIBRATION CONFIGURATION*

GMLAN applications use unique 1000/2000 Series vocational model calibrations. The CAN port protocol and network speed assignments are fixed:

- CAN1 is always set to a special limited subset of SAE J1939 message and parameter support. The network speed is set to either 250 kbps or 500 kbps, depending on the VMC.

- CAN2 is always set to GMLAN with a 500 kbps network speed.

If further information is necessary, please contact your Allison Customer Integration Engineering representative.

C.1.2.2. *ALLISON FUNCTIONS SUPPORTED VIA GMLAN*

The GMLAN protocol supports equivalents to the following Allison J1939- or GPIO-based functions:

- Accelerator Pedal
- Anti-Lock Brakes (ABS)
- Automatic Traction Control (ATC or ASR)
- Cruise Control, Standard
- Dynamic Shift Sensing
- Engine Management – SEM
- High N/V Ratio
- Range Selection Mode (Tap Up, Tap Down)
- Service Brake Status

C.1.2.3. *J1939 MESSAGE AND PARAMETER SUPPORT IN GMLAN APPLICATIONS*

The subset of J1939 parameter broadcast and reception support is denoted by a superscript “1” in the 1K–2K column of the J1939 MESSAGE & PARAMETER OVERVIEW tables.

C.1.2.4. *J1939-BASED FUNCTION SUPPORT IN GMLAN APPLICATIONS*

The J1939-based functions supported in GMLAN applications are denoted by a superscript “1” in the 1K–2K column of the J1939-BASED FUNCTION OVERVIEW table.

SECTION D: NETWORK ASSEMBLY

D.1. ALLISON COMPONENT CONNECTIONS

D.1.1. ALLISON TCM CONNECTIONS

D.1.1.1. *NETWORK CONFIGURATION*

Allison 6th Generation TCMs can support up to 3 different CAN networks through their CAN1, CAN2 and CAN3 ports. Network attributes are set via VEPS / ACCT; see NETWORK CONFIGURATION for details.

D.1.1.2. *NETWORK CONNECTIONS*

CAN1, CAN2 and CAN3 hardware are compatible with SAE J1939-11, J1939-14, J1939-15 and J2284-3 physical layer Recommended Practices.

The CAN1, CAN2 and CAN3 ports may be wired to networks via stub connections. On chassis-mount (1000 – 4000 Series) TCMs, CAN1 and CAN2 ports may also be installed as backbone termination.

D.1.1.2.1. General Connection Requirements

No two TCM CAN ports may be connected to the same vehicle network.

D.1.1.2.2. Stub Connection Requirements

TCMs installed via stub connection must meet the following requirements:

Wiring

CAN High, Low and shielding wires (if applicable) must conform to the SAE physical layer in use.

Network Location

The TCM cannot be connected at either end of the backbone; the backbone must terminate with termination resistor(s) and / or other controllers equipped with internal termination resistors.

D.1.1.2.3. Internal Termination Requirements (Chassis-Mount ONLY)

For networks connected to chassis-mount TCM ports CAN1 or CAN2, this implementation allows elimination of one of the two external termination resistors required in every J1939 network. A jumper wire connects an internal termination resistor across CAN high and low. Chassis-mount TCMs installed as backbone termination must meet the following requirements:

Jumper Wire

The termination resistor jumper wire must be 120 ohm impedance wire identical to that used throughout the rest of the given CAN network. The jumper wire should be kept as short as possible.

Labeling

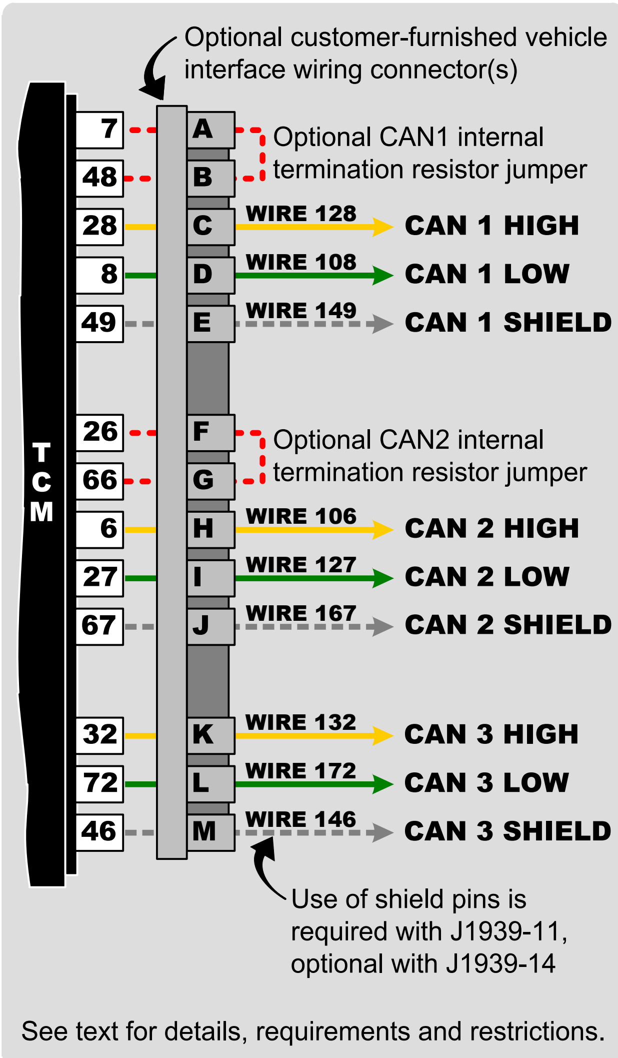
The TCM must be CLEARLY LABELED as utilizing the internal termination resistor. Otherwise, technicians may mistakenly believe a vehicle is missing a termination resistor, when in fact it is simply not visible to the naked eye.

Exact label wording is left to the vehicle OEM's discretion; phrasing such as "INTERNAL TERMINATION RESISTOR IN USE" is acceptable. The label must not be painted over during the vehicle assembly process.

Network Location

The TCM must be connected at one of the two ends of the network backbone.

D.1.1.3. *CHASSIS-MOUNT (1000 – 4000 SERIES) TCM NETWORK CONNECTIONS*



D.1.2. ALLISON SHIFT SELECTOR CONNECTIONS

All Allison 5th and 6th Generation shift selectors are J1939-based. The 6th Generation TCM no longer supports PDL-based selectors.

D.1.2.1. *NETWORK CONFIGURATION*

Shift selectors must be connected to a single properly configured TCM CAN port; see NETWORK CONFIGURATION for details.

D.1.2.2. *NETWORK CONNECTIONS*

Allison shift selectors are compatible with SAE J1939-11, J1939-14, J1939-15 and J2284-3 physical layer Recommended Practices.

Allison shift selectors may be wired to a network via stub connections, or as backbone termination.

D.1.2.2.1. General Connection Requirements

- Allison shift selectors auto-detect the baud rate of the network they are connected to; baud rate cannot be configured.
- Shift selectors cannot be connected to the TCM CAN3 port.
- In 3000/4000 Series applications where dual shift selectors are used, both selectors must be connected to the same TCM CAN port.

D.1.2.2.2. Stub Connection Requirements

Selectors installed via stub connection must meet the following requirements:

Wiring

J1939 High, Low and shielding wires (if applicable) must conform to the SAE physical layer in use.

Network Location

The selector(s) cannot be connected at either end of the backbone; the backbone must terminate with termination resistor(s) and / or <u>other</u> controllers equipped with internal termination resistors.

D.1.2.2.3. Internal Termination Requirements

This implementation allows elimination of one (in single selector applications) or both (in dual selector applications) external termination resistors that are required in every J1939 network. A jumper wire connects an internal termination resistor across J1939 High and Low.

Selector(s) installed as backbone termination must meet the following requirements:

Jumper Wire

The termination resistor jumper wire must be 120 ohm impedance wire identical to that used throughout the rest of the given CAN network. The jumper wire should be kept as short as possible.

Labeling

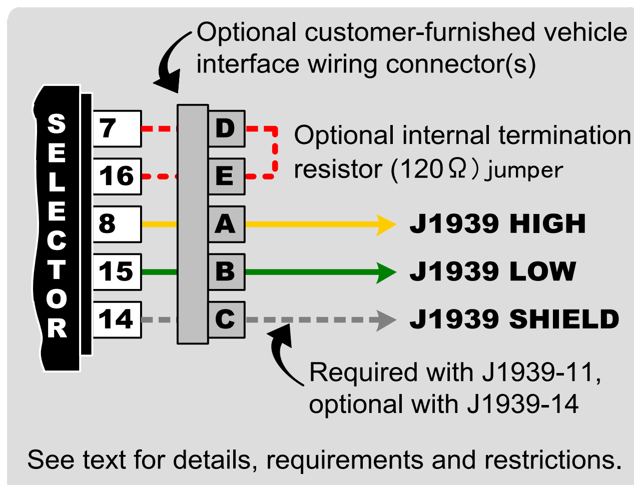
Selector(s) must be <u>clearly labeled</u> as utilizing the internal termination resistor. Otherwise, technicians may mistakenly believe a vehicle is missing a termination resistor, when in fact it is simply not visible to the naked eye.

Exact labeling is left to the vehicle OEM's discretion; phrasing such as "INTERNAL TERMINATION RESISTOR IN USE" is acceptable. The label must not be painted over during the vehicle assembly process.

Network Location

The selector(s) must be connected at one of the two ends of the network backbone.

D.1.2.3. *SHIFT SELECTOR CAN PINS*



D.1.3. ALLISON DOC® CONNECTIONS

D.1.3.1. *NETWORK CONFIGURATION*

There are no TCM configuration requirements for Allison DOC® support. Allison DOC® uses the UDS protocol which is compatible with all network protocols supported by the TCM.

For non-Allison tools, vehicle OEMs may choose among three diagnostic protocols; see NETWORK CONFIGURATION for details.

D.1.3.2. *NETWORK CONNECTIONS*

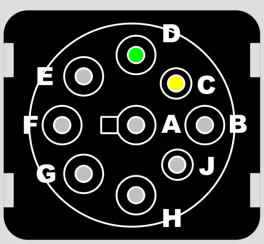
D.1.3.2.1. General Connection Requirements

All applications require at least one connection point for the Allison DOC® service tool, which can be on either CAN1, CAN2 or CAN3.

As long as the connector pin usage is correct, DOC® will be able to communicate with the TCM:

- SAE J1939 Type 1 and Type 2 connectors must have correct support of pins A through E.
- The SAE J1962 (ISO 15031-3) connector must have correct support of pins 4, 6, 14 and 16.

D.1.3.3. *SAE J1939-13 TYPE 1 DIAGNOSTIC CONNECTOR PINS*



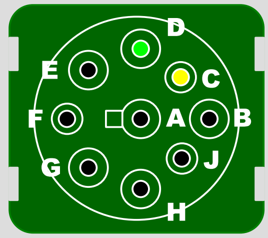
J1939-13 Type 1 Connector (BLACK or GREY)

Note: Vehicle connector view.

A = Battery (–)
B = Battery (+) unswitched, w/uncond.10A fuse
C = **J1939 High 250 Kbps** (typically yellow)
D = **J1939 Low 250 Kbps** (typically green)
E = **J1939 Shield** (J1939-11)
F = SAE J1708 (+) (typically blue)
G = SAE J1708 (–) (typically white)
H = Proprietary OEM use
J = Proprietary OEM use

Note: To satisfy the DOC® connector requirement, the TCM must be connected to pins C through E

D.1.3.4. *SAE J1939-13 TYPE 2 DIAGNOSTIC CONNECTOR PINS*



J1939-13 Type 2 Connector (GREEN)

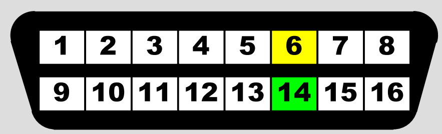
Note: Vehicle connector view.

A = Battery (–)
B = Battery (+) unswitched, w/uncond.10A fuse
C = **J1939 High 250 Kbps or 500 Kbps** (YEL)
D = **J1939 Low 250 Kbps or 500 Kbps** (GRN)
E = **J1939 Shield** (J1939-11)
F = J1708 High or CAN High 1 Mbps or lower
G =J1708 Low or CAN Low 1 Mbps or lower
H = Proprietary OEM use
J = Proprietary OEM use

Note: To satisfy the DOC® connector requirement, the TCM must be connected to pins C through E

D.1.3.5. *SAE J1962 (ISO 15031-3) DIAGNOSTIC CONNECTOR PINS*

SAE J1962 (ISO 15031-3) Connector



Note: Vehicle connector view.

Pin	SAE J1962 Assignment
1	Discretionary
2	Bus positive line of SAE J1850
3	Discretionary
4	Chassis ground
5	Signal ground
6	**CAN_H line of ISO 15765-4**
7	K line of ISO 9141-2 and ISO 14230-4
8	Discretionary
9	Discretionary
10	Bus negative line of SAE J1850
11	Discretionary
12	Discretionary
13	Discretionary
14	**CAN_L line of ISO-15765-4**
15	L line of ISO 9141-2 and ISO 14230-4
16	Permanent positive voltage

D.2. VEHICLE NETWORK WIRING

Allison TCMs and shift selectors support the following SAE-defined CAN physical layers:

— J1939-11 (250 kbps, shielded)
— J1939-14 (500 kbps, shielded or unshielded)
— J1939-15 (250 Kpbs, unshielded)

In addition, the TCM supports the J2284-3 (500 kbps, shielded or unshielded) physical layer.

Physical layer variations typically involve topology requirements such as length, node count and stub spacing. All use 120Ω impedance wire and 120Ω termination resistors. It is possible that the different TCM CAN ports are connected to different physical layer types.

D.2.1. GENERAL REQUIREMENTS

The vehicle OEM sets physical layer use, and is responsible for proper implementation per the applicable SAE physical layer document.

The following sections provide Allison and SAE requirements and recommendations for assembling robust networks. They may be used by vehicle OEMs to assist in wiring development; however, they **are not** a substitute for requirements and details found in J1939 physical layer documents, or elsewhere in this Datalink Tech Data document.

Allison Customer Integration Engineering will review new CAN installations for minimum requirements as noted by **bold text**.

All unused network connections **must be** covered with weather-tight caps.

D.2.2. SHIELDING

SAE J1939-11 defines the original J1939 cable system; a twisted wire pair surrounded by a shield and drain wire throughout the length of the cable. Shielding significantly reduces network susceptibility to electrical noise in the vehicle. However, shielding does make the cable more expensive and unwieldy in terms of making connections and cable routing.

Many vehicle OEMs prefer unshielded cable for its lower cost and physical flexibility. However:

— Unshielded networks are more susceptible to electromagnetic interference (EMI).

— EMI is extremely difficult to quantify and predict, and could be generated or influenced by components or modifications performed on the vehicle after manufacture by the primary OEM.

— Malfunctions due to EMI can be extremely difficult to diagnose and correct.

D.2.2.1. *1000 – 4000 SERIES RECOMMENDATION*

For the reasons listed above, Allison does not recommend use of unshielded cable (e.g. J1939-15).

NOTE: Allison accepts that some vehicle OEMs will opt for unshielded cable, however, Allison continues to **STRONGLY RECOMMEND** the use of shielded cable (e.g. J1939-11) in 1000 – 4000 Series applications.

As a supplier of a major system component, Allison deems it appropriate and important to communicate its position regarding the roles and responsibilities in the design, manufacture, and service of SAE J1939 networks. In regards to shielding:

— Network wiring is the responsibility of the vehicle manufacturer, as is other vehicle interface wiring.

— For malfunctions relating to any vehicle datalink or interface wiring, the first line of responsibility for diagnosis and repair lies with the vehicle manufacturer.

— Vehicle OEMs install unshielded cable at their own risk and are responsible for design and validation to assure unwanted or improper signals are not induced in the CAN wires.

— If unshielded cable causes transmission malfunctions, Allison will not be held responsible for costs associated with vehicle modifications or repairs.

D.2.2.2. *SHIELD CONNECTIONS*

The shield drain should break out of the backbone as close to the center as possible, and connect directly to the battery ground terminal, or the central grounding point of the vehicle electrical system.

The shield drain **must not** be grounded in more than one place, as this can create a “ground loop” with current flow that may induce noise onto the network wires.

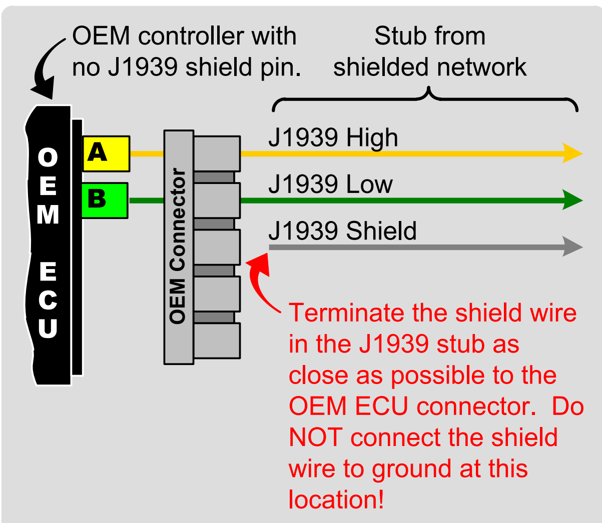
The shield drain wire should be connected to the shield pin of every controller that has one; it may never be connected to a ground pin.

Where network wiring passes through a bulkhead connector, shielding should be maintained as close to the connector as possible.

D.2.2.2.1. Installing Unshielded Components on Shielded Networks

Occasionally there are instances where a device with no shield pin must be connected to a shielded (e.g. J1939-11) network.

In these situations, the shield should be maintained along the stub as close to the controller as possible, as shown in the figure below. The shield drain wire at the end of this stub should not be terminated, and under no circumstances should it be grounded at the OEM controller.



TERMINATING A SHIELD WIRE WHEN A CONTROLLER HAS NO SHIELD PIN

D.2.3. CABLE ROUTING

Inducted noise tends to be a much greater issue with unshielded cable. As such, it is critical that routing of unshielded cable provide a minimum of 3 to 4 inches of physical separation from items such as solenoids, alternators, flasher modules, high output CB radios, starter motors, relays, or any other high-current switching device. While critical for unshielded cable, such routing is also good practice with shielded cable.

Where network wires share a connector with other vehicle circuits (such as a firewall bulkhead), the CAN pins should be located away from any high current switching circuits in that connector.

D.2.4. IMPEDANCE MATCHING

While not specified in the J1939 physical layer documents, it is good practice to avoid mixing cable types (e.g. shielded and unshielded) on a given network.

Cable impedance is determined by all of the components in a given cable package, including not only the wire strands, *but the insulation, shielding, and sheathing as well*. While the J1939 and J2284 physical layers all specify 120Ω impedance, it is possible for signal degradation to occur at the junction between two cable types.

Cable mismatching most often occurs when additional datalink components are installed after initial vehicle manufacture, or during vehicle repairs.

D.2.5. TERMINATION RESISTORS

SAE J1939 networks require two 120Ω termination resistors, one at each end of the backbone.

All SAE J1939 physical layers have provisions which allow one or both termination resistors to be built into controllers if they reside at the end of a backbone. This can reduce the number of wiring connections and components in a CAN network.

Allison chassis-mount TCMs and shift selectors have internal termination resistors available. See ALLISON TCM CONNECTIONS and ALLISON SHIFT SELECTOR CONNECTIONS for details.

Since internal termination resistors are not visible to service technicians, J1939 documents require that controllers utilizing an internal termination resistor be clearly labeled indicating such. Otherwise, technicians may incorrectly believe a vehicle is missing one or both termination resistors, when in fact their location is simply not visible.

D.2.6. CABLE LENGTH REQUIREMENTS

D.2.6.1. *SAE J1939-11*

Overall network length **must be** ≤ 40 m. Stub lengths are not included in this calculation.

Backbone-to-node stub length **must be** ≤ 1 m, with one exception: backbone-to-diagnostic-connector stub must be ≤ 0.66 m. The diagnostic-connector-to-service-tool cable must be ≤ 5 m.

Stub spacing on the backbone **must be** ≥ 10 cm.

D.2.6.2. *SAE J1939-14*

Cable that meets SAE J1939-11 or SAE J1939-15 is acceptable.

The maximum allowable distance between nodes is dependent on the number of nodes in use and **must not be** exceeded; see SAE J1939-14.

Backbone-to-node stub length **must be** ≤ 1.67 m, and stub spacing on the backbone **must be** ≥ 30 cm.

D.2.6.3. *SAE J1939-15*

The distance between the termination resistors or between any two nodes (including the diagnostic scan tool) **shall not** exceed 40 m.

All backbone-to-node stub lengths **must be** ≤ 3 m, including service tool connections. In other words, total cable length from the backbone-to-diagnostic connector-to-service-tool must be ≤ 3 m.

Stub spacing on the backbone **must be** ≥ 10 cm.

D.2.7. SAE J2284-3 WIRING REQUIREMENTS

SAE J2284-3 defines a high-speed 500 kbps CAN communication link that uses either shielded or unshielded cabling. In practice, most applications use unshielded cable.

The main advantage of J2284-3 is reduced wiring in single controller installations; it has a unique set of topology requirements for networks with only one control module and one diagnostic connection.

In this configuration, only one termination resistor is needed. By using the TCM internal termination resistor available on chassis-mount TCM CAN1 or CAN2, a simple, low-cost diagnostic connection can be achieved. By definition, this network does not have a backbone. A sample schematic is provided in the NETWORK WIRING EXAMPLES section.

D.2.7.1. *ALLISON REQUIREMENTS AND RESTRICTIONS*

— J2284-3 may only be used to connect a TCM to a J1962 diagnostic connector, with no other devices on the network.

— Any TCM CAN port may be used, as long as its VEPS value for **ON-VEHICLE PROTOCOL** is 0 = OFF.

— Wiring must meet all J2284-3 requirements, e.g. the distance between the TCM and the diagnostic connector must be ≤ 5 m.

— Allison requirements for internal termination resistor use must be followed.

D.2.8. NETWORK WIRING EXAMPLES

The following pages illustrate these examples:

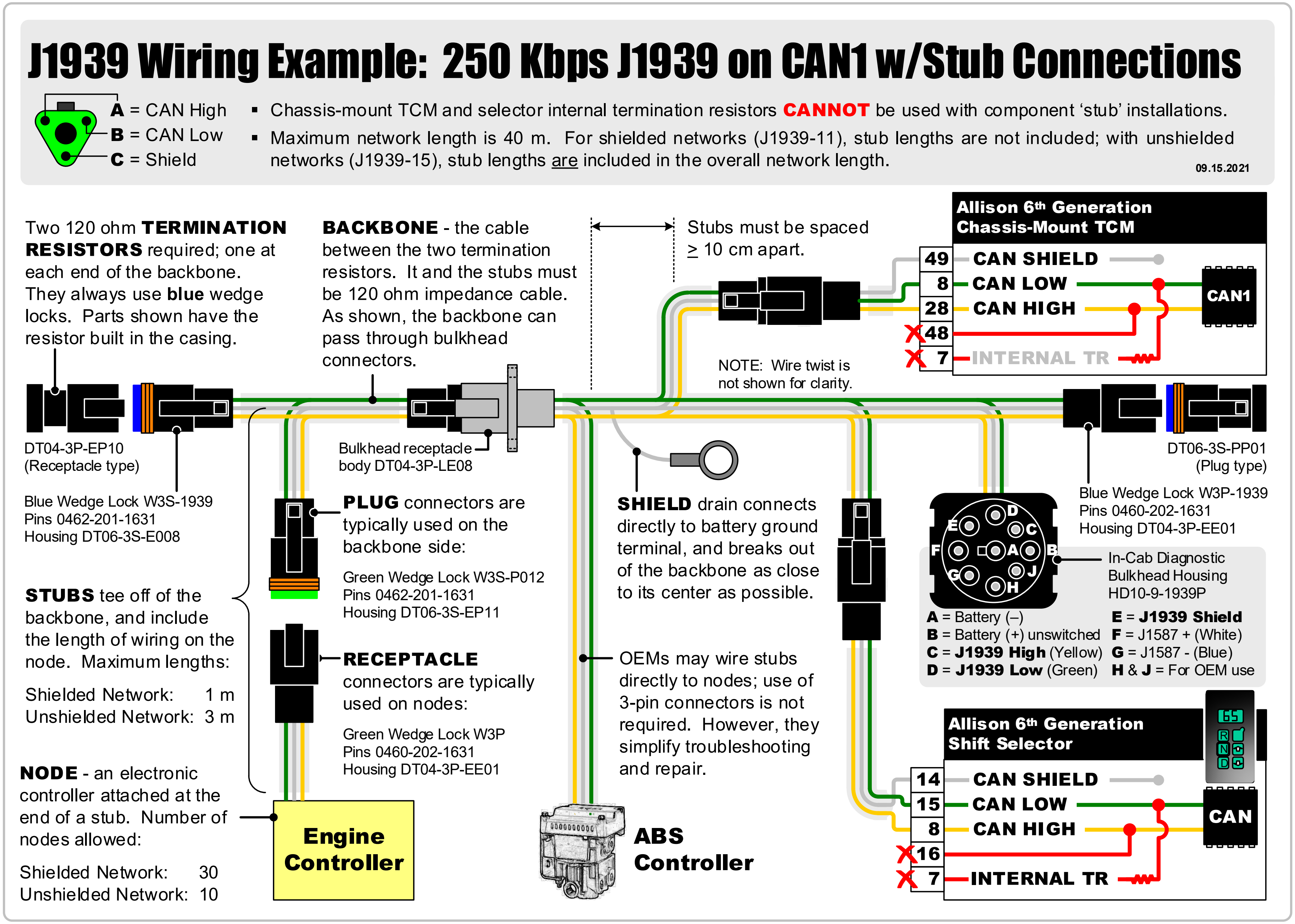
— A “traditional” 250 kbps J1939 network connected to chassis-mount TCM CAN1, and the associated SAE terminology,

— A 500 kbps J1939 network connected to chassis-mount TCM CAN2 utilizing the TCM and shift selector internal termination resistors, and

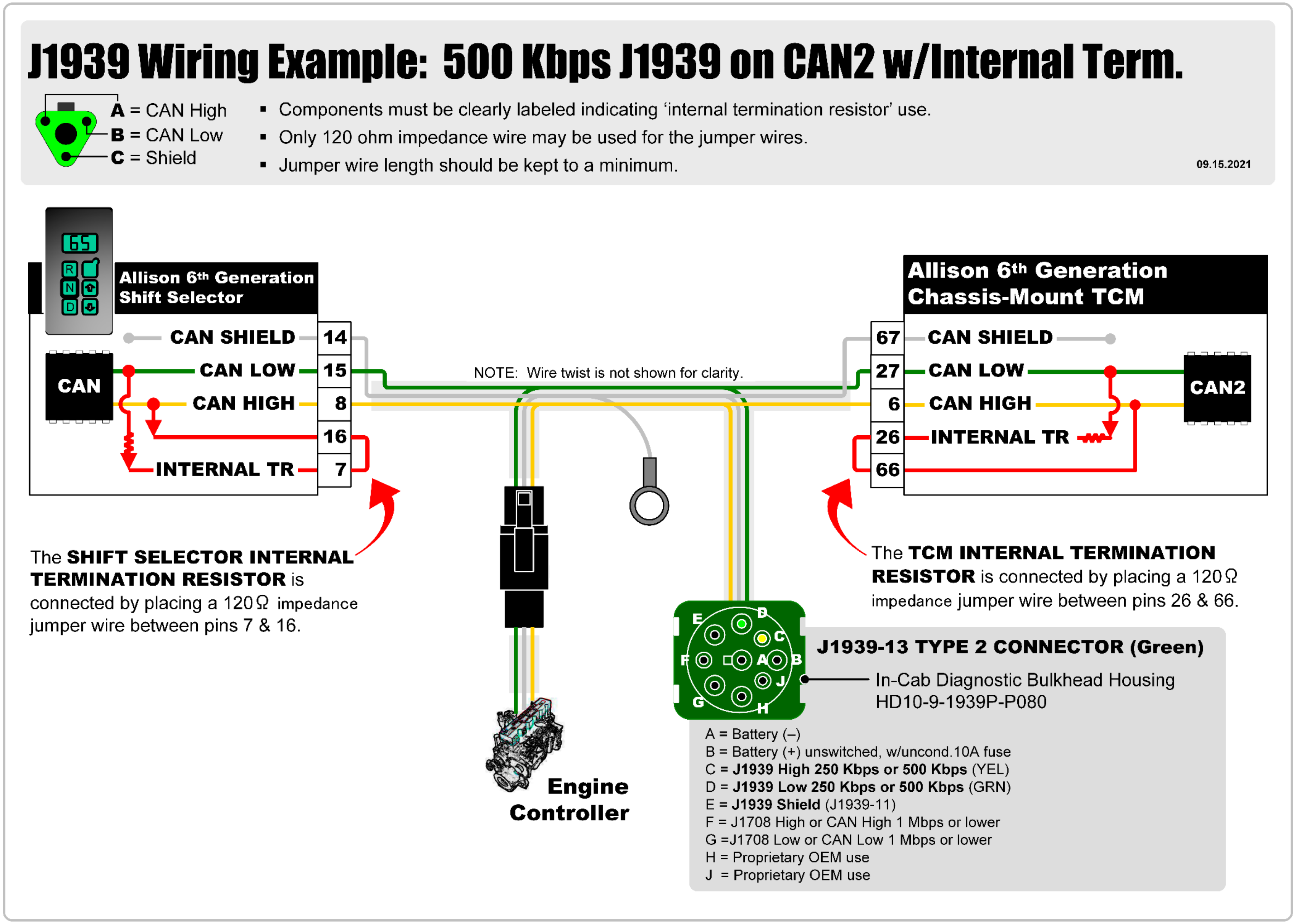
— A J2284-3 installation of a diagnostic connector connected to chassis-mount TCM CAN2.

These illustrations are not intended to replace SAE J1939 or Allison Datalink Tech Data requirements; they are intended as overviews for those getting acquainted with on-board vehicle networks.

D.2.8.1. *250 KBPS J1939 WIRING EXAMPLE, CHASSIS-MOUNT TCM WITH STUB CONNECTIONS*

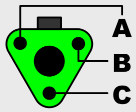


D.2.8.2. *500 KBPS J1939 WIRING EXAMPLE, CHASSIS-MOUNT TCM WITH INTERNAL TERMINATION*



D.2.8.3. *J2284-3 WIRING EXAMPLE, CHASSIS-MOUNT TCM WITH INTERNAL TERMINATION*

J2284-3 Wiring Example: Diagnostic Connector Installation on CAN2



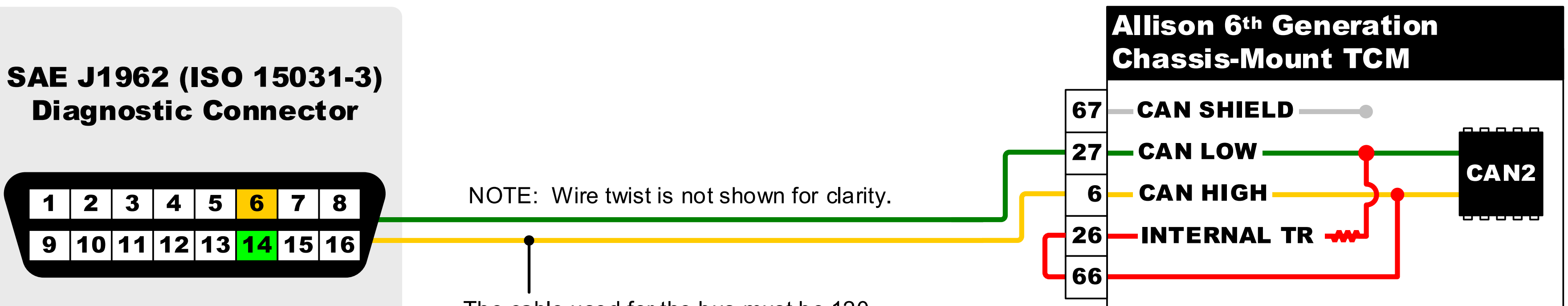
A = CAN High
B = CAN Low
C = Unused

- TCM must be clearly labeled indicating 'internal termination resistor' use.
- Only 120Ω impedance wire may be used for the jumper wire.
- Jumper wire length should be kept to a minimum.

09.15.2021

SAE J1962 (ISO 15031-3)
Diagnostic Connector

Allison 6th Generation
Chassis-Mount TCM



Pin 6 = **CAN High** (Yellow)
Pin 14 = **CAN Low** (Green)

Pin 4 = Chassis ground
Pin 16 = Permanent positive voltage

The cable used for the bus must be 120 ohm impedance cable. Per SAE J2284-3, shielding is not required, and there is no shield pin defined on the J1962 connector.

The distance between the TCM and diagnostic connector must be < 5 meters.

The **TCM INTERNAL TERMINATION RESISTOR** is connected by placing a 120Ω jumper wire between pins 26 & 66.

- Use of a **SINGLE TERMINATION RESISTOR** is a **SPECIAL CASE** permitted by J2284-3 when only **ONE** controller (our TCM) and **ONE** off-board service tool (DOC™) will be connected to the network.
- The system will work fine if two termination resistors are installed (one at each end of the backbone as done traditionally); the above special case was developed by vehicle OEMs as a cost saving measure.

D.2.9. CAN CABLE & CONNECTORS

D.2.9.1. *CABLE SUPPLIERS*

Allison does not endorse any specific cable supplier. J1939 compliant cable is available from various manufacturers, and national and international distributors.

D.2.9.2. *CONNECTOR SUPPLIERS*

Allison does not endorse any specific connector supplier. Deutsch (now Tyco Connectivity) is one of the more common connector suppliers for J1939. Information and part numbers in this section are provided for convenience and should be confirmed with the supplier.

D.2.9.3. *3-PIN WEDGE LOCK COLORS*

The most common CAN network connectors were developed from Deutsch's "DT" connector series, which traditionally used grey connector bodies with orange wedge locks. Orange locks were used for node connections while blue wedge locks were added to indicate termination resistors.

Around 1999, Deutsch introduced a new DT version with improved seal retention on the plugs. These connectors are distinguished by their black color, and use either green (node connections) or blue (termination resistors) wedge locks.

Node wedge lock color changed from orange to green to signify the new seal retention design. Termination resistor wedge locks remained blue; however, they have a different part number because of the newer seal retention design. The wedge locks and seals for the black plug connector assemblies <u>cannot</u> be interchanged with those on the grey plug connector assemblies.

D.2.9.4. *PART NUMBERS COMMONLY USED WITH UNSHIELDED CAN NETWORKS*

The following are all two-pin connectors. While effort has been made to ensure correctness, please contact your Deutsch connector supplier for the latest information.

Receptacles

DTM04-2P-P007 ... Receptacle, "Y" connector
DTM04-2P-E007 .... Receptacle, Grey, w/shrink boot adapter
DTM04-2P-P006 .... Receptacle, Grey, w/120 Ohm termination resistor
DTM04-2P-EE03 .... Receptacle, Black, w/shrink boot adapter
WM-2P .... Wedge Lock, Orange
WM-2PA .... Wedge Lock, Grey
WM-2PB .... Wedge Lock, Black
0460-202-2031 .... Pin, size 20, gold
1060-20-0144 .... Pin, size 20, gold, stamped and formed

Plugs

DT06-2S-P007 .... Plug, Grey, w/shrink boot adapter on tail
DT06-2S-P006 .... Plug, Grey, w/120 Ohm termination resistor
DT06-2S-EE03 .... Plug, Black, w/shrink boot adaptor
DT06-2S-EP10 .... Plug, Black, w/120 Ohm termination resistor
WM-2S .... Wedge Lock, Orange
WM-2SA .... Wedge Lock, Grey
WM-2SB .... Wedge Lock, Black
0462-201-2031 .... Socket, size 20, gold
1062-20-0144 .... Socket, size 20, gold, stamped and formed

D.2.9.5. *PART NUMBERS COMMONLY USED WITH SHIELDED NETWORKS*

While effort has been made to ensure correctness, please contact your Deutsch connector supplier for the latest information.

Receptacles

DT04-3P-P007 .... Receptacle, Grey, “Y” connector (shown at right)
DT04-3P-E008 .... Receptacle, Grey, w/shrink boot adapter (shown at right)
DT04-3P-LE08 .... Receptacle, Grey, w/bulkhead flange and shrink boot adapter on tail
DT04-3P-P006 .... Receptacle, Grey, w/120 Ohm termination resistor (shown at right)
DT04-3P-EE01 .... Receptacle, Black, w/shrink boot adapter on tail
DT04-3P-EP10 .... Receptacle, Black, w/120 Ohm termination resistor
W3P .... Wedge Lock, Green (functionally identical to former Orange part)
W3P-1939............... Wedge Lock, Blue, for grey termination resistor receptacle
0460-202-1631 .... Pin, size 16, gold
1060-16-0144 .... Pin, size 16, gold, stamped and formed
0460-247-1631 .... Pin, size 16, extended

Plugs

DT06-3S-E008 .... Plug, Grey, w/shrink boot adapter on tail (shown in assembly at right)
DT06-3S-P006 .... Plug, Grey, w/120 Ohm termination resistor (shown at right)
W3S .... Wedge Lock, Orange, for grey plug
W3S-1939............... Wedge Lock, Blue for grey plug
DT06-3S-EP11 .... Plug, Black, w/shrink boot adapter and seal retention groove on front. Two piece molding like the DT06-3S-E008.
DT06-3S-PP01 .... Plug, Black, w/120 Ohm termination resistor and seal retention groove
DT06-3S-PE01 .... Plug, Black, w/120 Ohm resistor w/seal retention groove & latch guard
DT06-3S-P032 .... Plug, Black, w/shrink boot adapter and seal retention groove (shown in assembly at right). This is a stronger single piece molding, and is shorter than the EP11.
W3S-1939-P012 ..... Wedge Lock, Blue (for black termination resistor plug w/seal retention lip)
W3S-P012 .... Wedge Lock, Green (for black plug w/seal retention lip)
0462-201-1631 .... Socket, size 16, gold
1062-16-0144 .... Socket, size 16, gold, stamped and formed
0462-221-1631 .... Socket, size 16, extended

“Type 1” 9-Pin Diagnostic

HD10-9-1939P .... Receptacle (shown in assembly at right)
HD10-9-1939PE ..... Receptacle w/reduced wire seal (for smaller wire, such as 18 gauge)
HD16-9-1939S .... Plug, w/coupling ring
HD16-9-1939SE ..... Plug, w/coupling ring and reduced wire seal
HD17-9-1939S .... Plug, no coupling ring (slip on)
HD17-9-1939SE ..... Plug, no coupling ring (slip on), reduced wire seal
0460-202-1631 .... Pin, size 16, gold
0460-247-1631 .... Pin, size 16, extended
0462-201-1631 .... Socket, size 16, gold
0462-221-1631 .... Socket, size 16, extended

“Type 2” 9-Pin Diagnostic

HD10-9-1939P-P080 ..... Cab mounted receptacle (shown at right)
HD10-9-1939P-BP03 .... Cab mounted receptacle, with jam nut mount
HDC16-9-E004 .... Sealing Cap
HD17-9-1939S-P080 ..... Plug, no coupling ring (slip on)
HD16-9-1939S-P080 ..... Plug, w/coupling ring
HD18-009 .... Strain Relief


DT04-3P-P007


DT04-3P-E008


DT04-3P-P006


DT06-3S-E008


DT06-3S-P006


DT06-3S-P032


HD10-9-1939P-P080


HD10-9-1939P

D.3. NETWORK SIGNAL INFORMATION

D.3.1. J1939 BUS LOADING

D.3.1.1. *GENERAL DISCUSSION*

Allison does not publish a recommended maximum bus loading, as the bus load capability of a CAN network in a given vehicle is only as high as that of the weakest component in the network.

For example, if a certain device on a network can only handle 30% bus loading, the resulting network is limited to 30% bus loading to preserve normal network and vehicle operation.

Allison components have been tested with success at bus load levels approaching 100%.

D.3.1.2. *ALLISON BUS LOAD CONTRIBUTIONS – 250 KBPS J1939*

Allison Component / Function	Bus Load Contribution
Base: 1000/2000 Series TCM	+9.8 %
Base: 3000/4000 Series TCM	+9.8 %
1st Allison J1939-based selector	+3.4 %
2nd Allison J1939-based selector	+0.6 %
Allison driveline retarder	+0.9 %
Engine Management activity; intermittent broadcasts	+5.0 %
Engine Brake control activity; intermittent broadcasts in certain applications	+1.0 to +2.0 %
TCM-Initiated Selector Calibration (TISC) event; only occurs at end of assembly line or during vehicle service	11 % max

The approximate values shown are for the CAN port set to SAE J1939 FULL FUNCTIONALITY and depend on the actual TCM calibration. The impact of an Allison transmission on a given vehicle installation can be approximated by adding up the contributions of the applicable components and J1939-based functions.

When 500 kbps operation is utilized, bus loading will be reduced to about half the 250 kbps level.

In some cases, VEPS options are available to disable unused TCM broadcast messages, thus reducing the Allison bus load contribution. In addition, Allison J1939-based shift selector(s) communication may be transferred to the CAN port set to SAE J1939 LIMITED FUNCTIONALITY.

D.3.2. CAN BIT TIMING

TCM and Allison shift selector CAN bit timing registers are set such that they produce the CAN chip operation shown in the tables below.

D.3.2.1. *TCM CAN BIT TIMING*

Item	250 kbps Baud Rate	500 kbps Baud Rate
Clock Frequency	80 MHz	80 MHz
Bus Frequency	250 kHz	500 kHz
Bit Time	4 µs	2 µs
No. of Samples	1	1
Sample Point 75 %:		
Time Quanta	250 ns	125 ns
SJW	3 TQ	3 TQ
Sample Point 80 %:		
Time Quanta	25 ns	25 ns
SJW	30 TQ	15 TQ
Sample Point 87.5 %:		
Time Quanta	125 ns	125 ns
SJW	3 TQ	2 TQ

D.3.2.2. *6TH GEN SHIFT SELECTOR CAN BIT TIMING*

Item	250 kbps Baud Rate	500 kbps Baud Rate
Clock Frequency	80 MHz	80 MHz
Bus Frequency	250 kHz	500 kHz
Bit Time	4 µs	2 µs
No. of Samples	1	1
Sample Point	87.5 %	87.5 %
Time Quanta	250 ns	125 ns
SJW	2 TQ	2 TQ