SECTION D
VEHICLE ELECTRICAL SYSTEM INTERFACE

ALLISON 6TH GENERATION CONTROLS

APPLICABLE MODELS: 1000/2000 Product Family
2900 Product Family
3000 Product Family
4000 Product Family

Contents:

SECTION D: VEHICLE ELECTRICAL SYSTEM INTERFACE

1.0 INTRODUCTION

The purpose of this section is to discuss the electrical interfaces between the transmission controls and the vehicle electrical systems which are necessary for basic transmission and vehicle operation.

2.0 REFERENCED DOCUMENTS

Unless otherwise noted, all documents referenced in this document may be found in the Allison HUB website at https://hub.allisontransmission.com/login. To locate the referenced documents look for Tech Data under the Engineering heading on the Allison HUB home page. In this document, these references are identified by italic font. Contact your Allison Transmission representative if you do not have access to the Allison HUB. A list of all items referenced in this document can be found at the end of this document.

3.0 GENERAL REQUIREMENTS

3.1 VEHICLE ELECTRICAL SYSTEM

For some functions the Allison 6th Gen Controls utilize a ground path through the transmission case to the chassis. In order for these functions to operate properly, the vehicle chassis **must** be connected to battery ground. A floating chassis ground is not acceptable with Allison Transmission installations.

Electrical grounding for the transmission case is accomplished through mounting to the engine or chassis. Electrically connecting any additional wires to the transmission housing or to items mounted to the transmission is not permitted. The transmission must not be used as a ground path for any other vehicle electrical system.

3.2 TRANSMISSION CONTROL SYSTEM

This section defines and describes the transmission control system interface with the vehicle. The transmission control system operating specifications are found in *Allison 6th Generation Controls System Data*.

For transmission interface wiring, refer to the following *System Schematic Installation Drawings*:

- *AS07-621,* 1000 & 2000 Product Families
- *AS07-628,* 2900 Product Families (Shift-by-Wire)
- *AS07-629,* 2900 Product Families (Shift-by-Cable)
- *AS07-622,* 3000 & 4000 Product Families, Base Models
- *AS07-624,* 4000 Product Family, 7-Speed Models

As an alternative to the electrical interfaces discussed in this section, some functions may be provided through the SAE J1939 vehicle communications interface, including the following:

- CHECK TRANS indicator light
- TRANS SERVICE indicator light
- RANGE INHIBITED indicator light
- Neutral Start
- Speedometer Signal
- Reverse Warning
- Anti-lock Brake System (ABS) Input
- Service Brake Status Input
- Retarder Active Indicator
- Retarder Modulation Controls
- Sump/Retarder Temperature Indicator

- Engine Water Temperature Signal
- Range Requested

For additional information refer to *Datalink Communications*.

An optional Vehicle Interface Module (VIM), which contains relays and fuses that are necessary for proper system operation and protection, is available from the Allison Parts Distribution Center (PDC). For more information, refer to *Installation Drawing AS07-552*.

Interface wiring supplied and installed by the vehicle builder must comply with all requirements in *Technical Document 173 (TD173), Wiring Harnesses for Allison 4th, 5th & 6th Generation Controls*.

NOTE: All relay coils, solenoids, and inductive loads associated with the transmission system must be suppressed. Any relay or inductive load driven by the TCM or VIM must be suppressed. Suppression reduces inductive switching transients and the possibility of coupling the transients into the transmission electronics. Diode suppression is recommended because it provides the best protection against excessive voltage peaks. The TCM provides suppression for all transmission solenoids.

NOTE: The output provisions of the TCM are designed to be compatible with both indicator lamps and relays. With this design, leakage current in the circuits of the TCM output provisions may be sufficient to slightly illuminate (glow) some LEDs, depending upon their operating characteristics. One possible solution to a glowing LED is to install a 10k resistor in parallel to the LED.

Circuits affected by this phenomenon are:
- **Check Transmission light**
- **Range Inhibited Indicator light**
- **Output functions associated with I/O Function Packages.**

The Allison Service Department has established required maximum times for removal and replacement (R&R) for Allison transmissions, controls, and related components. For additional information regarding these requirements, refer to *Technical Document 176 (TD-176), Service Requirements – Removal and Replacement Times for Allison Transmissions*.

4.0 INTERFACES RELATED TO TRANSMISSION OPERATION

The following electrical connections are required for proper transmission operation:
- TCM power
- TCM system ground
- Ignition power
- CHECK TRANS light
- TRANS SERVICE light
- Range Inhibited Indicator light (1000/2000 Product Family and 2900 Product Family only)

4.1 TCM POWER AND GROUND REQUIREMENTS

The TCM must have a dedicated power and ground. If not, parasitic noise currents may be introduced into the TCM through the circuits shared with other vehicle systems. Failure to provide dedicated power and ground may result in degraded transmission system performance. Installation of the power and ground wires must meet the following requirements:

- The power and ground wires must be connected to the battery in one of two ways:
  - Connect the TCM power supply and ground wires directly to the battery terminals

- Connect the TCM power supply and ground wires directly to power supply and ground points which are dedicated to vehicle electronic devices. Refer to Figure D-1.

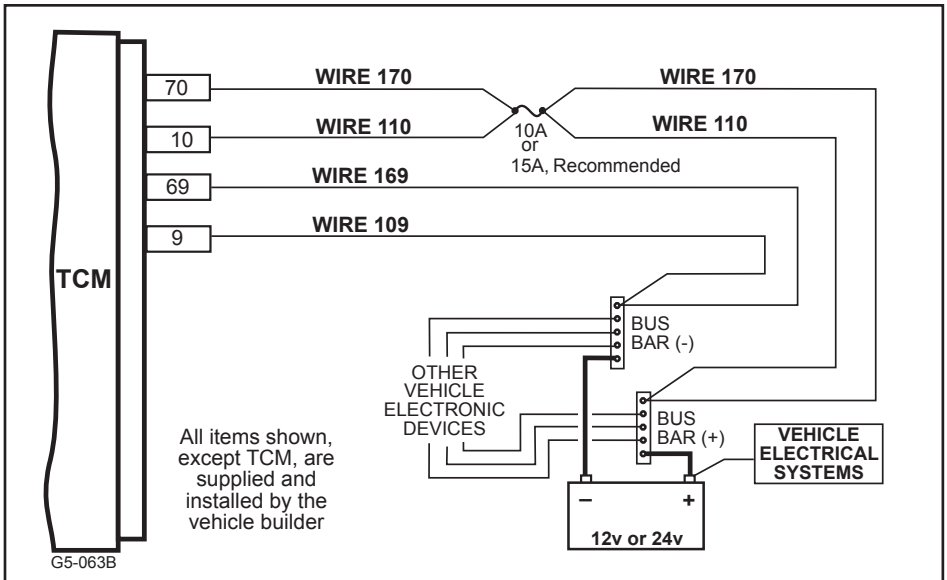


Figure D-1: Power/Ground Circuits

Such electronic devices must draw no more than 30 amps and conform to an EMC specification equivalent to SAE J1455. Total resistance for the connection from battery to bus bar must not exceed 1 mOhm. 0-GA wire is recommended. **DO NOT** attach wiring for other vehicle systems to terminals or bus bars used for the transmission TCM system. This design provides suitable power and ground paths to the TCM if heavy resistive and electromechanical loads are not attached to these points.

- When making connections to bus bar terminals, **DO NOT** attach more than two ring terminals to either the TCM power or TCM ground bus bar stud. This reduces the potential for loosening of terminals over time.

- Total resistance for transmission TCM power circuit or ground circuit **MUST NOT** exceed a maximum of 100 mOhms. Total resistance includes cables, wires, and bus bar. Refer to *Allison 6th Generation Controls System Data* for assistance with estimating maximum allowable wire lengths.

- The TCM must have a power source and a ground that will maintain, under all operating conditions, the minimum supply voltage defined in *Allison 6th Generation Controls System Data*.

- Power supply and ground wires must be as short and direct as possible to minimize voltage drop.

- The number of electrical connections between the TCM and battery must be minimized to reduce the potential for poor connections and corrosion.

CAUTION: The TCM power supply and ground wires must be disconnected from the battery when welding is done on the vehicle.

4.2 TCM POWER (WIRES 110 AND 170)

The TCM power supply lines provide power directly to the system from the battery. In addition to the requirements in paragraph 4.1, the TCM power supply circuit must meet the following requirements:

NOTE: To minimize possible problems caused by power fluctuation, no high resistive electrical or electromechanical loads are allowed on the TCM power circuit.

NOTE: The TCM must have power at all times when the engine is running and for a short period of time after engine power-down. Refer to paragraph 4.4, Ignition (Wire 163), for further details.

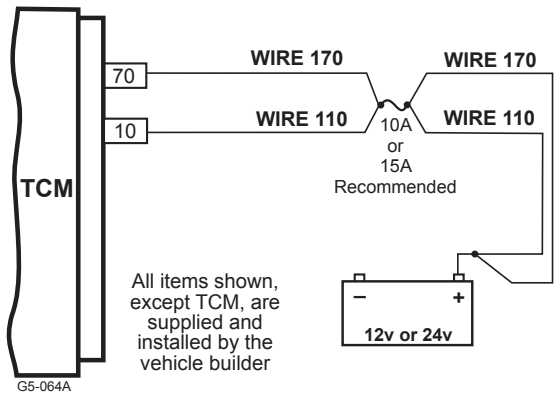


Figure D-2: Master Disconnect Switch Installation

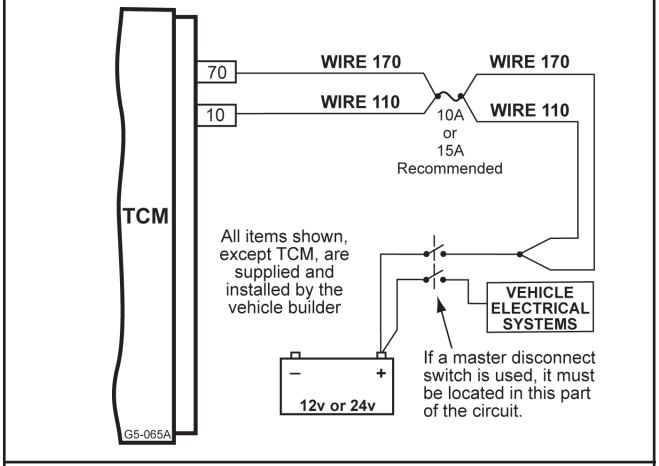


Figure D-2: Master Disconnect Switch Installation

- If the vehicle is equipped with a master disconnect switch for the electrical system, the disconnect must be in the positive (power) side of the system. Isolating the TCM from other vehicle electrical loads at the master disconnect switch, as shown in Figure D-2, will ensure that the TCM will not be affected by electrical load or electrical noise fluctuations.

  Locating the Master switch in the negative (ground) side of the system may result in the TCM being powered at all times, even when the switch is in the Off position, resulting in excessive drain on the battery. Locating the disconnect in the negative side (ground) of the system may also result in noise generated in the system and possible loss of transmission system functions.

- The TCM has internal protection from reverse polarity. The vehicle builder is responsible for evaluating the need for a fuse or circuit breaker in the power supply to the TCM. The 12-volt or 24-volt power may be provided to the TCM through a fuse or circuit breaker. This option is represented by a fuse shown on the *System Schematic Installation Drawings*. The optional vehicle interface module (VIM) contains a 15A fuse for the TCM power supply.

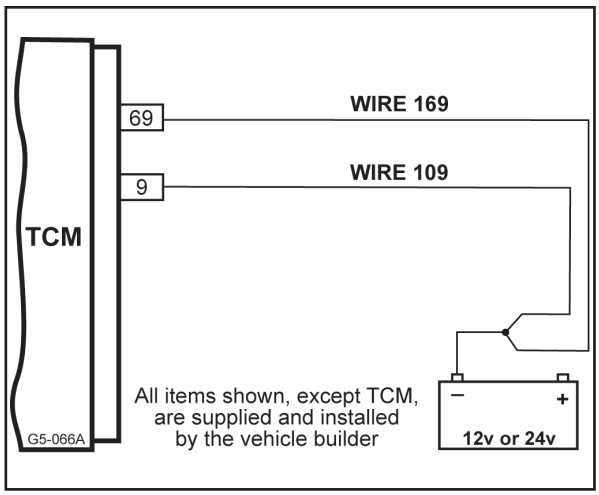
4.3 TCM SYSTEM GROUNDS (WIRES 109 AND 169)

Wires 109 and 169, system grounds, provide battery ground to the TCM. In addition to the requirements in paragraph 4.1, the TCM ground circuits must meet the following requirements:

CAUTION: Do not ground vehicle systems to the TCM signal return or ground terminals.

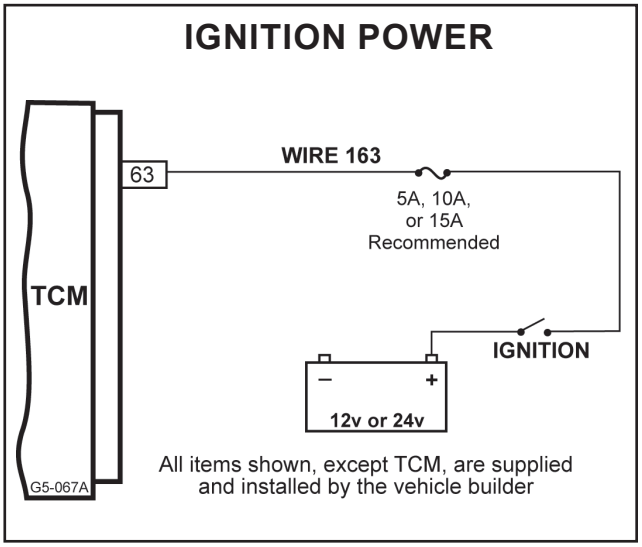
NOTE: The most common installation problem associated with TCM voltage is an inadequate ground. To minimize these potential problems:

- **Never use chassis for system grounds.**
- **DO NOT use the transmission TCM ground or return wire as a ground point for any other system.**
- **Do not ground the TCM to a common point with other large loads such as headlights, sirens, large solenoids, or non-electronic loads. These can cause voltage surges and intermittent symptoms.**
- **Do not connect signal return wires 103 and 158 to any other ground wire or to chassis ground.**



4.4 IGNITION (WIRE 163)

The ignition sense power signal is turned on with the ignition switch. The signal from Wire 163 turns the TCM on from its power-down state. The TCM then reads the calibration data in memory, checks all sensors for readiness, then commands the transmission and shift selector to Neutral. The throttle position calibration is adjusted as necessary from the stored data, and the neutral start relay activates to permit starting of the engine.



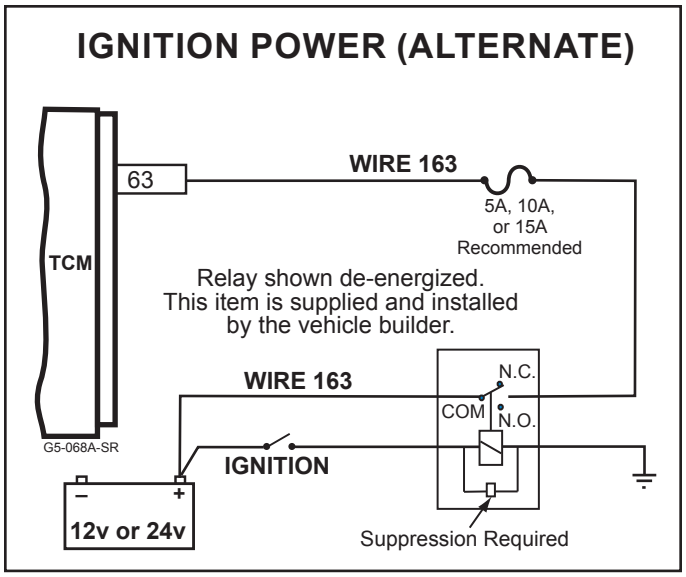
After the ignition switch is turned Off, the TCM will power-down when both input and output speeds are zero and the appropriate data has been stored in memory. This process is normally completed in approximately two seconds. If the system has a display, the display will go blank after the process is completed. TCM power, as described in 4.2, TCM Power, must be maintained during the power-down period.

The TCM ignition power signal may be provided through a 5, 10, or 15 amp fuse, or a manually-reset circuit breaker. This option is represented by a fuse on the *System Schematic Installation Drawings*. A 10 amp ignition circuit fuse is included with the optional Allison vehicle interface module (VIM).

NOTE: **The Ignition Power wire MUST stay powered as follows:**

- **Continually during engine cranking**
- **Continually during transition from the crank position of the start switch to the on or run position**
- **Continually once the engine is running in order to achieve proper operation of the relays which control the Neutral Start, Reverse Warning, and other transmission-related vehicle functions.**

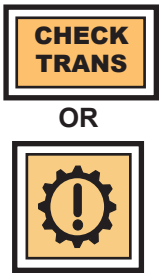
This wire MUST NOT be powered in the accessory position, as it may cause significant and unnecessary drain on the battery.



NOTE: **Ignition input to the TCM must be free of unsuppressed inductive loads. If the source defined by the IGNITION POWER diagram does not meet this requirement, refer to the IGNITION POWER (ALTERNATE) diagram.**

NOTE: **If the vehicle electrical system is a "Dual Voltage" system, the TCM Ignition Power must originate from the same power source as the TCM Battery Power (wires 110 and 170) so that if a "Load Dump" occurs, the voltage profile present at the TCM ignition pin is the same as the voltage profile present at the TCM power pins. Dual Voltage systems may be present on vehicles with multiple alternators or those having both 12 volt and 24 volt electrical systems. A Load Dump may occur when a battery terminal is suddenly disconnected while the alternator has a high charging demand.**

4.5 CHECK TRANS LIGHT (WIRE 129)



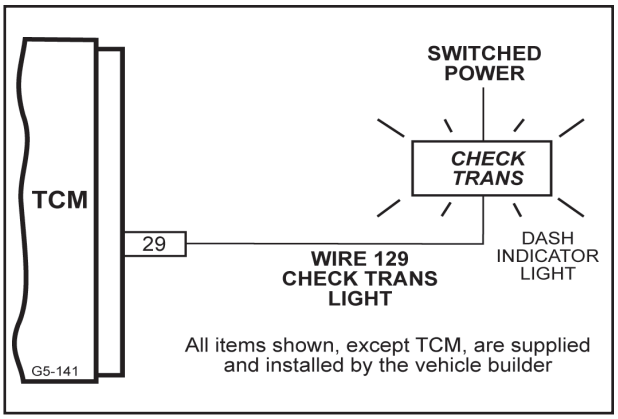
Every installation is required to have a CHECK TRANS warning light to indicate that a problem has been detected in the transmission or control system. When the CHECK TRANS is illuminated transmission shifts may be restricted. For further operational information, refer to *Section B: System Operation* for the *1000/2000 Product Family* , *2900 Product Family*, or for the *3000 and 4000 Product Families*.

The CHECK TRANS light is supplied and installed by the vehicle builder. The CHECK TRANS light must have the following properties:

- Labelled CHECK TRANS or include the ISO 2575 symbol as illustrated
- Yellow or amber color is highly recommended
- Clearly visible both in bright sunlight and at night
- Circuit must include a relay if the current is 0.5 amps or greater
- Located in the dash panel. If the vehicle is equipped with two shift selectors, the indicator must be clearly visible from both operator stations or two indicators must be installed in parallel.

The light may be controlled by one of two methods:

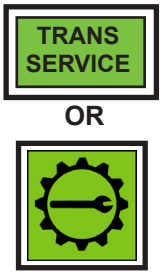
- Discrete TCM output on wire 129, see illustration. The light will illuminate briefly at TCM power-up as a bulb check.
- Messages over the SAE J1939 datalink. Refer to *Datalink Communications* for additional information. The controller that physically activates the light provides the bulb check at start-up.



When installed using wire 129, the **CHECK TRANS** light is illuminated when the TCM switches wire 129 from OPEN to GROUND. If current draw exceeds 0.5 amps, the light must be activated through a circuit that includes a relay.

NOTE: Do NOT use this signal in a vehicle shutdown system.

4.6 TRANS SERVICE INDICATOR



This indicator is applicable to transmission installations that utilize the Prognostics features of the transmission controls system. Illumination of the indicator alerts the operator that transmission service is required. The nature of the service issue can be determined by one of the following:

- Monitoring the behavior of the **TRANS SERVICE** light; refer to *Section B: System Operation* for the *1000/2000 Product Family* , *2900 Product Family*, or for the *3000 and 4000 Product Families*.
- Dash display messages based on messages sent by the TCM over the vehicle SAE J1939 datalink; refer to *Datalink Communications*
- Using the *Allison DOC®* diagnostics program

A **TRANS SERVICE** indicator is required in the following installations:

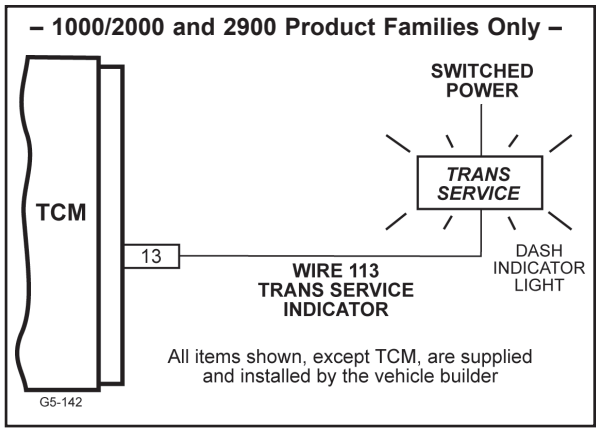
- 1000/2000 Product Family transmissions that utilize the Prognostics feature.
- 2900 Product Family transmissions that utilize the Prognostics feature with Shift-by-Cable.
- 3000 and 4000 Product Family transmissions that utilize the Prognostics feature and are equipped with an Allison strip pushbutton selector, which has no display.

The indicator is optional for the 2900 with Shift-by-Wire, 3000 and 4000 Product Family transmission installations with the Allison keypad pushbutton or bump lever shift selectors. A **TRANS SERVICE** indicator icon is provided as a standard feature of the Allison shift selector display.

Listed below are three options for implementing the **TRANS SERVICE** indicator:

- An SAE J1939-based vehicle controller activates a dedicated **TRANS SERVICE** dash light as directed by the SAE J1939 message broadcast by the TCM. Examples of recommended light configurations are illustrated at the right.
- SAE J1939 messages broadcast by the TCM are used for an informational text display in the dash. A standard red or amber SAE warning light may be used in conjunction with the text display, but is not required.

- 1000/2000 and 2900 Product Families: Discrete TCM *Output O* on wire 113 may be used to illuminate a dedicated **TRANS SERVICE** light on the vehicle dash. If the light is enabled in this manner, the light will illuminate briefly at TCM power-up as a bulb check.



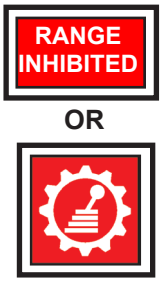
Per standard J1939 practice, the controller which physically activates this light must perform a bulb check or functionality check at the beginning of each ignition key switch cycle. Refer to *Datalink Communications* documentation for additional information and requirements.

The **TRANS SERVICE** indicator is supplied and installed by the vehicle builder. This indicator must have the following properties:

- If the indicator is a dedicated light, it must be labelled **TRANS SERVICE** or include an appropriate ISO symbol or symbols.
- Indicator must be clearly visible both in bright sunlight and at night. Green color is highly recommended.
- Circuit must include a relay if the current is 0.5 amps or greater
- Indicator must be located in the dash panel. If the vehicle is equipped with two shift selectors, the indicator must be clearly visible from both operator stations or two indicators must be installed in parallel.

4.7 RANGE INHIBITED INDICATOR (WIRE 124) – 1000/2000 AND 2900 PRODUCT FAMILIES ONLY

The Range Inhibited Indicator (RII) alerts the operator that transmission operation is being inhibited and that range shifts being requested by the operator may not occur. Refer to *Section B: System Operation – 1000/2000* for further operational information.

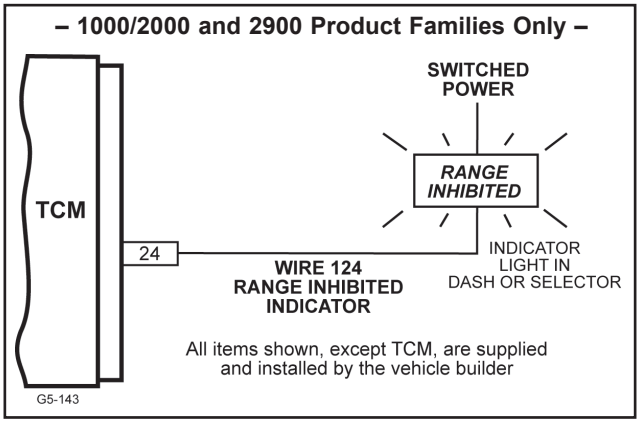


This indicator is required for all installations of the 1000 and 2000 Product Families. The RII light may be controlled by one of the following methods:

- Discrete TCM output on wire 124 may be used to illuminate a dedicated **RANGE INHIBITED** light on the vehicle dash. If the current is 0.5 amps or greater, the circuit must include a relay. The TCM will illuminate the light briefly at power-up as a bulb check.
- Messages sent by the TCM over the SAE J1939 datalink may be used to illuminate the RII dash light. A bulb check is suggested, but requires special handling by the module that controls the light. The datalink message from the TCM does not provide the bulb check feature. Refer to *Datalink Communications* for additional information on J1939 implementation.

The RII light is supplied and installed by the vehicle builder. The RII must have the following properties:

- Labelled **RANGE INHIBITED** or **RANGE INHIBIT**
- Preferred color is yellow or amber, which is consistent with ISO symbol color conventions
- Clearly visible both in bright sunlight and at night
- Located in the dash panel, on the shift selector, or near the shift selector. If the vehicle is equipped with two shift selectors, the indicator must be clearly visible from both operator stations or two indicators must be installed in parallel.



5.0 INTERFACES WITH VEHICLE FUNCTIONS

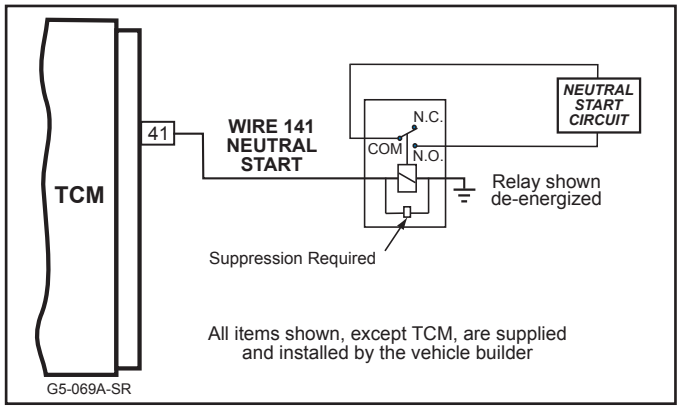
The following transmission controls functions are provided to support or perform vehicle functions which may be mandated by various governing bodies:

- Neutral Start
- Speedometer Signal
- Reverse Warning
- Anti-lock Brake System (ABS) Input
- Shift Selector Dimmer (2900 Shift-by-Wire, 3000 & 4000 Product Families Only)

5.1 NEUTRAL START / CRANK ENABLE (WIRE 141)

The Neutral Start / Crank Enable signal indicates when the transmission is in Neutral or Park (if equipped with Park position) for starting the engine. It is available as a discrete TCM output on wire 141 or as an SAE J1939 message.

The discrete output on wire 141 goes from open to + TCM voltage (+12V or +24V) when Neutral or Park (if equipped with Park position) has been selected with the shift selector and attained by the transmission. This output is defined only for passive loads such as a relay.



NOTE: The Neutral Start / Crank Enable signal is not intended to be used as a direct input to other controllers. The relay contact circuit must be protected by a 15 amp fuse, which is supplied and installed by the vehicle manufacturer.

NOTE: Voltage during engine cranking must not fall below the relay dropout voltage.

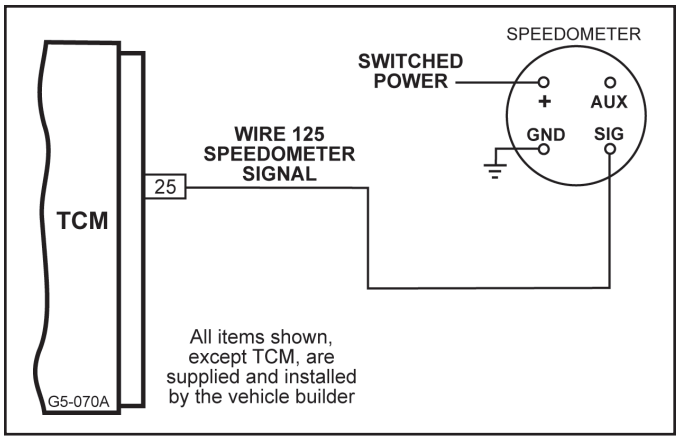
Do not use the neutral start feature to interface with auxiliary vehicle systems which require neutral indication. Two output functions, *Output C, Range Indicator,* and *Output S: Neutral Indicator for PTO and PTO Request*, are available for this purpose. Refer to the Allison HUB for detailed documentation of these output functions. The Auto Neutral input functions (such as L, O, AG, AK, CD, CF and CH) do not activate the neutral start wire.

A neutral start relay is provided in the optional VIM.

5.2 SPEEDOMETER SIGNAL (WIRE 125)

This signal provides a zero to (V_{BAT}–2) volt pulse signal from the TCM to drive an electronic speedometer. This signal conforms to a 50% duty cycle square wave as defined in the *Allison 6th Generation Controls System Data*. The number of pulses per output shaft revolution may vary by calibration and transmission model. The 1000, 2000 and 2900 Product Families calibration default is 16 pulses per revolution with an option of 8 or 40 pulses per revolution. The 3000, 4000 Product Families calibration default is 16 pulses per revolution with the option for 8 pulses per revolution. Refer to the *Allison 6th Generation Controls System Data* for detailed definition.

The speedometer signal may be used directly by the speedometer or other device. 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 speedometer signal. The receiving device may need to implement signal filtering provisions appropriate for the intended use. If a different type of speedometer signal is needed, wire 125 may be used as an input to a signal converter. Signal converters are used to convert the TCM output signal into either zero-crossing or non-zero-crossing format. See *Section F: Support Equipment* of this manual for sources of electronic speed signal distribution modules which have this conversion capability.



NOTE: This signal will not accurately represent transmission output speed below a low-speed threshold. Before using this signal as an input to another vehicle system controller relating to very low vehicle speed, the signal must be verified for the intended use. Refer to the discussion regarding Speedometer Output in *Allison 6th Generation Controls System Data*.

CAUTION: DO NOT splice into the transmission harness to use the signal directly from the speed sensors. The speed sensor signal is for use only by the transmission TCM.

If a transmission output shaft speed signal is needed for a tachograph or other electronic device, the optional tachogaph provision may be used. Refer to *Tachograph Drive Provision* for more information.

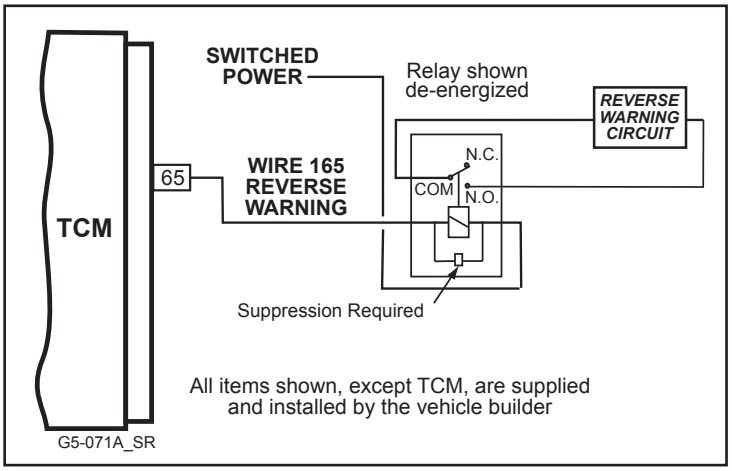
Transmission output speed is also available over the SAE J1939 datalink. Refer to *Datalink Communications*.

5.3 REVERSE WARNING (WIRE 165)

This signal is used to activate backup lights or an audible reverse warning signal when the transmission is in reverse. Reverse Warning is available as a discrete TCM output on wire 165 or as an SAE J1939 message.

If implemented using wire 165 an external relay is required. Wire 165 goes from open to ground when Reverse has been commanded by the TCM.

The optional Vehicle Interface Module contains a relay for Reverse Warning.



NOTE: The relay contact circuit must be protected by a 15 amp fuse, which is supplied and installed by the vehicle manufacturer.

5.4 ANTI-LOCK BRAKE SYSTEM (ABS) INPUT

If the vehicle is equipped with an anti-lock brake system (ABS), an interface between the ABS and transmission control system is required. This interface facilitates the disengagement of the transmission lockup clutch during vehicle braking conditions which activate the vehicle's ABS system. In addition, the TCM modifies the downshift points during an ABS event. For 3000 and 4000 Product Family models with a retarder, the TCM can also disable the retarder when ABS is active. The retarder's response to an ABS event can be selected when defining the calibration. The response is defined by setting the calibration parameter "RETARDER: Cancel Retarder when ABS Input is Active". The default setting, Yes, will result in the retarder being disabled when the ABS input is active. Refer to *Allison Calibration Configuration Tool (ACCT)*. The ABS input signal interface to the TCM is accomplished in one of two ways:

- The transmission TCM detects an ABS active message on the SAE J1939 data link. Refer to *Datalink Communications* and *Input Y, Anti-Lock Brake System Input*.
- The transmission TCM receives a discrete ABS Active input signal from the ABS system. Refer to *Input Y, Anti-Lock Brake System Input*.

5.5 ROAD SPEED GOVERNORS

Automatic vehicle speed controls, sometimes called road speed governors or cruise control, are often used in medium duty and heavy duty vehicles.

As an integral function of controlling transmission operation, the shift controls monitor output shaft speed and throttle position when determining transmission shift points. Road speed controls typically monitor transmission output shaft speed, and subsequently control the vehicle speed while overriding the throttle position. For electronically-controlled engines, the throttle position is typically indicated as full throttle under these conditions, which results in a false signal being sent to the transmission controls. This condition can create incorrectly scheduled shift points and unacceptable shift quality.

To correct this situation, specific messages in the SAE J1939 communication link must be implemented when road speed limiting or cruise control is in use. Refer to *Datalink Communications*. If the J1939 communication link is not used, the Allison throttle position sensor must be used, or a PWM throttle signal must be active, when the cruise control or road speed limiting function is active.

An area of concern in the use of road speed controls is speedometer accuracy and readability. In some cases, vehicles equipped to perform within the above guidelines experienced shift problems. Investigation revealed that the actual vehicle speed was, in fact, being governed at a point **below** the predicted range upshift point, but the indicated speed was **above** the expected shift point. This error results from a combination of several factors: readability of the speedometer, variations in tire size specifications and actual rolling radius, and tolerance in speedometer calibration. To address this problem, either the Road Speed Governor control speed must be raised or the transmission top range shift speed must be lowered.

5.6 SHIFT SELECTOR DIMMER – 2900 SHIFT-BY-WIRE, 3000 & 4000 PRODUCT FAMILIES ONLY

The following features are illuminated on the Allison shift selectors:

- Display – keypad pushbutton and bump lever shift selectors
- MODE button – keypad pushbutton and bump lever shift selectors
- Range buttons – keypad and strip pushbutton selectors

The brightness of these features can be controlled by connecting the selector's dimmer input to the dash dimmer switch. Refer to the *System Schematic Installation Drawings*.

NOTE: The shift selector microprocessor, which controls the selector backlighting, is initialized by an ignition signal and not by power in the headlight circuit. Thus, the shift selector backlighting and dimmer are functional only when both the headlights AND the ignition are turned on.

The following types of dimmers may be used to control the intensity of the selector backlighting:

- **Analog/resistive dimmers** that operate from 0 volts to + battery voltage. Brightness is proportional to average dimmer voltage with respect to the + battery voltage.
- **PWM dimmers** that operate based on percent duty cycle. Low duty cycle yields low brightness. High duty cycle yields high brightness. The frequency of the PWM signal may range from 50 to 2000 Hz. The voltage must cycle between 0-volts and + battery voltage.

When the headlights and dimmer are turned off, daylight conditions are assumed and the selector lighting is restored to full brightness. If configured to use the hardwire input and the wire is not connected, the display will be at full brightness and there will be no backlighting for all the keypad buttons.

The shift selector dimmer may also be controlled by SAE J1939 messages; refer to *Datalink Communications*. If the dimmer is controlled via J1939, the source of the dimmer control must be specified when the TCM calibration is defined.

5.6.1 KEYPAD PUSHBUTTON SELECTOR:

Display: (Vacuum Fluorescent)	Nine discrete settings – Off, Maximum Brightness, and seven intermediate step-increase settings
MODE Button Backlighting (LED)	Eight discrete settings — Off and seven settings for On (step-increases)
RANGE Button Backlighting (LED)	Eight discrete settings — Off and seven settings for On (step-increases)

If the selector is not wired into the dimmer circuit, the Display will always be at full brightness as if the dash lights are off. But, there will be no backlighting for the MODE Button and the Range Buttons.

5.6.2 STRIP PUSHBUTTON SELECTOR:

Display:	Display is not available with this selector.
MODE Button Backlighting:	MODE button is not available with this selector.
Range Button Backlighting: (LED)	Eight discrete settings – Off and seven settings for On (step-increases)

If the selector is not wired into the dimmer circuit, there will be no backlighting for the Range Buttons.

5.6.3 BUMP LEVER SELECTOR:

Display: (Vacuum Fluorescent)	Nine discrete settings – Off, Maximum Brightness, and seven intermediate step-increase settings
MODE Button Backlighting (LED)	Eight discrete settings — Off and seven settings for On (step-increases)

If the selector is not wired into the dimmer circuit, the Display will always be at full brightness, as if the dash lights are off. But, there will be no backlighting for the MODE Button.

6.0 INTERFACE WITH VEHICLE COMMUNICATIONS

Allison 6th Generation Controls support the SAE J1939 communications protocol. Refer to *Datalink Communications* for detailed communication link information.

6.1 GENERAL COMMUNICATION

The TCM supports three separate CAN ports, CAN1, CAN2 and CAN3, as follows:

- CAN1 and CAN2 are used for communications with
  - Other electronic on-vehicle systems
  - Shift selectors
  - Diagnostic tools
  - Allison Hybrid components
- CAN3 is currently for diagnostic use only.
- SAE J1939 communication is supported at 250 kbps or 500 kbps for all three CAN ports.
- Protocol assignments and network speed are configurable for each CAN port.

Refer to *Datalink Communications*.

Allison's shift selectors auto-detect the baud rate of the network they are connected to. If dual selectors are used, both selectors must be connected to the same CAN interface, either CAN1 or CAN2.

6.2 PHYSICAL INTERFACE

The TCM CAN ports may be connected to the following networks:

- SAE J1939-11
- SAE J1939-14
- SAE J1939-15
- SAE J2284-3 for diagnostic communication only

NOTE: Allison Transmission strongly recommends the use of shielded cable such as SAE J1939-11. Shielded cable significantly reduces the susceptibility of the system to electromagnetic interference, which can cause system malfunctions. Refer to *Datalink Communications*.

Internal termination in the TCM is available on CAN1 and CAN2. For interface wiring, refer to the *System Schematic Installation Drawings* and to *Datalink Communications*.

6.3 DIAGNOSTIC SUPPORT

The vehicle manufacturer must provide a diagnostic connector for use with the *Allison DOC®* diagnostic program. The diagnostic connector must be appropriate for the physical interface being used; refer to *Datalink Communications* for details.

Allison 6th Gen Controls support the following diagnostic protocols for non-Allison diagnostic tools or for vehicle dash displays:

- SAE J1939-73
- UDS with SAE J2012 DTC format
- SSF14230 with SAE J2012 DTC format

The diagnostic protocol must be specified when the TCM is defined.

The diagnostic connector must meet the following installation requirements:

- Be located in an area of the driver's compartment that is clean and dry, and where a technician can easily access the connector.
- Be protected with a cover when the connector is not in use.

NOTE: Transmissions using Allison 6th Generation Controls, in general, are not compatible with industry OBDII (On-Board Diagnostics II) requirements. If your vehicle must satisfy these requirements, contact your Allison Customer Integration Engineering representative.

7.0 ELECTRICAL CONNECTIONS REQUIRED FOR CERTAIN TRANSMISSION OPTIONS

7.1 RETARDER OPTION – 3000 & 4000 PRODUCT FAMILIES ONLY

The following functions may be required for retarder models. Each may be used independently in a separate circuit to perform its function as described, or they may be used together in an integral retarder control circuit. As an option, some requirements may be satisfied through the use of retarder-related messages broadcast over the SAE J1939 communications network. Refer to *Datalink Communications*.

Refer to *Section B: System Operation – 3000/4000 Product Families* in this manual for further information regarding retarder operation.

7.1.1 RETARDER ENABLE SWITCH

Every retarder installation is required to have an enable/disable switch. Refer to *Retarder Interface Input, Input Z*, on the Allison HUB for a detailed description and wiring schematic. The switch is supplied and installed by the vehicle builder.

7.1.2 RETARDER ACTIVE INDICATOR

Every retarder installation is required have a provision to illuminate the vehicle brake lights when the retarder is in use; except during Retarder: Enhanced Speed Control operation. Simultaneous illumination of an optional dash mounted indicator light may also be desirable. Both items are supplied and installed by the vehicle manufacturer.

The TCM provides a discrete signal which indicates that the retarder is in use. Additional description and a wiring schematic are included with *Retarder Interface: Input Z / Output Q*.

The TCM also broadcasts a message indicating the retarder is active over SAE J1939; refer to *Datalink Communications* for additional information.

7.1.3 RETARDER MODULATION CONTROLS (WIRES 112, 156, 158)

Retarder modulation controls provide a means for the operator to request a desired level of retardation. The various types of retarder controls are discussed in *Section A-1: Controls System Familiarization* of this manual and in *Technical Document 175 (TD175), Guidelines for Selecting Retarder Controls*.

The schematic at the right shows the interface of the retarder modulation controls to the TCM.

7.1.4 SERVICE BRAKE STATUS (SBS) INPUT

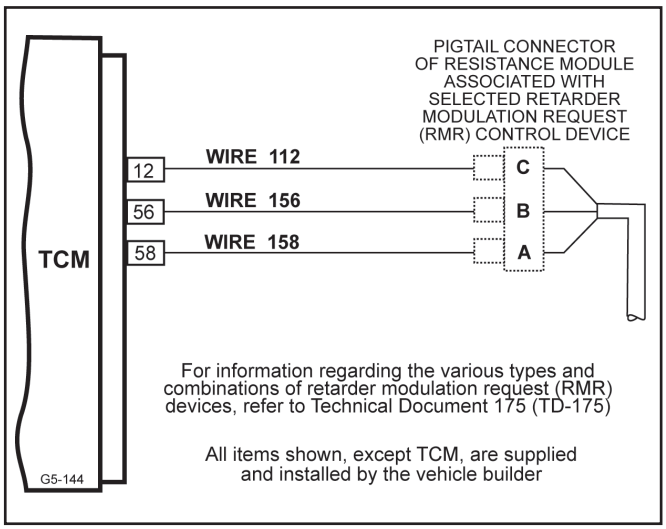
All retarder installations require an input to the TCM indicating when the service brakes are applied. If the throttle position signal is lost, the TCM typically reacts as though the engine is at full throttle. Under normal circumstances, the TCM does not permit retarder operation when the throttle position is greater than zero. However, if the throttle position signal has failed and the SBS input indicates that the service brakes are being applied, the TCM will permit application of the retarder.

Refer to *Input AA, Service Brake Status Input*, for a detailed description and wiring schematics. The Service Brake Status can also be implemented over SAE J1939; refer to *Datalink Communications*.

7.1.5 SUMP / RETARDER TEMPERATURE INDICATOR

This signal is typically used to activate a yellow or amber dash-mounted indicator to alert the operator to one or more of the following impending changes in transmission operation:

- Programmed use of the preselect downshift shift schedule which results in automatic downshifting at speeds higher than normal
- Automatic reduction of retarder capacity due to high transmission fluid temperatures



Refer to *Output B, Sump/Retarder Temperature Indicator*, for a detailed description and wiring schematic. Retarder temperature indication is also available over SAE J1939; refer to *Datalink Communications*.

NOTE: Over-Temperature Warning is required for all retarder installations with the exception of transit buses.

Refer to *Transmission Cooling - Retarder* for over-temperature warning requirements and additional methods of sensing transmission or retarder temperature.

7.1.6 ENGINE WATER TEMPERATURE SIGNAL (WIRE 135)

The transmission controls system is designed to recognize a signal from an engine water temperature sensor, which detects an over-temperature condition in the engine. This signal may be used in addition to transmission temperatures to alter operation of the retarder in an overheat condition.

Refer to the appropriate *System Schematic Installation Drawing* for wiring information. Refer to *Section B: System Operation – 3000/4000 Product Families* for an operational description of retarder capacity reduction based on engine water temperature.

7.1.7 ELECTRONIC BRAKING SYSTEMS (EBS) WITH RETARDER

EBS may be used with Allison Transmissions both with and without the retarder. However, applications of EBS that blend the retarder into the braking system have special requirements. The requirements include a special retarder configuration that must be ordered with the transmission. The EBS retarder configuration is limited to specific models and specific geographical locations. To determine availability of this retarder configuration, refer to the *Customer Specification Sheet (CSS)* or contact your Allison Representative.

Refer to *Technical Document 182 (TD182), Use of EBS with Allison Transmissions*, for a detailed description of the interface between Allison transmissions and EBS systems.

7.2 RANGE HOLD AND DISABLE CONTROLS – 1000/2000 AND 2900 PRODUCT FAMILIES ONLY

The shift selector system for 1000/2000 models is designed with hold positions for four forward range positions. Consequently, the standard configuration of the shift control system permits the vehicle operator to select the highest forward range (typically 5th or 6th) and to selectively hold three of the remaining intermediate gear ranges. However, the capability for the operator to hold additional intermediate ranges may be provided through the use of three supplementary shift selector system features:

- Tap Up / Tap Down – Range Selection Mode

- 3-Position Hold Switch (Not available with the 2900 Product Family)
- OverDrive Disable switched input function

Installation requirements for these features are discussed in the following paragraphs.

For further information regarding the availability and selection of these provisions, refer to *Section A-1: Controls System Familiarization* of this manual.

7.2.1 TAP UP / TAP DOWN – RANGE SELECTION MODE

This provision relies on the vehicle SAE J1939 communications interface to request a TCM command to upshift or downshift the selected forward range, one range at a time. Use of this feature also requires the vehicle manufacturer to supply and install a display for Requested Range. For additional information regarding this and other J1939 datalink communications requirements, refer to *Datalink Communications*.

7.2.2 3-POSITION HOLD SWITCH

This provision is applicable only to six-speed transmission models. Installation includes a non-momentary switch that permits the operator to select 6, 5, or 4 as the highest available range during transmission operation. The installation also requires four resistors as illustrated on *Installation Drawing AS07-621*. These components and all interface wiring are supplied and installed by the vehicle manufacturer.

7.2.3 OVERDRIVE DISABLE INPUT

This provision may be used with both five- and six-speed transmission models. Refer to *Overdrive Disable Interface: Input AR*, for implementation details and a wiring schematic.

When used with a five-speed transmission model and enabled by a customer-supplied switch on an input function circuit, this function sets 4th as the highest available forward range during transmission operation.

The function operates similarly with a six-speed transmission model, except the selected high range for transmission operation may be set to either 4th or 5th. When set to 4th, this function is effectively becomes a Double OverDrive Disable function.

8.0 INPUT / OUTPUT AND INTERFACE FUNCTIONS

Refer to *Input and Output Functions for 6th Gen Controls* on the Extranet for descriptions and wiring schematics.

With 6th Generation Controls, one of the following two signals may be used for grounded input functions:

- Chassis ground – preferred
- Wire 103, Signal Return

If chassis ground is used for grounded input functions, the following requirements must be met:

- The ground signal must be clean and free from heavy resistive and electromechanical loads.
- The clean ground connection must be capable of being maintained for the life of the vehicle.
- Signal Return, wire 103, must be omitted from the circuit.
- Do not connect wire 103 to chassis ground, to any other ground, or to any other wire in the vehicle system.

9.0 INTERFACE WITH VEHICLE SHUTDOWN SYSTEMS

Some engines may be equipped with a control system to either reduce power or cease engine operation when the engine controller receives data indicating a vehicle system malfunction or anomaly.

The control system for these transmission models is designed to alert the operator of a transmission system malfunction through the use of indicator lights and diagnostic codes. Consequently, Allison Transmission does not agree with the practice of shutting down the engine in the case of a sole transmission incident. Such an incident could include, but is not limited to, transmission diagnostic codes, excessively high or low transmission operating temperatures or fluid levels, or any loss of electrical power to the transmission control system. Although the reduction of engine power resulting from a transmission incident may be appropriate in some circumstances, restricting engine speed will limit the ability to move the vehicle, particularly from a stationary condition.

LIST OF REFERENCED DOCUMENTS

Allison 6th Generation Controls Manual

- *Section A-1: Controls System Familiarization*
- *Section B: System Operation*
  - for the *1000/2000 Product Family*
  - for the *2900 Product Family*
  - for the *3000 and 4000 Product Families*
- *Section F: Support Equipment*

- *Input, Output and Interface Functions* for Allison 6th Gen Controls
  - *Input Y, Anti-Lock Brake System (ABS) Input*
  - *Input Z / Output Q: Retarder Interface*
  - *Input AA, Service Brake Status Input*
  - *Input AF / Output R: Differential Clutch Interface*
  - *Input AR, Overdrive Disable Interface*
  - *Output B, Retarder/Sump Temperature Indicator*
  - *Output C, Range Indicator*
  - *Output O, Transmission Service Indicator*
  - *Output S, Neutral Indicator for PTO and PTO Request (NIPTO)*

- *Allison 6th Generation Controls System Data*
- *Customer Specification Sheet (CSS)*
- *Datalink Communications* for Allison 6th Gen Controls
- *Tachograph Drive Provision*
- *Transmission Cooling - Retarder*
- *Allison DOC® service tool*
- *Allison Calibration Configuration Tool (ACCT)*

Allison 6th Generation Controls Installation Drawings
- *AS07-621, System Schematic for the 1000/2000 Product Families*
- *AS07-628, System Schematic for the 2900 (Shift-by-Wire) Product Families*
- *AS07-629, System Schematic for the 2900 (Shift-by-Cable) Product Families*
- *AS07-622, System Schematic for the 3000 & 4000 Product Families, Base Models*
- *AS07-624, System Schematic for the 4000 Product Family, 7-Speed Models*
- *AS07-552, Vehicle Interface Module (VIM)*

Technical Documents (TD's)

- *TD173, Wiring Harnesses for Allison 4th, 5th & 6th Generation Controls*
- *TD175, Guidelines for Selecting Retarder Controls*
- *TD176, Service Requirements – Removal and Replacement Times for Allison Transmissions*
- *TD182, Use of EBS with Allison Transmissions*

REVISION HISTORY

May 24, 2022

- Added the 2900 Product Family

September 20, 2021

- In 5.2, added, "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 speedometer signal. The receiving device may need to implement signal filtering provisions appropriate for the intended use".

July 29, 2020

- Created, Allison 6th Generation Controls - Controls Installation Manual - Section D: Vehicle Electrical System Interface