SECTION E: INPUT / OUTPUT (I/O) FUNCTIONS

Allison 4th Generation Controls

Contents:

Note: H 40 EP and H 50 EP are the new names for Allison's E^P 40 and E^P 50 Hybrid Electric Drive Systems. In this document they are collectively referred to as the H 40/50 EP, replacing E^P 40/50 System™.

SECTION E: INPUT / OUTPUT (I/O) FUNCTIONS

1.0 INTRODUCTION

This section describes the Input and Output (I/O) Functions of the H 40/50 EP control system.

2.0 REFERENCED DOCUMENTS

Unless otherwise noted, all documents referenced in this document may be found in the Extranet channel of the Allison Transmission website, *www.allisontransmission.com*. To locate the referenced documents, look for Tech Data under the Engineering heading on the Extranet 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 Transmission Extranet. A list of referenced documents can be found at the end of this document.

3.0 GENERAL DESCRIPTION

The H 40/50 EP control system provides functional control of transmission and vehicle operations tailored to the expected duty of the vehicle. This is done using Input and Output (I/O) Functions.

- **Input Functions** send vehicle data **to the TCM or VCM** indicating the operating state of other vehicle systems or components.

- **Output Functions** send data **out of the TCM or VCM** for use in controlling the operation of other vehicle systems or components.

The output functions may be turned on and off based on the state of related input function signals or the operating state of the H 40/50 EP system.

4.0 SELECTING THE I/O FUNCTIONS

The combination of Input Functions and Output Functions which are used in a specific vehicle normally relate very closely with the expected use of the vehicle. The desired Inputs and Outputs must be selected when the vehicle builder defines the system calibration (SID). Refer to the *Customer Specification Sheets (CSS), H 40/50 EP CSS form*, on the Extranet.

The H 40/50 EP I/O's can not be enabled or disabled using Allison's DOC™ for PC (AED) diagnostic tool.

5.0 ACTIVATING THE I/O FUNCTIONS

The control of each function is dependent upon the proper installation of an electrical interface with the propulsion system controls. This is accomplished either directly through the H 40/50 EP system wiring harness which connects to the TCM and VCM, or through the vehicle's electrical circuits.

WARNING: Some input and output functions involve complex control algorithms within the controls logic. If any of these particular functions are enabled in the calibration but the control circuit for the function is not complete, the potential exists for one or more system failure modes which could result in undesirable propulsion system operation and/or generation of diagnostic codes.

If any of these functions is enabled in the calibration, the function MUST BE properly integrated into the wiring system of the vehicle in which they are installed. If the function is not being used in the vehicle, it MUST BE disabled in the calibration.

Undesirable propulsion system or vehicle operation resulting from failure to comply with this requirement is NOT the responsibility of Allison Transmission.

This WARNING applies to the following functions:

- **Input E, Aux Function Range Inhibit**
- **Input BL, Front Operation Mode 1 / Front Operation Mode 2**
- **Output C, Range Indicator**
- **Output D, Output Speed Indicator**
- **Output AH, HUSH™ Mode Active**
- **Output AI, HUSH™ Pre-Charge Mode Active**

6.0 WIRING SCHEMATICS

The remainder of this document is devoted to wiring schematics that illustrate the recommended interface and activation method for each input and output function. Included with each wiring schematic is a description of the function, its typical use in the vehicle, any variables to be specified, and the normal vocational application of the function.

WARNING: Each of these schematics shows the intended use of a special controls feature that has been validated in the configuration shown. Any miswiring or use of this feature that differs from what is shown could result in damage to equipment or property, personal injury, or loss of life.

Allison Transmission is NOT LIABLE for the consequences associated with miswiring or unintended use of these features.

INPUT FUNCTION E: AUXILIARY FUNCTION RANGE INHIBIT
ENABLED BY: TCM INPUT WIRE 301

DESCRIPTION:
This function is enabled when a switch is opened to break the circuit between TCM input wire 301 and wire 303, Signal Return. When activated, the controls command an inhibit on all shifts from Neutral-to-Drive and Neutral-to-Reverse. The inhibit remains in effect until the auxiliary vehicle function is disabled (wire 301 switched from open to wire 303).

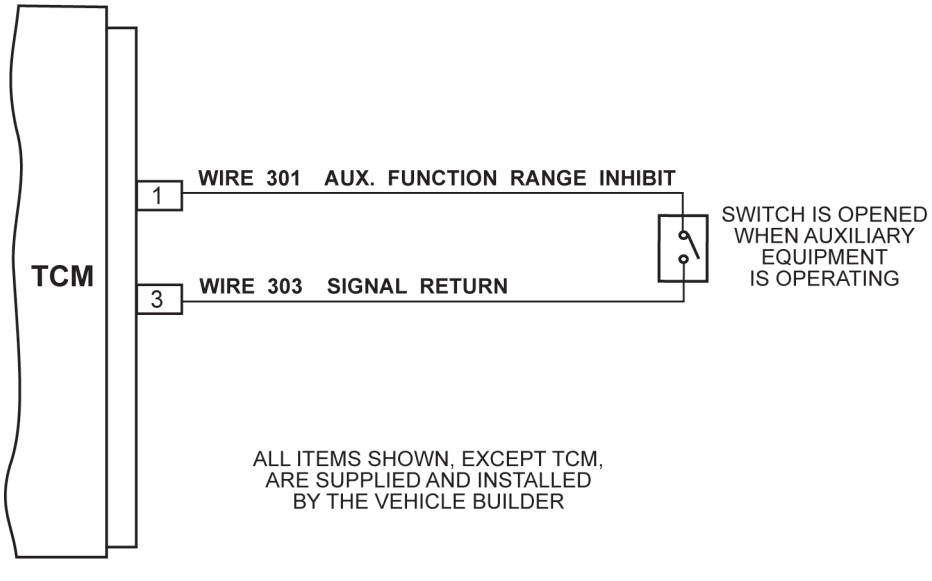
NOTE: Most functions are enabled when the control circuit is closed (switched from open-to-power or open-to-ground). This function is based on inverted logic; it is enabled when the circuit is open and subsequently disabled when the control circuit is switched closed. Design and installation of the control circuit for this function requires special attention in order that circuit actuation creates the desired result in vehicle operation.

USES:
To prevent inadvertent range selection when auxiliary equipment is operating, for example during wheelchair lift operation.

CUSTOMER MODIFIABLE CONSTANTS:
None

VOCATIONS:
No vocational restrictions.

WARNING: If this function is enabled in the system calibration, the function MUST be integrated into the vehicle wiring. If the function will not be used in the vehicle, it MUST be disabled in the calibration. Refer to 5.0, Activating the I/O Functions.



WARNING: This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. **Allison Transmission is not liable for consequences associated with miswiring or unintended use of this feature.**

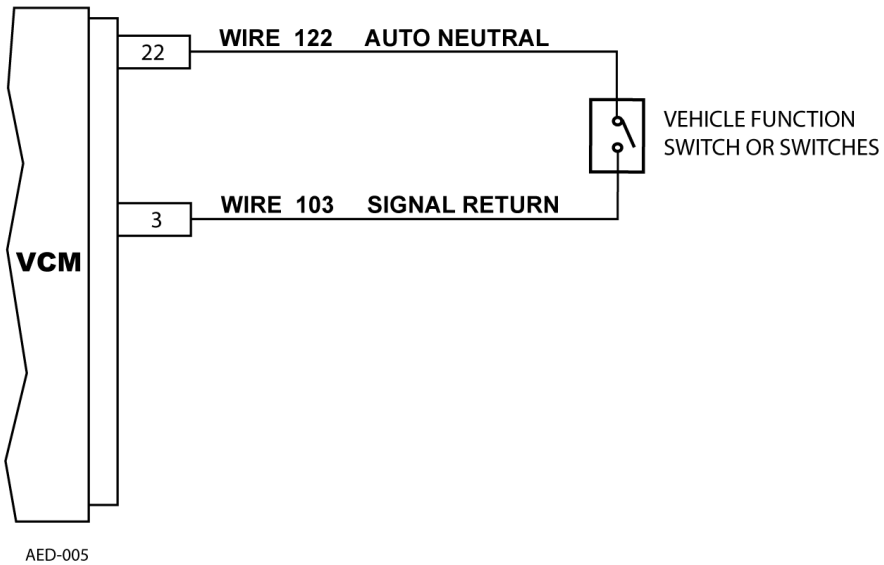
INPUT FUNCTION L: AUTOMATIC NEUTRAL – SINGLE INPUT
ENABLED BY: VCM INPUT WIRE 122

DESCRIPTION:
This function is enabled when a switch is closed to complete the circuit between VCM input wire 122 and wire 103, Signal Return. When this signal is activated and both output speed and throttle position are at or near zero, Neutral is commanded regardless of shift selector position. While in this mode, the shift selector display will flash “F”. Shifting back into range occurs when this input is deactivated and the range is re-selected with the service brake applied.

USES:
- This input signal can be provided by application of the parking brake plus a key switch to prevent vehicle theft when the driver must leave the vehicle.
- This input signal can be provided by application of the parking brake and vehicle sitting at idle for some calibratable period of time, to prevent long periods of time at idle stall.

CUSTOMER MODIFIABLE CONSTANTS:
None

VOCATIONS:
No vocational restrictions.



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WARNING: This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. **Allison Transmission is not liable for consequences associated with miswiring or unintended use of this feature.**

INPUT FUNCTION BH: SYSTEM OVERRIDE REQUEST
ENABLED BY: VCM INPUT WIRE 142

DESCRIPTION:
This function is enabled when a momentary switch is closed to complete the circuit between VCM input wire 142 and wire 103, Signal Return. This driver input may be used when the system has shutdown or is in the process of shutting down and the STOP SYSTEM light is on. This input requests the system to continue running for a short time. When the switch is open, the shutdown request is not overridden. When pin 42 is grounded, the override request is active (shutdown will be overridden) and the CHECK SYSTEM light comes on. If the engine won't start after the override switch is pressed, the key or run switch may need to be cycled. Once the override request is active, it stays active for 30 seconds. If the override switch is pressed again during that 30 seconds, the request remains active for another 30 seconds from that point. This sequence can continue, however it is strongly recommended that the override feature be used for the minimum time possible to avoid possible further damage or damage to other components.

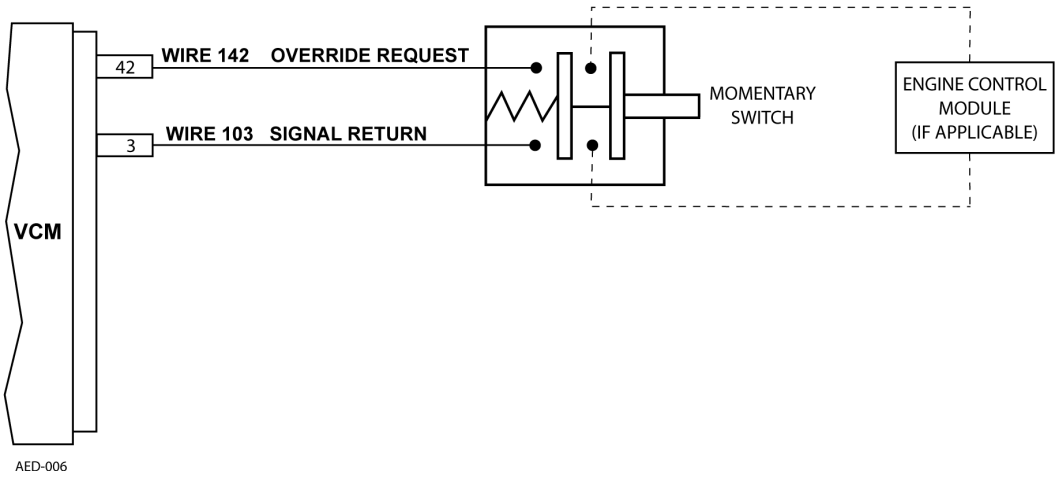
If the engine supports a shutdown override function, a signal from the switch will also have to be wired to the engine controller.

USES:
Temporarily overrides a shutdown request so that vehicle can be moved away from imminent danger or from being an obstruction.

CUSTOMER MODIFIABLE CONSTANTS:
None

VOCATIONS:
No vocational restrictions.

WARNING: This function IS enabled in the calibration. If this function will not be used in the vehicle, care must be taken to assure that VCM pin 42 does not contact any ground circuit. If pin 42 is connected to ground, the system will be in override at all times and the CHECK SYSTEM light will be on.



WARNING: This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. **Allison Transmission is not liable for consequences associated with miswiring or unintended use of this feature.**

INPUT FUNCTION BI: HUSH™ MODE REQUEST
ENABLED BY: MODE BUTTON

DESCRIPTION:

HUSH™ mode is activated when the operator pushes the MODE button on the shift selector at a predetermined location at the tunnel entrance. The Pushbutton Selector display changes from F, Forward, to H, HUSH™, to indicate to the driver that HUSH™ mode is being activated. If the MODE light is still flashing, this indicates that the EP Energy Storage System pre-charge is not complete and the system could automatically switch out of HUSH™ mode before the vehicle exits the tunnel. Entering the tunnel with a flashing light or waiting for the pre-charge to complete (solid MODE light) is at the discretion of the transit property and/or the driver. HUSH™ mode provides for the engine to run at a lower power than normal during propulsion through the tunnel. Also, when vehicle speed drops below a pre-determined value and if the state of charge of the ESS is high enough, fuel is shut off to the engine. Fueling resumes when the vehicle speed increases to a pre-determined value.

HUSH™ mode is exited automatically at the end of the tunnel as determined by the distance traveled since HUSH™ mode was initiated. The Pushbutton Selector display changes back to F to indicate that HUSH™ mode has been discontinued. Pushing the MODE button on the shift selector any time the system is in HUSH™ mode will cause the system to exit HUSH™ mode.

This function is used in conjunction with the following I/O's:
- Input BJ: Station Mode Request
- Input BW: ESS Pre-Tunnel Charge Request
- Output AH: HUSH™ Mode Active
- Output AI: HUSH™ Pre-Charge Mode Active

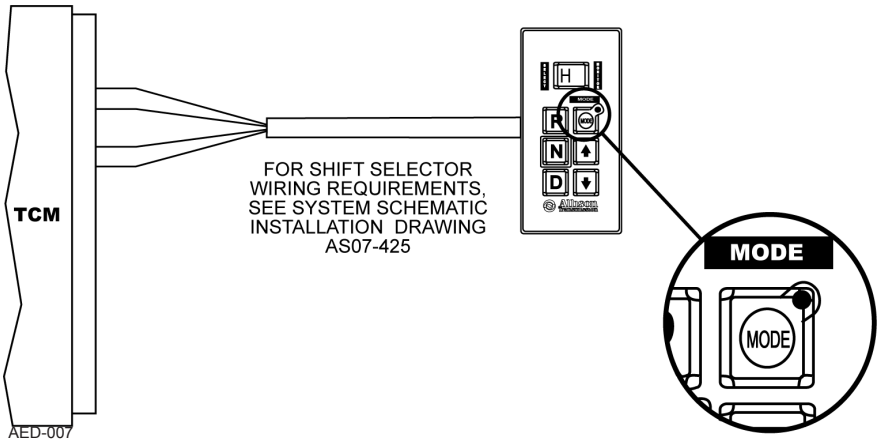
USES:

Reduce exhaust emissions and minimize noise while running in the tunnel in downtown Seattle.

CUSTOMER MODIFIABLE CONSTANTS:	**Value**
HUSH™ Mode Enable Select	Manual

VOCATIONS:

Transit bus in Seattle only



WARNING: This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. **Allison Transmission is not liable for consequences associated with miswiring or unintended use of this feature.**

INPUT FUNCTION BJ: STATION MODE REQUEST
ENABLED BY: TCM INPUT WIRE 302

DESCRIPTION: This function is enabled when a switch is closed to complete the circuit between TCM input wire 302 and switched 12v power, and HUSH™ Mode is active. If the output speed is zero or near zero, the controls command the Drive Unit to shift to neutral and the engine speed is reduced to zero. The H (HUSH™ Mode) on the shift selector display will flash, indicating that Station mode is active. Typically, this signal is sent when the rear bus door is opened.

When the Station Mode input is removed (input wire 302 is open), the engine will be automatically restarted. If the service brakes are applied, the controls will shift the Drive Unit into Forward range, and the H on the shift selector will stop flashing. If the selector display continues to flash H after the engine is started, the operator must apply the service brakes and press D on the shift selector in order to attain Forward range.

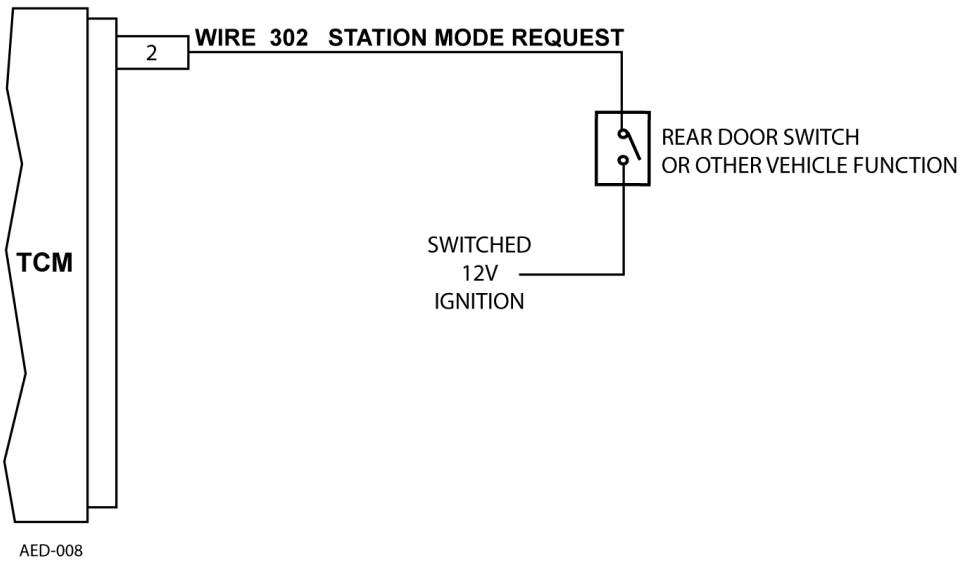
This function is used in conjunction with the following I/O's:
- Input BI: HUSH™ Mode Request
- Output AH: HUSH™ Mode Active

CAUTION: Since the Drive Unit is in NEUTRAL when this function is active, the vehicle is subject to rolling if not on level ground. It is strongly recommended that the vehicle manufacturer assure that the service brake or parking brake is applied.

USES: Shuts the engine off for minimum noise while stopped in the stations to load and unload passengers while traveling in the tunnel in downtown Seattle.

CUSTOMER MODIFIABLE CONSTANTS: None

VOCATIONS: Transit bus in Seattle only.



WARNING: This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. **Allison Transmission is not liable for consequences associated with miswiring or unintended use of this feature.**

INPUT FUNCTION BK: AUXILIARY BRAKE ENABLE REQUEST
ENABLED BY: VCM INPUT WIRE 161

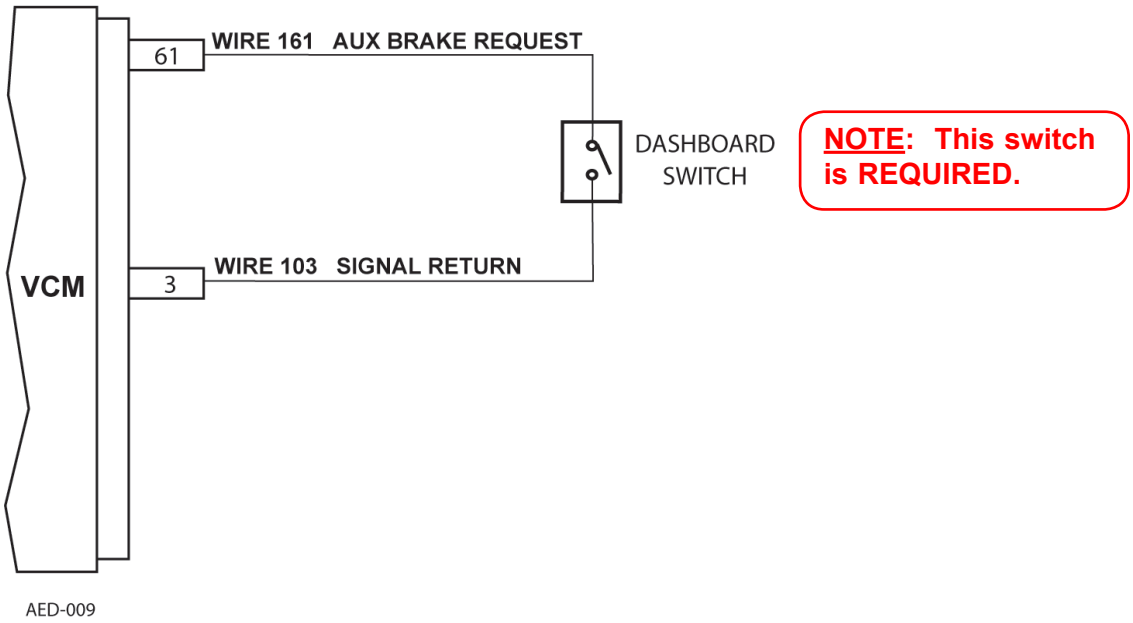
DESCRIPTION:
This function is enabled when a switch is closed to complete the circuit between VCM input wire 161 and wire 103, Signal Return. When this function is activated, auxiliary braking supplements the vehicle service brakes. When this signal is removed, the vehicle service brakes are not supplemented. An ABS Active signal from SAE J1939 also deactivates auxiliary braking. Auxiliary braking typically consists of regenerative braking and the engine brake.

USES:
Disable auxiliary braking when traveling on slippery roads where there is the likelihood that a wheel or wheels could lose traction.

CUSTOMER MODIFIABLE CONSTANTS:
None

VOCATIONS:
No vocational restrictions.

WARNING: This function must be enabled in the system calibration, and this function MUST be integrated into the vehicle wiring.



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INPUT FUNCTION BL: FRONT OPERATION MODE 1 / FRONT OPERATION MODE 2

ENABLED BY: TCM INPUT WIRES 343 & 322

DESCRIPTION:

This function is enabled when both switches are closed, completing the following circuits:

- Between TCM input wire 343 and switched power
- Between TCM input wire 322 and wire 303, Signal Return

When both switches are closed, this function is enabled and the vehicle can be started from the driver's station.

When both switches are open, the vehicle can be started from a location other than the driver's station.

If one switch is open and one switch is closed, the engine can not be started from either location.

USES:

Typically used during service on rear engine buses where the engine compartment is very remote from the normal ignition switch.

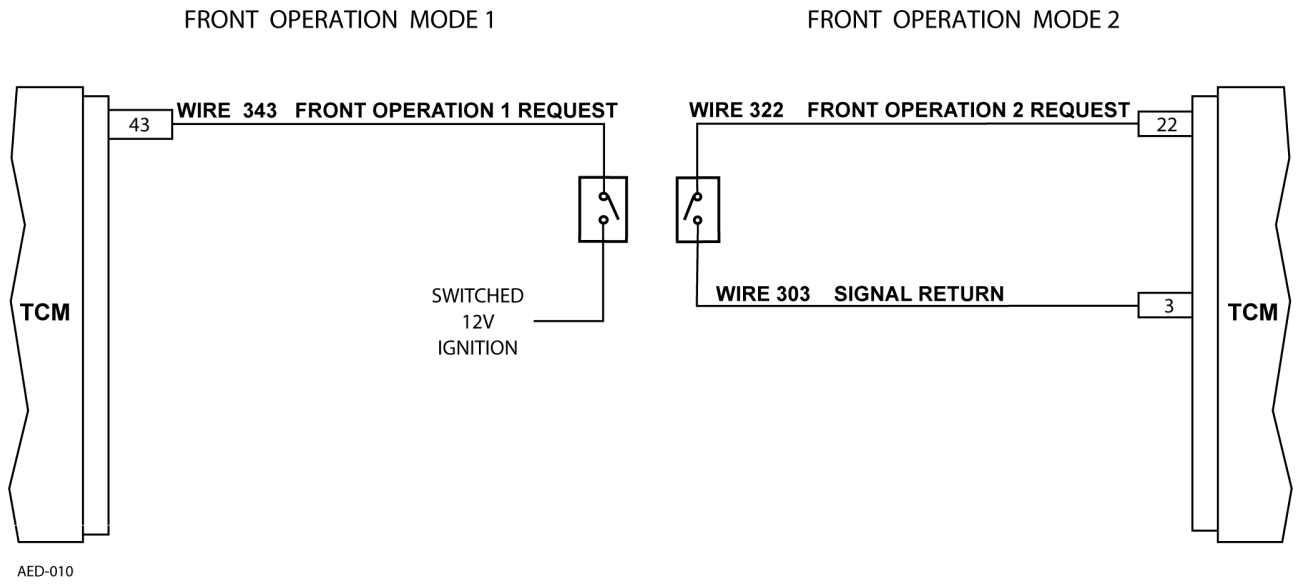
CUSTOMER MODIFIABLE CONSTANTS:

None

VOCATIONS:

Buses with the engine in the rear of the bus.

WARNING: If this function is enabled in the system calibration, the function MUST be integrated into the vehicle wiring. If the function will not be used in the vehicle, it MUST be disabled in the calibration. Refer to 5.0, Activating the I/O Functions.



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INPUT FUNCTION BM: FAST IDLE 1
ENABLED BY: TCM INPUT WIRE 342

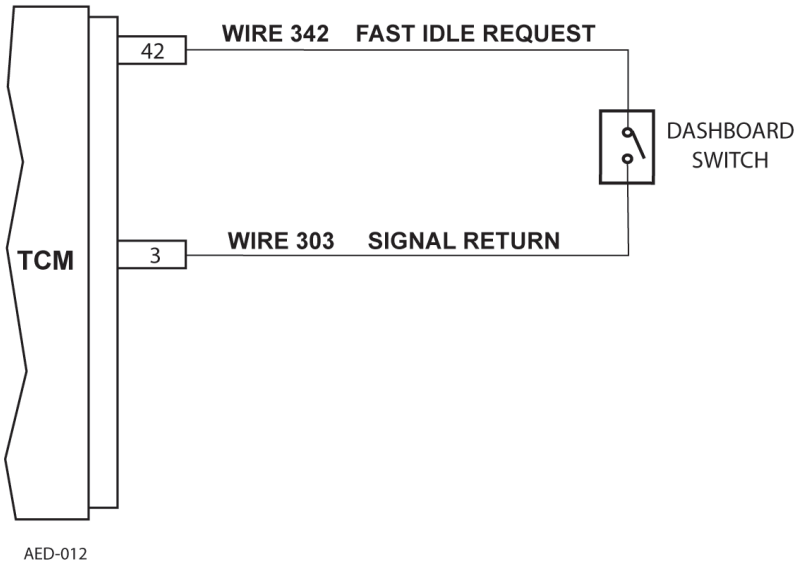
DESCRIPTION:
This function is enabled when a switch is closed to complete the circuit between TCM input wire 342 and wire 303, Signal Return. When this function is activated, the hybrid controls are signaled that a fast engine idle speed is requested. The hybrid controls then command a higher than normal engine idle speed when the drive unit is in Neutral. When the drive unit is shifted into forward or reverse range, the engine idle speed returns to the normal idle speed. When this input signal is removed, the hybrid controls command the normal engine idle speed in all ranges, including Neutral

NOTE: Selecting Fast Idle will adversely affect fuel economy.

USES:
To keep engine speed elevated in order to operate engine-driven accessories when the vehicle is stopped and in Neutral.

CUSTOMER MODIFIABLE CONSTANTS:	Standard Value	Allowable Range	Units
Fast Idle Speed 1	1000	800 – 1300	rpm

VOCATIONS:
No vocational restrictions.



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WARNING: This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. **Allison Transmission is not liable for consequences associated with miswiring or unintended use of this feature.**

INPUT FUNCTION BN: FAST IDLE 2
ENABLED BY: TCM INPUT WIRE 361

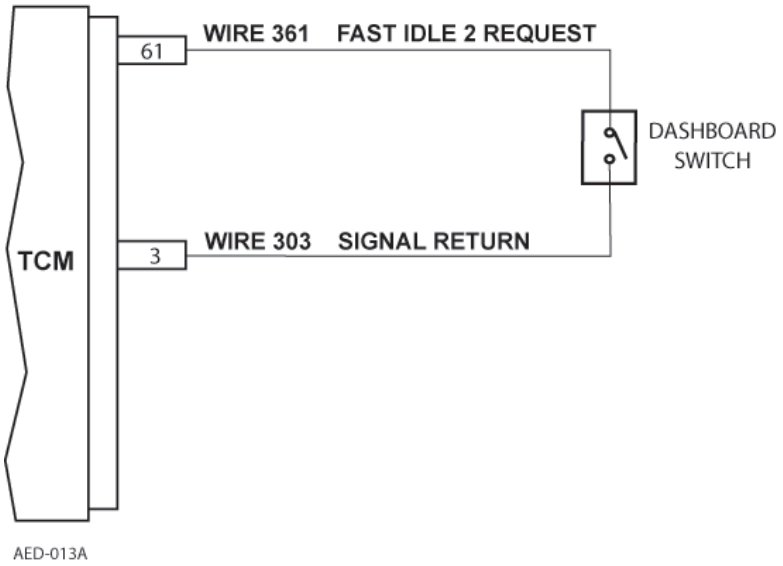
DESCRIPTION:
This function is enabled when a switch is closed to complete the circuit between TCM input wire 361 and wire 303, Signal Return. When this function is activated, the hybrid controls are signaled that a **very** fast engine idle speed is requested. The hybrid controls then command a much higher than normal engine idle speed when the drive unit is in Neutral. When the drive unit is shifted into forward or reverse range, the engine idle speed returns to the normal idle speed. When this input signal is removed, the hybrid controls command the normal engine idle speed in all ranges.

NOTE: Selecting Fast Idle or Fast Idle 2 will adversely affect fuel economy.

USES:
To keep engine speed elevated in order to operate engine-driven accessories when the vehicle is stopped and in Neutral. This feature can be wired with Input BM, Fast Idle, by using a three position switch – Fast Idle, Off (normal idle), and Fast Idle 2.

CUSTOMER MODIFIABLE CONSTANTS:	Standard Value	Allowable Range	Units
Fast Idle Speed 2	1000	800 – 1300	rpm

VOCATIONS:
No vocational restrictions.



AED-013A

WARNING: This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. **Allison Transmission is not liable for consequences associated with miswiring or unintended use of this feature.**

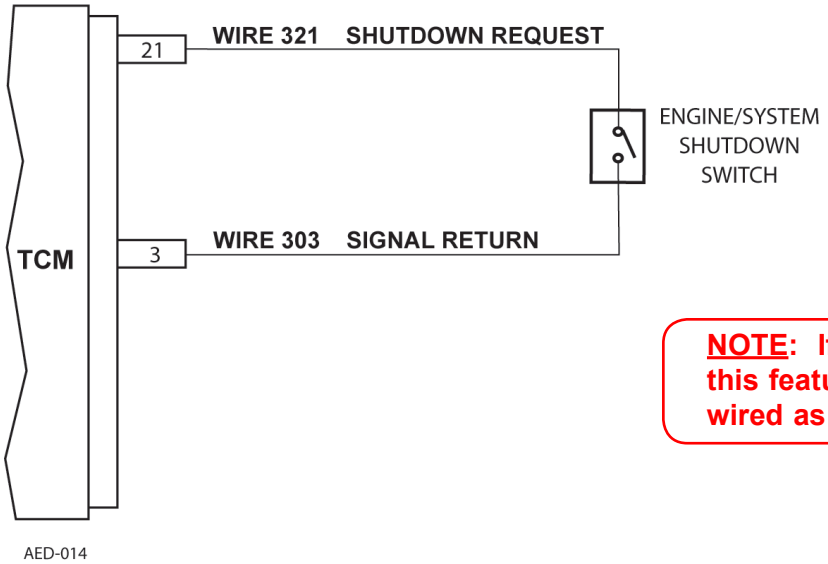
INPUT FUNCTION BO: REMOTE SHUTDOWN REQUEST
ENABLED BY: TCM INPUT WIRE 321

DESCRIPTION:
This function is enabled when a switch is closed to complete the circuit between TCM input wire 321 and wire 303, Signal Return. When this function is activated, the TCM is signaled that an engine or system shutdown is being requested. After flashing the STOP SYSTEM light for 30 seconds, the TCM powers down the engine and discharges the high voltage bus. To restart the engine, the operator must cycle the ignition switch off and then on again.

USES:
Emergency shutdown of the engine in case of fire so fuel is shut off and the cooling fan does not fan the fire or blow the fire suppressant away from the fire.

CUSTOMER MODIFIABLE CONSTANTS:
None

VOCATIONS:
No vocational restrictions.



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NOTE: If the vehicle has this feature, it MUST be wired as shown.

WARNING: This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. **Allison Transmission is not liable for consequences associated with miswiring or unintended use of this feature.**

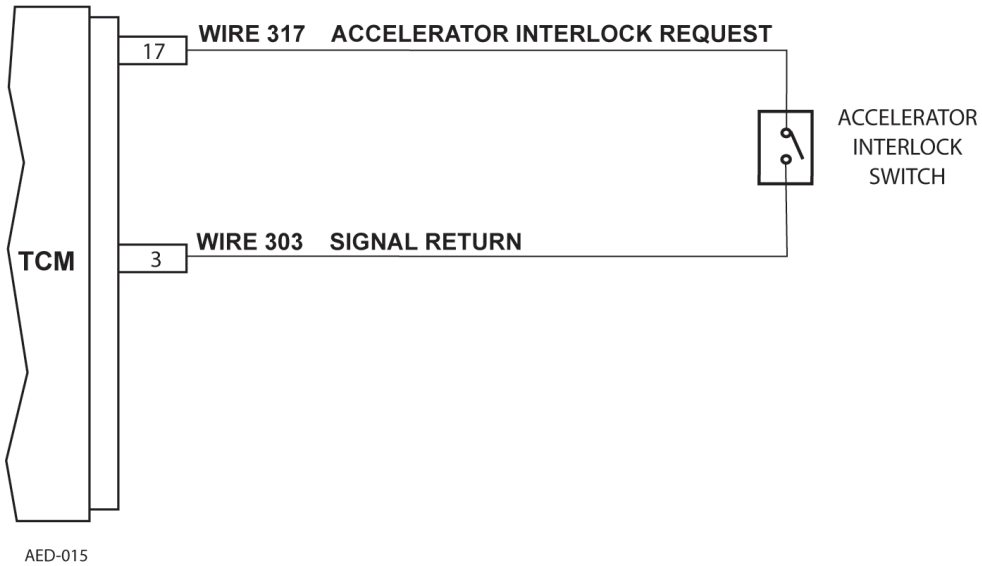
INPUT FUNCTION BP: ACCELERATOR INTERLOCK
ENABLED BY: TCM INPUT WIRE 317

DESCRIPTION:
This function is enabled when a switch is closed to complete the circuit between TCM input wire 317 and wire 303, Signal Return. When this function is activated, accelerator pedal signals that are sent to the TCM are ignored and a zero accelerator pedal position is assumed.

USES:
If a specific vehicle condition is present, typically the rear door of a bus is open, pressing the accelerator pedal will not cause a change to Drive Unit output torque and a minimum output torque is assumed.

CUSTOMER MODIFIABLE CONSTANTS:
None

VOCATIONS:
No vocational restrictions.



AED-015

WARNING: This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. **Allison Transmission is not liable for consequences associated with miswiring or unintended use of this feature.**

INPUT FUNCTION BW: ESS PRE-TUNNEL CHARGE REQUEST
ENABLED BY: MODE BUTTON

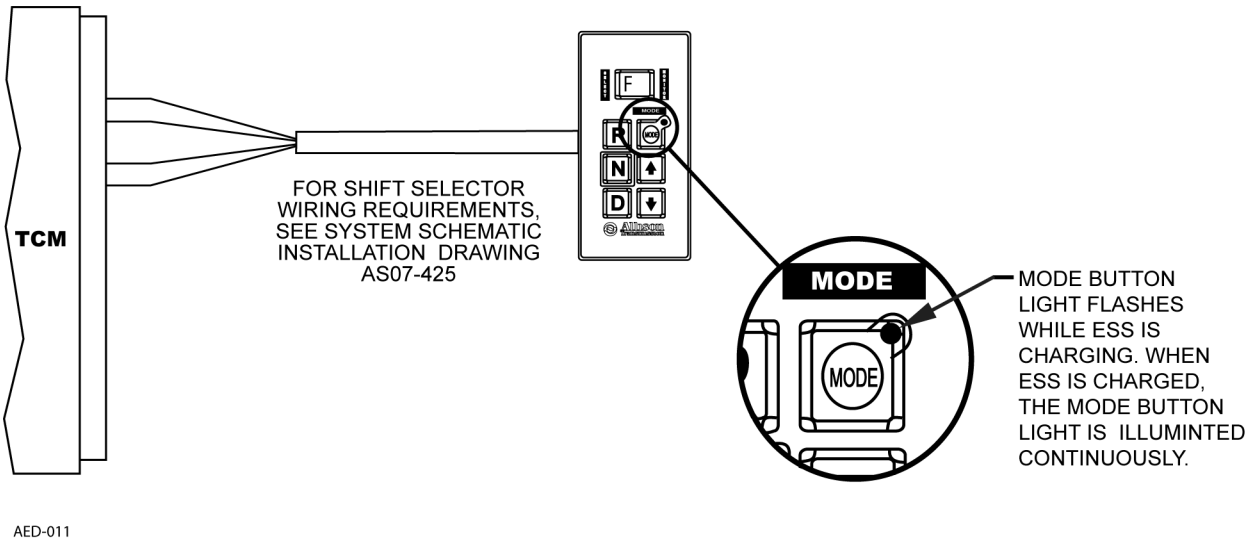
DESCRIPTION:
This function is enabled when the MODE button on the shift selector is pressed. Activation of this function initiates dynamic pre-tunnel charging of the Energy Storage System (ESS). This occurs at a pre-defined location that is a sufficient distance before the tunnel to allow for a full ESS charge to occur before entering the tunnel. During dynamic pre-tunnel charging, the ESS state of charge (SOC) is raised while continuing to operate the vehicle in the normal hybrid mode. The MODE lamp on the Pushbutton Selector flashes while the target SOC is being attained. The MODE lamp becomes solid when the target SOC has been reached indicating that the vehicle is ready to proceed into HUSH™ mode. This function is used in conjunction with the following I/O's:

- Input BI: HUSH™ Mode Request
- Output AI: HUSH™ Pre-Charge Mode Active

USES:
Elevate ESS SOC prior to entering the tunnel and activating HUSH™ mode.

CUSTOMER MODIFIABLE CONSTANTS:	**Value**
HUSH™ Mode Enable Select	Manual

VOCATIONS:
Transit bus in Seattle only.



WARNING: This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. **Allison Transmission is not liable for consequences associated with miswiring or unintended use of this feature.**

OUTPUT FUNCTION C: RANGE INDICATOR
ENABLED BY: VCM OUTPUT WIRE 124

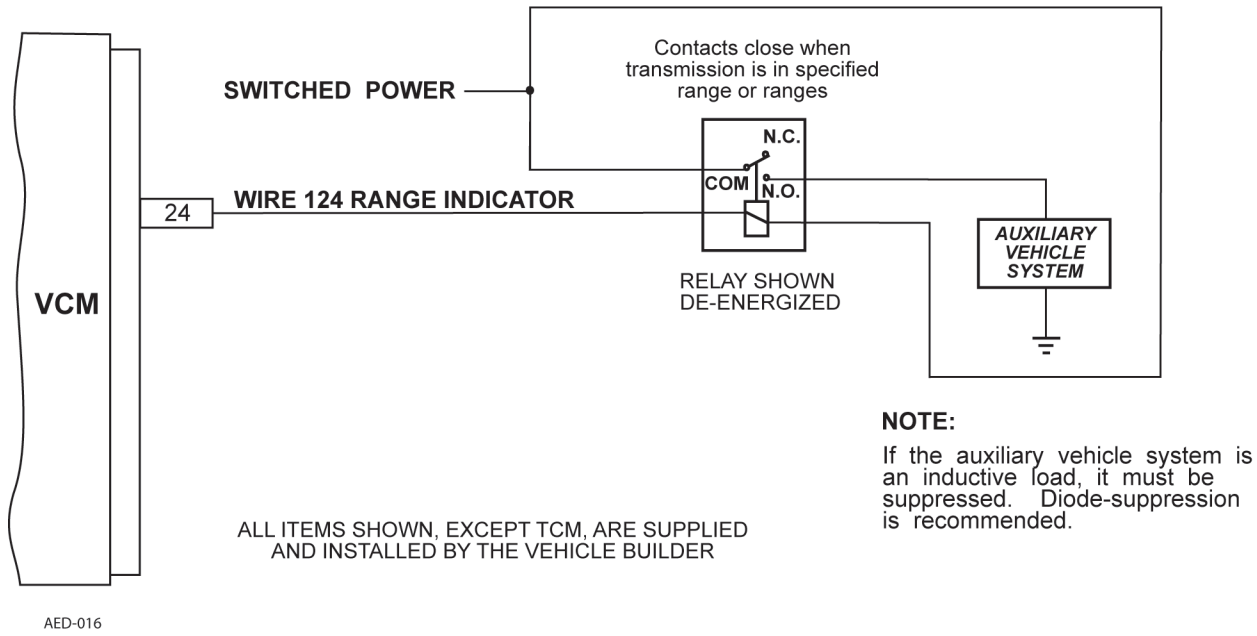
DESCRIPTION:
This output function is activated by the VCM switching wire 124 from open to ground when Neutral is being commanded by the hybrid controls.

USES:
To permit operation of an auxiliary vehicle system only when the Drive Unit is in Neutral.

CUSTOMER MODIFIABLE CONSTANTS:
None. The H 40/50 EP controls activate the Range Indicator output only in Neutral.

VOCATIONS:
No vocational restrictions.

WARNING: If this function is enabled in the system calibration, the function MUST be integrated into the vehicle wiring. If the function will not be used in the vehicle, it MUST be disabled in the calibration. Refer to 5.0, Activating the I/O Functions.



NOTE:
If the auxiliary vehicle system is an inductive load, it must be suppressed. Diode-suppression is recommended.

WARNING: This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. **Allison Transmission is not liable for consequences associated with miswiring or unintended use of this feature.**

OUTPUT FUNCTION D: OUTPUT SPEED INDICATOR
ENABLED BY: TCM OUTPUT WIRE 345

DESCRIPTION:
This output function is activated by the TCM switching wire 345 from open to ground when a preset drive unit output speed has been exceeded in either forward or reverse.

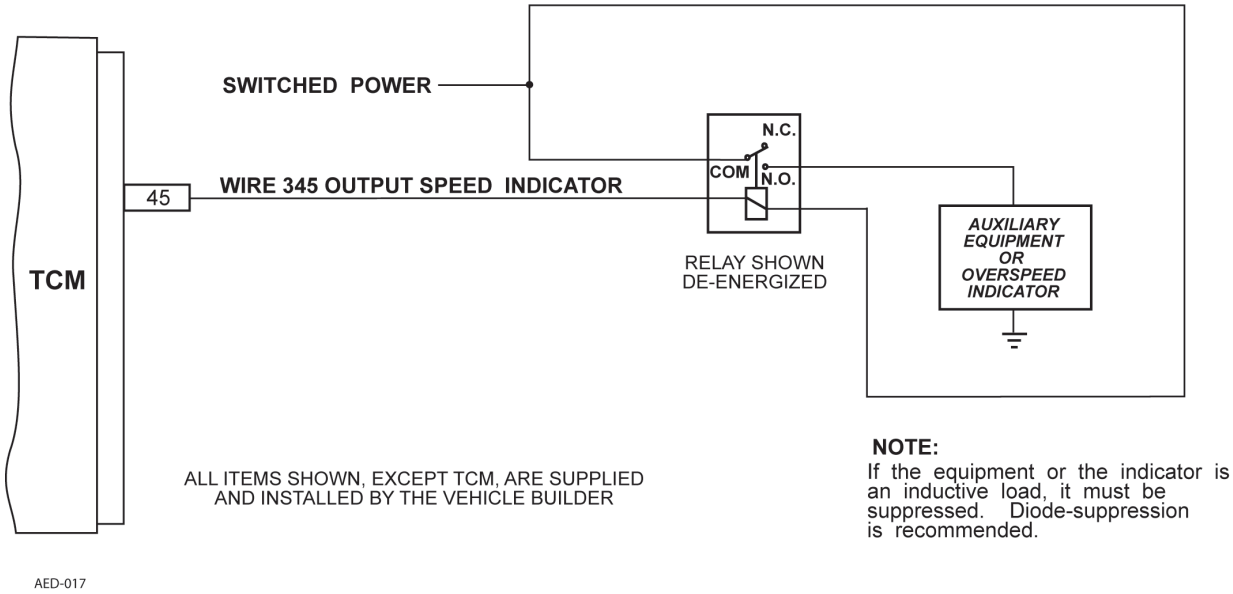
USES:
- To indicate a maximum or minimum operating speed has been attained in order to control the vehicle or auxiliary equipment. Typically, this output signal is used to keep the rear bus door from opening above a set vehicle speed.
- To turn on an over-speed indicator light

CUSTOMER MODIFIABLE CONSTANTS:	Standard Value	Allowable Range	Units
• Output speed to turn the signal On	132	0 – 4000	rpm
• Output speed to turn the signal Off	66	0 – 4000	rpm

The Off value must be lower than the On value.
These values can be specified when the calibration is defined or programmed using Allison DOC™ for PC (AED).

VOCATIONS:
No vocational restrictions.

WARNING: If this function is enabled in the system calibration, the function MUST be integrated into the vehicle wiring. If the function will not be used in the vehicle, it MUST be disabled in the calibration. Refer to 5.0, Activating the I/O Functions.



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OUTPUT FUNCTION AA: BATTERY COOLING REQUEST
ENABLED BY: VCM OUTPUT WIRE 145

DESCRIPTION:
This output function is activated by the VCM switching wire 145 from open to ground when the energy storage system (ESS) has exceeded a temperature limit and requires more than just ambient air flow for cooling. If the ESS is cooled by a vehicle air conditioning system with more than one compressor, the compressor cooling the ESS must be capable of operating whenever requested by Output AA.

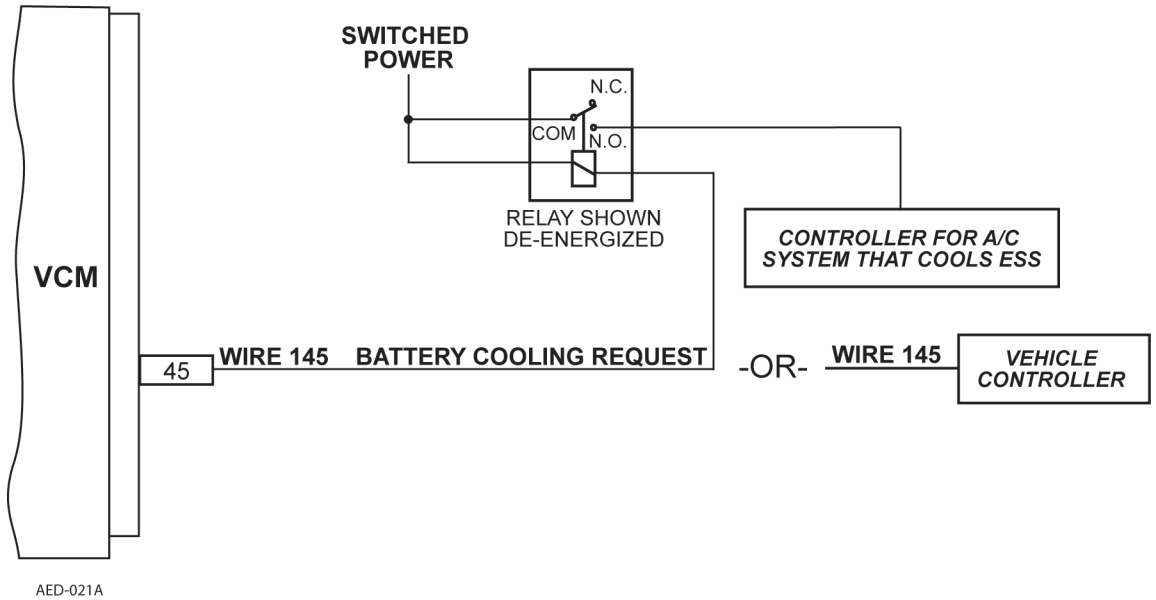
For additional ESS cooling requirements, refer to *H 40/50 EP Installation Manual Section J: Energy Storage System (ESS)*.

USES:
To activate the air conditioning system that cools the ESS.

CUSTOMER MODIFIABLE CONSTANTS:
None

VOCATIONS:
No vocational restrictions.

CAUTION: This function MUST be enabled in the system calibration, and this function MUST be integrated into the vehicle wiring.



WARNING: This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. **Allison Transmission is not liable for consequences associated with miswiring or unintended use of this feature.**

OUTPUT FUNCTION AB: AUXILIARY BRAKE INDICATOR
ENABLED BY: TCM OUTPUT WIRE 304

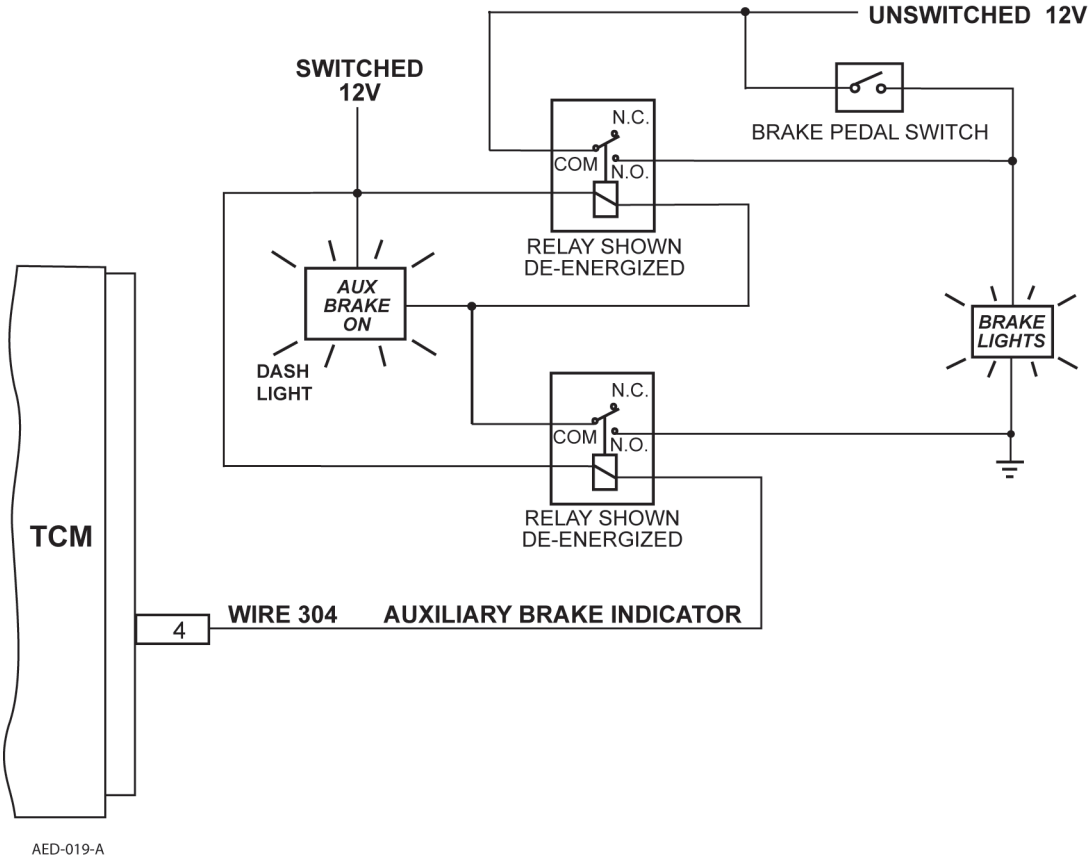
DESCRIPTION:
This output function is activated by the TCM switching wire 304 from open to ground when auxiliary braking is active. Auxiliary Braking is provided by the engine brake and the regenerative braking of the H 40/50 EP. This function is used with Input BK, Auxiliary Brake Enable Request.

USES:
To turn on the vehicle brake lights and a dash light whenever auxiliary braking is active.

CUSTOMER MODIFIABLE CONSTANTS:
None

VOCATIONS:
No vocational restrictions.

NOTE: The vehicle MUST be wired so that the brake lights are ON whenever auxiliary braking is active. It is also recommended that a dash light be used to alert the operator when auxiliary braking is active.



WARNING: This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. **Allison Transmission is not liable for consequences associated with miswiring or unintended use of this feature.**

OUTPUT FUNCTION AH: HUSH™ MODE ACTIVE
ENABLED BY: VCM OUTPUT WIRE 150

DESCRIPTION:
This output function is activated by the VCM switching wire 150 from open to ground when HUSH™ Mode is activated upon entering the tunnel in downtown Seattle.

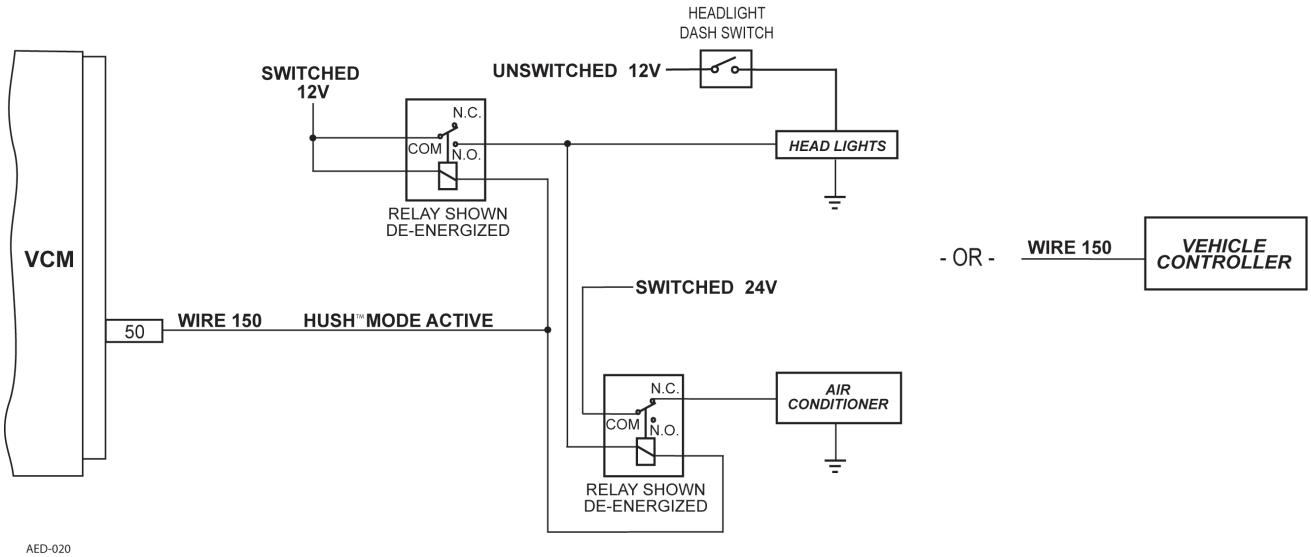
This function is used in conjunction with the following I/O's:
- Input BI: HUSH™ Mode Request
- Input BJ: Station Mode Request

USES:
To turn on the vehicle headlights and to reduce electrical load by turning the air conditioning off when entering the tunnel in Seattle.

CUSTOMER MODIFIABLE CONSTANTS:
None

VOCATIONS:
Transit bus in Seattle only.

WARNING: If this function is enabled in the system calibration, the function MUST be integrated into the vehicle wiring. If the function will not be used in the vehicle, it MUST be disabled in the calibration. Refer to 5.0, Activating the I/O Functions.



WARNING: This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. **Allison Transmission is not liable for consequences associated with miswiring or unintended use of this feature.**

OUTPUT FUNCTION AI: HUSH™ PRE-CHARGE MODE ACTIVE
ENABLED BY: TCM OUTPUT WIRE 313

DESCRIPTION:
This output function is activated by the TCM switching wire 313 from open to ground when the HUSH™ Pre-Tunnel Charge Mode has been activated.

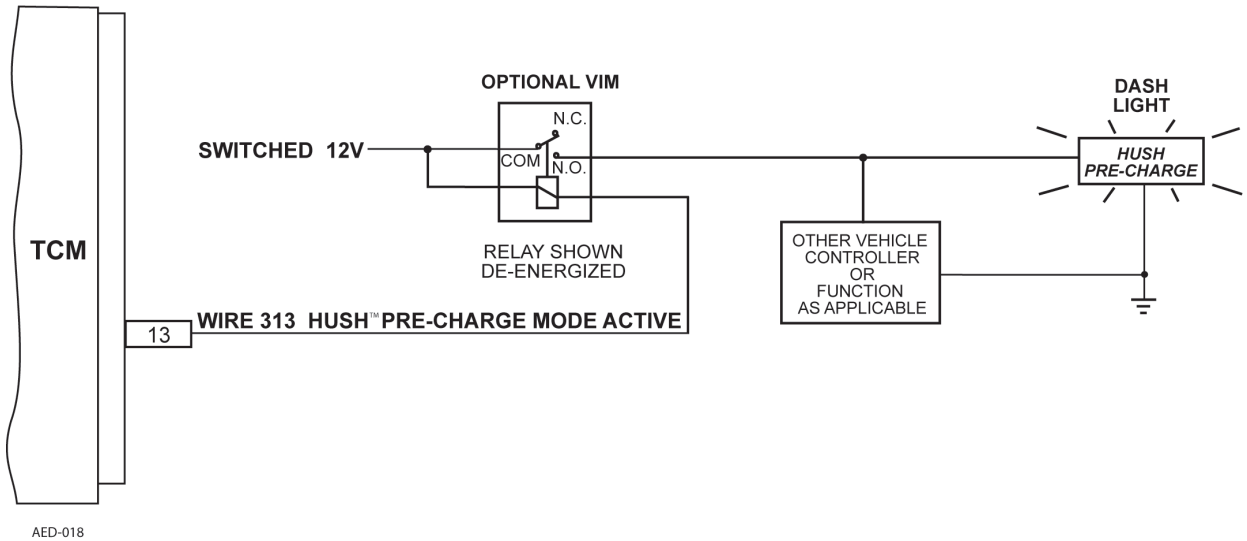
This function is used in conjunction with the following I/O's:
- Input BI: HUSH™ Mode Request
- Input BW: ESS Pre-Tunnel Charge Request

USES:
- To signal another controller that the HUSH™ Pre-Tunnel Charge Mode has been attained.
- To activate a dash light or other indicator when the hybrid system is in the HUSH™ Pre-Tunnel Charge Mode.

CUSTOMER MODIFIABLE CONSTANTS:
None

VOCATIONS:
Transit bus in Seattle only.

WARNING: If this function is enabled in the system calibration, the function MUST be integrated into the vehicle wiring. If the function will not be used in the vehicle, it MUST be disabled in the calibration. Refer to 5.0, Activating the I/O Functions.



WARNING: This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. **Allison Transmission is not liable for consequences associated with miswiring or unintended use of this feature.**

LIST OF REFERENCED DOCUMENTS

H 40/50 EP Installation Manual Section J: Energy Storage System (ESS)

Customer Specification Sheet (CSS), H 40/50 EP CSS form for 4th Gen Controls

REVISION HISTORY

November 18, 2010

- Inputs BI and BW, added Customer Modifiable Constant; previously was None.
- Input BM and BN, added Customer Modifiable Constant, Standard Value and Allowable Range; previously was None.
- Output D, to the Customer Modifiable Constants, added the Standard Values and Allowable Ranges.

October 12, 2010

- Input BJ, added description of system response when station mode input goes from active to inactive.
- Inputs BN and BM, revised description to indicate that when Fast Idle is requested, it is active only in Neutral.
- Input BN, corrected wire numbers on schematic; 361 and 303 were 161 and 103.
- Output AA, revised schematic to show A/C controller and option for input to vehicle controller. Added requirement that compressor cooling the ESS must be capable of operating whenever requested by Output AA. Revised CAUTION to indicate that Output AA must be enabled in the calibration and integrated with the vehicle wiring.
- Changed name of hybrid drive system to H 40/50 EP; was E^P 40/50 System™. Added name change note to front cover.

May 20, 2009

- Corrected Output AB, Aux Brake Indicator. This output function supplies a ground signal when auxiliary braking is active. Previously, this function was incorrectly described and shown as removing the ground signal when auxiliary braking is active.

May 11, 2009

- Created new preliminary document for EPTM 40/50 with Allison 4th Generation Controls, Controls Manual Section E: Input/Output Functions.