

Fuller® Automated Transmissions TRIG2500

October 2007

RTO-10910B-DM2
RTO-12910B-DM2
RTO-14910B-DM2
RTO-16910B-DM2



Powering Business Worldwide

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Roadranger

SUPPORT

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How to Use this Manual

This Eaton publication is intended to be a reference guide for the installation of the UltraShift™ DM Transmission. General vehicle and transmission information is provided to cover the wide range of applications. This information benefits the OEM installer by providing the correct installation procedures to ensure the utmost in satisfactory operation and long service life. For additional transmission information, see the Suggested Tools section in the back of this manual. For specific engine information contact the engine OEM.

Failure to adhere to Eaton Installation Requirements may affect transmission performance and/or warranty coverage.

UltraShift DM transmissions are compatible with electronically governed engines equipped with a J-1939 data link and certified by Eaton Corporation. Transmissions installed at OEM facilities must meet and be approved by Eaton Application Engineering. Contact Eaton Application Engineering or your OEM Application Engineering department for proper Application form. All applications must be submitted for approval.

OEM facilities must submit a design package to Eaton Corporation OEM Engineering Support Group for approval prior to any OEM build. A design package consist of the following information.

Electrical Systems

Wiring Schematic: This should show how the DM would interface with the vehicle.

Individual Harness Drawings: This should show the construction of each harness.

Harness Routings: This should show how each harness is routed in the vehicle. The locations of relays, fuses, power connections, tie-downs, etc.

Transmission Air Supply (if required)

Transmission Cooling System (if required)

Cooler size/type

Cooler line routing

Every effort has been made to ensure the accuracy of the information contained in this manual. However, Eaton Corporation makes no warranty, either expressed or implied, based on the information provided. With each new application, engine manufacturers should be contacted to make sure desired engines are compatible with their systems.

Suggested Tools

Pressure Gauges

0-100 PSI Air Pressure Gauge

O.E. Tool & Equipment Group/Kent-Moore SPX Corporation 1(800) 520-2584

Kent-Moore Part no.	Description
5505027	Volt/Ohm Meter (Standard commercially available VOM)

Eaton Corporation OEM Engineering Support Group

TBD	Pull to Neutral Box
-----	---------------------

O.E. Tool & Equipment Group/Kent-Moore SPX Corporation 1(800) 328-6657

Kent-Moore Part no.	Description
J-43318	Eaton Test Adapter Kit
	MD-100

Eaton Service Parts 1 (800) 826-HELP (1-800-826-4357)

Part No.	Description
	MD-200

Related Publications

Troubleshooting Guide	Eaton TRTS-
Service Manual	Eaton TRSM-
Driver Instructions	Eaton TRDR-2500

For more information call 1-800-826-4357.

Requirements

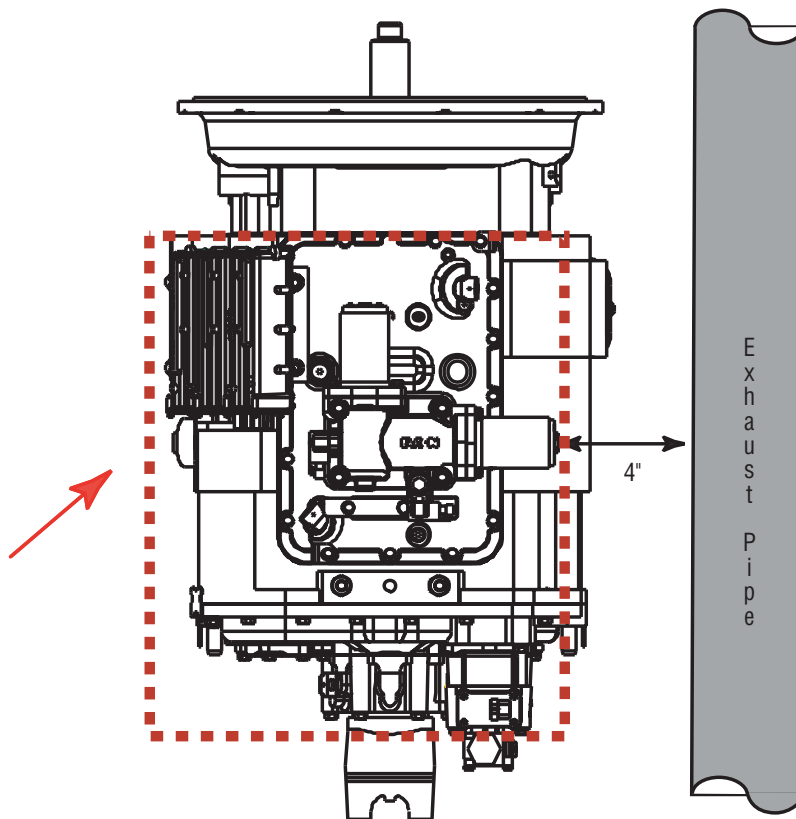
Fuller UltraShift DM transmission systems installed at OEM facilities must meet the requirements and be approved using the Eaton Transmission Application Approval Form. Please contact Eaton Application Engineering or your OEM's Application department for the latest Application form.

1. **Space Requirements** - Fuller UltraShift DM transmission systems require a minimum of 5" (127 mm) clearance from any high temperature device (i.e. Exhaust Crossover Pipes, Catalytic Converter) that generate heat at a maximum of 500° F. The systems to be avoided are the Shift Motors, Sensors, Wire Harness and Transmission Controller (see figure). * If you must deviate from this distance and temperature an Eaton Approved heat shield must be used.
2. **Cab Floor Access Plate** - A cab floor access plate is necessary for access and removal of components from the transmission top. Plate size must be sufficient to allow removal of the transmission Controller or the Electric Shifter.
3. **Clutch Requirements** - Must use Eaton DM clutch module.
4. **Lubrication Requirements** - Roadranger® CD50 or equivalent E500 synthetic as specified in Eaton publication TCMT-0021.
5. **Electrical Wiring Requirements** - It is the OEM responsibility to provide power and ground to the Transmission Controller from a reliable battery source. The power (+) connection must include overload protection per Federal Motor Carrier Safety Regulations, Section 393.31 Main Power and Ground must be able to carry 20 amps @ 9 volts with no more than .05 ohms from the battery source.
 - The cable outside the cab shall be a minimum of 16 gauge (1.0 mm²). The cable inside the cab shall be a minimum of 18 gauge (0.8 mm²).
 - When the Eaton Push Button Shift Control is used the Blithe communications link between the Shift Control and the Transmission Controller must be a twisted pair; Belden, J-1939, or equivalent.
 - The J-1939 (the communications link between the Shift Control and the Engine Controller ECM) must follow SAE J-1939 specifications for either J-1939/11 or J-1939/15.
 - The SAE J-1587 connector must be easily accessible and mounted on the left side of the cab
6. **Harnesses** - Do not splice any Transmission Harness to supply another system with information. Using the cabling for any purpose other than transmission control could cause a system failure.
7. **Power-Battery (+) and (-)** - must be disconnected PRIOR to any type of welding on any Fuller UltraShift DM equipped vehicles.
8. **Power- Battery Negative(-)** - Must be disconnected PRIOR to removal or installation of ECU harness connectors.
9. **Speedometers** - No mechanical speedometers.
10. **Line Inspection** - Prior to shipment of Eaton transmission systems installed at OEM plants, the transmission must pass the requirements outlined on the checklist form. See the Line Inspection section in this manual.
11. **Engine Retarder** - Recommended for improved transmission performance on UltraShift DM transmissions. When using an exhaust brake, the recommended practice is the exhaust brake on/off switches be wired in the engine ECM separately from the exhaust brake solenoid. Failure to comply with this recommended practice can cause Eaton trans-

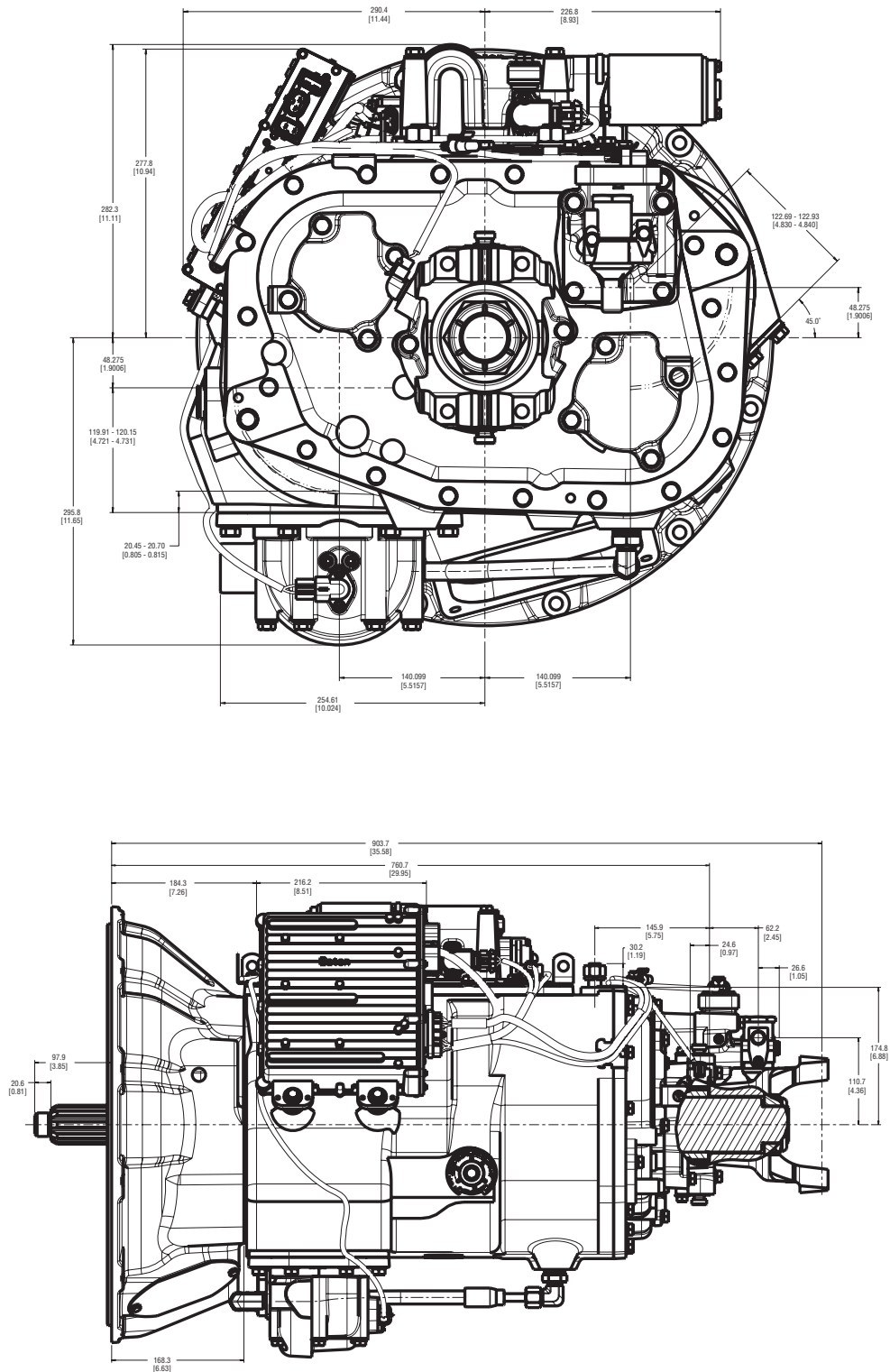
missions to miss shifts when the exhaust brake is required. For more information contact Eaton Application Engineering and refer to J1939 Engine Requirements for Eaton Transmissions.

12. **Lifting Eyes and Sensor Position** - Bolts used for retaining sensors or lifting eyes are not to be used for any other purposes or have any other brackets attached to them.
 - Do not tie wrap any cables or hoses to the existing transmission wire harnessing. Anchor points on the transmission may be used as long as addition of cable or hoses do not interfere with existing harness.
 - Vehicle harness must be tied to harness bracket on transmission. Allow sufficient length for service and free movement of transmission
 - Any addition of bracketing must be approved by Eaton. Contact you OEM representative for further information.
13. **Air Dryer Requirements** - A high quality vehicle air dryer is required with the 10-Speed Eaton transmissions.
14. **Fan Drive Requirements** - The recommended practice is for the engine fan to be wired into the engine ECM, this includes the manual fan override switch. The OEM should use fan clutches that can be controlled by the engine (i.e. electromechanical). Failure to comply with this recommended practice can cause Eaton transmissions to inhibit shifts when the engine fan is on.
15. **OEM Supplied Shift Lever** - Shift Lever must have gated positions.
16. **Engine Configuration** - Prior to shipment of Eaton Transmission Systems installed at OEM plants, the engine ECU must contain the proper configuration settings. For the proper engine configuration settings required for Eaton Transmission operation, contact Eaton OEM Engineering Support Group.

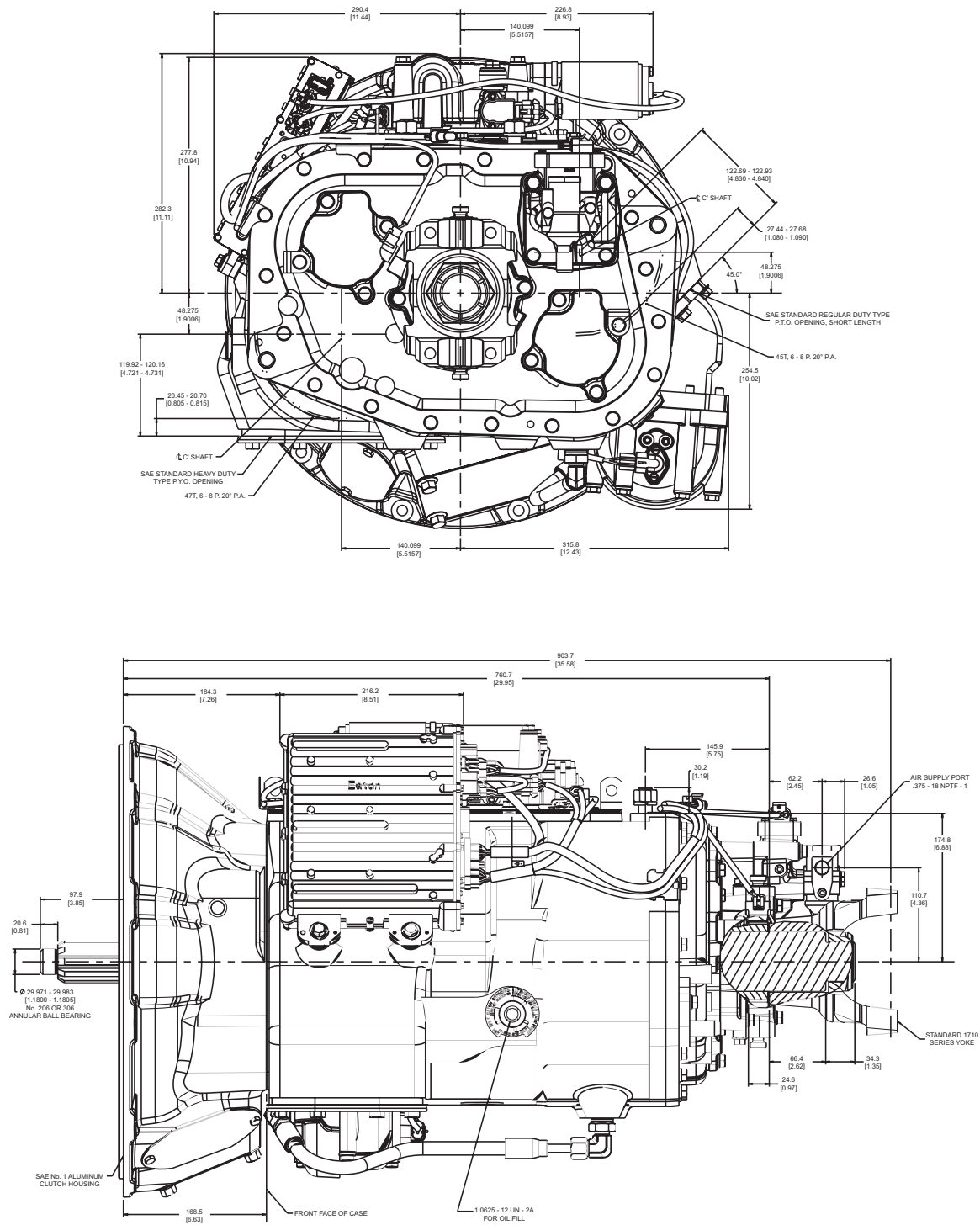
This area must be left clear of all wires and hoses for serviceability



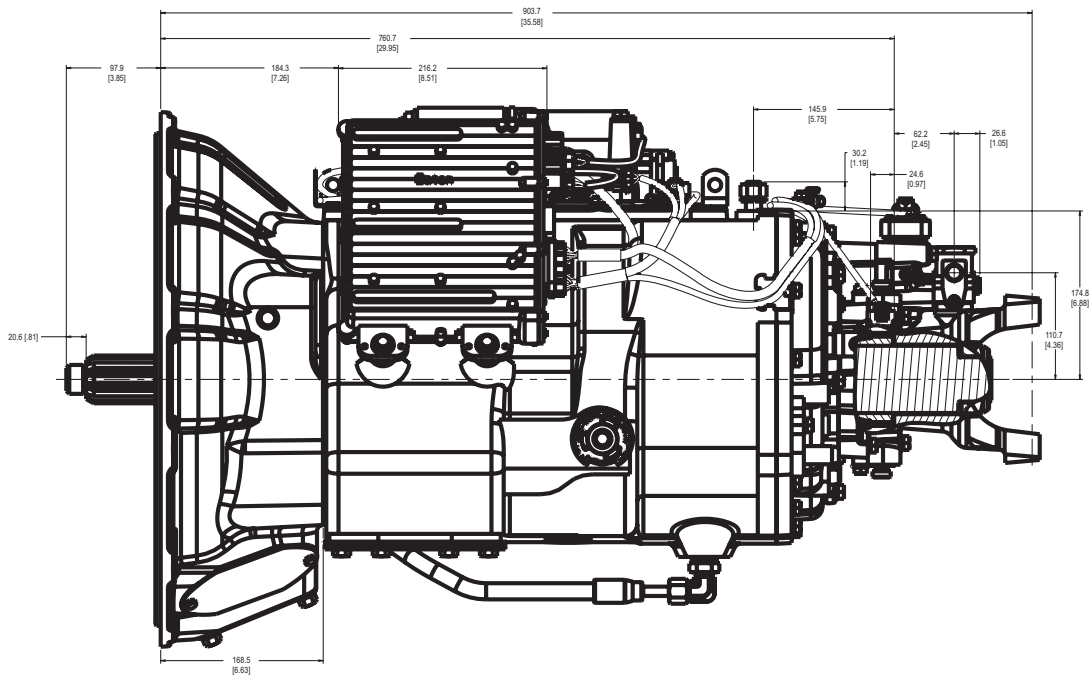
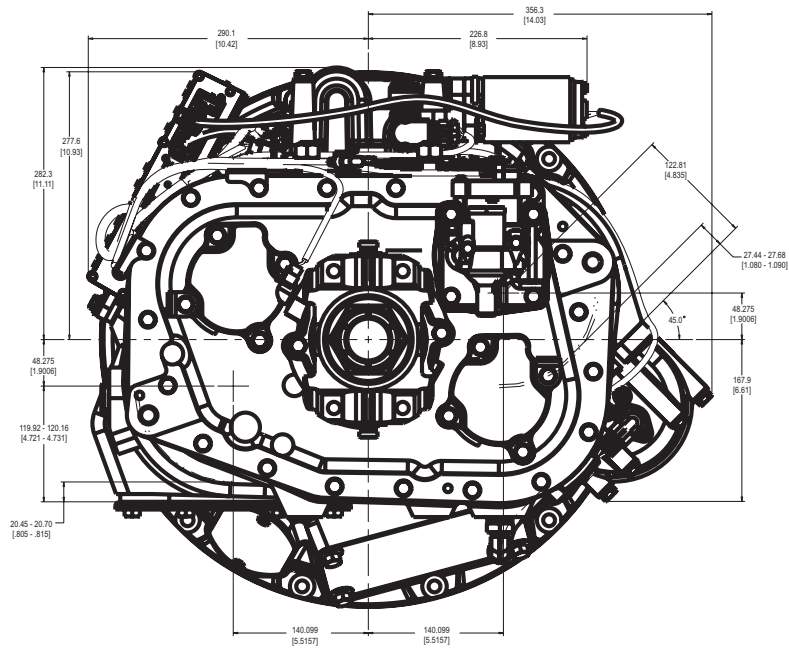
10-Speed RTO-XX910X-DM2



10-Speed RT0-XX910X-DM2



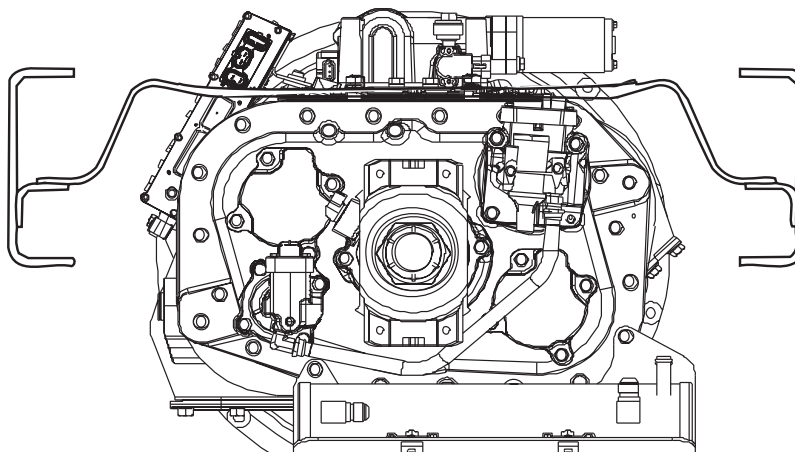
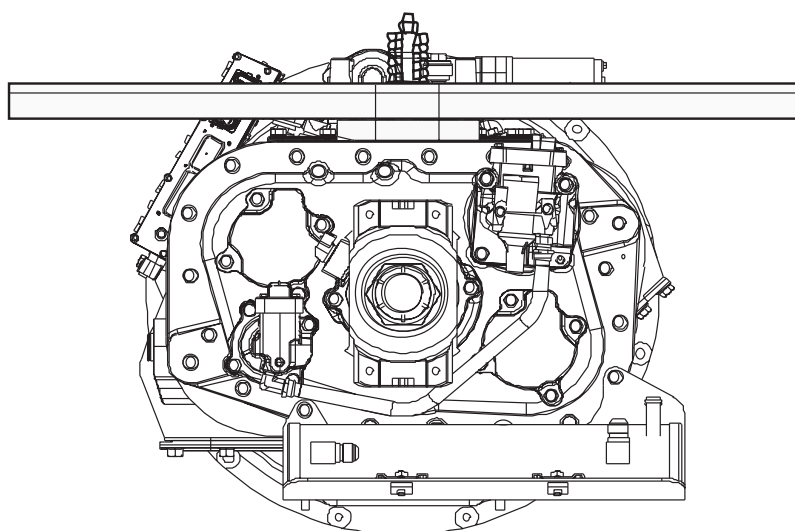
10-Speed RT0-XX910X-DM2



Rear Supports

A rear support is required for all installations where the nodal mount supports are not used. The OEM is responsible for this design.

1. The transmission nodal mounting pads are approved to be used as a rear engine support location.
2. The OEM is responsible for nodal mount design.
3. Torque transmission nodal mount capscrews (3/4-10 UNC) to 180-190 lbs-ft. [224-258 Nm] of torque.



Lubrication Requirements

Eaton Fuller Transmissions are designed so the internal parts operate in a bath of lubricant circulated by the motion of gears and shafts. Thus, all parts will be amply lubricated if these procedures are closely followed:

- Use Roadranger® CD50 or equivalent E500 synthetic per Eaton publication TCMT-0021.
- When adding lubricant, types and brands of lubricant should not be mixed because of possible incompatibility.
- Use clean lubricant and clean containers when filling the transmission. Containers that have been used for antifreeze or water should not be used for transmission lubricant.
- Additives and friction modifiers are not recommended for use in Eaton Fuller Transmissions.

Recommended Lubricant

Type	Grade (SAE)	Temperature
Roadranger CD50 Transmission Fluid	50	ALL

Includes all Eaton approved comparable synthetic lubricant.

Proper Lubricant Level

Transmission Capacity

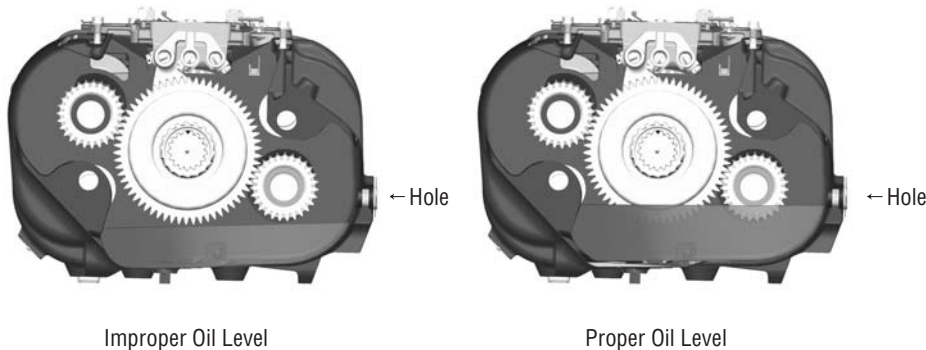
10-Speed	26 pints (12.3 liters)
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Note: Failure to adhere to Eaton Installation Requirements may effect transmission performance and /or warranty coverage.

Note: The quantity for proper fill level will vary from unit to unit.

Make sure lubricant is level with fill hole opening. Because you can reach lubricant with your finger does not mean lubricant is at the proper level. (On heavy duty transmissions, one inch of lubricant level equals about 8 pints of oil)

DO NOT remove the Electric Shifter (X-Y Shifter) at any time.



Lubrication Requirements

Operating Temperatures with Oil Coolers

Operating at temperatures above 250°F (120°C) causes loaded gear tooth temperatures to exceed 350°F (177°C) which will ultimately destroy the heat treatment of the gears. Temperatures above 250°F (120°C) should be regarded as a warning of inadequate cooling. If the elevated temperature is associated with unusual operating conditions that will reoccur, a cooler should be added, or the capacity of the existing cooling system increased.

The following conditions in any combination can cause operating temperatures of over 250°F (120°C):

- Operating consistently at slow speeds
- High ambient temperatures
- Restricted air flow around the transmission
- Exhaust system too close to the transmission
- High horsepower operation
- Engine Retarders

External oil coolers are available to reduce operating temperatures when the above conditions are encountered.

Oil cooler systems must meet a minimum requirement of 3/4 I.D. cooler lines and 8 GPM system flow @ 1500 RPM. The end user is ultimately responsible for maintaining transmission lube temperatures below 250°F (120°C).

Transmission Oil Coolers are recommended	Transmission Oil Coolers are required
With engines of 350 H.P. and above	With engines 400 H.P. and above and GCW's of 90,000 lbs [40,823 kg] or greater
	With engines 400 H.P. and above and 1400 lbs-ft [1898 Nm] or greater torque
	With engines 450 H.P. and above
	With engines 1500 lbs-ft [2033 Nm] and above

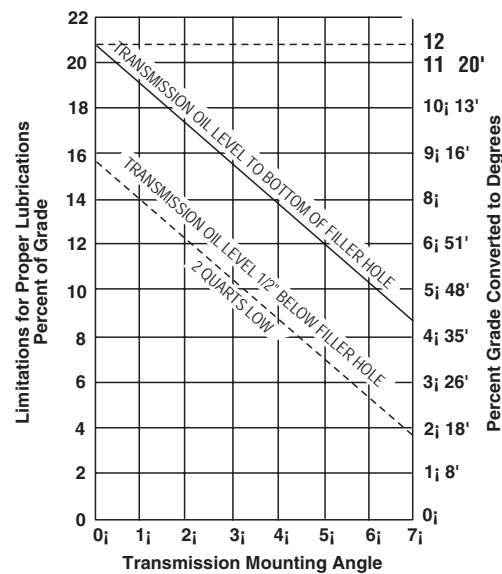
Proper Lubrication Levels as Related to Transmission Installation Angles

If the transmission operating angle is more than 12 degrees, improper lubrication can occur. The operating angle is the transmission mounting angle in the chassis plus the percent of upgrade (expressed in degrees).

For example: If you have a 4 degree transmission mounting angle, then 8 degrees (or 14 percent of grade) is equal to the limit of 12 degrees. If you have a 0 degree mounting angle, the transmission can be operated on a 12 degree (21 percent) grade.

Note: The chart shows the effect a lubricant level 1/2" below normal can have on safe operating angles. Operating the vehicle 1/2" low on lubricant reduces the safe degree of grade by approximately 3 degrees (5.5 percent).

Proper Lubrication Levels are Essential!



Dotted line showing "2 Quarts Low" is for reference only. Not recommended

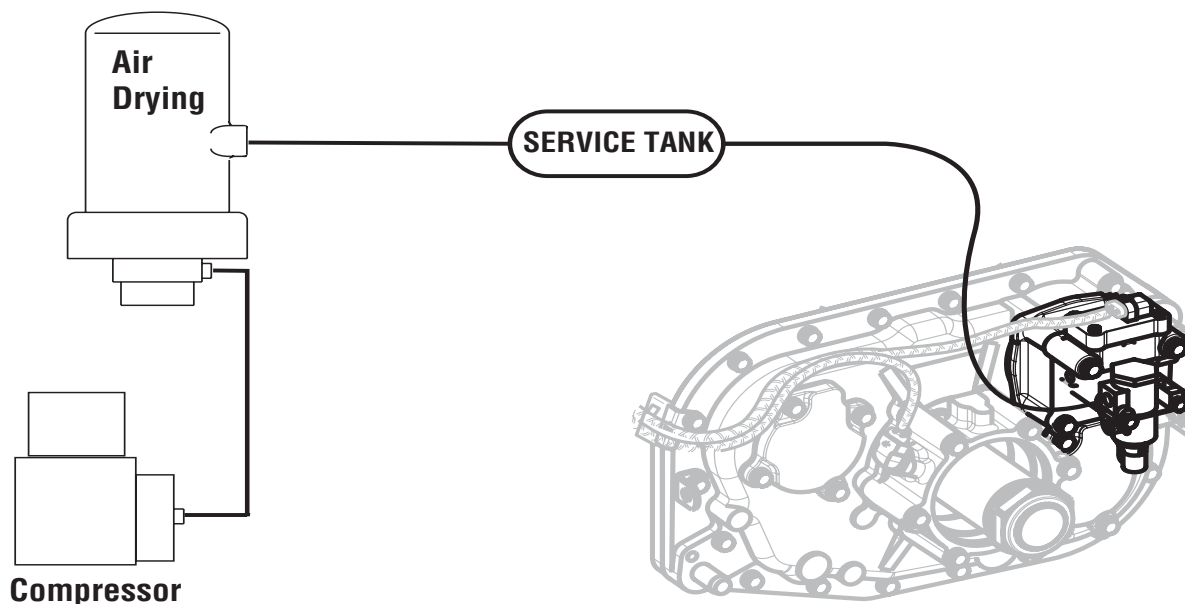
Note: For transmissions with coolers installed, make sure lubricant is level with fill hole opening, run the truck, stop and check lubricant level. Lubricant must be level with fill hole.

Air Supply Requirements for 10-Speed Transmissions

1. It is required to use a high quality commercially available air dryer in the air supply line before the transmission.
2. Minimum air requirement for the transmission is 65 PSI.
3. A minimum of 1/4" diameter air supply line is required.
4. The transmission air supply is required to be routed from the air tank, which supplies air to either the front or rear vehicle service brakes, with a gauge indicator in the cab.
5. Transmission airlines should not be routed or attached at the bottom air tank fittings to avoid any chances of introducing moisture into the airline.
6. Care should be used when routing the air supply to avoid kinks and close contact to heat sources.
7. The transmission air supply must be connected to the air filter/regulator mounted on the range cylinder cover.

Note: The air filter/regulator must not be removed during installation.

8. Air additives such, as alcohol devices should not be permitted to enter the transmission air supply. Additives could cause damage to air system components, which could lead to degraded transmission performance.



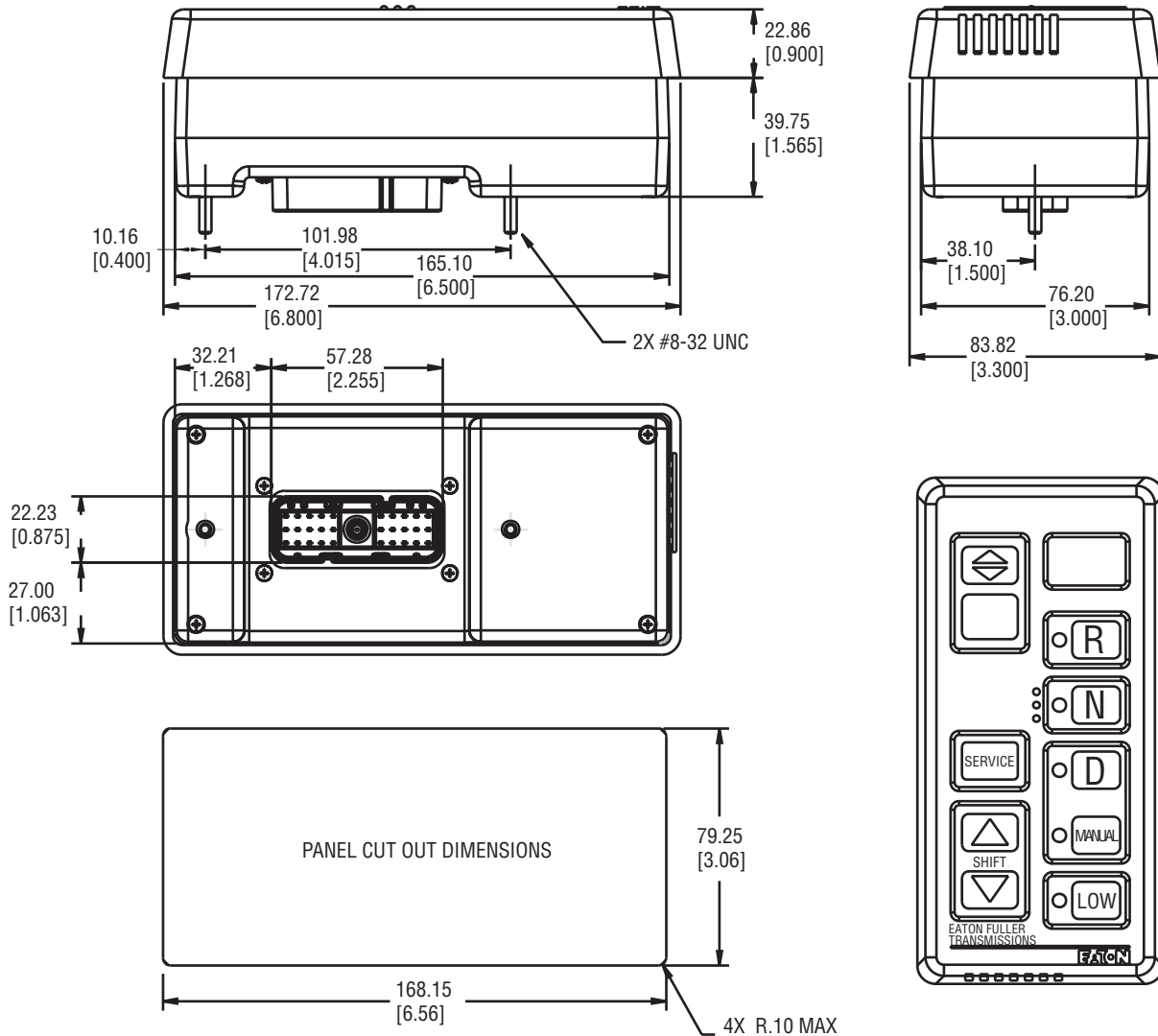
**Do not tie wrap air line
to wire harness on transmission**

Engine Retarder Requirements

An engine retarder (compression or exhaust) is recommended to aid in shifting performance of the Fuller UltraShift DM transmission. It is recommended on the 10-Speed UltraShift transmission.

1. The transmission sends J-1939 Torque/Speed Control 1 (TSC1) torque control commands to the engine retarder (compression or exhaust) only when deceleration assistance during a shift is required. The transmission automatically detects the retarder source address (compression or exhaust) and addresses the TSC1 accordingly. If both compression and exhaust are present, the transmission will address exhaust only.
2. The engine retarder shall respond to TSC1 control commands as indicated by Actual Retarder Percent torque within 50 msec of the TSC1 command.
3. The engine retarder shall respond to TSC1 commands regardless of the status of the engine brake control switches on the dash.
4. The engine retarder shall affect the engine deceleration rate within 250 msec to 300 msec of the request. Longer response times will adversely affect the transmission's upshift capabilities on a grade and may limit applications to grades 8% and lower. Response times greater than 500 msec are not acceptable.
5. The engine retarder shall respond to zero percent torque control command by turning off the engine brake within 250 msec. Longer delay times to turn off may cause harsh gear engagements and loss of vehicle speed.
6. The engine shall have a minimum deceleration rate of 1000 rpm/sec with the engine retarder at 100%. The engine is disengaged from the driveline and is virtually unloaded.
7. The recommended practice is for the exhaust brake on/off switches to be wired in the engine ECM separately from the exhaust brake solenoid. Failure to comply with this recommended practice can cause AutoShift/UltraShift transmissions to miss shifts when the exhaust brake is required. For more information contact Eaton Application Engineering and refer to J1939 Engine Requirements for Fuller UltraShift Transmissions.

Shift Console Space Requirements



Mating Connector Information

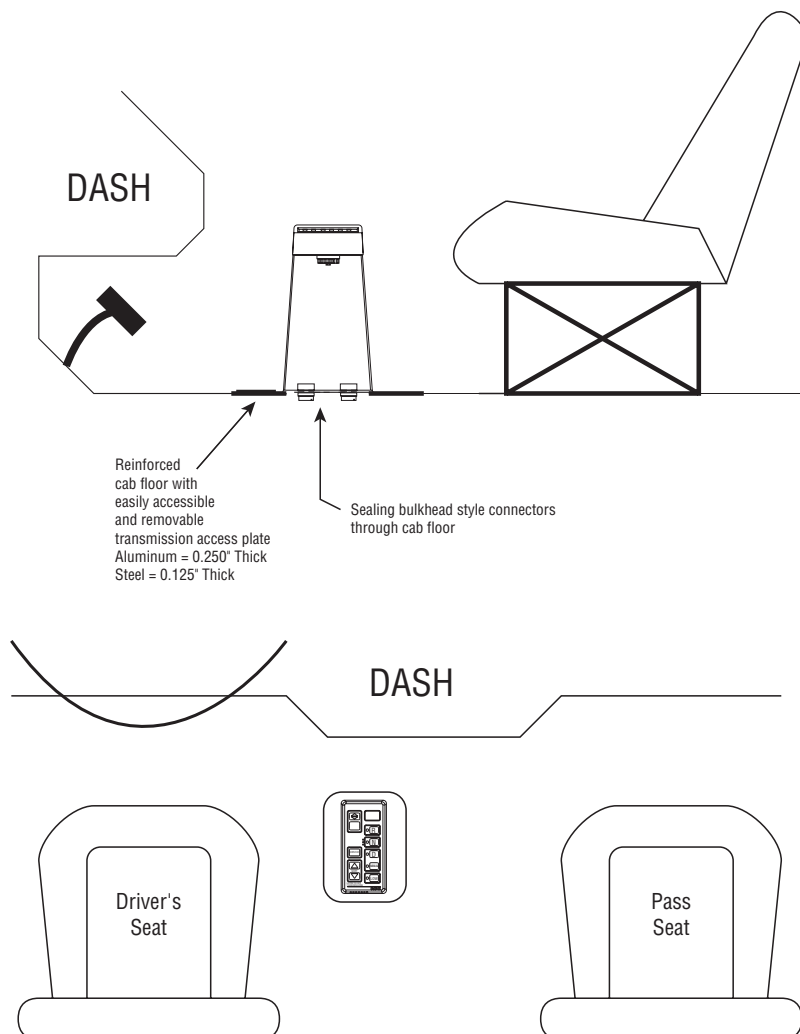
1. Packard 30-way
2. Body 12048455
3. Terminal 12103881

Typical Tower Mount Configuration

1. Minimum floor or support plate thickness for mounting the tower assembly is .250" for aluminum or .125" for steel. The OEM is responsible for providing a tower mounting surface sufficient to make the shift tower "feel solid".
2. Floor plate connectors must be mounted to prevent contamination from entering the tower area.
3. The Shift Control assembly must be mounted in the cab within easy reach of the driver's normal position.

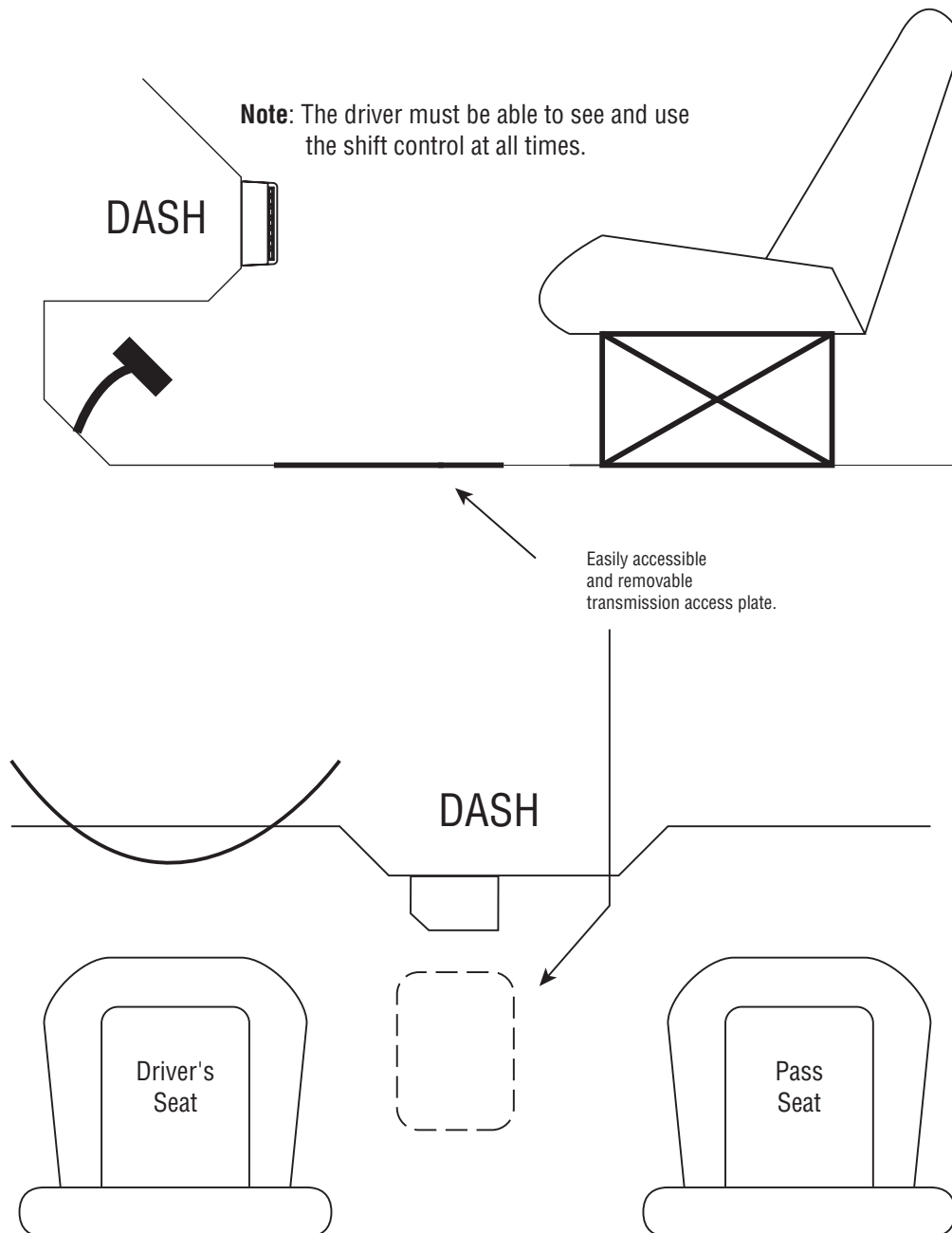
Note: The driver must be able to see and use the Shift Control at all times.

4. The Shift Control assembly should not interfere with other vehicle related controls or features.
5. If the shift tower is not mounted on a removable plate, an access floor plate is necessary to service components on top of the transmission. See "Requirements" on page 3 for details.



Typical Dash Mount Configuration

1. Sealed bulkhead style harness connectors must be used when running harness connections through cab floor or fire-wall.
2. The shift console should be mounted to the dash using an OEM supplied mounting bezel. If no bezel is used, the OEM must ensure the Shift Control is accessible to the driver at all times.
3. A cab floor transmission access plate is necessary to service components on the top of the transmission. See "Requirements" on page 3 for details.



Cable

Conductor Size

The cable outside the cab shall be a minimum of 16 gauge (1.0 mm²). The cable inside the cab shall be a minimum size of 18 gauge (0.8 mm²). Note that these sizes are minimum requirements only. Conductor size may need to be increased depending on current carrying requirements.

Cable Size	20 AWG (.05 mm ²)	18 AWG (.08 mm ²)	16 AWG (1 mm ²)	14 AWG (2 mm ²)	12 AWG (3 mm ²)	10 AWG (5 mm ²)
Current Capability	13 Amp	17 Amp	21 Amp	28 Amp	36 Amp	46 Amp

Conductor Material

Conducting material shall be stranded bare copper wire.

Conductor Construction

Cable Size	20 AWG (.05 mm ²)	18 AWG (.08 mm ²)	16 AWG (1mm ²)	14 AWG (2mm ²)	12 AWG (3mm ²)	10 AWG (5mm ²)
Conductor Strands x size	7 x 28 AWG	16 x 30 AWG	19 x 29 AWG	19 x 27 AWG	19x 25 AWG	19 x 23 AWG

Insulation Material and Thickness

The cable shall be GXL: General Purpose, Cross (X) Linked polyerthylene conforming to SAE J-1128.

Connectors

Connectors shall be designed for use in the heavy-duty industry. Each connector shall feature a quick-disconnect through a bayonet coupling, positive lock or bolt-together style. Packard/Delphi 280 Series or equivalent should be used when possible. Connectors shall have the capability of being probed by a commercially available volt/ohm meter without being damaged.

Sealed Connectors

Sealed connectors shall be required outside the cab environment. The connector seal shall not come off when removing a connector from its mate. Cable seals shall be required to fix the size of the cable per manufacturer specifications.

Unsealed Connectors

Unsealed connectors can be used inside a cab environment only.

Cable

Terminals

Terminals shall be sized for the correct current capacity of the circuit as stated by the manufacturer.

Terminals shall be plated with tin, nickel, gold, etc. Mating terminals shall be plated with the same material. Gold plated terminals shall be required in 5 volt dry circuits. Beryllium Copper or equivalent should be used as a base material.

Ring Terminals

Terminals such as ring, bullet, spade, ect., shall be sized for the correct current capacity of the circuit as stated by the manufacturer. Terminals shall be plated and non-insulated. Sleeves shall be insulated with a double wall shrink tubing.

Convolute Conduit

Convolute conduit must have a maximum operating temperature of at least 300°F (149°C).

Braided Loom (Mesh)

Coverage: A minimum of 10, maximum of 12 picks per inch. The braid shall be woven so as to produce a tight non-slip covering over the cables. The braid shall be heat-sealed to prevent unraveling. Braid must have a minimum service temperature of 280°F (138°C).

Insulating Sleeves

Sleeves shall be constructed of a heat shrinkable, irradiated, adhesive lined, semi-rigid polyolefin. The color shall be black. Typical shrinkage shall be 50% in diameter when exposed to heat (300°F) (150°C).

Tape

Adhesive tape for harness forming and spot taping shall be polyvinyl chloride (PVC). The tape shall have a pressure sensitive adhesive coating on one side.

Assembly Procedures

Crimping

The crimp shall be applied with a tool specified by the manufacture of the terminal.

Terminals shall be applied according to terminal manufacturer's specifications.

Stripping

An allowable maximum of 2 strands may be cut on 16 gauge or larger, 1 strand on 18 gauge, and no strands on 20 gauge in the crimp area.

Cable

Soldering

No terminals shall be soldered unless specifically indicated on the individual print. The function of solder is to join two or more metals at temperatures below their melting point. This provides metal and electrical continuity resulting in low resistance connections. It also precludes corrosive affects from the junction. A solder point also allows for temperature induced torsional stress without rupture of the joint. Solder connections shall conform to Eaton's workmanship specifications. Flux shall clean the metal but not attack, corrode or oxidize the metal. Acid type flux shall not be used.

Splice

Splice clips are allowed. The splice clip shall be crimped and variac-soldered with 60/40 solder. Resistive weld is also an approved method for splicing. Splices shall be insulated with 2-inch long, heat-shrinkable tubing.

Circuit Identification

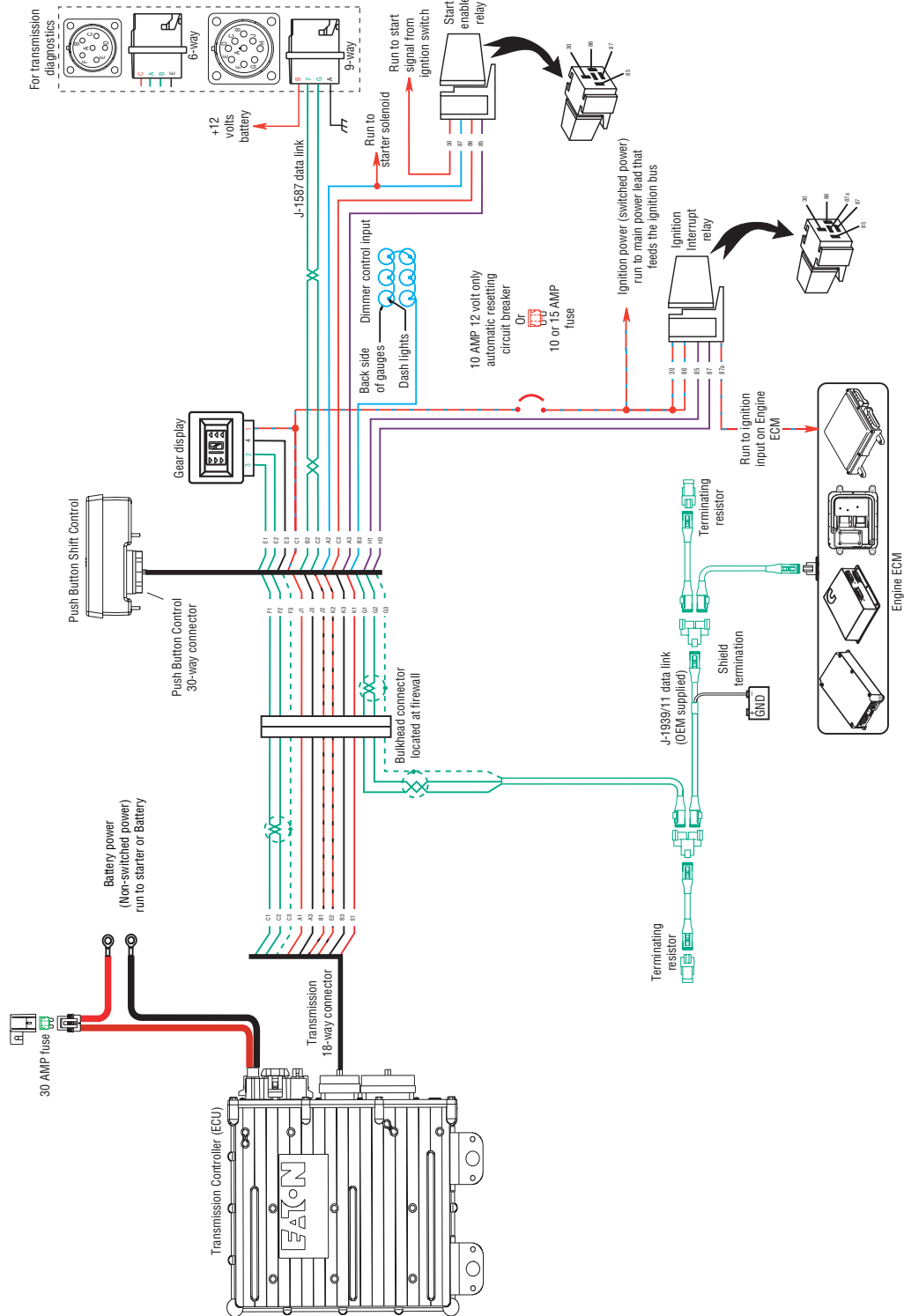
Circuit identification shall be by either numbers/letters or color-coding. When numbers/letters are used, coding shall be applied continuously along the length in approximately two to three inch increments. Code shall be visible at breakouts. When color-coding is used, the color identification shall consist of a color stripe. If greater color combinations are required, the cable shall have a color dash with stripe on opposite sides. Stripe and numbers shall be resistant to oil, grease, dirt, and ethylene glycol.

Twisted Cables

2 conductor cables shall have 12 twists/foot. (16 and 18 gage cable only)

All cable lengths to multi-cavity connectors shall be cut and dressed to ensure no undue stress is on an individual wire after insertion into the connector. After insertion, all terminals shall be checked for retention.

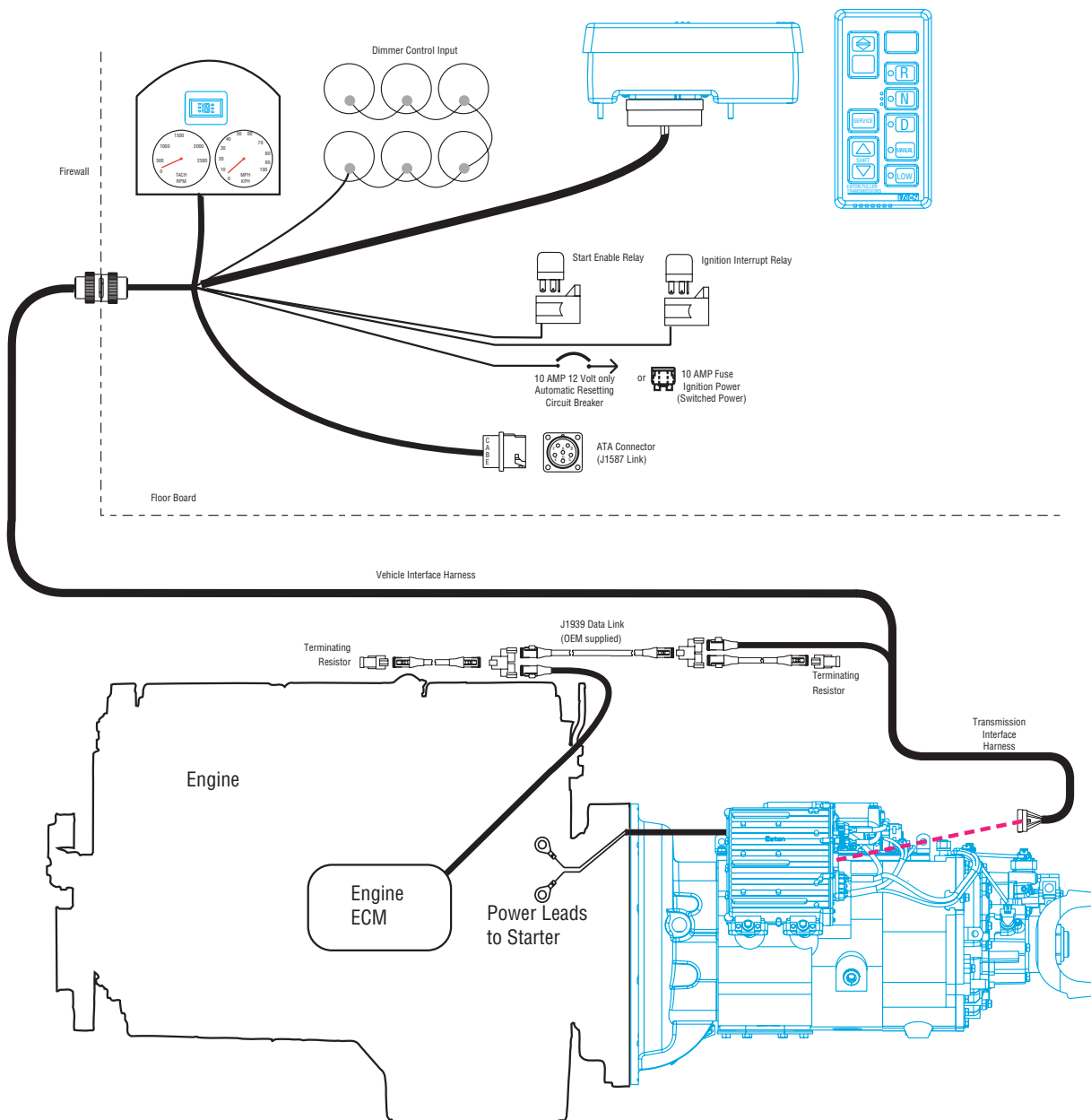
Wiring Diagrams OEM Responsibility



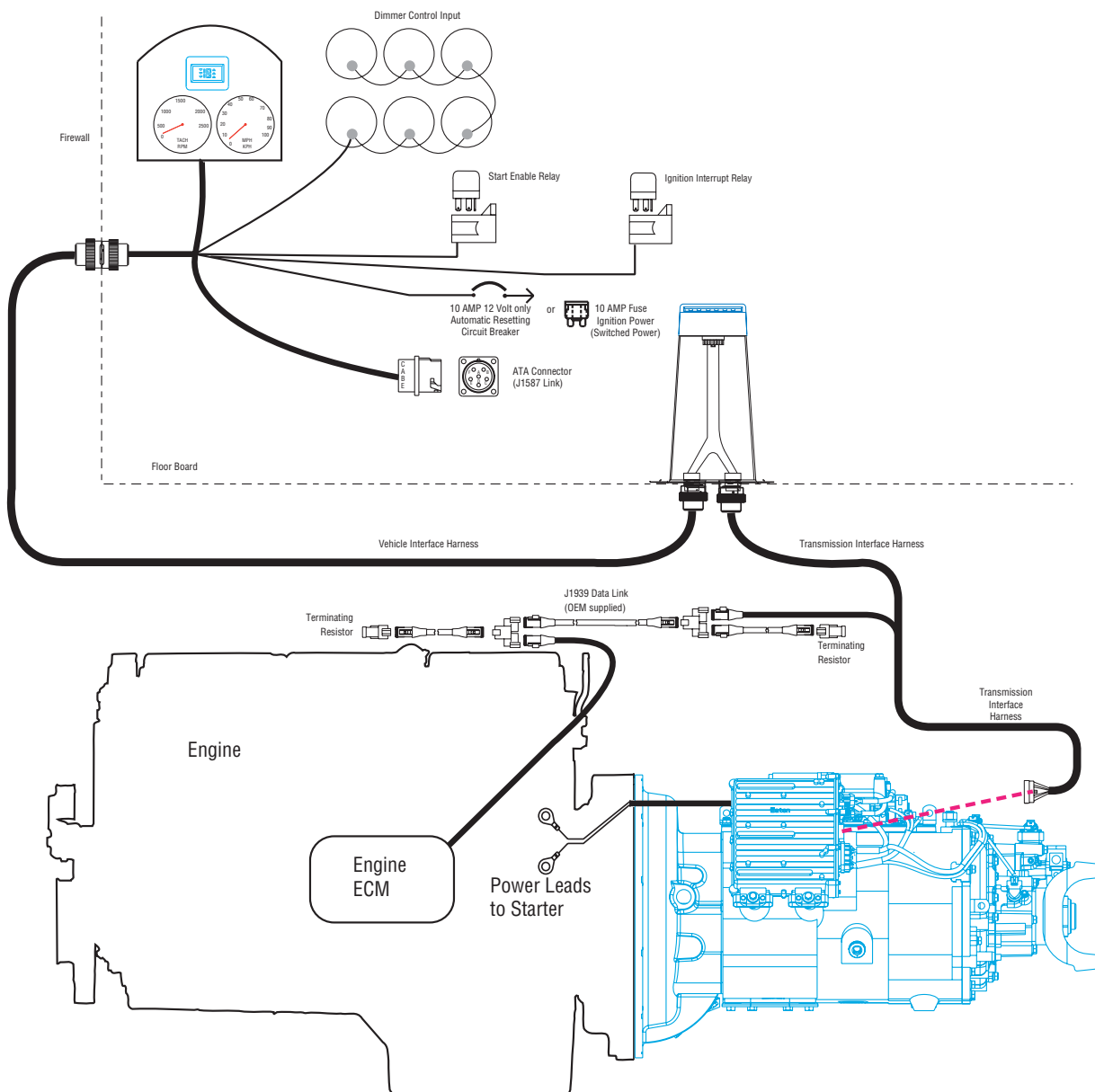
Typical Dash Mounted System

The dash location is for the following:

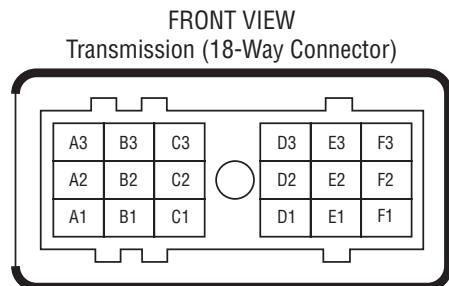
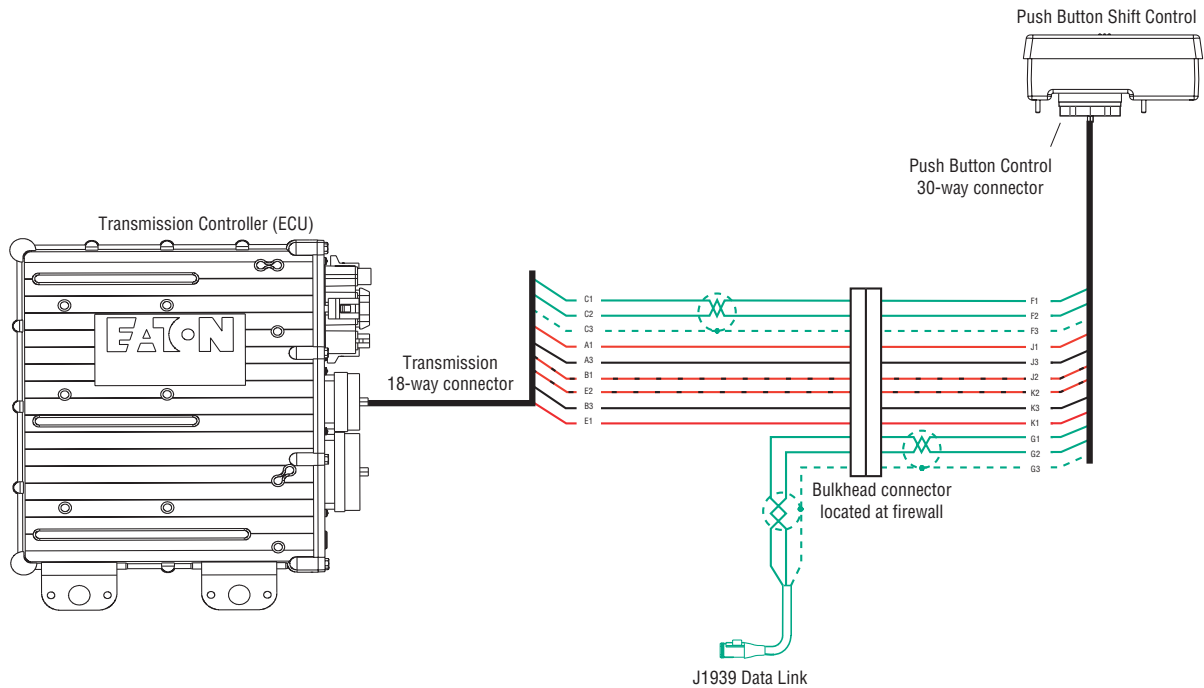
- Start Enable Relay
- Gear Display
- Push Button Shift Control
- ATA Connector (J1587 Link)
- Dimmer Control Input (VDash)
- Ignition Interrupt Relay



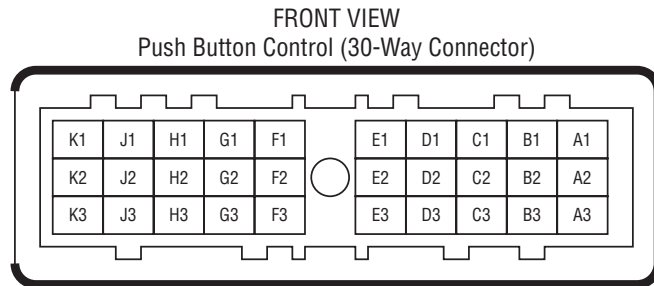
- Start Enable Relay
Gear Display
ATA Connector (J1587 Link)
Dimmer Control Input (VDash)
Ignition Power (VIGN)
Ignition Interrupt Relay



Transmission Interface

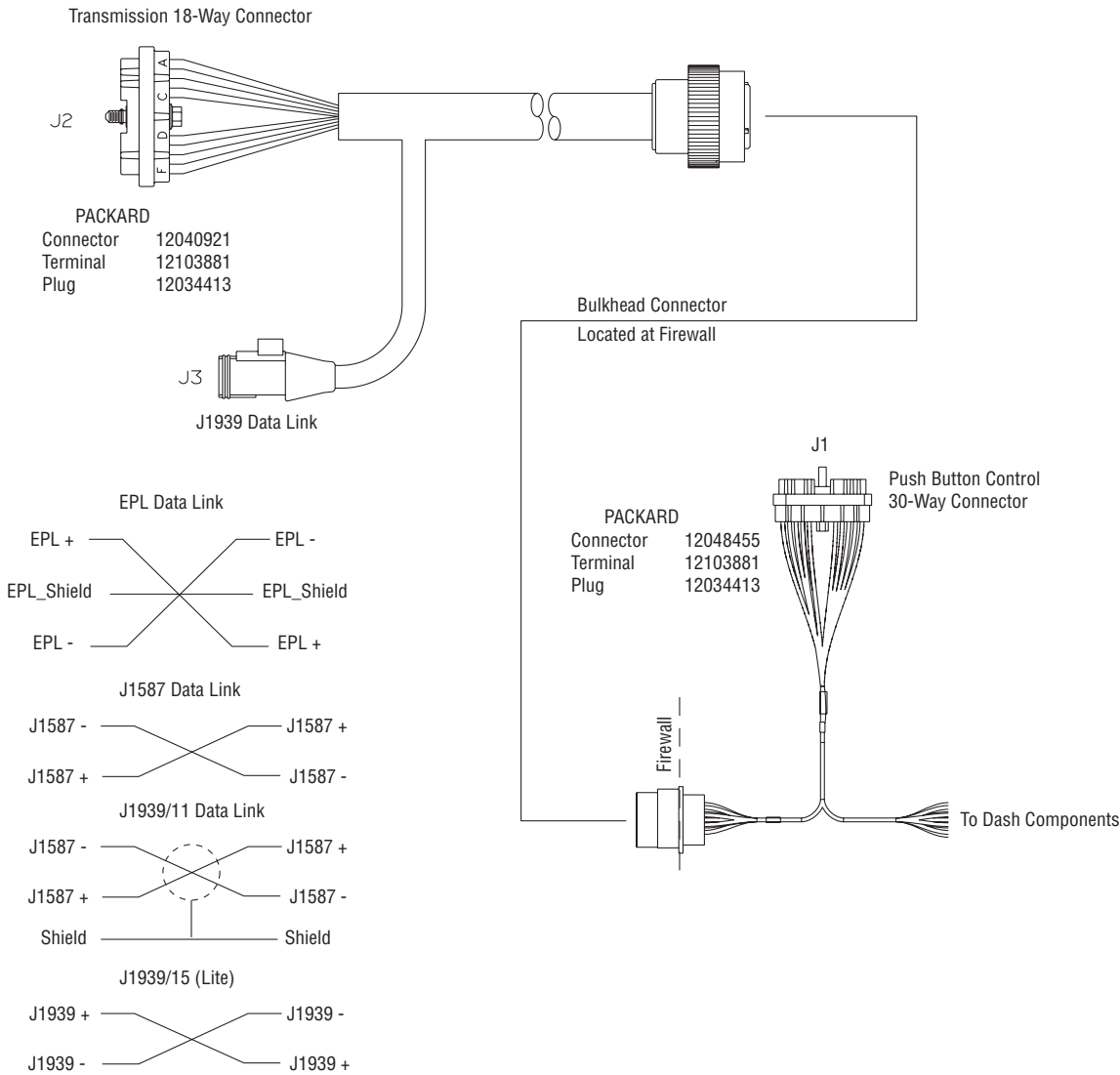


PACKARD
Connector 12040921
Terminal 12103881
Plug 12034413



PACKARD
Connector 12048455
Terminal 12103881
Plug 12034413

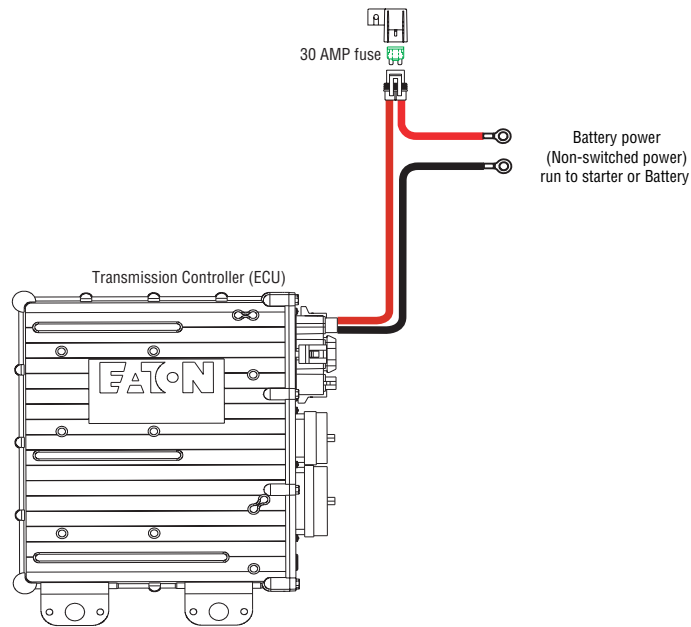
Transmission Interface



FROM	TO	DESCRIPTION
J1-F1	J2-C1	EPL+
J1-F2	J2-C2	EPL-
J1-F3	J2-C3	EPL Shield
J1-J1	J2-A1	VBATT 1
J1-K1	J2-E1	VBATT2
J1-J3	J2-A3	GND 1

FROM	TO	DESCRIPTION
J1-K3	J2-B3	GND 2
J1-J2	J2-B1	TRANSBATT 1
J1-K2	J2-E2	TRANSBATT 2
J1-G1	J3-A	J-1939 + (Yellow)
J1-G2	J3-B	J-1939 - (Green)
J1-G3	J3-C	J-1939 Shield

Power Harness



The OEM is responsible for the design of the Main Power Harness.

Note: Main power and ground must be able to carry 20 amps at 9 Volts with no more than .05 ohms.

To calculate the .05 ohms, take the length of the wire from the battery or starter to transmission and multiply the ohms per foot for that wire gauge.

12AWG(3.0mm²)=.0016 ohms per ft. (25.4 mm)

10AWG (5.0mm²)= .001 ohms per ft. (25.4mm)

Each connection is <.005 ohms

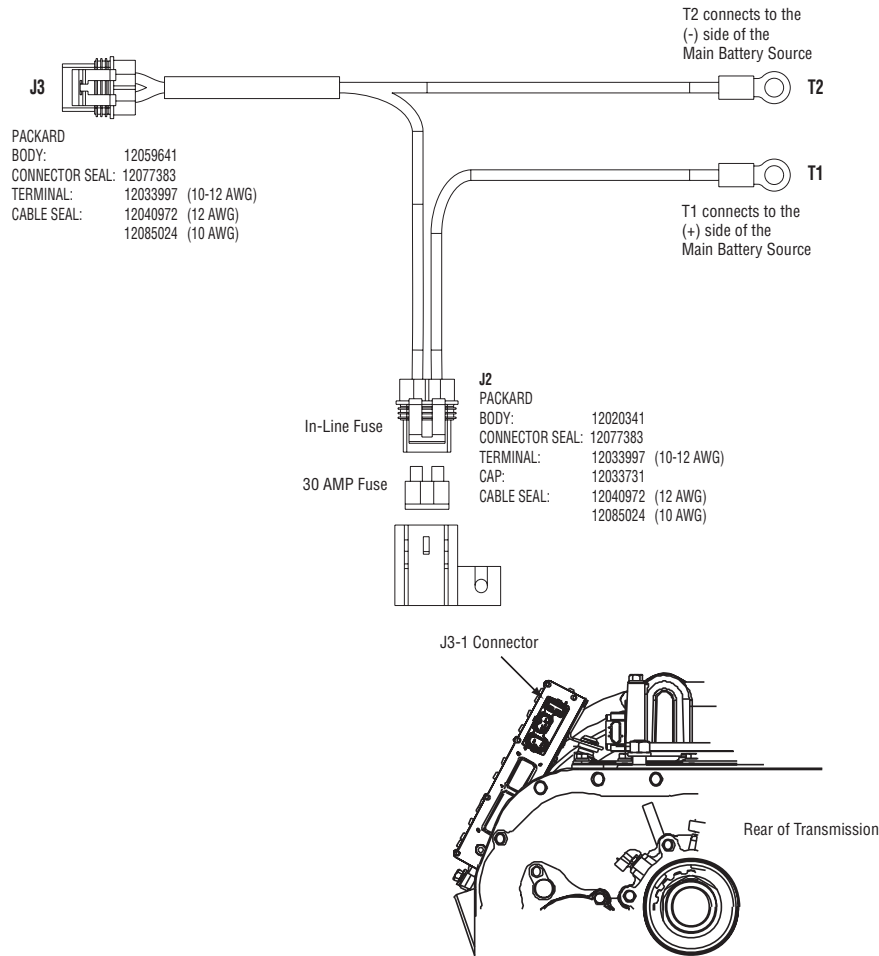
Example: The Main Power Harness is four foot long made of 12 AWG. (3.0mm²) which equals .0016 ohms per foot. +12 vdc and ground wires combined equals 8 feet (203mm).

The Main Power connector is connected to the starter, which equals six connections. According to the Delphi Packard Electrical Systems, each connector is .005 ohms.

1. 8ft * .0016 ohms = .013 ohms
2. 6 connectors * .005 ohms = .03 ohms
3. .03 + .013 = .043 ohms

For this example the total resistance is a .043 ohm.

Power Harness



Note: The main power and ground must be able to carry 20 amps at 9 volts with no more than .05 ohms from the battery source.

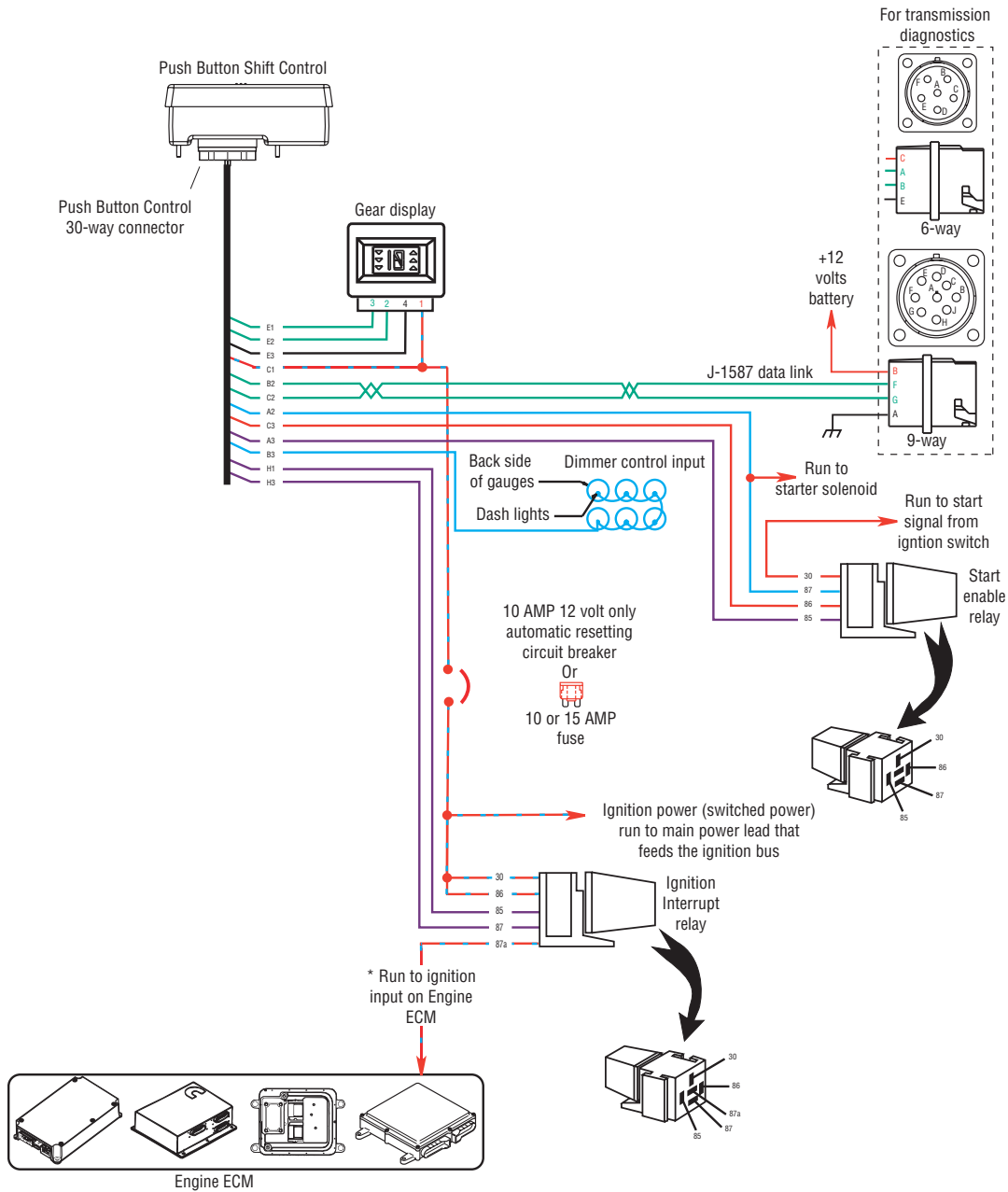
Note: The main battery source can be Starter or Battery terminals (Power Distribution Module is acceptable). Frame rails and splices into other harnesses are not considered reliable battery sources.

FROM	TO	WIRE DESCRIPTION
J3-A	T2	Ground
J3-B	J2-B	12 Volts
J2-A	T1	Battery

Note: Power-Battery Negative (-) Must be disconnected PRIOR to removal or installation of ECU harness connectors.

Note: Removal of fuses is not recommended as the method of disconnecting power from the ECU. Making and breaking a circuit through tin plated terminals (e.g. ring terminals, fuses, most connectors) will destroy the plating on the terminal. Opening a switch contact or the main power link is the recommended method of interrupting power.

Typical Dash Harness

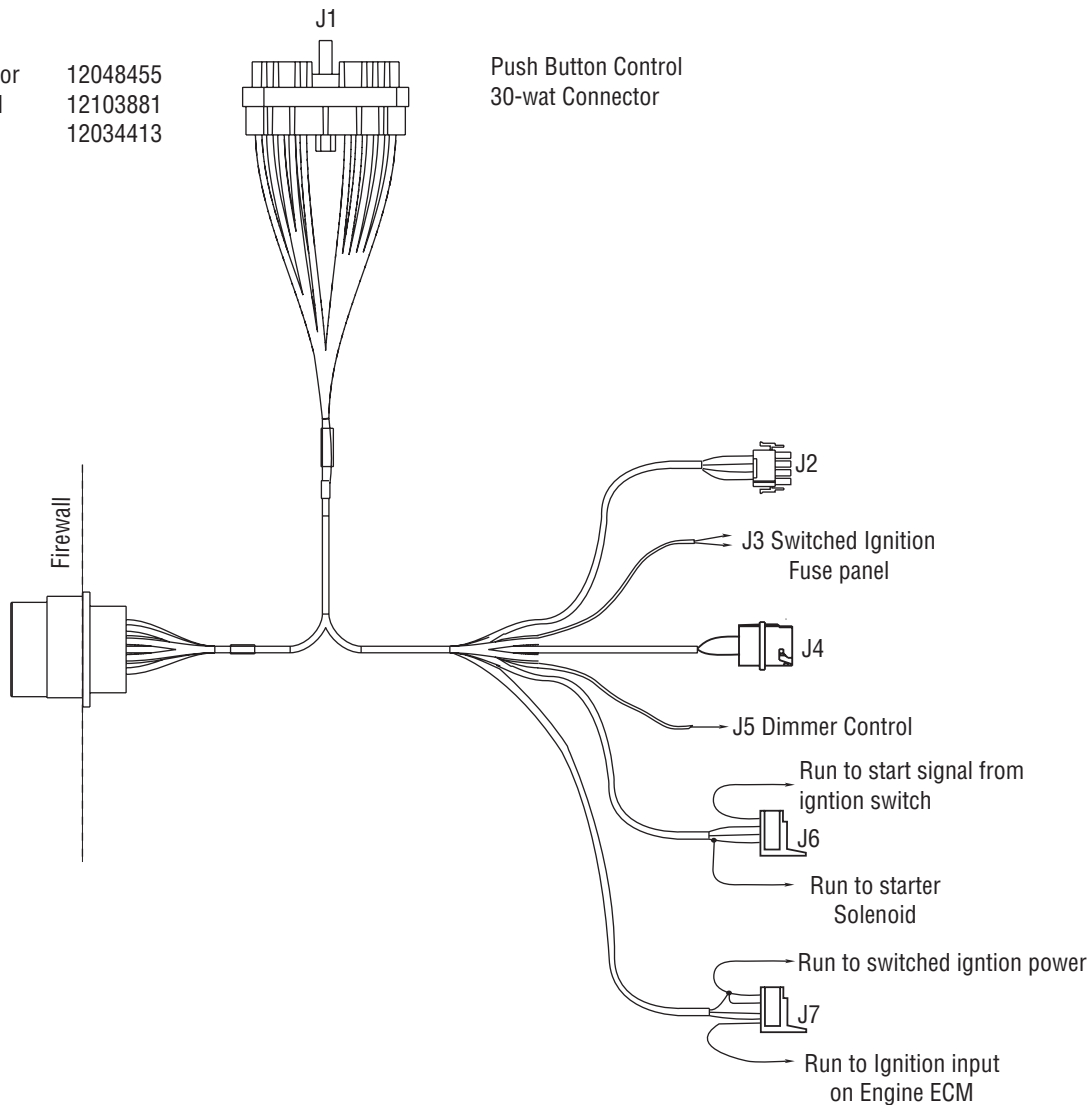


* For vehicle/engine systems which use a vehicle system ECU, contact the Eaton OEM Engineering Support Group for installation schematics.

Typical Dash Harness

Packard
Connector 12048455
Terminal 12103881
Plug 12034413

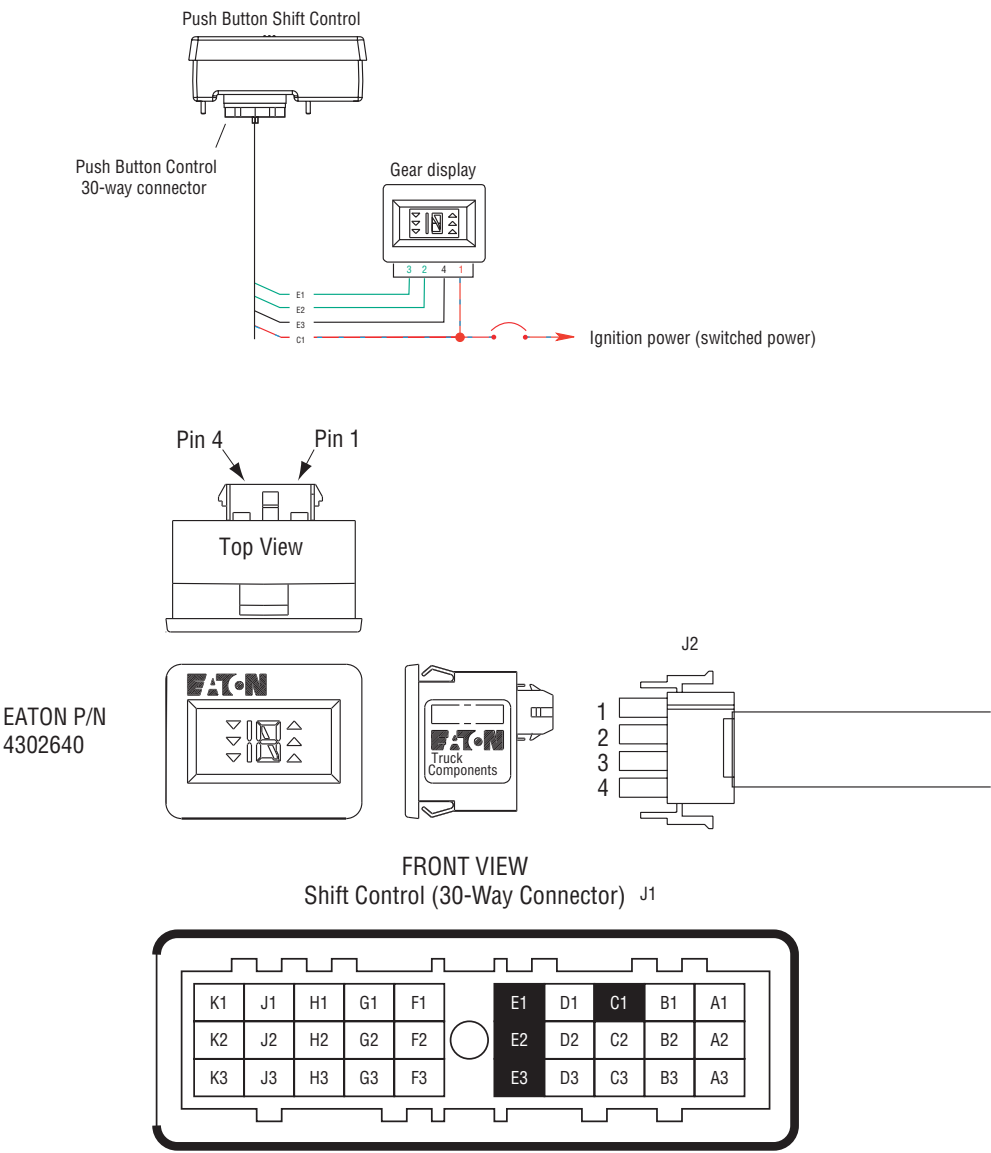
Push Button Control
30-wat Connector



FROM	TO	WIRE DESCRIPTION
J1-E1	J2-3	CLOCK +
J1-E2	J2-2	DATA -
J1-E3	J2-4	GND
J2-1	SPLICE (J3)	IGNITION 1
J1-C1	SPLICE (J3)	IGNITION 2
J1-B2	J4-A	J1587 + (6-pin)
J1-C2	J4-B	J1587 - (6-pin)
J1-B3	J5	DIMMER CONTROL
J1-C3	J6-85	START ENABLE RELAY +

FROM	TO	WIRE DESCRIPTION
J1-A3	J6-86	START ENABLE RELAY -
J1-A2	J6-87	START ENABLE RELAY LATCH
J6-87	SPLICE	STARTER SOLENOID
J6-30	-----	STARTER SWITCH
J1-H1	J7-85	IGNITION INTERRUPT RELAY -
J7-30	J7-86	IGNITION INTERRUPT RELAY+
J7-30	SPLICE	IGNITION POWER
J7-87a	J3	ENGINE ECM
J1-H3	J7-87	DIAGNOSTIC FEEDBACK

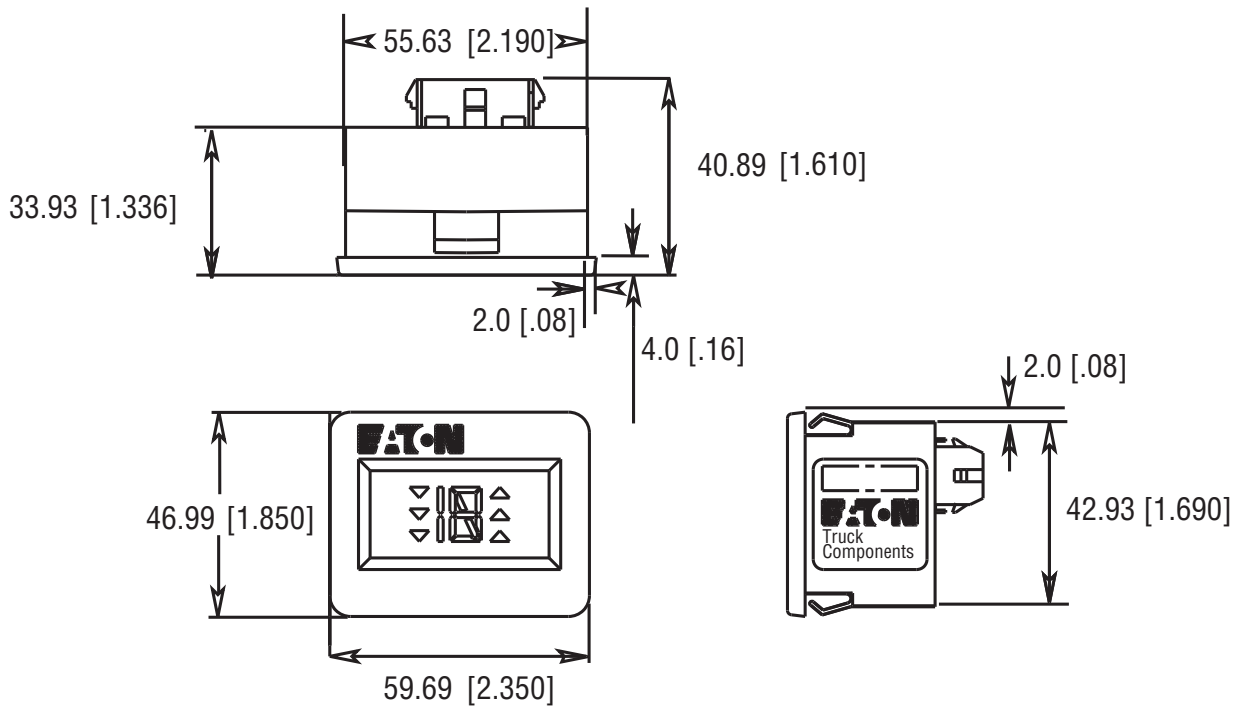
Gear Display Module



Interconnection Table

FROM	TO	DESCRIPTION
J1-E1	J2-3	CLOCK +
J1-E2	J2-2	DATA -
J1-C1 (spliced with ignition)	J2-1	DISPLAY POWER +
J1-E3	J2-4	DISPLAY POWER -

Gear Display Module



Panel Cut-Out Dimensions:

43.1 [1.70] X 56.1 [2.20] X 0.254 [.010]

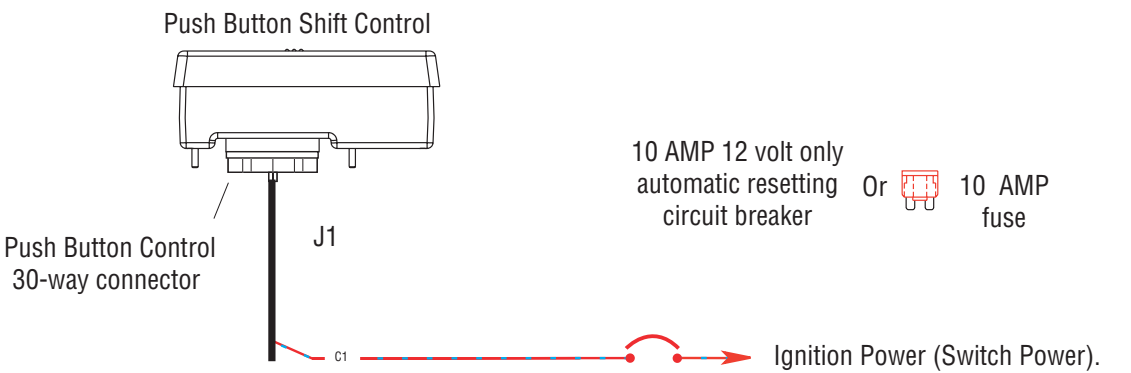
Mating Connector information:

AMP 4-way

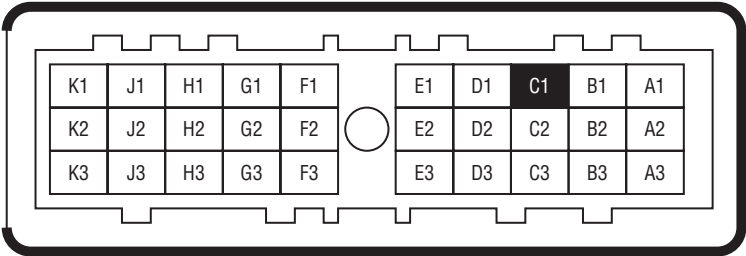
Body 1-480702-0

Terminal 350551-2

Ignition Circuit Detail



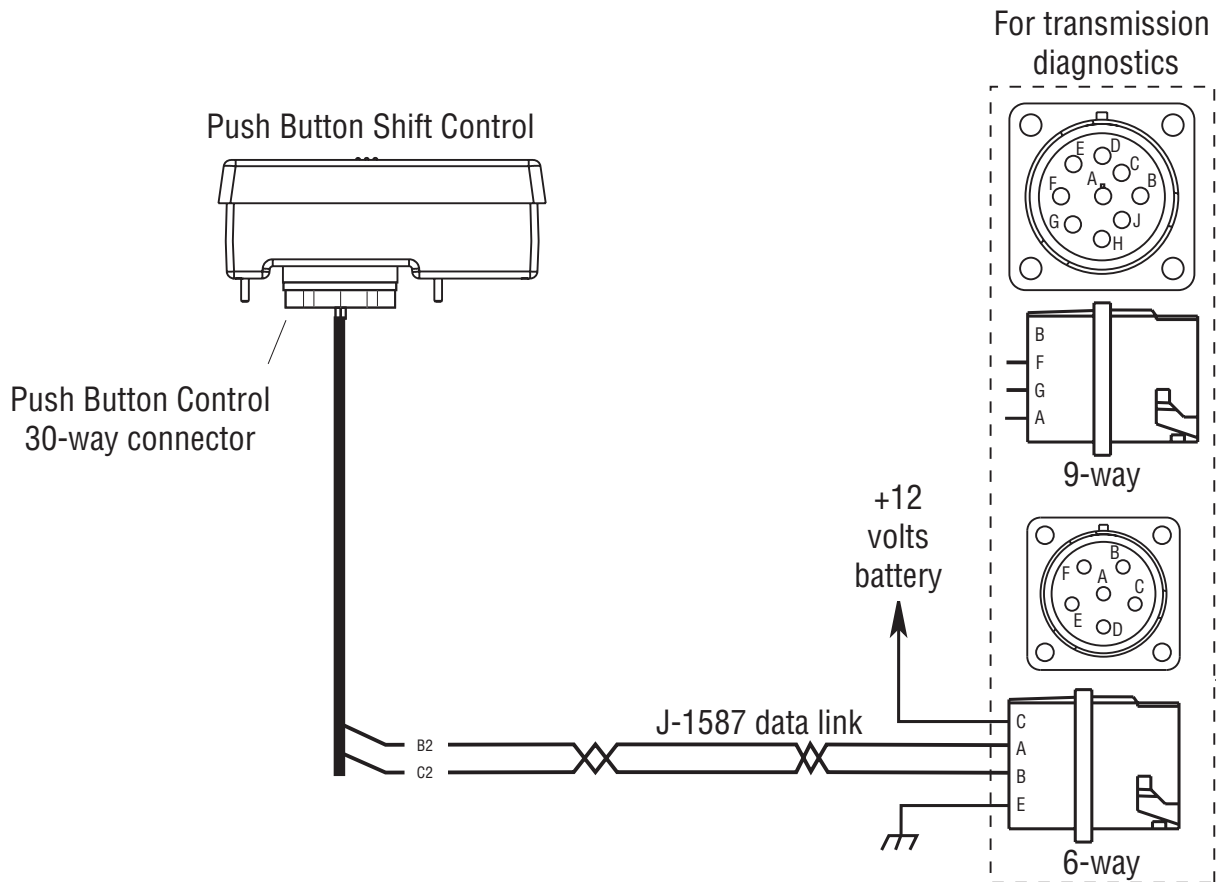
FRONT VIEW
Shift Control (30-Way Connector) J1



FROM	TO
J1-C1	VIGN

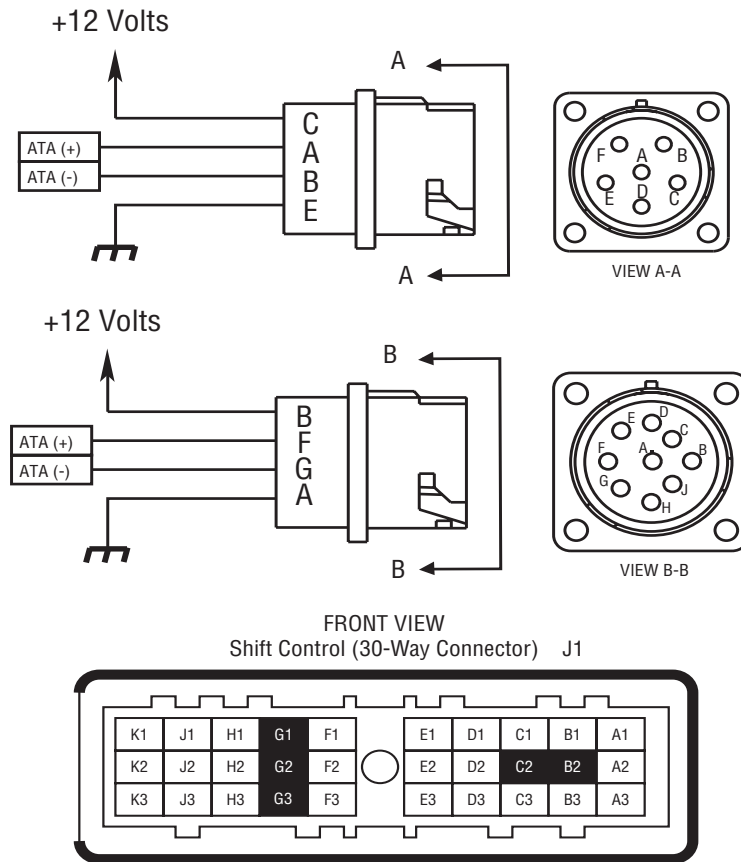
Note: On isolated battery systems, the ignition should be supplied by the “start” battery.

J-1587 Diagnostic Link



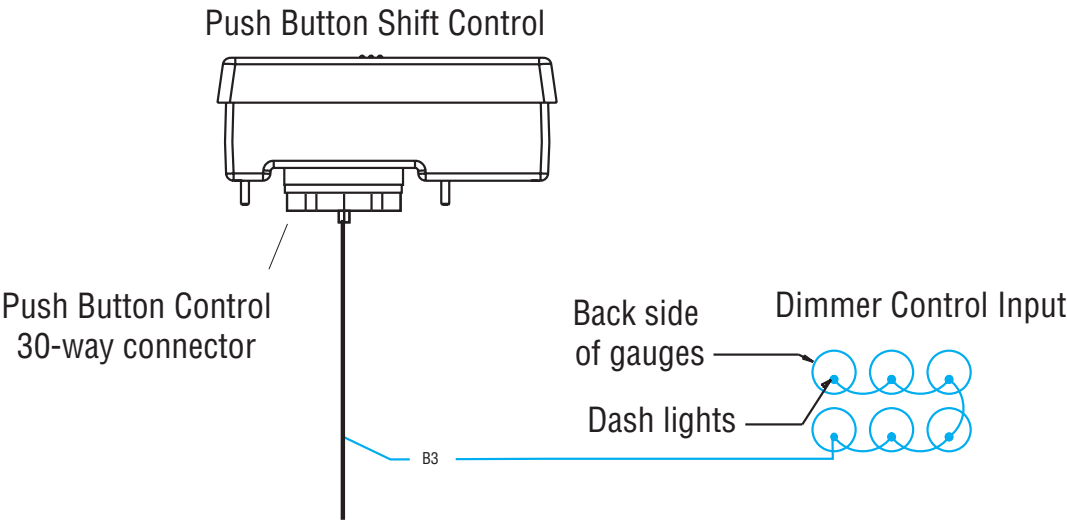
Note: The diagnostic connector must be mounted on the left side of the cab and easily accessible per SAE J -1587.

Note: SAE has two approved connectors. Eaton recommends the Deutsch 6-pin connector shown. The Deutsch 9-pin is shown for reference only.

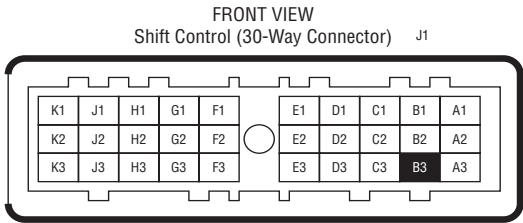
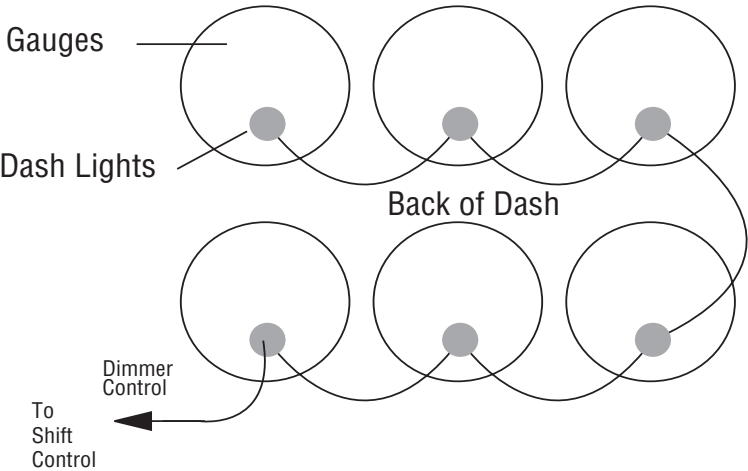


FROM	TO 6-PIN	TO 9-PIN	DESCRIPTION
J1-B2	A	F	ATA +
J1-C2	B	G	ATA -
—	C	B	BATTERY +
—	E	A	GROUND -
J1-G1	—	C	J-1939 +
J1-G2	—	D	J-1939 -
J1-G3	—	E	J-1939 shield

Dimmer Control Input Connection



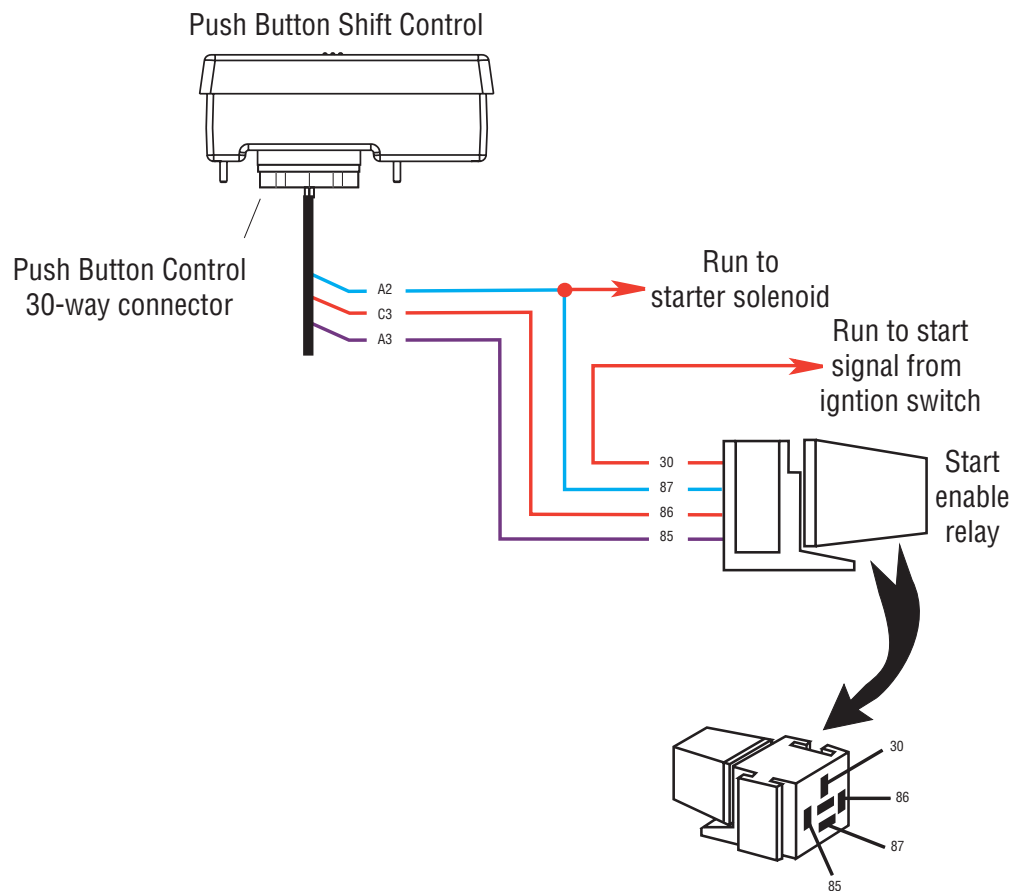
Note: Connect VDASH to the dash lights or running lights. This input will dim the lights on the Shift Control when the lights are on. When VDASH input is off, the lights on the Shift Control will be on full.



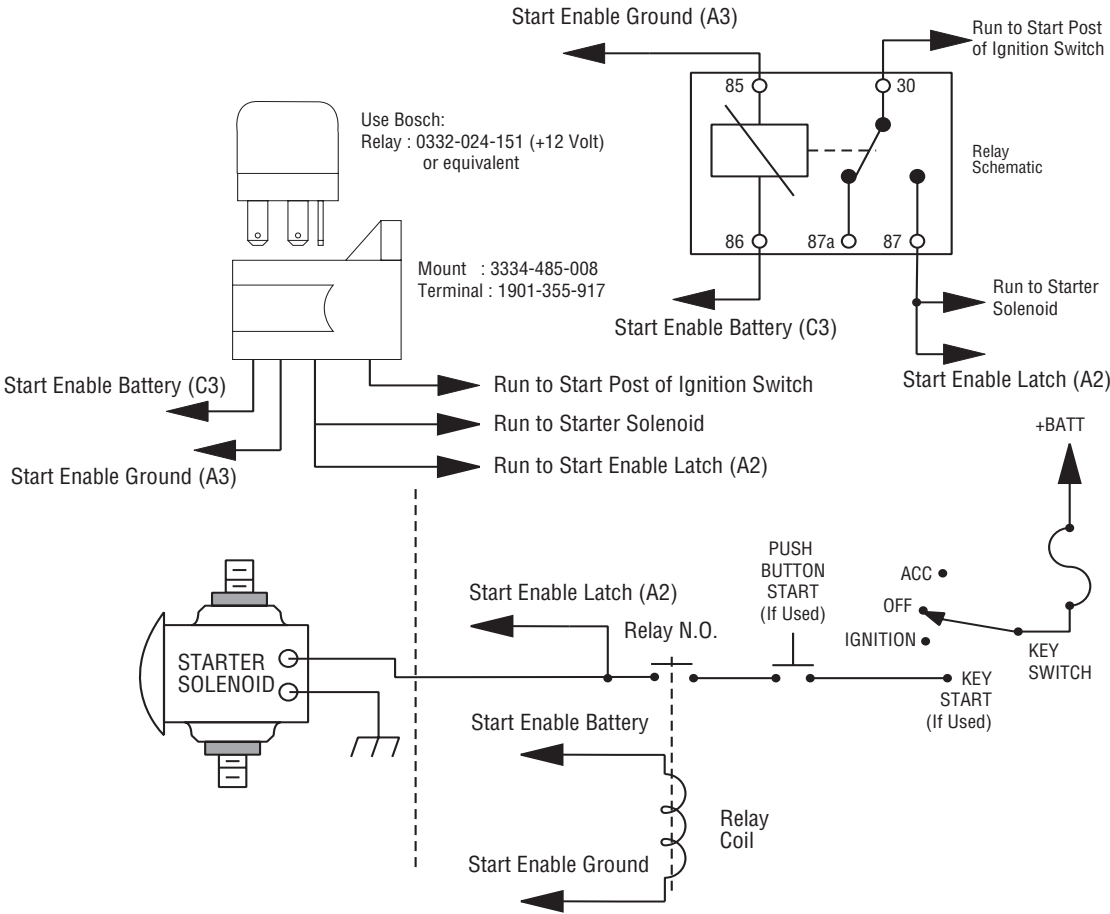
FROM	TO
J1-B3	VDASH

Typical Start Enable Circuit

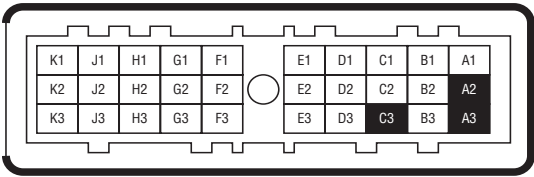
Startability must meet FMVSS Standard 102, Section 3.1.3: “The engine starter shall be inoperative when the transmission shift lever is in a forward or reverse direction position.”



Typical Start Enable Circuit

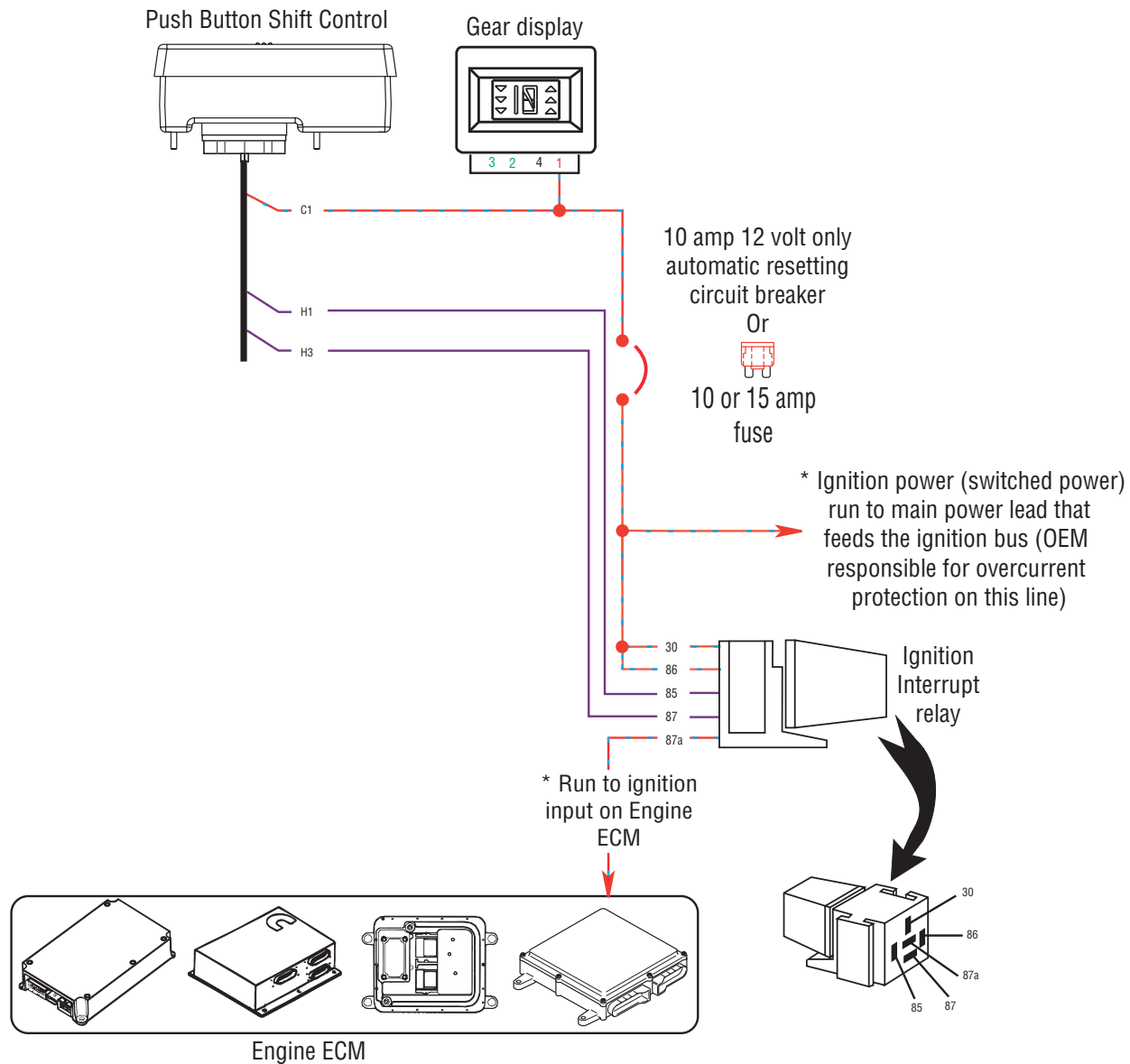


FRONT VIEW
Shift Control (30-Way Connector) J1



FROM	TO RELAY PIN	DESCRIPTION
J1-C3	86	START ENABLE BATTERY
J1-A2	87	START ENABLE LATCH
J1-A3	85	START ENABLE GROUND

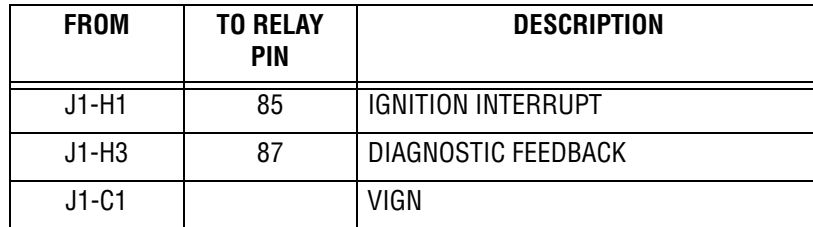
Typical Ignition Interrupt Circuit



Note: In isolated battery systems the ignition should be supplied by the “start” battery.

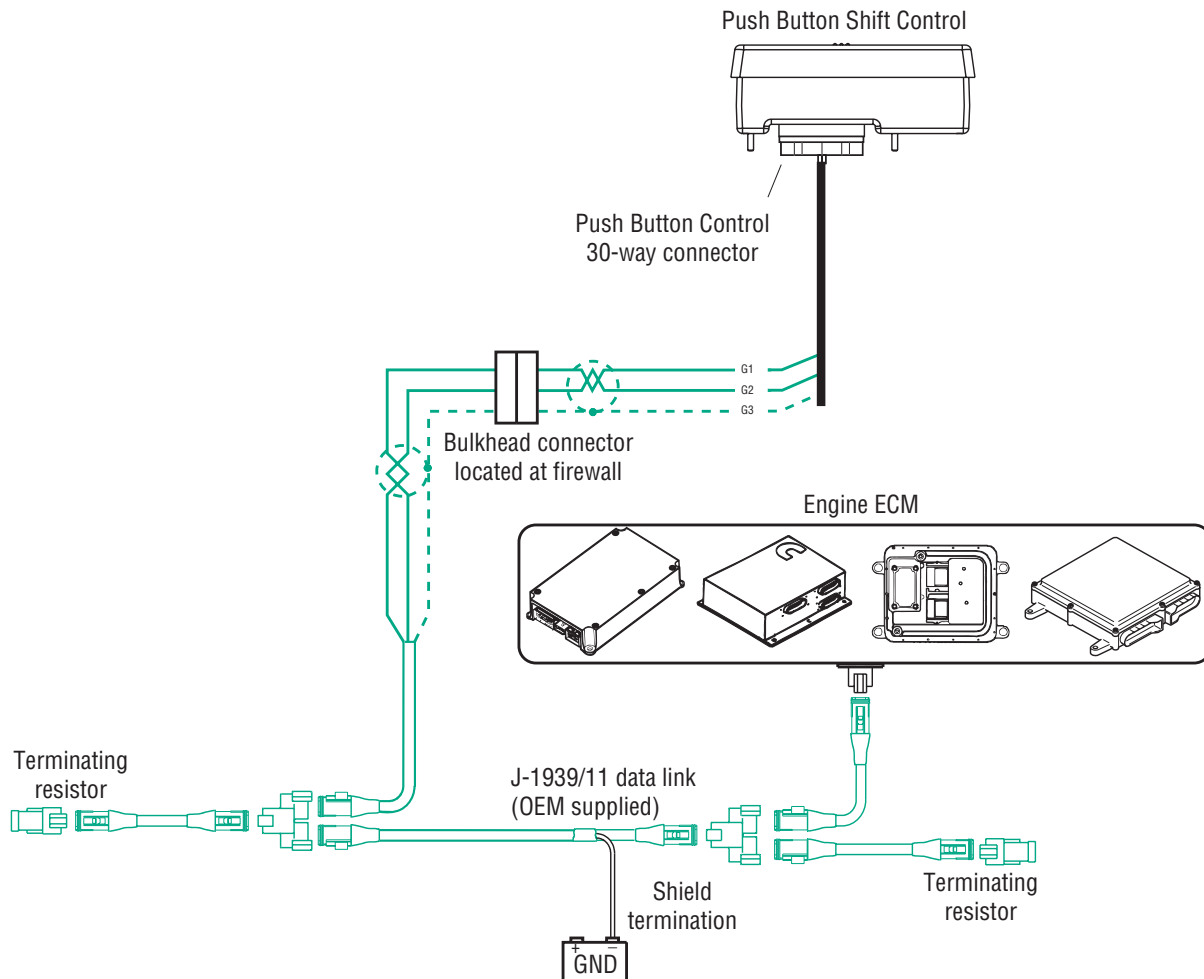
* For vehicle/Engine systems which use a vehicle system ECU, contact the Eaton OEM Engineering Support Group for installation schematics.

* For vehicle/engine systems which use a vehicle system ECU, contact the Eaton OEM Engineering Support Group for installation schematics.

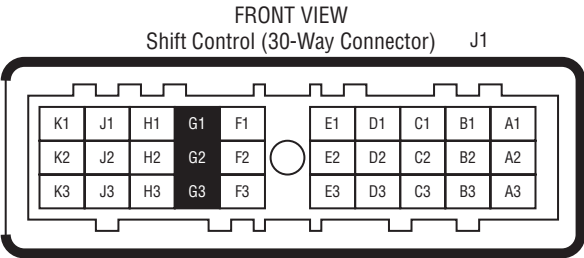
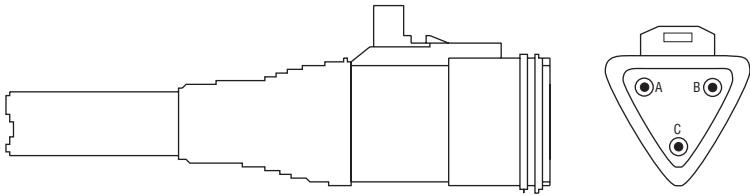


* For vehicle/engine systems which use a vehicle system ECU, contact the Eaton OEM Engineering Support Group for installation schematics.

J-1939 Data Link



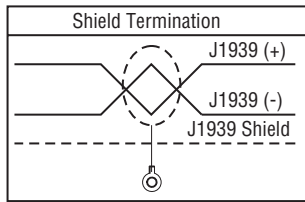
J-1939 Data Link Detail



FROM	TO	DESCRIPTION
J1-G1	A	J-1939 High +
J1-G2	B	J-1939 Low -
J1-G3	C	J-1939 Shield

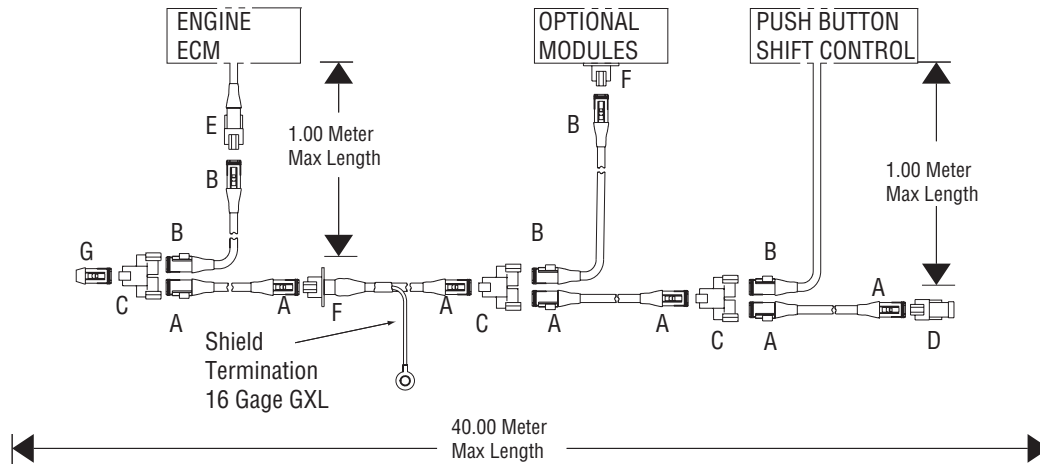
J-1939/11 Data Link Detail

Recommended Cable Manufacturer	Cable Part Number	Round	J-1939 (+) (PIN "A") Color	J-1939 (-) (PIN "B") Color	J-1939 (PIN "C") Shield
Champlain	23-00013-001	Yes	Yellow	Green	N/A
Champlain	23-00028-001	No	Yellow	Green	N/A
Raychem	2021D0311	No	Yellow	Green	N/A
Raychem	2021D0001	No	Yellow	Green	N/A
Raychem	2021D0301	Yes	Yellow	Green	N/A
BICC Brand-Rex	T-14945	Yes	Yellow	Green	N/A



** If an additional wire is added to the drain for insertion into the connector, no shield terminal is used and the signal terminal quantity is 3.
If the drain wire is to be directly inserted into the connector, then a shield terminal is used and the signal terminal quantity is 2.

Ref.	Body	Signal Terminals (QTY)	Shield Terminal (QTY)	Wedge	Function
A	DT06-3S-E008	0462-201-1631 (3) **	0462-221-1631 (1) **	W3S-1939	Through Connector
B	DT06-3S-E008	0462-201-1631 (3) **	0462-221-1631 (1) **	W3S	Stub Connector
C	DT04-3P-P007	N/A	N/A	N/A	"T" Receptacle
D	DT04-3P-P006	N/A	N/A	N/A	120 Ohm Termination
E	DT04-3P-E008	0460-202-1631 (3) **	0460-247-1631 (1) **	W3P	ECU Receptacle
F	DT04-3P-LE08	0460-202-1631 (3) **	0460-247-1631 (1) **	W3P	Flang Receptacle
G	DT06-3S-P006	N/A	N/A	N/A	120 Ohm Termination



SAE J-1939/11 Recommended Cable Termination Procedure

Remove cable outer jacket approximately 25 mm.

Remove foil from exposed wires to within 2 mm from cable jacket.

Strip insulation from data wires 7 mm.

Attach extended wire barrel socket contact to the drain wire or attach adhesive filler solder sleeve and wire to drain wire per manufacturer's recommendations.

For the solder sleeve option, cut the wire on the solder sleeve to a length of 25 mm and strip the insulation back 7 mm.

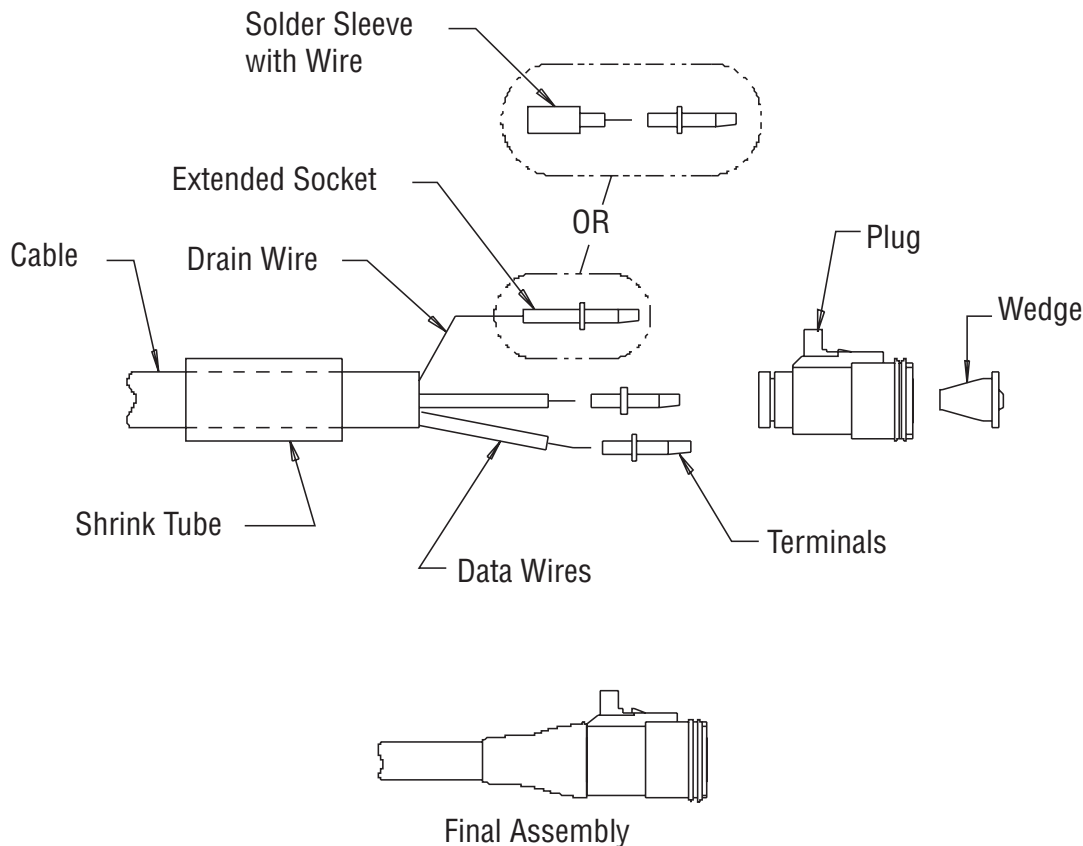
Crimp the appropriate terminal on each data wire and solder sleeve wire or the extended socket per the manufacturer's recommendations.

Slide an adhesive filler shrink tube over the cable end.

Install the terminals into the connector body per the manufacturer's instructions.

Install the wedge in the front of the connector body per the manufacturer's instructions.

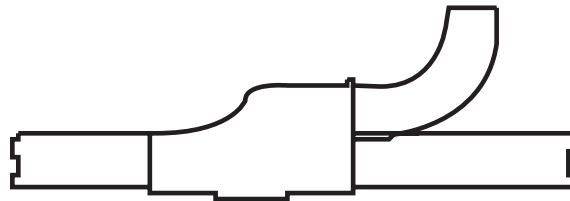
Apply the shrink tube to the end of the connector body per the manufacturer's recommendation.



Existing Drain Wire Splice/ Sealing Method

SAE J1939/11 Recommended Cable Splice Procedure

- Remove cable outer jacket approximately 40-100 mm.
- Remove foil shield from exposed wires to within 2 mm from cable jacket.
- Strip insulation from data wires 7 mm \pm 0.8 mm.
- Crimp stub branch lines and drain wire to main backbone data lines and drain wire.
- Cover each splice with insulation shrink tubing.
- Wrap unshielded area with shielding material.
- Apply adhesive filled shrink tube to splice junction.
- For shield termination, crimp minimum 16 gauge GXL wire to drain wire.



SAE J-1939/11 Recommended Cable Splice Procedure

Remove cable outer jacket approximately 40-100 mm.

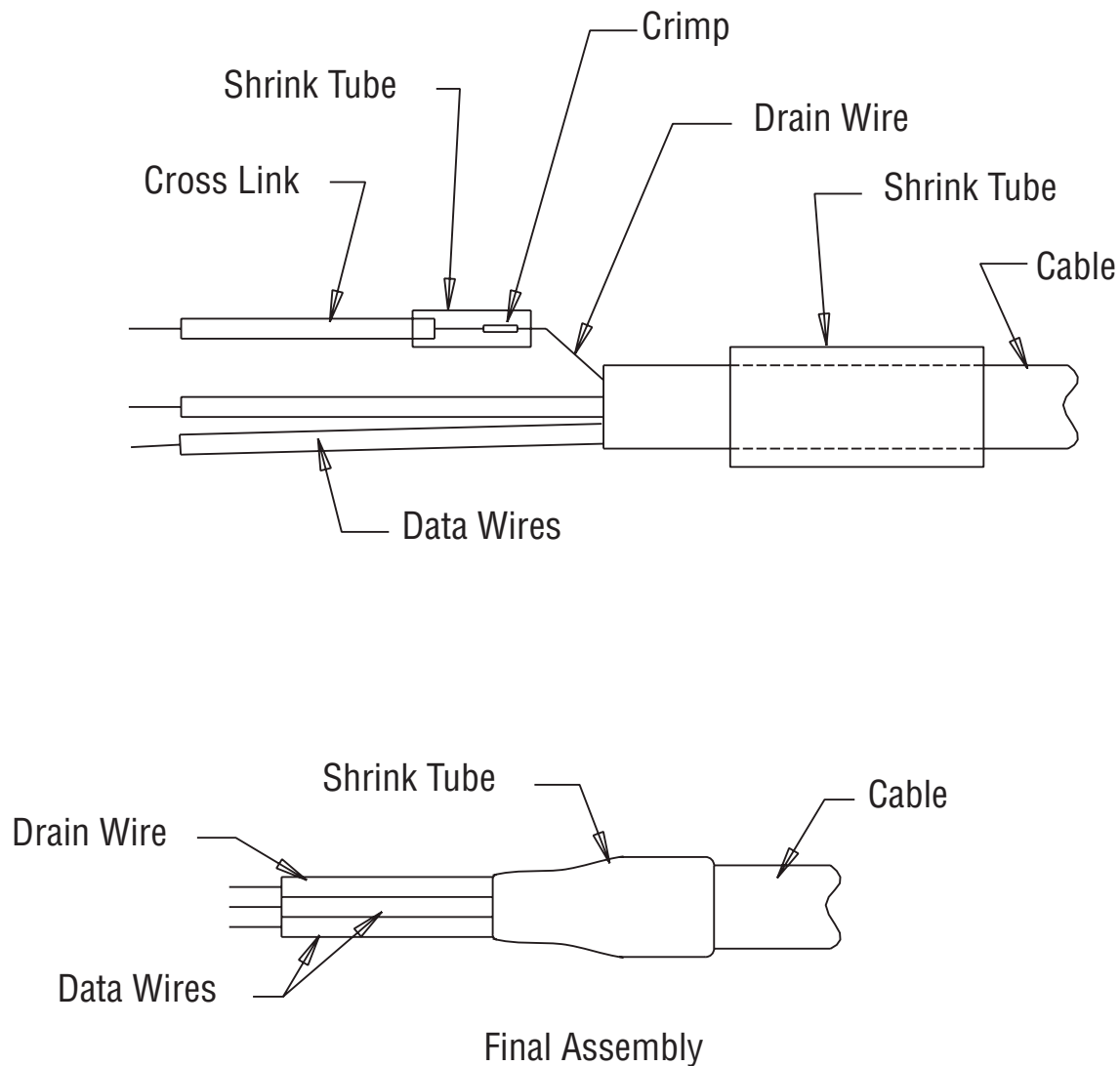
Remove foil shield from exposed wires to within 2 mm from cable jacket.

Strip insulation from data wires $7 \text{ mm} \pm 0.8 \text{ mm}$.

Attach X-link wire to drain wire with crimp splice per manufacturer's recommendation.

Slide adhesive filled shrink tube over crimp splice.

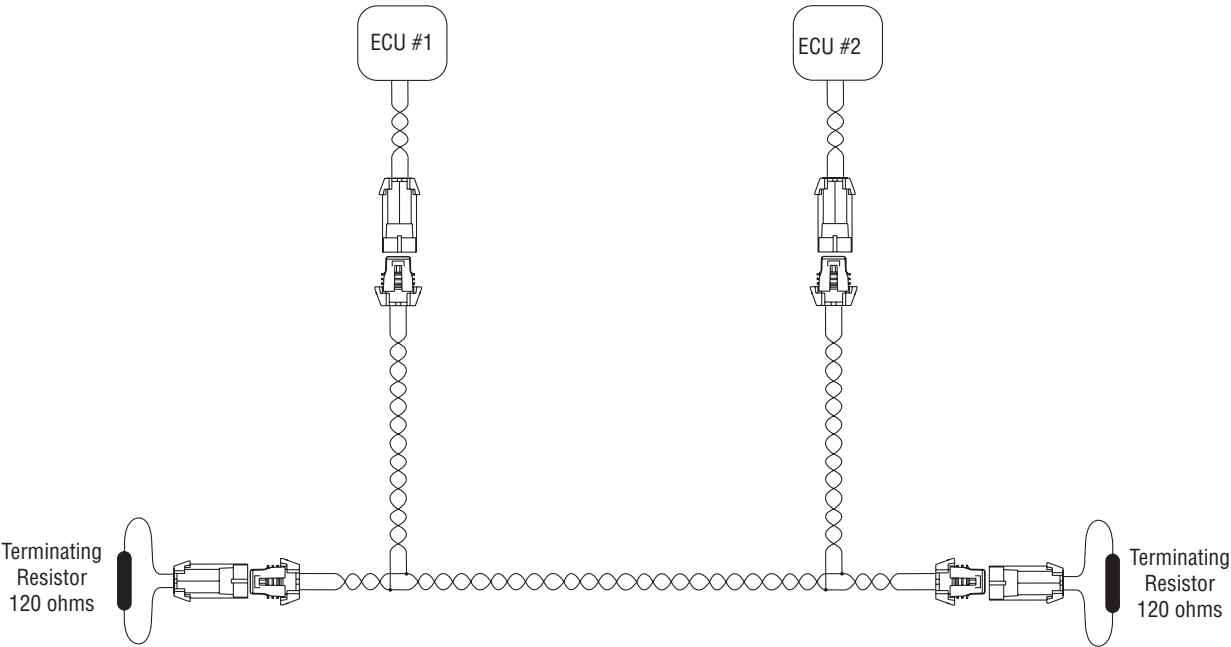
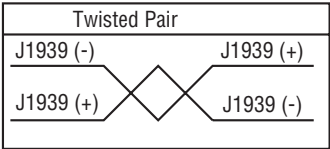
Slide adhesive filled shrink tube over cable end.



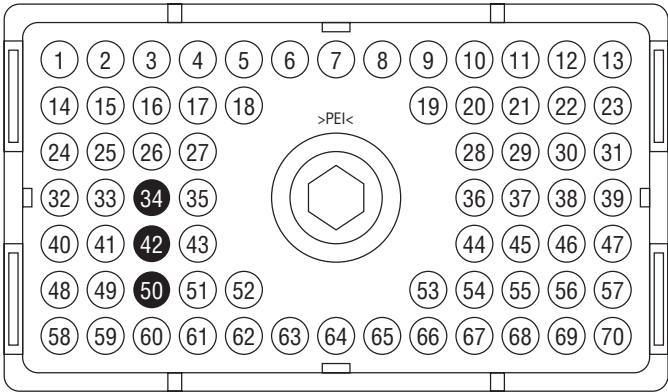
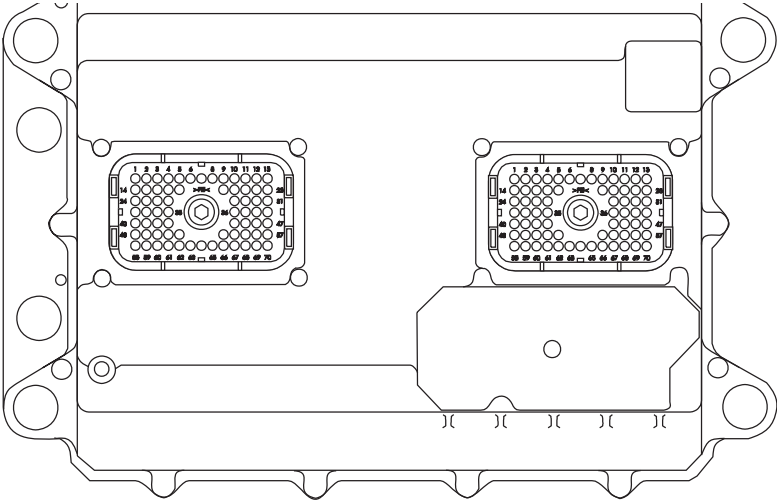
J-1939/15 (lite) Data Link Specifications

- Maximum 40 meter Length.
- Maximum 3 meter stub length.
- Maximum 10 modules on segment.
- Twisted pair (18 or 20 AWG) with 1 twist per inch.
- 120 Ohm terminating resistors must be used.
- Connector at ECU is not defined.
- The third pin for shield is not used in ‘in-line’ and T-connectors.

Recommended Cable Manufacturer	Cable Part Number	Round	J-1939 (+) (PIN "A") Color	J-1939 (-) (PIN "B") Color
Champlain	J1939/15	Yes	Yellow	Green



Vehicle Harness Connector for all Caterpillar Adam III Electronic Engines

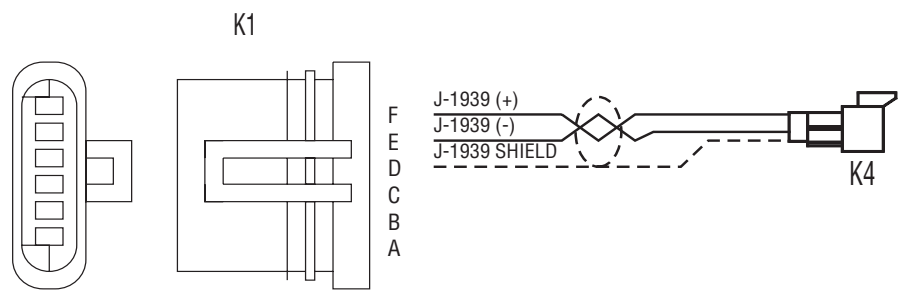
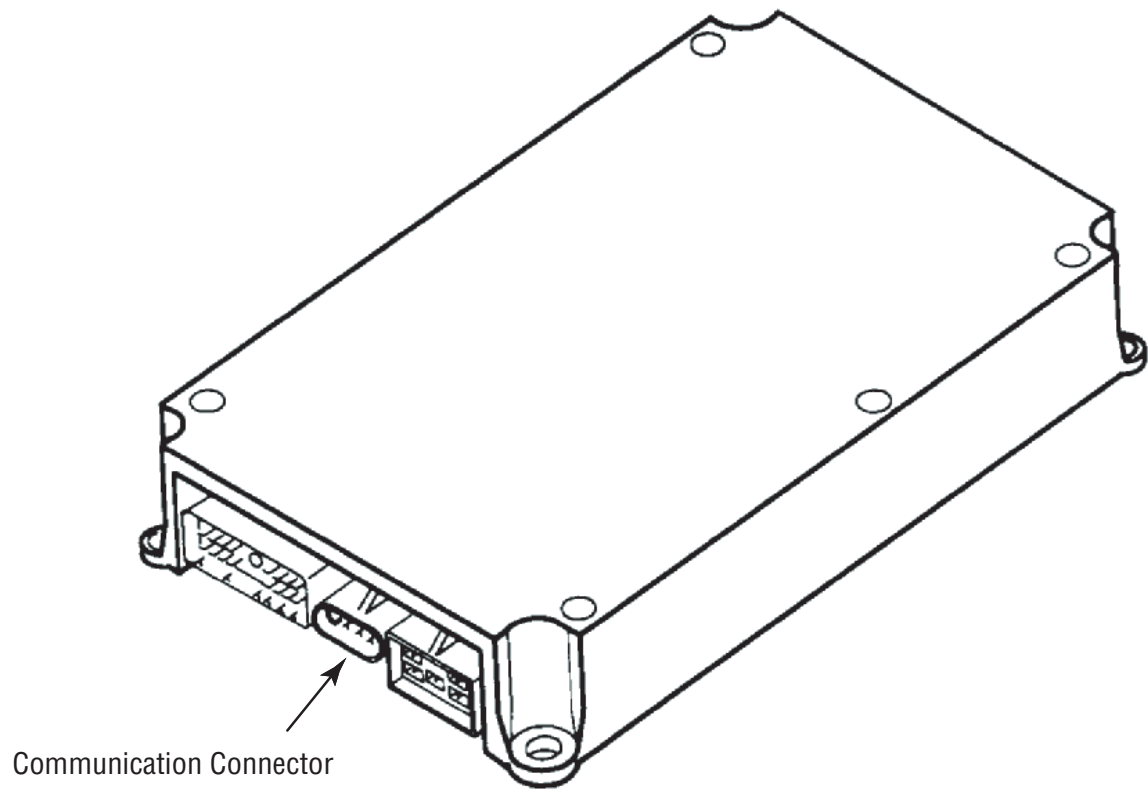


View From Harness Side of Connector P1

Note: See J-1939 Backbone section in this manual for connector information

FROM	DESCRIPTION
P1-50	J-1939 High +
P1-34	J-1939 Low -
P-42	J-1939 Shield

Location of the J-1939 Control Data Link on Detroit Diesel DDECIII and IV Engines
Electronic Control Module (ECM)

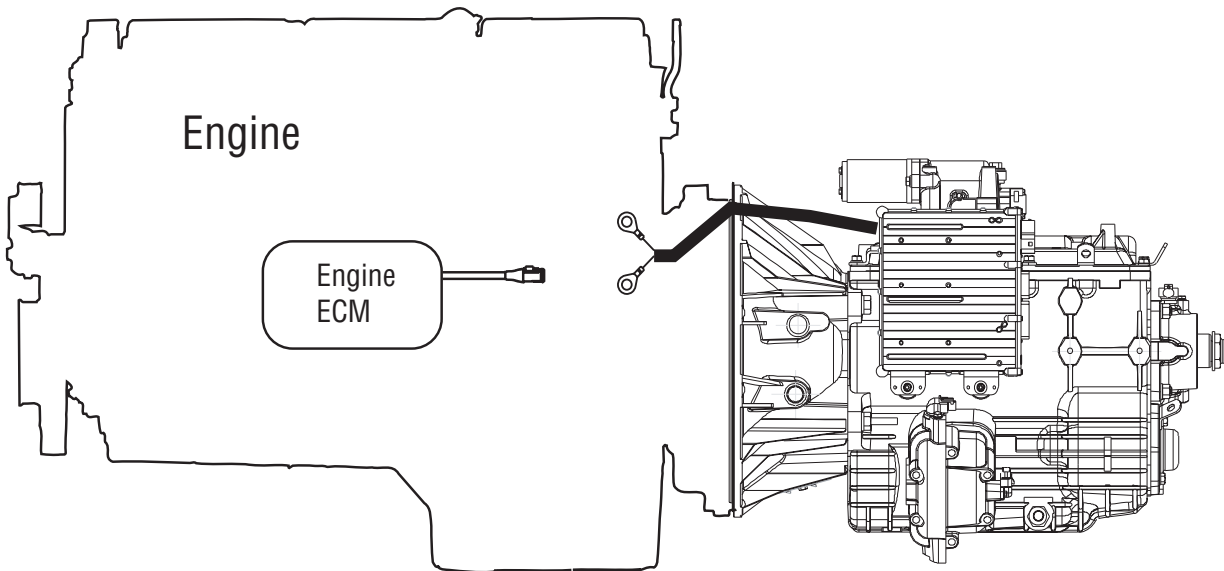


FROM	TO	DESCRIPTION
K1-F	K4-A	J-1939 High +
K1-E	K4-B	J-1939 Low -
K1-D	K4-C	J-1939 Shield

Location of the J-1939 Control Data Link on Cummins Engines

As a part of Cummins ECU Interface Harness, J-1939 3-pin Deutsch connector will already be present. No additional connections are needed to connect the engine ECM to the J-1939 backbone.

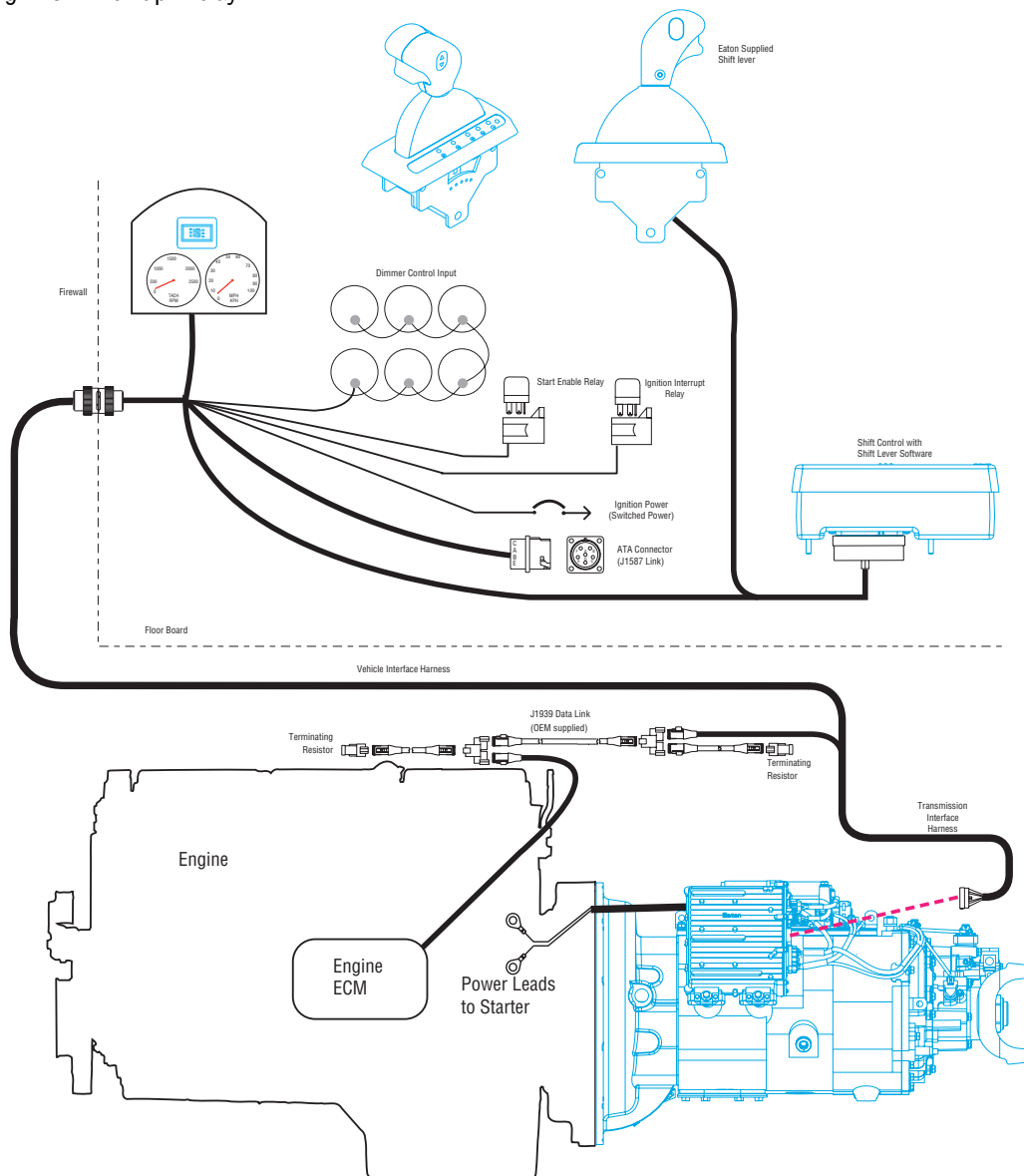
Note: It may be necessary to extract the connector from behind a bracket located at the rear of the engine. Simply push the connector out from behind the bracket.



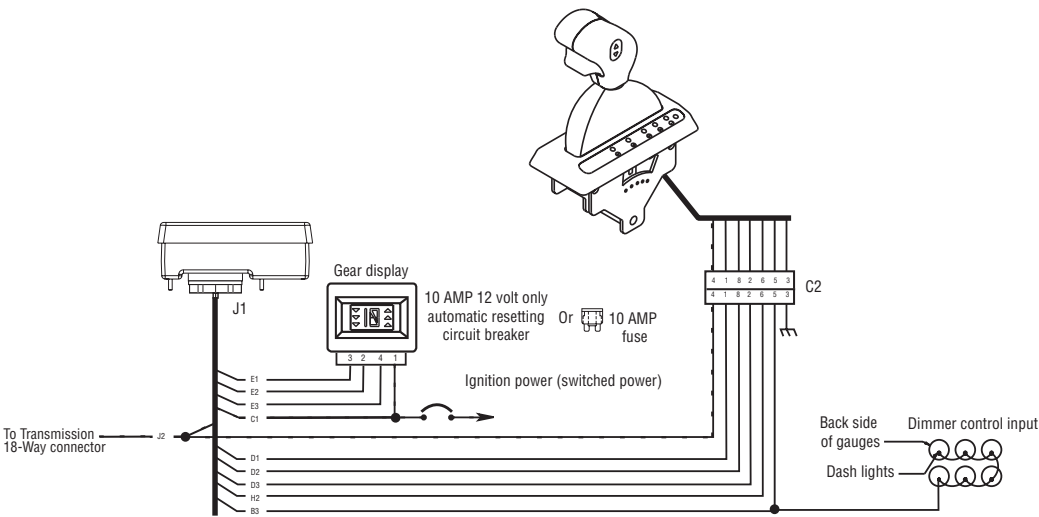
Typical System with Eaton Shift Lever

The dash area location is for the following:

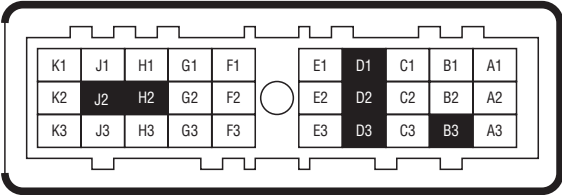
- Start Enable Relay
- Gear Display
- Push Button Shift Control
- ATA Connector (J-1587 Link)
- Dimmer Control Input (V Dash)
- Ignition Power (VIGN)
- Ignition Interrupt Relay



Shift Lever Detail

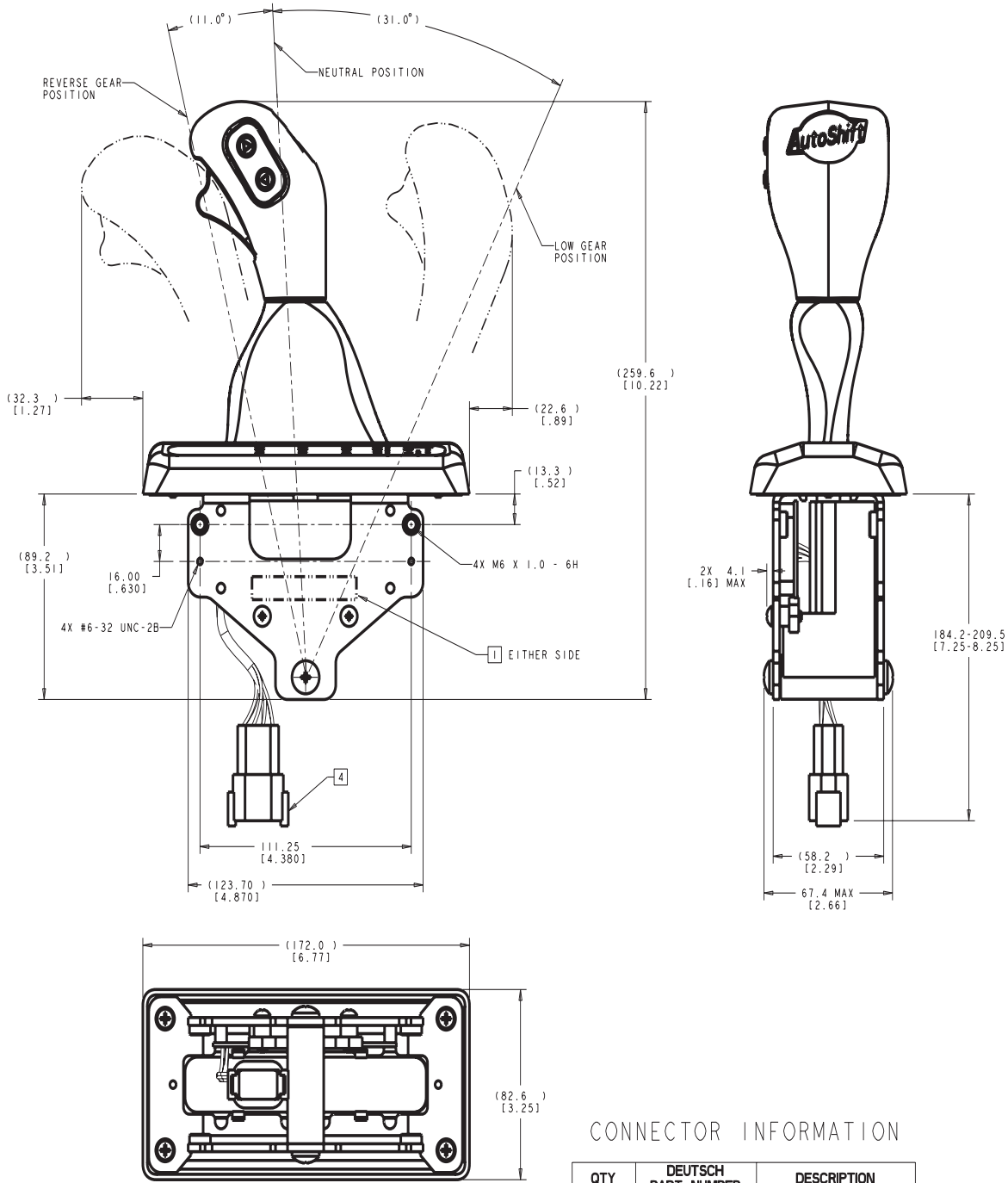


FRONT VIEW
Shift Control (30-Way Connector) J1

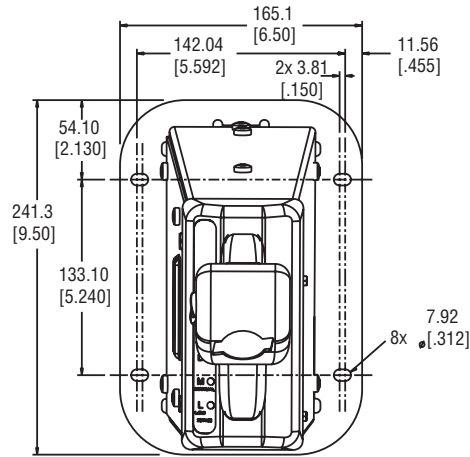
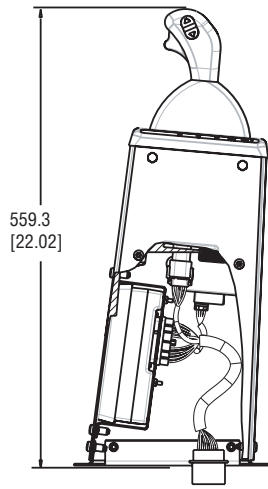


FROM	TO	DESCRIPTION
J1-D1	C2-1	RNDHL
J1-D3	C2-2	COMMON
-----	C2-3	GROUND
J1-J2	C2-4	SPLICE into TRANS BATT 1
J1-B3	C2-5	DIMMER CONTROL
J1-H2	C2-6	SERVICE LAMP
J1-D2	C2-8	MANUAL MODE

Shift Lever



Cobra Lever Pinouts/Dimensions



Mating Connector
Deutsch Connector
Connector Body: HDP24-24-31pt
Terminal: 0460-202-1631
Plug: 114017

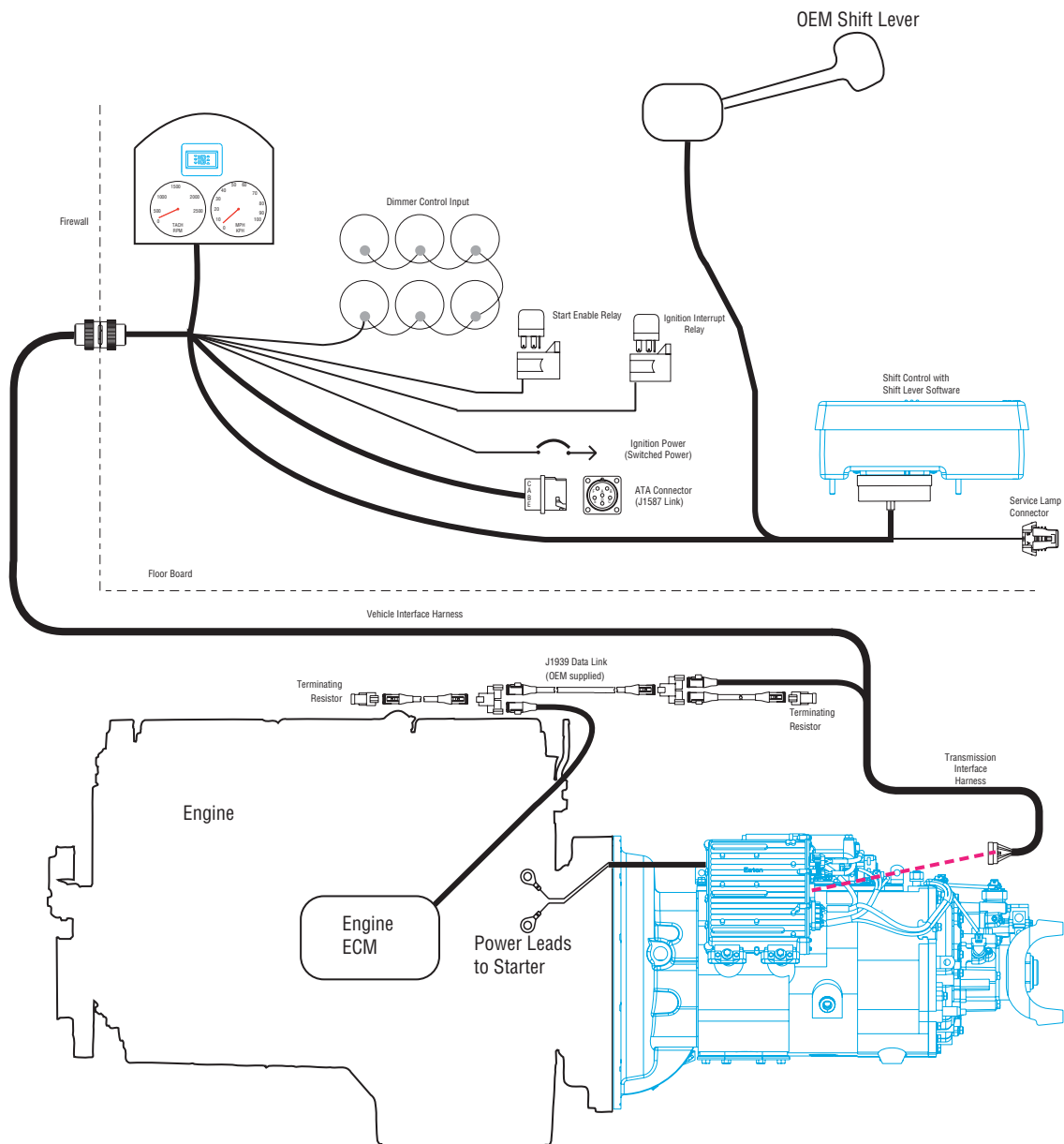
CONNECTOR PINOUT

PIN NO.	DESCRIPTION	PIN NO.	DESCRIPTION
1	CLOCK +	17	EPL-SHIELD
2	DATA -	18	J-1587 -
3	PLUG	19	VIGN
4	DISPLAY POWER -	20	TRANS BATT 1
5	EPL +	21	DIMMER CONTROL
6	EPL -	22	VBATT 1
7	J-1587 +	23	GND 1
8	J-1939 +	24	AUX-IN-RTN2
9	J-1939 -	25	DIAGNOSTIC FEEDBACK
10	J-1939 SHIELD	26	PLUG
11	IGNITION INTERRUPT	27	PLUG
12	AUX-IN-SIG	28	GND 2
13	START ENABLE RELAY +	29	VBATT 2
14	START ENABLE RELAY -	30	PLUG
15	START ENABLE RELAY LATCH	31	TRANS BATT 2
16	PLUG		

Typical System with OEM Shift Lever

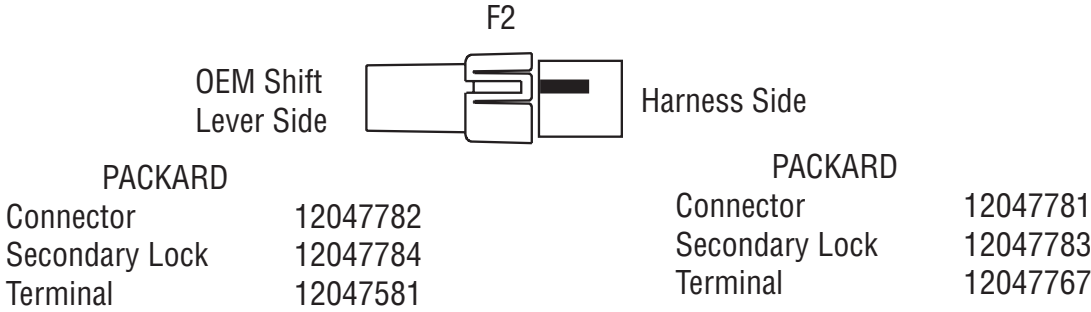
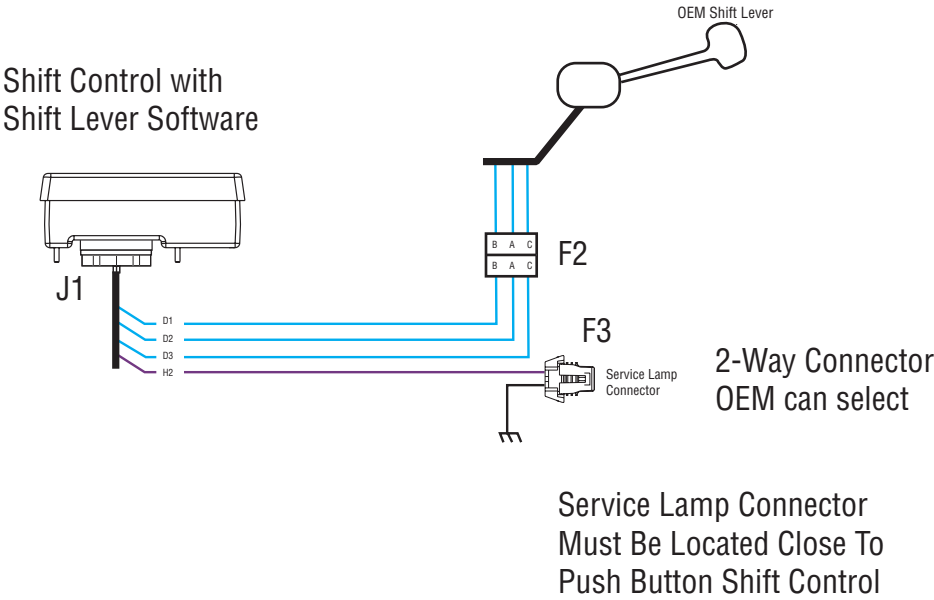
The dash area location is for the following:

- Start Enable Relay
- Gear Display
- Push Button Shift Control
- ATA connector (J-1587 Link)
- Dimmer Control Input (input)
- Ignition Power (VIGN)
- Ignition Interrupt Relay



OEM Shift Lever Detail

Note: OEM supplied Shift Lever must have gated positions per the UltraShift remote mounted Shift Lever and J-1587 display/ OEM interface specification.



FROM	TO	DESCRIPTION
J1-D1	F2-B	RNDHL
J1-D2	F2-A	MANUAL MODE
J1-D3	F2-C	COMMON
J1-H2	F3-A	SERVICE LAMP
F3-B		GROUND

Power Take-Off “Countershaft Driven”

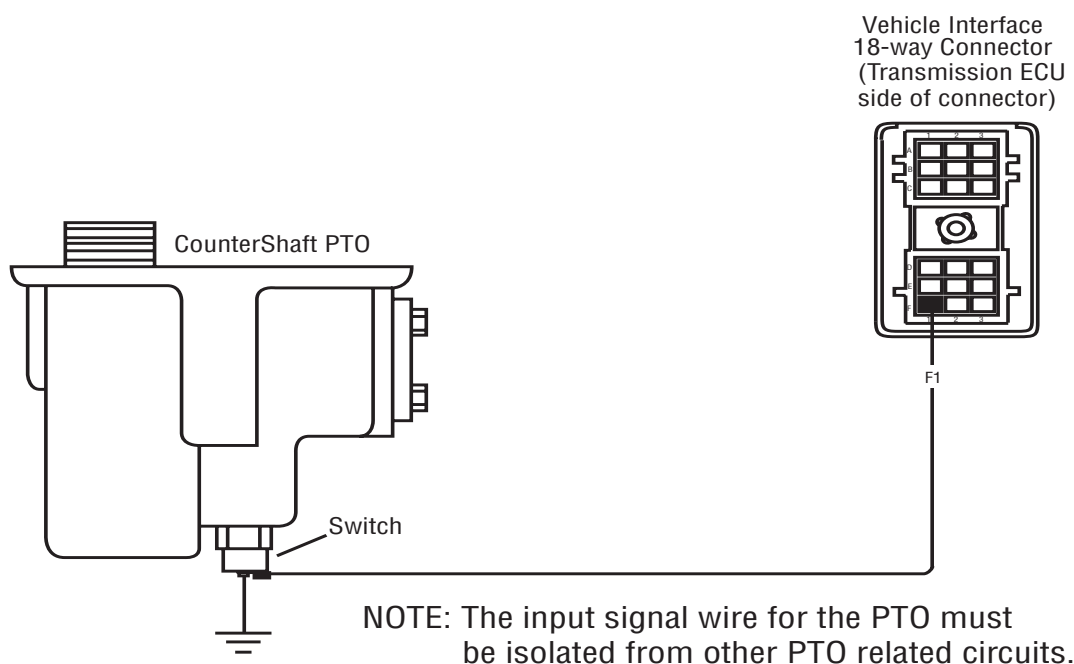
Electrical Interface Requirements

All countershaft driven Power Take-Off's mounted on an Fuller UltraShift DM transmission must provide an electrical interface with the transmission. The standard PTO mounted switch can be used to activate the PTO operating mode of the transmission. This feature uses pin F1 of the 18-way transmission connector. See the figure below for countershaft driven PTO electrical interface diagram.

The Fuller UltraShift DM transmission must have an input signal from the countershaft driven Power Take-Off when it is active. In this active state, the clutch engagement is controlled when the operator raises the engine speed to engage the clutch and drive the transmission main box countershaft. Incorrect or no PTO interface signal to the transmission will result in uncontrolled engagement of the clutch during PTO operation.

The active signal will illuminate the “Mode” indicator on the Push Button Console

The input signal wire for the PTO must be isolated from other PTO related circuits.



Interconnection Table

From	To	Wire Description
F1	PTO +	PTO +

Inertia Brake Relocation Instructions 8 to 6-Bolt PTO Opening

Removal

CAUTION

Oil may be hot.

Note: Drain the lubricant from the transmission. Drain the lubricant from the Inertia Brake. On older product the Inertia Brake will still remain full of lubricant (no drain plug).

1. Disconnect the Transmission Harness from the Inertia Brake Coil and remove the tie straps restraining this harness branch.

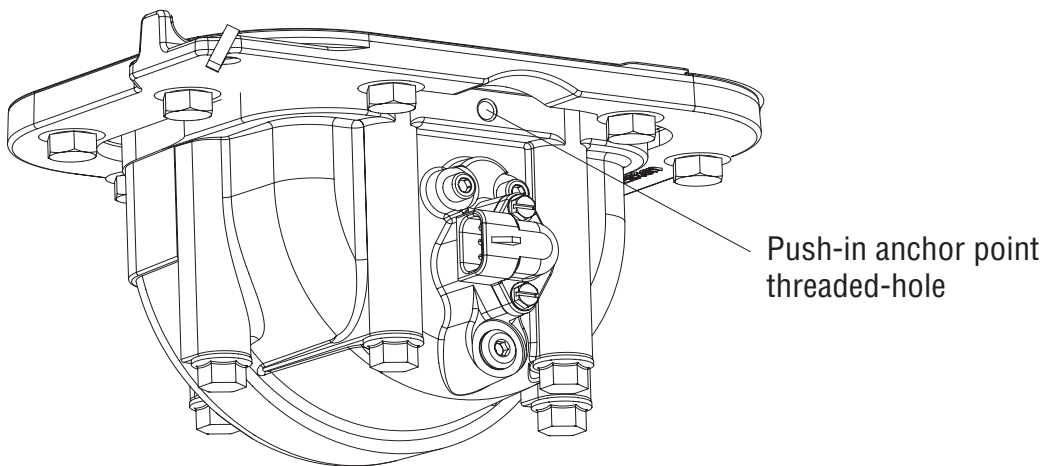
Note: Use care not to damage the harness.

2. Disconnect the lubricant supply line from the Inertia Brake.

CAUTION

The Inertia Brake is heavy. Be prepared to handle the weight of the Inertia Brake when the mounting bolts are removed.

3. Remove the six (6) mounting bolts from the Inertia Brake.
4. Remove the Inertia Brake and gasket from the Adapter Plate.
5. Remove the eight (8) mounting bolts from the Adapter Plate.
6. Remove and discard the Adapter Plate and gasket from the transmission.
7. Remove the six (6) mounting bolts from the 6-bolt PTO cover.
8. Remove and discard the 6-bolt PTO cover and gasket from the transmission.



Standard Inertia Brake mounting to 8-bolt PTO opening
as viewed from the rear of the transmission

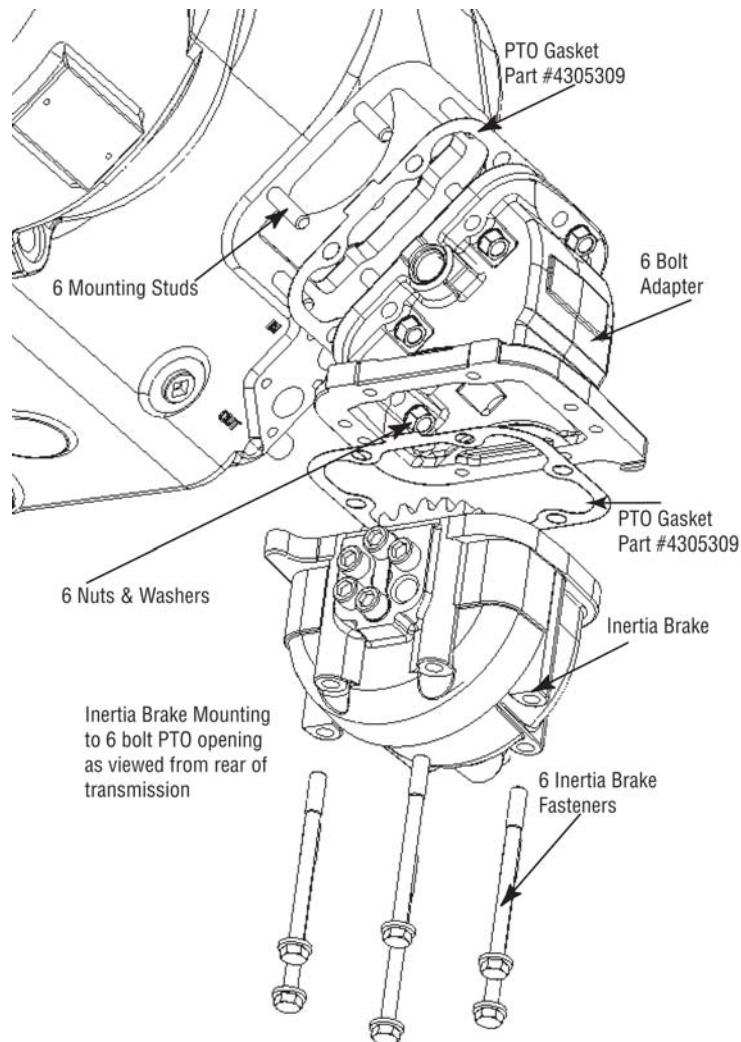
Note: Clean and remove all old gasket material from the mating surfaces of the Inertia Brake and transmission PTO openings. Locate the harness push-in anchor point for reference during re-installation to 6-bolt opening.

Installation

1. Clean and thoroughly dry all mating surfaces (including the gasket) prior to assembly.

Note: The transmission Inertia Brake may be mounted to the 6-bolt PTO opening directly, or mounted utilizing a 6-bolt PTO Angle Adaptor to assist in aiding chassis clearance. (See picture below)

2. If a 6-bolt PTO Angle Adapter is required, install the angle adapter to the 6-bolt PTO opening following the manufacturer's instructions. (See picture below)



CAUTION

The Inertia Brake is heavy. Be prepared to handle the weight of the Inertia Brake when the mounting bolts are removed.

3. Inertia Brakes installed without the angle adapter require a new lubrication hose, Eaton part number K-3683.
4. Using the six (6) 3/8 mounting bolts, install the Inertia Brake and gasket, being careful to align the Inertia Brake gear with the drive gear. Tighten mounting bolts to 40-45 lbs-ft. (54-61 Nm) using a cross pattern.

Note: When mounted directly - orient the Inertia Brake housing with hose connection forward and electrical connection rearward, same orientation as 8-bolt. When mounted to a 6-bolt PTO Angle Adaptor - orient the Inertia Brake housing with hose connection rearward / electrical connection forward. Ensure gasket, Inertia Brake and mating mounting faces are assembled dry (no lubricant or grease).

5. Reconnect the lubricant supply line to the Inertia Brake and tighten to 20-22 lbs-ft. (27-30 Nm).
6. Reroute and reconnect the Transmission Harness to the Inertia Brake Coil. Dress the harness along the transmission case from the Inertia Brake up to the top of the transmission. Install the harness push-in anchor to the threaded-hole anchor point in the Inertia Brake housing. Install tie wraps every 6-10 inches. The harness should not have sharp bends or be under tension.
7. Install the PTO to the 8-bolt PTO opening following the manufacturers instructions.

Note: Fill the transmission with lubricant.

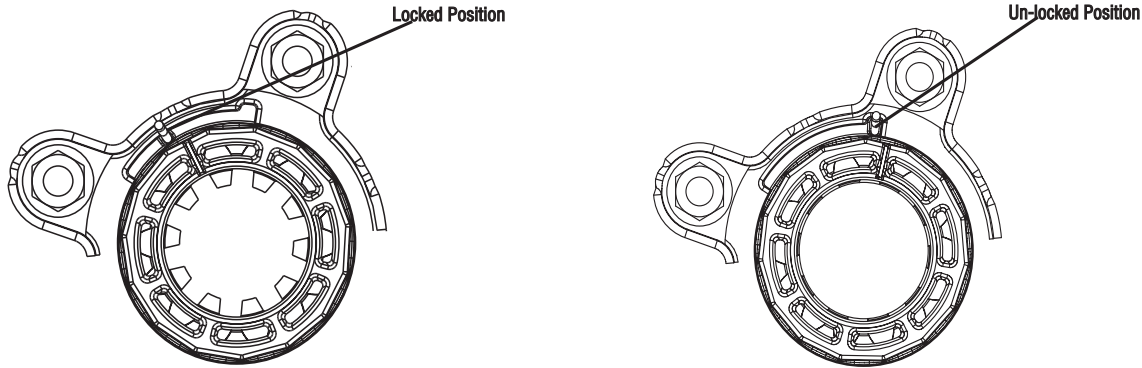
Final Check

- Make sure the mounting bolts are properly tightened.
- Make sure the lubricant supply line is properly tightened.
- Make sure the transmission is properly filled with lubricant.
- Make sure the Transmission Harness is connected and locked.
- Check for lubricant leaks after operating the vehicle.
- Check that the Inertia Brake has sufficient clearance to prevent contacting tanks, brackets, frame rails, exhaust or any other part of the vehicle. Contacting anything when stationary or moving will cause damage to Inertia Brake, angle adaptor or other vehicle equipment.

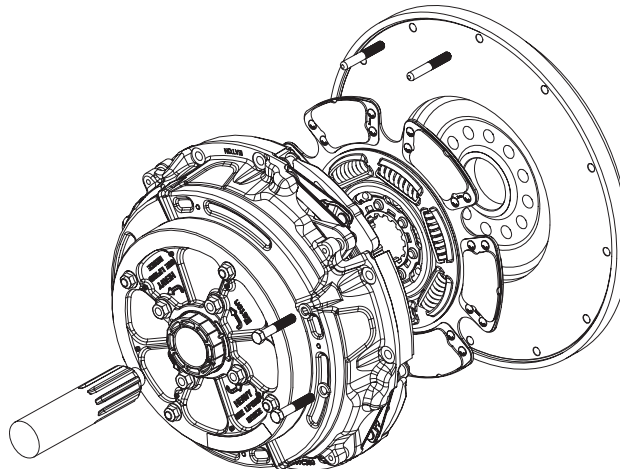
Heavy and Medium Duty DM Clutch Installation

The DM clutch operates in a normally released condition. Therefore, when the clutch is bolted to the flywheel there will be no plate load to hold the driven discs in place.

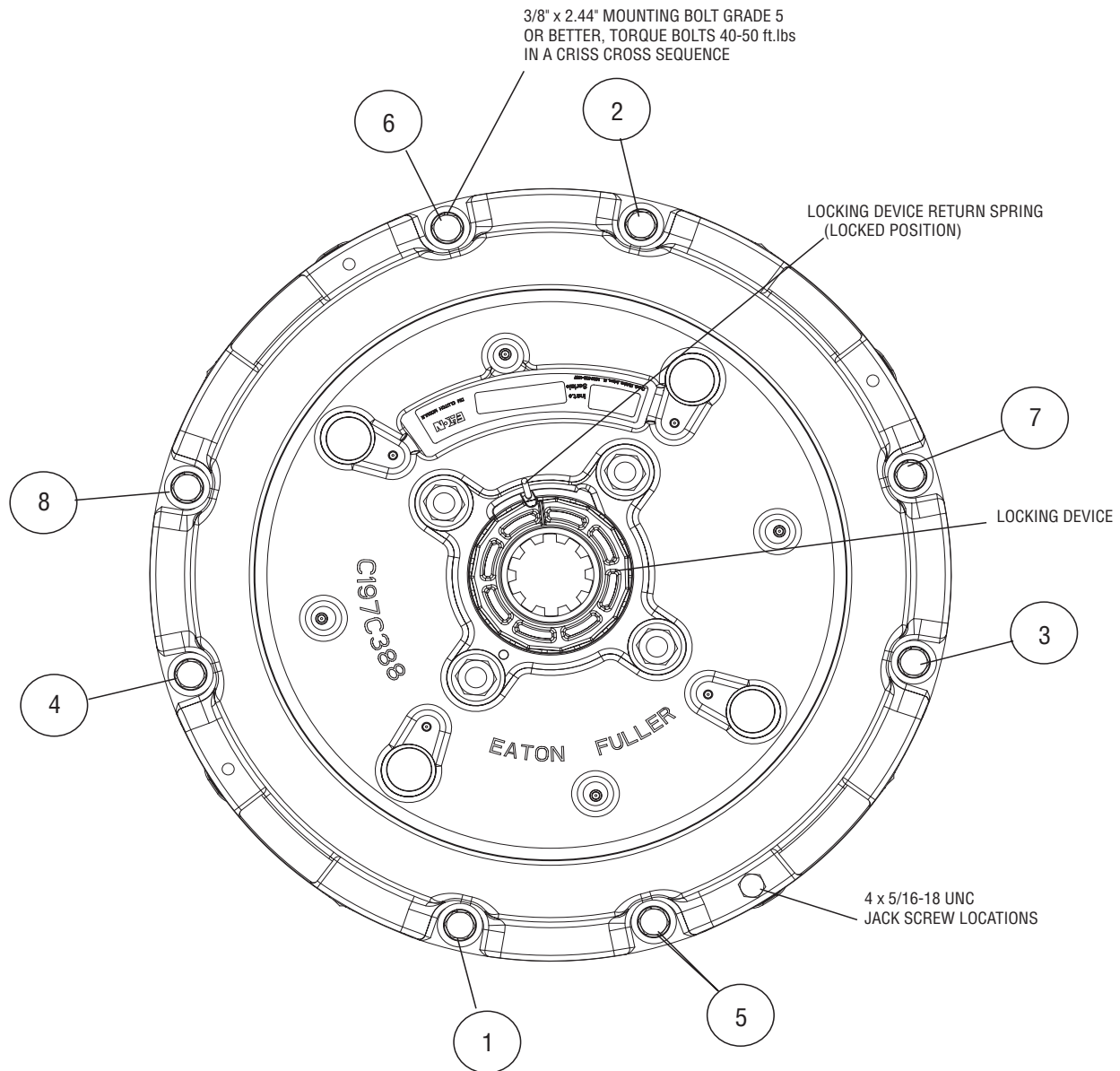
1. The clutch should be shipped with the clutch locking device engaged. Verify that it is engaged before bolting the clutch to the engine. To engage the locking device, simultaneously push in on the locking device return spring and turn the lock approximately 1/3 of a turn in the counter clockwise direction.



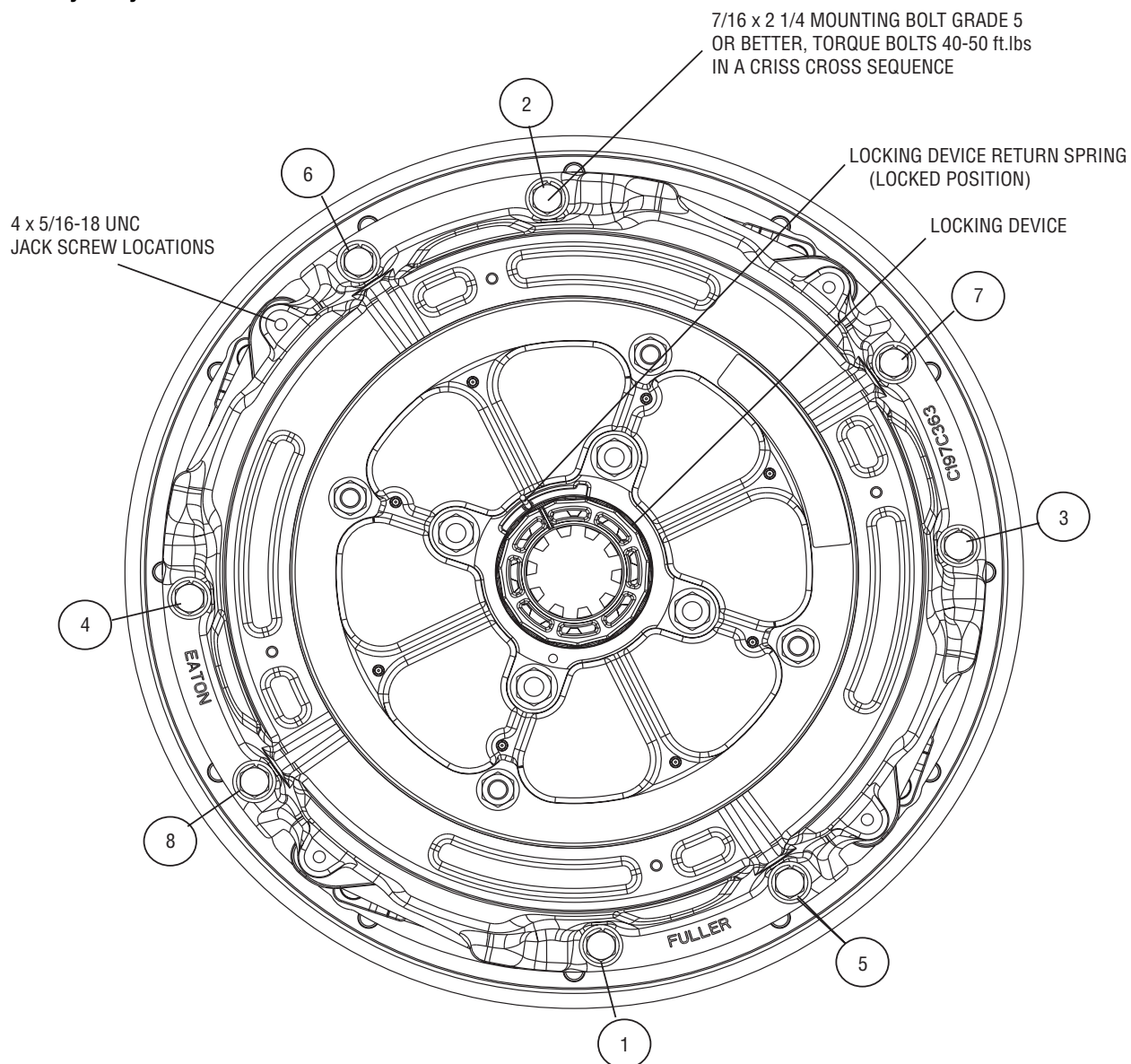
2. Install two guide studs into two of the clutch mounting holes. It is recommended to use holes at the three o'clock and nine o'clock positions. Be sure to use guide studs to ensure proper alignment of the clutch assembly to the flywheel.
3. Use a lifting device to pick up the clutch. **For Heavy Duty**, note that the intermediate plate is bolted to the cover assembly and the rear driven disc is in place between the pressure plate and intermediate plate. **DO NOT** unbolt the intermediate plate from the cover assembly. With an alignment shaft through the cover assembly and the rear disc, install the front driven disc on the alignment shaft. **For Medium Duty**, install the alignment shaft through the cover assembly and driven disc.
4. Slide the clutch assembly over the guide studs and start six of the clutch mounting bolts. **Note: For the Medium Duty Clutch position it with the balance arrow up as close to vertical as practical (see Medium Duty Clutch picture on next page).** Start at the lower left when tightening the clutch mounting bolts. This will ensure that the clutch is properly pulled into the flywheel pilot. Failure to do this could result in improper piloting of the clutch and cause clutch damage. Remove the guide studs and install the two remaining mounting bolts. Tighten the clutch mounting bolts in a crossing pattern as on any other clutch and torque to specification.
5. Remove the alignment shaft.



Medium Duty DM Clutch



Heavy Duty DM Clutch



Note: The DM clutch is only intended to work with an Eaton UltraShift transmission.

Mounting Transmission to Engine

Use the two transmission lifting eyes provided. The lifting eye position must not be changed on the transmission. Do not remove the Electric Shifter (X-Y Shifter) at any time.

Note: For lifting eye and sensor retaining bolt locations, see Appendix. These bolts can not be used for brackets or for any other purpose.

1. Use a two point lift chain or transmission jack with a minimum capacity of 1500 lbs.
2. Inspect the engine to transmission mating surfaces for damage or debris prior to installation. Make sure engine flywheel housing face, transmission clutch housing face, input shaft, etc. are free of paint, debris, rust, and any type of damage before installation.
3. Input Shaft to Clutch Alignment: The transmission is shipped from Eaton with the transmission in gear. The transmission must be in gear in order to rotate the input shaft by turning the output shaft/yoke. In the event that the transmission is not received in gear, the input shaft will have to be manually indexed to mate up with the clutch splines.
4. Adjust the lift chain or transmission jack to obtain the same relative angle as the engine. The face of the engine flywheel housing and the face of the transmission clutch housing must be parallel during installation. If the transmission is properly aligned and the clutch is installed properly, very little force is required to slide the input shaft through the clutch and into the pilot bearing.
5. If interference is encountered, move the transmission away from the engine to investigate the cause. The use of excessive force to overcome misalignment may cause damage to the transmission input shaft and the clutch.
6. Rotate the output shaft/yoke while sliding the input shaft into the clutch to line up the splines.
7. Once the transmission is seated against the engine flywheel housing, align the clutch housing bolt holes with the engine flywheel housing bolt holes and install all capscrews and tighten finger tight.

Note: The clutch housing must be flush against the engine flywheel housing before tightening any capscrews. Do not use the capscrews to seat housing.

8. Tighten four capscrews at 90° intervals around the clutch housing, then tighten the remaining transmission mounting capscrews using the recommended torque specifications.

Note: Do not tighten any mounting capscrews until all capscrews have been installed and finger tightened. Do not remove the transmission support chain or jack until all mounting bolts have been tightened.

9. Use the pull to neutral box to place transmission in neutral for remaining assembly.

WARNING

Improper installation of the OEM Start Enable Circuit could result in enabling the vehicle to be started in gear. Therefore, Eaton recommends the use of a Pull to Neutral Box to place the transmissions neutral for remaining assembly.

Line Inspection Instructions

The checklist was developed as an installation tool for line personnel to ensure the correct operation of each vehicle and to assist the vehicle OEM to identify transmission quality related issues as well as OEM line quality issues. Used correctly, this checklist identifies transmission issues and aids in tracking the problem until corrected.

The recommended use of the checklist is as follows:

1. A separate checklist should be filled out for each vehicle built with Eaton Fuller transmissions. If these checks and information can be combined with an existing form, the Line Inspection form does not need to be used.
2. The section identified as PRE-START CHECKS should be performed prior to the initial start-up of the vehicle. This section ensures the transmission has the correct power supplies, sufficient lubricant, and correct transmission shift tables.
3. Perform any necessary corrective action prior to the dyno or road testing.
4. The DYNO/ROAD TEST section is used to verify that all transmission systems are functional and the driver information is supplied in the cab.
5. With a record of transmission related information and repairs made to each unit, the OEM is able to track and correct repeated quality issues.
6. A copy of the checklist should be recorded for installation history. OEM line personnel should become familiar with the checklist for the transmission prior to a scheduled build. Eaton OEM Engineering Support Group can coordinate training and information to expedite this process.

This checklist represents a generic system which can be tailored to the individual OEM to achieve the best possible method of transmission installation verification. Eaton recommends the use of this system to maintain the utmost in satisfactory operation and long service life.

Each transmission system installed at the OEM must pass the line checklist requirements per the Eaton Line Inspection Form prior to shipment from the OEM plant.

Line Inspection



This transmission is equipped with a neutral interlock system that when properly installed prevents the engine from starting with the transmission in-gear.

Failure to perform installation pre-start checks may result in the engine cranking immediately when ignition is moved to the “START” position or to the “ON” position.

To prevent undesired vehicle movement for new installations, always set the parking brake prior to turning the ignition key “ON” and also prior to attempting “START”.

Checklist Instructions

Refer to the line inspection form while performing the following procedure.

Note: All information must be filled in at form top.

Pre-Start Checks

1. Visually verify that the transmission ignition power supply is protected by an auto resetting 10 amp/12 VDC circuit breaker or fuse and verify that main power is protected by a 30 amp/12 VDC fuse.
2. Verify polarity of main power connection.
3. Verify the transmission has been filled with the correct amount and type of lubricant before starting the engine. Failure to add sufficient lubricant could damage the transmission. Use Roadranger CD 50. See Lubricant Requirement section in this manual for details.
4. Turn the key switch to the “On” position and visually observe the power up procedure. Gear Display will show a solid “N” when power up is complete.

Note: The transmission will automatically reset to neutral position as soon as the vehicle is powered up (key switch on).

Warning: Improper installation of the OEM Start Enable Circuit could result in enabling the vehicle to be started in gear.

5. Start the engine and rev it above 1500 rpm. This will allow the clutch locking device to disengage and allow normal clutch function.

Note: Failure to perform this step will set a clutch disengagement fault and inhibit transmission gear engagement.

Note: UltraShift equipped vehicles with programmable VSS Tamper Resistance options or other artificial engine speed limits which prevent reaching the required 1500 rpm may prevent proper disengagement of the clutch locking device after initial installation. These options may need to be disabled until after the clutch locking device is disengaged.

Dyno/Road Test

1. With Engine not running, select drive and attempt to start the engine. Repeat for each of the forward and reverse mode positions to verify the engine will not start.
2. Verify forward and reverse gears can not be obtained without having the service brake applied.

Note: The service brake input is required while selecting a starting gear. If the service brake is **not applied** while selecting a starting gear, the initial start gear will not be found and the driver will have to **re-select neutral** and press the brake while re-selecting the desired mode.

3. Verify all forward and reverse gears are obtained.
4. Verify through normal operations that the temperature gauge (if installed) is functional.
5. Visually verify that the gear display module is easily visible and lights up when the ignition is turned on.

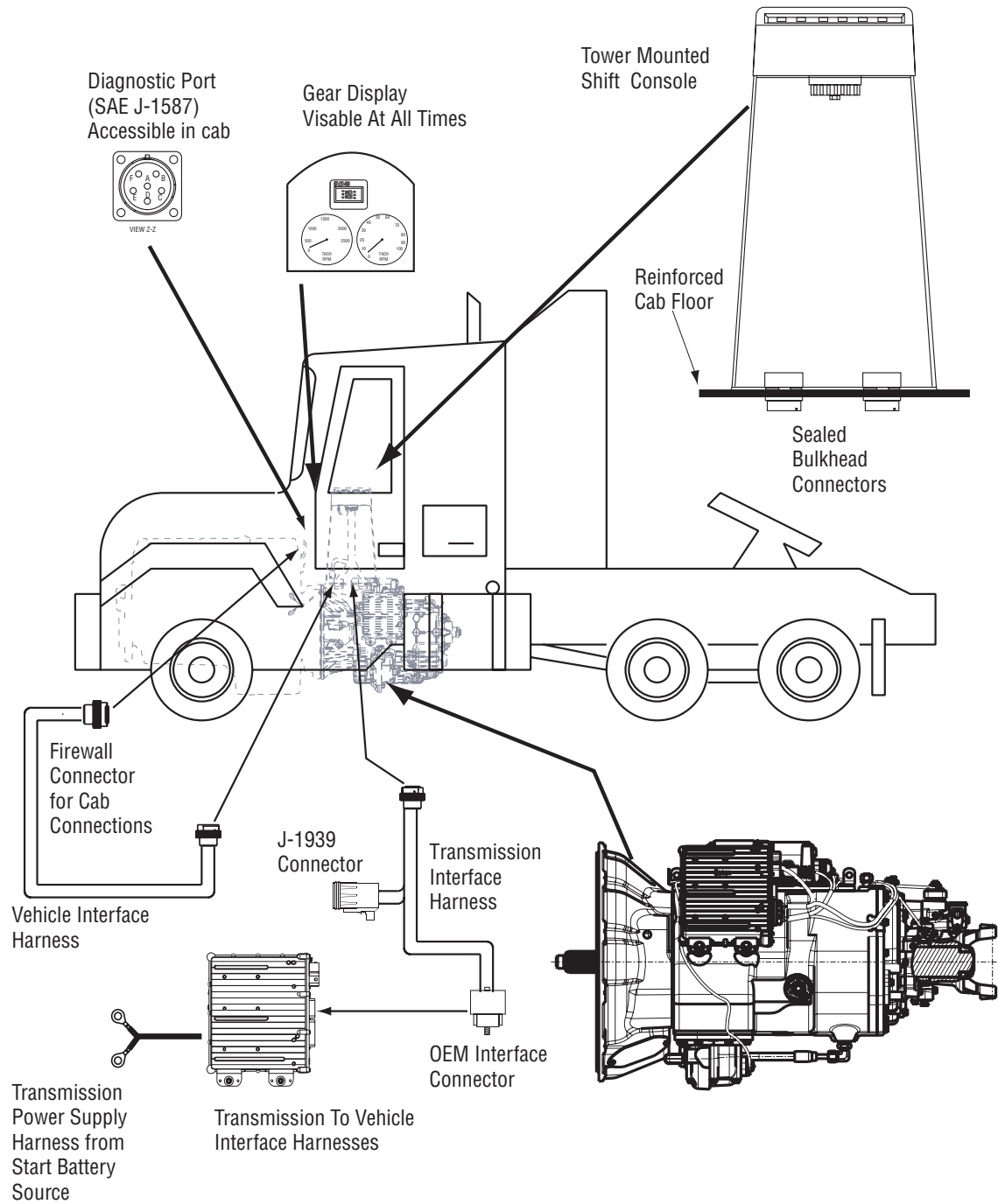
Note: When testing on a dynamometer which decelerates quickly, the display module may not appear to function correctly. Should this occur, drive the vehicle off the dynamometer and note how the display functions. If it functions correctly when driving, the problem is that the dynamometer decelerates too quickly.

6. Verify through normal operation that the engine brake (if equipped) functions correctly per the manufacturer's specifications.
7. Verify that the panel lights on the Shift Control illuminate when the vehicle dash lights are turned on.
8. Visually check for lubricant drips or residue on the transmission and related cooler lines (if used).
9. Make sure the correct transmission dash label is present and that the driver's instruction booklet is included with the other vehicle information.
10. Verify that the transmission diagnostic port (SAE J-1587) is accessible, either mounted on the dash left side or under the dash left side.
11. Verify that a label to alert the customer of type and brand of lubricant used in the transmission is attached to the transmission or included with the other vehicle information.
12. Clear historical fault codes by using the key switch. To do this, place the Shift Lever in neutral and set the parking brakes. Begin with the switch in the on position. Turn the key off and back on six times within five seconds (off/on/off/on/off/on/off/on/off/on).
13. Verify engine ECU contains proper configuration settings for Fuller UltraShift operation. The engine ECU must contain the proper configuration settings. For proper engine configuration settings required for Fuller UltraShift operation, contact Eaton OEM Engineering Support Group.

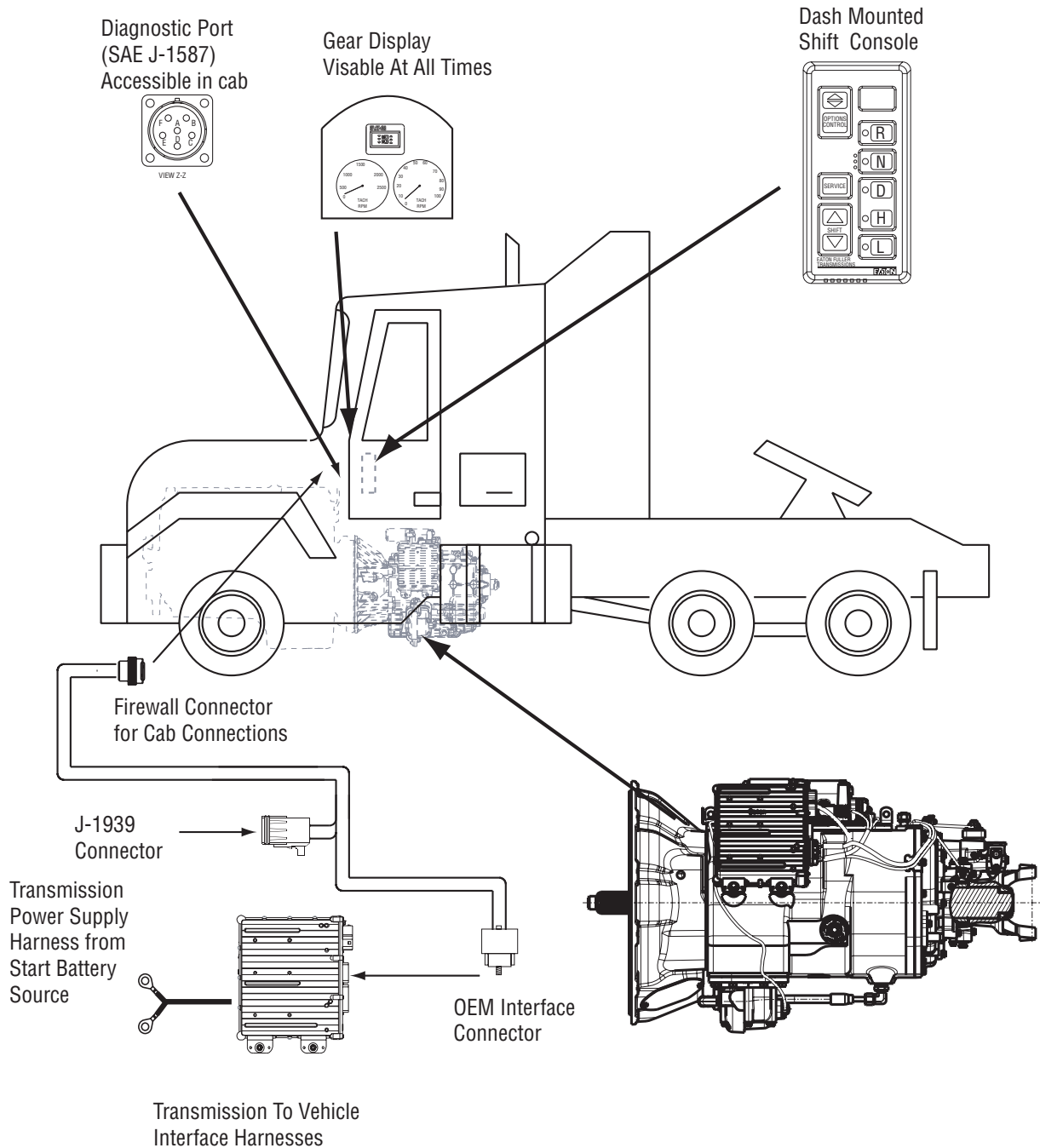
Line Inspection Form

Fuller® UltraShift™ with DM Clutch Line Inspection		OEM:		
		Chassis S/N:		
		Trans Model:	Trans S/N:	
Description		Yes	No	Corrected
Pre-Start Checks				
1.	Power Supply check: (auto reset type) or fuse			
	Min. 10 amp/12 VDC Ignition Bus			
	Min. 30 amp/12VDC Main Power Fuse			
2.	Oil Fill (see lubricant section for details)			
3.	Power up procedure: System powers up and “N” on Gear Display			
4.	Start engine and rev above 1500 RPM (initial clutch disengagement)			
DYN0/Road Test Checks				
1.	Verify that engine does not start in the forward or reverse mode position			
2.	Verify forward and reverse gear not obtained without service brake applied			
3.	Verify all forward and reverse gears are obtained with engine control			
4.	Verify engine ECU contains proper configuration settings for Eaton UltraShift			
5.	Verify transmission temperature gauge is functional - if equipped			
6.	Verify gear display module (DDM) works correctly			
7.	Verify engine brake is functional - if equipped			
8.	Verify Shift Control panel lights functional			
9.	Verify no transmission oil leaks			
10.	Verify correct dash label and drivers book is present			
11.	Transmission diagnostic port accessible			
12.	Lubricant type and brand label affixed to vehicle			
13.	Clear Fault Codes and Verify J-1587 Diagnostic Connector works			
Comments:				
Final Inspection Date:				
Signature:				
Please send copy to: Eaton Corp, P.O. Box 4013, Galesburg, MI 49003 ATTN: Automation Installation Group				
Fuller® UltraShift with DM Clutch		OEM:		

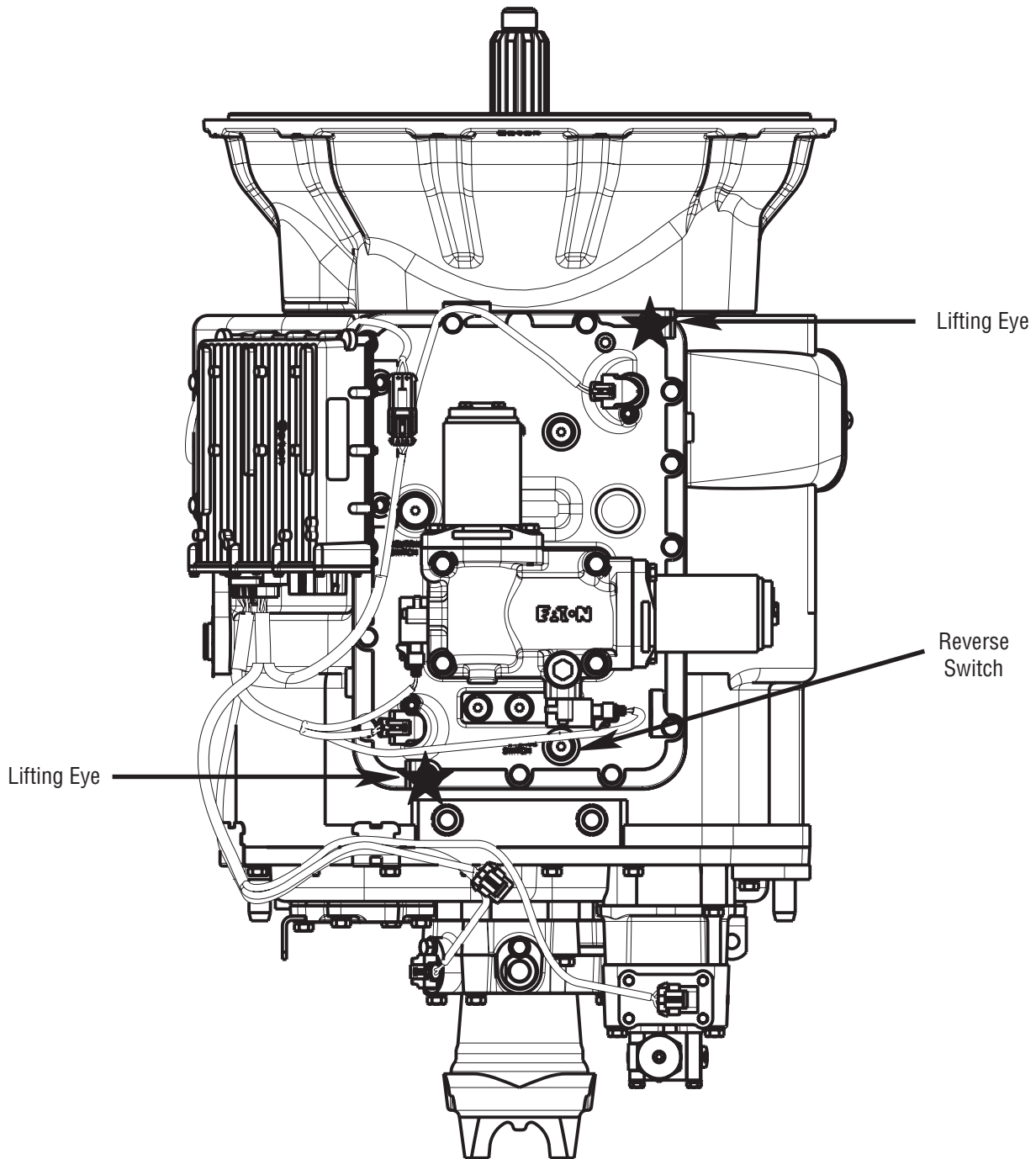
Typical System Overview (Tower Mounted)



Typical System Overview (Dash Mounted)



10-Speed Lifting Eyes and Sensor Position (RT0-XX910X-DM2)



Torque Specifications

Part	Torque
Flywheel capscrews	Follow engine manufacture's specifications
DM Clutch-to-Flywheel capscrews 7/16 x 2-1/4"	40 - 50 lbs-ft [54 - 68 Nm]
Transmission-to-Engine capscrews	
7/16-14	37 - 50 lbs-ft* [50 - 68 Nm]
3/8-16	25 - 32 lbs-ft* [34 - 43 Nm]
M10-35	26 - 35 lbs-ft* [35 - 47 Nm]
Output yoke nut:	
6-Speed	300 - 350 lbs-ft [407 - 475 Nm]
7, 10,18-Speed	450 - 500 lbs-ft [610 - 678 Nm]
PTO mounting capscrews:	
6-bolt opening	20 - 25 lbs-ft* [27 - 34 Nm]
8-bolt opening	50 - 65 lbs-ft* [68 - 88 Nm]
Reverse switch (9/16-18)	20 - 25 lbs-ft [27 - 34 Nm]
Neutral switch/cap (3/4-16)	20 - 25 lbs-ft [27 - 34 Nm]
ECU Connector Bolt	8 - 12 lbs-ft [10.8 - 16.2 Nm]
Lubricant fill plug	
6-Speed (3/4-NPT)	45 - 55 lbs-ft [61 - 75 Nm]
7, 10,18-speed (1 1/4-NPT)	60 - 75 lbs-ft [47 - 61 Nm]
Lifting bracket capscrew (3/8-16)	
Rear bearing cover capscrew: (3/8-16)	
6-Speed (1/2-20)	60 - 70 lbs-ft [81 - 95 Nm]
7, 10,18-Speed	35 - 45 lbs-ft [47 - 61 Nm]
Transmission nodal mount capscrews (3/4-10)	180 - 190 lbs-ft [244 - 258 Nm]
Deutsch Connector to Transmission ECU	25 - 28 lbs-in [2.82 - 3.16 Nm]
Packard Connector to Push Button Controller	7.1 - 13.3 lbs-in [0.8 to 1.5 Nm]

Vendor List

AMP Incorporated

(Connectors)
P.O.Box 3608
Harrisburg, PA 17105-3608
1-800-522-6752
Fax (727) 986-3611
www.amp.com

BELDEN WIRE AND CABLE

(EPL and J-1939 Cable)
P.O. Box 1980
Richmond, IN 47375
(317) 983-5200
Fax (765) 983-5294
www.Belden.com

BRAND-REX CO.

(J-1939 Cable)
300 Brickston Square
Andover, MA 01801
(978) 933-5100
www.brand-rex.com

CHAMPLAIN CABLE CO.

(J-1939 Cable)
12 Hercules Dr.
Colchester, VT 05446
(802) 655-2121
Fax (802) 654-4224
www.champcable.com

DEUTSCH

(Connectors)
Industrial Products Division
37140 Industrial Ave.
Hemet, CA 92545
(909) 765-2250
Fax (909) 765-2255
www.deutschipd.com
www.laddinc.com (Ladd Industries)

PACKARD Electric

(Connectors)
Pioneer-Standard Electronics, Inc.
Packard Branch
5440 Naiman Parkway
Solon, OH 44139
1-800-PARKARD (722-5273)
Fax (219) 378-6650
www.delphiconnect.com

RAYCHEM

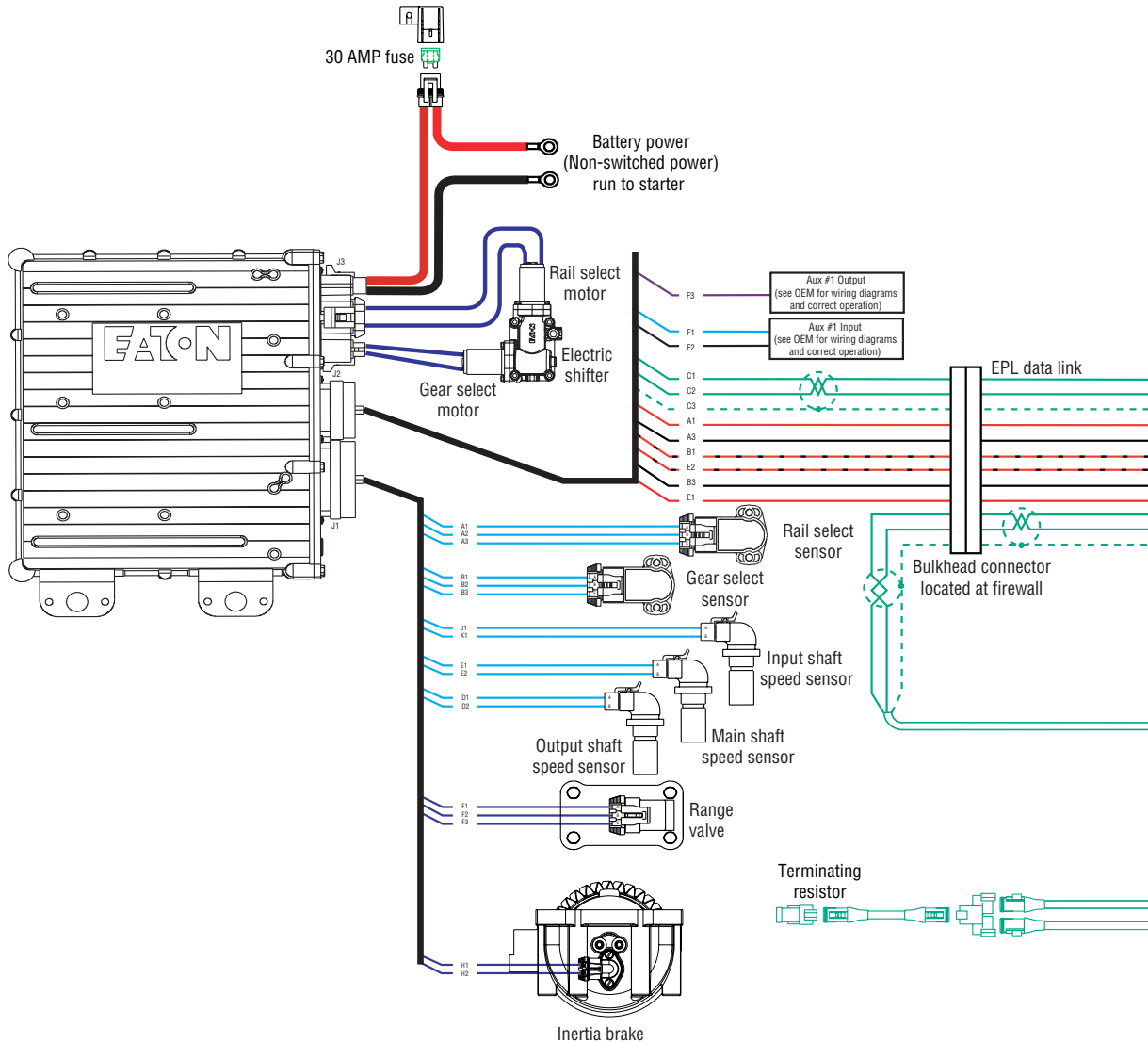
(Wire)
Electronics OEM Components Division
300 Construction Drive
Menlo Park, CA 94025-1164
1-800-260-9909
Fax United States (800) 260-9999
Fax Worldwide (650) 361-5579
www.raychem.com

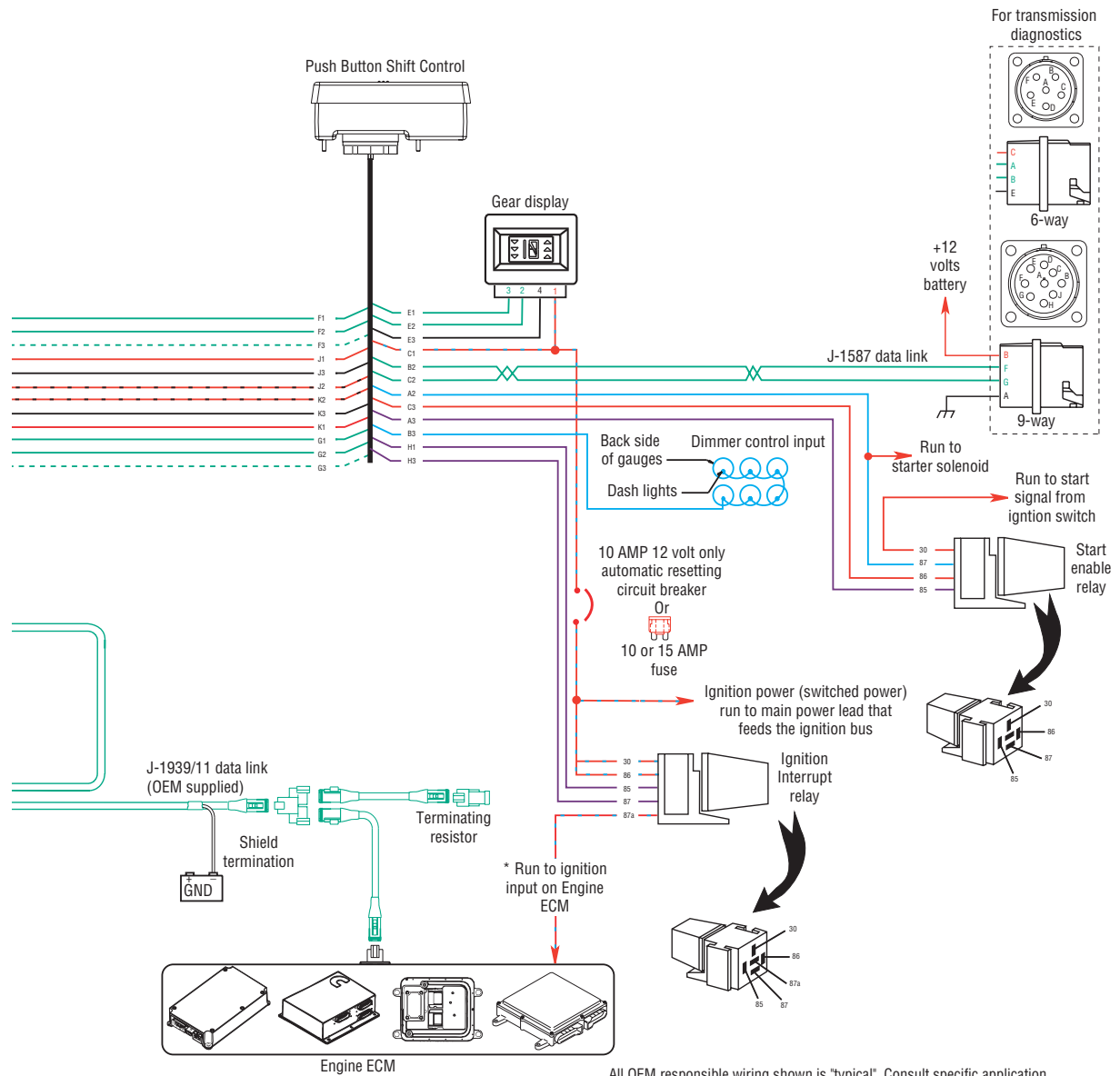
ROBERT BOSCH CORPORATION

(Relays)
2800 South 25th Avenue
Broadview, IL 60153
(708) 865-5301
Fax (708) 865-5203
www.bosch.de

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10-Speed DM2 Wiring Diagram





* For vehicle/engine systems which use a vehicle system ECU, contact the Eaton OEM liaison for installation schematics

All OEM responsible wiring shown is "typical". Consult specific application.
 +12 volt non-switched from battery
 +12 volt switched from shift control to transmission controller
 +12 volt switched from ignition switch
 Signals into the ECU
 Communication from and to the ECU
 Signal returns, grounds, and general OEM wiring
 +12 volt solenoid source

Connector Pin Descriptions

Transmission Controller 18-way (Vehicle Interface Connector)

18-WAY	DESCRIPTION	NOTES
A1	Batt 1	
A2	ATA +	
A3	GND 1	
B1	Trans batt 1	
B2	ATA -	
B3	GND 2	
C1	EPL +	
C2	EPL-	
C3	EPL shield	
D1	Aux speed 1 +	
D2	Aux speed 1 -	
D3	Aux input 2	Input, LO side
E1	Batt 2	
E2	Trans batt 2	
E3	Aux input 2	(Return)
F1	Aux input 1	Input, LO side
F2	Aux input 1	(Return)
F3	Aux output 1	Output, LO side driver

Connector Pin Descriptions

Shift Control 30-way connector

30-WAY	DESCRIPTION	NOTES
A1	Aux input/output 3	Input/output, LO side driver
A2	Start enable latch	
A3	Start enable relay -	
B1	Aux input 5	(Return)
B2	1587 +	
B3	Vdash	
C1	Ignition	
C2	1587 -	
C3	Start enable relay +	
D1	Aux input 5	Input, LO side
D2	Aux input 6	Input, LO side
D3	Aux output 3	Output, LO side driver
E1	Gear display clock	
E2	Gear display data	
E3	Gear display	(Return)
F1	EPL +	
F2	EPL -	
F3	EPL shield	
G1	1939 +	
G2	1939 -	
G3	1939 shield	
H1	Ignition Interrupt	Output, LO side driver
H2	Aux output 2	Output, HI/LO side driver
H3	Diagnostic Feedback	Input/output, LO side driver
J1	Batt 1	
J2	Trans batt 1	
J3	GND 1	
K1	Batt 2	
K2	Trans batt 2	
K3	GND 2	

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