Application Engineering Bulletin

Subject	This AEB is for the following applications:
Installation Recommendations	☐ **Automotive** ☒ **Industrial** ☐ **Power Generation**

Date April 2001 (Rev Dec 2001)	Page 1 of 38	AEB Number 15.44

Engine Models included: QSB,QSC,QSL9,QSM11,QSX15,QSK19,QST30,QSK45,QSK60

Fuel Systems included:

Changes in blue

Introduction

The Quantum Installation Recommendations Technical Package was written to assist OEMs in integrating Quantum engines into their equipment. This technical package includes the wiring diagram, pinouts, and other pertinent information needed to install a Quantum engine

Refer to the following other Industrial AEB's:

AEB 15.40 – Electronic Features

AEB 15.42 – OEM Components and Interfaces

AEB 15.43 – Datalinks and Diagnostics

Authors: Scott Decker, Michael L. Hill, Brian Landes, Jeffrey Martin, Stewart Sullivan, Tiffany Walker

Table of Contents

Section I - Grid Heaters

QSB, QSC, QSL9

The intake air heater system is used to aid in starting during cold temperatures and to reduce white smoke after such a start. The system consists of two heater elements that are controlled by the ECM via two high current relays. Grid heaters are required for QSB/C/L9 engines.

Note: The installer is responsible for procuring and mounting the grid heater power relays in a location free of road splash and also for routing battery connections through the relay contacts to the (2) grid heaters which are shipped with the engines. The intake air heater relays must not be mounted on engine.

Since power routed to the grid heaters is through one wire then the gauge of the wire should be 2 AWG minimally since each of the grid heating elements require 105 amps during the heating cycle. The gauge of the wire from the grid heater, relays to the grid heater elements, also need to be 6 AWG minimally to carry the required current. Fuses or fusible links set to 125 amps are advocated for the grid heating elements. The 24 V DC heater-relay is connected to the OEM interface connector. The ECM can source up to 3 amps to turn this relay on. The switch contact of this relay must carry the current from battery (+) to the grid heating elements. Only one relay is required to drive both grid heaters on 24 V DC systems since the grid heaters are wired in series.

QSM11, QSX15

The intake air heater system is used to aid in starting during cold temperatures and to reduce white smoke after such a start. The system consists of one heater elements that are controlled by the ECM via one high current relay.

Note: The installer is responsible for procuring and mounting the grid heater power relays in an acceptable location in respect to vibration and environmental influences such as road splash. The intake air heater relays must not be mounted on engine.

The gauge of the wire from the grid heater, relays to the grid heater elements, also need to be sized for the heater's current requirement. Typically, a 6 AWG minimally to carry the required current. Fuses or fusible links set to 125 amps are advocated for the grid heating elements. The 24 V DC heater-relay is connected to the OEM interface connector. The ECM can source up to 3 amps to turn this relay on. The switch contact of this relay must carry the current from battery (+) to the grid heating elements. Only one relay is required to drive both grid heaters on 24 V DC systems since the grid heaters are wired in series.

The QSM11 grid heater requires that the installer provide the ground wire or strap. This ground wire should be routed directly to the starter ground connection or the battery ground. It is not acceptable to ground the grid heater to the engine block or cylinder head.

The QSX15 grid heater is grounded directly to the engine's ground lug. The QSX15 grounding wire is supplied with the engine.

QST 30

The intake air heater system is used to aid in starting during cold temperatures, while helping to reduce white smoke. The system consists of twelve heater elements that are controlled by a primary and secondary ECM via two high current relays. The ECM can source up to 3 amps.

Note: The installer is responsible for routing battery (+) connections to the contacts of the grid heater relays, which are shipped with each engine.

Each grid heater element is rated for 86A@12V. As a result, each bank of grid heater elements will draw 258 amps in an ideal 24-volt system and have a total current draw of 512 amps for both banks. Therefore, the

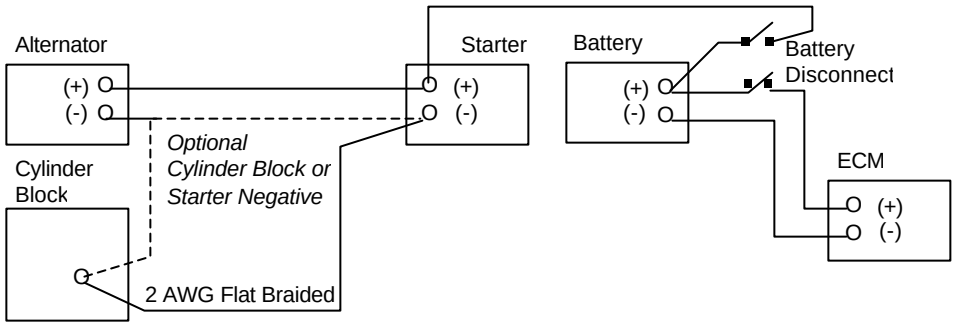
equipment manufacturer must be sure to size the supply wire appropriately to support the grid heater current draw requirements. A minimum #000 gauge cable routed to each bank is recommended.

Engine Family	Voltage	Heater Current	ECM Relay Source
QSB/QSC/QSL9	12	210	3 Amps
QSB/QSC/QSL9	24	105	3 Amps
QSM11	24	90	2 Amps
QSX15	24	105	2 Amps
QST30	24	258 amps/bank 512 amps total	3 Amps

Section II - Power and Ground Requirements

Power and Ground

System Grounding Requirements - Ground loops and electrical noise is a source of numerous problems with today's electronic engines. For example, a high current device such as an alternator can inject electromagnetic interference (EMI) through the cylinder block back through the ECM, which is case-grounded to the block to shunt radio frequency noise. Other examples are relays that switch at high speeds introducing high frequency noise into the cylinder block, which can introduce noise into the ECM. To minimize these problems, follow the practices described in interface specification IS-1377-9807 and the following paragraphs. Refer to the Power Connection Layout figure below.



Power Connection Layout

High-Current Accessory Grounds - Alternators and other engine accessories greater than 10 amps should be grounded to the starter negative terminal (always follow starter manufacturer's recommendations) rather than to the cylinder block. This minimizes the electrical noise and ground loops present in the overall system. Optional locations are to the battery negative terminal or a central location on the cylinder block. If the alternator is grounded to a central location on the cylinder block, e.g. ground stud or ground boss, it must be attached to the same location as the starter or battery negative.

Cylinder Block as Ground - The cylinder block represents a very large capacitance to system ground, which makes it a highly effective RF shunt. Therefore, many devices, including the engine ECM, prefer to shunt RF noise to the cylinder block. However, if the block contains current-induced voltage noise, it can become a point of noise entry for devices using it as a RF shunt. It is acceptable to use the cylinder block as a return for devices that are powered continuously. For devices that carry high currents (engine accessories greater than 10 amps) or that switch on and off rapidly, the return should route to starter or battery negative.

Starter Ground - Ground the starter negative with a 2 AWG wire or larger to the cylinder block to help shunt RD noise. A flat, braided wire is more effective than a round, stranded cable. An insulated welding cable is also acceptable. Since the braided wire is not insulated, the welding cable is acceptable and typically has a longer service life. This low impedance ground path design should take into account long-term degradation.

Frame Returns - Cab and chassis components should have common ground points to reduce ground loops. Frame ground returns are often a source of problems and should be avoided. The frame ground alternative adds more resistance to a return circuit.

Minimum wire size – The preferred method of connecting the ECM power supply to the batteries is by maintaining the required number of stranded 18 AWG wires over the entire length of the connection (see each engine family wiring diagram). When splices occur, a minimum of four stranded 10 AWG or larger wires must be used between the splices and the battery, two for (+) and two for (-). Circuit resistance must not exceed 40 milliohms, but 10 milliohms is desirable. This circuit resistance limit includes the OEM-supplied circuit protection system and any switches or interconnects.

Switches and Sensors Grounding Requirements

All switches and sensors that are wired directly to the ECM must be referenced to an ECM switch return. These components use inputs that are susceptible to noise and voltage offsets that can be introduced through the return path. Follow these guidelines when designing the machine wiring.

Inductive Load Sharing - When used as a switch return, an ECM switch return must never be used to return unsuppressed inductive loads. Relay coils on the same circuit should be avoided. However, if a relay is used, it should contain a suppression diode. This will isolate noise from the return, which can impair the reliability of a switch or sensor input.

Sensor Dedication - When used as a return for certain analog sensors (i.e. pressure, temperature, or APS), an ECM switch return should be dedicated solely to that sensor. Radiometric and resistive ECM inputs are very sensitive, even a small change in voltage drop will affect the detected parameter.

Isolation - An ECM switch return must be kept isolated from machine chassis ground. This will prevent undesirable ground loops.

Sourcing - An ECM switch return should not be used to return any voltage that has not been sourced from the ECM. This will prevent overloading of the ECM supply returns.

Star Ground - For switch panels that contain critical switches such as the MUS on/off switch, it is good practice to establish a "star" ground fed by dual redundant ECM switch returns. A proper star ground will have a separate return to each switch. When designed in this manner, a single-point open-circuit return fault will result in the loss of no more than one switch.

Solenoid Grounding Requirements

Solenoids and relay coils that are wired directly to the ECM may be referenced either to a good chassis ground or to an ECM solenoid return. The ECM solenoid return is a convenience and is not a requirement. If an ECM solenoid return is used, follow these guidelines when designing the machine wiring.

Inductive Load Sharing - When used as a solenoid return, an ECM solenoid return must not be used as a return for critical components such as switches or sensors. Guidelines for these components are more extensive as detailed in the previous paragraphs.

Isolation - An ECM solenoid return must be kept isolated from machine chassis ground. This will prevent undesirable ground loops.

Sourcing - An ECM switch return should not be used to return any voltage that has not been sourced from the ECM. This will prevent overloading of the ECM supply returns.

Section III - Keyswitch Requirement

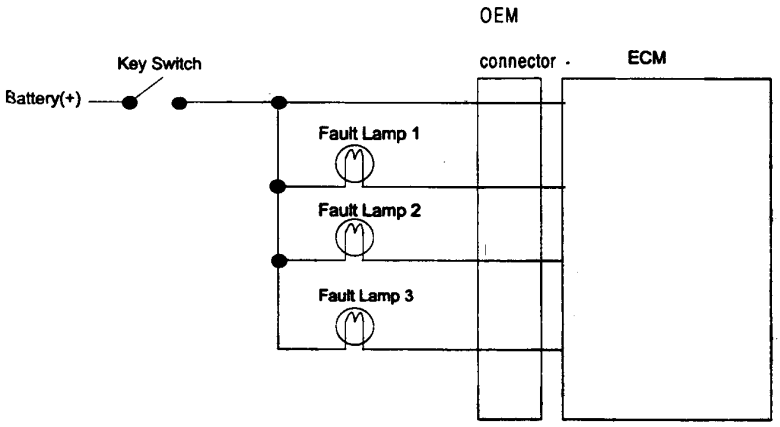
Keyswitch Connection Requirements

Proper connections of the keyswitch to the ECM are critical for proper operation of the engine. The keyswitch signal must be continuously present in order for the engine to operate. A loss of this signal, even a momentary loss, can cause undesirable ECM resets, which can stall the engine and cause fault codes. Follow the installation guidelines in interface specification IS-1377-9807 and the following paragraphs.

Sourcing - The keyswitch must be connected directly to the ECM. There must be no switches or relay contacts between the keyswitch and the pinouts at ECM connector. Any engine shutdown systems designed to interrupt key switch power must have a Cummins application review completed and approved for that system.

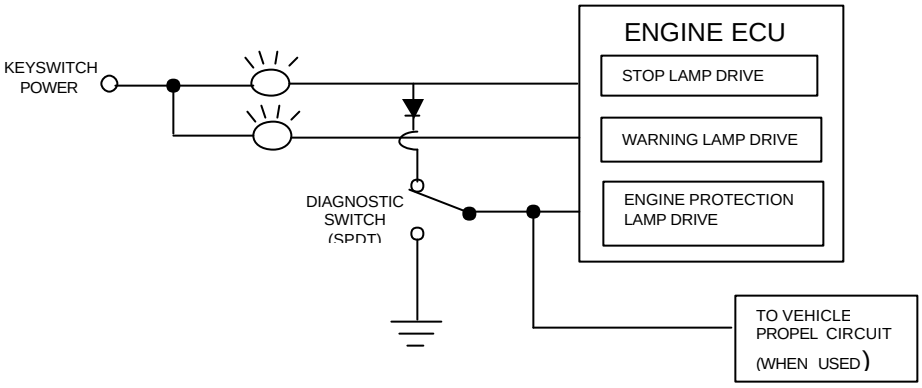
Fusing - The keyswitch signal must be fused so that an electrical short due to some other component does not affect voltage at the ECM keyswitch input.

Inductive Load Sharing - The keyswitch signal must not share its circuit with unsuppressed inductive loads. Relay coils on the same circuit should be avoided. However, if a relay is used, it should contain a suppression diode. This will isolate noise, which can impair the reliability of the keyswitch input.

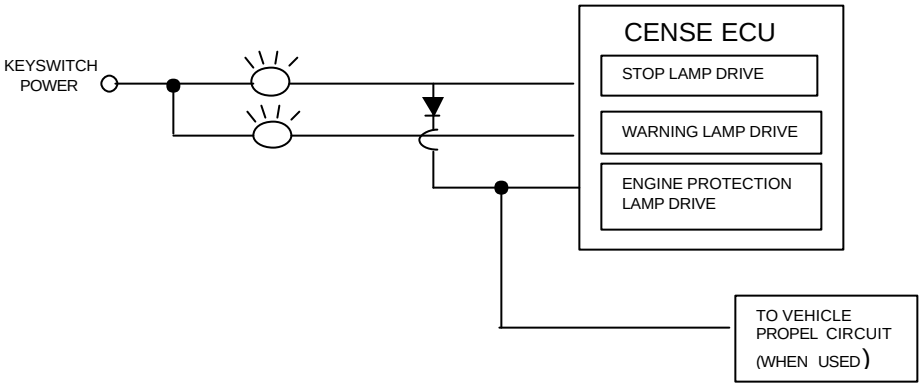


Fault Lamp/Keyswitch Wiring Configuration

Optional - 2 Lamp Strategy - QSK19/45/60 - The Optional 2-lamp strategy will eliminate the Engine Protection (white) Lamp. Therefore, the operator will only have a warning (yellow) andstop (red) lamp on the dashboard. All of the faults that were mapped to the Engine protection lamp will become annunciated through the stop (red) lamp. This change will only affect the wiring of the fault lamps and not the software or calibration. See wiring below.



2-Lamp Strategy with Cense



2-Lamp Strategy without Cense

Section IV - Welding Requirements

Welding

Welding on the engine or engine mounted components is not recommended. Cummins recommends disconnecting all OEM connectors. Attach the welder ground cable no more than two feet from the part being welded. Never connect the ground cable of the welder to the ECM.

Section V - OEM Harness and Harness Routing

Wire Selection

Wire selection is critical for proper operation of the engine. Follow these guidelines when designing the OEM wiring harness.

Wire Size - The size requirement for the harness wiring is 18 AWG stranded wire, covered with GXL or TXL insulation for all underhood wiring. Diameter range including insulation is 0.040-0.095 inches. This wire size and insulation type is the only one tested and approved by Cummins with the Deutsch 50-pin connector.

Twisted Pairs - There are three sets of twisted-pair wires. The wires are twisted at a rate of one twist per inch and are used with the Shaft Speed sensor, the tachometer and the J1587 datalink.

Twisted Triplets - There are three sets of twisted-triplet wires. The wires are twisted at the rate of one twist per inch and are used with the base throttle, remote throttle, and variable throttle option of the Intermediate Speed Control (ISC) feature.

Datalinks - A separate cable must be used on the J1939 datalink. Refer to SAE J1939/11 and J1939/13 for detailed specifications on the datalink wire requirements. Refer to AEB 15.43 Datalink and Diagnostics.

Contacts and Connectors

The connection points of the OEM wiring harness must be adequately protected from vibration and moisture intrusion. The design practices and manufacturing methods for typical 12- and 24- volt systems are not adequate when the subsystem operates with low signal level electronics on some circuits. Follow the guidelines in the following paragraphs.

Datalinks - The quantum electronic subsystem requires gold plating for the OEM connector terminals and any J1939 and J1708 datalink connections.

Switches - The Quantum subsystem recommends that all switch contacts (except keyswitch) be gold flashed to ensure reliable switching at low voltages and currents. Ring terminals may be either solder dipped or tin plated. Follow the guidelines in interface specification IS-1377-9802.

Connectors - Chassis-mounted connectors should be environmentally sealed and, at a minimum, be tin-plated or nickel-plated. A lubricant should be applied to connector terminal surfaces as an added safeguard for use with tin-plated or nickel-plated contacts to reduce the risk of fretting corrosion. In the cab area, tin plating should be on wire-to-wire and wire-to-switch interconnections. This is a minimum requirement.

Recommended Plating - A detailed review of the termination and connector uses is to be conducted with the connector supplier. A sample of typical connector supplier recommendations for plating subsystems used in low current signal applications is shown in the Recommended Plating Systems table.

Recommended Plating Systems Table

Surface Plating	Underplating	Terminal material
Gold, cobalt hardened	**Nickel, matte**	**Brass**
120-200 Knoop	180-300 Knoop	
50-80 micro-inches	80-110 micro-inches	
Tin, Matte	**Nickel, matte**	**Brass**
30-120 micro-inches	50-120 micro-inches	
<250 micro-inches/pair		

Plating Systems Not Recommended - The following plating systems are not recommended: Tin with >250 micro-inches per terminal pair (male + female interface), gold with no underplating barrier, brass, silver, and copper.

Dissimilar Metals - The use of dissimilar metals for any terminal pair (male + female interface) is not recommended. Use of dissimilar metals will cause galvanic corrosion, resulting in terminal pitting and premature circuit failure.

Throttle Circuit - It is recommended that the connector terminal between the base throttle pedal and ECM be gold plated. This recommendation also applies to the remote throttle circuit and the variable ISC throttle circuit.

OEM Sensor Circuit - It is recommended that the connector terminals between the OEM temperature sensor and the ECM and between the OEM pressure sensor and the ECM, be gold plated.

Protective Covering

The protective covering for the OEM wiring harness should have high abrasion and cut resistance, continuous temperature capability to 125^{o} C (257^{o} F) and intermittent temperature capability to 150^{o} C (302^{o} F). The material should also have high chemical resistance to fuel, engine oil and engine coolant. The harness covering should not strain the wire or the wire seal at the connector and typically should be terminated approximately 1/2 inch from the connector shell. Convoluted tubing, woven braid, or overfoamed is recommended as protective covering.

Convoluted Tubing - If convoluted conduit is selected, nylon material should be specified. The material should be slit lengthwise and have drainage provisions for fluids. Conduit ends should be secure to prevent unraveling.

Woven Braid - If woven braid is selected, the material should consist of a nylon core with a vinyl covering. The covering should be a minimum of 12 picks per inch and a tight, non-slip covering over the cables should be provided. The braid tail should be secured to prevent unraveling.

Harness Routing and Support

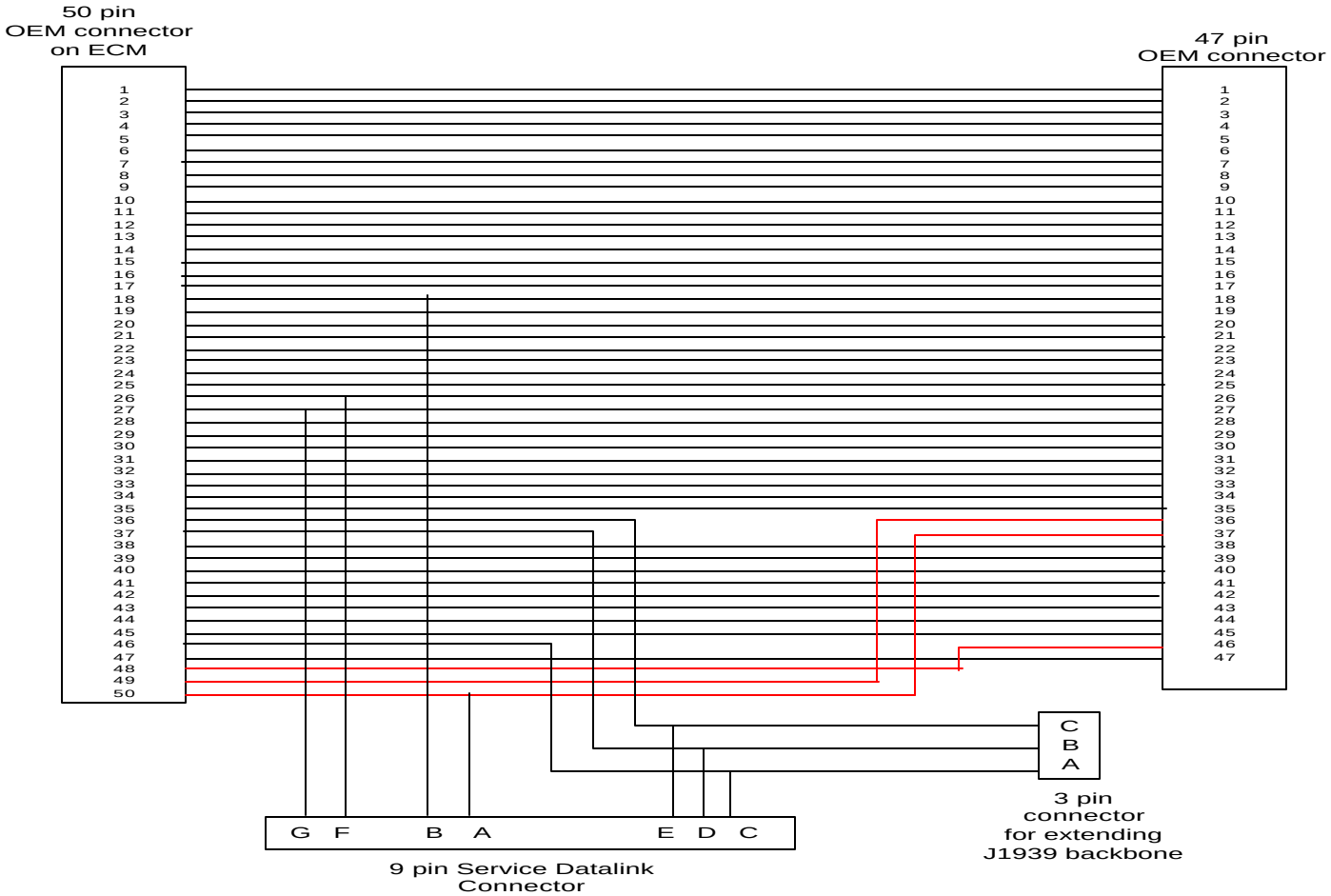
The physical routing and support of the OEM wiring harness should minimize strain in the wire seals and of all connectors and should protect the harness from damage due to abrasion, heat and sharp objects. The harness should be clamped at any location on the engine/machine where support is required to protect the harness from strain damage. Wherever possible, wires associated with the OEM harness should be routed physically close to metals connected to battery (-) (e.g. frame rails, engine block) to minimize electromagnetic interference with other electronic subsystems in the vehicle. All wiring should be kept free from sharp bends around components that can cause nicks, cuts or other damage. The harness should be routed away from sharp objects, exhaust system components and other high temperature components.

Section VI - Datalink Requirements for QSM11 and QSX15

The 9-pin service datalink does not ship on the QSM11 and QSX15 engine unless you order the designated EA option. A 47-pin OEM Deutsch connector will also available as the interface instead of connecting directly to the 50-pin OEM connection on the ECM. This option will include a 9-pin connector, 3-pin connector, a 50-pin connector and a 47- pin round connector. The new 47-pin OEM connector is in a mounting bracket generally above the ECM. The 9 and 3 pin connectors are in the same location, but are not mounted into the bracket. They come off the wiring harness extension. See wiring diagram below.

J1939 Backbone - A J1939 backbone is required on every machine that contains a QSM11 or QSX15 engine. Terminating resistors should be used on the J1939 backbone as specified in AEB 15.43 Datalinks and Diagnostics technical package. Recommended termination receptacles and stub connectors are defined in the OEM Components technical package.

Stub Connector - A 3-pin J1939 receptacle stub connector must be inserted between the ECM and the J1939



backbone. This is to prevent wiring faults between the ECM and the datalink connector from preventing communication with the ECM, thus rendering it unserviceable. This stub must be located within 12 inches of the 50-pin OEM connector.

OEM Datalink option wiring diagram

RED — INDICATES POWER SUPPLIED BY THE ECM
BLUE — INDICATES POWER AND SIGNALS INTO THE ECM
BLACK — INDICATES ECM RETURNS, GROUNDS AND GENERIC OEM WIRING
GREEN — INDICATES DATA LINKS
PURPLE — INDICATES ECM OUTPUTS

OEM RESPONSIBILITY

CUMMINS RESPONSIBILITY

ECM "B" CONNECTOR 50 PIN

TACHOMETER
TACHOMETER OUT (LOGIC LEVEL) < 12 <
V THROTTLE +5VDC < 29 <
THROTTLE POSITION INPUT SIGNAL < 30 <
THROTTLE RETURN < 19 <
ON IDLE SWITCH < 26 <
OFF IDLE SWITCH < 25 <
ENGINE SYNC ON/OFF SWITCH
ENGINE SYNC COMPLEMENTARY SWITCH
A/C PRESSURE SWITCH
MULTI-UNIT SYNC ON/OFF SWITCH < 24 <
MULTI-UNIT SYNC COMPLEMENTARY SWITCH < 38 <
A/C PRESSURE SWITCH < 43 <
INTERMEDIATE SPEED CONTROL 2 < 47 <
PWM DEDICATED PIN OUT < 21 <
CRUISE/ISC INC/DEC
CRUISE ON/OFF
EXHAUST BRAKE ON/OFF
DIAGNOSTIC ON/OFF
IDLE/DIAG INC./DEC.
BOOST POWER REQUEST < 17 <
INTERMEDIATE SPEED VALIDATION/ISC3 < 23 <
INTERMEDIATE SPEED CONTROL 1 < 28 <
CRUISE CONTROL RESUME/ISC INCREMENT < 07 <
CRUISE SET/ISC DECREMENT < 13 <
CRUISE ON/OFF < 14 <
EXHAUST BRAKE ON/OFF INPUT < 34 <
DIAGNOSTIC ON/OFF INPUT < 37 <
IDLE AND DIAGNOSTIC INCREMENT INPUT < 35 <
IDLE AND DIAGNOSTIC DECREMENT INPUT < 36 <
STOP LAMP
WARNING LAMP
MAINTENANCE LAMP
WAIT LAMP
WIF LAMP
STOP LAMP < 01 <
DIAGNOSTIC LAMP < 03 <
MAINTENANCE LAMP < 04 <
WAIT TO START LAMP < 11 <
WATER-IN-FUEL LAMP < 02 <
BRAKE SWITCH
CLUTCH SWITCH
TRAILER BRAKE SWITCH
BRAKE SWITCH INPUT < 33 <
CLUTCH SWITCH INPUT < 27 <
SWITCHED TORQUE DERATE < 39 <
AUX GOVERNOR/OEM PRESSURE SENSOR < 48 <
J1587 DATALINK
J 1587 (+) < 49 <
J 1587 (-) < 50 <
VEHICLE/TAIL SHAFT SPEED SENSOR
VSS + < 08 <
VSS - < 18 <
OTHER SERIES FAN SWITCHES
MANUAL FAN CLUTCH SWITCH
ALTERNATE IDLE SPEED < 44 <
DUAL OUTPUT DRIVER 'A' < 05 <
FAN CLUTCH SWITCH INPUTS < 16 <
REM. THROTTLE ON/OFF
AUX/TAIL SHAFT GOVERNOR ON/OFF
REMOTE THROTTLE ON/OFF INPUT < 45 <
AUX/TAIL SHAFT GOVERNOR < 46 <
REMOTE THROTTLE ASSEMBLY
REMOTE THROTTLE +5VDC (VSENSOR B) < 10 <
REMOTE THROTTLE PEDAL POSITION INPUT < 09 <
REMOTE THROTTLE RETURN (SRTN B) < 20 <
WIF SENSOR
RETURN
WATER IN FUEL < 40 <
GRID HEATER RELAYS #1 #2
COLD STARTING AID RELAY 1 < 41 <
COLD STARTING AID RELAY 2 < 31 <
BATTERY GROUND
5.0A

BULKHEAD CONNECTOR

KEY SWITCH
STARTER
ACCESSORY
IGNITION
BATTERY
VEHICLE KEY SWITCH INPUT
5.0A
7.5A
7.5A
7.5A
(14 AWG) 10 AMP (14 AWG)
(14 AWG) 10 AMP (14 AWG)
FAN CLUTCH
EXHAUST BRAKE RELAY
EXHAUST BRAKE SOLENOID

VP44 FUEL PUMP 9 PIN AMP CONNECTOR
VP44 POWER < 7 <
ENGINE SYNC SIGNAL < 8 <
VP44 IDLE SELECT < 4 <
VP44 FUEL SHUTOFF < 5 <
VP44 CAN + (POS) < 2 <
VP44 CAN - (NEG) < 1 <
CAN SHIELD < 3 <
< 9 <
< 6 <
BATTERY [NEG.]

ECM "A" CONNECTOR 50 PIN

LIFT PUMP
LIFT PUMP < 11 <
BATTERY [NEG.]
ENGINE SPEED SENSOR
ENGINE SPEED +5VDC (V SENSOR) < 08 <
ENGINE SPEED INPUT SIGNAL < 17 <
ENGINE SPEED SENSOR RETURN < 18 <
ENGINE POSITION SENSOR
ENGINE POSITION +5VDC < 10 <
ENGINE POSITION INPUT SIGNAL < 09 <
ENGINE POSITION INPUT RETURN < 19 <
OIL PRESSURE
OIL PRESSURE +5VDC (VSENSOR) < 33 <
OIL PRESSURE INPUT SIGNAL
OIL PRESSURE INPUT RETURN (SRTN)
BOOST PRESSURE
BOOST PRESSURE +5VDC (VSENSOR) < 45 <
BOOST PRESSURE INPUT SIGNAL
BOOST PRESSURE INPUT RETURN (SRTN)
COOL TEMPERATURE
COOLANT TEMPERATURE INPUT SIGNAL < 23 <
COOLANT TEMPERATURE RETURN
AIR TEMPERATURE
INTAKE MANIFOLD AIR TEMPERATURE SIGNAL < 34 <
INTAKE MANIFOLD AIR TEMPERATURE RETURN
COOLANT LEVEL
COOLANT LEVEL +5VDC < 49 <
COOLANT LEVEL INPUT RETURN (SRTN) < 27 <
COOLANT LEVEL HIGH INPUT SIGNAL < 37 <
COOLANT LEVEL LOW INPUT SIGNAL
VEHICLE KEY SWITCH INPUT < 05 <
12 OR 24 VDC BATTERY (+) < 39 <
12 OR 24 VDC BATTERY (+) < 40 <
12 OR 24 VDC BATTERY (+) < 38 <
VP44 POWER (14 AWG)
VP44 POWER (14 AWG)
BATTERY (-) < 20 <
BATTERY (-) < 28 <
BATTERY (-) < 29 <
BATTERY (-) (14 AWG)
BATTERY (-) (14 AWG)
FAN CLUTCH DRIVER < 31 <
EXHAUST BRAKE ENABLE < 42 <
FREQUENCY THROTTLE INPUT < 14 <
RETURN
DUAL OUTPUT DRIVER 'B' < 21 <
MULTI-UNIT SYNC/MASTER < 47 <
MULTI-UNIT SYNC/SLAVE < 48 <
USER DATALOG SWITCH < 26 <
SWITCHED DROOP < 24 <
OEM SWITCH < 15 <
RETURN
VARIABLE INTERMEDIATE SPEED < 22 <
FUEL SHUTOFF < 43 <
BATTERY (-)
VP44 POWER (12 AWG)
VP44 POWER (12 AWG)
VP 44 RELAY
SERVICE TOOL POWER
BATTERY (+)
BATTERY (-)

ENGINE CONNECTOR* (A) 50 1C 41 1
OEM CONNECTOR** (B) 50 1C 41 1

BACKBONE HARNESS
J1939 (+) < 02 <
J1939 (-) < 12 <
J1939 SHIELD < 44 <
J1939 (+)
J1939 (-)
J1939 SHIELD

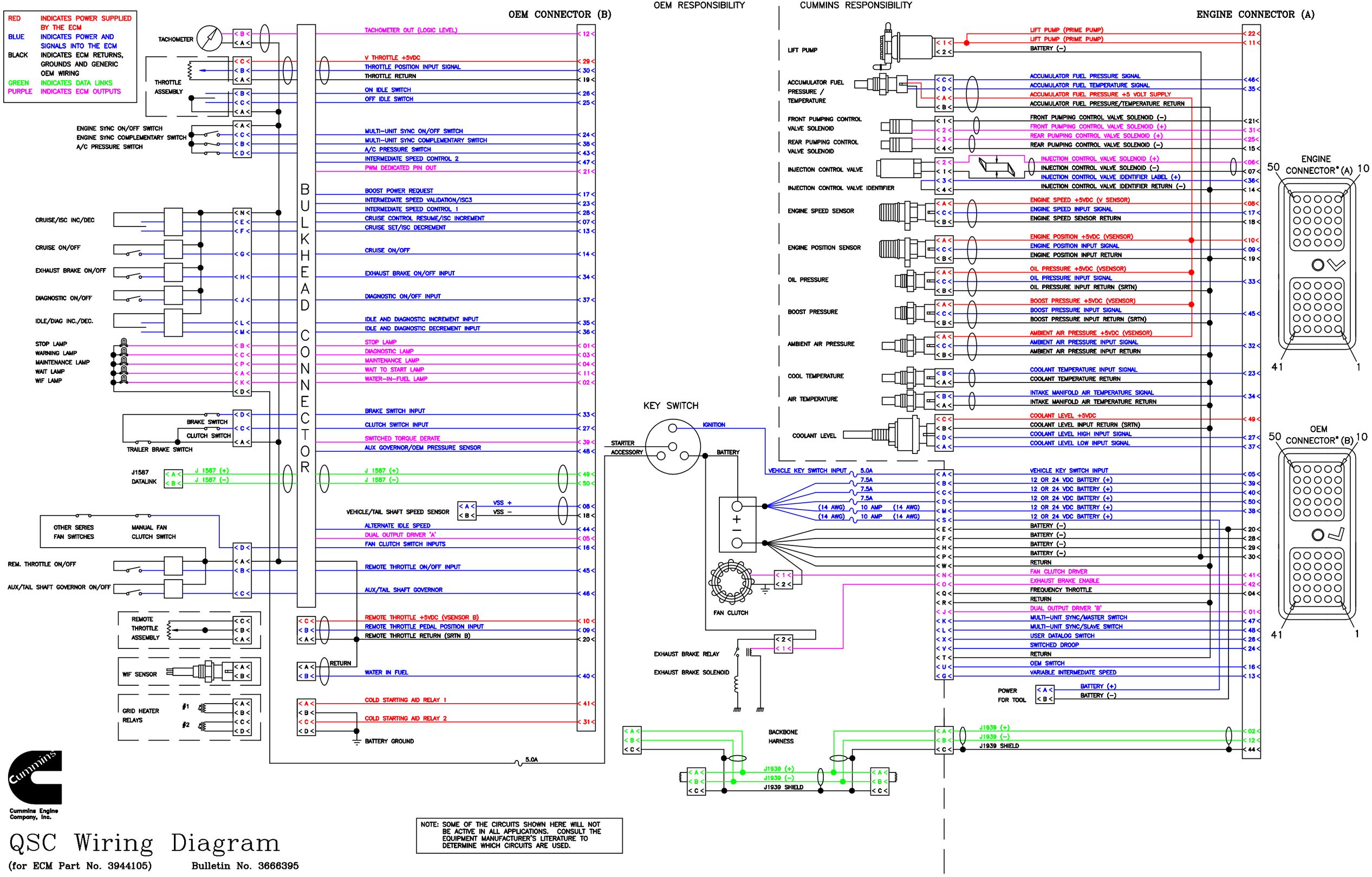
OEM RESPONSIBILITY — CUMMINS RESPONSIBILITY

Cummins Engine Company, Inc.

QSB Wiring Diagram

(for ECM Part No. 3942860 & 3944124) Bulletin No. 3666396

NOTE: SOME OF THE CIRCUITS SHOWN HERE WILL NOT BE ACTIVE IN ALL APPLICATIONS. CONSULT THE EQUIPMENT MANUFACTURER'S LITERATURE TO DETERMINE WHICH CIRCUITS ARE USED.



Cummins Engine Company, Inc.

QSC Wiring Diagram

(for ECM Part No. 3944105) Bulletin No. 3666395

NOTE: SOME OF THE CIRCUITS SHOWN HERE WILL NOT BE ACTIVE IN ALL APPLICATIONS. CONSULT THE EQUIPMENT MANUFACTURER'S LITERATURE TO DETERMINE WHICH CIRCUITS ARE USED.

RED DC VOLTAGE
BLUE INPUT SIGNALS
BLACK GROUNDS, SHIELDS AND RETURNS
PURPLE OUTPUT SIGNALS
GREEN DATA LINKS

OEM RESPONSIBILITY

OEM HARNESS CONNECTOR

CUMMINS RESPONSIBILITY

ENGINE HARNESS CONNECTOR

OEM DEVICE

TACHOMETER

ISS ACCELERATOR ASSEMBLY

NON-ISS ACCELERATOR ASSEMBLY

MULTI-UNIT SYNCHRONIZATION ON/OFF SWITCH

CRUISE CONTROL/ ISC RESUME/SET SWITCH

CRUISE CONTROL ON/OFF

EXHAUST/ENGINE BRAKE ON/OFF

DIAGNOSTIC ON/OFF

IDLE INCREMENT/DECREMENT

REMOTE THROTTLE ON/OFF

AUXILIARY GOVERNOR SWITCH ON/OFF

FAN CLUTCH ON/OFF

SERVICE BRAKE SWITCH

CLUTCH SWITCH

BOOST POWER REQUEST SWITCH

INTERMEDIATE SPEED CONTROL 1 SWITCH

SWITCHED TORQUE DERATE SWITCH

AUXILIARY GOVERNOR/OEM PRESSURE SENSOR SWITCH

INTERMEDIATE SPEED VALIDATION/ISC 3 SWITCH

CAB SWITCHABLE GOVERNOR SWITCH

STOP LAMP SIGNAL

DIAGNOSTIC LAMP SIGNAL

MAINTENANCE LAMP

WAIT TO START LAMP

WATER IN FUEL LAMP

INTERMEDIATE SPEED CONTROL 2 SWITCH

ALTERNATE IDLE SPEED

DUAL OUTPUT DRIVER OUTPUT "A"

OEM DEVICE

SWITCHED DROOP SWITCH

USER ACTIVATED DATALOGGER SWITCH

OEM SWITCH

VARIABLE INTERMEDIATE SPEED SWITCH

ENGINE BRAKE HI / LOW SWITCH

KEY SWITCH

IGNITION

5A FUSE

STARTER

BATTERY

BULKHEAD CONNECTOR

VEHICLE SPEED SENSOR

VEHICLE SPEED SENSOR (+) <08
VEHICLE SPEED SENSOR (-) <18
TACHOMETER SIGNAL <12
PWM DEDICATED OUTPUT <21
THROTTLE POSITION +5 VOLT SUPPLY <29
THROTTLE POSITION SIGNAL <30
THROTTLE POSITION RETURN <19
IDLE VALIDATION IDLE SIGNAL <26
IDLE VALIDATION OFF - IDLE SIGNAL <25
MULTI-UNIT SYNCHRONIZATION ON/OFF SWITCH <24
MULTI-UNIT SYNCHRONIZATION COMPLEMENTARY SWITCH <38
CRUISE CONTROL RESUME/ACCEL ISC/INCREMENT <07
CRUISE CONTROL SET/COAST ISC/DECREMENT <13
CRUISE CONTROL ON/OFF SIGNAL <14
EXHAUST/ENGINE BRAKE ON/OFF SIGNAL <34
DIAGNOSTIC ON/OFF SIGNAL <37
IDLE/DIAGNOSTIC INCREMENT SIGNAL <35
IDLE/DIAGNOSTIC DECREMENT SIGNAL <36
REMOTE THROTTLE ON/OFF SIGNAL <45
AUXILIARY GOVERNOR <46
FAN CLUTCH SWITCH SIGNAL <16
SERVICE BRAKE SWITCH SIGNAL <33
CLUTCH SWITCH SIGNAL <27
BOOST POWER REQUEST <17
INTERMEDIATE SPEED CONTROL 1 <28
SWITCHED TORQUE DERATE <39
AUXILIARY GOVERNOR/OEM PRESSURE SENSOR <48
INTERMEDIATE SPEED VALIDATION/ISC 3 <23
CAB SWITCHABLE GOVERNOR <06
STOP LAMP SIGNAL <01
WARNING LAMP SIGNAL <03
MAINTENANCE LAMP SIGNAL <04
WAIT TO START LAMP SIGNAL <11
WATER IN FUEL LAMP SIGNAL <02
ALTERNATE IDLE SPEED <44
DUAL OUTPUT DRIVER OUTPUT "A" <05
INTERMEDIATE SPEED CONTROL 2 <47
AIR CONDITIONING PRESSURE SWITCH <43
REMOTE THROTTLE +5 VOLT SUPPLY <10
REMOTE THROTTLE POSITION SIGNAL <09
REMOTE THROTTLE RETURN <20
WATER IN FUEL SENSOR SIGNAL <40
COLD START AID RELAY 1 <41
COLD START AID RELAY 2 <31
J1587 DATA LINK (+) <49
J1587 DATA LINK (-) <50

AIR CONDITIONER PRESSURE SWITCH

ACCUMULATOR FUEL PRESSURE SENSOR
ACCUMULATOR FUEL PRESSURE +5 VOLT SUPPLY <46
ACCUMULATOR FUEL PRESSURE SIGNAL <35
ACCUMULATOR FUEL PRESSURE RETURN <31

ACCUMULATOR FUEL TEMPERATURE SENSOR
ACCUMULATOR FUEL TEMPERATURE SIGNAL <21
ACCUMULATOR FUEL TEMPERATURE RETURN <25

FRONT PUMPING CONTROL VALVE SOLENOID
FRONT PUMPING CONTROL VALVE SOLENOID (+) <15
FRONT PUMPING CONTROL VALVE SOLENOID (-)

REAR PUMPING CONTROL VALVE SOLENOID
REAR PUMPING CONTROL VALVE SOLENOID (+)
REAR PUMPING CONTROL VALVE SOLENOID (-)

TRANSIENT SUPPRESSOR

INJECTION CONTROL VALVE
INJECTION CONTROL VALVE SOLENOID (+) <08
INJECTION CONTROL VALVE SOLENOID (-) <07

INJECTION CONTROL VALVE IDENTIFIER
INJECTION CONTROL VALVE IDENTIFIER LABEL <36
INJECTION PUMPING CONTROL VALVE IDENTIFIER RETURN LINES <14

LIFT PUMP
LIFT PUMP RETURN
LIFT PUMP +12 VOLT SUPPLY <11

ENGINE SPEED SENSOR
ENGINE SPEED +5 VOLT SUPPLY <08
ENGINE SPEED SIGNAL <17
ENGINE SPEED RETURN <18

ENGINE POSITION SENSOR
ENGINE POSITION +5 VOLT SUPPLY <10
ENGINE POSITION SIGNAL <09
ENGINE POSITION RETURN <19

OIL PRESSURE SENSOR
OIL PRESSURE +5 VOLT SUPPLY <33
OIL PRESSURE SIGNAL
OIL PRESSURE RETURN

INTAKE MANIFOLD PRESSURE SENSOR
INTAKE MANIFOLD PRESSURE +5 VOLT SUPPLY <45
INTAKE MANIFOLD PRESSURE SIGNAL
INTAKE MANIFOLD PRESSURE RETURN

COOLANT TEMPERATURE SENSOR
COOLANT TEMPERATURE INPUT SIGNAL <23
COOLANT TEMPERATURE RETURN

INTAKE MANIFOLD AIR TEMPERATURE SENSOR
INTAKE MANIFOLD AIR TEMPERATURE INPUT SIGNAL <34
INTAKE MANIFOLD AIR TEMPERATURE RETURN

AMBIENT AIR PRESSURE SENSOR
AMBIENT AIR PRESSURE +5 VOLT SUPPLY <32
AMBIENT AIR PRESSURE SIGNAL
AMBIENT AIR PRESSURE RETURN

COOLANT LEVEL SENSOR
COOLANT LEVEL +5 VOLT SUPPLY <49
COOLANT LEVEL RETURN
COOLANT LEVEL HIGH SIGNAL <27
COOLANT LEVEL LOW SIGNAL <37

SHORTING PLUG

J1939 (+) <02
J1939 (-) <12
J1939 DATALINK SHIELD <44

ENGINE BRAKE HI/LOW SWITCH SHORTING PLUG

ENGINE BRAKE SOLENOID 1
ENGINE BRAKE SOLENOID 2

23 PIN OEM CONNECTOR

OEM DEVICE
FREQUENCY THROTTLE <04
DUAL OUTPUT DRIVER "B" <01
MULTI-UNIT SYNCHRONIZATION PRIMARY <47
MULTI-UNIT SYNCHRONIZATION SECONDARY <48
VEHICLE KEY SWITCH INPUT <05
SWITCHED DROOP <24
USER ACTIVATED DATALOGGER SWITCH <26
OEM SWITCH <16
VARIABLE INTERMEDIATE SPEED <13
EXHAUST / ENGINE BRAKE <42
RETURN

EXHAUST BRAKE RELAY

TOOL POWER SUPPLY
BATTERY (-)
BATTERY (+)
RETURN

7.5A FUSE
7.5A FUSE
7.5A FUSE
10.0A FUSE
10.0A FUSE

BATTERY (+) <39
BATTERY (+) <40
BATTERY (+) <50
BATTERY (+) <38
BATTERY (+)
BATTERY (-) <20
BATTERY (-) <28
BATTERY (-) <29
BATTERY (-) <30
RETURN
FAN CLUTCH DRIVER <41

FAN CLUTCH

BATTERY

6 - PIN DEUTSCH
NOT CONNECTED
NOT CONNECTED
BATTERY (+)
BATTERY (-)
DATA LINK (+)
DATA LINK (-)

9 - PIN DEUTSCH
J1939 (+)
J1939 (-)
J1939 DATA LINK SHIELD
NOT CONNECTED
NOT CONNECTED
BATTERY (+)
BATTERY (-)
J1587 DATA LINK (+)
J1587 DATA LINK (-)

OEM PORT ENGINE PORT

ENGINE CONNECTOR* (A)
10 6 5 1
50 46 45 41

OEM CONNECTOR* (B)
10 6 5 1
50 46 45 41

NOTE: SOME OF THE CIRCUITS SHOWN HERE WILL NOT BE ACTIVE IN ALL APPLICATIONS. CONSULT THE EQUIPMENT MANUFACTURER'S LITERATURE TO DETERMINE WHICH CIRCUITS ARE USED.

QSL9 Wiring Diagram

Bulletin No. 3666478

Cummins Engine Company, Inc.

RED DC VOLTAGE
BLUE INPUT SIGNALS
BLACK GROUNDS, SHIELDS AND RETURNS
PURPLE OUTPUT SIGNALS
GREEN DATA LINKS

MULTIPLE UNIT SYNCHRONIZATION IDENTIFICATION SHORTING PLUGS — SECONDARY 1 2 3 4 — PRIMARY 1 2 3 4

MULTIPLE UNIT SYNCHRONIZATION IDENTIFICATION SWITCH
1 MULTIPLE UNIT SYNCHRONIZATION ID PIN 1 — 22
2 MULTIPLE UNIT SYNCHRONIZATION ID PIN 2 — 31
3 MULTIPLE UNIT SYNCHRONIZATION ID PIN 3 — 32
4 MULTIPLE UNIT SYNCHRONIZATION RETURN — 19

REMOTE THROTTLE
REMOTE THROTTLE SWITCH
A REMOTE THROTTLE / VARIABLE ISC SPEED +5 VOLT SUPPLY
B REMOTE THROTTLE / VARIABLE ISC SPEED POSITION SIGNAL — 21
C REMOTE THROTTLE / VARIABLE ISC SPEED RETURN (GND)
B REMOTE THROTTLE ENABLE SIGNAL — 43
A REMOTE THROTTLE RETURN — 20

THROTTLE ASSEMBLY — THROTTLE ASSEMBLY
THROTTLE POSITION +5 VOLT SUPPLY — 48
THROTTLE POSITION SIGNAL — 47
THROTTLE POSITION RETURN — 49
OFF IDLE VALIDATION SWITCH — 03
ON IDLE VALIDATION SWITCH — 13
PANEL GROUND — 09

TACHOMETER — 11
IDLE SHUTDOWN RELAY — 35
PANEL GROUND — 10

ALTERNATE TORQUE SWITCH — ALTERNATE TORQUE CURVE SELECT — 02
AUXILIARY GOVERNOR SWITCH — AUXILIARY GOVERNOR SWITCH — 01

INTERMEDIATE SPEED CONTROL SWITCH
INTERMEDIATE SPEED CONTROL 2 — 25
ISC VALIDATE / INTERMEDIATE SPEED CONTROL 3 — 33
INTERMEDIATE SPEED CONTROL 1 — 23

ALTERNATE IDLE — ALTERNATE IDLE SWITCH — 45

INCREMENT / DECREMENT
DIAGNOSTICS INCREMENT — 14
DIAGNOSTICS DECREMENT — 24

ALTERNATE DROOP SWITCH — ALTERNATE DROOP SELECT SWITCH — 41

MULTIPLE UNIT ON/OFF
MULTIPLE UNIT SYNCHRONIZATION ON/OFF VALIDATION SWITCH — 34
MULTIPLE UNIT SYNCHRONIZATION ON/OFF — 42

ENGINE PROTECTION — ENGINE PROTECTION OVERRIDE — 12

DIAGNOSTIC / USER-ENGAGED SNAPSHOT ON/OFF — DIAGNOSTIC / USER-ENGAGED SNAPSHOT — 44

MANUAL FAN ON/OFF — MANUAL FAN SWITCH SIGNAL — 15

ENGINE STOP LAMP (RED) — ENGINE STOP LAMP — 06
ENGINE WARNING LAMP (YELLOW) — ENGINE WARNING LAMP — 16
MAINTENANCE LAMP — MAINTENANCE LAMP — 05
WAIT TO START LAMP — WAIT-TO-START LAMP — 04

KEY SWITCH (KEY) — 38

5A FUSE — IGNITION — KEY SWITCH — STARTER — BATTERY

UNSWITCHED POWER RETURN (−) — 29
UNSWITCHED POWER RETURN (−) — 30
UNSWITCHED POWER RETURN (−) — 39
UNSWITCHED POWER RETURN (−) — 40
UNSWITCHED POWER RETURN (−) — 50
UNSWITCHED POWER (+) — 18
UNSWITCHED POWER (+) — 28
UNSWITCHED POWER (+) — 07
UNSWITCHED POWER (+) — 08
UNSWITCHED POWER (+) — 17

FUSE 15A 12V 10A 24V

9 PIN DATALINK
BATTERY (−) — 46
BATTERY (+) — 37
SAE J1939 DATA LINK (+) — 36
SAE J1939 DATA LINK (−) — 26
SAE J1939 DATA LINK SHIELD — 27
SAE J1708 DATA LINK (+)
SAE J1708 DATA LINK (−)
SAE J1939 DATALINK (−)

SERVICE TOOL CONNECTION

BULKHEAD CONNECTOR

OEM CONNECTOR

OEM RESPONSIBILITY

E − J1939 SHIELD
D − J1939 (−)
C − J1939 (+)
F − J1708 (+)
ENGINE SIDE DATA LINK CONNECTOR
A − BATTERY (−)
B − BATTERY (+)
G − J1708 (−)
J − OPEN
H − OPEN

COOLANT LEVEL SENSOR SHORTING JUMPERS — 5 6 7 19

31 PIN-OEM CONNECTOR

COOLANT LEVEL SENSOR
OEM SWITCH
SWITCHED OUTPUT A SOLENOID
SWITCHED OUTPUT B SOLENOID
GRID HEATER SOLENOID
FAN
AIR CONDITIONER PRESSURE SWITCH
MAGNETIC PICKUP SHAFT SPEED SENSOR
FREQUENCY THROTTLE
FUSE 2A

23 SPARE TEMPERATURE — 28
30 SPARE SWITCH INPUT — 01
24 SPARE — 46
25 SPARE — 21
04 OEM TEMPERATURE — 12
03 OEM TEMPERATURE RETURN — 13
05 COOLANT LEVEL HIGH SWITCH — 24
06 COOLANT LEVEL LOW SWITCH — 22
07 COOLANT LEVEL SWITCH +5 VOLT SUPPLY — 25
19 COOLANT LEVEL RETURN — 23
31 OEM SWITCH INPUT — 16
27 OEM PRESSURE SUPPLY +5 VOLT SUPPLY — 18
28 OEM PRESSURE SIGNAL — 19
08 OEM PRESSURE RETURN — 20
09 SWITCHED OUTPUT A — 14
10 SPARE — 11
11 SWITCHED OUTPUT A — 32
12 OEM SWITCH RETURN — 45
13 SWITCHED OUTPUT B — 35
14 PULSE WIDTH MODULATED DEDICATED OUTPUT — 34
17 GRID HEATER ACTUATOR SIGNAL — 43
18 GRID HEATER / SWITCHED OUTPUT RETURN — 05
20 FAN CLUTCH ACTUATOR SIGNAL — 42
29 FAN CLUTCH ACTUATOR RETURN — 19
21 SPARE SUPPLY — 18
22 SPARE INPUT — 13
16 AIR CONDITIONER PRESSURE SWITCH — 12
AIR CONDITIONER PRESSURE SWITCH RETURN — 46
SPARE — 25
SHAFT SPEED (+) — 40
SHAFT SPEED (−) / FREQUENCY THROTTLE (+) / TRANSMISSION SYNCHRONIZATION (+) — 30
FREQUENCY THROTTLE RETURN — 17

SWITCHED OUTPUT A SHORTING PLUG
SWITCHED OUTPUT A CONNECTOR

CUMMINS RESPONSIBILITY

SENSOR CONNECTOR

ENGINE POSITION
WE B ENGINE POSITION SENSOR 1 (+) — 47
GN C ENGINE POSITION SENSOR 1 (−) — 48
RD D ENGINE POSITION SENSOR 2 (+) — 50
BK A ENGINE POSITION SENSOR 2 (−) — 49

AMBIENT AIR PRESSURE SENSOR
A AMBIENT AIR PRESSURE +5 VOLT SUPPLY — 17
C AMBIENT AIR PRESSURE SIGNAL — 06
B AMBIENT AIR PRESSURE RETURN — 31

OIL PRESSURE/ TEMPERATURE SENSOR
1 OIL PRESSURE / TEMPERATURE +5 VOLT SUPPLY — 45
3 OIL PRESSURE SIGNAL — 44
4 OIL TEMPERATURE SIGNAL — 42
2 OIL PRESSURE / TEMPERATURE RETURN — 43

COOLANT TEMPERATURE SENSOR
A COOLANT TEMPERATURE RETURN — 03
B COOLANT TEMPERATURE INPUT — 02

PWM CONNECTOR
1 NOT USED +5 VOLT SUPPLY (VSEN2)
3 NOT USED SIGNAL — 07
2 NOT USED SENSOR RETURN — 26
4 PWM DEDICATED OUTPUT — 35
5 SPARE
6 RETURN

INTAKE MANIFOLD (BOOST) PRESSURE SENSOR
A INTAKE MANIFOLD PRESSURE +5 VOLT SUPPLY — 37
C INTAKE MANIFOLD PRESSURE SIGNAL — 39
B FRONT FUEL PRESSURE RETURN (GND) — 40

INTAKE MANIFOLD (BOOST) TEMPERATURE SENSOR
A INTAKE MANIFOLD TEMPERATURE RETURN — 38
B INTAKE MANIFOLD TEMPERATURE INPUT

WATER IN FUEL SENSOR
1 WATER IN FUEL SIGNAL RETURN — 10
2 WATER IN FUEL SIGNAL — 09

FUEL INLET RESTRICTION SENSOR
A FUEL INLET RESTRICTION +5 VOLT SUPPLY — 29
C FUEL INLET RESTRICTION SIGNAL — 28
B FUEL INLET RESTRICTION RETURN — 27

WASTEGATE
WASTEGATE ACTUATOR 1 — 24
WASTEGATE ACTUATOR 2 — 23

REAL TIME CLOCK BATTERY BACKUP MODULE
REAL TIME CLOCK BATTERY BACKUP SUPPLY (+) — 20
REAL TIME CLOCK BATTERY BACKUP RETURN (−) — 47

FUEL SHUTOFF VALVE
FUEL SHUTOFF ACTUATOR — 33

CYLINDER #1
CYLINDER NO.1 ACTUATOR SUPPLY (+) — 10
CYLINDER NO.1 ACTUATOR RETURN (−) — 09
CYLINDER #2
CYLINDER NO.2 ACTUATOR SUPPLY (+) — 08
CYLINDER NO.2 ACTUATOR RETURN (−) — 07
CYLINDER #3
CYLINDER NO.3 ACTUATOR SUPPLY (+) — 06
CYLINDER NO.3 ACTUATOR RETURN (−) — 16
CYLINDER #4
CYLINDER NO.4 ACTUATOR SUPPLY (+) — 26
CYLINDER NO.4 ACTUATOR RETURN (−) — 36
CYLINDER #5
CYLINDER NO.5 ACTUATOR SUPPLY (+) — 04
CYLINDER NO.5 ACTUATOR RETURN (−) — 03
CYLINDER #6
CYLINDER NO.6 ACTUATOR SUPPLY (+) — 02
CYLINDER NO.6 ACTUATOR RETURN (−) — 01
SPARE — 44
SPARE — 15
SPARE — 31

15 PIN PASS THROUGH CONNECTOR

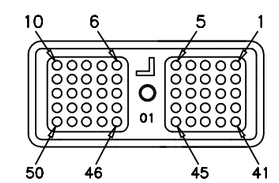
ACTUATOR CONNECTOR

NOTE: SOME OF THE CIRCUITS SHOWN HERE WILL NOT BE ACTIVE IN ALL APPLICATIONS. CONSULT THE EQUIPMENT MANUFACTURER'S LITERATURE TO DETERMINE WHICH CIRCUITS ARE USED.

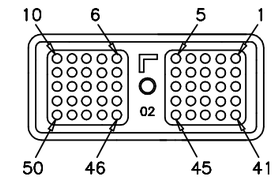
OEM RESPONSIBILITY — CUMMINS RESPONSIBILITY

OEM PORT — ACTUATOR PORT — SENSOR PORT

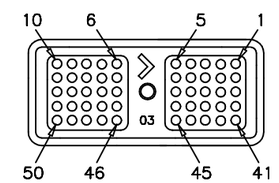
OEM CONNECTOR
VIEW OF HARNESS CONNECTOR MATING FACE



ACTUATOR CONNECTOR
VIEW OF HARNESS CONNECTOR MATING FACE



SENSOR CONNECTOR
VIEW OF HARNESS CONNECTOR MATING FACE



Cummins Engine Company, Inc.

QSM11 Wiring Diagram

Bulletin No. 3666413-01 (For ECM Part No. 3680509, 3681404, 3681405)

RED	DC VOLTAGE
BLUE	INPUT SIGNALS
BLACK	GROUNDS, SHIELDS AND RETURNS
PURPLE	OUTPUT SIGNALS
GREEN	DATA LINKS

OEM RESPONSIBILITY

CUMMINS RESPONSIBILITY

OEM CONNECTOR

SENSOR CONNECTOR

MULTIPLE UNIT SYNCHRONIZATION IDENTIFICATION SHORTING PLUGS — SECONDARY, PRIMARY

MULTIPLE UNIT SYNCHRONIZATION IDENTIFICATION SWITCH

- MULTIPLE UNIT SYNCHRONIZATION ID PIN 1 — 22
- MULTIPLE UNIT SYNCHRONIZATION ID PIN 2 — 31
- MULTIPLE UNIT SYNCHRONIZATION ID PIN 3 — 32
- MULTIPLE UNIT SYNCHRONIZATION RETURN — 19

REMOTE THROTTLE

REMOTE THROTTLE SWITCH

- REMOTE THROTTLE / VARIABLE ISC SPEED +5 VOLT SUPPLY
- REMOTE THROTTLE / VARIABLE ISC SPEED POSITION SIGNAL — 21
- REMOTE THROTTLE / VARIABLE ISC SPEED RETURN (GND)
- REMOTE THROTTLE ENABLE SIGNAL — 43
- REMOTE THROTTLE RETURN — 20

THROTTLE ASSEMBLY — THROTTLE ASSEMBLY

- THROTTLE POSITION +5 VOLT SUPPLY — 48
- THROTTLE POSITION SIGNAL — 47
- THROTTLE POSITION RETURN — 49
- OFF IDLE VALIDATION SWITCH — 03
- ON IDLE VALIDATION SWITCH — 13
- PANEL GROUND — 09

TACHOMETER

- TACHOMETER — 11

IDLE SHUTDOWN RELAY

- IDLE SHUTDOWN RELAY — 35
- PANEL GROUND — 10

ALTERNATE TORQUE SWITCH

AUXILIARY GOVERNOR SWITCH

- ALTERNATE TORQUE CURVE SELECT — 02
- AUXILIARY GOVERNOR SWITCH — 01

INTERMEDIATE SPEED CONTROL SWITCH

- INTERMEDIATE SPEED CONTROL 2 — 25
- ISC VALIDATE / INTERMEDIATE SPEED CONTROL 3 — 33
- INTERMEDIATE SPEED CONTROL 1 — 23

ALTERNATE IDLE

- ALTERNATE IDLE SWITCH — 45

INCREMENT / DECREMENT

- DIAGNOSTICS INCREMENT — 14
- DIAGNOSTICS DECREMENT — 24

ALTERNATE DROOP SWITCH

- ALTERNATE DROOP SELECT SWITCH — 41

MULTIPLE UNIT ON/OFF

- MULTIPLE UNIT SYNCHRONIZATION ON/OFF VALIDATION SWITCH — 34
- MULTIPLE UNIT SYNCHRONIZATION ON/OFF — 42

ENGINE PROTECTION

- ENGINE PROTECTION OVERRIDE — 12

DIAGNOSTIC / USER-ENGAGED SNAPSHOT ON/OFF

- DIAGNOSTIC / USER-ENGAGED SNAPSHOT — 44

MANUAL FAN ON/OFF

- MANUAL FAN SWITCH SIGNAL — 15

ENGINE STOP LAMP (RED)
ENGINE WARNING LAMP (YELLOW)
MAINTENANCE LAMP
WAIT TO START LAMP

- ENGINE STOP LAMP — 06
- ENGINE WARNING LAMP — 16
- MAINTENANCE LAMP — 05
- WAIT-TO-START LAMP — 04
- KEY SWITCH (KEY) — 38

5A FUSE — IGNITION — KEY SWITCH — STARTER — BATTERY

- UNSWITCHED POWER RETURN (−) — 29
- UNSWITCHED POWER RETURN (−) — 30
- UNSWITCHED POWER RETURN (−) — 39
- UNSWITCHED POWER RETURN (−) — 40
- UNSWITCHED POWER RETURN (−) — 50
- UNSWITCHED POWER (+) — 18
- UNSWITCHED POWER (+) — 28
- UNSWITCHED POWER (+) — 07
- UNSWITCHED POWER (+) — 08
- UNSWITCHED POWER (+) — 17

FUSE 15A 12V 10A 24V

9 PIN DATALINK

- BATTERY (−)
- BATTERY (+)
- SAE J1939 DATA LINK (+) — 46
- SAE J1939 DATA LINK (−) — 37
- SAE J1939 DATA LINK SHIELD — 36
- SAE J1708 DATA LINK (+) — 26
- SAE J1708 DATA LINK (−) — 27
- SAE J1939 DATALINK (−)
- SAE J1939 DATALINK SHIELD
- SAE J1939 DATALINK (+)

SERVICE TOOL CONNECTION

BULKHEAD CONNECTOR

E — J1939 SHIELD
F — J1708 (+)
D — J1939 (−)
C — J1939 (+)
ENGINE SIDE DATA LINK CONNECTOR
A — BATTERY (−)
B — BATTERY (+)
G — J1708 (−)
J — OPEN
H — OPEN

COOLANT LEVEL SENSOR SHORTING JUMPERS — 5, 6, 7, 19

31 PIN-OEM CONNECTOR

COOLANT LEVEL SENSOR

- 30
- 23
- 04
- 05
- 06
- 07
- 19
- 25
- 24
- 31

PWM ACTUATOR

- PULSE WIDTH MODULATED DEDICATED OUTPUT
- SPARE
- RETURN

SWITCHED OUTPUT A SHORTING PLUG

SWITCHED OUTPUT A CONNECTOR

SWITCHED OUTPUT B SOLENOID

SWITCHED OUTPUT A SOLENOID

GRID HEATER SOLENOID

FAN

OEM SWITCH

AIR CONDITIONER PRESSURE SWITCH

MAGNETIC PICKUP SHAFT SPEED SENSOR

FREQUENCY THROTTLE

FUSE 2A

- 27
- 08
- 09
- 10
- 11
- 12
- 13
- 14
- 15
- 28
- 17
- 18
- 01
- 02
- 24
- 20
- 21
- 22
- 03
- 16

NOTE: SOME OF THE CIRCUITS SHOWN HERE WILL NOT BE ACTIVE IN ALL APPLICATIONS. CONSULT THE EQUIPMENT MANUFACTURER'S LITERATURE TO DETERMINE WHICH CIRCUITS ARE USED.

CRANKSHAFT ENGINE SPEED SENSOR

- CRANKSHAFT ENGINE SPEED SIGNAL — 47
- CRANKSHAFT ENGINE SPEED +5 VOLT SUPPLY — 41
- CRANKSHAFT ENGINE SPEED RETURN — 32

CAMSHAFT ENGINE POSITION SENSOR

- CAMSHAFT ENGINE POSITION SIGNAL — 50
- CAMSHAFT ENGINE POSITION +5 VOLT SUPPLY — 11
- CAMSHFT ENGINE POSITION RETURN — 21

AMBIENT AIR PRESSURE SENSOR

- AMBIENT AIR PRESSURE SUPPLY — 17
- AMBIENT AIR PRESSURE SIGNAL — 06
- AMBIENT AIR PRESSURE RETURN — 31

FUEL PRESSURE SENSOR

- FUEL PRESSURE +5 VOLT SUPPLY — 27
- FUEL PRESSURE SIGNAL — 29
- FUEL PRESSURE RETURN — 30

OIL PRESSURE / TEMPERATURE SENSOR

- OIL PRESSURE / TEMPERATURE +5 VOLT SUPPLY — 45
- OIL PRESSURE SIGNAL — 44
- OIL TEMPERATURE INPUT — 42
- OIL PRESSURE/TEMPERATURE RETURN — 43

COOLANT TEMPERATURE SENSOR

- COOLANT TEMPERATURE INPUT — 02
- COOLANT TEMPERATURE RETURN — 13

FRONT FUEL PRESSURE SENSOR

- FRONT FUEL PRESSURE +5 VOLT SUPPLY — 05
- FRONT FUEL PRESSURE SIGNAL — 04
- FRONT FUEL PRESSURE RETURN (GND) — 03

REAR FUEL PRESSURE SENSOR

- REAR FUEL PRESSURE +5 VOLT SUPPLY — 35
- REAR FUEL PRESSURE SIGNAL — 34
- REAR FUEL PRESSURE RETURN (GND) — 33

INTAKE MANIFOLD PRESSURE / TEMPERATURE SENSOR

- INTAKE MANIFOLD PRESSURE +5 VOLT SUPPLY — 37
- INTAKE MANIFOLD PRESSURE SIGNAL — 39
- INTAKE MANIFOLD TEMPERATURE INPUT — 38
- INTAKE MANIFOLD PRESSURE / TEMPERATURE RETURN — 40

WATER IN FUEL

- WATER IN FUEL SIGNAL — 09
- WATER IN FUEL RETURN — 10

- SPARE SWITCH INPUT — 01
- SPARE TEMPERATURE — 28
- OEM TEMPERATURE — 12
- COOLANT LEVEL HIGH SWITCH — 24
- COOLANT LEVEL LOW SWITCH — 22
- COOLANT LEVEL +5 VOLT SUPPLY — 25
- COOLANT LEVEL RETURN — 23
- SPARE — 46
- SPARE RETURN — 26
- OEM SWITCH INPUT — 16
- NOT USED — 15
- NOT USED — 07

- OEM PRESSURE +5V SUPPLY — 18
- OEM PRESSURE SIGNAL — 19
- OEM PRESSURE RETURN — 20
- SWITCHED OUTPUT A — 14
- SPARE
- SWITCHED OUTPUT A — 11
- SWITCHED OUTPUT B — 45
- PULSE WIDTH MODULATED DEDICATED OUTPUT — 35
- GRID HEATER ACTUATOR SIGNAL — 34
- GRID HEATER / SWITCHED OUTPUT RETURN — 43
- FAN CLUTCH ACTUATOR SIGNAL — 05
- FAN CLUTCH ACTUATOR RETURN — 42
- SPARE SUPPLY — 19
- SPARE INPUT — 18
- OEM SWITCH RETURN — 32
- AIR CONDITIONER PRESSURE SWITCH — 13
- AIR CONDITIONER PRESSURE SWITCH RETURN — 12
- SPARE PRESSURE SUPPLY — 49
- SPARE PRESSURE SIGNAL — 48
- SPARE PRESSURE RETURN — 47
- SPARE — 46
- SHAFT SPEED (+) — 40
- SHAFT SPEED (−) / FREQUENCY THROTTLE (+) / TRANSMISSION SYNCHRONIZATION (+) — 30
- OEM TEMPERATURE RETURN — 37
- FREQUENCY THROTTLE RETURN — 17

WASTEGATE

- WASTEGATE ACTUATOR 1 — 24
- WASTEGATE ACTUATOR 2 — 23

FUEL INLET RESTRICTION

- FUEL INLET RESTRICTION +5 VOLT SUPPLY — 29
- FUEL INLET RESTRICTION SIGNAL — 28
- FUEL INLET RESTRICTION RETURN — 27

FRONT FUELING ACTUATOR

- FRONT FUELING ACTUATOR (+) — 10
- FRONT FUELING ACTUATOR (−) — 09

FRONT TIMING ACTUATOR

- FRONT TIMING ACTUATOR (+) — 08
- FRONT TIMING ACTUATOR (−) — 07

REAR TIMING ACTUATOR

- REAR TIMING ACTUATOR (+) — 26
- REAR TIMING ACTUATOR (−) — 36

REAR FUELING ACTUATOR

- REAR FUELING ACTUATOR (+) — 06
- REAR FUELING ACTUATOR (−) — 16

FUEL SHUTOFF VALVE

- FUEL SHUTOFF ACTUATOR — 33

REAL TIME CLOCK BATTERY BACKUP MODULE

- REAL TIME CLOCK BATTERY BACKUP SUPPLY (+) — 20
- REAL TIME CLOCK BATTERY BACKUP RETURN (−) — 22

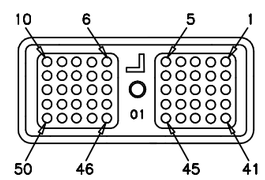
ENGINE BRAKE CONNECTOR

- ENGINE BRAKE ACTUATOR 1 — 25
- ENGINE BRAKE ACTUATOR 2 — 44
- ENGINE BRAKE ACTUATOR 3 — 15
- ENGINE BRAKE 1 RETURN — 31
- ENGINE BRAKE 2 RETURN — 41
- ENGINE BRAKE 3 RETURN — 21

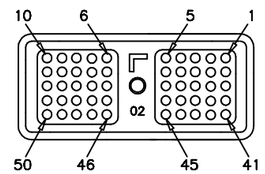
ACTUATOR CONNECTOR

OEM PORT — ACTUATOR PORT — SENSOR PORT

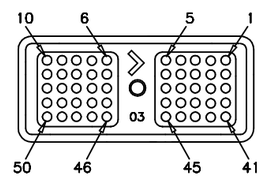
OEM CONNECTOR
VIEW OF HARNESS CONNECTOR MATING FACE



ACTUATOR CONNECTOR
VIEW OF HARNESS CONNECTOR MATING FACE



SENSOR CONNECTOR
VIEW OF HARNESS CONNECTOR MATING FACE



Cummins

Cummins Engine Company, Inc.

QSX15 Wiring Diagram

Bulletin No. 3666414 (For ECM Part No. 3680509, 3681404, 3681405)

RED — INDICATES POWER SUPPLIED BY ECM AND BATTERY

BLUE — INDICATES SIGNALS INTO THE ECM

BLACK — INDICATES ECM RETURNS, GROUNDS, NO CONNECTS AND GENERIC OEM WIRING

GREEN — INDICATES DATA LINKS

PURPLE — INDICATES ECM OUTPUTS

NW — NO WIRE

OEM RESPONSIBILITY | CUMMINS RESPONSIBILITY

Battery

21 PIN

WIRE NUMBER B

10 AMP — UNSWITCHED BATTERY + — 018 — <03<

10 AMP — UNSWITCHED BATTERY + — 019a — <04<

UNSWITCHED BATTERY + — 019b — <05<

OEM PRESSURE SIGNAL — 005 — <15<

OEM TEMPERATURE SIGNAL — 050 — <27<

OEM TEMPERATURE SIGNAL RETURN

DUAL OUTPUT A — 008 — <01<

DUAL OUTPUT B — 009 — <09<

PWM OUTPUT — 012 — <24<

SHORTING PLUG

J1939 SHIELD - E; D - J1939 (-); C - J1939 (+); J1708 (+) - F; A - BATTERY (-); J1708 (-) - G; B - BATTERY (+); OPEN - H; J - OPEN

ENGINE SIDE DATA LINK CONNECTOR

TO J1939 BUS

J1939/DATA LINK SHIELD — 003 — <31<

J1939/DATA LINK 2 - — 002 — <22<

J1939/DATA LINK 2 + — 001 — <32<

COOLANT LEVEL LOW SIGNAL — 011 — <23<

COOLANT LEVEL RETURN (-)

COOLANT LEVEL +5VDC SUPPLY (+)

COOLANT LEVEL HIGH SIGNAL — 010 — <14<

+5VDC; SIGNAL; RETURN

REMOTE THROTTLE POSITION +5VDC SUPPLY (+) — 014a — <16<

REMOTE THROTTLE POSITION SIGNAL — 015a — <30<

REMOTE THROTTLE POSITION RETURN (-) — 013a — <21<

FREQUENCY INPUT SIGNAL (VSS) — 006 — <17<

FREQUENCY INPUT SIGNAL (VSS) RETURN (-) — 007 — <18<

31 PIN

UNUSED +5VDC SUPPLY (+)

THROTTLE POSITION +5VDC SUPPLY (+) — 021 — <26<

THROTTLE SIGNAL A/D / AXG REF — 020 — <29<

THROTTLE POSITION RETURN (-) — 022 — <11<

IVS OFF IDLE SIGNAL — 023 — <12<

IVS IDLE SIGNAL — 024 — <13<

IDLE VALIDATION SWITCH RETURN (-)

TACHOMETER OUTPUT SIGNAL — 025 — <25<

CENTINEL REMOTE OIL LEVEL SIGNAL — 026 — <28<

OEM SWITCH/COLD IDLE INHIBIT/FREQUENCY PULL-UP — 027 — <33<

MULTI-UNIT SYNC ON/OFF SWITCH — 028 — <34<

RED STOP LAMP OUTPUT — 029 — <06<

AMBER WARNING LAMP OUTPUT — 030 — <07<

MAINTENANCE LAMP OUTPUT — 031 — <02<

VEHICLE KEY SWITCH INPUT — 040a — <10<

ALTERNATE TORQUE CURVE SWITCH SIGNAL — 032 — <20<

ALTERNATE DROOP SWITCH SIGNAL — 033 — <19<

ALT IDLE SW / AXG SW / TSG SW — 034 — <36<

ISC / IDLE INCREMENT SIGNAL — 035 — <40<

ISC / IDLE DECREMENT SIGNAL — 036 — <39<

ISC 1 SIGNAL — 037 — <35<

ISC 2 SIGNAL / REMOTE THROTTLE SELECT — 038 — <38<

ISC VALIDATION / ISC 3 SIGNAL — 039 — <37<

VEHICLE KEY SWITCH INPUT

CENTINEL BURN VALVE — 054 — <08<

10 AMP

PUBLIC DATA LINK 1+ — 027a — <14<

PUBLIC DATA LINK 1- — 028a — <15<

ETHER INJ/CENTINEL MAKE-UP VALVE — 031 — <02<

FAN CLUTCH/PWM4 (+) — 032 — <04<

DASHBOARD FAN CLUTCH — 029a — <07<

UNSWITCHED BATTERY (+) — 029b — <08<

BLOCK GROUND

BLOCK GROUND

ISS THROTTLE DESIGN: ISS; +5VDC; SIGNAL; RETURN; OFF-IDLE; ON-IDLE; RETURN

6-PIN OPTION

TWO 3-PIN OPTION

NON-ISS THROTTLE DESIGN: +5VDC; SIGNAL; RETURN; OFF-IDLE; ON-IDLE; RETURN

TO BATTERY (+)

KEY SWITCH

MULTI-UNIT SYNC ON/OFF

DASHBOARD FAN CLUTCH

LAMP 1

LAMP 2

LAMP 3

KEY SWITCH INPUT

MOMENTARY

EXPANSION

DIAGNOSTIC SWITCH

1.5K NO

ALTERNATE TORQUE CURVE SELECT

1.5K NO

ALTERNATE DROOP/HSG SELECT

ALTERNATE LOW IDLE SELECT

MOMENTARY

ISC/IDLE INCREMENT

ISC/IDLE DECREMENT

ISC 1

ISC 2

ISC VALIDATE

GROUND

CAB INTERFACE PANEL

ETHER SOLENOID

TO ETHER SOLENOID

8 - PIN AMP: OPEN; OPEN; OPEN; NOT USED; UNSWITCHED BATTERY(+); GROUND; DATA LINK (+); DATA LINK (-)

6 - PIN DEUTSCH: OPEN; NOT USED; UNSWITCHED BATTERY(+); GROUND; DATA LINK (+); DATA LINK (-)

6-PIN DATA LINK CONNECTOR

WIRE NUMBER A

ENGINE SPEED SIGNAL 1+ — 011 — <27<

ENGINE SPEED SIGNAL 1- — 012 — <28<

ENGINE SPEED SIGNAL 2+ — 013 — <37<

ENGINE SPEED SIGNAL 2- — 014 — <38<

COOLANT TEMPERATURE RETURN (-)

COOLANT TEMPERATURE SIGNAL — 008 — <22<

INTAKE MANIFOLD AIR TEMP. RETURN (-)

INTAKE MANIFOLD AIR TEMP. SIGNAL — 009 — <23<

OIL PRESSURE SIGNAL — 005 — <24<

OIL PRESSURE RETURN (-) — 002 — <17<

OIL PRESSURE +5VDC SUPPLY (+) — 003 — <06<

AMBIENT AIR PRESSURE SIGNAL — 001 — <34<

AMBIENT AIR PRESSURE RETURN (-)

AMBIENT AIR PRESSURE +5VDC

INTAKE MANIFOLD AIR PRESS SIGNAL — 004 — <35<

INTAKE MANIFOLD AIR PRESS RETURN (-)

INTAKE MANIFOLD AIR PRESS +5VDC

BLOCK GROUND

FUEL SHUTOFF SUPPLY +24VDC — 026 — <30<

KEYSWITCH INPUT

CENSE ONLY

KEYSWITCH INPUT

SPARE (OIL LEVEL SIGNAL) — 034 — <19<

BLOCK GROUND

COOLANT PRESSURE +5VDC SUPPLY

COOLANT PRESSURE SIGNAL — 007 — <16<

COOLANT PRESSURE RETURN (-)

BLOWBY PRESSURE +5VDC SUPPLY

BLOWBY PRESSURE SIGNAL A/D — 019 — <25<

BLOWBY PRESSURE RETURN (-)

ANALOG OIL LEVEL +5VDC SUPPLY

ANALOG OIL LEVEL SIGNAL A/D — 035 — <12<

ANALOG OIL LEVEL RETURN (-)

ENGINE SIDE DATA LINK CONNECTOR

TO J1939 BUS

FUEL TEMPERATURE RETURN (-)

FUEL TEMPERATURE SIGNAL — 010 — <26<

COMPACT PUMP ACTUATOR SUPPLY (+) — 015 — <11<

COMPACT PUMP ACTUATOR RETURN (-) — 016 — <40<

COMPACT PUMP PRESSURE SIGNAL — 021 — <32<

COMPACT PUMP PRESSURE RETURN (-)

COMPACT PUMP PRESSURE +5VDC SUPPLY (+)

FUEL RAIL PRESSURE SIGNAL — 024 — <31<

FUEL RAIL PRESSURE RETURN (-) — 022a — <18<

FUEL RAIL PRESSURE +5VDC SUPPLY (+) — 023a — <05<

TIMING RAIL PRESSURE SIGNAL — 025 — <33<

TIMING RAIL PRESSURE RETURN (-)

TIMING RAIL PRESSURE +5VDC SUPPLY (+)

FUEL RAIL ACTUATOR SUPPLY (+) — 017 — <03<

FUEL RAIL ACTUATOR RETURN (-) — 018 — <10<

TIMING RAIL ACTUATOR SUPPLY (+) — 019 — <01<

TIMING RAIL ACTUATOR RETURN (-) — 020 — <20<

TIMING RAIL ACTUATOR SUPPLY (+)

TIMING RAIL ACTUATOR RETURN (-)

QSK 45/60 ONLY

MULTI-UNIT SYNC ID PIN 1 — 029 — <13<

MULTI-UNIT SYNC ID PIN 2 — 039 — <36<

MULTI-UNIT SYNC ID PIN 3

DASHBOARD FAN CLUTCH SWITCH OR MUS ON/OFF COMP SWITCH

CENTINEL MAKE-UP VALVE

CENTINEL BURN VALVE

ENGINE HARNESS CONNECTOR A

40; 10; 31; 1

NW PINS 9, 12, 13, 21 29, 36, 39

OEM INTERFACE HARNESS CONNECTOR B

40; 10; 31; 1

NW PINS 8, 27

ENGINE SIDE OEM INTERFACE CONNECTORS

21-PIN

31-PIN

QSK19/45/60 WIRING DIAGRAM

(For ECM Part NO. 3867401) Bulletin No. 3666133-03

OEM RESPONSIBILITY

CUMMINS RESPONSIBILITY

RED	DC VOLTAGE
BLUE	INPUT SIGNALS
BLACK	GROUNDS, SHIELDS AND RETURNS
PURPLE	OUTPUT SIGNALS
GREEN	DATALINKS

NOTE: SOME OF THE CIRCUITS SHOWN HERE WILL NOT BE ACTIVE IN ALL APPLICATIONS. CONSULT THE EQUIPMENT MANUFACTURER'S LITERATURE TO DETERMINE WHICH CIRCUITS ARE USED.

21 PIN

J1587 DATALINK (+) SECONDARY
J1587 DATALINK (–) SECONDARY
–V BATTERY
+V BATTERY
VEHICLE KEY SWITCH INPUT
–V BATTERY
+V BATTERY
REMOTE ACCELERATOR +5 VOLT SUPPLY
REMOTE ACCEL POSITION INPUT SIGNAL
REMOTE ACCELERATOR RETURN
REMOTE IDLE VALIDATION 2 OFF IDLE
REMOTE IDLE VALIDATION 1 ON IDLE
ACCELERATOR +5 VOLT SUPPLY
ACCELERATOR POSITION INPUT SIGNAL
ACCELERATOR RETURN
IDLE VALIDATION 2 OFF IDLE
IDLE VALIDATION 1 ON IDLE
SOLENOID A
SOLENOID B
J1587 DATALINK (+) PRIMARY
J1587 DATALINK (–) PRIMARY

RIGHT BANK HARNESS ONLY
J1587 DATALINK (–) SECONDARY
J1587 DATALINK (+) SECONDARY
FOR ENGINES EQUIPPED WITH 9–PIN ENGINE–SIDE DATA LINK CONNECTOR

31 PIN

TACHOMETER OUTPUT SIGNAL
OIL PRESSURE GAUGE
COOLANT TEMPERATURE GAUGE
PWM TORQUE BROADCAST OUTPUT
LAMP 4/WAIT TO START
LAMP 5/SPARE LAMP #1
LAMP 6/SPARE LAMP #2
LAMP 1/STOP
LAMP 2/DIAGNOSTIC
LAMP 3/ENGINE PROTECTION
GRID HEATER RELAY
DIAGNOSTIC ON / OFF
IDLE AND DIAGNOSTIC INCREMENT
IDLE AND DIAGNOSTIC DECREMENT
ALTERNATE TORQUE CURVE SELECT
ALTERNATE DROOP SWITCH INPUT
ALTERNATE IDLE SWITCH INPUT
ISC 1
ISC 2/REMOTE ACCELERATOR SELECT
ISC VALIDATE
ISC INCREMENT
ISC DECREMENT
ISC ON / OFF
FREQUENCY THROTTLE INPUT SIGNAL
SERVICE BRAKE SWITCH INPUT
CLUTCH SWITCH INPUT
NEEDLE MOVEMENT RETURN
FAN CLUTCH SWITCH INPUT

OEM CONNECTOR

MATES TO SECONDARY CONNECTOR

ISS THROTTLE DESIGN
6–PIN OPTION
TWO 3–PIN OPTION
NON–ISS THROTTLE DESIGN

TACHOMETER

CAB INTERFACE PANEL
OIL PRESSURE
COOLANT TEMPERATURE
LAMP 4
LAMP 5
LAMP 6
LAMP 1 RED
LAMP 2 YELLOW
LAMP 3
KEYSWITCH

WAIT TO START LAMP
SPARE LAMP
SPARE LAMP
STOP LAMP SIGNAL
DIAGNOSTIC LAMP SIGNAL
ENGINE PROTECTION

DIAGNOSTIC SWITCH ON / OFF
IDLE INCREMENT / DECREMENT
ALTERNATE TORQUE CURVE SELECT SWITCH
ALTERNATE DROOP SWITCH
ALTERNATE IDLE SWITCH ON / OFF
ISC 1 & 2/REMOTE VALIDATE SWITCH
ISC INCREMENT / DECREMENT
ISC ON / OFF SWITCH
SERVICE BRAKE SWITCH
FAN CLUTCH SWITCH
CLUTCH SWITCH

VEHICLE GROUND

BULKHEAD CONNECTOR

COOLANT LEVEL SENSOR SHORTING PLUG
COOLANT LEVEL SENSOR

9–PIN ENGINE–SIDE DATA LINK (FOR ENGINES EQUIPPED WITH THE 9–PIN ENGINE–SIDE DATA LINK ONLY)
J1587 DATALINK (–) PRIMARY
J1587 DATALINK (+) PRIMARY
+ V BATTERY
– V BATTERY
J1939 DATALINK (+)
J1939 DATALINK (–)
J1939 SHIELD

FOR ENGINES NOT EQUIPPED WITH A 9–PIN ENGINE–SIDE DATA LINK CONNECTOR

J1587 SECONDARY ECM SERVICE TOOL CONNECTOR

FUSE #3 (10 AMP)

J1939 BACKBONE HARNESS
120 OHM CONNECTOR
SERVICE TOOL INTERFACE CONNECTOR (FOR ENGINES NOT EQUIPPED WITH THE 9–PIN ENGINE–SIDE DATA LINK CONNECTOR)
LEFT BANK ENGINE HARNESS CONNECTOR
RIGHT BANK ENGINE HARNESS CONNECTOR
CENSE INTERFACE CONNECTOR
120 OHM CONNECTOR
1K OHM RESISTOR DIODE

10A FUSE #2

NOTE: THE SECONDARY ECM WIRING HARNESS HAS THIS MODIFICATION:
TO PIN A19 SECONDARY ID BIT (SENSOR RETURN) <A47
TO PIN A10 SECONDARY ID BIT (V SENSOR) <A48

15A FUSE #1

ENGINE CONNECTOR

ENGINE SPEED SENSOR
ENGINE SPEED +5 VOLT SUPPLY
ENGINE SPEED SIGNAL
ENGINE SPEED RETURN

INTAKE MANIFOLD AIR TEMPERATURE SENSOR
INTAKE MANIFOLD AIR TEMP SIGNAL
INTAKE MANIFOLD AIR TEMP RETURN

BOOST PRESSURE SENSOR
BOOST PRESSURE +5 VOLT SUPPLY
BOOST PRESSURE SIGNAL
BOOST PRESSURE RETURN

ENGINE POSITION SENSOR
ENGINE POSITION +5 VOLT SUPPLY
ENGINE POSITION SIGNAL
ENGINE POSITION RETURN

LEFT BANK HARNESS ONLY

COOLANT PRESSURE SENSOR
COOLANT PRESSURE +5 VOLT SUPPLY
COOLANT PRESSURE SIGNAL
COOLANT PRESSURE RETURN

COOLANT TEMPERATURE SENSOR
COOLANT TEMPERATURE SIGNAL
COOLANT TEMPERATURE RETURN

OIL PRESSURE SENSOR
OIL PRESSURE +5 VOLT SUPPLY
OIL PRESSURE SIGNAL
OIL PRESSURE RETURN

AMBIENT AIR PRESSURE SENSOR
AMBIENT AIR PRESSURE +5 VOLT SUPPLY
AMBIENT AIR PRESSURE SIGNAL
AMBIENT AIR PRESSURE RETURN

SOLENOID A
SOLENOID B

MATES TO CENSE CONNECTOR
J1587 DATALINK (+) PRIMARY
J1587 DATALINK (–) PRIMARY
OIL PAN TEMPERATURE SIGNAL
SENSOR RETURN
SENSOR +5 VOLT SUPPLY
CRANKCASE BLOWBY PRESSURE SIGNAL
VEHICLE KEY SWITCH INPUT
+ V BATTERY
– V BATTERY

COOLANT LEVEL +5 VOLT (VSENSOR)
COOLANT LEVEL INPUT RETURN SR7N
COOLANT LEVEL HIGH INPUT SIGNAL
COOLANT LEVEL LOW INPUT SIGNAL
FAN CLUTCH SOLENOID
FAN CLUTCH RETURN

VEHICLE KEY SWITCH INPUT
FREQUENCY THROTTLE INPUT
FAN CLUTCH SWITCH INPUT
HIGH SPEED GOVERNOR DROOP INPUT

PRIMARY ID BIT +5 VOLT
PRIMARY ID BIT RETURN

RP39 FUEL PUMP
RP39 FUEL +
RP39 FUEL +
RP39 FUEL +
RP39 FUEL +
RP39 LO
RP39 LO/LX
RP39 LX
TIMING SLEEVE +
TIMING SLEEVE –

RRP398 NBF INJECTOR
NEEDLE MOVEMENT SENSOR +
NEEDLE MOVEMENT SHIELD
#16 AWG
2.2K OHM RESISTOR (RIGHT BANK HARNESS ONLY)

RP39 EHAB
FUEL SHUTOFF
ENGINE BLOCK

+ V BATTERY
+ V BATTERY
+ V BATTERY
+ V BATTERY
– V BATTERY
– V BATTERY
– V BATTERY
– V BATTERY

J1939 DATALINK (+)
J1939 DATALINK (–)
J1939 SHIELD

ENGINE HARNESS CONNECTOR (A)

OEM INTERFACE HARNESS CONNECTOR (B)

ENGINE SIDE OEM INTERFACE CONNECTORS
21–PIN
31–PIN OEM INTERFACE ENGINE SIDE

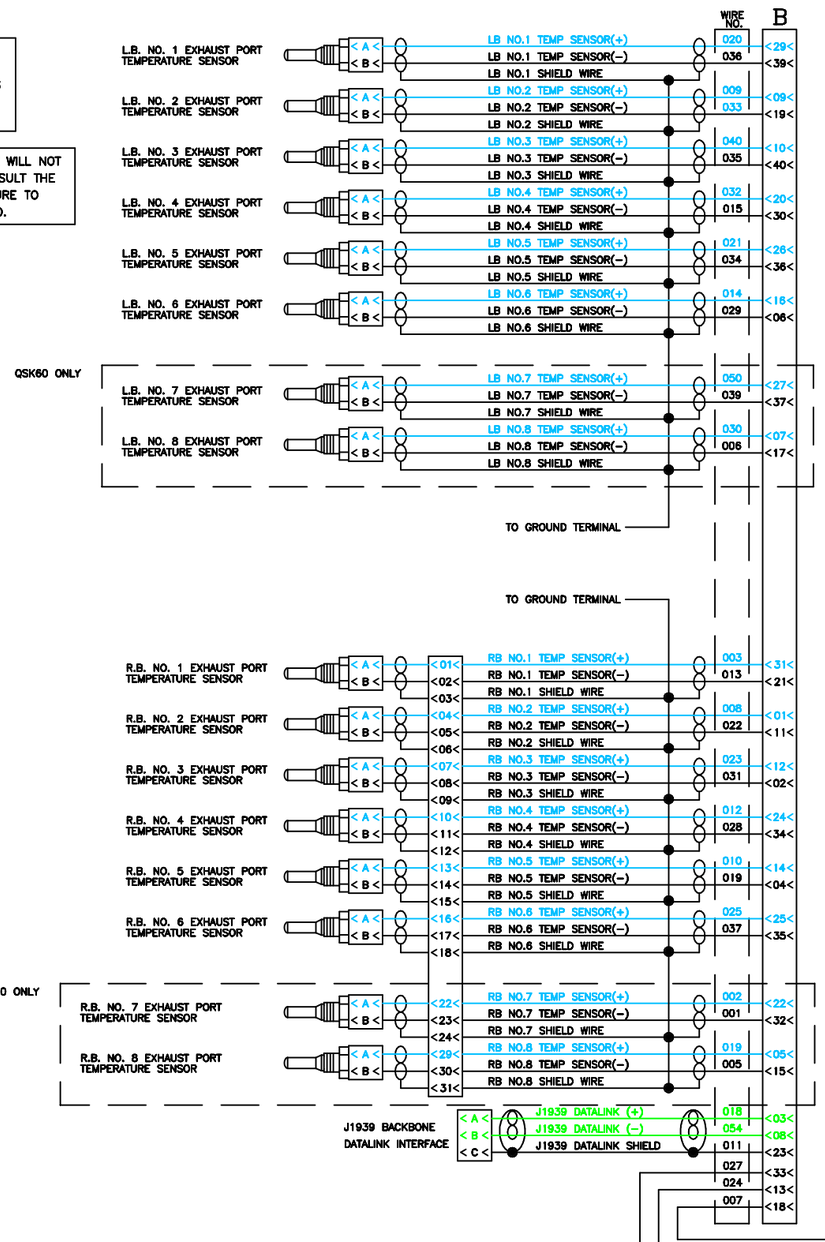
Industrial QST30 Wiring Diagram
PRIMARY ECM WIRING HARNESS

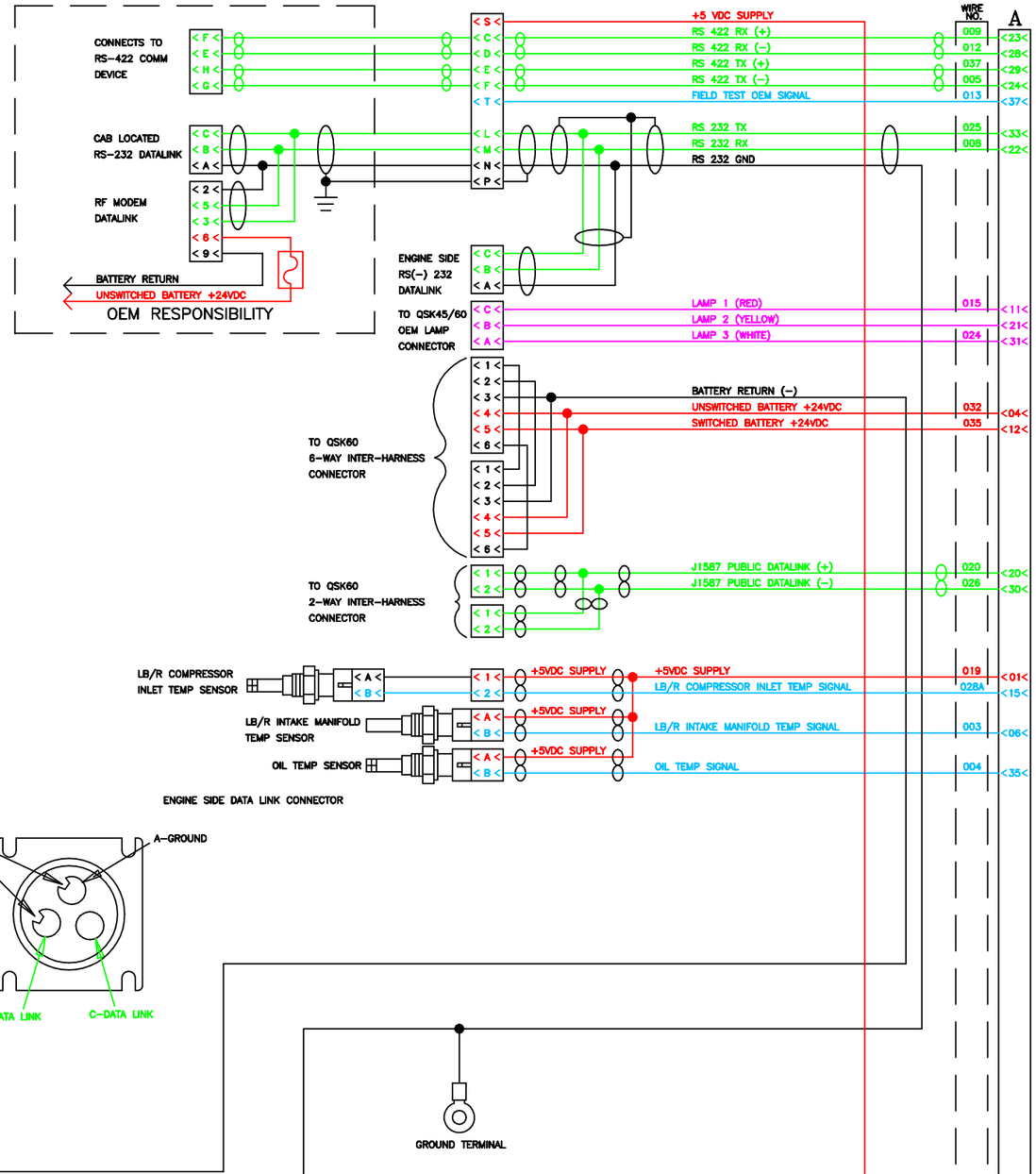
Bulletin No. 3666234–02

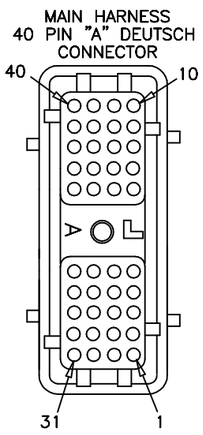
Cummins Engine Company, Inc.

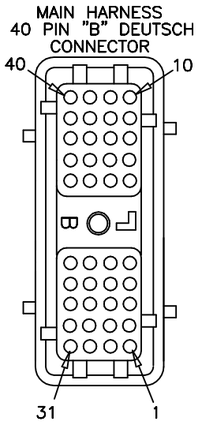
RED	DC VOLTAGE
BLUE	INPUT SIGNALS
BLACK	GROUNDS, SHIELDS AND RETURNS
PURPLE	OUTPUT SIGNALS
GREEN	DATA LINKS

NOTE: SOME OF THE CIRCUITS SHOWN HERE WILL NOT BE ACTIVE IN ALL APPLICATIONS. CONSULT THE EQUIPMENT MANUFACTURER'S LITERATURE TO DETERMINE WHICH CIRCUITS ARE USED.









Industrial QSK45/60 CENSE Wiring Diagram

Bulletin No. 3666357

Cummins Engine Company, Inc.

Pin Mapping

QSB - OEM 50 Pin connector

Pin	Pinout Type	Signal Name	Feature
1	600 mA current sink to ground	Stop Lamp	Engine Protection/Diagnostics
2	600 mA current sink to ground	Water In Fuel Lamp	Water-In-Fuel
3	600 mA current sink to ground	Diagnostic Lamp	Diagnostics
4	600 mA current sink to ground	Maintenance Lamp	Diagnostics
5	600 mA current sink to ground	Dual Output Driver A	Dual Outputs
7	<50 ohm Closed, 50Kohm Open	Cruise Control/ISC Increment/ ISC Resume	Cruise Control/ISC Increment
8	Vehicle/Tail Shaft Speed Sensor	Vehicle Speed Sensor Positive Input	Vehicle Speed
9	Remote Throttle Sensor	Remote Throttle Analog Input	Remote Throttle
10	Remote throttle (VsensorB)	Remote Throttle +5Vdc	Remote Throttle
11	600 mA current sink to ground	Wait to Start Lamp	Intake Air Heater/Grid Heater
12	Frequency Output	Tachometer Out (Logic Level)	Tachometer
13	<50 ohm Closed, 50Kohm Open	Cruise Set/ISC Decrement	Cruise Control/ISC Decrement
14	<50 ohm Closed, 50Kohm Open	Cruise On/Off	Cruise Control
15		Reserved	
16	<50 ohm Closed, 50Kohm Open	Fan Clutch Switch Inputs	Fan Clutch
17	<50 ohm Closed, 50Kohm Open	Boost Power Request Switch	Boost Power
18	Vehicle Speed Sensor	Vehicle Speed Sensor Negative Input	Vehicle Speed
19	Ground	Throttle Return	Throttle
20	Ground	Remote Throttle Return	Remote Throttle
21	3 amps	Dedicated PWM Output	Dedicated PWM
22		Reserved	
23	<50 ohm Closed, 50Kohm Open	ISC 3 / ISC Validation Switch	Intermediate Speed Control
24	50 ohm Closed, 50Kohm Open	Multi-Unit Sync On/Off Switch Input	Multi-Unit Sync
25	125 ohm Closed, 50 Mohm Open	Off Idle Switch	Idle Validation
26	<125 ohm Closed, 50 Mohm Open	On Idle Switch	Idle Validation
27	<50 ohm Closed, 50Kohm Open	Clutch Switch Input	Exhaust Brakes
28	<50 ohm Closed, 50Kohm Open	ISC 1 Switch	Intermediate Speed Control
29	+5 Vdc supply	Throttle\Potentiometer +5 Vdc	Throttle
30	Throttle Position Sensor	Throttle Position Input Signal	Throttle
31	1 amp, Hi side Drive	Cold Starting Aid Relay 2	Intake Air Heater/Grid Heater
32		Reserved	
33	<50 ohm Closed, 50Kohm Open	Brake Switch	Exhaust Brakes
34	<50 ohm Closed, 50Kohm Open	Exhaust Brake On/Off Switch	Exhaust Brakes
35	<50 ohm Closed, 50Kohm Open	Idle and Diagnostic Increment Switch	Diagnostics, Low Idle Gov.

36	<50 ohm Closed, 50Kohm Open	Idle and Diagnostic Decrement Switch	Diagnostics, Low Idle Gov., ISC
37	<50 ohm Closed, 50Kohm Open	Test (Diagnostic) On/Off Switch	Diagnostics
38	<50 ohm Closed, 50Kohm Open	Multi-Unit Sync Complementary Switch	Multi-Unit Sync
39	A/D Input	Alternate Torque Derate Switch Input	Alternate Torque
40	Water In Fuel Sensor	Water In Fuel Sensor	Water-In-Fuel
41	1 amp, Hi side drive	Cold Starting Aid Relay1	Intake Air Heater/Grid Heater
42		Reserved	
43	<125 ohm Closed, 50 Mohm Open	A/C Pressure Switch	Fan Clutch
44	<50 ohm Closed, 50Kohm Open	Alternate Idle Speed Switch Input	Alternate Idle
45	<50 ohm Closed, 50Kohm Open	Remote Throttle On/Off Switch	Remote Throttle
46	Switch (Pulled up)	Aux. Governor On/Off Switch	Auxiliary Speed Governor
47	<50 ohm Closed, 50Kohm Open	ISC 2 Switch	Intermediate Speed Control
48	A/D Input	OEM Pressure Sensor	OEM Pressure
49	Datalink	J1708/J1587 Datalink +	J1587 Datalink
50	Datalink	J1708/J1587 Datalink -	J1587 Datalink

QSC/QSL9 - OEM 50 Pin connector

Pin	Pinout Type	Signal Name	Feature
1	600 mA current sink to ground	Stop Lamp	Engine Protection/Diagnostics
2	600 mA current sink to ground	Water in Fuel Lamp	Water-In-Fuel
3	600 mA current sink to ground	Diagnostic Lamp	Diagnostics
4	600 mA current sink to ground	Maintenance Lamp	Diagnostics
5	600 mA current sink to ground	Dual Output Driver A	Dual Outputs
7	<50 ohm Closed, 50Kohm Open	CC/ISC Resume Switch Input	Cruise Control/ISC Increment
8	Vehicle/Tail Shaft Speed Sensor	Vehicle Speed Sensor + Input	Vehicle Speed
9	Remote Throttle Sensor	Remote Throttle Pedal Position Input	Remote Throttle
10	Remote throttle (VsensorB)	Remote Throttle +5VDC	Remote Throttle
11	600 mA current sink to ground	Wait to Start Lamp	Intake Air Heater/Grid Heater
12	Frequency Output	Tachometer Output (Logic Level)	Tachometer
13	Switch (Pulled up)	CC/ISC Set /Coast Switch Input	Cruise Control/ISC Decrement
14	<50 ohm Closed, 50Kohm Open	CC/On-OFF Switch Input	Cruise Control
15		Reserved	
16	<50 ohm Closed, 50Kohm Open	Fan Clutch Switch Input	Fan Clutch
17	<50 ohm Closed, 50Kohm Open	Boost Power Request Switch	Boost Power
18	Vehicle Speed Sensor	Vehicle Speed Sensor - Input	Vehicle Speed
19	Ground	Throttle Return	Throttle
20	Ground	Remote Throttle Return	Remote Throttle
21	3 amps	Dedicated PWM Output	Dedicated PWM
22		Reserved	
23	<50 ohm Closed, 50Kohm Open	ISC 3 / ISC Validation	Intermediate Speed Control
24	50 ohm Closed, 50Kohm Open	Multi-Unit Sync On/Off Switch	Multi-Unit Sync

25	125 ohm Closed, 50 Mohm Open	Off Idle Sw	Idle Validation
26	<125 ohm Closed, 50 Mohm Open	On Idle Sw	Idle Validation
27	<50 ohm Closed, 50Kohm Open	Clutch Switch Input	Exhaust Brakes
28	<50 ohm Closed, 50Kohm Open	ISC 1 Switch Input	Intermediate Speed Control
29	+5 Vdc supply	V Throttle +5VDC	Throttle
30	Throttle Position Sensor	Throttle Pos Input Signal	Throttle
31	1 amp, Hi side Drive	Cold Start Aid Relay 2	Intake Air Heater/Grid Heater
32		Reserved	
33	<50 ohm Closed, 50Kohm Open	Brake Switch Input	Exhaust Brakes
34	<50 ohm Closed, 50Kohm Open	Exhaust Brake On/Off Switch Input	Exhaust Brakes
35	<50 ohm Closed, 50Kohm Open	Idle/Diag Increment Switch Input	Diagnostics, Low Idle Gov.
36	<50 ohm Closed, 50Kohm Open	Idle/Diag Decrement Switch Input	Diagnostics, Low Idle Gov.
37	<50 ohm Closed, 50Kohm Open	Diagnostic On/Off Switch Input	Diagnostics
38	<50 ohm Closed, 50Kohm Open	Multi-Unit Sync Complementary Switch	Multi-Unit Sync
39	A/D Input	Alternate Torque Derate Switch Input	Alternate Torque
40	Water In Fuel Sensor	Water In Fuel	Water-In-Fuel
41	1 amp, Hi side drive	Cold Start Aid Relay 1	Intake Air Heater/Grid Heater
42		Reserved	
43	<125 ohm Closed, 50 Mohm Open	AC Pressure Switch	Fan Clutch
44	<50 ohm Closed, 50Kohm Open	Alternate Idle Switch	Alternate Idle
45	<50 ohm Closed, 50Kohm Open	Remote Throttle On/Off Input	Remote Throttle
46	Switch (Pulled up)	Aux. Governor On/Off Input	Auxiliary Speed Governor
47	<50 ohm Closed, 50Kohm Open	ISC 2 Switch Input	Intermediate Speed Control
48	A/D Input	OEM Pressure Sensor Input	OEM Pressure
49	Datalink	J1708/J1587 Datalink +	J1587 Datalink
50	Datalink	J1708/J1587 Datalink -	J1587 Datalink

QSM11/QSX15 - OEM 50 Pin connector

Pin	Pinout Type	Signal Name	Feature
1	10V Switched Pullup Input	AXG On/Off Switch	Auxiliary Speed Governor
2	10V Switched Pullup Input	Alternate Torque Switch	Switchable Torque
3	IVS 10V Switched Pullup Input	Off Idle Switch	Base Throttle
			Frequency Throttle
4	Switched Sink Driver Output	Wait-To-Start Lamp	Intake Air Heater
5	Switched Sink Driver Output	Maintenance Lamp	Real-Time Clock
			Water-In-Fuel
			Maintenance Monitor
6	Switched Sink Driver Output	Stop Lamp	Diagnostics
			Engine Protection
7	ECM Supply (+)	ECM Supply (+)	All
8	ECM Supply (+)	ECM Supply (+)	All

9	ECM Switch Return	Panel Return 1	All
10	ECM Switch Return	Panel Return 2	All
11	Tachometer Source Driver Output	Tachometer	All Tachometer
12	10V Switched Pullup Input	EP Shutdown Override Switch	Engine Protection
13	IVS 10V Switched Pullup Input	On Idle Switch	Base Throttle
			Frequency Throttle
14	10V Switched Pullup Input	Diagnostics Increment	Diagnostics
	F MULTIFUNCTION pinout	ISC Increment	Intermediate Speed Control
		Idle Increment	Low Idle Governor
15	10V Switched Pullup Input	Fan Accessory Switch	Electronic Fan Clutch
16	Switched Sink Driver Output	Warning Lamp	Diagnostics
			Low Idle Shutdown
17	ECM Supply (+)	ECM Supply (+)	All
18	ECM Supply (+)	ECM Supply (+)	All
19	ECM Switch Return	MUS ID Return	Multiple Unit Synchronization
20	ECM Switch Return	Remote Return	Remote Throttle
21	APS Ratiometric Analog Input	Remote Throttle Position	Remote Throttle
	F RECONFIGURABLE pinout	Variable ISC	Intermediate Speed Control
22	10V Switched Pullup Input	MUS ID1 Engine Brake Select 1	Multiple Unit Synchronization Engine Brakes
23	10V Switched Pullup Input	ISC Switched Speed 1	Intermediate Speed Control
24	10V Switched Pullup Input	Diagnostics Decrement	Diagnostics
	F MULTIFUNCTION pinout	ISC Decrement	Intermediate Speed Control
		Idle Decrement	Low Idle Governor
25	10V Switched Pullup Input	ISC Switched Speed 2	Intermediate Speed Control
26	J1587 Datalink (+)	J1587 Datalink (+)	J1708/J1587 Datalink
27	J1587 Datalink (-)	J1587 Datalink (-)	J1708/J1587 Datalink
28	ECM Supply (+)	ECM Supply (+)	All
29	ECM Supply Return	ECM Supply Return	All
30	ECM Supply Return	ECM Supply Return	All
31	10V Switched Pullup Input	MUS ID2 Engine Brake Select 2	Multiple Unit Synchronization Engine Brakes
32	10V Switched Pullup Input	MUS ID3 Engine Brake Select 3 (QSX15)	Multiple Unit Synchronization Engine Brakes (QSX15)
33	10V Switched Pullup Input	ISC Switched Speed 3	Intermediate Speed Control
	F RECONFIGURABLE pinout	ISC Validation	Intermediate Speed Control
34	10V Switched Pullup Input	MUS On/Off Validation	Multiple Unit Synchronization
35	Switched Source Driver Output	Idle Shutdown Relay	Low Idle Shutdown
36	J1939 Datalink Shield	J1939 Datalink Shield	J1939 Datalink
37	J1939 Datalink (-)	J1939 Datalink (-)	J1939 Datalink
38	Switched Pulldown Input	Keyswitch	All
39	ECM Supply Return	ECM Supply Return	All
40	ECM Supply Return	ECM Supply Return	All
41	10V Switched Pullup Input	Alternate Droop Switch	Alternate Droop
42	10V Switched Pullup Input	MUS On/Off Switch	Multiple Unit Synchronization
43	10V Switched Pullup Input	Remote Throttle Switch	Remote Throttle
44	10V Switched Pullup Input	Diagnostics Enable	Diagnostics
	F MULTIFUNCTION pinout	Manual Snapshot	User-Activated Datalogger
45	10V Switched Pullup Input	Alternate Low Idle Switch	Switchable Low Idle

46	J1939 Datalink (+)	J1939 Datalink (+)	All
47	APS Ratiometric Analog Input	Base Throttle Position	Base Throttle
48	APS 5V Sensor Voltage Source	Throttle Supply (+)	Base Throttle
			Remote Throttle
			Intermediate Speed Control
49	ECM Switch Return	Throttle Supply Return	Base Throttle
			Remote Throttle
			Intermediate Speed Control
50	ECM Supply Return	ECM Supply Return	All

QSM11/QSX15 - OEM 31 Pin connector

Pin	Pinout Type	Signal Name	Feature
1	5V Sensor Voltage Source	not used	none
2	Ratiometric Analog Input	not used	none
3	ECM Switch Return	OEM Temperature Return	Switched Outputs
			Electronic Fan Clutch
4	Resistive Analog Input	OEM Temperature	Switched Outputs
			Electronic Fan Clutch
5	5V Switched Pullup Input	Coolant Detected	Engine Protection
6	5V Switched Pullup Input	Coolant Not Detected	Engine Protection
7	5V Sensor Voltage Source	Coolant Level Supply (+)	Engine Protection
8	Switched Source Driver Output	Switched Output B	Switched Outputs
9	Switched Source Driver Output	Engine Speed	PWM Dedicated Output
	F RECONFIGURABLE pinout	Engine Torque	PWM Dedicated Output
		Commanded Throttle	PWM Dedicated Output
10	Switched Source Driver Output	Intake Air Heater	Intake Air Heater
11	ECM Solenoid Return	Solenoid Return	Switched Outputs
12	Switched Source Driver Output	Fan Clutch	Electronic Fan Clutch
13	ECM Solenoid Return	Fan Clutch Return	Electronic Fan Clutch
14	5V Sensor Voltage Source	not used	none
15	Hall Effect Input	not used	none
16	ECM Switch Return	SE Return	various features
17	10V Switched Pullup Input	AC Pressure Switch	PWM Dedicated Output
18	ECM Switch Return	AC Pressure Return	Electronic Fan Clutch
19	ECM Switch Return	Coolant Level Return	Electronic Fan Clutch
20	Switched Sink Driver Output	not used	none
21	Variable Reluctance Input (+)	Shaft Speed (+)	Auxiliary Governor
	F RECONFIGURABLE pinout		Switched Outputs
22	Variable Reluctance Input (-)	Shaft Speed (-)	Auxiliary Governor
	F RECONFIGURABLE pinout		Switched Outputs
		Frequency Throttle (+)	Frequency Throttle
		Transmission Synch (+)	Transmission Synchronization
23	Resistive Analog Input	not used	none
24	ECM Switch Return	spare	as required
25	10V Switched Pullup Input	not used	none
26	not connected	not used	none
27	Switched Source Driver Output	Switched Output A	Switched Outputs
28	ECM Switch Return	OEM Switch Return	Switched Outputs
29	Switched Source Driver Output	not used	none

30	5V Switched Pullup Input	Alternate Torque Select	Alternate Torque
31	5V Switched Pullup Input	OEM Switch	Switched Outputs

QSK19 – OEM 21 Pin Connector

Pin	Pinout Type	Signal Name	Feature
A	Source Driver Output	Dual Output A	Dual Outputs
C	Source Driver Output	Dual Output B	Dual Outputs
D	ECM Supply (+)	Unswitched Battery	All
F	Ratiometric A/D Input	OEM Pressure	Dual Outputs
			Electronic Fan Clutch
			Engine Protection
			Auxiliary Governor
G	ECM Supply (+)	Unswitched Battery	All
H	PWM Source Driver	Fan Clutch	Electronic Fan Clutch
J	Resistive A/D Input	OEM Temperature Return	Dual Outputs
			Electronic Fan Clutch
			Engine Protection
K	Ratiometric A/D Input	OEM Temperature	Dual Outputs
			Electronic Fan Clutch
			Engine Protection
L	Variable Reluctance Input (+)	Auxiliary Shaft Speed	Auxiliary Governor
		Frequency Throttle	Frequency Throttle
M	Variable Reluctance Input (-)	Auxiliary Shaft Speed	Auxiliary Governor
		Frequency Throttle	Frequency Throttle
N	APS Ratiometric Analog Input	Remote Throttle Position	Remote Throttle
		Variable ISC Position	Variable ISC
P	APS Sensor 5V Source Voltage	Remote Throttle Supply	Remote Throttle
		Variable ISC Supply	Variable ISC
U	5V Sensor Supply	Coolant Level Supply (+)	Engine Protection
			OEM Pressure Sensor Supply
S	5V Switched Pullup Input	Coolant Level High Input	Engine Protection
T	5V Switched Pullup Input	Coolant Level Low Input	Engine Protection
V	ECM Sensor Return	Coolant Level Return	Engine Protection
			OEM Pressure Sensor Supply
			Centinel (CORS)
W	PWM Output Output	Dedicated PWM Output	Dedicated PWM
X	ECM Throttle Return	Remote Throttle Return	Remote Throttle
		Variable ISC Return	Variable ISC

QSK19 – OEM 31 Pin Connector

Pin	Pinout Type	Signal Name	Feature
1	Switched Pulldown Input	Vehicle Keyswitch Input	Keyswitch
2	J1587 Data Link +	J1587 Data Link +	J1708/J1587 Datalink
3	J1587 Data Link +	J1587 Data Link -	J1708/J1587 Datalink
4	APS Sensor 5V Source Voltage	Throttle Supply	Primary Throttle
5	APS Ratiometric Analog Input	Throttle Position	Primary Throttle
6	ECM Throttle Return	Throttle Return	Primary Throttle
7	Switched Pullup Input	Idle Validation Off Idle	Idle Validation
8	Switched Pullup Input	Idle Validation On Idle	Idle Validation
9	12V Switched Pullup Input	AXG Enable Switch	Auxiliary Governor
		Alternate Idle Switch	Switched Alternate Idle
10	12V Switched Pullup Input	OEM Switch	Dual Outputs
		Cold Idle Inhibit	Coolant Temp. Based Alt. Idle
11	12V Switched Pullup Input	Multi-Unit Sync On/Off	Multi-Unit Synchronization

12	12V Switched Pullup Input	ISC/Idle Increment	Diagnostics
			Intermediate Speed Control
			Low Idle Governor
13	12V Switched Pullup Input	ISC/Idle Decrement	Diagnostics
			Intermediate Speed Control
			Low Idle Governor
14	12V Switched Pullup Input	Alternate Torque Switch	Alternate Torque
15	12V Switched Pullup Input	Alternate Droop Switch	Alternate Droop
16	Switched Sink Driver Output	Red Stop Lamp	Diagnostics
			Engine Protection
17	Switched Sink Driver Output	Yellow Warning Lamp	Diagnostics
			Low Idle Shutdown
18	Switched Sink Driver Output	White Maintenance Lamp	Engine Protection
			Maintenance Monitor
19	12V Switched Pullup Input	ISC 3/ISC Validation	Intermediate Speed Control
20	12V Switched Pullup Input	ISC 2/Remote Throttle	Intermediate Speed Control
			Remote Throttle
21	12V Switched Pullup Input	ISC 1	Intermediate Speed Control
22	Tachometer Source Driver	Tachometer Output	Tachometer
23	12V Switched Pullup Input	Remote Oil Level	Centinel (CORS)
24	Battery Supply	Unswitched Battery	Datalink Connector Supply
25	ECM Return	Block Ground	All
26	Switched Source Driver Output	Ether Injection Centinel Make-Up Valve	Controlled Ether Injection
27	12V Switched Pullup Input	Dashboard Fan Clutch	Electronic Fan Clutch
28	APS Ratiometric Analog Input	Remote Throttle Position	Remote Throttle
		Variable ISC Position	Variable ISC
29	5V DC Supply (+)	Unused 5V DC Supply (+)	N/A
30	ECM Return	Block Ground	All
31	ECM Switch Return	Idle Validation Switch Return	Idle Validation

QST 30 - OEM 21 Pin Connector

Pin	Pinout Type	Signal Name	Feature
A	Switched Pullup Input	Vehicle Key Switch Input	ALL
B	Battery Ground	-V Battery	ALL
C	Switched Driver Output	Solenoid A	Switched Outputs
D	Unswitched Battery Supply	+V Battery (secondary engine)	ALL
E	Battery Ground	-V Battery (Secondary engine)	ALL
F	Switched Driver Output	Solenoid B	Switched Outputs
G	Unswitched Battery Supply	-V Battery	ALL
H	Data Bus	J 1587 Data Link + (primary engine)	J1587 Datalink
J	Data Bus	J 1587 Data Link - (primary engine)	J1587 Datalink
K	Output	Remote Throttle Supply	Remote Throttle
L	Analog Input	Remote Throttle Position Input Signal	Remote Throttle
M	Input	Remote Throttle Return	Remote Throttle
N	Switched Pulldown Input	Remote Idle Validation 1 On	Idle Validation
P	Switched Pulldown Input	Remote Idle Validation 2 Off	Idle Validation
R	Output	Throttle Supply	Primary Throttle
S	Analog Input	Throttle Position Input Signal	Primary Throttle
T	Input	Throttle Return	Primary Throttle
U	Switched Pulldown Input	Idle Validation 1 On	Idle Validation
V	Switched Pulldown Input	Idle Validation 2 Off	Idle Validation

W	Data Bus	J1587 Data Link + (secondary engine)	J1587 Datalink
X	Data Bus	J 1587 Data Link - (secondary engine)	J1587 Datalink

QST30 - OEM 31 Pin Connector

Pins	Pinout Type	Signal Name	Feature
1	Analog Input	Frequency Throttle Input	Frequency Throttle
2	Switched Pulldown Input	Fan Clutch Switch	Fan Clutch
3	Analog Output	Coolant Temperature Gauge	Coolant Temp Gauge
4	PWM Source Driver Output	PWM Torque Broadcast Output	Dedicated PWM
5	Analog Output	Oil Pressure Gauge	Oil Pressure Gauge
6	Switched Source Driver Output	Tachometer Output Signal	Tachometer Output
7	Switched Sink Driver Output	Lamp 4 / Wait To Start	Grid Heater
8	Switched Pulldown Input	Coolant Level High Input Signal	Coolant Level
9	Switched Pulldown Input	Coolant Level Low Input Signal	Coolant Level
10	Switched Sink Driver Output	Lamp 5 / Spare Lamp #1	Diagnostics
11	Switched Sink Driver Output	Lamp 6 / Spare Lamp #2	Diagnostics
12	Switched Sink Driver Output	Lamp 1 / Stop	Diagnostics
13	Switched Sink Driver Output	Lamp 2 / Diagnostics	Diagnostics
14	Switched Sink Driver Output	Lamp 3 / Engine Protection	Diagnostics
15	Switched Pulldown Input	Diagnostic On/Off	Diagnostics
16	Switched Pulldown Input	Torque Curve Select	Alternate Torque
17	Switched Pulldown Input	Hi Speed Gov. Droop Select	Alternate Droop
18	Switched Pulldown Input	Alternate Idle Switch Input	Alternate Idle
19	Switched Pulldown Input	Idle and Diagnostic Increment	Diagnostics & Low Idle
20	Output	Coolant Level Supply	Coolant Level
21	Input	Coolant Level Return	Coolant Level
22	Switched Pulldown Input	Idle and Diagnostic Decrement	Diagnostics & Low Idle
23	Switched Pulldown Input	PTO 1	Intermediate Speed Control
24	Switched Pulldown Input	PTO 2 / Remote Throttle Select	Intermediate Speed Control/Remote Throttle
25	Switched Pulldown Input	PTO Validate	Intermediate Speed Control
26	Switched Pulldown Input	Clutch Switch	Clutch Input
27	Switched Pulldown Input	PTO Increment	Intermediate Speed Control
28	Switched Pulldown Input	PTO Decrement	Intermediate Speed Control
29	Switched Pulldown Input	PTO On/Off	Intermediate Speed Control
30	Switched Pulldown Input	Service Brake	Service Brakes
31	Switched Pulldown Input	Droop Switch Input	High Speed Governor Droop

Section VIII – Pinout Specifications

Disclaimer: The pinout specification is applicable to the QSM11/QSX15 circuit requirements and descriptions may be different for each engine platform.

* Note - the differences will be added in future revisions to this document

5V Sensor Voltage Source Pinout Specifications/APS 5V Sensor Voltage Source Pinout Specifications

Application. There are two 5V ECM regulated power supplies available to the OEM. The primary supply is available at any 5V Sensor Voltage Source pinout. This supply is used as excitation voltage for ratiometric sensors such as pressure sensors. There is also an electrically independent 5V supply available at the APS 5V Sensor Voltage Source pinout. It is designed to provide excitation voltage for Accelerator Position Sensors (APS's).

> **Note**: Specifications for the APS 5V Sensor Voltage Source Pinout are defined in CES 14118 except as noted.

5V Sensor Voltage Source Pinout Specifications

Item	Requirement
Pin Voltage	5V ±5%
Maximum Current Per Pin	50 mA, 10 mA APS
Maximum Total Current (Sum of All Pins)	200 mA, 10 mA APS
Maximum Ripple Voltage	100 mV p-p

5V Switched Pullup Input Pinout Specifications

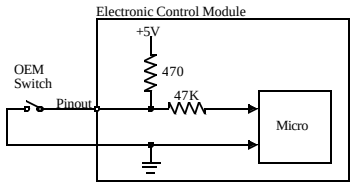
Application. The 5V Switched Pullup Input pinout type detects the state of a low-voltage, OEM-supplied binary switch or switching device. A typical application is the coolant level switch. The pinout is connected to one contact of the OEM switch. ECM ground is connected to the other contact of the OEM switch.

Note. For proper operation, the OEM switch must always be returned to ECM ground as defined in the Installation Recommendations section and IS-1377-9802.

Operation. The 5V Switched Pullup Input pinout can exist is one of two states: Grounded (@ 0 volts) or Not Grounded (@ 5 volts). These states are dictated by OEM switch position as follows.

a. Grounded State. When the OEM switch is closed, Nominal Pinout Current is present through the pinout by way of the 470 Ohm pullup resistor. Grounded Source Resistance can be measured between the pinout and ECM ground. Grounded Pin Voltage can be measured at the pinout with respect to ECM ground. The microprocessor detects a logic level low.

b. Not Grounded State. When the OEM switch is opened, Pinout Current is minimal. Not Grounded Source Resistance can be measured between the pinout and ECM ground. Not Grounded Pin Voltage can be measured at the pinout with respect to ECM ground. The microprocessor detects a logic level high



5V Switched Pullup Input Pinout Simplified Circuit

5V Switched Pullup Input Pinout Specifications

Item	Requirement
Number of States	Two: GROUNDED or NOT GROUNDED
Nominal Pinout Current	10 mA
Maximum Grounded Pin Voltage	1.5 V
Minimum Not Grounded Pin Voltage	4 V
Maximum Grounded Source Resistance	125 Ohm
Minimum Not Grounded Source Resistance	50k Ohm

10V Switched Pullup Input Pinout Specifications/IVS 10V Switched Pullup Input Pinout Specifications

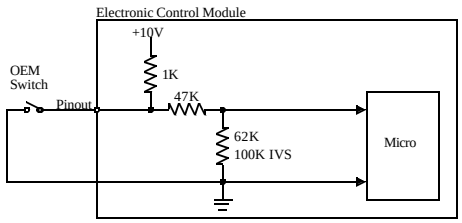
Application. The 10V Switched Pullup Input pinout type detects the state of an OEM-supplied binary mechanical or solid-state switch. Typical applications are panel-mounted toggle switches and Idle Validation Switches (IVS's). The pinout is connected to one contact of the OEM switch. ECM ground is connected to the other contact of the

OEM switch. There are two 10V Switched Pullup Input pinouts designated IVS which are similar in operation to, but electrically independent from, non-IVS pinouts.

> **Note**. For proper operation, the OEM switch must always be returned to ECM ground as defined in the Installation Recommendations section and IS-1377-9802. Specifications for the IVS 10V switched Pullup Input pinout are defined in CES 14118 except as noted.

Operation. The 10V Switched Pullup Input pinout can exist in one of two states: Grounded (@ 0 volts) or Not Grounded (@ 10 volts). These states are dictated by OEM switch position as follows.

> **a. Grounded State**. When the OEM switch is closed, Nominal Pinout Current is present through the pinout by way of the 1K pullup resistor. Grounded Source Resistance can be measured between the pinout and ECM ground. Grounded Pin Voltage can be measured at the pinout with respect to ECM ground. The microprocessor detects a logic level low.
>
> **b. Not Grounded State**. When the OEM switch is opened, Pinout Current is minimal. Not Grounded Source Resistance can be measured between the pinout and ECM ground. Not Grounded Pin Voltage can be measured at the pinout with respect to ECM ground. The microprocessor detects a logic level high.



10V Switched Pullup Input Pinout Simplified Circuit

10V Switched Pullup Input Pinout Specifications

Item	Requirement
Number of States	Two: GROUNDED or NOT GROUNDED
Nominal Pinout Current	10 mA
Maximum Grounded Pin Voltage	2 V, 1.5 V IVS
Minimum Not Grounded Pin Voltage	8 V, 5.5 V IVS
Maximum Grounded Source Resistance	100 Ohm, 125 Ohm IVS
Minimum Not Grounded Source Resistance	50k Ohm

ECM Supply (+) Pinout Specifications/ECM Supply Return Pinout Specifications

Application. There are five ECM Supply (+) pinouts and five ECM Supply Return pinouts. These pinouts supply primary CM570 subsystem operating power to the ECM.

> **Not**e. This is a critical interface, special connection requirements must be followed as defined in the Installation Recommendations section and IS-1377-9807.

ECM Supply Pinout Specifications

Item	Requirement
Supply Voltage	9-32 Vdc
Maximum Key-On Current	25A @ 12V, 15A @ 24V
Maximum Key-Off Current (Dormant Mode)	40 mA @ 12V, 80 mA @ 24V
Maximum Circuit Resistance, ECM to battery (+ and -)	40mOhms

ECM Switch Return Pinout Specifications

Application. There are two types of ECM returns available to the OEM. These returns are available at several ECM pinouts. The ECM Switch Return pinouts provide a return for switches or sensors. The ECM Solenoid Return pinouts provide a return for relay coils or solenoids.

> **Note**. For proper operation, special installation requirements must be followed as defined in the Installation Recommendations section and IS-1377-9807.

ECM Return Pinout Specifications

Item	Requirement
Maximum Current Per Pin	7.5A*
Maximum Total Current (Sum of all Pins)	12.5A

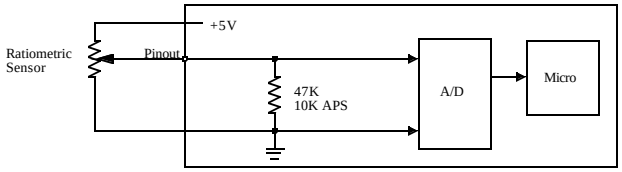
* The following pinouts are limited to 5 A: Frequency Return and OEM Switch return

Ratiometric Analog Input Pinout Specifications/APS Ratiometric Analog Input Pinout Specifications

Application. The Ratiometric Analog Input pinout detects the signal from an OEM-supplied ratiometric sensor. Ratiometric sensors are three-wire sensors that provide a continuously variable output voltage that represents a measured analog parameter. Typical applications are pressure sensors and Accelerator Position Sensors (APS's). The pinout is connected to the center tap of the ratiometric sensor. This sensor is typically connected to an excitation voltage and ECM ground. There are two Ratiometric Analog Input pinouts designated APS which are similar in operation to, but electrically independent from, non-APS pinouts.

Note. For proper operation, the ratiometric sensor must always be returned via a dedicated ECM ground as defined in the Installation Recommendations section. Specifications for the APS Ratiometric Analog Input pinout are defined in CES 14118 except as noted.

Operation. Current flow is present through the ratiometric sensor, whenever the ECM is powered up, by way of the +5V source. This results in a voltage drop at the center tap of the ratiometric sensor, which is applied to the ratiometric Analog Input pinout. Pinout Current is present through the pinout by way of the pulldown resistor. Pinout Voltage can be measured at pinout with respect to ECM ground. This voltage is sampled by the A/D converter and supplied to the microprocessor.



Ratiometric Analog Input Pinout Simplified Circuit

Ratiometric Analog Input Pinout Specifications

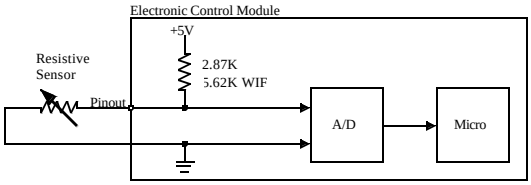
Item	Requirement
Resolution	5 mV
Maximum Pinout Current	100 µA, 500 µA APS
Maximum Pinout Voltage	5V

Resistive Analog Input Pinout Specifications/WIF Resistive Analog Input Pinout Specifications

Application. The Resistive Analog Input pinout detects the signal from an OEM-supplied resistive sensor. Resistive sensors are two-wire sensors that provides a continuously variable resistance that represents a measured analog parameter. Typical applications are temperature sensors. The pinout is connected to one side of the OEM sensor. ECM ground is connected to the other side of the OEM sensor. There is a Resistive Analog Input pinout designated WIF which provides a lower current draw. Its applications are limited to Water-In-Fuel (WIF) sensors.

Note. For proper operation, the resistive sensor must always be returned via a dedicated ECM ground as defined in the Installation Recommendations section.

Operation. Pinout Current is present through the Resistive Analog Input pinout, whenever the ECM is powered up, by way of the pullup resistor. This results in a voltage drop between the pullup resistor and the sensor. Pinout Voltage can be measured at the pinout with respect to ECM ground. This voltage is sampled by the A/D converter and supplied to the microprocessor.



Resistive Analog Input Pinout Simplified Circuit

Resistive Analog Input Pinout Specifications

Item	Requirement
Resolution	5 mV
Maximum Pinout Current	1.7 mA, 0.9 mA WIF
No-Load Pinout Voltage	5 V

Switched Pulldown Input Pinout Specifications

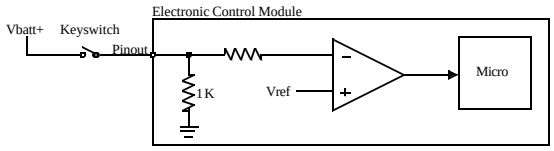
Application. The Switched Pulldown Input pinout detects the critical Keyswitch signal. This signal must be present in order for the engine to operate. Proper connection of the Keyswitch signal is critical to proper operation of the CM570 electronic subsystem.

> **Note**. This is a critical interface; special connection requirements must be followed as defined in the Installation Recommendations section and IS-1377-9807.

Operation. The Switched Pulldown Input pinout can exist in one of two states: Key-On (@ Vbatt+) or Key-Off (@ 0 volts). Pinout state is dictated by keyswitch position as follows.

> **a. Key-On**. When the keyswitch is closed, Nominal Pinout Current is present through the pinout by way of the 1K pulldown resistor. Key-On Source Voltage can be measured at the pinout with respect to ECM ground. This voltage is greater than a reference voltage and turns an op amp OFF. After the op amp has been OFF for the Key-On Time, the micro assumes the Key-On state.

b. Key-Off. When the keyswitch is opened, Pinout Current is minimal. Key-Off Source Voltage can be measured at the pinout with respect to ECM ground. This voltage is less than a reference voltage and turns the op amp ON. After the op amp has been ON for the Key-Off Time, the micro assumes the Key-Off state.



Switched Pulldown Input Pinout Simplified Circuit

Switched Pulldown Input Pinout Specifications

Item	Requirement
Number of States	Two: KEY ON or KEY OFF
Nominal Pinout Current	12 mA @ 12V, 24 mA @ 24V
Maximum Key-On Source Voltage	32 V
Minimum Key-On Source Voltage	6.0 V
Maximum Key-Off Source Voltage	4.0 V
Minimum Key-On Time	50 msec
Minimum Key-Off Time	150 msec
Maximum Allowable Key-On Drop-Out Time	80 msec

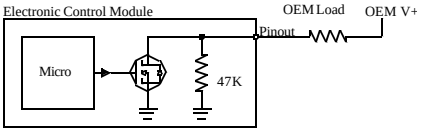
Switched Sink Driver Output Pinout Specifications

Application. The Switched Sink Driver Output pinout type sinks an OEM-supplied load. The only applications are dashboard lamps. The pinout is connected to one side of the OEM load. A voltage source, typically Vbatt+, is connected to the other side of the OEM load.

Operation. The Switched Sink Driver Output pinout can exist in one of two states: Sink (low impedance) or Off (high impedance). These states are dictated by a microprocessor-controlled FET switch as follows.

a. Sink State. Pinout Voltage can be measured at the pinout with respect to ECM ground. When the FET switch is opened, Pinout Current is present through the pinout by way of the FET switch. Load Resistance can be measured between the pinout and the OEM voltage source. The OEM load is on or energized.

b. Off State. When the FET switch is closed, some leakage Pinout Current is still present by way of the 47K resistor. The OEM load is off or de-energized.



Switched Sink Driver Output Pinout Simplified Circuit

Switched Sink Driver Output Pinout Specifications

Item	Requirement
Number of States	Two: SINK or OFF
Maximum Pinout Voltage	32V
Maximum Pinout Current (Non-Inductive Load)	600 mA
Minimum Load Resistance	20 Ohm @ 12V, 40 Ohm @ 24V
Maximum Peak Current (Non-Inductive Load)	6.0 A for 20 msec
Maximum Pinout Current (Inductive Load)	2.5 A @ 12V, 1 A @ 24V
Maximum Load Induction	40 mH @ 12V, 130 mH @ 24V

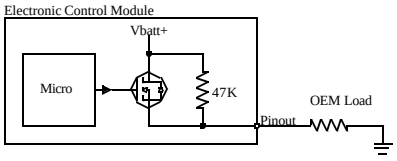
Switched Source Driver Output Pinout Specifications

Application. The Switched Source Driver Output pinout type drives a bi-state or PWM OEM-supplied load. Typical applications are fan clutches or relays. The pinout is connected to one side of the OEM load. A good chassis ground is connected to the other side of the OEM load. An ECM Solenoid Return pinout may be used as ground if desired.

Operation. The Switched Source Driver Output pinout can exist in one of two states: Source (@ Vbatt+) or Off (@ 0 volts). These states are dictated by a microprocessor-controlled FET switch as follows.

a. Source State. When the FET switch is opened, Pinout Current is present through the pinout by way of the FET switch. Load Resistance can be measured between the pinout and ECM ground. Nominal Pinout Voltage can be measured at the pinout with respect to ECM ground. The OEM load is on or energized.

b. Off State. When the FET switch is closed, some leakage Pinout Current is still present through the pinout by way of the 47K resistor. Nominal Pinout Voltage can still be measured at the pinout with respect to ECM ground. The OEM load is off or de-energized.



Switched Source Driver Output Pinout Simplified Circuit

Switched Source Driver Output Pinout Specifications

Item	Requirement
Number of States	Two: SOURCE or OFF
Number of Modes	Two: 2-STATE or PWM
Nominal Pinout Voltage	(Vbatt+) - 0.5 volts
Maximum Pinout Current	2 A
Minimum Load Resistance	6 Ohm @ 12V, 12 Ohm @ 24V
Maximum Load Resistance (non-inductive load)	2.2 KOhm
Maximum Load Capacitance (non-inductive load)	.01 µF
Frequency Range (PWM)	61-3907 Hz
Maximum Load Induction	130 mH

Tachometer Source Driver Output Pinout Specifications

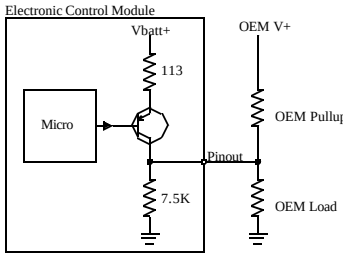
Application. The Tachometer Source Driver Output pinout type drives a low-current non-inductive OEM-supplied load. This pinout may be used to drive a tachometer with a single-ended pulse stream based on engine RPM. Tachometer requirements are defined ATA/TMC RP-123 except as noted below and in the Signal Descriptions section.

Operation. The Tachometer Source Driver Output pinout has two states, Source (@ Vbatt+) or Sink (@ 0 volts). These states are dictated by the microprocessor-controlled transistor switch as follows.

a. Source State. When the transistor switch is opened, forward current flow at the value of Source Current is present through the pinout by way of the transistor and the 113 Ohm pullup resistor. Load Resistance can be measured between the pinout and ECM ground. Nominal Source Voltage can be measured at the pinout with respect to ECM ground.

b. Sink State. For some applications, Sink Voltage can be measured at the pinout with respect to ECM ground. When the transistor switch is closed, reverse current flow at the value of Sink Current is present through the pinout by way of the 7.5K pulldown resistor

.



Tachometer Source Driver Output Pinout Simplified Circuit

Tachometer Source Driver Output Pinout Specifications

Item	Requirement
Number of States	Two: SOURCE or SINK
Number of Modes	One: PWM
Nominal Source Voltage	(Vbatt+) - 0.5 volts
Maximum Source Current	100 mA
Minimum Load Resistance	500 Ohm
Maximum Sink Voltage	500 mV
Maximum Sink Current	50 µA
Frequency Range	2-2000 Hz

Variable Reluctance Input Pinout Specifications - Differential Input

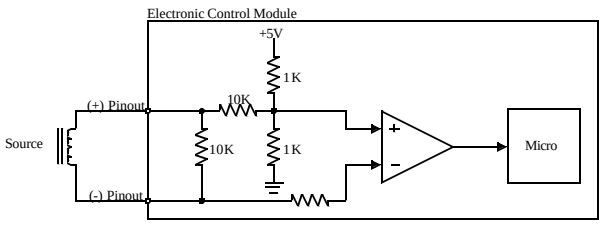
Application. The Variable Reluctance Input pinout detects the frequency of a periodic waveform. The pinout can operate in one of two configurations: differential or single-ended. A differential input is supplied by a Magnetic Pickup-type shaft speed sensor. This sensor's waveform will be an approximately sinusoidal AC voltage. This input is supplied by two wires, with one wire designated as signal (+) which is referenced to signal (-). These wires are usually connected directly to the (+) and (-) inputs of the Variable Reluctance Input pinouts.

> **Note**. Specifications for the Variable Reluctance Input pinout are defined in the Installation Recommendations section and IS-1377-9803 except as noted.

Operation. The Variable Reluctance Input pinout can exist in one of two states: High or Low. The states are dictated by input voltage as follows.

a. High. Source Voltage can be measured at the (+) pinout with respect to the (-) pinout. Current flow is from the (+) pinout to the (-) pinout by way of the 10K load resistor. Source voltage is positive and turns an op amp ON.

b. Low. Current flow is from the (-) pinout to the (+) pinout by way of the 10K load resistor. Source voltage is negative and turns the op amp OFF. The microprocessor monitors op amp state and uses this information to calculate the signal's frequency.



Variable Reluctance Input Pinout Simplified Circuit - Differential Input

Variable Reluctance Input Pinout Specifications - Differential Input

Item	Requirement
Maximum Source Voltage	26 V rms
Minimum Source Voltage	±0.4 Vrms @ 2 Hz ±0.6 Vrms @ 200 Hz ±4.0 Vrms @ 2 kHz ±8.0 Vrms @ 4 kHz
Maximum Noise Voltage	±0.1 Vrms
Frequency Range	2-8500 Hz

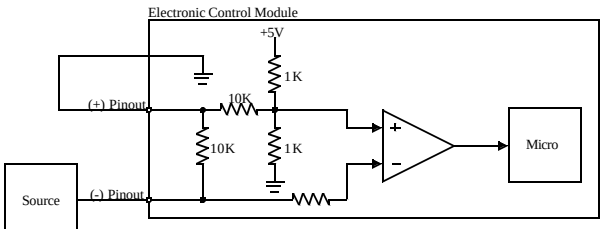
Variable Reluctance Input Pinout Specifications - Single-Ended Input

Application. The Variable Reluctance Input pinout detects the frequency of a periodic waveform. The pinout can operate in one of two configurations: differential or single-ended. A single-ended input is supplied by a pulse generator source such as a Frequency Throttle. This circuit's output waveform will be a positive-going pulse stream with a constant duty cycle and a variable frequency. This signal is usually connected directly to the (-) input of the Variable Reluctance Input pinouts. The (+) input may be connected to an ECM Switch Return or allowed to float (grounding is recommended).

> **Note**. Specifications for the Variable Reluctance Input pinout are defined in the Installation Recommendations section and IS-1377-9803 except as noted. The pulse generator source must be properly grounded as defined in the Installation Recommendations section and the Wiring Diagram section.

Operation. The Variable Reluctance Input pinout can exist in one of two states: High or Low. Pinout state is dictated by pinout voltage as follows.

> **a. High**. High State Pinout Voltage can be measured at the (-) pinout with respect to ECM ground. This voltage is greater than a reference voltage and turns the op amp OFF.
>
> **b. Low**. Low State Pinout Voltage can be measured at the (-) pinout with respect to ECM ground. This voltage is less than a reference voltage and turns the op amp ON. The microprocessor monitors op-amp state and uses this information to calculate the signal's frequency.



Variable Reluctance Input Pinout Simplified Circuit - Single-Ended Input

Variable Reluctance Input Pinout Specifications - Single-Ended Input

Item	Requirement
Number of States	Two: HIGH or LOW
Maximum High State Pinout Voltage	32 V
Maximum Low State Pinout Voltage	0.9 V
Minimum High State Pinout Voltage	4.2 V