J1939 Communication for the PCS Automatic Transmission Controller

1. Overview

The PCS TCU transmits and receives information over the J1939 CAN Bus. Before implementing J1939 communication using the TCU, PCS should be contacted for the proper firmware and calibration software.

The TCU receives the following information:

- Transmission Gear Bypass Mode (PGN 256, SPN 1852)
- Transmission Lock-up Clutch State (PGN 256, SPN 1853)
- Coast Clutch Bypass State (PGN 256, SPN 1854)
- Coast Clutch State (PGN 256, SPN 1855)
- Accelerator Pedal Position (PGN 61443, SPN 91)
- Percent Load at Current Speed (PGN 61443, SPN 92)
- Engine Speed (PGN 61444, SPN 190)
- Actual Engine – Percent Torque (PGN 61444, SPN 513)
- Engine Coolant Temperature (PGN 65262, SPN 110)
- Wheel-Based Vehicle Speed (PGN 65265, SPN 84)
- Boost Pressure (PGN 65270, SPN 102)

The TCU transmits the following standard transmission information:

- Shift in Process (PGN 61442, SPN 574)
- Torque Converter Lockup Engaged (PGN 61442, SPN 573)
- Output Shaft Speed (PGN 61442, SPN 191)
- Percent Clutch Slip (PGN 61442, SPN 522)
- Input Shaft Speed (PGN 61442, SPN 161)
- Selected Gear (PGN 61445, SPN 524)
- Actual Gear Ratio (PGN 61445, SPN 526)
- Current Gear (PGN 61445, SPN 523)
- Transmission Requested Range (PGN 61445, SPN 162)
- Transmission Current Range (PGN 61445, SPN 163)
- Transmission Oil Temperature (PGN 65272, SPN 177)
- Transmission Gear Bypass Mode Indicator (PGN 65098, SPN 2536)
- Transmission Lock-up Clutch State Indicator (PGN 65098, SPN 2537)
- Coast Clutch Bypass State Indicator (PGN 65098, SPN 2538)
- Coast Clutch State Indicator (PGN 65098, SPN 2539)

Further details of the messages expected by the TCU are contained in Section 2. Details of the standard messages transmitted by the TCU are contained in Section 3.

In this application, the TCU uses address $04 as Transmission #1 Controller. It assumes the Engine Controller uses address $00. Control requests sent using TC1 (PGN 256) are expected from source address $27.

2. J1939 Received Messages

PGN $100 (256) **Transmission Control 1 – TC1**
Source Address: $27
Repetition Rate: 50 ms
Data Page: 0
PDU Specific: DA
Timeout Period: 250 ms
Priority: 3
Data Length: 8 bytes
PDU Format: 1
29-Bit Identifier: $0C010427

Byte	Bits	Parameter
1	8-1	*Not Defined, Don't Care*
2	8-1	Requested Percent Clutch Slip (SPN 684) - Parameter which represents the percent clutch slip requested by a device. 0 = Unlock clutch $FF = Lock clutch
3	8-1	Requested Gear (SPN 525) - Gear requested by the operator, ABS, or engine.
4	8-1	*Not Defined, Don't Care*
5	8-1	*Not Defined, Don't Care*
6	8-7	Transmission Mode 4 (SPN 1855) – Coast clutch state. If SPN 1854 = 01: 00: Unlock Clutch 01: Lock Clutch
	6-5	Transmission Mode 3 (SPN 1854) – Coast clutch bypass state. 00: Coast clutch bypass mode disabled 01: Coast clutch bypass mode enabled (coast clutch state controlled by SPN 1854)
	4-3	Transmission Mode 2 (SPN 1853) – Lock-up clutch bypass state. 00: Lock-up clutch bypass mode disabled 01: Lock-up clutch bypass mode enabled (lock-up clutch state controlled by SPN 684)
	2-1	Transmission Mode 1 (SPN 1852) – Transmission gear bypass mode. 00: Gear bypass mode disabled 01: Gear bypass mode enabled (gear selection controlled by SPN 525)
7	8-1	*Not Defined, Don't Care*
8	8-1	*Not Defined, Don't Care*

J1939 Received Messages (Continued)

PGN $F003 (61443) Electronic Engine Controller 2 - EEC2

Source Address: $00
Repetition Rate: 50 ms
Data Page: 0
PDU Specific: 3
Timeout Period: 250 ms
Priority: 3
Data Length: 8 bytes
PDU Format: 240
29-Bit Identifier: $0CF00300

Byte	Bits	Parameter
1	8-7	*Not Defined, Don't Care*
	6-5	Road Speed Limit Status (SPN 1437) *Not Implemented, Don't Care*
	4-3	Accelerator Pedal Kickdown Switch (SPN 559) *Not Implemented, Don't Care*
	2-1	Accelerator Pedal 1 Low Idle Switch (SPN 558) *Not Implemented, Don't Care*
2	8-1	Accelerator Pedal Position (SPN 91) - The ratio of the actual position of the accelerator pedal to the maximum position of the pedal. Resolution: 0.4 %/bit , 0 offset Data Range: 0 to 100 % Timeout Value: 50%
3	8-1	Percent Load At Current Speed (SPN 92) - The ratio of actual engine percent torque (indicated) to maximum indicated torque available at the current engine speed, clipped to zero torque during engine braking. Resolution: 1 %/bit , 0 offset Data Range: 0 to 250 % Timeout Value: 50%
4	8-1	Remote Accelerator Pedal Position (SPN 974) *Not Implemented, Don't Care*
5	8-1	*Not Defined, Don't Care*
6	8-1	*Not Defined, Don't Care*
7	8-1	*Not Defined, Don't Care*
8	8-1	*Not Defined, Don't Care*

J1939 Received Messages (Continued)

PGN $F004 (61444) Electronic Engine Controller 1 – EEC1

Source Address: $00
Repetition Rate: 50 ms
Data Page: 0
PDU Specific: 4
Timeout Period: 250 ms
Priority: 3
Data Length: 8 bytes
PDU Format: 240
29-Bit Identifier: $0CF00400

Byte	Bits	Parameter
1	8-5	*Not Defined, Don't Care*
	4-1	Engine Torque Mode (SPN 899) *Not Implemented, Don't Care*
2	8-1	Driver's Demand Engine - Percent Torque (SPN 512) *Not Implemented, Don't Care*
3	8-1	Actual Engine - Percent Torque (SPN 513) - The calculated output torque of the engine. The engine percent torque value will not be less than zero and it includes the torque developed in the cylinders required to overcome friction. Resolution: 1 %/bit , -125% offset Data Range: -125 to 125%
4-5	8-1	Engine Speed (SPN 190) - Actual engine speed which is calculated over a minimum crankshaft angle of 720 degrees divided by the number of cylinders. Resolution: 0.125 rpm/bit , 0 offset Data Range: 0 to 8,031.875 rpm Timeout Value: 0 RPM
6	8-1	Source Address of Controlling Device for Engine Control (SPN 1483) *Not Implemented, Don't Care*
7	8-5	*Not Defined, Don't Care*
	4-1	Engine Starter Mode (SPN 1675) *Not Implemented, Don't Care*
8	8-1	Engine Demand - Percent Torque (SPN 2432) *Not Implemented, Don't Care*

J1939 Received Messages (Continued)

PGN $FEEE (65262) Engine Temperature 1 - ET1
Source Address: $00
Repetition Rate: 1 s
Data Page: 0
PDU Specific: 238
Timeout Period: 3 s
Priority: 6
Data Length: 8 bytes
PDU Format: 254
29-Bit Identifier: $18FEEE00

Byte	Bits	Parameter
1	8-1	Engine Coolant Temperature (SPN 110) - Temperature of liquid found in engine cooling system. Resolution: 1 deg C/bit , -40 deg C offset Data Range: -40 to 210 deg C Timeout Value: 100 deg C
2	8-1	Fuel Temperature (SPN 174) *Not Implemented, Don't Care*
3-4	8-1	Engine Oil Temperature (SPN 175) *Not Implemented, Don't Care*
5-6	8-1	Turbo Oil Temperature (SPN 176) *Not Implemented, Don't Care*
7	8-1	Engine Intercooler Temperature (SPN 52) *Not Implemented, Don't Care*
8	8-1	Engine Intercooler Thermostat Opening (SPN 1134) *Not Implemented, Don't Care*

J1939 Received Messages (Continued)

PGN $FEF1 (65265) Cruise Control/Vehicle Speed - CCVS

Source Address: $00
Repetition Rate: 100 ms
Data Page: 0
PDU Specific: 241
Timeout Period: 500 ms
Priority: 6
Data Length: 8 bytes
PDU Format: 254
29-Bit Identifier: $18FEF100

Byte	Bits	Parameter
1	8-7	Not Defined, Don't Care
	6-5	Cruise Control Pause Switch (SPN 1633) *Not Implemented, Don't Care*
	4-3	Parking Brake Switch (SPN 70) *Not Implemented, Don't Care*
	2-1	Two Speed Axle Switch (SPN 69) *Not Implemented, Don't Care*
2-3	8-1	Wheel-Based Vehicle Speed (SPN 84) - Speed of the vehicle as calculated from wheel or tailshaft speed. Resolution: 1/256 km/h per bit , 0 offset Data Range: 0 to 250.996 km/h Timeout Value: 0 km/h
4	8-7	Clutch Switch (SPN 598) *Not Implemented, Don't Care*
	6-5	Brake Switch (SPN 597) *Not Implemented, Don't Care*
	4-3	Cruise Control Enable Switch (SPN 596) *Not Implemented, Don't Care*
	2-1	Cruise Control Active (SPN 595) *Not Implemented, Don't Care*
5	8-7	Cruise Control Accelerate Switch (SPN 602) *Not Implemented, Don't Care*
	6-5	Cruise Control Resume Switch (SPN 601) *Not Implemented, Don't Care*
	4-3	Control Coast (Decelerate) Switch (SPN 600) *Not Implemented, Don't Care*
	2-1	Cruise Control Set Switch (SPN 599) *Not Implemented, Don't Care*
6	8-1	Cruise Control Set Speed (SPN 86) *Not Implemented, Don't Care*
7	8-6	Cruise Control States (SPN 527) *Not Implemented, Don't Care*
	5-1	PTO State (SPN 976) *Not Implemented, Don't Care*
8	8-7	Engine Shutdown Override Switch (SPN 1237) *Not Implemented, Don't Care*
	6-5	Engine Test Mode Switch (SPN 966) *Not Implemented, Don't Care*
	4-3	Idle Decrement Switch (SPN 967) *Not Implemented, Don't Care*
	2-1	Idle Increment Switch (SPN 968) *Not Implemented, Don't Care*

J1939 Received Messages (Continued)

PGN $FEF6 (65270) Inlet/Exhaust Conditions 1 – IC1
Source Address: $00
Repetition Rate: 500 ms
Data Page: 0
PDU Specific: 246
Timeout Period: 2.5 s
Priority: 6
Data Length: 8 bytes
PDU Format: 254
29-Bit Identifier: $18FEF600

Byte	Bits	Parameter
1	8-1	Particulate Trap Inlet Pressure (SPN 81) *Not Implemented, Don't Care*
2	8-1	Boost Pressure (SPN 102) - Gage pressure of air measured downstream on the compressor discharge side of the turbocharger. Resolution: 2 kPa/bit , 0 offset Data Range: 0 to 500 kPa Timeout Value: 0 kPa
3	8-1	Intake Manifold 1 Temperature (SPN 105) *Not Implemented, Don't Care*
4	8-1	Air Inlet Pressure (SPN 106) *Not Implemented, Don't Care*
5	8-1	Air Filter 1 Differential Pressure (SPN 107) *Not Implemented, Don't Care*
6,7	8-1	Exhaust Gas Temperature (SPN 173) *Not Implemented, Don't Care*
8	8-1	Coolant Filter Differential Pressure (SPN 112) *Not Implemented, Don't Care*

3. J1939 Broadcast Messages

PGN $F002 (61442) Electronic Transmission Controller 1 - ETC1
Source Address: $04
Repetition Rate: 10 ms
Data Page: 0
PDU Specific: 2
Priority: 3
Data Length: 8 bytes
PDU Format: 240
29-Bit Identifier: $0CF00204

Byte	Bits	Parameter
1	8-7	*Not Defined, Bits set to 1.*
	6-5	Shift in Process (SPN 574) - Indicates that the transmission is in process of shifting from the current gear to the selected gear. 00 - Shift is not in process 01 - Shift in process
	4-3	Torque Converter Lockup Engaged (SPN 573) - State signal which indicates whether the torque converter lockup is engaged. 00 - Torque converter lockup disengaged 01 - Torque converter lockup engaged
	2-1	Driveline Engaged (SPN 560) *Not Implemented, Bits set to 1.*
2-3	8-1	Output Shaft Speed (SPN 191) - Calculated speed of the transmission output shaft. Resolution: 0.125 rpm/bit , 0 offset Data Range: 0 to 8,031.875 rpm
4	8-1	Percent Clutch Slip (SPN 522) - Parameter which represents the ratio of input shaft speed to current engine speed (torque converter slippage in percent). Resolution: 0.4 %/bit , 0 offset Data Range: 0 to 100 %
5	8-5	*Not Defined, Bits set to 1.*
	4-3	Progressive Shift Disable (SPN 607) *Not Implemented, Bits set to 1.*
	2-1	Momentary Engine Overspeed Enable (SPN 606) *Not Implemented, Bits set to 1.*
6-7	8-1	Input Shaft Speed (SPN 161) - Rotational velocity of the output of the torque converter. Resolution: 0.125 rpm/bit , 0 offset Data Range: 0 to 8,031.875 rpm
8	8-1	Source Address of Controlling Device for Transmission Control (SPN 1482) *Not Implemented, Byte set to $FF.*

J1939 Broadcast Messages (Continued)

PGN $F005 (61445) Electronic Transmission Controller 2 - ETC2

Source Address: $04
Priority: 6
Repetition Rate: 100 ms
Data Length: 8 bytes
Data Page: 0
PDU Format: 240
PDU Specific: 5
29-Bit Identifier: $18F00504

Byte	Bits	Parameter
1	8-1	Selected Gear (SPN 524) - The gear that the transmission will attempt to achieve during the current shift if a shift is in progress, or the next shift if one is pending. Park: $FB Reverse: $7C Neutral: $7D Gear 1: $7E Gear 2: $7F Gear 3: $80 Gear 4: $81 Gear 5: $82 Gear 6: $83
2-3	8-1	Actual Gear Ratio (SPN 526) - Actual ratio of input shaft speed to output shaft speed. Resolution: 0.001/bit , 0 offset Data Range: 0 to 64.255
4	8-1	Current Gear (SPN 523) - The gear currently engaged in the transmission or the last gear engaged while the transmission is in the process of shifting to the new or selected gear. Transitions toward a destination gear will not be indicated. Once the selected gear has been engaged then Current Gear will reflect that gear. Current gear is the same format as selected gear (SPN 524).
5-6	8-1	Transmission Requested Range (SPN 162) - Range selected by the operator. If only one displayed character is required, the second character shall be used and the first character shall be a space (ASCII 32). Park: " P" Reverse: " R" Neutral: " N" Gear 1: " 1" Gear 2: " 2" Gear 3: " 3" Gear 4 (Drive): " D" Gear 5 (Overdrive): "OD" Gear 6: " 6"
7-8	8-1	Transmission Current Range (SPN 163) - Range currently being commanded by the transmission control system. ASCII characters will be the same format as SPN 162.

J1939 Broadcast Messages (Continued)

PGN $FE4A (65098) Electronic Transmission Controller 7 – ETC7

Source Address: $04
Repetition Rate: 100 ms
Data Page: 0
PDU Specific: 248
Priority: 6
Data Length: 8 bytes
PDU Format: 254
29-Bit Identifier: $18FE4A04

Byte	Bits	Parameter
1	8-1	*Not Implemented, Byte set to $FF*
2	8-1	Not Implemented, Byte set to $00
3	8-7	Transmission Mode 2 (SPN 1853) Indicator – Lock-up clutch bypass state. 00: Lock-up clutch bypass mode disabled 01: Lock-up clutch bypass mode enabled (lock-up clutch state controlled by SPN 684)
	6-5	Transmission Mode 1 (SPN 1852) Indicator – Transmission gear bypass mode. 00: Gear bypass mode disabled 01: Gear bypass mode enabled (gear selection controlled by SPN 525)
	4-1	Not Implemented, Bits set to $0
4	8-1	*Not Implemented, Byte set to $FF*
5	8-1	*Not Implemented, Byte set to $FF*
6	8-1	*Not Implemented, Byte set to $FF*
7	8-1	*Not Implemented, Byte set to $FF*
8	8-1	*Not Implemented, Byte set to $FF*

J1939 Broadcast Messages (Continued)

PGN $FEF8 (65272) Transmission Fluids - TF
Source Address: $04
Repetition Rate: 1 s
Data Page: 0
PDU Specific: 248
Priority: 6
Data Length: 8 bytes
PDU Format: 254
29-Bit Identifier: $18FEF804

Byte	Bits	Parameter
1	8-1	Clutch Pressure (SPN 123) *Not Implemented, Byte set to $FF*
2	8-1	Transmission Oil Level (SPN 124) *Not Implemented, Byte set to $FF*
3	8-1	Transmission Filter Differential Pressure (SPN 126) *Not Implemented, Byte set to $FF*
4	8-1	Transmission Oil Pressure (SPN 127) *Not Implemented, Byte set to $FF*
5-6	8-1	Transmission Oil Temperature (SPN 177) - Temperature of the transmission lubricant. Resolution: 0.03125 deg C/bit , -273 deg C offset Data Range: -273 to 1735 deg C
7-8	8-1	*Not Defined, Bytes set to $FF.*