Proprietary CAN Communication for the PCS Automatic Transmission Controller

1. Overview

The PCS TCU transmits and receives information over a CAN 2.0b Bus. Before implementing CAN communication using the TCU, PCS should be contacted for the proper firmware and calibration software.

Data is transmitted at 500 kbps for PCS Protocol or 250K for J1939. Data is in Big-Endian format. When data contains two bytes, the high byte is transmitted first.

This document specifies the PCS CAN Protocol. To enable the PCS Protocol when using the PCS Automatic Transmission Controller Software, select Transmission Setup -> CAN Setup -> CAN Communication from the software. Select PCS as the desired protocol as shown in Figure 1. Also select Transmit Proprietary PCS Messages.

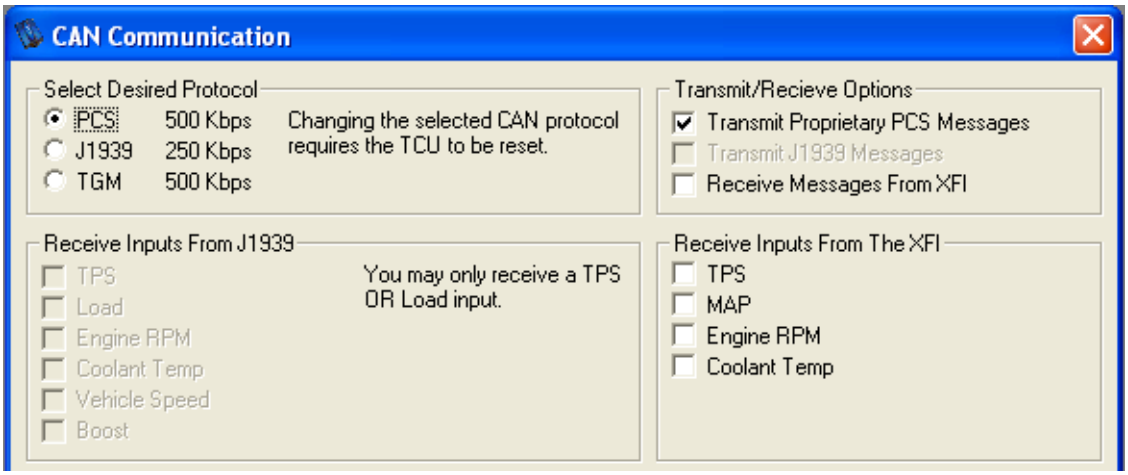

Figure 1 - CAN Communication Setup Form PCS Automatic Transmission Controller Software

To enable the PCS Protocol when using the PCS Universal TCU Software, select Setup Info -> CAN Setup -> CAN Selections from the software. Select PCS as the desired protocol as shown in Figure 2. Also select Transmit Proprietary PCS Messages and the desired source address if using J1939. The available source addresses are $03 or $04.

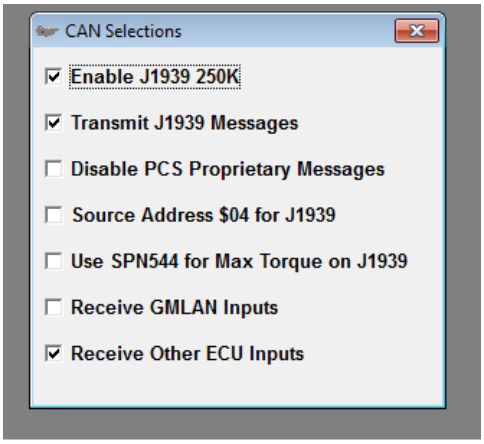

Figure 2 - CAN Communication Setup Form PCS Universal TCU Software

Details of the messages transmitted by the TCU are contained in Section 2.

2. CAN Broadcast Messages

TCU0 – Controller Firmware and Status
29-Bit Identifier: $00200000 29 Bit Identifier on J1939: $18FF01xx
Repetition Rate: 100 ms
Data Length: 8 bytes

Byte	Bits	Parameter
0	7-0	Firmware Major
1	7-0	Firmware Minor
2	7-0	Hardware Revision
4-3	7-0	On-board Temperature – Temperature of the TCU circuit board Resolution: 205/1025 ℃/bit, -40 offset Data Range: -40 – 165 ℃
5	0	1: Full throttle mode enabled
	1	1: Manual mode enabled
	2	1: Calibration B enabled
	3	1: Snow mode enabled
	4	1: Cancel overdrive mode enabled
	5	1: Dyno mode enabled
	6	1: Cancel TCC lockup mode enabled
	7	1: 4WD low mode enabled
6	0	1: TCC locked
	1	1: PWM lockup started
	2	1: Analog input failure exists
	3	0: Neutral or Park to Reverse; 1: Neutral or Park to Drive
	4	0: Downshift timer; 1: Upshift timer
	5	1: Never engage TCC
	6	1: True manual mode enabled
	7	1: Simple manual mode enabled
7	0	Speed units for paddle shifter 0: KPH 1: MPH
	1	MAP units for paddle shifter 0: kPa 1: InHg/PSI
	2	Temperature units for paddle shifter 0: ℃ 1: ℉
	7-3	*Reserved*

CAN Broadcast Messages (Continued)

TCU1 – Speed 1
29-Bit Identifier: $ 00200080 29 Bit Identifier on J1939: $18FF02xx
Repetition Rate: 20 ms
Data Length: 8 bytes

Byte	Bits	Parameter
1-0	7-0	Engine RPM Resolution: 1 RPM/bit, 0 offset Data Range: 0 – 65535 RPM
3-2	7-0	Turbine RPM Resolution: 1 RPM/bit, 0 offset Data Range: 0 – 65535 RPM
5-4	7-0	Driveshaft RPM Resolution: 1 RPM/bit, 0 offset Data Range: 0 – 65535 RPM
7-6	7-0	Vehicle Speed Resolution: 1/256 MPH/bit, 0 offset Data Range: 0 to 255.996 MPH

CAN Broadcast Messages (Continued)

TCU2 – Analog Voltages 1
29-Bit Identifier: $ 00200100 29 Bit Identifier on J1939: $18FF03xx
Repetition Rate: 20 ms
Data Length: 8 bytes

Byte	Bits	Parameter
1-0	7-0	Analog Input 0 Resolution: 5/65472 V/bit, 0 offset Data Range: 0 – 5 V
3-2	7-0	Analog Input 1 Resolution: 5/65472 V/bit, 0 offset Data Range: 0 – 5 V
5-4	7-0	Analog Input 2 Resolution: 5/65472 V/bit, 0 offset Data Range: 0 – 5 V
7-6	7-0	Analog Input 3 Resolution: 5/65472 V/bit, 0 offset Data Range: 0 – 5 V

CAN Broadcast Messages (Continued)

TCU3 – Analog Voltages 2
29-Bit Identifier: $ 00200180 29 Bit Identifier on J1939: $18FF04xx
Repetition Rate: 20 ms
Data Length: 8 bytes

Byte	Bits	Parameter
1-0	7-0	Analog Input 4 Resolution: 5/65472 V/bit, 0 offset Data Range: 0 – 5 V
3-2	7-0	Analog Input 5 Resolution: 5/65472 V/bit, 0 offset Data Range: 0 – 5 V
5-4	7-0	Analog Input 6 Resolution: 5/65472 V/bit, 0 offset Data Range: 0 – 5 V
7-6	7-0	Analog Input 7 Resolution: 5/65472 V/bit, 0 offset Data Range: 0 – 5 V

CAN Broadcast Messages (Continued)

TCU4 – Sensors and Gear
29-Bit Identifier: $ 00200200 29 Bit Identifier on J1939: $18FF05xx
Repetition Rate: 20 ms
Data Length: 8 bytes

Byte	Bits	Parameter
0	7-0	Throttle Position Resolution: 100/255 %/bit, 0 offset Data Range: 0 to 100%
1	7-0	Manifold Absolute Pressure Resolution: 2 kPa/bit, 0 offset Data Range: 0 to 510 kPa
2	7-0	Engine Coolant Temp Resolution: 1 ℃/bit, -50 offset Data Range: -50 to 205 ℃
3	7-0	Fluid Temp 1 Resolution: 1 ℃/bit, -50 offset Data Range: -50 to 205 ℃
4	7-0	Fluid Temp 2 Resolution: 1 ℃/bit, -50 offset Data Range: -50 to 205 ℃
5	7-0	Desired Gear 0: 1st Gear 1: 2nd Gear 2: 3rd Gear 3: 4th Gear 4: 5th Gear 5: 6th Gear 6: Reverse 7: Neutral 8: Park 255: Error
6	7-0	Lever Position 0: 1st Gear 1: 2nd Gear 2: 3rd Gear 3: 4th Gear 4: 5th Gear 5: 6th Gear 6: Reverse 7: Neutral 8: Park 255: Error
7	7-0	Current Gear 0: 1st Gear 1: 2nd Gear 2: 3rd Gear 3: 4th Gear 4: 5th Gear 5: 6th Gear 6: Reverse 7: Neutral 8: Park 255: Error

CAN Broadcast Messages (Continued)

TCU5 – Speed 2
29-Bit Identifier: $ 00200280 29 Bit Identifier on J1939: $18FF06xx
Repetition Rate: 20 ms
Data Length: 8 bytes

Byte	Bits	Parameter
1-0	7-0	Speed 1 RPM Resolution: 1 RPM/bit, 0 offset Data Range: 0 – 65535 RPM
3-2	7-0	Speed 2 RPM Resolution: 1 RPM/bit, 0 offset Data Range: 0 – 65535 RPM
5-4	7-0	Speed 3 RPM Resolution: 1 RPM/bit, 0 offset Data Range: 0 – 65535 RPM
7-6	7-0	Speed 4 RPM Resolution: 1/256 MPH/bit, 0 offset Data Range: 0 to 255.996 MPH

CAN Broadcast Messages (Continued)

TCU6 – PWM
29-Bit Identifier: $ 00200300 29 Bit Identifier on J1939: $18FF07xx
Repetition Rate: 20 ms
Data Length: 8 bytes

Byte	Bits	Parameter
0	7-0	PWM 1 Resolution: 100/255 %/bit, 0 offset Data Range: 0 to 100%
1	7-0	PWM 2 Resolution: 100/255 %/bit, 0 offset Data Range: 0 to 100%
2	7-0	PWM 3 Resolution: 100/255 %/bit, 0 offset Data Range: 0 to 100%
3	7-0	PWM 4 Resolution: 100/255 %/bit, 0 offset Data Range: 0 to 100%
4	7-0	PWM 5 Resolution: 100/255 %/bit, 0 offset Data Range: 0 to 100%
5	7-0	PWM 6 Resolution: 100/255 %/bit, 0 offset Data Range: 0 to 100%
6	7-0	Line Pressure Solenoid Duty Cycle Resolution: 100/255 %/bit, 0 offset Data Range: 0 to 100%
7	7-0	Accumulator Pressure Solenoid Duty Cycle Resolution: 100/255 %/bit, 0 offset Data Range: 0 to 100%

CAN Broadcast Messages (Continued)

TCU7 – Digital I/O, TCC Lock, Slip
29-Bit Identifier: $00200380 29 Bit Identifier on J1939: $18FF08xx
Repetition Rate: 20 ms
Data Length: 8 bytes

Byte	Bits	Parameter
0	2-0	*Reserved*
	3	Digital Output Status Channel 1 0: OFF, 1: ON
	4	Digital Output Status Channel 2 0: OFF, 1: ON
	5	Digital Output Status Channel 3 0: OFF, 1: ON
	7-6	*Reserved*
1	7-0	Digital Input Status Channels 1-8 Bit X = Digital input X+1 status 0: OFF, 1: ON
2	7-0	Digital Input Status Channels 9-16 Bit X = Digital input X+9 status 0: OFF, 1: ON
3	7-0	Torque Converter Clutch Lock Percentage Resolution: 100/255 %/bit, 0 offset Data Range: 0 to 100%
4	7-0	Torque Converter Clutch Slip Resolution: 201/255 %/bit Negative Slip: 129 to 255, where 255 = -100% Zero Slip: 128 Positive Slip: 0 to 127, where 0 = 100% Data Range: 100 to -100%
5	7-0	Vehicle Slip Resolution: 201/255 %/bit Negative Slip: 129 to 255, where 255 = -100% Zero Slip: 128 Positive Slip: 0 to 127, where 0 = 100% Data Range: 100 to -100%
6	7-0	Gear Size – Number of available gears in the transmission Resolution: 1 gear/bit, +1 offset Data Range: 1 to 6 Gears
7	7-0	Transmission Slip Resolution: 201/255 %/bit Negative Slip: 129 to 255, where 255 = -100% Zero Slip: 128 Positive Slip: 0 to 127, where 0 = 100% Data Range: 100 to -100%

CAN Broadcast Messages (Continued)

TCU8 – PWM2
29-Bit Identifier: $00200400 29 Bit Identifier on J1939: $18FF09xx
Repetition Rate: 20 ms
Data Length: 8 bytes

Byte	Bits	Parameter
0	7-0	PWM 7 Resolution: 100/255 %/bit, 0 offset Data Range: 0 to 100%
1	7-0	PWM 8 Resolution: 100/255 %/bit, 0 offset Data Range: 0 to 100%
2	7-0	PWM 9 Resolution: 100/255 %/bit, 0 offset Data Range: 0 to 100%
4-3	7-0	Vehicle Speed 2 Resolution: 1/256 MPH/bit, 0 offset Data Range: 0 to 255.996 MPH
5	7-0	*Reserved*
6	7-0	*Reserved*
7	7-0	*Reserved*

TCU9 – Inching Status
29-Bit Identifier: $00200480 29 Bit Identifier on J1939: $18FF0Axx
Repetition Rate: 10 ms
Data Length: 8 bytes

Byte	Bits	Parameter
0	0	Inching Mode Enabled 0: False, 1: True
	1	Inching Forward Pressed 0: False, 1: True
	2	Inching Reverse Pressed 0: False, 1: True
	3	Inching Entry Mode Started 0: False, 1: True
	4	Inching Entry Mode Complete 0: False, 1: True
	5	Inching Moving Forward 0: False, 1: True
	6	Inching Moving Reverse 0: False, 1: True
	7	Inching Entry Conditions Not Met 0: False, 1: True
1	0	Inching Button Not Released 0: False, 1: True
	1	Inching E-Stop Not Pressed 0: False, 1: True
	2	Inching Neutral Commanded 0: False, 1: True
	3	*Reserved*
	4	*Reserved*
	5	Inching TPS Limit Exceeded 0: False, 1: True
	6	Inching Moving After Stop Commanded 0: False, 1: True
	7	Inching Exit Since Failed Stop 0: False, 1: True
2-7	7-0	*Reserved*

TCU10 – Body Function Status
29-Bit Identifier: $00200500 29 Bit Identifier on J1939: $18FF0Bxx
Repetition Rate: 10 ms
Data Length: 8 bytes

Byte	Bits	Parameter
0	7-0	Fuel Level Resolution: 100/255 %/bit, 0 offset Data Range: 0 to 100%
1	7-0	Oil Pressure Resolution: 2 PSI/bit, 0 offset Data Range: 0 to 510 PSI
2	0	Coolant Level 0: Level OK, 1: Level below minimum
	1	Park Brake 0: Not Applied, 1: Applied
	2	Seat Switch 0: Driver in Seat, 1: Empty Seat
	3	Brake Pad Wear 0: Pad OK, 1: Pad Worn
	7-4	*Reserved*
3	0	Alarm Buzzer 0: Off, 1: On
	1	Over Speed Light 0: Off, 1: On
	2	*Reserved*
	3	Engine Shutdown 0: Timer not active, 1: Timer active *Engine will shut down when timer (bytes 5-4) is 0.*
	7-4	Engine Shutdown/Alarm Buzzer Reason 1: Low Fuel Level 2: Low Oil Pressure 3: Engine Over Temp 4: Low Coolant Level 5: Seat Switch 6: Idle Timeout 7: E-Stop Switch 8: Buzzer On for Park Brake 9: Transmission DTC Active 10: Brake Pad Wear Indicator
5-4	7-0	Engine Shutdown Timer Resolution: 1 second/bit, 0 offset Data Range: 0 to 65535 seconds
7-6	7-0	Electrical Shutdown Timer Resolution: 1 second/bit, 0 offset Data Range: 0 to 65535 seconds

TCU11 – Diagnostic Data
29-Bit Identifier: $00200580 29 Bit Identifier on J1939: $18FF0Cxx
Repetition Rate: 100 ms
Data Length: 8 bytes

Byte	Bits	Parameter
0	7-0	Current or Stored 0: Message is current DTC's, 1: Message is stored DTC's
1	0	*Reserved*
	1	Code 21 – 0: Clear, 1: Set **applies to all codes*
	2	Code 22
	3	Code 24
	4	Code 28
	5	Code 37
	6	Code 38
	7	Code 39
2	0	Code 51
	1	Code 52
	2	Code 53
	3	Code 58
	4	Code 59
	5	*Reserved*
	6	Code 68
	7	Code 69
3	0	Code 71
	1	Code 73
	2	Code 74
	3	Code 75
	4	Code 79
	5	Code 81
	6	Code 82
	7	Code 83
4	0	Code 85
	1	Code 86
	2	Code 87
	3	Code 72
	4	Code 101
	7-5	*Reserved*
5	0	Code 91
	1	Code 92
	2	Code 93
	3	Code 94
	4	Code 95
	7-5	*Reserved*
7-6	7-0	*Reserved*

TCU12 – Hour Meter and Odometer
29-Bit Identifier: $00200600 29 Bit Identifier on J1939: $18FF0Dxx
Repetition Rate: 100 ms
Data Length: 8 bytes

Byte	Bits	Parameter
3-0	7-0	Hour Meter Resolution: 0.01 hour/bit, 0 offset Data Range: 0 to 42,949,672.95 Hours
7-4	7-0	Odometer Resolution: 0.01 miles/bit, 0 offset Data Range: 0 to 42,949,672.95 Miles