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Title		Communicating with a PDM via the CAN bus	
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Introduction

This document outlines how to send, receive and use CAN bus data with a MoTeC PDM.

Scope

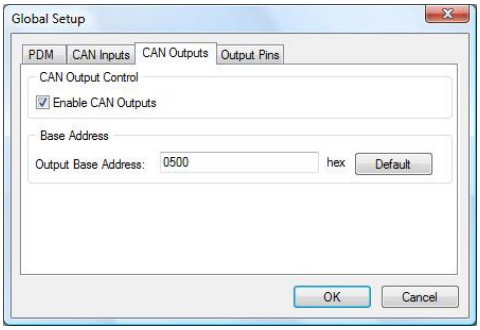
Applies to a Motec PDM32 or PDM16 when used with a Motec Dash/ACL or hundred series ECU connected on the same CAN bus.

Transmitting data from a PDM

The PDM constantly monitors the voltage on all inputs and outputs and the current on all outputs as well as many status channels and other parameters. All of this data can be sent via the CAN bus to a Dash/ACL for display, logging, alarms, etc.

To set data to be sent from a PDM

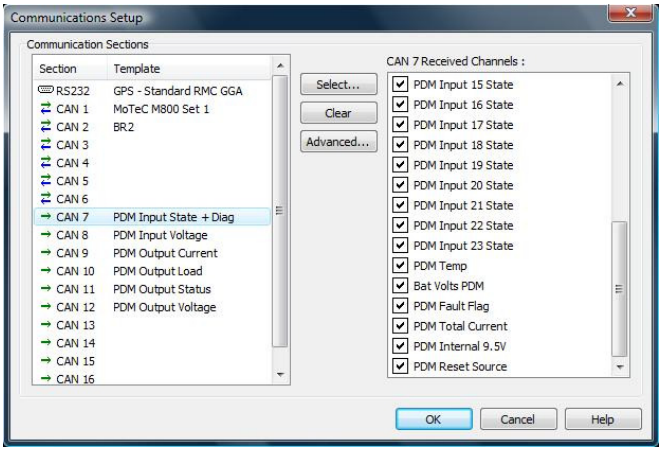
1. In PDM Manager open the configuration and click Global Setup, then click the 'Can Outputs' tab and go to menu 'Edit – Properties'.
2. Check the Enable CAN Outputs check box and set the CAN Output Address as 0500 hex (default).
3. Send the configuration to the PDM. The PDM will now transmit all channels on CAN address 500h.



To receive PDM data into a dash or logging device

1. From Dash/ACL Manager, open the configuration then goto 'Inputs – Communications'.
2. Select an empty CAN slot and click 'Select'.
3. From the popup window, select the CAN template appropriate to the information you want to receive. For the PDM there are 6 different templates available:
   - PDM Input State + Diag
   - PDM Input Voltage
   - PDM Output Current
   - PDM Output Load
   - PDM Output Status
   - PDM Output Voltage

   Select all 6 to receive all channels. Note: If you do not have the PDM CAN templates showing in your list, please install the latest version of Dash/ACL Manager.



4. For each template, select the channels to receive by clicking the check boxes next to the channel names.
5. Setup logging, display, alarms or any other functions you wish to use these channels for then send the configuration to the Dash/ACL.

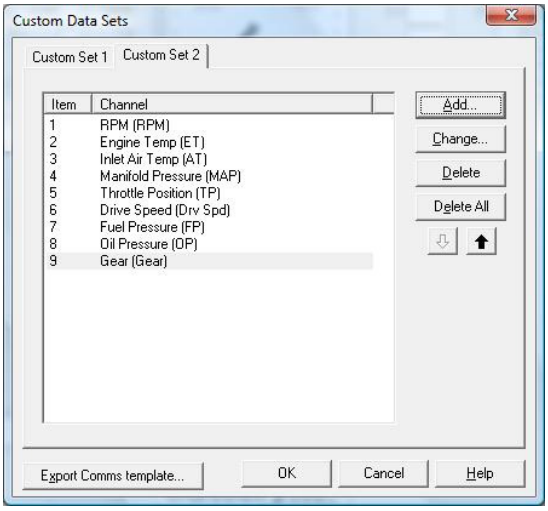
Sending Data to a PDM

Data sent to a PDM can be used to switch outputs directly or used as part of a condition to control an output. Data can be sent from an ADL/2, ACL or a hundred series ECU in the form of a custom data set.

Sending Data from an ECU

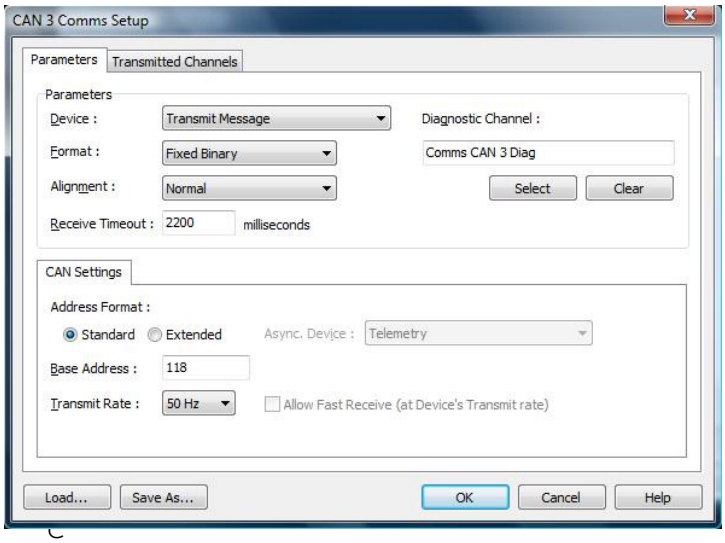
1. To setup the CAN transmit in the ECU, connect to the ECU with ECU Manager. Go to the menu 'Adjust - General Setup – Communication - CAN Setup'.
2. Change the settings for CAN slot 1 to use "Custom Set 2 Sequential" and address 280* (118h).
   - CAN 1 Data 11
   - CAN 1 Address 280
   - CAN 1 Transfer Rate 50

   Note: Only CAN slots 0 and 1 can send custom data sets. CAN slot 1 is recommended for sending to a PDM.
3. Next go to the Menu 'Adjust - General Setup – Communication – Setup - Custom Data Sets'
4. Select the Custom Set 2 tab and add the channels you want to send to the PDM. Write down the item numbers, channel names units and what resolution the channel has when it appears in the view screen. A maximum of 16 channels can be sent.
5. Reset the ECU.



Sending data from an ADL2/ACL

1. To setup the CAN transmit from an ADL2/ACL, open the configuration file and go to menu item 'Inputs – Communications'.
2. Select an empty CAN slot to transmit from and click Advanced+.
3. Set the CAN Comms Setup parameters to as shown on the right.
4. Click on the Transmitted Channels tab and select Single as the Message Type.



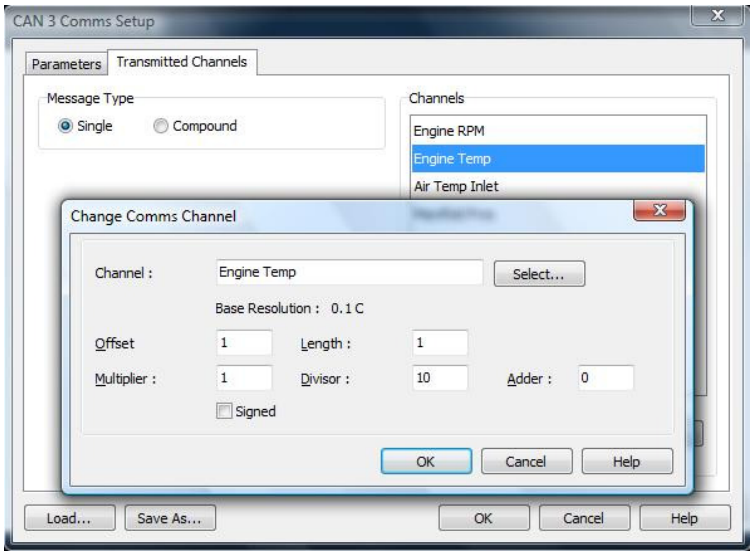
Setup parameters to transmit to a PDM

5. Click Add then Select and find the channel you wish to transmit then click OK.

* Note that CAN addresses in ECU Manager are entered in decimal format, while in other MoTeC products CAN IDs are entered as hexadecimal values.

+ Use any available slot in an ACL, in an ADL2 data can be transmitted from slots 1-6 only.

6. Leave the Offset as its default but note what value it is. Set the length to 1 and uncheck the Signed checkbox.
7. Use the multiplier, divisor and adder to change the value of the channel to fit in an 8 bit value as described below. Note the base resolution and units as shown under the channel name as this tells us what format the data is sent in. Note that it is sent without the decimal point.
8. Click OK then repeat steps 5 to 8 for other channels to be sent. A maximum of 8 single byte channels can be sent on one CAN address in one CAN slot. If more than 8 channels need to be sent, repeat from step 2 but increment the Address from 118 to 119, 11A and 11B sequentially to send up to 32 channels.
9. Click OK on the Communication Setup and send the configuration to the ADL2/ACL.



Engine Temp base resolution 0.1C, Divided by 10 this will be sent in deg C with no DP, 1 byte long, unsigned giving a range of 0 – 255 degC

Receiving CAN messages with a PDM

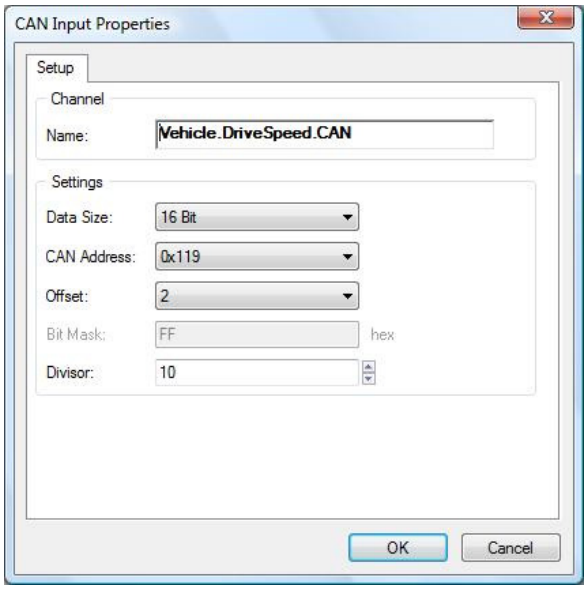
The PDM can receive up to 32 bytes of data from other devices on the CAN bus. How is it received depends on how it is transmitted. Data transmitted from an ECU is fixed as 16 bit channels while an ADL2/ACL can transmit data as 16 or 8 bit channels. A combination of 16 and 8 bit channels could also be configured. It is also possible to send data to a PDM from an ADL2/ACL and ECU at the same time by configuring them with different transmit CAN IDs.

Receiving channels

1. Within PDM Manager, open the configuration file and select Global Setup page.
2. Check the CAN input is set at its default base address of 118hex. Change if required.
3. Select the CAN Inputs page and for each received channel go to menu 'Edit – Add'
4. Set the Channel Name to your channel description (eg: Engine.Temp.Can)

8 Bit Channels from a ADL2/ACL

5. Set Data Size to 8 bit.
6. Set the CAN Address and Offset to the same as set in the ADL2/ACL for the transmitted channel.
7. Set the bit mask as required. Default FF hex, no bit mask.



Setup for receiving a Speed channel from an ECU Item No. 6. Sent as 0.1kmh resolution then divided by 10 to give 0-255kmh value with 1kmh resolution.

16 Bit channels from an ECU

5. Set the Data Size to 16 bit.
6. The channel Item numbers set in ECU Manager Custom Data Set 2 becomes Address and Offset in PDM Manager, as follows.

M800	CAN Address	Offset	M800	CAN Address	Offset
Item 1	0x118	0	Item 9	0x11A	0
Item 2	0x118	2	Item 10	0x11A	2
Item 3	0x118	4	Item 11	0x11A	4
Item 4	0x118	6	Item 12	0x11A	6
Item 5	0x119	0	Item 13	0x11B	0
Item 6	0x119	2	Item 14	0x11B	2
Item 7	0x119	4	Item 15	0x11B	4
Item 8	0x119	6	Item 16	0x11B	6

7. Set the Devisor as described below.
8. Send the configuration to the PDM and use'>Online - Monitor PDM' to view the values of the received channels. Check the values represent the values of the sent channels.

Setting the Channel Divisor

The PDM uses unsigned 8 Bit channels giving each channel a range of 0 to 255. A Dash, ACL or ECU all use signed 16 Bit channels with a range from -32768 to +32767. The Divisor is used to convert the large numbers to fit into the 0 to 255 range used in a PDM. This can be set in the PDM when receiving 16 Bit channels, dividing them down before use. Or the divisor can be set in the ADL2/ACL when transmitting to give an 8 Bit value. Note that in either case, the resolution of the channel is reduced.

When sent on CAN, the decimal point is ignored, so a channel that has two decimal points, eg: a Battery voltage of 12.34 V, will be sent as 1234. This is how it is seen by the receiving device – ie: the PDM. When receiving channels on CAN containing values still larger than 255 after dividing, the value is clamped to 255. Likewise, all negative values are clamped to 0.

When sending divided 8 bit channels from an ADL2/ACL, the absolute minimum and maximum value after dividing must be within the 0 – 255 range. No negative numbers or values greater than 255 can be sent or the resulting value will be 'rolled over' and become incorrect.

Some examples of different channels divided to suit the PDM channel range.

ECU Channel	ECU Value	Divisor	PDM Value	Maximum before Clamping
Engine RPM	2000 RPM	10	200	2550 RPM
Engine RPM	6000 RPM	50	120	12750 RPM
A/C Request Status	On (1)	1	1	255
Manifold Pressure	220.8 kPa	25	98	637.5 kPa
Engine Temp	85.7 °C	5	171	127.5 °C
Throttle Position	88.8 %	4	222	102.0 %
Drive Speed	155.7 Km/h	10	155	255.0 Km/h

As an example, for the Engine RPM channel sent from an ECU, with the divisor set to 1, the readable range is 0 to 255rpm. At anything over 255rpm the channel is clamped to 255. This can be quite useful as it shows if the engine is running or not, however it is not helpful if you need to switch on an output at 2000rpm, for example.

Instead, if the divisor is set to 10, this takes the received value and divides it by 10, giving a range of 0 to 2550rpm in 10rpm steps. Now an output can be turned on at 2000rpm by setting the condition 'true if greater than 200' (2000 / 10 = 200). But still this only gives a range up to 2550rpm. If needing to switch an output at 6000rpm. A devisor of 25 can be set which will give a RPM range of 0 to 6375rpm with 25rpm steps. In this case, the condition set would be 'true if greater than 240' (6000 / 25 = 240).

Setting the divisor correctly can be a little tricky so it is advised to check the received channels have the correct values before configuring an output control. To do this, within PDM Manager go to menu 'Online - Monitor PDM'. The channel values relating to the received CAN data can be seen in the lower left side of the page.