

Introduction

The VBOX-III is the first VBOX to feature two CAN Bus interfaces. The benefit of being equipped with two interfaces is that the VBOX can record data from Racelogic external modules, such as ADC03 analogue module or TC8 thermocouple module, while logging CAN data from a separate bus. The separate CAN bus can be a vehicle CAN bus on a car or truck.

The use of CAN bus in cars has been around for over ten years. This started with prestige models but is now commonplace in most European cars. As the use of CAN has evolved, each manufacturer has developed their own CAN Protocol. The term 'Protocol' in this application note refers to the protocol used to transmit data over a CAN bus network. A CAN bus message consists of an identifier and up to eight data bytes. This is the same for all CAN busses on all vehicle makes. The protocol for a given manufacturer therefore defines what data signals they attach to a given identifier and how the signal data is organised within the eight data bytes for each CAN message. A simplified structure of a CAN bus message is shown below with example identifier and data. In this example, the Identifier is a 29bit identifier with a value of hexadecimal 0x0CF00400. The 4th and 5th data bytes correspond to engine RPM. Therefore for another control unit (or a VBOX) to pick up engine RPM, it only has to listen out for identifier 0x0CF00400 and extract the data from bytes 4 and 5.

Example	Identifier segment	Data segment							
	11 bit or 29 bit	0 to 8 bytes							
	0x0CF00400	F8	E4	DF	89	37	FF	FF	FF

J1939 is an attempt by the SAE to standardise a protocol for transmitting CAN data in trucks, off-road and agricultural equipment. It defines a fixed CAN Baud rate of 250Kbit/s and defines how data signals are sent over the CAN network.

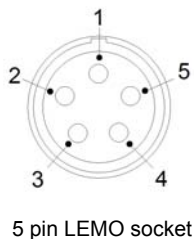
This note explains how to record basic data parameters from a J1939 equipped vehicle using the VBOX-III but also contains useful information for people logging any kind of CAN data.

Equipment used

VBOX III	
VBCAB19	Lemo to 9 way Sub-d
VBCAB01	RS232 cable
Laptop PC	Latest VBOX software installed

Procedure

As previously mentioned, the VBOX III is equipped with 2 CAN Bus interfaces. The primary bus is designed for transmitting VBOX GPS data and recording data from Racelogic external interface modules. This is referred to as the Racelogic bus. The secondary CAN bus is designed for recording CAN Bus data from other sources such as vehicle CAN buses. The pin-out of the two connectors is shown below.



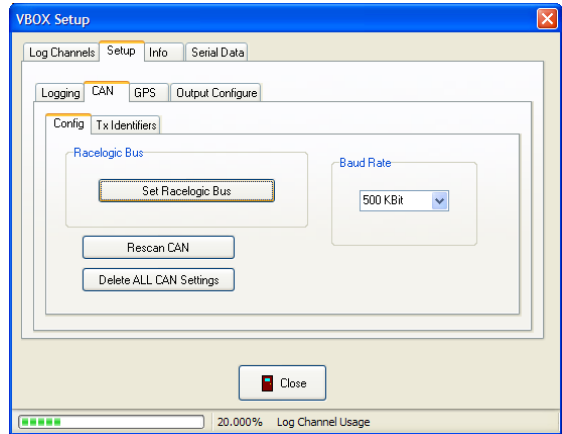
PIN	In/Out	Description
1	O	RS232 Tx (PORT B)
2	I	RS232 Rx (PORT B)
3	I/O	CAN Bus High (PORT A)
4	I/O	CAN Bus Low (PORT A)
5	O	+V Power

PIN	In/Out	Description
1	O	RS232 Tx (PORT A)
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3	I/O	CAN Bus High PORT B)
4	I/O	CAN Bus Low (PORT B)
5	O	+V Power

Default organisation of the two CAN bus interfaces is such that the Racelogic bus is on the connector marked "CAN" and that the secondary CAN bus is on the connector marked "RS232".

For convenience, it is possible to swap the orientation of the CAN Bus interfaces. To move the secondary CAN bus to the "CAN" connector, it is necessary to select "Set Racelogic Bus" from the setup menu.

When the front panel view appears (below) the Primary CAN bus will be highlighted in Red. To swap the primary and secondary CAN buses, click on the RS232 connector. This will highlight the RS232 connector. The secondary CAN bus will now be on the VBOX III connector marked "CAN". VCI channels that are configured in the VBOX will now record data from this connector.



Example 1.

"RS232" Connector = Racelogic external modules (using splitter box)

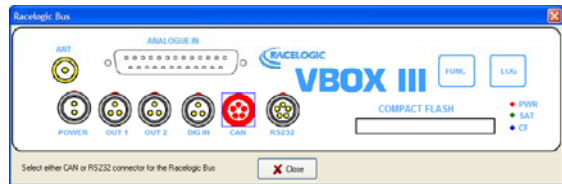
"CAN" Connector = External CAN bus eg; Vehicle CAN bus defined by VCI settings



Example 2.

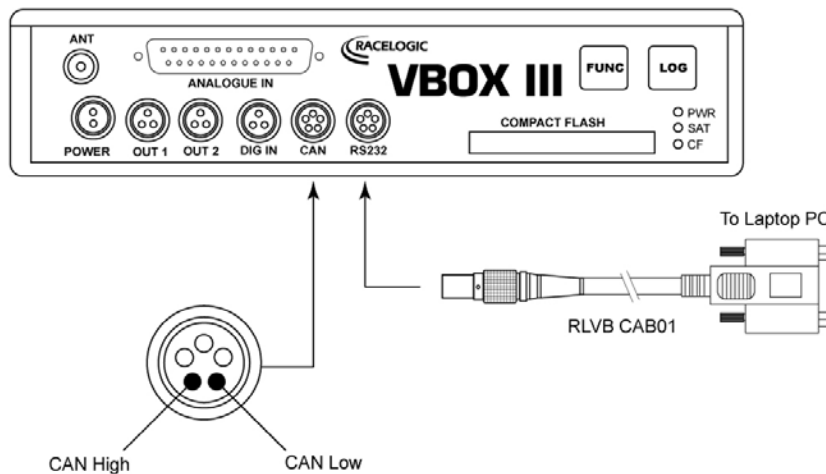
"CAN" Connector = Racelogic external modules

"RS232" Connector = External CAN bus eg; Vehicle CAN bus defined by VCI settings (using splitter box)



Because the J1939 bus operates at 250Kbit/s it is also necessary to select **250 Kbit** in the baud rate selector on the CAN Config panel. Once the connector option and baud rate have been set, close the setup window and wait for the VBOX software to finish writing settings before removing, and then re-applying power to the VBOX. This step ensures that the secondary CAN bus is properly initialised at 250Kbits.

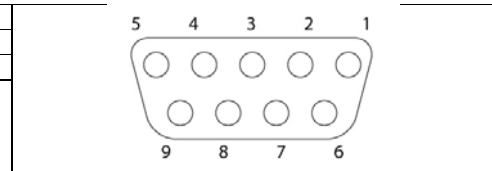
For this applications note, we will set the CAN bus order as shown in **Example 1** above so that the J1939 CAN Bus is connected to the connector marked CAN on the VBOX-III. Connections will be as shown below.



VBCAB19 Cable

The RLVBCAB19 cable provides a convenient method for accessing the CAN connection of the VBOX. It has a LEMO 5 way connector at one end and a 9 way Sub-D connector at the other corresponding to an industry standard CAN pin assignment.

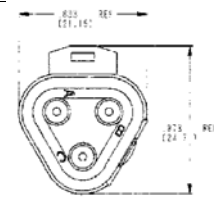
9 way Sub D Female	Signal	Description
2	CAN_L	CAN bus line, low
7	CAN_H	CAN bus line, high



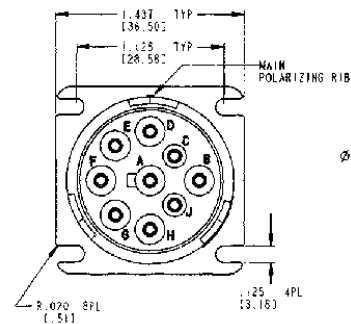
J1939 CONNECTOR

The J1939-11 specification defines two connectors, the 3-pin Deutsch part number DT06-3S-E008 for interconnection within the vehicle and the 9-pin Deutsch part number HD10-9-1939P for an off-board diagnostic connector normally located in the driver's cab.

3-pin Deutsch DT06-3S-E008	Signal	Description
A	CAN_L	CAN bus line, low
B	CAN_H	CAN bus line, high
C	CAN_GND	CAN ground



9-pin Deutsch HD10-9-1939P	Signal	Description
A	BATTERY -	Battery return
B	BATTERY +	Positive battery supply
C	CAN_H	CAN bus, high
D	CAN_L	CAN bus, low
E	CAN_GND	CAN ground



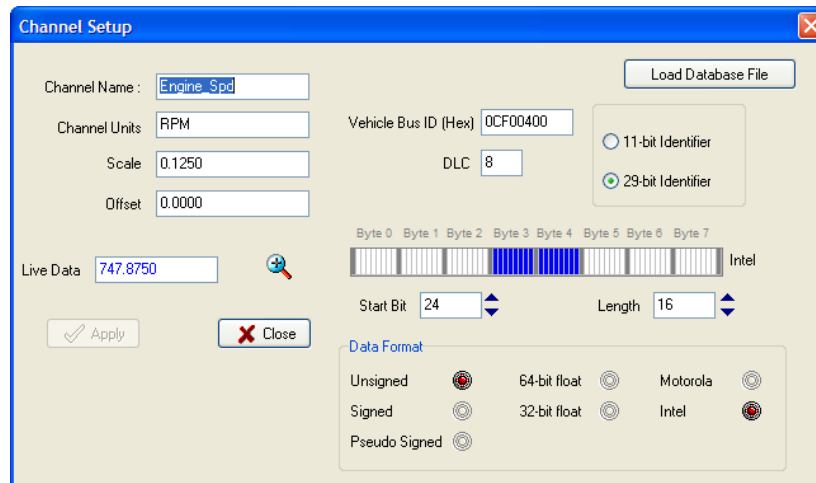
Configuring message data

With everything connected and powered up, choose the following:-

1. VBOX setup
2. click the "log channels" tab
3. click the "VCI modules" tab
4. click one of the buttons to configure CAN data for the channel

The screenshot below shows a CAN channel set up to receive Engine Speed. The settings are described as follows:-

Parameter	Value	Description
Channel Name	"Engine_Spd"	channel label (10 chars max)
Channel Units	"RPM"	Units label (9 chars max)
Scale	0.125	Scaling value for CAN data to obtain true RPM
Offset	0	Offset value of CAN data
Vehicle Bus ID	0CF00400	CAN Bus identifier (in Hexadecimal). The PGN (parameter group number) is 0x00F004 but the actual identifier is 0x0CF00400.
DLC	8	Data Length Code. Normally set to 8 bytes for a J1939 message
Identifier type	29-Bit identifier	J1939 used 29bit (also called "extended" CAN)
Start bit	24	Location of 1 st bit of RPM data in CAN message
Length	16	Size of Engine RPM signal within the CAN message
Data format	Unsigned	RPM signal is represented within CAN message as Unsigned Integer with Motorola byte order (eg; High byte 1 st , Low byte 2 nd)
	Intel	



The byte position display corresponds to the 8 bytes in a CAN message. As the start bit and length are changed, this display will update to give a visual confirmation of the data source.

After selecting the correct values click on [APPLY] to apply these values to the VBOX setting. If the engine is running, the Live data box should now show the true vehicle RPM.

When closing the channel setup, ensure that the checkbox next to the button is checked to log the data. To view the CAN channel in the VBOX software, also ensure that the corresponding checkbox in Serial data -> VCI channels is checked.

Database

The 'Load Database File' option in the channel setup window allows CAN signal information to be imported automatically from an existing database.

Racelogic can provide a basic database file for J1939 vehicles upon request. Further information can be found on the SAE website at the address below.

References

<http://www.sae.org/standardsdev/groundvehicle/j1939.htm>