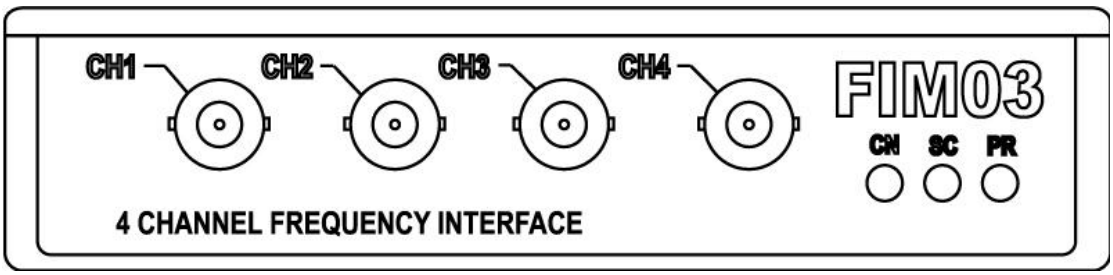
Frequency **I**nput **M**odule
RLVB**FIM**03

Instruction Manual



Contents

EC Declaration of Conformity

We declare that this product has been tested to and meet the requirements of:

EC Directive 2004/104/EC

"Adapting to Technical Progress Council directive 72/245/EEC relating to the radio interference (Electromagnetic Compatibility) of vehicles and amending directive 70/156/EEC on the approximation of the laws of the member states relating to the type-approval of motor vehicles and their trailers."

And has also been assessed, via Technical Construction File, by an independent DTI Competent Body and found to be in conformance with the essential requirements of:

EC Directive 89/336/EEC (and amending directives)

"Council Directive of 03 May 1989 on the approximation of the laws of the member states relating to electromagnetic compatibility."

DTI Competent Body responsible for issuing certificate of compliance:

3C Test Ltd,
Silverstone Technology Park,
Silverstone,
Northants
NN12 8GX

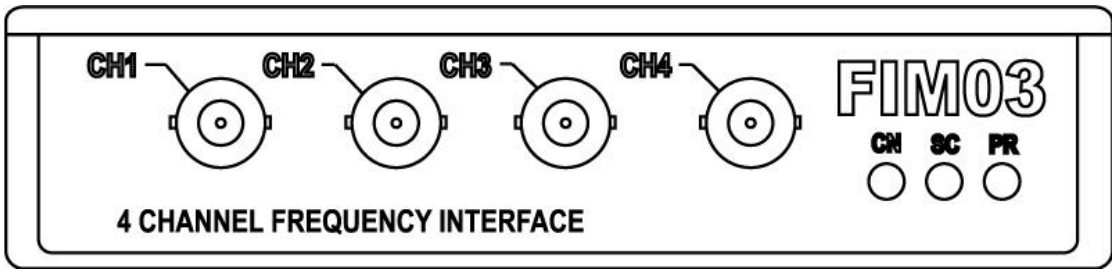
Introduction

The RLVBFIM03 is a 4-channel frequency capture and pulse counter unit. It enables frequency-based signals in the range of 1Hz to 20KHz to be recorded or logged by a VBOX. The input circuit for each channel can accept a wide signal amplitude range from TTL output sensors up to the higher voltages created by inductive sensors. This means that direct connection to ABS wheel speed sensors, RPM sensors or fuel flow sensors is possible.

The FIM03 can be configured through software to process the input frequency or pulse data to provide logged data in real units. By configuration of each channel the incoming frequency or pulse train can be easily configured into any of the following data formats:

- Frequency (Hz)
- RPM
- Speed Km/h
- Speed Mph
- Pulse count
- Fuel Used (Lt/Gal)
- Fuel Flow rate (Lt/Hr-Gal/Hr)
- Fuel Consumption (Lt/100Km)
- Fuel Consumption (Km/Lt – MPG)

In Pulse count or Fuel Used mode the device can also be configured to reset the data value when the VBOX brake trigger is applied.

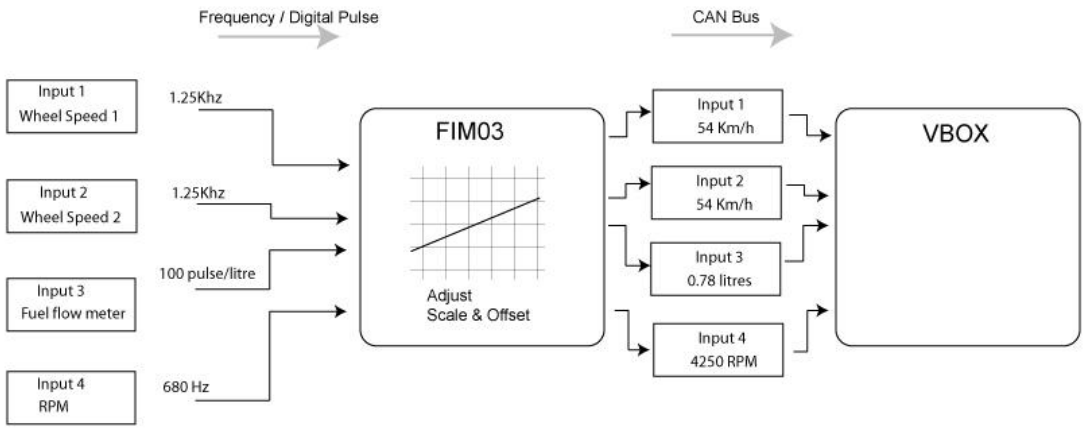


Features

- Frequency input range 1Hz to 20KHz
- Pulse counting mode
- Input channels can accept direct connection to inductive sensors such as ABS or Crankshaft sensor
- Internal scale and offset to provide SI units from sensors
- Modes for automatic calculation of RPM or wheel speed
- BNC connection for signal input

Applications

- ABS Brake stops
- Tire traction testing
- Aqua plane testing.
- Fuel Flow/Consumption
- General Vehicle evaluation
- Engine monitoring (RPM)



Parts supplied with RLVBFIM03

1 x **RLFIM03**	Frequency Input Module
1 x **RLCAB006**	Connection cable to VBOX
1 x **VBFIM03MAN**	VBOX FIM03 Manual

Specification

Input voltage (max range)	-50 volts to +50 volts
Minimum signal amplitude	Approx 1v pk-pk
Input frequency range	1Hz to 32Khz
Timer	24 Bit
Timer resolution	67ns
Max Pulse count before reset	1 000 000 pulses
Data output to VBOX	Frequency **Hz** Wheel speed **Km/h** or **Mph** Wheel **RPM** Scaleable pulse count Fuel Used **Lt or Ga**l Fuel Flow rate **Lt/Hr** or **Gal/Hr** Fuel Consumption **Lt/100Km** or **MPG** User defined scale and offset for sensor calibration
Signal Input connection	4 x BNC Connector
VBOX Connection	2 x Lemo socket for connection to VBOX CAN Bus
Height	32mm
Width	128mm
Depth	120mm
Operating Voltage	+12v DC

Connection of FIM03 to VBOX

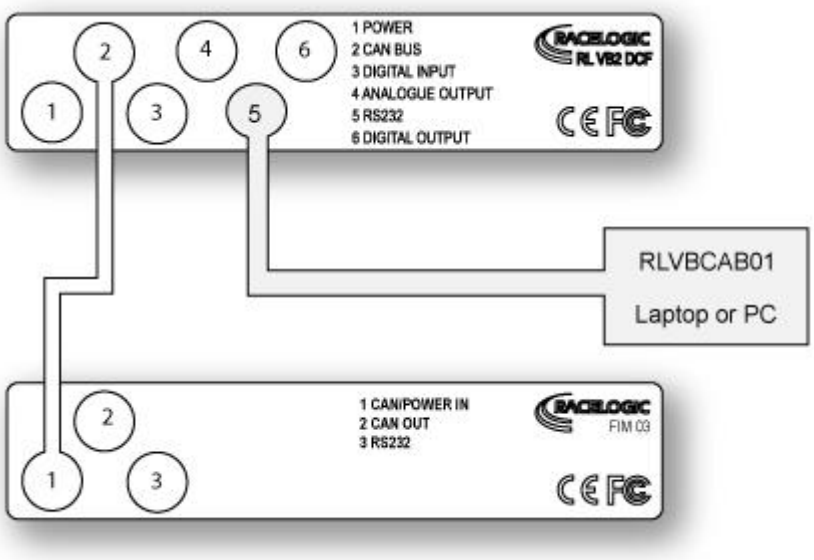


Fig. 1

The FIM03 is supplied with a connecting cable for connection to the VBOX CAN Bus.

Connectors 1 and 2 on the FIM03 share the same pin-out to allow “daisy-chaining” of multiple Racelogic units. It is therefore possible, for example, to link two FIM03 units together with a VBOX to record eight wheel speeds simultaneously.

Setup Channel Information

Set up of the FIM03 is accomplished through the VBOX setup facility in VBOXTools software. With the FIM03 connected to the VBOX, ensure that the VBOX is powered and connected to the PC serial port. Click **VBOX Setup** on the main menu bar. When the VBOX Setup window appears, a **FIM Modules** tab should be present. Click the **FIM Modules** tab. This will display the serial number of the FIM03 module along with 6 channel buttons (fig.2). The check boxes associated with each channel allow the user to enable (checked) or disable (unchecked) a channel for logging or inclusion into the RS232/USB serial data stream.

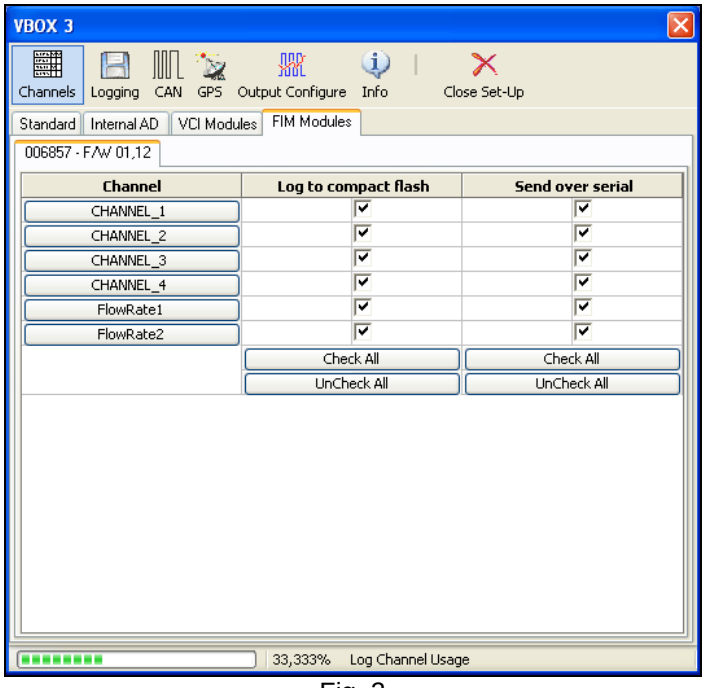
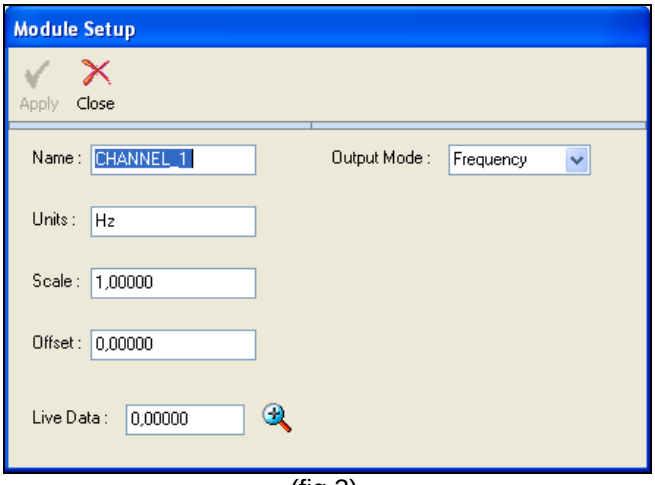


Fig. 2

To configure a channel, click the corresponding Channel button. A channel setup window will appear showing the current settings for Channel Name, Channel units, Output mode, Scale and offset



(fig.3).

Channel Name
The user can change the channel name to provide a meaningful description for the input channel.

Units
The 'Units' option does not alter the recorded data. It is only a description for the user to understand the data. The value of the data is only affected by the scale and offset values.
Scale
The scale value corresponds to X in the equation Y=MX+C that is applied to the input signal.
Offset
The offset value corresponds to C in the equation Y=MX+C.

In the Y=MX+C equation, Y is the output value that is logged by the VBOX while M corresponds to the input or "Measured" value.

Output Mode
The OUTPUT MODE selection is used to select one of five operating modes for each channel. These are frequency, RPM, mph, km/h and pulse count plus fuel flow and fuel rate on channels 2 & 3 modes and are described as follows.

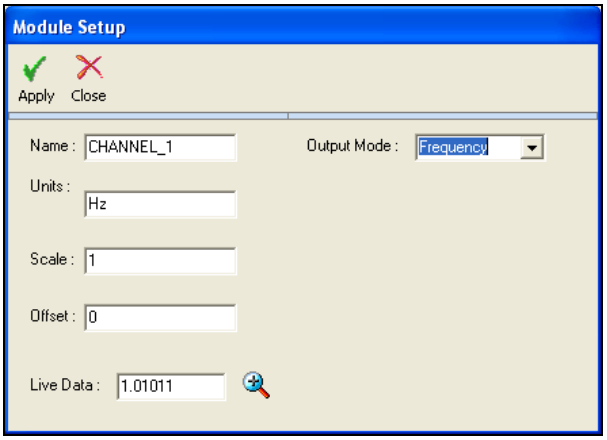


Fig. 4

Output Mode = Frequency

In the frequency mode, the channel will be measured as a direct frequency. Scale and offset are available in this mode. A scale of 1 and offset of 0 will record a value in Hz. Changing the scale and offset allows calibration for SI units when using digital output sensors such as pressure transducers.

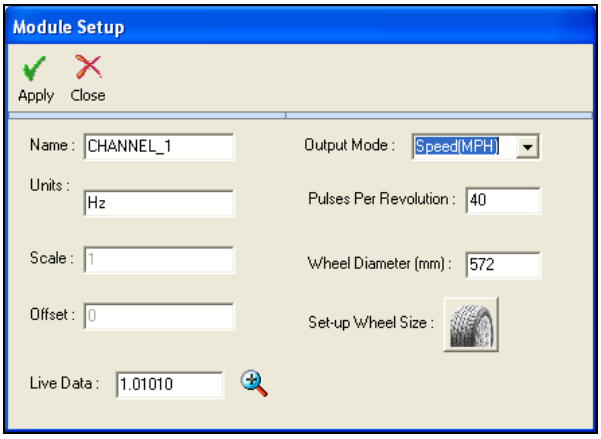


Fig. 6

Output Mode = Speed (Km/h or Mph)

Selecting speed out mode is designed for use in vehicle testing. It enables the user to configure pulses per revolution corresponding to, for example, an ABS wheel speed sensor, and a wheel diameter (in millimetres). Wheel circumference is calculated from the wheel diameter and in conjunction with the pulses per revolution allows the FIM03 to output either Km/h or Mph values for each of the four signal inputs.

Output Mode = Pulse Count

Selecting pulse count mode enables

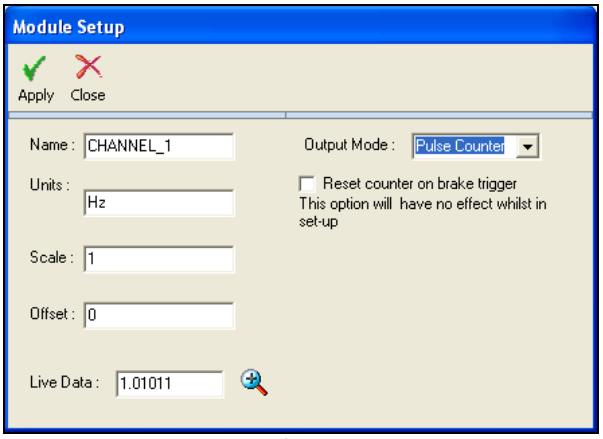


Fig. 7

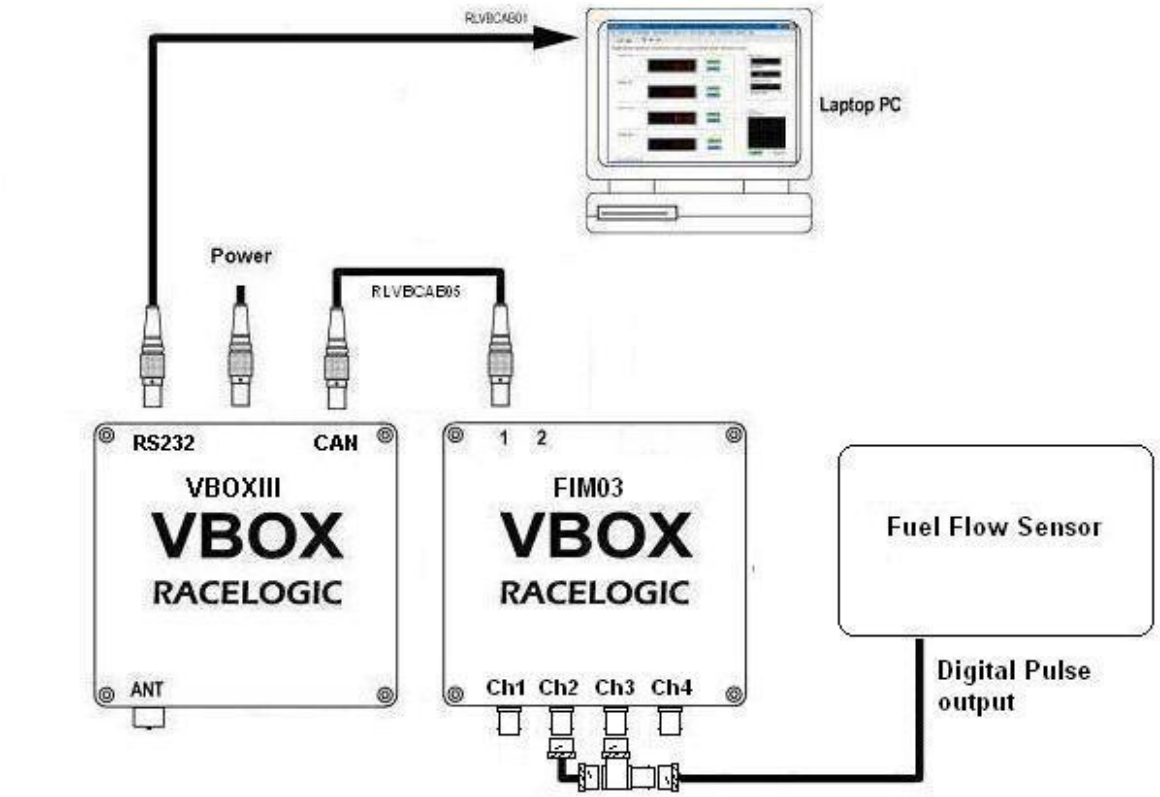
the user to view the number of pulses received since the last reset. The counter can also be configured to reset when the brake trigger signal into the VBOX is activated (this setting will not take effect until set-up is exited). The maximum number of pulses that are counted before the count is reset is 1000000.

Fuel Flow Modes

The FIM03 has a dedicated Fuel Flow function, in which the FIM03 will automatically scale and create the following fuel flow related channels:

- Fuel Used (L,Gal)
- Fuel Flow rate (L/Hr, Gal/Hr)
- Fuel Consumption rate (L/100Km)
- Fuel Consumption rate (Km/L, MPG)

Also in this mode two new Channels 5 and 6 are created for the fuel consumption channels. However, to use Fuel Flow mode Channels 2 and 3 must be connected to the fuel flow sensor. The FIM03 must be connected in the following way in order to be able to output all of the channels listed above:



Channel 2 input is dedicated to a fuel used measurement.
Channel 3 input is dedicated to a fuel rate measurement.
NOTE: Channel 3 must be connected to the fuel flow input when fuel consumption data is required, e.g. Km/L and L/100Km.

Configuring the FIM03 in fuel flow modes:

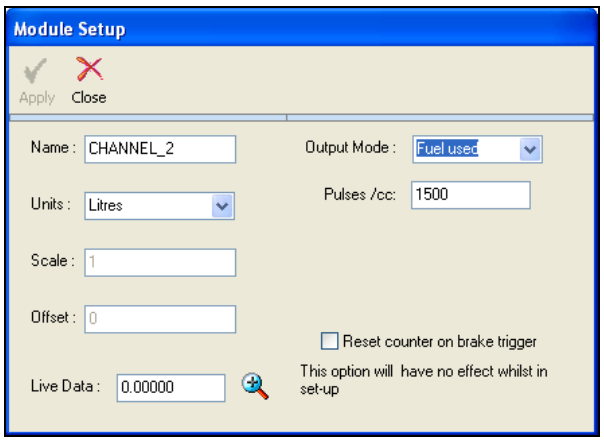


Fig. 8

Fuel Used (channel 2)
Set Channel 2 to Fuel Used mode by selecting “Fuel used” in the Output Mode dropdown list.
Enter the pulse/cc value for the fuel flow sensor that is connected to the FIM03. The FIM03 will then automatically calculate and scale this channel to Fuel Used in either Litres, Gallons (UK) or Gallons (US). Select the desired units form the drop down menu.
If the “Reset counter on brake trigger” option is enabled then the fuel used value will be reset to zero whenever a switch connected to the VBOX brake trigger input is activated.

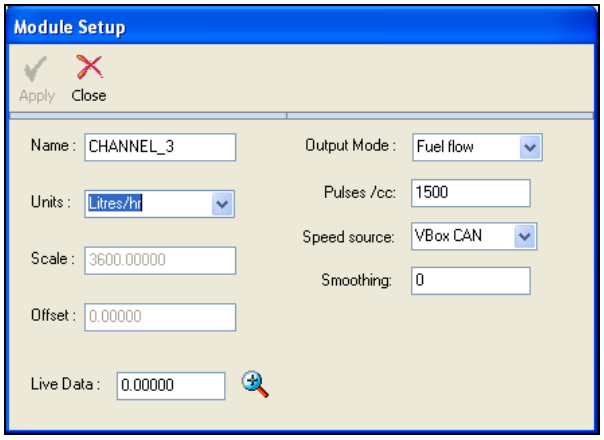


Fig. 9

Fuel Flow (channel 3)
Set Channel 3 to Fuel Flow mode by selecting “Fuel flow” in the Output Mode dropdown list.
Enter the pulse/cc value for the fuel flow sensor that is connected to the FIM03. The FIM03 will then automatically calculate and scale this channel to Fuel flow in Litres/hr or Gallons/hr (UK or US). Select the units form the dropdown menu.

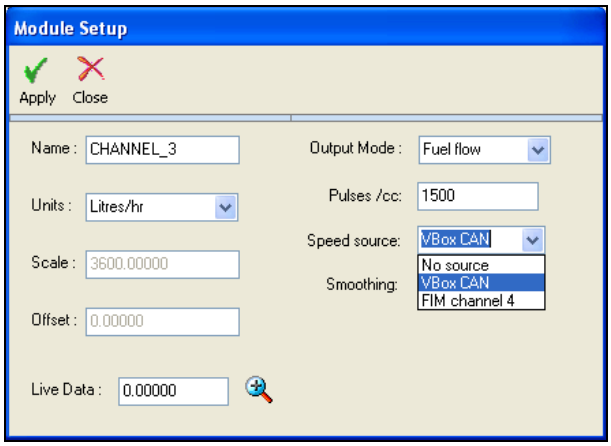


Fig. 10

Fuel Consumption rates (channels 5 & 6)
Fuel Consumption rate (L/100Km)
Fuel Consumption rate (Km/L, MPG)

The FIM03 will only generate the fuel rate data shown above (Channels 5 & 6) if Channel 3 is connected to a fuel flow sensor and configured correctly. Configure Channel 3 as shown above in Fig 9.
Set the Speed source to “VBOX CAN” if the FIM03 is being used with VBOX.

Using an alternative speed source for fuel flow measurement on the FIM03
Speed is required by the FIM03 to calculate the Fuel Consumption rates. In most cases this will come from the VBOX via the existing CAN connection.
If it is required to use a speed source other than that from the connected VBOX, Channel 4 of the FIM03 can be set to be the speed source for the calculations.
NOTE: When Channel 4 is used as the speed source it must be configured to measure speed in km/h, otherwise the Fuel Consumption rates on Channels 5 & 6 will be wrong.

Example Data

Fuel flow example data. (taken from a Truck)
In the screen shot below Fuel used (litres) is displayed in Green.
Fuel flow rate (L/100Km) is displayed in Blue
Speed is displayed in Red and RPM in Brown.
You can see the Flow rate displaying a high flow rate (L/100Km) as the vehicle is accelerating and the RPM climbs
Then as the RPM drops, because the throttle pedal has been lifted, the Flow rate drops to zero in line with when the fuel injectors stop injecting.
You can also see the Fuel used (litres) rising in line with the Fuel flow rate.

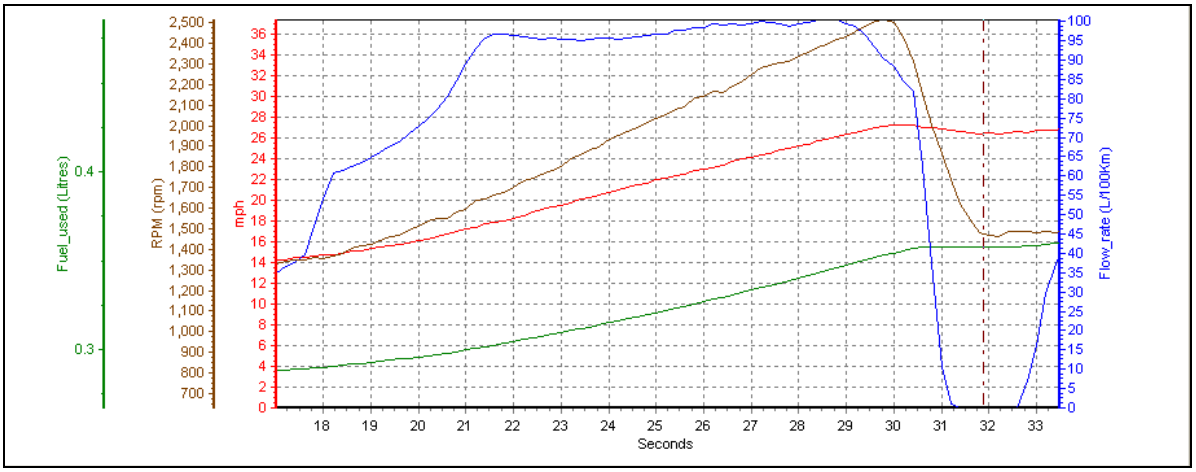


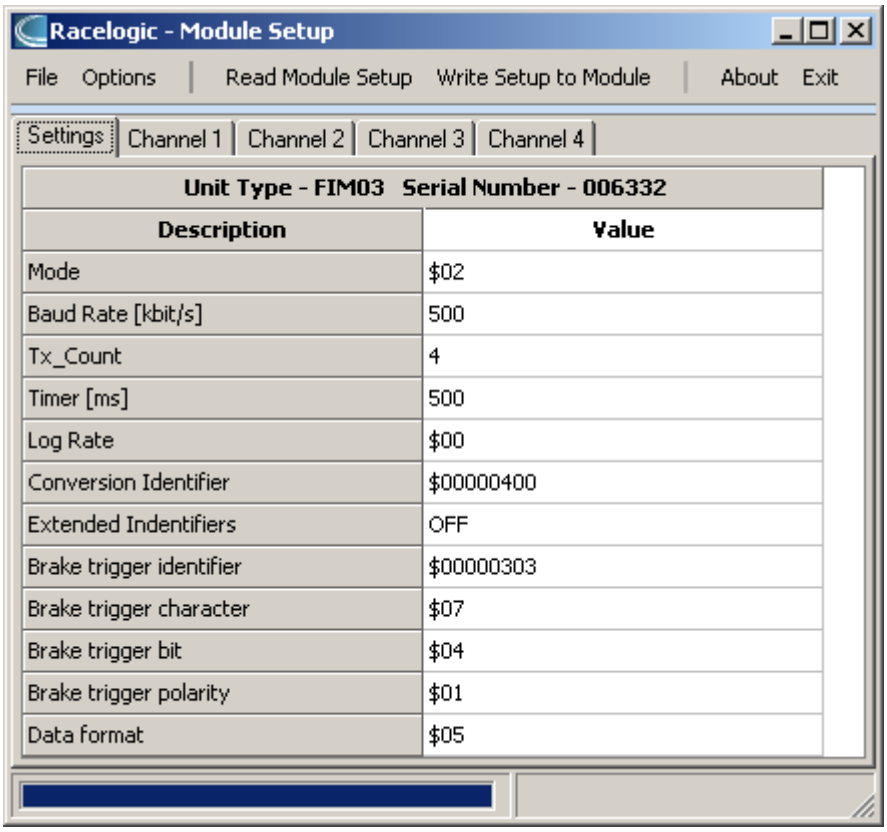
Fig. 11

Stand Alone mode (using the FIM03 with a Datalogger other than VBOX)

The FIM03 can be easily configured to run in different CAN Bus operating modes using the supplied RLVBCAB30 cable and Racelogic “Module Setup” software.

Configuring the FIM03 with Racelogic Module Setup Software

1. Connect the FIM03 to a PC using the supplied RLVBCAB30 cable.
2. Power up the FIM03 using a suitable 12v power source. Please observe correct polarity (Red=12v, Black = Ground).
3. Run the Module Setup software.
4. Click “Read Module Setup” – you should see a screen similar to that shown below. If you get a “No response” message then check the FIM03 is correctly connected, the power supply is on and that the correct COM Port is selected in the Module Setup software.
5. Make the changes required and then click the “Write Setup to Module” button.



Note: When any change is made using the Module Setup Software the POWER MUST BE CYCLED for the change to take effect!

CAN Operating Modes

Mode 0 Racelogic Polled CAN Mode
Mode 1 User Polled CAN Mode
Mode 2 Timed CAN Mode

Racelogic Polled CAN Mode **- *Mode 0***
This mode should be set if the module is to be used with a Racelogic VBOX. All the CAN parameters are set to work with the Racelogic VBOX CAN protocol. In this mode no other parameters need be set or indeed will have any effect.

User Polled CAN Mode **- *Mode 1***
This mode allows a customer's own datalogging system to poll the module for data using the CAN bus. In this way, the output timing of the sensor can be synchronised with other CAN information. The following parameters are all used and so must be set:
Baud rate (Selectable from 125kbit/s, 250kbit/s, 500kbit/s or 1Mbit/s)
Extended Identifiers (OFF or ON)
Request identifiers (Identifiers used to request data from the sensor)
Response identifiers (Identifiers used to transmit data from the sensor)

The timer parameter has no effect in this mode.

Timed CAN Mode **- *Mode 2***
In this mode the module will send CAN data at intervals determined by the Timer value. The following parameters are all used and so must be set:
Timer (Time interval in milliseconds between output data)
Baud rate (Selectable from 125kbit/s, 250kbit/s, 500kbit/s or 1Mbit/s)
Extended Identifiers (OFF or ON)
Response identifiers (Identifiers used to transmit data from the sensor)

The Request Identifiers have no effect in this mode.

Setup Parameters

Baud Rate
Baud Rate sets the bit rate of the CAN messages (not the frequency at which the messages are sent). The range of values that can be entered is 0 to 65535 however only the values indicated in the Setup Parameters Table should be used. A value other than these will cause the module to change the Baud Rate value to 500kbit/s on the next power cycle.

Tx Count
This TX count is the number of CAN channels transmitted so for the FIM03 this should be set to 4.

Timer
The timer value is in milliseconds (ms). A smaller value means data will be sent more frequently, a larger value means data will be sent less frequently. The range of values that can be entered is 0 to 65535 however the minimum value that should be entered is 10. Below this value data values may be repeated on successive cycles. If a value of 0 is entered the module will change it to 1 on the next power cycle.

Frequency output can be calculated as follows:
Freq = (1/Timer) * 1000

The Timer value for a required frequency can be calculated as follows:
Timer = (1/Freq) * 1000

Some example Timer values are shown against the frequency output.

Timer Value [ms]	Frequency [Hz]
10	100
50	20
100	10
400	2.5
1000	1

Log Rate
This setting has no user-adjustable settings at present and should always be kept at a value of 1.

Conversion Identifiers
The Conversion Identifier only has an effect in User Polled Mode. When the module receives this identifier with zero data bits it will sample its inputs. This is set as separate command to a data request identifier so that it gives the module time to make a data conversion before having to send the data on the CAN bus.

Extended Identifiers
Extended Identifiers can be set either ON or OFF. If they are off the CAN identifier type will be standard (11 bit). If they are on the CAN identifier type will be extended (29 bit). The Standard Identifier type allows 2048 different CAN message identifiers or message “names”. The Extended Identifier type allows 436207616 different CAN message identifiers. The identifier type should be set to match the CAN data logging equipment that the module is connected to.

Entering a value of “off”, “OFF” or “0” will turn Extended Identifiers off. Any non-zero value, “on” or “ON” will turn Extended Identifiers on.

Brake Trigger ID
Sets the ID of the CAN message which contains the brake trigger signal for resetting the value of channels acting as a pulse counter. Note that each individual channel must have its ‘Reset On Brake’ value set to YES ($0010) for the brake trigger to affect it.

Brake Trigger Character
Defines which byte of the CAN message specified above contains the brake trigger bit. This value reads from left to right, from 0 upwards.

Brake Trigger Bit
Defines which bit of the byte specified above is the brake trigger bit. This value reads from right to left, from 0 to 7.

Brake Trigger Polarity
Specifies whether a brake trigger bit of 1 signifies that the brake trigger is ON (1) or OFF (0).

Data Format
This option allows you to change the format in which data is transmitted in stand-alone mode.
The available Format options are:

- IEEE 32-bit float
- 32-bit unsigned integer
- 16-bit signed integer
- 16-bit unsigned integer
- Racelogic float
- 32-bit signed integer

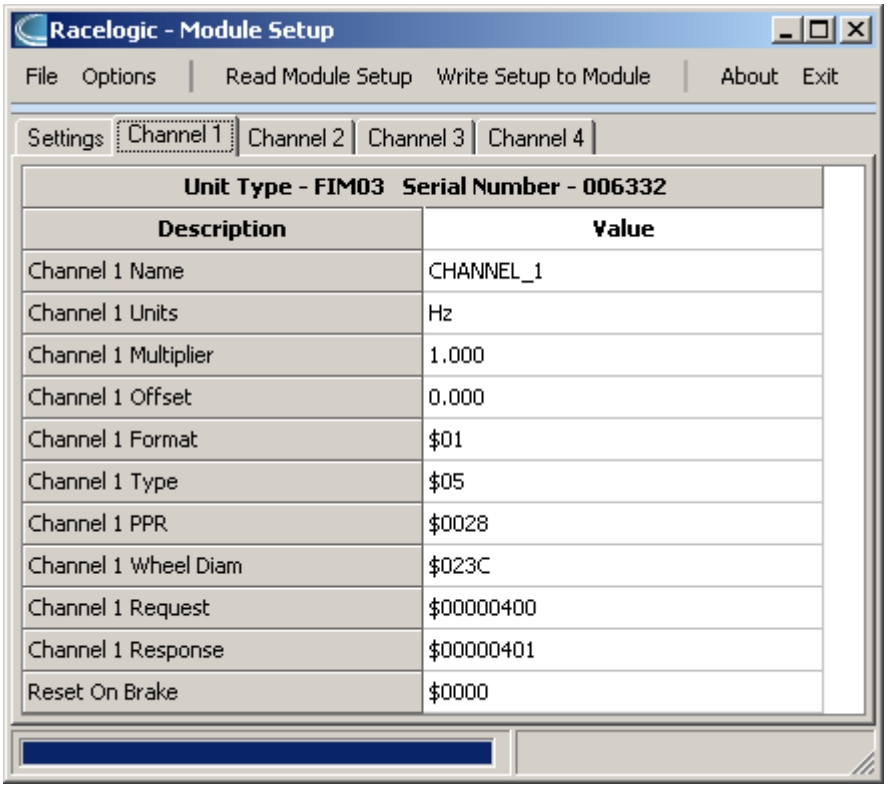
Setup Parameters Table

Parameter	Options	Value to Enable	Comments
CAN Mode	Racelogic Polled mode	0	VBOX compatible mode. In this mode no other parameter has any effect.
	User Polled mode	1	Baud Rate must be set. Extended Identifiers must be set. Request Identifiers must be set. Response Identifiers must be set.
	Timed mode	2	Timer must be set. Baud Rate must be set. Extended Identifiers must be set. Response Identifiers must be set.
Baud Rate [kbit/s]	1000 kbit/s	1000	If a Baud Rate value other than those specified is entered it will be changed to a default value of 500kbit/s.
	500 kbit/s	500	“
	250 kbit/s	250	“
	125 kbit/s	125	“
TX Count	0-max no of module channels	4 (for normal FIM03 use)	
Timer [ms]	(message interval in ms)	10-65535	Minimum value is 10 (100Hz) – below this value data may be erroneous. If the Timer value is set to 0ms and Timed CAN Mode is on then Timer value will be changed to 1ms.
Extended Identifiers	Standard (11 bit)	OFF	Request and Response Identifier range is 0 – 0x7FF (0 – 2047).
	Extended (29 bit)	ON	Request and Response Identifier range is 0 – 0x19FFFFFF (0 – 436207615).
Brake Trigger ID	(User-defined identifier)	Dependant on “Extended Identifiers” parameter	ID of CAN message containing brake trigger.

Parameter	Options	Value to Enable	Comments
Brake Trigger Character	(Brake trigger byte position)	Dependant on brake trigger CAN message's DLC	The position of the bit within the brake trigger byte that is used for the brake trigger, counting from left to right, 0 upwards. Between 0 and CAN DLC-1.
Brake Trigger Bit	(Brake trigger bit position)	0-7	The position of the bit within the brake trigger byte that is used for the brake trigger, counting from right to left, 0 to 7.
Brake Trigger Polarity	ON	1	Brake trigger bit value of 1 counts as brake trigger on.
	OFF	0	Brake trigger bit value of 0 counts as brake trigger on.
Data Format	IEEE 32-bit float	0	
	32-bit unsigned integer	1	
	16-bit signed integer	2	
	16-bit unsigned integer	3	
	Racelogic float	4	
	32-bit signed integer	5	

Channel setup parameters

The channel setup tab allows adjustment of individual channels settings. The basic Name, Units, Multiplier and Offset values allow you to set the channel name and units (for use with equipment that can display this data) and to change the scale and offset values of the data sent for that channel. Format has no user-adjustable settings at present and should always be kept at a value of 1.



Type
This determines the output mode of the channel, which can directly display values as frequency, speed, rpm or counts:

Value:	Type:
1	Frequency
2	RPM
3	Speed (km/h)
4	Speed (mph)
5	Pulse Counter

PPR (Pulses Per Revolution)
For data types that require information about the number of pulses generated per revolution of a wheel, this value allows you to set the required value.

Wheel Diam (Wheel Diameter)
For data types that require information about the wheel diameter, this value allows you to set this value, in mm.

Request and Response Identifiers
The Request Identifiers only have an effect in User Polled CAN Mode. They set the identifier values that the module will filter for. If a CAN message is received that matches a Request Identifier then

the module will respond by sending the corresponding channel data on the corresponding Response Identifier. *Note: All channels can have the same Request Identifier – this means that on receipt of a single CAN message the module will respond with all channels of data. The Response Identifiers MUST all be different.*

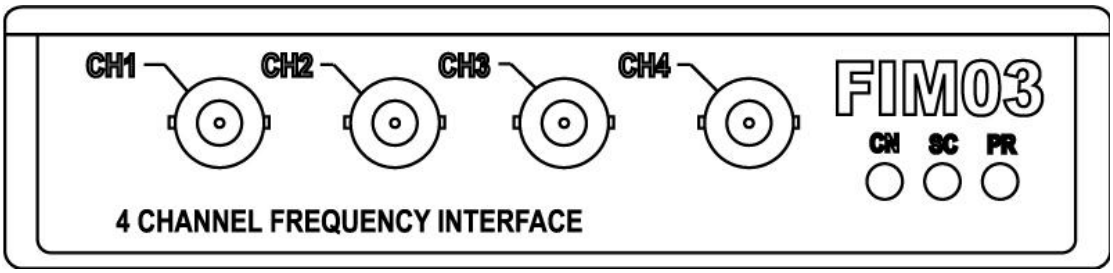
In Timed Mode the channel data will be sent at intervals with the corresponding Response Identifier – the Request Identifiers have no effect.

When using Standard Identifiers the maximum value for the identifiers is $7FF. Entering a value higher than this may result in unexpected results, for instance a Response Identifier of $00FFAA23 will result in a message being sent with Identifier $223. To avoid anything unexpected the request and response identifiers should be set appropriately for use with Standard Identifiers by observing the range of values in the Setup Parameters Table.

Reset On Brake
This option allows you to specify whether or not the channel's pulse count is reset when the FIM03 receives a brake trigger CAN message:

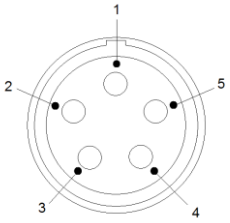
Set Value:	Returned Value:	Effect:
ON	$0010	Brake trigger will reset that channel's pulse counter.
OFF	$0000	Brake trigger will NOT reset that channel's pulse counter.

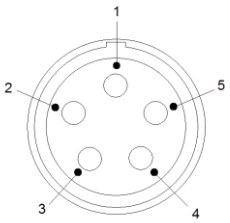
Connector Assignments

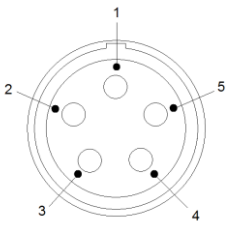


BNC Connections for Channels 1 to 4

Connection	Function
Centre Pin	Signal Input
Outer shield	Signal Ground

LEMO Connector 1 – CAN/POWER IN			
Pin	I/O	Function	
1	I/O	Direct connection to Connector 2 pin 1	
2	I/O	Direct connection to Connector 2 pin 2	
3	I/O	CAN High	
4	I/O	CAN Low	
5	I	+12 V Power	
Chassis		Ground	

LEMO Connector 2 – CAN OUT			
Pin	I/O	Function	
1	I/O	Direct connection to Connector 1 pin 1	
2	I/O	Direct connection to Connector 1 pin 2	
3	I/O	CAN High	
4	I/O	CAN Low	
5	O	+12 V Power	
Chassis		Ground	

LEMO Connector 3 – RS232			
Pin	I/O	Function	
1	O	TxD, Serial Data Transmit	
2	I	RxD, Serial Data Receive	
3	-	-	
4	-	-	
5	-	+12 V Power	
Chassis		Ground	

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Document updates

#	Description	Date
1	First issue. CLS	15/04/05
2	Additions to the stand alone output formats	6/01/06
3	Amendment to supplied parts	13/03/07
4	Specification of max pulse count	15/03/07
5	Inclusion of Declaration of Conformity Statement	05/06/07
6	New screen shots for VBOXTools compatibility	9/4/08
7	New Fuel Mode, explanation added	9/4/08
8	Contact details updated	30/04/08
9	Addition of 12v Power connection into RS232 socket	16/8/13