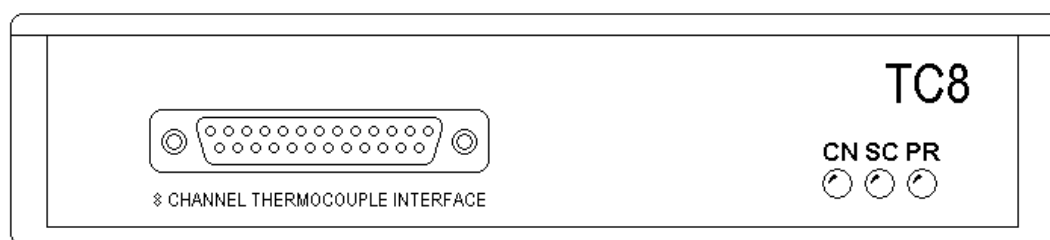


8 Channel CAN Bus K Thermocouple Interface RLVBTC8

Instruction Manual



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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 RLVBTC8 8 Channel thermocouple interface module is designed for use with a VBOX 2 data logging system. The module is configured via CAN through the VBOX setup function of the VBOX software.

Key features

- 8 * K-type thermocouple inputs
- Supports standard & extended CAN frames
- CAN data rate up to 1Mbit
- Configuration via

Parts supplied with RLVBTC8

1 x RLVBTC8	Thermocouple interface
1 x RLVBCAB06	Connection cable to VBOX II.
1 x Terminal block	Sub D terminal block with integrated CJC (Cold Junction Compensation).

Optional accessories

RLVBACS002	2m Thermocouple extension with high accuracy dynamic CJC.
RLVBCAB01	Serial connection cable for firmware upgrades

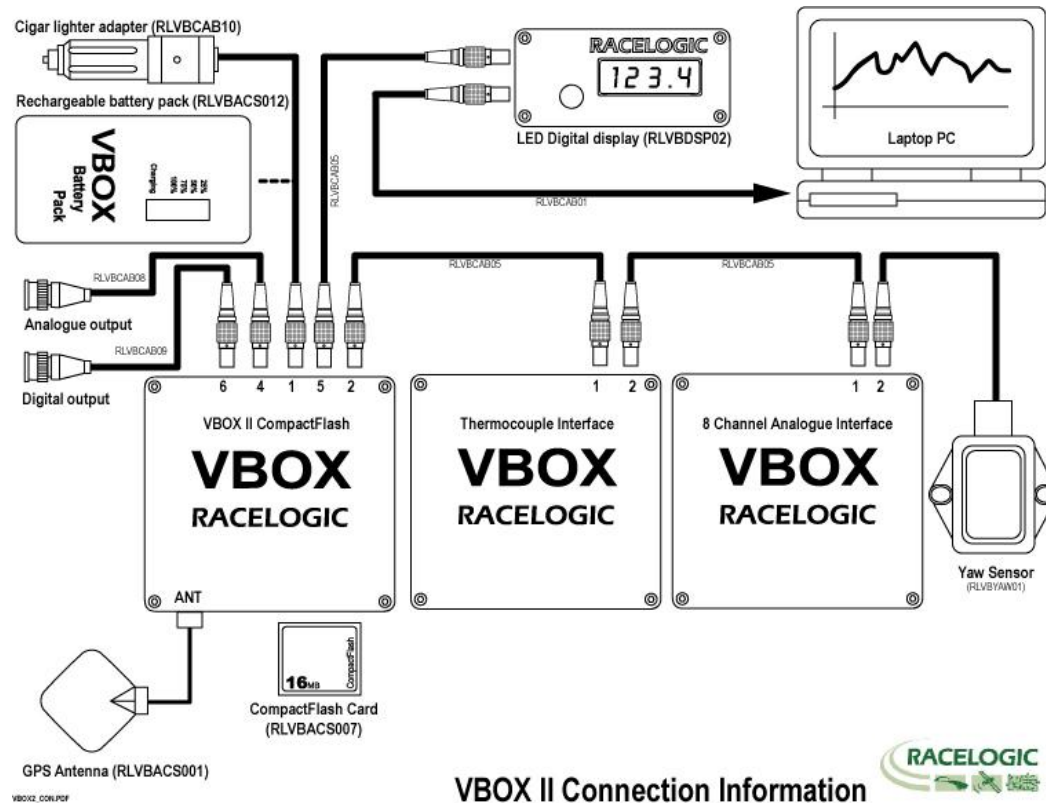
Specification

Input Channels	8 Differential input channels		
Input Signals			
Thermocouple type			
K	-270 °C	To	1372°C
Sample rate	6Hz continual update		
Resolution	16 bit		
Accuracy			
Thermocouple	CJC within 25way D sub connector typically better than $\pm 0.3^{\circ}\text{C}$		
Isolation voltage	1000 VDC to processor		
Over voltage protection	± 35 VDC		
Common mode voltage	< 2 V		
CMR (50/60)Hz	> 92dB		
Power supply voltage	+12 VDC ($\pm 10\%$)		
CAN			
Type	CAN 2.0A or CAN 2.0B compatible		
Baud Rates	250Kbit/s 500Kbit/s 1Mbit/s		

Installation

The module is designed for use with the VBOX system. To connect the module to a VBOX II use the 5 way LEMO to 5 way LEMO cable (RLVBCAB06). Plug one end of this cable into connector 2 (CAN bus) on the VBOX. Plug the other end of the cable into either connector 1 or connector 2 of the thermocouple module. The function of connectors 1&2 on the thermocouple module is the same to allow daisy chain connection of other devices on to the CAN bus. Power is also supplied to the module through the CAN Bus cable.

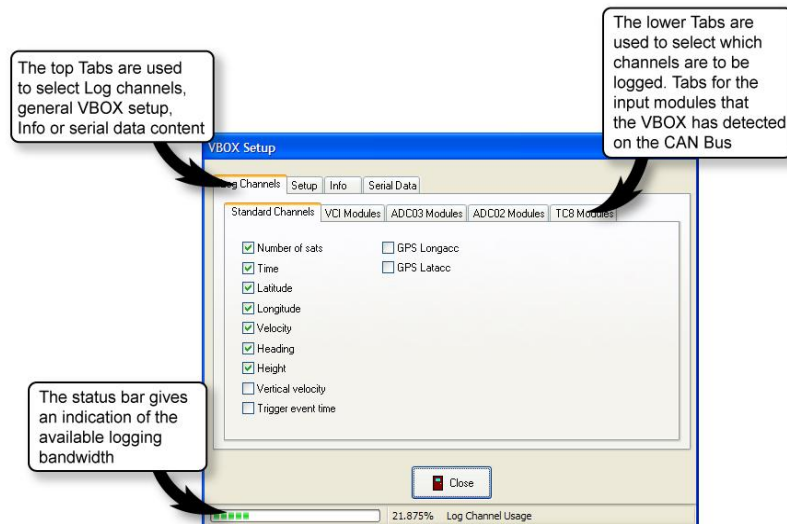
Typical installation



Configuring the TC8 for use with VBOX

The configuration of the TC8 module and its individual channels is done through the connected VBOX using VBOX software.

When a module is connected to a VBOX, it will be automatically recognised and a Tab for the module will appear in VBOX setup section of the VBOX software.

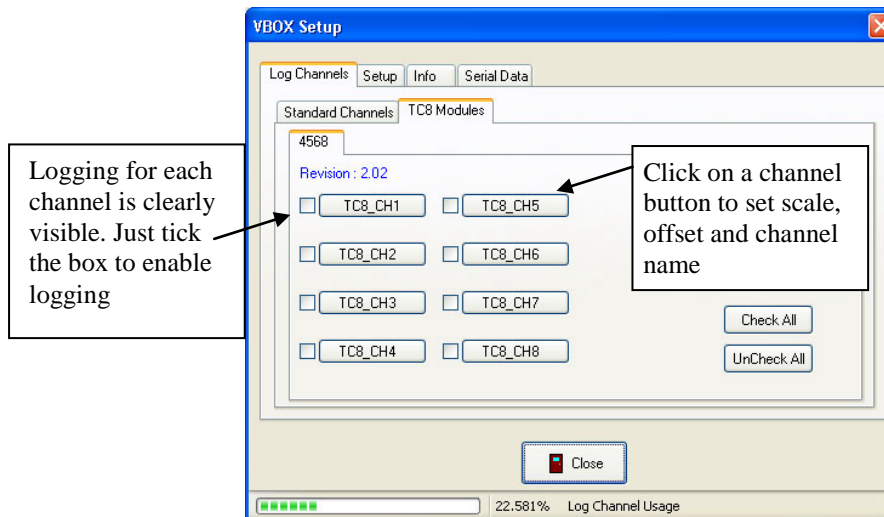


The bandwidth status bar gives an indication of available logging bandwidth. When the status bar is full, all of the bandwidth is used. If more logging channels are added beyond this, there is a risk that data will be lost. The bandwidth status bar is calculated for a speed optimised compact flash card. If a windows formatted card is used (see applications note Compact Flash Formatting on Racelogic web site), the status bar may be inaccurate with the risk that data will be lost.

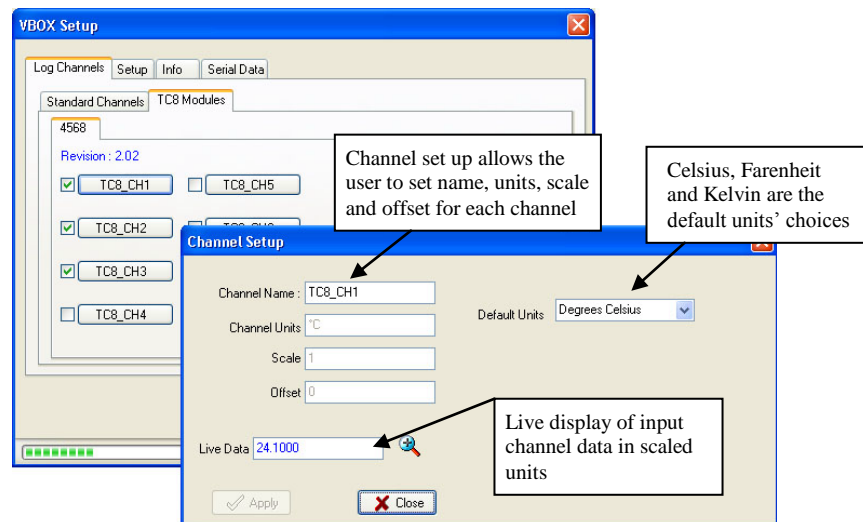
Thermocouple Interface

The VBOX creates a tabbed page in the set up window for each input module that it finds. If it finds two modules of the same type (e.g.; 2 x TC8) then it lists each one by its serial number. A Channel is enabled for logging by clicking in the small box to the left of the larger channel box.

Clicking on the 'Check All' button enables all of the channels, in the same manner, clicking on the 'Uncheck All' disables all of the channels.



Clicking on a channel button opens up a channel set up allowing the user to set the channel name, the units of measurement, the scale and the offset. Once a channel is configured, the settings are stored within the associated module. Also displayed in the channel set up is a real-time view of the data on that channel.

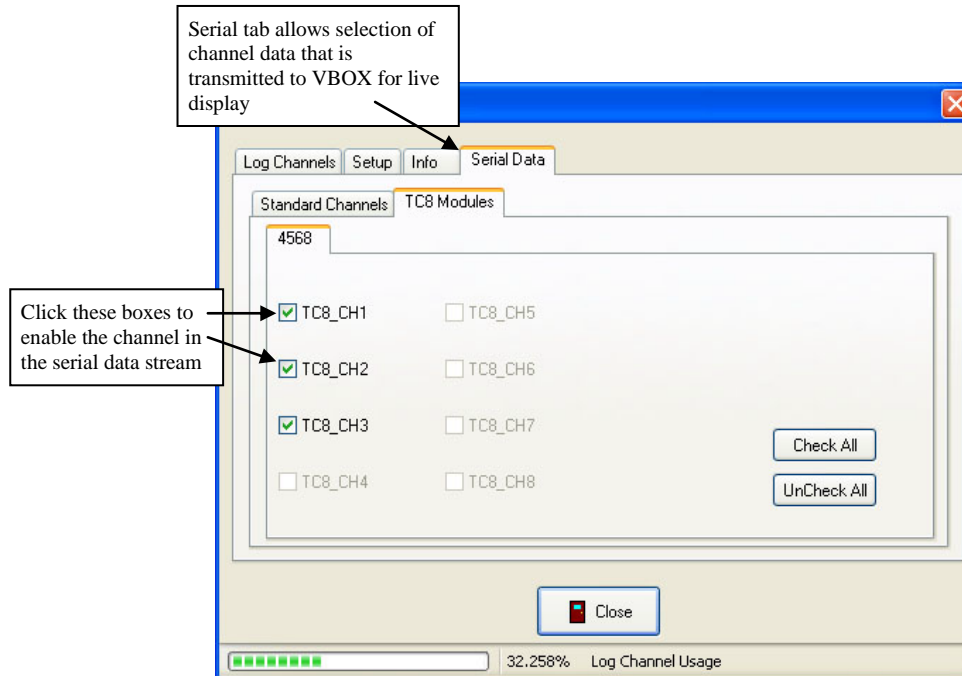


If the user wishes to specify their own units then the 'User Defined' option needs to be selected from the Default Units drop down menu.

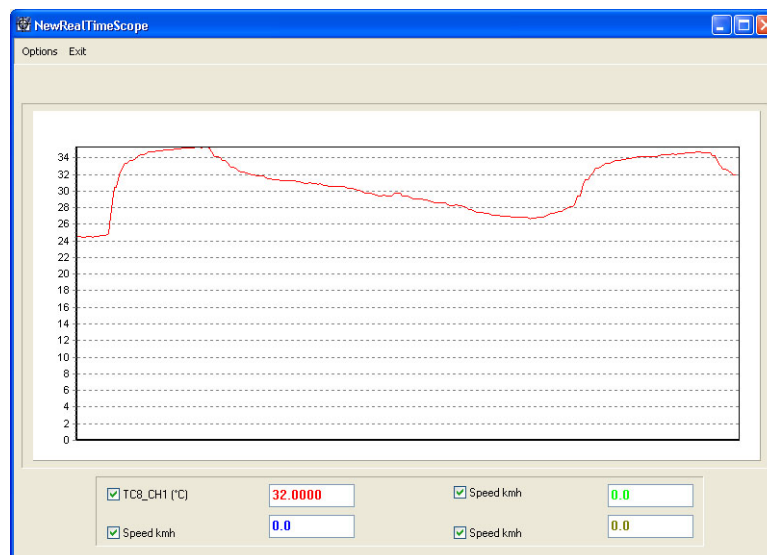
Thermocouple Interface

Serial Data

In addition to the data that is logged by the VBOX, there is a serial data stream that is transmitted to the PC. This serial data stream can now be freely configured to include data from input modules. This then allows the data to be displayed in the real-time scope display.



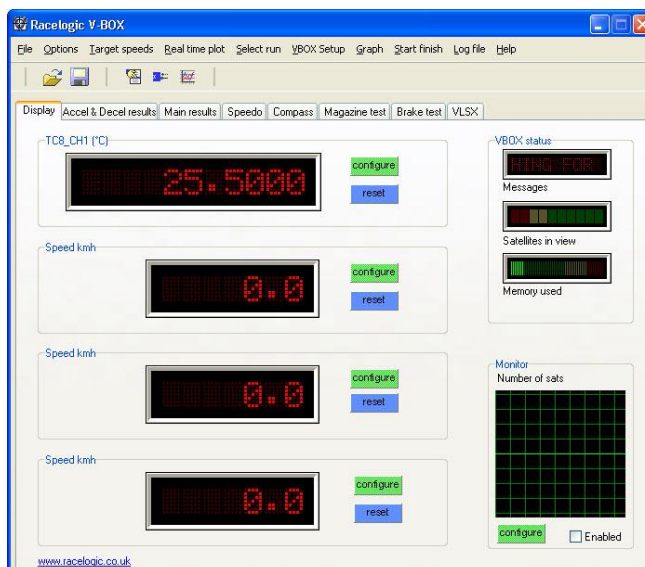
Channels in the serial data can be displayed through the real-time scope view. This can show up to 4 separate data values at once.



Thermocouple Interface



Serial data channels can also be displayed in the 4 user configurable displays on the main VBOX screen.

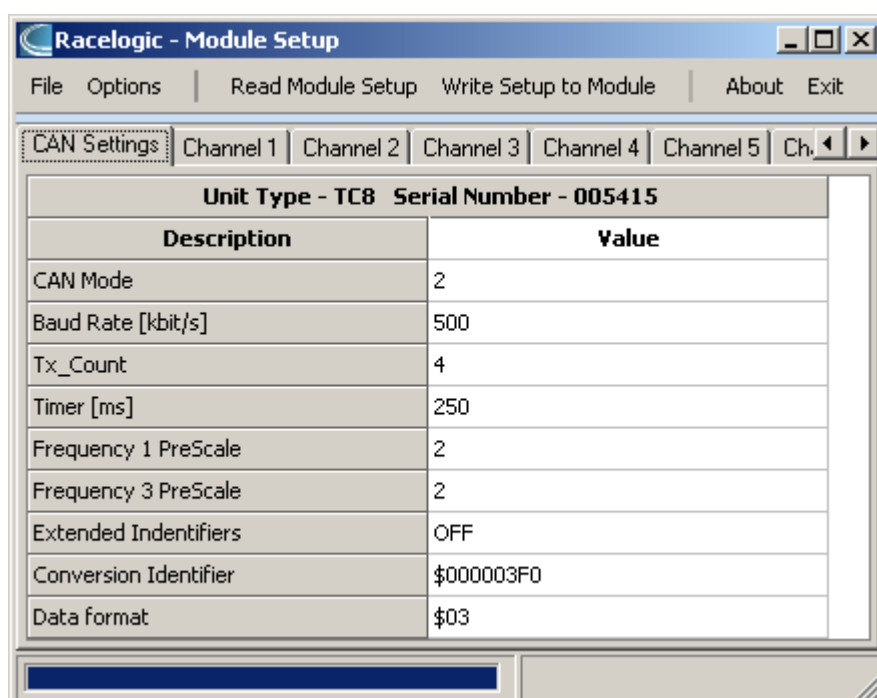


Stand Alone mode (Using the TC8 with a Datalogger other than VBOX)

The TC8 can be easily configured to run in different CAN Bus operating modes using the supplied RLVCAB30 cable and Racelogic "Module Setup" software.

Configuring the TC8 with Racelogic Module Setup Software

1. Connect the TC8 to a PC using the supplied RLVCAB30 cable.
2. Power up the TC8 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. The screenshot shows the settings for a TC8. If you get a "No response" message then check the TC8 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.

Data Format in User Polled and Timed CAN 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 TC8 this should be set to 8.

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:

$$\text{Freq} = (1/\text{Timer}) * 1000$$

The Timer value for a required frequency can be calculated as follows:

$$\text{Timer} = (1/\text{Freq}) * 1000$$

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

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.

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.

Data Format

This option allows you to change the format in which data is transmitted in stand-alone mode.

Thermocouple Interface

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	8 (for normal TC8 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).
Data Format	IEEE 32-bit float	0	
	32-bit unsigned integer	1	
	16-bit signed integer	2	

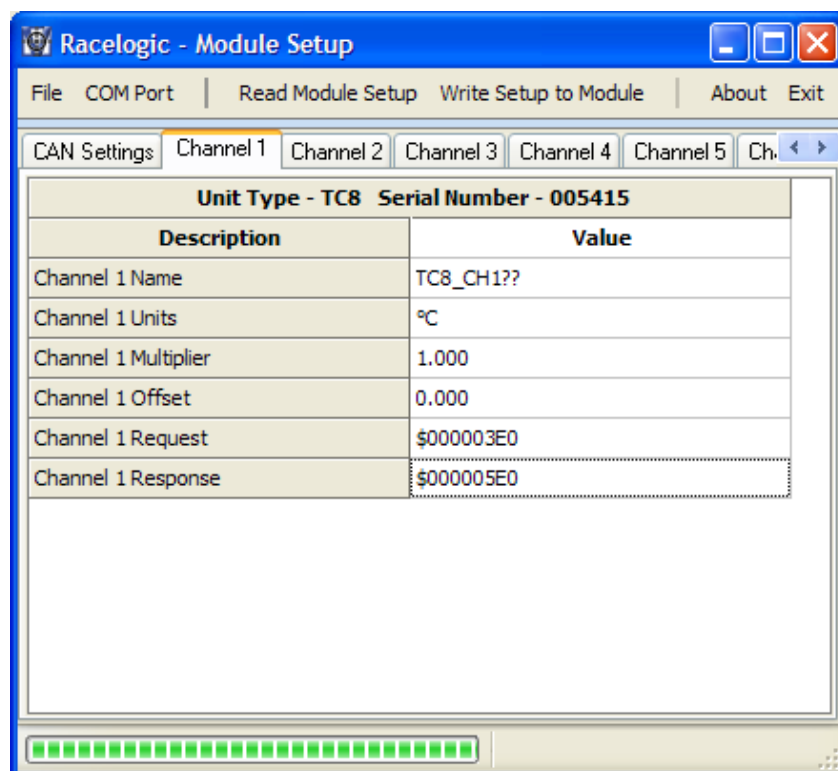
Thermocouple Interface



Parameter	Options	Value to Enable	Comments
	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. In the example for TC8 shown below it can be seen that multiplier and offset values are available to allow the user to re-scale the output data. In the case of the TC8, its native output is in Degrees Celsius and so a scale of 1 and offset of 0 will give a reading in Degrees C. However, the scale and offset could for example be changed to rescale the output value to Fahrenheit.



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.

Upgrading Firmware

Occasionally it is required to upgrade the firmware of your Racelogic module. This may be due to improvements to functionality or fixes to bugs that may be found. The latest firmware is always available on the website www.racelogic.co.uk/2003/vbox.

As part of the original VBOX software installation there should be a Vbox_Upgrade.exe file in the Utilities folder of the VBOX directory. If not, this is also available for download from the website.

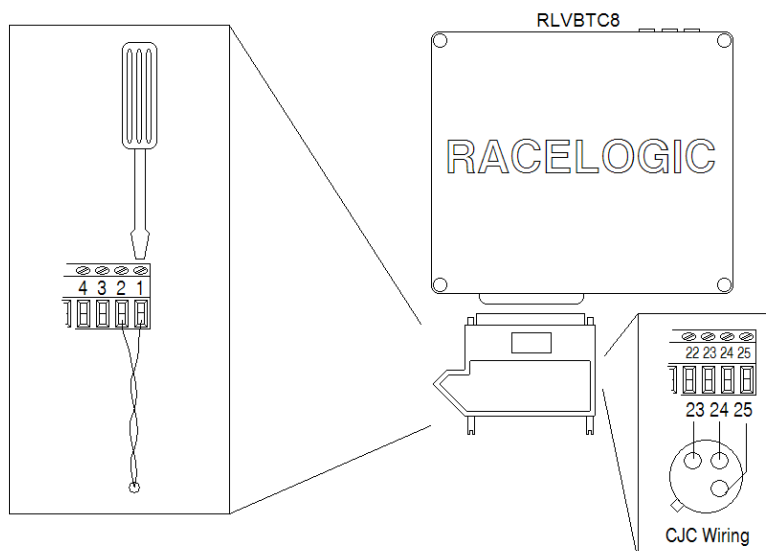
Connect the TC8 module to a VBOX to get power and connect the PC serial lead RLVBCAB01 directly to the TC8 module socket 3.

Then either double click on the upgrade file or run the upgrade software and open the upgrade file. Then simply follow the onscreen instructions and the software will automatically upgrade the TC8 module.

Connections

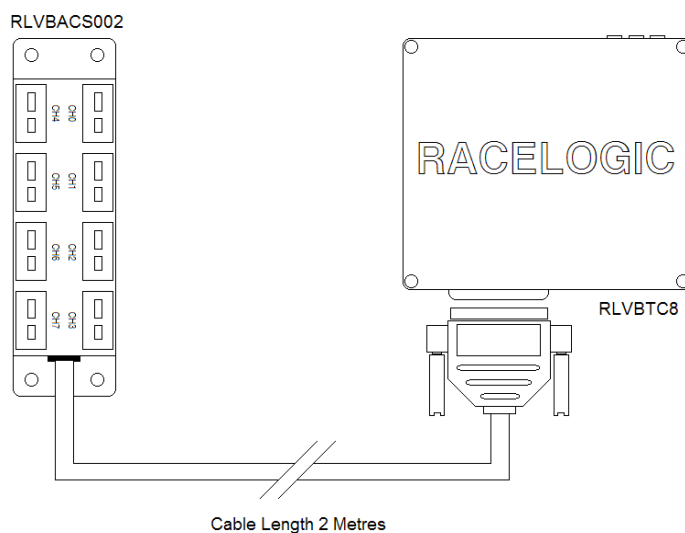
Thermocouple connection using screw terminal block

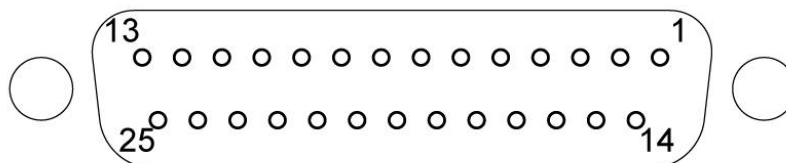
8 Channel thermocouple module with K-type thermocouples connected directly using 25 way D-type terminal block (supplied as standard) . Terminal block contains integral CJC (Cold Junction Compensation) device.



Thermocouple connection using RLVBACS002

8 Channel thermocouple module with K-type high precision adapter including dynamic CJC (not supplied as standard).

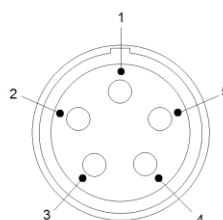




25 way socket connections

Input Connector 25 way D type female

Pin	Function	Pin	Function
1	Channel 0 (+)	14	Channel 6 (-)
2	Channel 0 (-)	15	Channel 7 (+)
3	Channel 1 (+)	16	Channel 7 (-)
4	Channel 1 (-)	17	No Connect
5	Channel 2 (+)	18	No Connect
6	Channel 2 (-)	19	No Connect
7	Channel 3 (+)	20	+12 V Sensor supply
8	Channel 3 (-)	21	No Connect
9	Channel 4 (+)	22	GND
10	Channel 4 (-)	23	CJC
11	Channel 5 (+)	24	CJC
12	Channel 5 (-)	25	CJC
13	Channel 6 (+)		



LEMO Socket connections

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	O	+12 V Power
Chassis		Ground

Thermocouple Interface

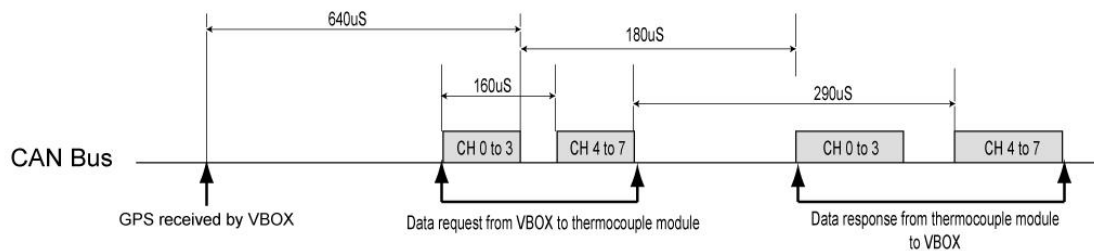
Connector 2 – CAN/POWER OUT

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

Connector 3 – Serial Configuration

Pin	I/O	Function
1	O	TxD, Serial Data Transmit
2	I	RxD, Serial Data Receive
3	I/O	Reserved (RS-485 A)
4	I/O	Reserved (RS-485 B)
5	O	+12 V power
Chassis		Ground

CAN Bus timing parameters



CAN Bus timing for VBOX with thermocouple input module at 500Kbit/s
Temperature data sampled at 6Hz asynchronous to CAN

Contact details

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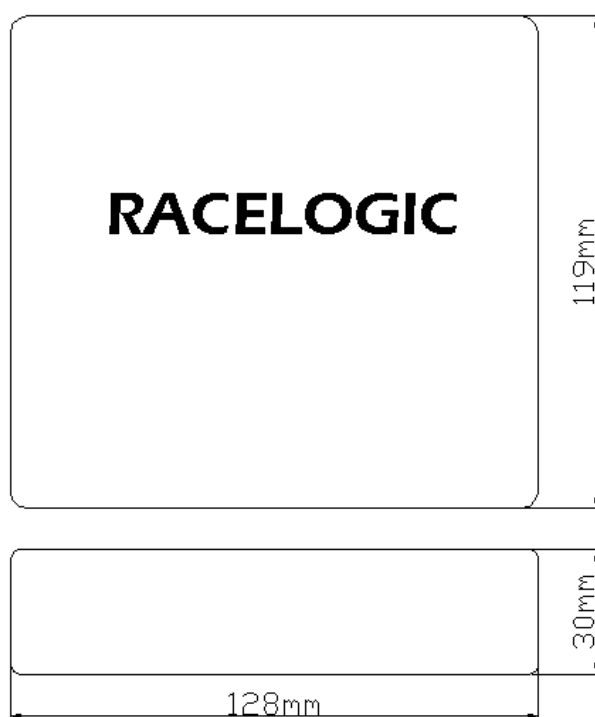
Email vbox@racelogic.co.uk

Web www.racelogic.co.uk

Document updates

Revision	Description	Date	Author
1	Inclusion of Declaration of Conformity Statement	05/06/07	CAS
2	Updated contact details	30/04/08	MG

Module Dimensions



RLVBACS002 Dimensions

