Micro Input Module
User Guide

This page intentionally left blank

Contents

EC declaration of conformity

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

EC directive 2004/108/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."

Racelogic Ltd
Unit 10
Swan Business Centre
Osier Way
Buckingham
MK18 1TB

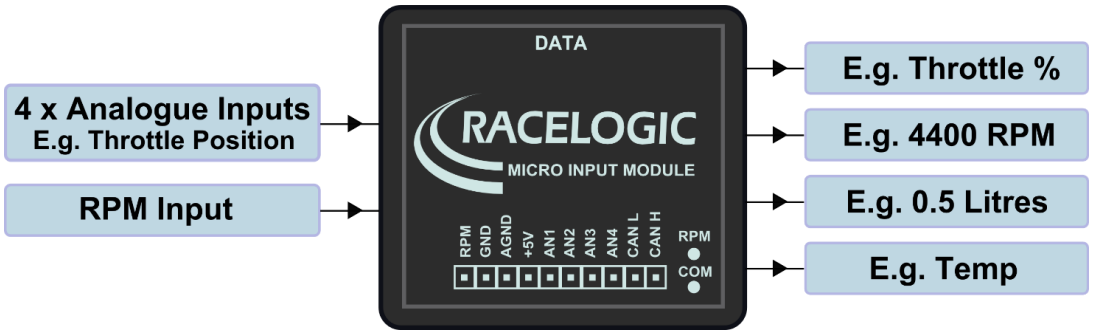
Introduction

The VBOX Micro input module is a general-purpose input module and comes in two versions designed for use with either the PerformanceBox or VBOX products. Communication with connected units is via RS232 to the PerformanceBox range (including VBOX Mini) and via CAN to any other VBOX product.

The Micro Input module allows data such as RPM, Throttle angles and Pedal forces to be easily measured along with the VBOX GPS data.

Inputs

4 x 10 bit 0 – 14.5 V Analogue inputs (30mV accuracy)
1 x Low-Tension RPM input



Standard inventory

Description	Qty	RL Part #
RLVBMICIN01F (VBOX Micro)		
Micro Input Module unit	1	VBMICIN01C
Connecting cable	1	RLCAB091
CD with manual	1	CDVBMICIN01
RLVBMICIN01L (VVB / VBOX)		
Micro Input Module unit	1	VBMICIN01C
Connecting cable	1	RLCAB091
CD with manual	1	CDVBMICIN01
RLPBMICIN01 (PB)		
Micro Input Module unit	1	VBMICIN01
Connecting cable	1	RLCAB094
CD with manual	1	CDVBMICIN01

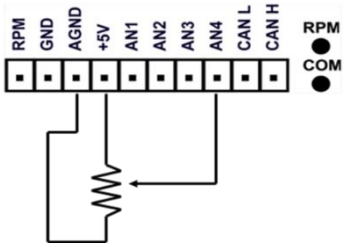
Optional accessories

Description	RL Part #
Additional 9 way phoenix contact connector	1840434

Analogue inputs

All of the analogue inputs are non-opto isolated 10 bit 0 – 14.5V inputs. They are all single-ended inputs that share the common 'A Ground' and a 4 MΩ input impedance means the unit can be used for direct connection to existing pots on a car.

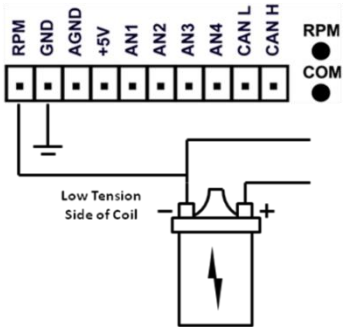
An example of how to connect an isolated individual potentiometer is shown on the right.



Connecting to a potentiometer already installed on a car, such as a throttle potentiometer, would only require the output signal from the pot and the earth to be connected to the MICIN01.

RPM input

The diagram on the right shows a typical connection to the 'low tension side of an ignition coil for RPM pickup.



Connecting to a VBOX

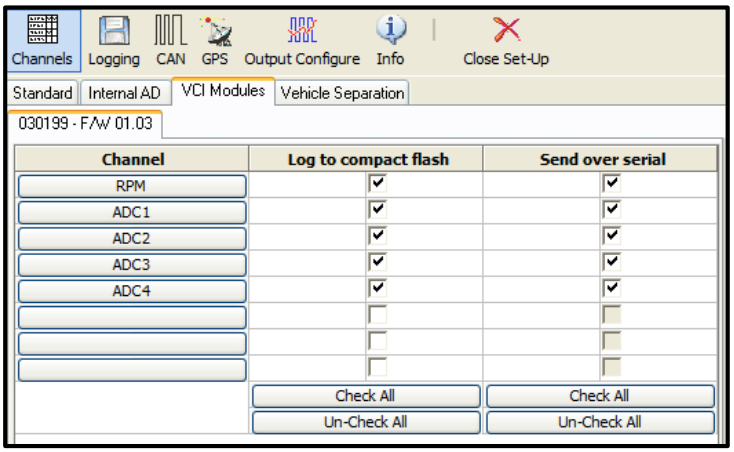
The Micro Input Module is connected to a VBOX via the CAB094 cable.

Configuring the MICIN01 when connected to a VBOX

Make sure your VBOX is connected to your computer via RLCAB01 or USB, load up VBOX Tools and select **VBOX Setup** on the main menu bar.

The MICIN01 can be connected to a VBOX via an RLCAB090/C cable. The user is required to load the MICIN01.DBC file on the VCI Modules tab, and then click a blank channel bar under the channels column to select one of the Micro Input Module's data channels. Once the channels are loaded, the user can then individually choose specific channels they wish to log and, or send over the serial bus.

Please note. The micro input module is only compatible with VBOX's with VCI capability.



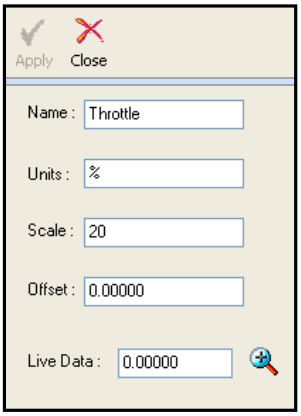
Configuring an input channel

To configure a channel, click the corresponding channel button. A channel setup window will appear showing the current settings.

The Channel Name and Units can be changed for each of the input channels and a scale, offset, minimum and maximum can be applied to selected input channels. Edit the Name, units, scale, offset, minimum and maximum, then click the Apply button for the changes to be saved.

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 format of the data. The value of the data is only affected by the scale and offset values.



Scale
The scale value corresponds to M 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.

Minimum
The minimum value the data is capable of displaying

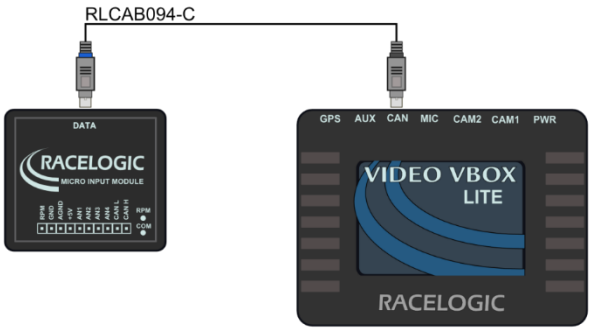
Maximum
The maximum value the data is capable of displaying

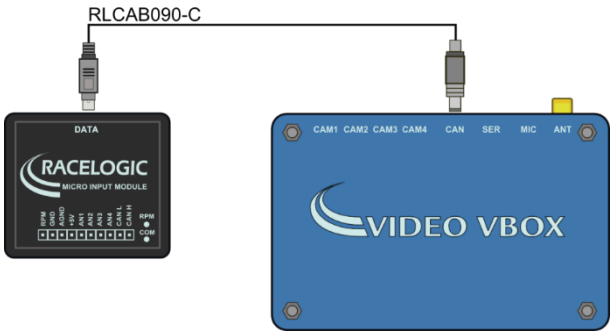
NB: See page 10 for how to calculate the Scale and Offset to be applied to an input channel

Connecting to a Video VBOX

Hardware setup

When connecting the Micro Input Module to a Video VBOX Lite, the connecting cable must be used the correct way around. The end labelled with a blue band must connect into the MICIN module, the other end must connect into the CAN port on the VVB Lite.





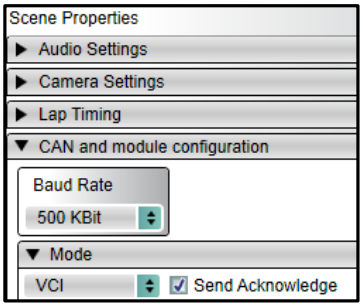
When connecting the Micro Input Module to a Video VBOX Pro, plug the Mini-Din connector into the DATA port on the MICIN module, and the Lemo connector into the CAN port on the VVB Pro.

Software Setup

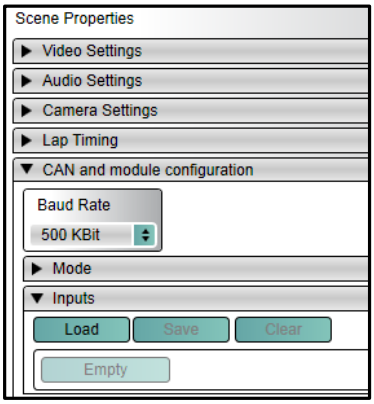
There are two ways to setup a Video VBOX to use a Micro-Input module.

1. Using the MICIN01 CAN database file

To use the Micro Input Module with a VCI enabled Video VBOX ensure that the CAN mode is set to 'VCI' and the 'Send Acknowledge' box is ticked.



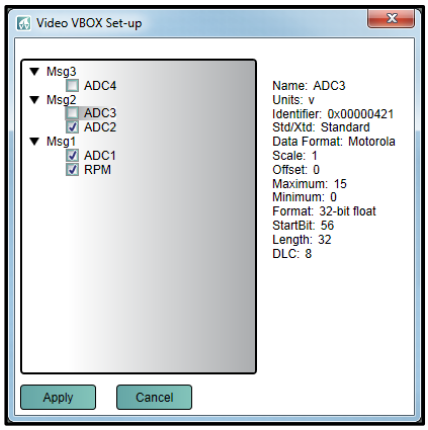
NB: If using an < 2012 Video VBOX Lite, there may be limited CAN channels available using this method. See part 2 for a description of how to use the default channel presets and log all available MICIN01 channels.



Under the 'CAN and Module Configuration' tab, expand the 'Inputs' dropdown menu bar.

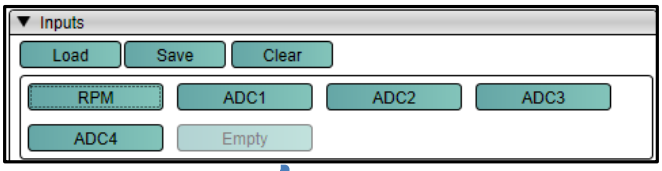
Click on the 'Load' button to bring up a file browser window, and navigate to the folder containing the MICIN01 CAN .dbc file and double click on it. Note, the MICIN01.dbc file can be downloaded from here if required.

Select the channels that are to be logged and/or displayed by the Video VBOX, then click apply.



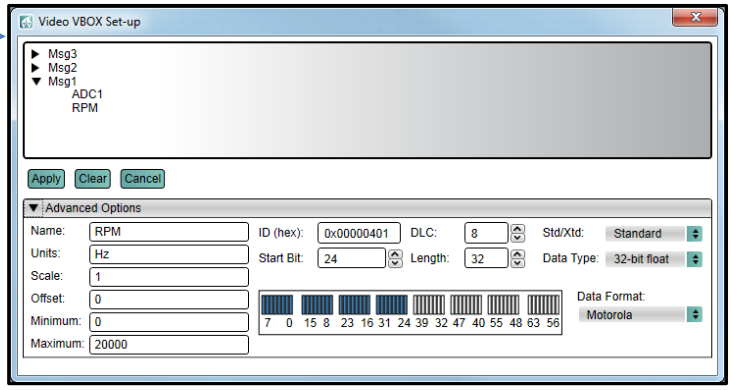
The ticked channels will now appear under the 'Inputs' section.

The channel attributes can be configured by clicking on each channel button



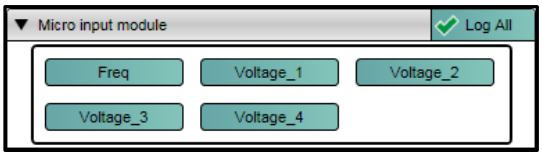
Under the Advanced Options tab you then have the list of channel parameters that can be edited

NB: See page 10 for how to calculate parameter scale and offset.



2. Using the MICIN01 channel pre-sets

Under 'CAN and Module Configuration' there is an additional drop down menu called 'Micro Input Module'.

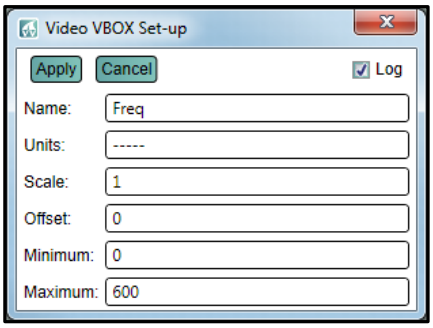


Expanding the drop-down menu displays the available Micro Input Module channels

To log all of the Micro-Input module channels, click the 'Log All' button in the top right of the drop-down menu. All of the channel buttons will now become coloured indicating that they will be logged to the SD card by the Video VBOX.

The channel attributes can be configured by clicking on the channel buttons:

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 format of the data logged to the SD card.
Scale
This scale value corresponds to M 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.
Minimum
The minimum value the channel is capable of displaying
Maximum
The maximum value the channel is capable of displaying



Connecting to a VBOXMini, PerformanceBox or DriftBox

When a MICIN01 is connected to a VBOXMini, PerformanceBox or DriftBox, the VBOXMini will automatically log all of the input channels.

Each of the input channels has configuration attributes that can be configured through the VBOXMini, PB or DB. Changing the Name, Units and Scale for a channel is not required but makes the logged data much easier to understand. See below for descriptions

Important: MICIN01 communication requires an RS232 chip to be fitted within the PB/DB unit.
This is standard for units built after September 2009.
For units older than this, or to check a unit's age, please contact Racelogic for further information.

Configuring input channel parameters

To configure any of the input channel parameters, change the mode to Input Module Mode

- Press the MENU button to enter the Input Module Menu.
- Highlight the Setup Inputs option by using the ▲▼buttons then press OK to enter the Setup Inputs option.
- Use the ▲▼buttons to scroll up and down the channel list then press OK to edit the Channel setup screen for an individual channel
- Then press the ▲▼buttons to scroll up and down the list of channel parameters then press OK to edit one.

Editing Name/Units:

Enter a channel setup parameter edit window by following the 'Configuring input channel parameters' instructions above.
Move the highlight box to the character you wish to edit using the ▲▼buttons then press OK to edit the character, and then press the ▲▼buttons to scroll through an alphanumeric list when you have highlighted the character you want then press the OK button. Then move to the next character you wish to edit.

NB: The Name and Units text fields are a maximum of 10 characters long

Editing Digital modes and options:

The digital input channels have additional modes and options that need configuring. To do this, enter the channel setup parameter of the digital channel by following the 'Configuring input channel parameters' instructions above.

The configurable modes and options depend on the Digital input channel that you are editing.

Highlight the MODE option then press the OK button, then press the ▲▼buttons to scroll between the available modes and press the OK button to select the mode you require.

To edit the options available in a mode, highlight the option and press the ▲▼buttons to scroll between the available option or value, then press the OK button to select the option or value you require.

Calculating scale and offset

When reading data from a vehicle using sensor equipment such as the Mini-Input Module it is often necessary to convert the data into a more meaningful format, for example converting a voltage from a throttle or brake pedal into something more useful like percentage pedal press.

There is an **online scale and offset calculator** on our VBOX Motorsport website which can be used to quickly calculate the required scale and offset for analogue inputs. This can be found here.

Typical RPM scales

Typically an RPM signal from an ignition coil will need to be scaled to get an RPM in the form:
RPM = f *60* 2/cylinders.
This is because Input Modules gives pulses per second which we need to convert into revolutions per minute.
E.G. 1 pulse per second = 60 pulses per minute x 2 (2 revolutions of crankshaft per combustion of spark plug) = 120 divided by the number of cylinders (4) = revs per minute (30).
So, for a four cylinder engine it would be 120 divided by 4 = 30.
Try these values as starting points.

Cylinders	Scale
3	40
4	30
5	24
6	20
8	15
10	12
12	10

Calculating scale and offset manually

This application note will explain step-by-step how to calculate the scale and offset values required to convert the throttle position voltage from the input of a Mini-Input Module to percentage throttle applied.

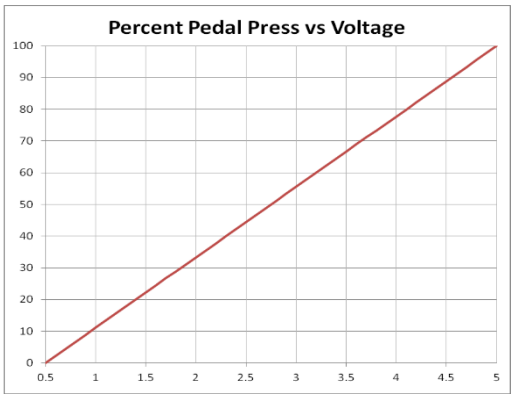
It should be noted that this calculation only works for linear data where the plot of the data produces a straight line.

1: Obtain full scale voltage values
Assume that the voltage read by the MIM is 0.5 volts when the pedal is not being pressed and 5 volts when the pedal is fully pressed. You have two values which correspond to 0% and 100% throttle pedal position. So how do we determine what scale and offset values to apply to a voltage value to obtain throttle position as a percent?

2: Visualising the Data
If you were to plot voltage (x) against percent (y), you have two sets of points that you can plot.

Voltage (x)	Pedal Press (y)
0.5	0 %
5	100 %

The line between these two points is a straight line.



3: The equation of a straight line.
The equation describing a straight line is as follows:

$Y = Mx + c$

Where;
Y = The Y values (pedal press)
X = The X values (sensor voltage)
m = scale (gradient of the line)
c = offset (intercept with the Y-axis)

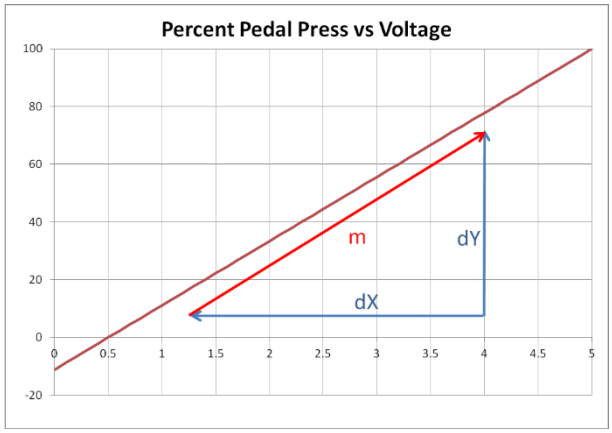
4: Calculating the gradient of the line
The gradient of a line is the change in Y divided by the change in X which gives:

m = dY/dX

dY = 100 – 0 = 100
dX = 5 – 0.5 = 4.5

Therefore the gradient of the line is:

dY/dX = (100 - 0)/(5 – 0.5)
= 22.22



5: Substituting values to find the offset
To find the offset value we simply substitute the known values back into our equation as follows:
Taking the values when the pedal is not pressed.

Voltage = 0.5 v, percent = 0.

Y = mX + c therefore 0 = (22.22 * 0.5) + c
0 = 11.11 + c
C = -11.11

Taking 11.11 from both sides of the equation gives us:

6: The full equation for the line
Substituting these values back into the equation again gives us the full equation of the line which passes through our two points.

Y = 22.22X – 11.11

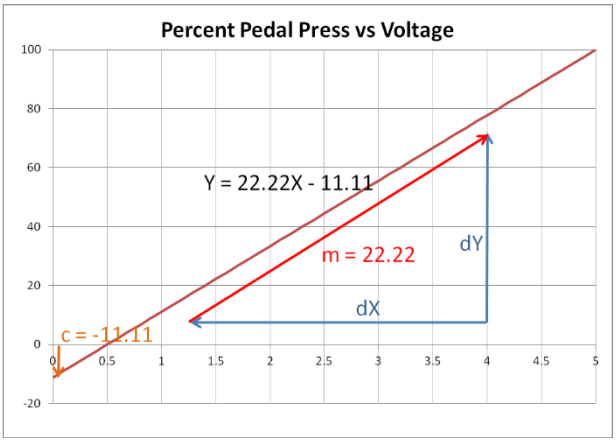
7: Checking the equation
We can double check our equation is correct by calculating a percentage value for a known voltage output.
We know that:

Voltage (x)	Percent Pedal Press (y)
0.5	0
5	100

Using the equation we have just derived produces the following results:

Y = 22.22X – 11.11
Y = (22.22 * **0.5**) – 11.11 = **0%** This is correct, as 0.5 volts is equal to a 0% pedal press.
Y = (22.22 * **5.0**) – 11.11 = **99.99%** This is also correct as we know that 5 volts = 100% pedal press.

8: Plotting the full line
The graph below illustrates the calculated scale and offset values.

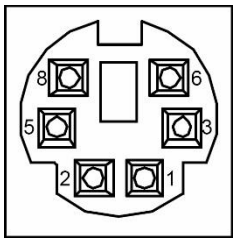


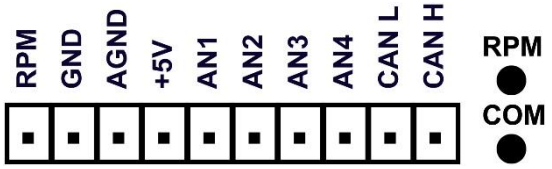
Specifications

Analogue Inputs		RPM Input	
Number of Channels	4	Input type	Low tension Coil Signal
DC Accuracy	30 mV	Minimum signal	12V
Input range	0 - 14.5 V	Input frequency range	0 – 666 Hz
Input impedance	4 MΩ	Resolution	0.1 RPM

Power		Environmental and physical	
Input Voltage range	6-30v DC	Weight	Approx 65 grammes
+5 V Output	5V supply – 300mA max	Size	68mm x 68mm x 30mm
		Operating temperature	-30°C to +70°C
		Storage temperature	-40°C to +85°C

Connection Data





Looking from the outside of the box into the socket.

Connector 1 – Data In – Kycon 6 W

Pin	I/O	Function
1	I	Module RS232 Rx
2	I/O	CAN High (on appropriate model)
3	I/O	CAN Low (on appropriate model)
5		Ground
6	O	Module RS232 Tx
8		Power

Input Connector 1 x 10 way

Pin	Function	Pin	Function
1	RPM	6	A/D Channel 2 +
2	GND	7	A/D Channel 3 +
3	Analogue GND	8	A/D Channel 4 +
4	Isolated +5 Volt supply	9	CAN L
5	A/D Channel 1 +	10	CAN H

CAN bus data format

Data format: 32 bit Float (Motorola), Baud rate: 500Kb/s.

Format	Motorola															
ID**	Data Bytes															
	0		1		2		3		4		5		6		7	
	76543210		76543210		76543210		76543210		76543210		76543210		76543210		76543210	
	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB
0x401	Digin / RPM								Analogue 1							
0x421	Analogue 2								Analogue 3							
0x441	Analogue 4								---							

The MICIN01 CAN database is available in Vector Database (DBC File) and can be downloaded from here if required.

Contact Information

Racelogic Ltd
Unit 10
Osier Way
Swan Business Centre
Buckingham
MK18 1TB
England

Tel: +44 (0) 1280 823803

Fax: +44 (0) 1280 823595

Email: support@racelogic.co.uk

Web: www.racelogic.co.uk