

# HV THERMOCOUPLE TO CAN USER MANUAL

## HV-TEC4

The HV-TEC4 is a 4x channel K-type thermocouple interface used for exhaust gas temperature or cylinder head temperature with a range of -50 to 1350 Degrees Celsius. The device also includes 4x high resolution 0 - 5.0V analog channels for input expansion. The device can be connected to any ECU or logging device via 2.0B CAN bus.



Rev 1.0

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## 1.0 Specification

### Sensor Type

- Thermocouple K- Type. Supports up to 4 channels, resolution 1 degree
- Analog Inputs 12bit up to 4 channels, resolution 1.22mV
- Built-in cold junction compensation
- Temperature Range: -50°C to 1300°C
- Thermocouple open circuit fault detection

### Power Supply

- Operating Voltage: 7.0 to 22.0 Volts DC
- Operating Average Current: 50mA at 14.0V
- Reverse Battery Protection via External Fuse
- 5V Analog Sensor Supply Output

### Internal

- 64MHz 16 bit Automotive Processor

### Communications

- CAN Baud Rate: 250kbaud, 500kbaud or 1Mbaud Auto Detect
- CAN transmit rate adjustable: 100 Hz, 250 Hz, 500 Hz

### Operating Temperature

- Operating Temperature Range: -30 to 85°C (-22 to 185°F)

### Physical

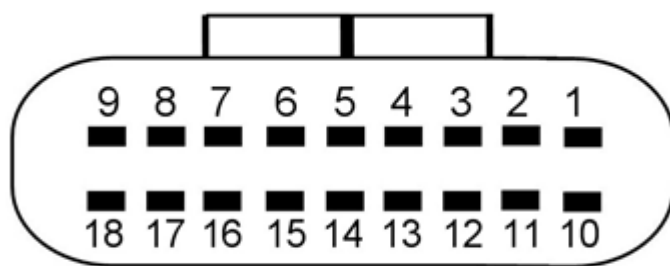
- Billet CNC Aluminium Enclosure
- Enclosure Size 50 mm x 38 mm x 15 mm
- 80g

## 2.0 Pinout

The pinouts are shown below in Table 2.0 and Figure 2.0.

Pin Number	Function
9	14V
8	CAN Lo
7	EGT 1 +
6	EGT 2 +
5	EGT 3 +
4	EGT4 +
3	Analog Input 2
2	Analog Input 4
1	5V Out (200mA)
18	Ground
17	CAN Hi
16	EGT 1 -
15	EGT 2 -
14	EGT 3 -
13	EGT 4 -
12	Analog Input 1
11	Analog Input 3
10	Sensor Ground Out

Table 2.0. Connector Pinout



### LOOKING INTO MODULE

Figure 2.0. Connector Pinout.

## 3.0 Device Installation

When mounting the HV-TEC4, it should never be placed where it can be exposed directly to radiated heat i.e. next to an exhaust manifold. Instead mount in cooler locations away from heat sources. Also in high vibration applications rubber mounting is recommended.

### 3.1 CAN Bus Wiring and Noise Immunity

To minimise signal contamination and maximise noise immunity, it is recommended to twist the following wire pairs as shown in Table 3.0. It is recommended to twist the wire pairs at a minimum one twist per 40mm of cable. This is very important and should always be implemented.

Pair 1	Pair 2
CAN Low	<-----> CAN High

Table 3.0. CAN wire pairing

The HV-TCE4 does not include an on-board CAN termination resistor. CAN Bus termination must be done correctly by using a 120 ohm resistor at each end of the bus system.

- The CAN Bus High and Low are differential signals, so twisted pair **MUST** be used. Failing to do so will compromise the entire CAN Bus System.
- In some extreme environments, shielded twisted pair may be required to help with reliability and data integrity.
- The less connectors in any transmission system the better. Unnecessary connectors are almost guaranteed to present an impedance discontinuity and hence may cause reflections and data loss.
- CAN Bus termination must be done correctly by using a 120 ohm 0.25W resistor at each END of the bus system.
- Maximum Stub length to a device from the main Bus is recommended at 0.3m, in accordance with High-Speed ISO 11898 Standard specification.

### 3.2 Thermocouple Polarity

The polarity of the thermocouple is critical and must be connected to the correct input. In most applications the red cable is the negative (-) and the yellow is the positive (+).

Name	Thermocouple -	Thermocouple +
Wire Colour	RED	YELLOW
Wire Type	Alumel	Chromel

### 3.3 Cold Junction Compensation

This device includes built-in Cold Junction compensation.

The device has an internal temperature sensor that measures the temperature at the connector so cold junction temperature compensation can be applied. With this setup, the thermocouple wire should be connected directly to the device. If the wires must be extended, then matching thermocouple wire should be used.

### 3.4 Thermocouple open circuit fault detection

When a Thermocouple Input has been detected as Open Circuit, the Fault Value of -50.0 DegC will be transmitted over the CAN Bus.

## 4.0 CAN Communications

This section outlines the CAN Protocol used to communicate with the HVLC device(s).

### 4.1 Baud Rate

The device will Auto-scan the CAN bus until a successful baud rate has been detected. Once detected this rate will be stored by the device and used at the next power up.

The device will scan 3 different Baud rates at 500ms intervals moving from 1Mbaud -> 500kbaud -> 250k Baud -> 1Mbaud and so on.

For this process to function effectively, all new devices to the CAN bus should be connected one at a time.

### 4.2 Transmit Message Packet

The HV-TCE4 transmits 3 IDs as outlined below

ID	600 /0x258 (Default)
Data	EGT Channels 1-4
ID Type	Standard 11 bit identifier
Direction	Transmit from HV-TCE4
Length	8 bytes
Rate	100Hz - 500 Hz/10ms

ID	601 /0x259 (Default)
Data	Analog Volt Channels 1-4
ID Type	Standard 11 bit identifier
Direction	Transmit from HV-TCE4
Length	8 bytes
Rate	100Hz - 500 Hz/10ms

ID	602 /0x25A(Default)
Data	EGT Additional Data
ID Type	Standard 11 bit identifier
Direction	Transmit from HV-TCE4
Length	8 bytes
Rate	100Hz - 500 Hz/10ms

CAN ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
600/0x258	EGT Channel 1		EGT Channel 2		EGT Channel 3		EGT Channel 4	

EGT Channel 1	
Byte 0	MSB (Big Endian)
Byte 1	LSB
Type	16 Bit Unsigned Integer
Multiplier	1.0
Offset	0
Units	DegC, Odp

EGT Channel 2	
Byte 2	MSB (Big Endian)
Byte 3	LSB
Type	Signed Integer
Multiplier	0.1
Offset	0
Units	DegC, Odp

EGT Channel 3	
Byte 4	MSB (Big Endian)
Byte 5	LSB
Type	Signed Integer
Multiplier	0.1
Offset	0
Units	DegC, Odp

EGT Channel 4	
Byte 6	MSB (Big Endian)
Byte 7	LSB
Type	Signed Integer
Multiplier	0.1
Offset	0
Units	DegC,Odp



CAN ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
601/0x259	Analog Volt Channel 1		Analog Volt Channel 2		Analog Volt Channel 3		Analog Volt Channel 4	

Analog Voltage Channel 1	
Byte 0	MSB (Big Endian)
Byte 1	LSB
Type	16 Bit Unsigned Integer
Multiplier	0.001
Offset	0
Units	V, 3dp

Analog Voltage Channel 2	
Byte 2	MSB (Big Endian)
Byte 3	LSB
Type	Signed Integer
Multiplier	0.001
Offset	0
Units	V, 3dp

Analog Voltage Channel 3	
Byte 4	MSB (Big Endian)
Byte 5	LSB
Type	Signed Integer
Multiplier	0.001
Offset	0
Units	V, 3dp

Analog Voltage Channel 4	
Byte 6	MSB (Big Endian)
Byte 7	LSB
Type	Signed Integer
Multiplier	0.001
Offset	0
Units	V, 3dp

CAN ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
602/0x25A	Avg EGT Value		Peak EGT Value		Min EGT Value		5V Analog Supply	

Average EGT Value	
Byte 0	MSB (Big Endian)
Byte 1	LSB
Type	16 Bit Unsigned Integer
Multiplier	1.0
Offset	0
Units	DegC

Peak EGT Value	
Byte 2	MSB (Big Endian)
Byte 3	LSB
Type	Signed Integer
Multiplier	1.0
Offset	0
Units	DegC

Min EGT Value	
Byte 4	MSB (Big Endian)
Byte 5	LSB
Type	Signed Integer
Multiplier	1.0
Offset	0
Units	DegC

Analog 5V Supply	
Byte 6	MSB (Big Endian)
Byte 7	LSB
Type	Signed Integer
Multiplier	0.001
Offset	0
Units	V, 3dp

## 5.0 Ordering Information

Product	Part Number
Thermocouple and Expansion to CAN	HV-TCE4

## Appendices

### Appendix A - Emtron Device Configuration

An Emtron Custom CAN receive channel can be used and a template loaded automatically scaling the received CAN data so it's ready to use. With the Emtune tuning software open, Select Config View -> Communications -> Custom Rx Data Sets. Select "Load" and when the menu opens select "HV-TEC4-Rx-CAN.ecx" template. This is available for download from our [www](http://www.hvelectronics.co.nz).

Next select an unused CAN channel and setup as follows :

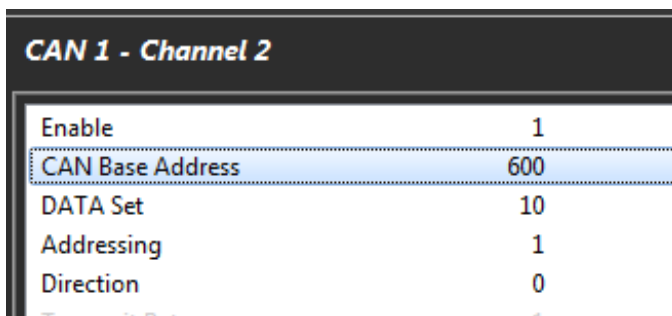
Enable = 1

CAN Base Address = 600

DATA Set = 10

Addressing = 1

Direction = 0



CAN 1 - Channel 2	
Enable	1
CAN Base Address	600
DATA Set	10
Addressing	1
Direction	0

EGT Data is now available on ECU channels "CAN EGT 1 - 4" and Analog data on "CAN AN Volt1 -4" channels.

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