

# 8ch Isolated Thermocouple to CAN

User Manual



## Revision History

Revision	Comment	Author	Date
1	Creation of Document and first issue	Joe Holdsworth	26/04/2025
2	Updated technical drawings	Claire Bishop	28/08/2025
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## 8ch Isolated Thermocouple to CAN

### System Overview

This CAN based 8 channel Isolated Thermocouple to CAN device measures temperatures from  $-200^{\circ}\text{C}$  to  $+1800^{\circ}\text{C}$  at a rate of up to 40Hz per channel with an accuracy of  $\pm 0.5^{\circ}\text{C}/\pm 1.5^{\circ}\text{C}$  (typ./max.) from 0 to  $85^{\circ}\text{C}$  and  $\pm 1^{\circ}\text{C}/\pm 3^{\circ}\text{C}$  (typ./max.) from  $-40$  to  $125^{\circ}\text{C}$ .

The unit also features open-circuit and short-circuit detection features, indicating when the thermocouple wire is broken, disconnected or if the thermocouple is shorted to ground or power.

The unit ships with K type miniature thermocouple connectors as standard allowing easy connection to standard thermocouples. The unit can also come with other types of miniature thermocouple connectors if required (it supports K, J, T, N, S, E, B and R).

It can be DIN rail mounted and has two IP67 JWPF connectors allowing it to be daisy chained with up to 128 additional modules enabling many measurement channels if required. The configurable CAN bus speed and address along with the supplied DBC file allows easy addition into almost any CAN bus. The input supply voltage can range from 9 to 32V.

## 8ch Isolated Thermocouple to CAN Max and Min Values

### Sensor

<b>Isolated Thermocouple Channels</b>	No. of Isolated Channels	8	
	Range [1]	-200 to +1800	°C
	Resolution	0.04	°C
	Accuracy	±0.5°C/±1.5°C (typ./max.) from 0 to 85°C ±1°C/±3°C (typ./max.) from -40 to 125°C	°C
	Max Update Rate (per channel)	40	Hz
	Supported Thermocouple Types	K (default), J, T, N, S, E, B and R	
	Isolation Voltage [2]	5000VDC for 1 min, 1120VDC continuous	VDC
<b>Environment</b>	Operating temperature	-40 to +85	°C
	Dust and Water Ingress	IP30	

**TABLE 1 SENSOR PERFORMANCE**

### Physical

<b>Mass</b>		250	grams
<b>Dimensions</b>	Height x Width x Length	33 x 69.1 x 128.3	mm (+0.3)

**TABLE 2 PHYSICAL PERFORMANCE INFORMATION**

## 8ch Isolated Thermocouple to CAN Electrical

<b>CAN [2]</b>	Baud Rates	1000, 500 (default), 250	kbps
	Default Address Range [3]	0x325 to 0x328	Hex

<b>Power</b>	Voltage Range	9 - 32	V
	Current	65 @ 12VDC	mA

**TABLE 3 ELECTRICAL PERFORMANCE**

## Connection

<b>Thermocouple Connectors</b>	
On Unit	Miniature Thermocouple Sockets
Mating	Miniature Thermocouple Flat Pin Plug
<b>Data and Power Connectors</b>	
Manufacturer	JST
Family	JWPF
On Unit	B06B-JWPF-SK-R
Mating [6]	06R-JWPF-VSLE-D
Crimp	SWPR-001T-P025
<b>Pin Outs</b>	
Pin No.	Function
1	Not Used
2	Supply Voltage
3	Ground
4	CAN High
5	CAN Low
6	Not Used

**TABLE 4 CONNECTION INFORMATION**

[1] Type K:  $T\Delta = -200^{\circ}\text{C}$  to  $+1372^{\circ}\text{C}$ , Type J:  $T\Delta = -150^{\circ}\text{C}$  to  $+1200^{\circ}\text{C}$ , Type T:  $T\Delta = -200^{\circ}\text{C}$  to  $+400^{\circ}\text{C}$ , Type N:  $T\Delta = -150^{\circ}\text{C}$  to  $+1300^{\circ}\text{C}$ , Type E:  $T\Delta = -200^{\circ}\text{C}$  to  $+1000^{\circ}\text{C}$ , Type S:  $T\Delta = 250^{\circ}\text{C}$  to  $+1664^{\circ}\text{C}$ , Type B:  $T\Delta = 1000^{\circ}\text{C}$  to  $+1800^{\circ}\text{C}$ , Type R:  $T\Delta = 250^{\circ}\text{C}$  to  $+1664^{\circ}\text{C}$

[2] The following values are derived from components used and creepage and clearance values but the unit is not tested to any standards as an assembly. Every isolation IC is tested by the manufacturer to 2.5KV for 1 second.

The below is the certification of the isolated components as provided by their manufacturer.

UL 1577: VISO = 2500 V rms for 1 minute, 5000 V for 1 minute between channels

- ▶ IEC/EN/CSA 60950-1
- ▶ IEC/CSA 62368-1
- ▶ IEC/CSA 61010-1
- ▶ DIN EN IEC 60747-17 (VDE 0884-17) (pending): VIORM = 560 V peak from measurement ground, 1120 V between channels

[3] The unit uses 4 CAN addresses which are in consecutive order from the address that the unit is set to.

## 8ch Isolated Thermocouple to CAN Electrical

### Mating Connector

Part No.: 06R-JWPF-VSLE-D

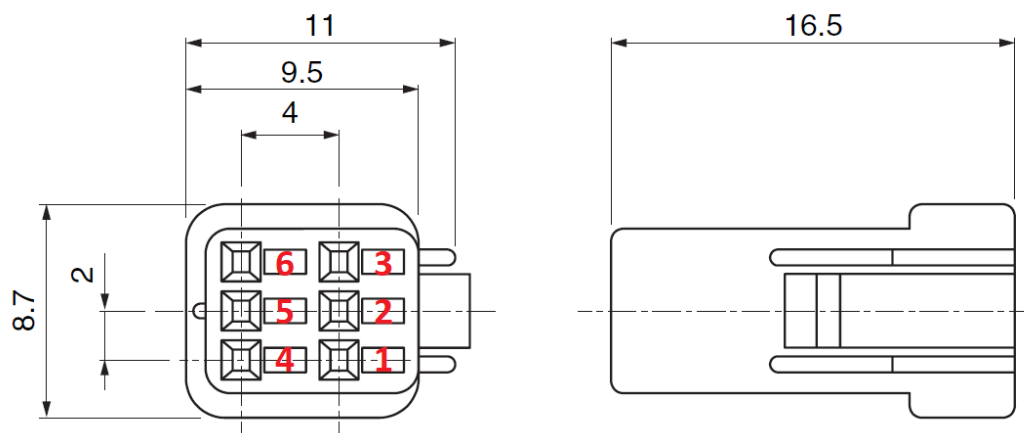


FIGURE 1 MATING CONNECTOR PIN NUMBERING (TOP DOWN VIEW)

### Crimps

Crimp Part No.: SWPR-001T-P025

Crimp Tool Part No.: WC-JWPF

12" Pre-Crimped Cable Part No.: AJWPFJWPF22K305R

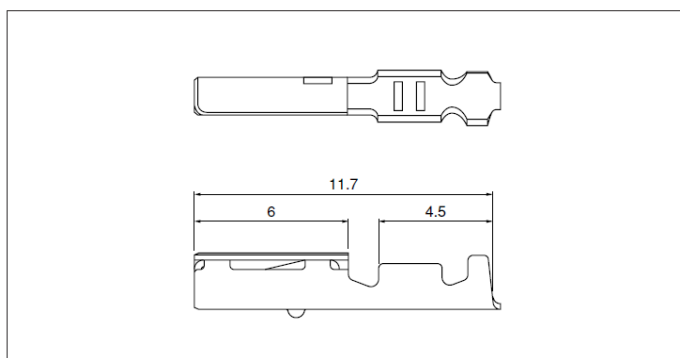


FIGURE 2 CONNECTOR CRIMP DETAILS

Model No.	Applicable wire		Insulation O.D (mm)	Q'ty / reel
	mm <sup>2</sup>	AWG#		
SWPR-001T-P025	0.13~0.33	26~22	1.4~1.7	8,200

#### Material and Finish

Copper alloy, tin-plated (reflow treatment)

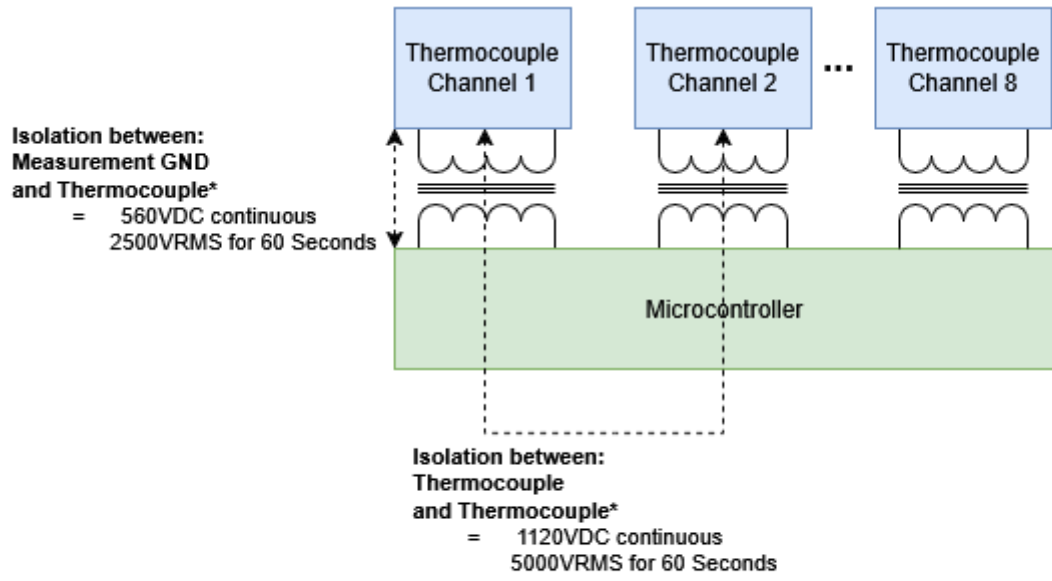
#### RoHS compliance

Contact	Crimping machine	Applicator		
		Crimp applicator	Dies	Crimp applicator with dies
SWPR-001T-P025	AP-K2N	MKS-L	MK/SWPR/T-001-025	APLMK SWPR/T001-025
		-	-	-

### CAN Termination

The unit does not have a termination resistor.

# 8ch Isolated Thermocouple to CAN Electrical Isolation



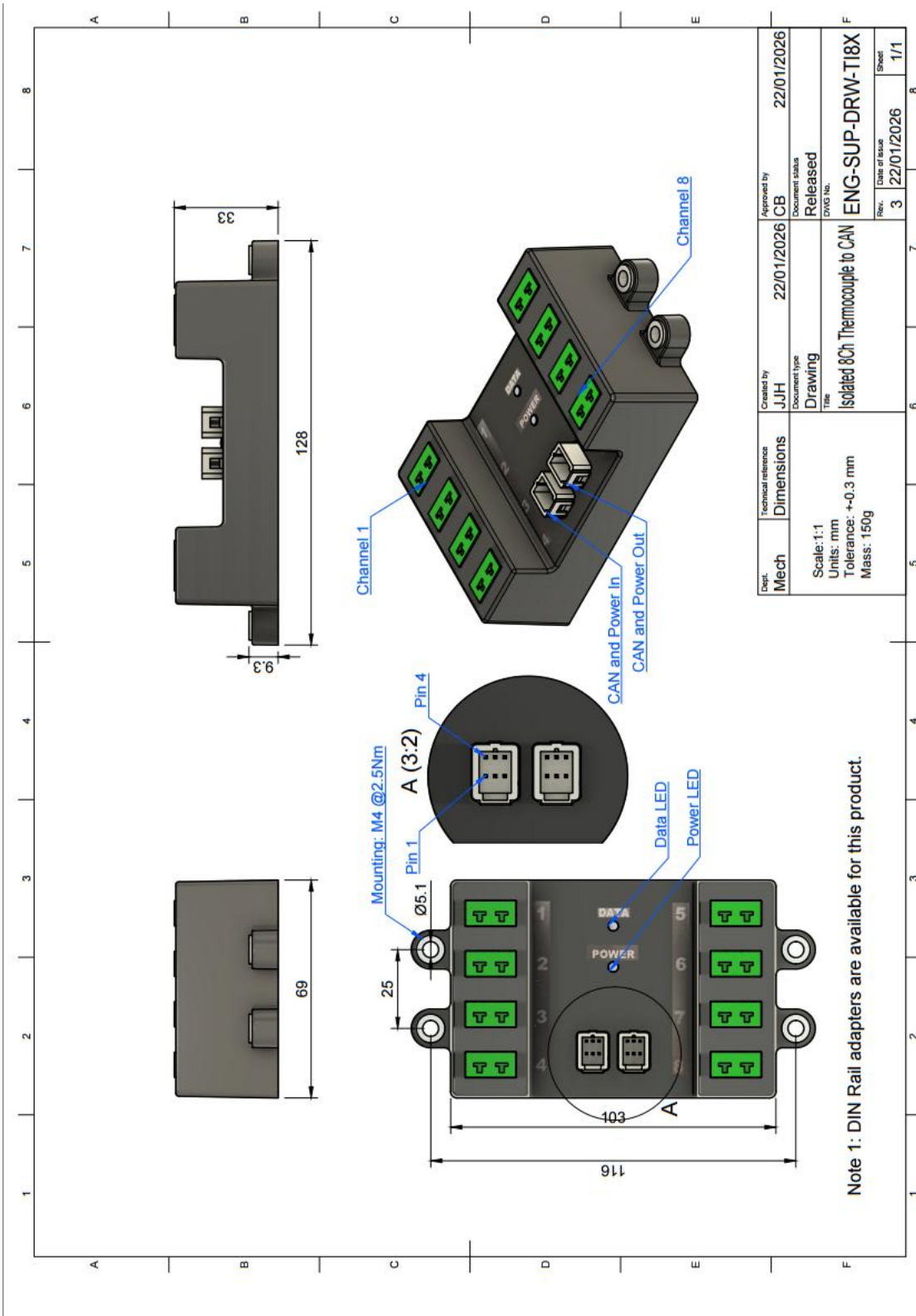
\*The isolation values are from data sheet information from components used and creepage and clearance values.

FIGURE 3 ELECTRICAL ISOLATION

# 8ch Isolated Thermocouple to CAN Mechanical

## Mounting

Mount using 4 x M4 bolts to ~2.5 Nm, a DIN rail mount adapter is available for this product.



Note 1: DIN Rail adapters are available for this product.

FIGURE 4 SENSOR DRAWING

**Part Number Ordering Details** TI8 - X

Default Part Number: **TI8-K**

**Connector Type**

- K = Type K:  $T\Delta = -200^{\circ}\text{C}$  to  $+1372^{\circ}\text{C}$
- J = Type J:  $T\Delta = -150^{\circ}\text{C}$  to  $+1200^{\circ}\text{C}$
- T = Type T:  $T\Delta = -200^{\circ}\text{C}$  to  $+400^{\circ}\text{C}$
- N = Type N:  $T\Delta = -150^{\circ}\text{C}$  to  $+1300^{\circ}\text{C}$
- E = Type E:  $T\Delta = -200^{\circ}\text{C}$  to  $+1000^{\circ}\text{C}$
- S = Type S:  $T\Delta = 250^{\circ}\text{C}$  to  $+1664^{\circ}\text{C}$
- B = Type B:  $T\Delta = 1000^{\circ}\text{C}$  to  $+1800^{\circ}\text{C}$
- R = Type R:  $T\Delta = 250^{\circ}\text{C}$  to  $+1664^{\circ}\text{C}$

Figure 5 Part Numbering

The unit can come with various thermocouple connector types, K Type is standard,

## 8ch Isolated Thermocouple to CAN

### Quick Start Guide

This section gives a quick overview of how to change settings on the device.

To see Default settings, please refer to the CAN Message Summary section.

#### Step 1: Power Up Unit

Make sure power and CAN is connected to the device using the pin outs as previously described in table 5.

If the CAN bus is unterminated or the unit is the only node on the CAN bus, please place a 120Ohm resistor between CAN high and CAN low lines.

Apply 9-32VDC to the unit with a supply capable of 50mA.

#### Step 2: Connect CAN Tool

1. Ideally use a CAN tool such as PCAN or CANalyser.
2. Make sure the CAN bus connection settings in the tool match the settings specified in the unit's default settings section e.g. 11bit address and 500kbps CAN bus speed.
3. Import the unit's DBC or symbols file into the CAN tool.
4. Start the CAN interface on the computer.
5. If connection is successful, the CAN Heartbeat message will appear from the unit. If not, then check the following.
  - a. The unit has power.
  - b. The CAN connection settings are correct.
  - c. The CAN bus is terminated correctly.
  - d. The CAN high and low lines are the correct way round.

Figure 2 below shows the default message output from the unit. **Please take note of the Unique ID value and the Key value** – these will be required when entering setup mode or saving any changes to the setup. Please be aware that the key value changes each time a valid enter setup command has been received.

Bus	CAN-ID	L.	Symbol	Data	Cycle Time
1	325	8	TI8_Config.x00_Heartb...	Unique_ID = 5463880 Key = 52410 Unit_ID = 0 Mode = Normal Mode Fault_EEPROM = OK	999.9
1	326	8	TI8_Ch1_Ch4	TC_1_DegC = 76.56 deg C TC_2_DegC = -200.00 deg C TC_3_DegC = -200.00 deg C TC_4_DegC = -200.00 deg C	200.0
1	327	8	TI8_Ch5_Ch8	TC_5_DegC = -200.00 deg C TC_6_DegC = -200.00 deg C TC_7_DegC = -200.00 deg C TC_8_DegC = -200.00 deg C	200.0
1	328	8	TI8_Status	TC_1_Comms_Fault = OK TC_1_Type = TYPE_K TC_1_Status = READY TC_2_Comms_Fault = OK TC_2_Status = OPEN CIRCUIT TC_2_Type = TYPE_K TC_3_Comms_Fault = OK TC_3_Status = OPEN CIRCUIT TC_3_Type = TYPE_K TC_4_Comms_Fault = OK TC_4_Status = OPEN CIRCUIT TC_4_Type = TYPE_K TC_5_Type = TYPE_K TC_6_Type = TYPE_K TC_7_Type = TYPE_K TC_8_Type = TYPE_K TC_5_Status = OPEN CIRCUIT TC_6_Status = OPEN CIRCUIT TC_7_Status = OPEN CIRCUIT TC_8_Status = OPEN CIRCUIT TC_5_Comms_Fault = OK TC_6_Comms_Fault = OK TC_7_Comms_Fault = OK TC_8_Comms_Fault = OK Unit_Temperature_DegC = 24.0 Deg C	199.9

Receive

FIGURE 6 EXAMPLE CAN MESSAGE OUTPUT

### Step 3: Enter Setup Mode

1. The Heartbeat message should give:
  - a. A Unique ID value.
  - b. A Key value.
  - c. The unit ID sending the heartbeat message.
  - d. The run mode - this should be 'Normal' if the unit has just powered up.
  - e. Unit fault information
  - f. Wake flag if a threshold has been exceeded. By default, the wake feature is turned off to begin with.
2. Take note of both the Unique ID value and the Key value.
3. Create a Setup Mode message as defined in the CAN DBC, this message is multiplexed with the unit's heartbeat message.
4. Populate the Unique ID and Key field in the setup message with the values noted from the heartbeat message.
5. Send the 'Enter Setup Mode' Command to the unit. This should only be sent once.

## 8ch Isolated Thermocouple to CAN

6. The next Heartbeat message received from the unit should have the run mode changed to 'Setup mode'. If this does not happen, check your unique ID and Key value match those in the heartbeat message.
7. Once in setup mode the unit can be configured.
8. Any changes that have been made will not be applied until a 'Save Setup' command has been sent.
9. To cancel any changes prior to the 'Save Setup' command, send the 'Cancel Setup' command or power cycle the device.

### Step 4: Change a Setting

To change a setting, the unit has to be in setup mode. Once in setup mode, send the correct CAN message to the unit, for example, to change the CAN start Address send `x0F_Cmd_Set_CAN_Start_Address` making sure the unit unique ID field is set correctly and the CAN address field is set correctly. Once the message is sent a confirmation `x10_Resp_CAN_Start_Address` message will be sent back from the sensor confirming the change.

### Step 5: Save Setup

To apply any configuration changes, send the 'Save Setup' command with the Unique ID and Key value field populated with the current value in the heartbeat message.

Note: The Key value changes each time a successful message has been received, any changes to the unit will not be applied until a 'Save Setup' command has been sent.

### Step 6: Reset to Factory Defaults

To restore factory settings, send a 'reset to factory settings' CAN message to the unit.

### Step 7: Calibrate the Sensors

The unit does not have any calibratable parameters.

## 8ch Isolated Thermocouple to CAN

# Sensor Maintenance

The unit should not need any maintenance.

## 8ch Isolated Thermocouple to CAN

### CAN Message Format

Can Messages Identifier: 11bit

Data Format (all messages): Intel.

Termination: Unterminated (no 120 Ohm termination resistor)

Default CAN Bus Speed: 500kBps

Default CAN Start Address (decimal): 0x325 805)

### CAN Message Summary

The unit uses up to 4 CAN message ID's.

When configuring the CAN start address in the unit's settings it configures the start address of the unit, other message addresses from the unit will have an offset from the start address.

Default CAN Address Hex (Decimal)	Message Name	Description	Max Frequency Sent from Unit (if not in sleep mode)	Frequency To Unit	Default On or Off
0x325 (805)	TI8_Config	Used to send and receive configuration settings and values from the unit. This address is also used by the unit to send it's heartbeat message. Functionality is selected by changing the multiplexor value field in this message	1000ms (Heartbeat)	Min 5ms	On (not configurable)
0x326 (806) [1 + Config Address]	TI8_Ch1_Ch4	Thermocouple Channels 1 to 4	25ms (200ms default) to 5000ms	NOT APPLICABLE	On
0x327 (807) [1 + Config Address]	TI8_Ch5_Ch8	Thermocouple Channels 5 to 8	25ms (200ms default) to 5000ms	NOT APPLICABLE	On
0x328 (808) [3 + Config Address]	TI8_Status	Status of each thermocouple channel, its type and the units internal temperature	25ms (200ms default) to 5000ms	NOT APPLICABLE	On

**TABLE 5 CAN MESSAGE OUTPUT SUMMARY**

## 8ch Isolated Thermocouple to CAN TI8 Config (0x325[default])

### Configuration CAN Message

CAN ID: Please see unit's default CAN start address details in the unit specific CAN message section.

Overview: This CAN message is used to send configuration commands to the unit and is also used to receive configuration data from the unit. To put the unit into Setup mode and any other commands CAN messages must be sent to this CAN address. The different commands sent to this address are selected by changing the Message Type Field.

Layout:

Byte(s)	Data Type	Name	Description
0 – 2	Unsigned 24 bit integer	Unique ID	The unit's unique identifier, enabling the user to distinguish between multiple unit's on the same CAN bus.
3	Unsigned 8 bit integer	Message Type	This field is a multiplexor used to identify the message type.  Mux values 0x00(0) to 0x29(41) are common across all units. Please refer to the common CAN message section.  Mux values 0x30(42) to 0xFF(255) change depending on what particular type the unit is being used. Please refer to the unit specific CAN message section.
4-7 (length can vary depending on message type)	Variable	Variable	The remaining 4 bytes are used depending on the command or data being sent back from the unit, not all 8 bytes are populated in every message.

TABLE 6: CAN CONFIGURATION MESSAGE

## 8ch Isolated Thermocouple to CAN

### Common CAN Message Types

Overview: These are the multiplexor message IDs that populate byte 3 of the configuration CAN message. The multiplexor messages highlighted in grey cells only work if the unit is in Setup mode.

Hex (Decimal) Value	Purpose	CAN DBC Name	Description
0x00 (0)	Heartbeat	x00_Heartbeat	Message that gets sent out to indicate the unit is alive on the CAN bus, it's status and what the unit type is.
0x01 (1)	Enter Setup	x01_Cmd_Enter_Setup	Command sent to unit to put it into setup mode, <b>the unit needs to be in setup mode to make any configuration changes to the unit.</b>
0x02 (2)	Save Setup	x02_Cmd_Save_Setup	Command to save any configuration changes that have been made whilst the unit was in Setup mode. <b>To apply any configuration changes this needs to be sent!</b> The unit reboots after this message is received.
0x03 (3)	Cancel Setup	x03_Cmd_Cancel_Setup	Command to cancel any changes that have been made in the current Setup mode.
0x04 (4)	Reset Unit to Factory Defaults	x04_Cmd_Rst_to_Factory_Defaults	Resets the unit to factory defaults.
0x05 (5)	Power cycle device	x05_Cmd_Reboot_Device	Any settings not saved will be lost
0x06 (6)	Get Unit Statistics	x06_Cmd_Get_Info_and_Errors	Request that the unit sends it's statistics
0x07 (7)	Reset Unit Statistics	x07_Cmd_Rst_Info_and_Errors	Request that the unit's statistics be reset
0x08 (8)	Get Unit ID	x08_Cmd_Get_Unit_ID	The unit replies with the current ID that has been set.
0x09 (9)	Set Unit ID	x09_Cmd_Set_Unit_ID	Sets the ID of the unit so if there is more than 1 unit on the CAN bus they can be distinguished.
0x0A (10)	Unit ID response	x0A_Resp_Unit_ID	The unit's reply to a request for its unit ID (this message is only used by the unit and should not be sent to the unit)
0x0B (11)	Get the CAN bus speed	x0B_Cmd_Get_CAN_Bus_Speed	Request the unit to send the current CAN bus speed. [1]
0x0C (12)	Set the CAN bus speed	x0C_Cmd_Set_CAN_Bus_Speed	Set the unit's CAN bus speed.
0x0D (13)	CAN bus speed response	x0D_Resp_CAN_Bus_Speed	The unit's response message indicating the current CAN bus speed.[1]
0x0E (14)	Get the CAN start address	x0E_Cmd_Get_CAN_Start_Address	Request the unit to send the current CAN start address. [1]
0x0F (15)	Set the CAN start address	x0F_Cmd_Set_CAN_Start_Address	Set the unit's CAN bus start address.
0x10 (16)	CAN bus start address response	x10_Resp_CAN_Start_Address	The unit's response message indicating the current CAN bus start address for the unit.[1]

Hex (Decimal) Value	Purpose	CAN DBC Name	Description
0x11 (17)	Get Low Power mode	x11_Cmd_Get_Unit_Mode	Gets the current unit mode
0x12 (18)	Set Low Power mode	x12_Cmd_Set_Unit_Mode	Sets the unit mode
0x13 (19)	Low Power mode response	x13_Resp_Unit_Mode	The unit's mode
0x17 (20)	Firmware Version	x17_Resp_Firmware_Version	The firmware version on the unit
0x18 (21)	Power Cycle Count	x18_Resp_Pwr_Cycle_Cnt	The number of times the unit has been turned on
0x1A (26)	EEPROM Write Count	x1A_Resp_EEPROM_Write_Cnt	The number of times EEPROM has been written to
0x1B (27)	MCU Statistics	x1B_Resp_MCU_Stats	Watchdog resets and other information
0x1C (28)	CAN Transceiver Statistics	x1C_Resp_CAN_Tran_Stats	Information on the CAN transceiver
0x1D	Command Not Recognised	x1D_Resp_Cmd_Not_Recognised	

TABLE 7 COMMON CONFIGURATION MESSAGE TYPES

[1] If the value has been reconfigured but not saved the unit will send the reconfigured value.

## 8ch Isolated Thermocouple to CAN

### Unit Specific CAN Message Types

Hex (Decimal) Value	Purpose	CAN DBC Name	Description
0x30 (48)	Get the Thermocouple messages update rate	x30_Cmd_Get_TC_Update_ms	
0x31 (49)	Set Thermocouple message update rate	x31_Cmd_Set_TC_Update_ms	
0x32 (50)	The current Thermocouple message update rate	x32_Resp_TC_Update_ms	
0x33 (51)	Get the Thermocouple status messages update rate	x33_Cmd_Get_TC_Status_Update_ms	
0x34 (52)	Set Thermocouple status message update rate	x34_Cmd_Set_TC_Status_Update_ms	
0x35 (53)	The current Thermocouple status message update rate	x35_Resp_TC_Status_Update_ms	
0x36 (54)	Get if the TI8_Ch1_Ch4 message is on or off	x36_Cmd_Get_Ch1_4_Msg_On	
0x37 (55)	Set if the TI8_Ch1_Ch4 message is on or off	x37_Cmd_Set_Ch1_4_Msg_On	
0x38 (56)	If the TI8_Ch1_Ch4 message is on or off	x38_Resp_Ch1_4_Msg_On	
0x39 (57)	Get if the TI8_Ch5_Ch8 message is on or off	x39_Cmd_Get_Ch5_8_Msg_On	
0x3A (58)	Set if the TI8_Ch5_Ch8 message is on or off	x3A_Cmd_Set_Ch5_8_Msg_On	
0x3B (59)	If the TI8_Ch5_Ch8 message is on or off	x3B_Resp_Ch5_8_Msg_On	
0x3C (60)	Get if the TI8_Status message is on or off	x3C_Cmd_Get_Status_Msg_On	
0x3D (61)	Set if the TI8_Status message is on or off	x3D_Cmd_Set_Status_Msg_On	
0x3E (62)	TI8_Status message is on or off unit response	x3E_Resp_Status_Msg_On	
0x3F (63)	Get if the Thermocouple type for each channel	x3F_Cmd_Get_Thermocouple_Types	
0x40 (64)	Set if the Thermocouple type for each channel	x40_Cmd_Set_Thermocouple_Types	The units thermocouple channels can be set to different types. It is recommended to only use the type that is physically on the unit otherwise there maybe inaccuracies in the readings.
0x41 (65)	If the Thermocouple type for each channel	x41_Resp_Thermocouple_Types	

TABLE 8 UNIT SPECIFIC CONFIGURATION MESSAGE TYPES

## 8ch Isolated Thermocouple to CAN

### Heartbeat – CG\_Config Multiplexor x00\_Heartbeat

#### Overview

This CAN message is used to output the unit's high-level status including errors, it is also the address that the user will send configuration messages to.

#### Default settings

- CAN Start Address + 0 = (0x320 by default)
- Message Multiplexor value: 0x0
- Output rate is set to 1000ms

#### Format

- Intel
- 8 bytes in length

#### Layout

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Unique_ID 7	6	5	4	3	2	1	0
Byte 1	Unique_ID 15	14	13	12	11	10	9	8
Byte 2	Unique_ID 23	22	21	20	19	18	17	16
Byte 3	x00_Heartbeat 31	30	29	28	27	26	25	24
Byte 4	Key 39	38	37	36	35	34	33	32
Byte 5	Key 47	46	45	44	43	42	41	40
Byte 6	55	54	53	52	Fault_EEPROM 51	50	Mode 49	48
Byte 7	Unit_ID 63	62	61	60	59	58	57	56

Byte(s)	Data Type	Name	Description
0 – 2	Unsigned 24 bit	Unique_ID	The unit's unique ID code, this cannot be changed
3	Enumeration	Multiplexor	The multiplexor value, for this message, Heartbeat it is 0x0, please see Table 7 Common Configuration Message Types for possible values
4 – 5	Unsigned 16 bit	Key	The key code required to enter setup or save any settings, this key changes please use the current stated key.
6 – bit 0-1	Enumeration	Mode	The unit's mode: <ol style="list-style-type: none"> <li>1. Normal</li> <li>2. Setup</li> <li>3. Silent – CAN is turned off and unit will wake if commanded to, power cycled or a threshold is detected</li> </ol>
6 – bit 3	Bit	Fault_EEPROM	Fault detected with EEPROM
7	Unsigned 8 bit	Unit_ID	A user configurable ID to identify multiple units if they are on the same CAN bus

TABLE 9 HEARTBEAT CAN MESSAGE

## 8ch Isolated Thermocouple to CAN

### Enter Setup Command (0x01\_Cmd\_Enter\_Setup)

Mux Value Hex (Decimal): 0x01 (1)

Type: Sent to unit

Frequency: NA

Description: No configuration options can be changed until the unit is in setup mode. Sending this command with the correct key value will put the unit into setup mode.

Layout:

Byte(s)	Data Type	Name	Description
0 – 2	Unsigned 24 bit integer	Unique ID	Unique ID
3	Unsigned 8 bit integer	Message Type	<b>0x01</b> – Enter setup command
4-5	Unsigned 16 bit integer	Key	The value in this field <b>must</b> be the same as the Key value in the heartbeat message for the command to be accepted. The key value will change each time a correct one has been received.

### Save Setup Command (0x02\_Cmd\_Save\_Setup)

Mux Value Hex (Decimal): 0x02 (2)

Type: Sent to unit

Frequency: NA

Description: Sending this message with the correct key value in the key field will save any configuration changes that have been made during setup mode.

Layout:

Byte(s)	Data Type	Name	Description
0 – 2	Unsigned 24 bit integer	Unique ID	Unique ID
3	Unsigned 8 bit integer	Message Type	<b>0x02</b> – Save setup command
4-5	Unsigned 16 bit integer	Key	The value in this field <b>must</b> be the same as the Key value in the heartbeat message for the command to be accepted. The key value will change each time a correct one has been received.

### Cancel Setup Command (0x03\_Cmd\_Cancel\_Setup)

Mux Value Hex (Decimal): 0x03 (3)

Type: Sent to unit

Frequency: NA

Description: Sending this message will exit the current setup mode and changes will **not** be saved.

Layout:

Byte(s)	Data Type	Name	Description
0 – 2	Unsigned 24 bit integer	Unique ID	Unique ID
3	Unsigned 8 bit integer	Message Type	<b>0x03</b> – Cancel setup command

## 8ch Isolated Thermocouple to CAN

### Reset Unit To Factory Default Settings (0x04\_Cmd\_Rst\_to\_Factory\_Defaults)

Mux Value Hex (Decimal): 0x04 (4)

Type: Sent to unit

Frequency: NA

Description: Sending this message and a valid Key will reset the unit to factory default settings. The unit does not need to be in setup mode for this to work.

Layout:

Byte(s)	Data Type	Name	Description
0 – 2	Unsigned 24 bit integer	Unique ID	Unique ID
3	Unsigned 8 bit integer	Message Type	<b>0x04</b> – Restore to Factory Defaults command
4-5	Unsigned 16 bit integer	Key	The value in this field must be the same as the Key value in the heartbeat message for the command to be accepted. The key value will change each time a correct one has been received.

### Reboot Device (0x05\_Cmd\_Reboot\_Device)

Mux Value Hex (Decimal): 0x05 (5)

Type: Sent to unit

Frequency: NA

Description: Sending this message and a valid Key will reboot the device. The unit does not need to be in setup mode for this to work.

Layout:

Byte(s)	Data Type	Name	Description
0 – 2	Unsigned 24 bit integer	Unique ID	Unique ID
3	Unsigned 8 bit integer	Message Type	<b>0x05</b> – Reboot device command
4-5	Unsigned 16 bit integer	Key	The value in this field must be the same as the Key value in the heartbeat message for the command to be accepted. The key value will change each time a correct one has been received.

### Get Unit Information and Errors (0x06\_Cmd\_Get\_Info\_and\_Errors)

Mux Value Hex (Decimal): 0x06 (6)

Type: Sent to unit

Frequency: NA

Description: This message only works if the unit is in setup mode. If this CAN message is sent, the unit will respond with the following multiplexor messages at the Heartbeat message address:

- 0x17\_Resp\_Firmware\_Version'
- 0x18\_Resp\_Pwr\_Cycle\_Cnt
- 0x1A\_Resp\_EEPROM\_Write\_Cnt
- 0x1B\_Resp\_MCU\_Stats
- 0x1C\_Resp\_CAN\_Trans\_Stats

Layout:

Byte(s)	Data Type	Name	Description
0 – 2	Unsigned 24 bit integer	Unique ID	Unique ID
3	Unsigned 8 bit integer	Message Type	<b>0x06</b> – Get unit's software version

## 8ch Isolated Thermocouple to CAN

### Reset Unit Information and Errors (0x07\_Cmd\_Rst\_Info\_and\_Errors)

Mux Value Hex (Decimal): 0x07 (7)

Type: Sent to unit

Frequency: NA

Description: This message only works if the unit is in setup mode. If this CAN message is sent, the unit will reset error counters (the units power cycle and EEPROM write count will not be reset).

Layout:

Byte(s)	Data Type	Name	Description
0 – 2	Unsigned 24 bit integer	Unique ID	Unique ID
3	Unsigned 8 bit integer	Message Type	<b>0x07</b> – Reset units Information and Errors

### Get Unit ID (0x08\_Cmd\_Get\_Unit\_ID)

Mux Value Hex (Decimal): 0x08 (8)

Type: Sent to unit

Frequency: NA

Description: This message only works if the unit is in setup mode. If this CAN message is sent, the unit will respond with the configured unit ID that is part of the heartbeat message.

Layout:

Byte(s)	Data Type	Name	Description
0 – 2	Unsigned 24 bit integer	Unique ID	Unique ID
3	Unsigned 8 bit integer	Message Type	<b>0x08</b> – Get Unit ID

### Set Unit ID (0x09\_Cmd\_Set\_Unit\_ID)

Mux Value Hex (Decimal): 0x09 (9)

Type: Sent to unit

Frequency: NA

Description: This message only works if the unit is in setup mode. If this CAN message is sent, the unit will respond with the configured unit ID that is part of the heartbeat message.

Layout:

Byte(s)	Data Type	Name	Description
0 – 2	Unsigned 24 bit integer	Unique ID	Unique ID
3	Unsigned 8 bit integer	Message Type	<b>0x09</b> – Set Unit ID
4	Unsigned 8 bit integer	Unit ID	The value that the unit ID field should show in the heartbeat message will accept a value of 0-255

## 8ch Isolated Thermocouple to CAN

### Received Unit ID (0x0A\_Resp\_Unit\_ID)

Mux Value Hex (Decimal): 0x0A (10)

Type: Transmitted from unit

Frequency: NA

Description: This is the response message from the sensor giving the current Unit ID that is in the heartbeat message.

Layout:

Byte(s)	Data Type	Name	Description
0 – 2	Unsigned 24 bit integer	Unique ID	Unique ID
3	Unsigned 8 bit integer	Message Type	<b>0x0A</b> - Received Unit ID
4	Unsigned 8 bit integer	Unit ID	The value that the unit ID field is (0-255)

### Get CAN Bus Speed (0x0B\_Cmd\_Get\_CAN\_Bus\_Speed)

Mux Value Hex (Decimal): 0x0B (11)

Type: Sent to unit

Frequency: NA

Description: This message only works if the unit is in setup mode. If this CAN message is sent, the unit will respond with the configured CAN bus speed.

Layout:

Byte(s)	Data Type	Name	Description
0 – 2	Unsigned 24 bit integer	Unique ID	Unique ID
3	Unsigned 8 bit integer	Message Type	<b>0x0B</b> – Get CAN bus speed command

### Set CAN Bus Speed (0x0C\_Cmd\_Set\_CAN\_Bus\_Speed)

Mux Value Hex (Decimal): 0x0C (12)

Type: Sent to unit

Frequency: NA

Description: This message only works if the unit is in setup mode. This will set the CAN bus speed.

Layout:

Byte(s)	Data Type	Name	Description
0 – 2	Unsigned 24 bit integer	Unique ID	Unique ID
3	Unsigned 8 bit integer	Message Type	<b>0x0C</b> – Set CAN bus speed command
4	Unsigned 8 bit integer	CAN bus speed	The below values in this field correspond to the following CAN speeds:  0 = 1000kbps 1 = 500kbps (default) 2 = 250kbps 3 = 125kbps

## 8ch Isolated Thermocouple to CAN

### Received CAN Bus Speed (0x0D\_Resp\_CAN\_Bus\_Speed)

Mux Value Hex (Decimal): 0x0D (13)

Type: Transmitted from unit

Frequency: NA

Description: This message only works if the unit is in setup mode. This is a unit response to a set or get CAN Bus Speed message.

Layout:

Byte(s)	Data Type	Name	Description
0 – 2	Unsigned 24 bit integer	Unique ID	Unique ID
3	Unsigned 8 bit integer	Message Type	<b>0x0D</b> – CAN bus speed
4	Unsigned 8 bit integer	CAN bus speed	The below values in this field correspond to the following CAN speeds:  0 = 1000kbps 1 = 500kbps (default) 2 = 250kbps 3 = 125kbps

### Get CAN start address (0x0E\_Cmd\_Get\_CAN\_Start\_Address)

Mux Value Hex (Decimal): 0x0E (14)

Type: Sent to unit

Frequency: NA

Description: This message only works if the unit is in setup mode. If this CAN message is sent, the unit will respond with the configured CAN start address. The start address is the Configuration CAN address, any CAN messages specific to the unit's functions will be sent consecutively after this address.

Layout:

Byte(s)	Data Type	Name	Description
0 – 2	Unsigned 24 bit integer	Unique ID	Unique ID
3	Unsigned 8 bit integer	Message Type	<b>0x0E</b> – get CAN start address

### Set CAN start address (0x0F\_Cmd\_Set\_CAN\_Start\_Address)

Mux Value Hex (Decimal): 0x0F (15)

Type: Sent to unit

Frequency: NA

Description: This message only works if the unit is in setup mode. If this CAN message is sent, the unit will set the new CAN start address and respond with the configured CAN start address. The start address is the Configuration CAN address, any CAN messages specific to the unit's functions will be sent consecutively after this address.

Layout:

Byte(s)	Data Type	Name	Description
0 – 2	Unsigned 24 bit integer	Unique ID	Unique ID
3	Unsigned 8 bit integer	Message Type	<b>0x0F</b> – set CAN start address
4 - 5	Unsigned 11 bit integer	CAN address	A value between 0x000 (0) to 0x7FF (2047), this is the theoretical maximum start address, but this will actually be determined by the number of CAN addresses used up by

## 8ch Isolated Thermocouple to CAN

			the unit. Maximum start address = 2047 – number of CAN addresses used.
--	--	--	--

### Received CAN Start Address (0x10\_Resp\_CAN\_Start\_Address)

Mux Value Hex (Decimal): 0x10 (16)

Type: Transmitted from unit

Frequency: NA

Description: This is a unit's response to a set or get CAN Bus start address message.

Layout:

Byte(s)	Data Type	Name	Description
0 – 2	Unsigned 24 bit integer	Unique ID	Unique ID
3	Unsigned 8 bit integer	Message Type	<b>0x10</b> – CAN start address
4 – 5	Unsigned 11 bit integer	CAN address	A value between 0x000 (0) to 0x7FF (2047), this is the theoretical maximum start address, but this will actually be determined by the number of CAN addresses used up by the unit. Maximum start address = 2047 – number of CAN addresses used.

### Get Unit Mode (0x11\_Cmd\_Get\_Sleep\_Mode)

Mux Value Hex (Decimal): 0x11 (17)

Type: Sent to unit

Frequency: NA

Description: This message only works if the unit is in setup mode. If this CAN message is sent, the unit will respond with the configured sleep mode.

Layout:

Byte(s)	Data Type	Name	Description
0 – 2	Unsigned 24 bit integer	Unique ID	Unique ID
3	Unsigned 8 bit integer	Message Type	<b>0x11</b> – Get unit mode command

## 8ch Isolated Thermocouple to CAN

### Set Unit Mode (0x12\_Cmd\_Set\_Unit\_Mode)

Mux Value Hex (Decimal): 0x12 (18)

Type: Sent to unit

Frequency: NA

Description: This message configures the unit mode and can be used to stop and start CAN messages from the unit. The unit does not need to be in setup mode for this command to work.

Layout:

Byte(s)	Data Type	Name	Description
0 – 2	Unsigned 24 bit integer	Unique ID	Unique ID
3	Unsigned 8 bit integer	Message Type	<b>0x12</b> – Set unit mode command
4-5	Unsigned 16 bit integer	Key	The current key from the heartbeat message
6	Unsigned 8 bit integer	Unit Mode	The below values in this field correspond to the following unit modes:  0 = Normal 1 = Low power (No CAN traffic until Wake threshold is reached or this CAN command is sent to put it back to Normal mode)

### Other Configuration CAN Messages

Please refer to the CAN dbc for more information.

## 8ch Isolated Thermocouple to CAN TI8\_Ch1\_Ch4 (0x326 [default])

### Overview

This CAN message is used to output the unit's Thermocouple temperature values from channels 1 to 4.

### Default settings

- CAN Start Address + 1 = (0x326 by default)
- Output rate is set to 200ms

### Format

- Intel
- 8 bytes in length

### Layout

Variables and Signals		Layout							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
Byte 0	TC_1_DegC 7	6	5	4	3	2	1	0	
Byte 1	TC_1_DegC 15	14	13	12	11	10	9	8	
Byte 2	TC_2_DegC 23	22	21	20	19	18	17	16	
Byte 3	TC_2_DegC 31	30	29	28	27	26	25	24	
Byte 4	TC_3_DegC 39	38	37	36	35	34	33	32	
Byte 5	TC_3_DegC 47	46	45	44	43	42	41	40	
Byte 6	TC_4_DegC 55	54	53	52	51	50	49	48	
Byte 7	TC_4_DegC 63	62	61	60	59	58	57	56	

Byte(s)	Data Type	Name	Description
0 – 1	unsigned 16 bit	Temperature deg C Channel 1	Temperature -200 to 2421.4 deg C (offset -200, scaling 0.04)
2 – 3	unsigned 16 bit	Temperature deg C Channel 2	Temperature -200 to 2421.4 deg C (offset -200, scaling 0.04)
4 – 5	unsigned 16 bit	Temperature deg C Channel 3	Temperature -200 to 2421.4 deg C (offset -200, scaling 0.04)
6 – 7	unsigned 16 bit	Temperature deg C Channel 4	Temperature -200 to 2421.4 deg C (offset -200, scaling 0.04)

TABLE 10 TI8\_CH1\_CH4 MESSAGE

## 8ch Isolated Thermocouple to CAN TI8\_Ch5\_Ch8 (0x327 [default])

### Overview

This CAN message is used to output the unit's Thermocouple temperature values from channels 5 to 8.

### Default settings

- CAN Start Address + 2 = (0x327 by default)
- Output rate is set to 200ms

### Format

- Intel
- 8 bytes in length

### Layout

Variables and Signals	Layout							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	TC_5_DegC <sup>7</sup>	6	5	4	3	2	1	0
Byte 1	TC_5_DegC <sup>15</sup>	14	13	12	11	10	9	8
Byte 2	TC_6_DegC <sup>23</sup>	22	21	20	19	18	17	16
Byte 3	TC_6_DegC <sup>31</sup>	30	29	28	27	26	25	24
Byte 4	TC_7_DegC <sup>39</sup>	38	37	36	35	34	33	32
Byte 5	TC_7_DegC <sup>47</sup>	46	45	44	43	42	41	40
Byte 6	TC_8_DegC <sup>55</sup>	54	53	52	51	50	49	48
Byte 7	TC_8_DegC <sup>63</sup>	62	61	60	59	58	57	56

Byte(s)	Data Type	Name	Description
0 – 1	unsigned 16 bit	Temperature deg C Channel 5	Temperature -200 to 2421.4 deg C (offset -200, scaling 0.04)
2 – 3	unsigned 16 bit	Temperature deg C Channel 6	Temperature -200 to 2421.4 deg C (offset -200, scaling 0.04)
4 – 5	unsigned 16 bit	Temperature deg C Channel 7	Temperature -200 to 2421.4 deg C (offset -200, scaling 0.04)
6 – 7	unsigned 16 bit	Temperature deg C Channel 8	Temperature -200 to 2421.4 deg C (offset -200, scaling 0.04)

TABLE 11 TI8\_Ch5\_Ch8 MESSAGE



## 8ch Isolated Thermocouple to CAN TI8\_Status (0x328 [default])

### Overview

This CAN message is used to see what each thermocouple channel is configured to, each channel can be a different thermocouple type, configured using a CAN command, we recommend keeping the thermocouple type that matches the connectors on the unit. In addition this message also shows the status of each thermocouple channel.

### Default settings

- CAN Start Address + 3 = (0x328 by default)
- Output rate is set to 10ms

### Format

- Intel
- 8 bytes in length

### Layout

Variables and Signals		Layout							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
Byte 0	TC_2_Type 7	6	5	4	TC_1_Type 3	2	1	0	
Byte 1	TC_4_Type 15	14	13	12	TC_3_Type 11	10	9	8	
Byte 2	TC_6_Type 23	22	21	20	TC_5_Type 19	18	17	16	
Byte 3	TC_8_Type 31	30	29	28	TC_7_Type 27	26	25	24	
Byte 4	TC_8_Comms_Fault 39	TC_7_Comms_Fault 38	TC_6_Comms_Fault 37	TC_5_Comms_Fault 36	TC_4_Comms_Fault 35	TC_3_Comms_Fault 34	TC_2_Comms_Fault 33	TC_1_Comms_Fault 32	
Byte 5	TC_4_Status 47	46	TC_3_Status 45	44	TC_2_Status 43	42	TC_1_Status 41	40	
Byte 6	TC_8_Status 55	54	TC_7_Status 53	52	TC_6_Status 51	50	TC_5_Status 49	48	
Byte 7	Unit_Temperature_DegC 63	62	61	60	59	58	57	56	

Byte(s) – [Bit(s)]	Data Type	Name	Description
0 - [0 – 3]	unsigned 4 bit	TC_1_Type	0 = Thermocouple Type K, 1 = Type J, 2 = Type T, 3 = Type N, 4 = Type S, 5 = Type E, 6 = Type B, 7 = Type R
0 - [4 – 7]	unsigned 4 bit	TC_2_Type	0 = Thermocouple Type K, 1 = Type J, 2 = Type T, 3 = Type N, 4 = Type S, 5 = Type E, 6 = Type B, 7 = Type R
1 - [0 – 3]	unsigned 4 bit	TC_3_Type	0 = Thermocouple Type K, 1 = Type J, 2 = Type T, 3 = Type N, 4 = Type S, 5 = Type E, 6 = Type B, 7 = Type R
1 - [4 – 7]	unsigned 4 bit	TC_4_Type	0 = Thermocouple Type K, 1 = Type J, 2 = Type T, 3 = Type N, 4 = Type S, 5 = Type E, 6 = Type B, 7 = Type R
2 - [0 – 3]	unsigned 4 bit	TC_5_Type	0 = Thermocouple Type K, 1 = Type J, 2 = Type T, 3 = Type N, 4 = Type S, 5 = Type E, 6 = Type B, 7 = Type R
2 - [4 – 7]	unsigned 4 bit	TC_6_Type	0 = Thermocouple Type K, 1 = Type J, 2 = Type T, 3 = Type N, 4 = Type S, 5 = Type E, 6 = Type B, 7 = Type R
3 - [0 – 3]	unsigned 4 bit	TC_7_Type	0 = Thermocouple Type K, 1 = Type J, 2 = Type T, 3 = Type N, 4 = Type S, 5 = Type E, 6 = Type B, 7 = Type R

## 8ch Isolated Thermocouple to CAN

3 - [4 - 7]	unsigned 4 bit	TC_8_Type	0 = Thermocouple Type K, 1 = Type J, 2 = Type T, 3 = Type N, 4 = Type S, 5 = Type E, 6 = Type B, 7 = Type R
4 - [0]	1 Bit	TC_1_Comms_Fault	The communication to Thermocouple Channel 1 has a fault
4 - [1]	1 Bit	TC_2_Comms_Fault	The communication to Thermocouple Channel 2 has a fault
4 - [2]	1 Bit	TC_3_Comms_Fault	The communication to Thermocouple Channel 3 has a fault
4 - [3]	1 Bit	TC_4_Comms_Fault	The communication to Thermocouple Channel 4 has a fault
4 - [4]	1 Bit	TC_5_Comms_Fault	The communication to Thermocouple Channel 5 has a fault
4 - [5]	1 Bit	TC_6_Comms_Fault	The communication to Thermocouple Channel 6 has a fault
4 - [6]	1 Bit	TC_7_Comms_Fault	The communication to Thermocouple Channel 7 has a fault
4 - [7]	1 Bit	TC_8_Comms_Fault	The communication to Thermocouple Channel 8 has a fault
5 - [0 - 1]	2 Bit	TC_1_Status	The status of Thermocouple Channel 1 0 = Pending (started a temperature conversion or communication) 1 = Open Circuit (the thermocouple is disconnected) 2 = Short Circuit (the thermocouple has connected to the units ground or 3.3V supply for this channel) 3 = Ready (the unit is ready to take a reading)
5 - [2 - 3]	2 Bit	TC_2_Status	The status of Thermocouple Channel 2 0 = Pending (started a temperature conversion or communication) 1 = Open Circuit (the thermocouple is disconnected) 2 = Short Circuit (the thermocouple has connected to the units ground or 3.3V supply for this channel) 3 = Ready (the unit is ready to take a reading)
5 - [4 - 5]	2 Bit	TC_3_Status	The status of Thermocouple Channel 3 0 = Pending (started a temperature conversion or communication) 1 = Open Circuit (the thermocouple is disconnected) 2 = Short Circuit (the thermocouple has connected to the units ground or 3.3V supply for this channel) 3 = Ready (the unit is ready to take a reading)
5 - [6 - 7]	2 Bit	TC_4_Status	The status of Thermocouple Channel 4 0 = Pending (started a temperature conversion or communication) 1 = Open Circuit (the thermocouple is disconnected) 2 = Short Circuit (the thermocouple has connected to the units ground or 3.3V supply for this channel) 3 = Ready (the unit is ready to take a reading)
6 - [0 - 1]	2 Bit	TC_5_Status	The status of Thermocouple Channel 5

			<p>0 = Pending (started a temperature conversion or communication)</p> <p>1 = Open Circuit (the thermocouple is disconnected)</p> <p>2 = Short Circuit (the thermocouple has connected to the units ground or 3.3V supply for this channel)</p> <p>3 = Ready (the unit is ready to take a reading)</p>
6 – [2 – 3]	2 Bit	TC_6_Status	<p>The status of Thermocouple Channel 6</p> <p>0 = Pending (started a temperature conversion or communication)</p> <p>1 = Open Circuit (the thermocouple is disconnected)</p> <p>2 = Short Circuit (the thermocouple has connected to the units ground or 3.3V supply for this channel)</p> <p>3 = Ready (the unit is ready to take a reading)</p>
6 – [4 – 5]	2 Bit	TC_7_Status	<p>The status of Thermocouple Channel 7</p> <p>0 = Pending (started a temperature conversion or communication)</p> <p>1 = Open Circuit (the thermocouple is disconnected)</p> <p>2 = Short Circuit (the thermocouple has connected to the units ground or 3.3V supply for this channel)</p> <p>3 = Ready (the unit is ready to take a reading)</p>
6 – [6 – 7]	2 Bit	TC_8_Status	<p>The status of Thermocouple Channel 8</p> <p>0 = Pending (started a temperature conversion or communication)</p> <p>1 = Open Circuit (the thermocouple is disconnected)</p> <p>2 = Short Circuit (the thermocouple has connected to the units ground or 3.3V supply for this channel)</p> <p>3 = Ready (the unit is ready to take a reading)</p>
7	8 bit unsigned	Unit_Temperature_DegC	Unit Internal Temperature -20 to 107.5 Deg C

TABLE 12 TI8\_STATUS CAN MESSAGE

## 8ch Isolated Thermocouple to CAN

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