

# Instruction Manual

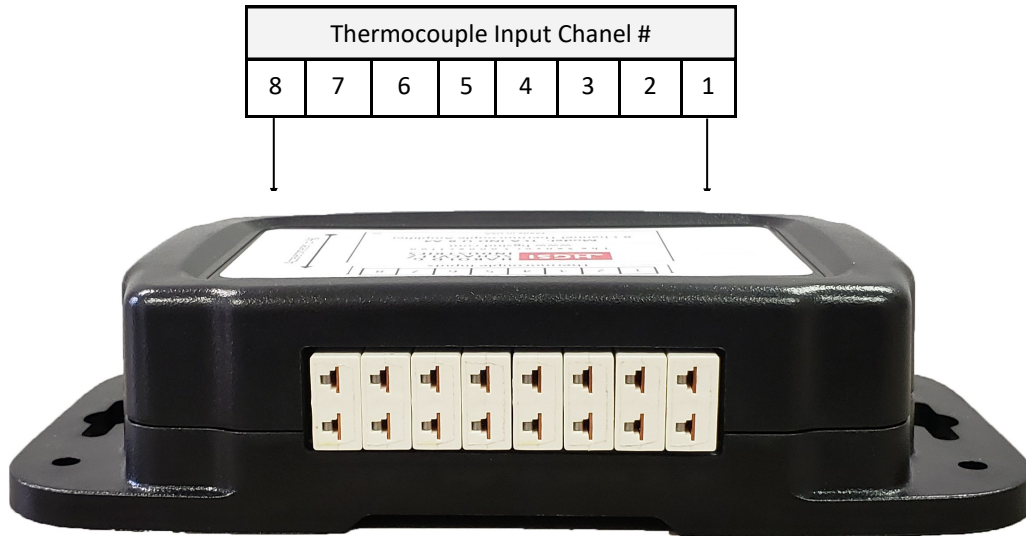
## 8-Channel Universal Thermocouple Amplifier + Accelerometer



TCA-IND-U-8-A4

# Instruction Manual - TCA-IND-U-8-A4 Thermocouple Amplifier

## Amplifier Thermocouple Input Connection:



## Thermocouple Mating Connector:



Use a Thermocouple *Mini* Connector (with flat pins)

## Housing Dimensions:

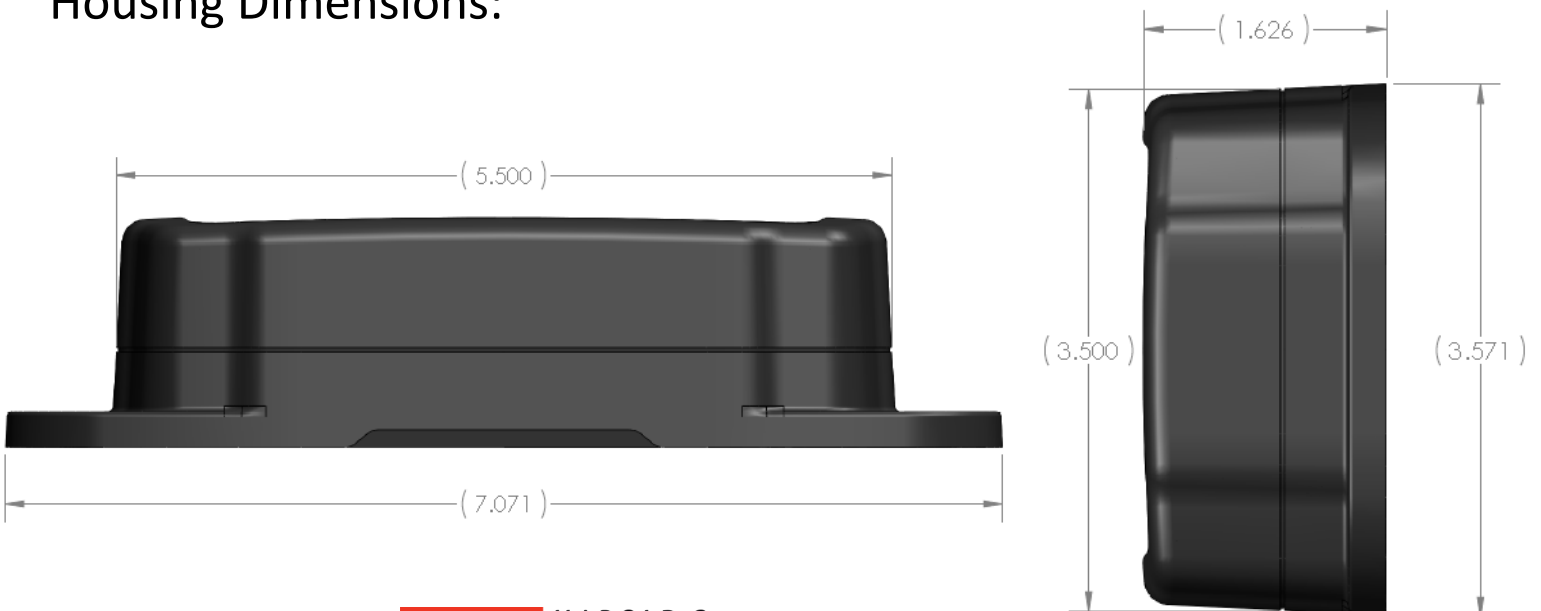
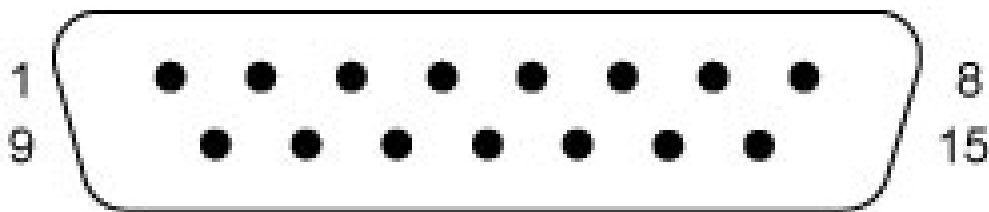


Table 1: Wiring Harness Pin-Out

Pin Number	Color	Description
1	Red	Power +
2	Black	Power/Signal Ground
3	Orange/White	UART Rx
4	Red/Black	ACCEL Output +
5	Orange	TC #7 Output +
6	Orange/Black	TC #5 Output +
7	Blue	TC #2 Output +
8	Blue/Black	TC #4 Output +
9	Pink	CAN-HI
10	Purple	CAN-LO
11	Brown	UART Tx
12	Green	TC #8 Output +
13	Green/Black	TC #6 Output +
14	White	TC #1 Output +
15	White/Black	TC #3 Output +

Figure 1: Amplifier Input/Output Connector Pin-Out



DA-15P (Male Plug Front View)

Table 2: Input Measuring Ranges; Thermocouple Channels

Thermocouple Measuring Range		
Type	Measuring Range (°F)	Measuring Range (°C)
J	-148 to +1382	-100 to +750
K	-238 to +2282	-150 to +1250
T	-220 to +662	-140 to +350
E	-238 to +1652	-150 to +900
N	-148 to +2192	-100 to +1200
R	+482 to +2552	+250 to +1400
S	+482 to +2552	+250 to +1400
B	+1832 to +3002	+1000 to +1650

Table 3: Analog & Digital Non-Linearity Output Specifications; Thermocouple Channels

Measurement Accuracy			
Type	Analog Output Non-Linearity (FSO) (Full TC Measuring Range)	Digital Output Non-Linearity (FSO) (0°C to Max Range)	Digital Output Non-Linearity (FSO) (Min Range to 0°C )
J	±1.54%	±0.57%	±0.75%
K	±1.38%	±0.21%	±1.42%
T	±3.40%	±1.70%	±4.07%
E	±1.82%	±0.64%	±1.91%
N	±1.82%	±0.58%	±0.62%
R	±2.40%	±1.40%	±1.40%
S	±2.30%	±1.20%	±1.20%
B	±4.42%	±4.06%	±4.06%

Table 4: Analog Output; Accelerometer Channel

Scale Factor (g)	1 V/g
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Volts	g
-4.0	-4.0
-3.8	-3.8
-3.6	-3.6
-3.5	-3.5
-3.3	-3.3
-3.2	-3.2
-3.0	-3.0
-2.8	-2.8
-2.7	-2.7
-2.5	-2.5
-2.4	-2.4
-2.2	-2.2
-2.0	-2.0
-1.9	-1.9
-1.7	-1.7
-1.6	-1.6
-1.4	-1.4

Volts	g
-1.2	-1.2
-1.1	-1.1
-0.9	-0.9
-0.8	-0.8
-0.6	-0.6
-0.4	-0.4
-0.3	-0.3
-0.1	-0.1
0.0	0.0
0.1	0.1
0.3	0.3
0.4	0.4
0.6	0.6
0.8	0.8
0.9	0.9
1.1	1.1
1.2	1.2

Volts	g
1.4	1.4
1.6	1.6
1.7	1.7
1.9	1.9
2.0	2.0
2.2	2.2
2.4	2.4
2.5	2.5
2.7	2.7
2.8	2.8
3.0	3.0
3.2	3.2
3.3	3.3
3.5	3.5
3.6	3.6
3.8	3.8
4.0	4.0

**Multiplier:**

g = Volts \* 1

**Offset:**

0 g

**Example:**

Output from amplifier = 4.0 Volts  
 (4.0 Volts \* 1) = 4.0 g

# Instruction Manual - TCA-IND-U-8-A4 Thermocouple Amplifier

## Amplifier Specifications:

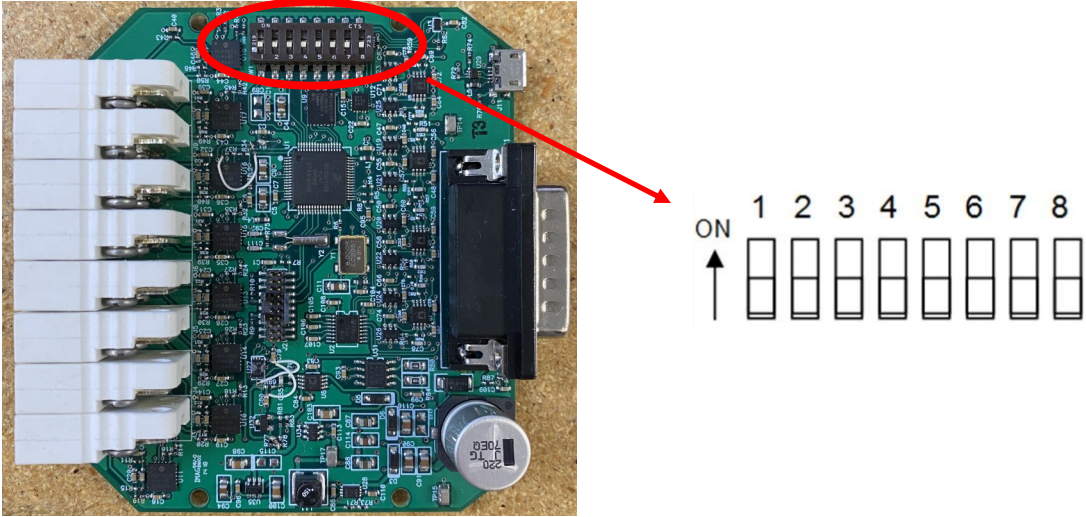
Input Specifications	
Number of Input Channels	8
Thermocouple Type	J, K, T, E, N, R, S, B
Measuring Range	(see table 2 on page 4)
Cold Junction Compensation	+32 to +185°F (0 to +85°C)
Input Connectors	Mini Thermocouple Jacks
Analog Output Specifications	
Number of Output Channels	9 Total 8-Thermocouple + Accelerometer
Analog Output Range	Linearized 0 to +5 VDC
Resolution:	0.0625 VDC
Response Time	10 ms (100 Hz)
Non-Linearity	(see table 3 on page 4)
Noise	$\leq \pm 5$ mV <sub>RMS</sub>
Output Connector	Male 15-pin D-sub (DA-15P)

Power Specifications	
Supply Voltage	10 to 28 VDC
Current Draw	< 50 mA
Environmental Specifications	
Operating Temperature Range	+32 to +125°F (0 to +50°C)
Humidity	85% Max. RH (non-condensing)
Liquid & Dust Protection	IP51
Mechanical Specifications	
Housing Dimensions (L x W x H)	5.5 x 3.5 x 1.5 inch
Weight	0.6 lb (265 g)

Digital Output Specifications			
Digital Resolution	Temperature Resolution	Sample Rate (ms)	Sample Rate (Hz)
12-bit	0.5 °C	25 ms	40 Hz
14-bit	0.25 °C	50 ms	20 Hz
16-bit	0.125 °C	100 ms	10 Hz
18-bit	0.0625 °C	330 ms	3.125 Hz

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Table 5: Internal Dip Switch Settings



Switch	Description	OFF Value (Default)	ON Value
1	Use Dip Switch Settings OR Software Settings	Use Software Settings	Use Dip Switch Settings
2	Set TC Type (all channels)	See table below	See table below
3	Set TC Type (all channels)	See table below	See table below
4	Set TC Type (all channels)	See table below	See table below
5	Resolution/Sample Rate	18-bit/3.125 Hz	12-bit/40 Hz
6	Toggle CAN Output	Disabled	Enabled
7	Toggle Outputs	Enabled	Disabled
8	UART Logging	Disabled	Enabled

Table: Set TC Type Dip Switch Settings

TC Type	Switch 2	Switch 3	Switch 4
K	OFF	OFF	OFF
J	OFF	OFF	ON
T	OFF	ON	OFF
N	OFF	ON	ON
S	ON	OFF	OFF
E	ON	OFF	ON
B	ON	ON	OFF
R	ON	ON	ON

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Table 6: CAN Message Frame Definition (*if option is enabled*)

	Arbitration Field		Control Field			Data Field					
	32 bits		6 bits			64 bits					
SOF	Identifier	RTR	IDE	r0	DLC	Channel x Data	Channel x+1 Data	CRC	CRC Delimiter	ACK Field	EOF
1 bit	11 bits	1 bit	1 bit	1 bit	4 bits	32 bits	32 bits	15 bits	1 bit	2 bits	7 bits

SOF = Start of Frame  
 RTR = Remote Transmission Request  
 IDE = Identifier Extension Bit  
 r0 = Reserved r0  
 DLC = Data Length Code  
 CRC = Cyclic Redundancy Check  
 ACK = Acknowledgement  
 EOF = End of Frame

Channels	1-2	3-4	5-6	7-8
Identifier (hex)	100	101	102	103
Identifier (decimal)	256	257	258	259

Baud Rate: 500k bits/sec  
 Multiplier: 0.000078125  
 Offset: 0  
 Byte Order: Motorola (big endian)  
 Integer: Signed  
 Update Rate: 1 second

**NOTES**

Send acknowledgment (silent mode disabled/off)  
 Add termination resistor if receiving device does not include it



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## Danger

- Ensure that the vehicle will remain stationary and turn off the engine before installing this product. Failure to do so could result in a fire, and could make the vehicle move during installation.
- Remove the key from the ignition and disconnect the negative (-) battery terminal prior to installation of this product. Failure to do so could result in a fire caused by an electrical short circuit.
- Take care not to install this product in a way that interferes with safety equipment such as seat belts and air bag systems or vehicle operation equipment such as engine controls, steering wheel or brake systems. Interference with normal operation of the vehicle can result in an accident or fire.
- Solder or use a solderless connector for wiring connections and make sure connections are insulated. In areas where there could be tension or sudden impacts on the wiring, safeguard the wiring with corrugated tubing or other shock absorbent material. Accidental shorts can cause fires.

## Warning

- Carefully consider the installation location and driver's operation of the product before installation. Do not install the product where it interrupts driving and the safety devices of vehicle such as the air bag system. Be sure not to install the unit where it could fall. Improper installation or operation could cause the product to fall and damage the vehicle or cause serious danger by impeding driving.
- Do not disassemble or modify this product. Such actions can not only damage or destroy the product but will also void the warranty.
- Do not perform installation of this product immediately after the engine has been switched off. The engine and exhaust system are extremely hot at this time and can cause burns if touched.
- Ensure that the wiring of this product does not have an adverse impact on the other wiring of the vehicle. Any controlling devices or other electronic components of the vehicle could be damaged.
- Please keep children and infants away from the installation area. Children may swallow small parts or be injured in other ways.

## Caution

- Insulate any unused wires. If any wires or connectors loosen during installation, please make sure they are correctly reattached.
- Dropping any of the components of this product will result in damage to the product.
- Excessive force on switches/terminals may result in damage to the product.
- Use only the wires provided. If additional wires are required, use the same of quality and gauge wire as is provided with the kit.
- Do not attach wires on the body of the vehicle or engine parts as this may result in damage to the product.
- Install wires away from ignition and also radio signal frequency interference as this could cause the gauges to malfunction.
- Do not place wires near the engine, exhaust pipe or turbine. It may result in damage or fusion of wires.
- Make sure the waterproof processing is done when routing wires in the engine compartment.
- When installing the sensor, do not bend the wire near the sensor body.
- Wear gloves to avoid burns when soldering and cuts when working with wiring.
- Do not share a single fuse with multiple gauges. Every gauge requires an independent fuse.
- Install amplifier away from hot or wet places.
- Do not pull the wires out of connectors forcefully. The connectors may be broken and the wires may be cut. When pulling out the wires, press the lock firmly and unclip the locks of connectors.

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## 12 MONTH LIMITED WARRANTY

HGSI - The Sensor Connection LLC (HGSI) warrants to the consumer that all HGSI products will be free from defects in material and workmanship for a period of twelve (12) months from date of the original purchase. Products that fail within this 12 month warranty period will be repaired or replaced at HGSI's option to the consumer, when it is determined by HGSI that the product failed due to defects in material or workmanship. This warranty is limited to the repair or replacement of parts in the HGSI instruments. In no event shall this warranty exceed the original purchase price of the HGSI instruments nor shall HGSI be responsible for special, incidental or consequential damages or costs incurred due to the failure of this product. Warranty claims to HGSI must be transportation prepaid and accompanied with dated proof of purchase. This warranty applies only to the original purchaser of product and is non-transferable. All implied warranties shall be limited in duration to the said 12 month warranty period. Breaking the instrument seal, improper use or installation, accident, water damage, abuse, unauthorized repairs or alterations voids this warranty. HGSI disclaims any liability for consequential damages due to breach of any written or implied warranty on all products manufactured or supplied by HGSI.

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