

# Thermocouple to DC Isolated Transmitter with Alarm Relay

K109TC 

**Input:** Thermocouples J, K, T, E, R, S, N, or B  
**Output:** 0-5 V, 1-5 V, 0-10 V, 10-0 V, 20-0 mA, 0-20 mA, 20-4 mA, 4-20 mA, Alarm Relay

- Only 6.2 mm Wide
- Convert Temperature to DC Output
- DIP Switch Configuration
- Full 3-Way Isolation
- Bus Power Options

## Applications

- Convert Thermocouple Temperature to PLC Input for Control and/or Validation
- Interface a T/C with Panel Meters, PLCs, Recorders, Data Acq., DCS, & SCADA Systems

## Description

The K109TC is a field configurable isolator/converter/alarm to convert a thermocouple sensor signal to a standard analog mA or V output. A SPST pilot duty relay is also provided and may be used to operate a low power alarm, a higher capacity relay, as an input to a control system, or as a thermostat.

The compact 0.25" wide size saves considerable panel space. Input and output are completely configurable via DIP switches.

## Specifications

### Thermocouple Temperature Range, Accuracy, Resolution

T/C	Range	Mean Error	Resolution
J	-210-1200°C (-346-2192°F)	0.025%+0.29°C	0.12°C
K	-200-1372°C (-328-2502°F)	0.025%+0.4°C	0.17°C
T	-200-400°C (-328-752°F)	0.025%+0.31°C	0.13°C
E	-200-1000°C (-328-1832°F)	0.025%+0.2°C	0.92°C
R	-50-1768°C (-58-3214°F)	0.025%+1.19°C	0.59°C
S	-50-1768°C (-58-3214°F)	0.025%+1.34°C	0.66°C
N	-200-1300°C (-328-2372°F)	0.025%+0.42°C	0.19°C
B*	250-1820°C (482-3308°F)	0.025%+1.87°C	0.90°C

\* Up to 250°C, the output is equivalent to a null temperature  
 100°C min. span  
 10 MΩ impedance  
 Cold junction error: 1.5°C max.

### Output

0-20 mA, 20-0 mA, 4-20 mA, 20-4 mA  
 Sourcing mA output, 10 V, max. load: 500 Ω  
 0-10 V, 10-0 V, 0-5 V, 1-5 V, min. load: 2 kΩ

### Relay Output

One SPST, 24 VAC, 60 mA max.

### Accuracy

±0.1% of span  
 Thermal drift: 120 ppm/K  
 Output resolution error  
 1 mV for voltage output  
 2 μA for current output  
 5 V output: 350 ppm of full scale  
 10 V output: 200 ppm of full scale

### Response Time

<25 ms typ., <55 ms with filter

### Sensor Test Current

<50 nA

### LED Indicators

Sensor fault, relay status

### Configuration

DIP switches

### Conversion

Input: 14 bit A/D conversion  
 Output: 16 bit A/D conversion, floating point 32 bit

### Isolation

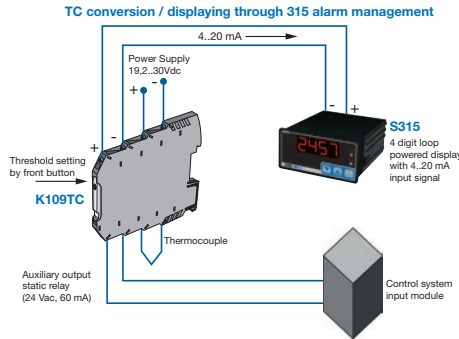
Full 3-way isolation: input, output, power  
 Galvanic and optocoupler  
 1500 V<sub>RMS</sub> 1 minute isolation  
 Hot swappable

### Over-Range Output

Over-range 102.5% FS, malfunction 105% of FS  
 Current output protection approximately 25 mA

Free Factory I/O Setup!

Quick Link [api-usa.com/k-line](http://api-usa.com/k-line)



3-Way Isolation

6.2 mm

0.1%

>500,000 h

Versatile DIP Switch Setup

<25 mA

### Ambient Conditions

-20°C to +65°C operating  
 -40°C to +85°C storage  
 10 to 90% RH at 40°C non-condensing

### Connections

24 to 14 AWG wire size stripped 5/16"  
 Spring clamp terminals or DIN rail K-BUS for power

### Housing

IP 20, requires installation in panel or enclosure  
 Mounts to standard 35 mm DIN rail  
 1.7 ounces (50 grams)

### Power

19.2 to 30 VDC via terminals or K-bus, 500 mW max typ.

### Dimensions

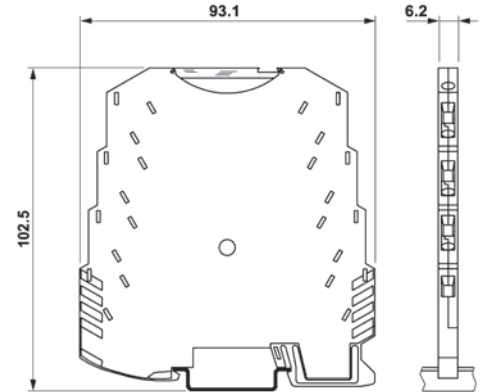
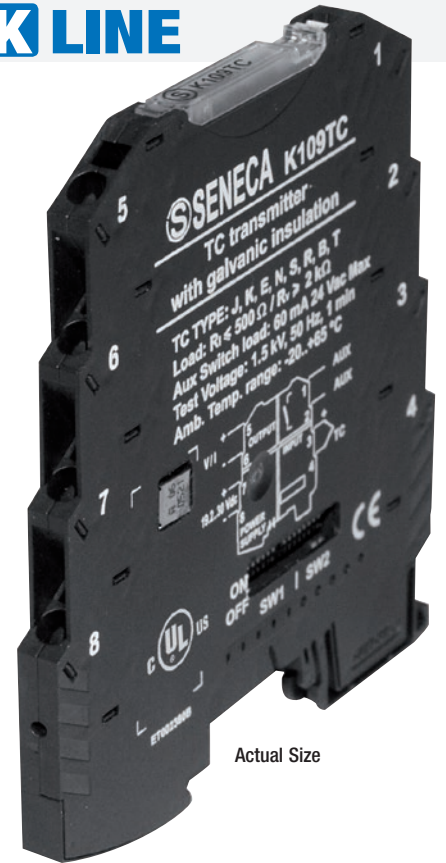
2.5" H x 0.25" W x 4" D (93.1 x 6.2 x 102.5 mm)

### Standards

CE, UL-UR CSAEN 50081-2, EN 50082-2, EN 61010-1, EN 60742, EN 61000-6-4, EN 61000-6-2

Call 1-800-942-0315 to place your order!	
Model	Description
K109TC	Thermocouple transmitter. User configurable thermocouple type, temperature range and mA or voltage output. 19.2-30 VDC powered.
K-BUS	DIN rail power connector system. See <a href="http://api-usa.com/kbus">api-usa.com/kbus</a>

**K LINE**



## K-Bus Power



K-BUS Backplane power connection snaps into DIN rail.

## More Slim Transmitters

K109PT	100 Ohm RTD to DC
K121	Universal temperature/mA/V/Ohm to DC
K109UI	DC to DC isolator/converter
K107A	RS485 - RS485 serial amplifier/isolator
K107B	RS232 - RS485 serial isolator/converter
K107USB	USB - RS485 isolator/converter

**Precautions**

**WARNING!** All wiring must be performed by a qualified electrician or instrumentation engineer. See diagram for terminal designations and wiring examples. Consult factory for assistance.

**WARNING!** Avoid shock hazards! Turn signal input, output, and power off before connecting or disconnecting wiring, or removing or installing module.

**Précautions**

**ATTENTION!** Tout le câblage doit être effectué par un électricien ou ingénieur en instrumentation qualifié. Voir le diagramme pour désignations des bornes et des exemples de câblage. Consulter l'usine pour assistance.

**ATTENTION!** Éviter les risques de choc! Fermez le signal d'entrée, le signal de sortie et l'alimentation électrique avant de connecter ou de déconnecter le câblage, ou de retirer ou d'installer le module.

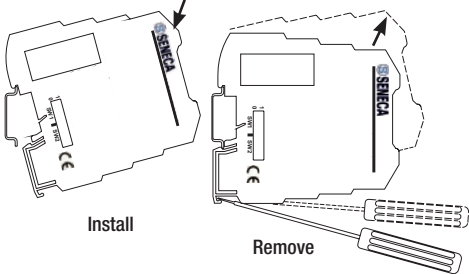
**DIP Switch Settings**

Set DIP switches SW1 and SW2 for your application as indicated in the tables at right.

Factory configuration with all DIP switches OFF is as follows: Type J thermocouple, 50 Hz line filter, input filter ON, 0 to 1000°C range, 4-20 mA output, upscale burnout, input over-range ON, relay output at 0% of scale.

**Installation and Removal**

The housing clips to a standard 35 mm DIN rail and requires installation in a protective enclosure. Install module in a vertical orientation and position in the lower part of the panel away from heat sources or objects that may block air flow.

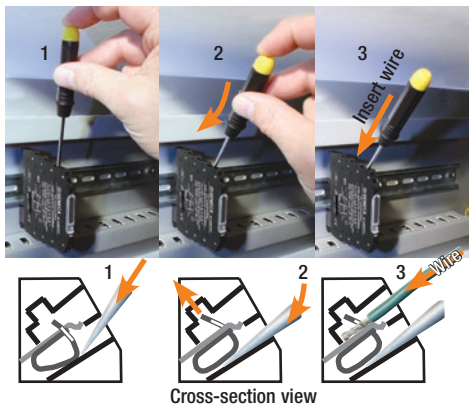


1. Tilt the front of module upward and clip the upper mount to the top edge of the DIN rail.
  2. Push front of module downward until lower mount snaps in place.
- To Remove: Avoid shock hazards! Turn input, output, and power off before removing module.
1. Use small screwdriver to pry to lower clip away from the DIN rail.
  2. Tilt the front of module upward to remove.

**Inserting Wires**

Use a flat blade screwdriver with a blade about 1/8" W to depress wiring spring clip for each connection.

1. Insert screwdriver at a nearly vertical angle into the square opening next to desired round terminal. Make sure the screwdriver goes under the spring clip and not into the clip opening.
2. Push the screwdriver down and in, (or up and in for lower terminals). The wire clip moves up exposing the opening in the round terminal opening.
3. Insert wire into round terminal hole, then remove the screwdriver and make sure wire is secure.



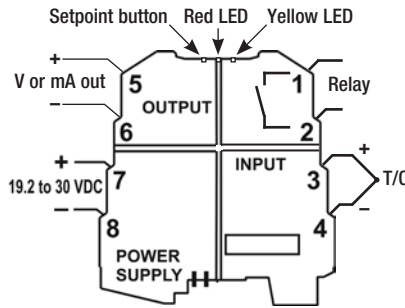
**Electrical Connections**

See the wiring diagram below. Use a Class 2 power supply. When using an isolated voltage/limited power supply, a max. 2.5 A fuse must be installed.

K-Line signal conditioners can be powered by a 24 VDC power supply connected to the module terminals or the K-BUS DIN rail power supply connector that can power up to 16 devices using up to 400 mA. The K-BUS eliminates the need to connect the power supply to each module. See [api-usa.com/kbus](http://api-usa.com/kbus).

In order to reduce the module's heat dissipation, either use the voltage output or the current output with a load of > 250 Ω.

Polarity must be observed for output wiring connections. If the output does not function, check wiring and polarity.



**Relay Output and Button Action**

The Normal state of the output depends on the primary output fault configuration via the setting of dip-switch SW2.7.

SW2.7	Type*	Burnout	Normal Relay	Button Action
OFF	Heating	Upscale	Closed, LED ON	Decrement
ON	Cooling	Downscale	Open, LED OFF	Increment

\*Application type with direct output selected: 0-20 mA, 4-20 mA, 0-5 V, 1-5 V, or 0-10 V

**Setting the Trip Point**

The trip point adjustment must be performed with the module powered up. During the adjustment of the trip point, the analog output assumes the value of the trip point. Connect an instrument such as a multimeter to the analog output to measure the V or mA value of the trip point.

The relay switches at the set value. While adjusting the trip point, the relay output operates normally, opening and closing at the previously set trip value until the new setting is stored.

1. Lift the front cover to access the trip point adjustment button. The button is behind a hole and can be pressed using a small screwdriver.
2. Press and release the button. The red LED flashes slowly and the analog output represents the value of the trip point. If within 5 seconds there is no button press, the module returns to normal operation.
3. With every button press, the trip point increases or decreases by approximately 0.2%. The direction of the change depends on the setting of dip-switch SW2.7. This only sets the trip point, the hysteresis is fixed.
4. If you continue to press the button for 2 seconds, the trip point increases or decreases by 3%. If the maximum/minimum value of the scale is reached, the cycle starts again.
5. After 5 seconds of button inactivity, the new set value is memorized and the module returns to normal operation.

Note: The trip point may not be modified if there is an internal fault. If the power supply is not sufficient during adjustments or before the 5 seconds of button inactivity have elapsed, the new value will not be stored.

Red LED	Function	Output Fault
Rapid flashing 3 x per sec.	Internal fault: insufficient power, out of range offset or reference, or error while setting alarm	YES
Slow flashing 1 x per sec.	DIP switch setting error	YES
	Setting trip point in progress	NO*
Steady light	T/C disconnected or open, input or temp. comp. out of range	YES
	Output limiting in progress	NO
Yellow LED	Function	
On	The relay output is closed	
Off	The relay output is open	

No indication in table = DIP switch is set to OFF.

SW1	1	2	3	Thermocouple Type			
					J		
	ON				K		
		ON			R		
	ON	ON			S		
			ON		T		
	ON		ON		B		
		ON	ON		E		
	ON	ON	ON		N		
SW1	4	Line Filter					
	ON				60 Hz		
					50 Hz		
SW1	5	Input Filter					
	ON				Yes		
					No		
Measurement Range Start							
SW1	6	7	8	J	K	R	S
				default*	0°C	0°C	0°C
	ON			0°C	100°C	100°C	100°C
		ON		100°C	200°C	200°C	200°C
			ON	200°C	400°C	300°C	300°C
				300°C	600°C	400°C	400°C
		ON		500°C	800°C	600°C	600°C
			ON	-100°C	-100°C	800°C	800°C
	ON	ON	ON	-200°C	-200°C	1000°C	1000°C
*0°C if ALL switches are off							
SW1	6	7	8	T	B	E	N
				0°C	0°C	0°C	0°C
	ON			50°C	400°C	100°C	100°C
		ON		100°C	500°C	200°C	200°C
			ON	200°C	600°C	300°C	300°C
				-50°C	800°C	400°C	500°C
		ON	ON	-150°C	1000°C	500°C	700°C
			ON	-100°C	1200°C	-100°C	-100°C
	ON	ON	ON	-200°C	1400°C	-200°C	-200°C
Measurement Range Upper End							
SW2	1	2	3	J	K	R	S
				1200°C	1350°C	1750°C	1750°C
	ON			1000°C	1200°C	1500°C	1500°C
		ON		800°C	1000°C	1300°C	1300°C
			ON	600°C	800°C	1100°C	1100°C
				500°C	700°C	900°C	900°C
		ON	ON	400°C	500°C	700°C	700°C
			ON	300°C	300°C	500°C	500°C
	ON	ON	ON	200°C	200°C	300°C	300°C
SW2	1	2	3	T	B	E	N
				400°C	1800°C	1000°C	1300°C
	ON			350°C	1600°C	800°C	1200°C
		ON		300°C	1500°C	600°C	1000°C
			ON	250°C	1300°C	500°C	800°C
				200°C	1100°C	400°C	600°C
		ON	ON	150°C	900°C	300°C	500°C
			ON	100°C	700°C	200°C	400°C
	ON	ON	ON	50°C	500°C	100°C	200°C
SW2	4	5	6	Output			
					4-20 mA		
	ON				0-20 mA		
		ON			20-4 mA		
			ON		20-0 mA		
				ON	0-10 VDC		
					1-5 VDC		
		ON	ON		10-0 VDC		
			ON		0-5 VDC		
SW2	7	Burnout Protection					
	ON				Downscale, relay NC, LED normally on		
					Upscale, relay NO, LED normally off		
SW2	8	Over-Range (See table below)					
	ON				No: malfunction causes 2.5% over-range value		
					Yes: 2.5% over-range OK, 5% is a malfunction		
Output limit	Over-range/mal. ±2.5%	Malfunction ±5%					
20 mA	20.5 mA	21 mA					
4 mA	3.5 mA	3 mA					
0 mA	0 mA	0 mA					
10 VDC	10.25 VDC	10.5 VDC					
5 VDC	5.125 VDC	5.25 VDC					
1 VDC	0.875 VDC	0.75 VDC					
0 VDC	0 VDC	0 VDC					

API maintains a constant effort to upgrade and improve its products. Specifications are subject to change without notice. Consult factory for your specific requirements.