EN

K109TC
ISOLATED CONVERTER FOR THERMOCOUPLES

General Description

The K109TC an isolated temperature transmitter. It converts a thermocouple temperature signal into a voltage or current signal and has a SPST relay output which can bet set by a button on the front.

The module's main features are its compact size 1/4" W (6.2 mm), attachment to a 35 mm DIN rail, bus-connector power supply option, quick connection using spring terminals, and easy configuration in the field by DIP-switches.

Technical Features

Power supply:	19.2 - 30 VDC
Consumption:	Max. 24 mA at 24 VDC
Input:	Thermocouple types: J, K, T, E, R, S, N, B
Standards:	EN60584-1 (ITS-90)
Measurement Range:	See Measurement Range Start and Measurement Range Upper End tables on pages 5 and 6
Minimum span:	100 °C
Impedance:	10 MΩ
Test Current:	<50 nA
CMRR(1):	135 dB, refered to power-supply side
DMRR (1) (2):	40 dB

(1) The values are valid at the set rejection frequency, with filter ON.
(2) A disturbance value such as an input signal peak does not exceed the limit of acceptability.

Input Range and Precision			
Thermocouple	Range	Mean Error	Resolution
J	–210 - 1200 °C	0.025% + 0.29 °C	0.12 °C
K	–200 - 1372 °C	0.025% + 0.4 °C	0.17 °C
E	–200 - 1000 °C	0.025% + 0.2 °C	0.92 °C
N	–200 - 1300 °C	0.025% + 0.42 °C	0.19 °C
S	–50 - 1768 °C	0.025% + 1.34 °C	0.66 °C
R	–50 - 1768 °C	0.025% + 1.19 °C	0.59 °C
B	250 - 1820 °C *	0.025% + 1.87 °C	0.90 °C
T	–200 - 400 °C	0.025% + 0.31 °C	0.13 °C

***** Up to 250 °C, the output is considered equivalent to a null temperature.

Voltage Output:	0-5 VDC, 1-5 VDC, 0-10 VDC, 10-0 VDC Min. load resistance 2 kΩ
Current Output:	0-20 mA, 4-20 mA, 20-0 mA, 20-4 mA Maximum load resistance 500 Ω
Maximum Voltage:	approximately 12.5 V
Maximum Current:	approximately 25 mA
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

Relay output contacts:	24 VAC max. Current: 60 mA max.

ADC :	14 bit
Class/Base Prec. :	0.1%
Thermal Drift :	120 ppm/K
Response Time : (10-90 %):	< 25 ms (without filter) < 55 ms (with repeat filter 50 Hz)
Cold junction error :	1.5 °C Max

Isolation Voltage:	1.5 kV (50 Hz for 1 min)
Protection Index:	IP20
Operating Conditions:	Temperature –20 to +65 °C Humidity 10-90% RH at 40 °C non-condensing
Storage Temperature:	–40 to +85 °C
Altitude:	Up to 2000 meters
LED Indicators:	Fault/anomaly, state of the auxiliary output
Connections:	Spring terminals
Wire Size:	24 to 14 AWG (0.2 to 2.5 mm^2)
Wire Stripping :	5/16" (8 mm)

Housing:	PBT polybutylene terephthalate, (black color)
Dimensions, Weight :	6.2 x 93.1 x 102.5 mm, 46 g.

Standards :

EN61000-6-4/2002 (electromagnetic emission, industrial surroundings)
EN61000-6-2/2005 (electromagnetic immunity, industrial surroundings)
EN61010-1/2001 (safety)
All the circuits must be provided with double insulation from the circuits under dangerous voltage. The power supply transformer must be built to compliance with EN60742: “Insulation transformers and Safety transformers”.

Notes:
- Use with copper conductor.
- Use in Pollution Degree 2 Environment .
- Power Supply must be Class 2.
- When supplied by an Isolated Limited Voltage/Limited Current power supply a fuse rated max 2.5 A shall be installed in the field.

RELAY OUTPUT DESCRIPTION

The relay output may be used as a pilot-duty alarm relay, to operate a higher capacity relay, or as an input to a supervisory control system. The K109TC may be used to generate an alarm or be utilized like a thermostat.

The **Normal** state of the output depends on the primary output fault configuration via the setting of dip-switch SW2.7 (see *Dip-Switch SW2.7* table).

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 instantaneously at the set value.

Setting the trip point

- The trip point adjustment must be performed with the module powered up.

- 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.

- Press and release the button. The primary output represents the value of the trip point. At this point the red LED flashes slowly.

- If within 5 seconds there is no button press, the module returns to normal operation.

- With every button press, the trip point increases or decreases by approximately 0.2%. The direction of the change depends on the normal state of the output set by dip-switch SW2.7. This only sets the trip point, the hysteresis is fixed.

- If the button is not released but continues to be pressed for 2 seconds, a continuous increment of 3% starts. If the maximum/minimum value of the scale is reached, the cycle starts again.

- While adjusting the trip point, the relay output operates normally, opening and closing as previously set.

- After 5 seconds of button inactivity, the set value is memorized and the module returns to normal operation.

Note: The threshold 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 memorized.

Details of Dip-Switch SW2.7

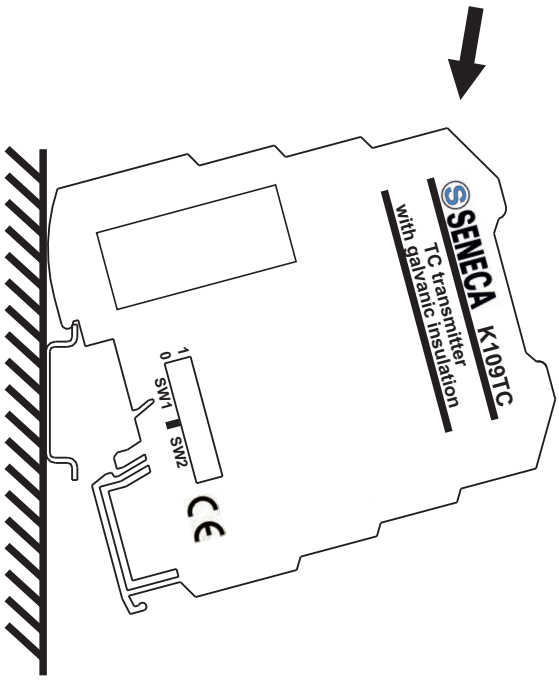
SW2.7	Regulation Type	Fault	Normal State	Set Threshold
OFF	Furnace *	Upscale Output	Closed (LED ON)	Decrement
ON	Refrigerator *	Downscale Output	Open (LED OFF)	Increment

* Direct output selected: 0-20 mA, 4-20 mA, 0-5 V, 1-5 V, or 0-10 V

Installation

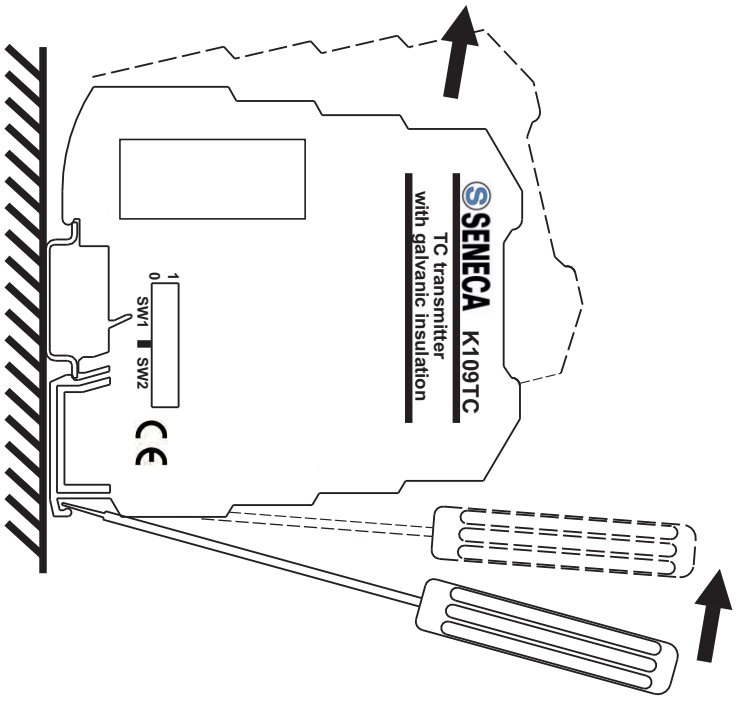
This module has been designed for attachment to a 35 mm DIN 46277 rail. Assembly in a vertical position is recommended in order to increase the module's ventilation, and no raceways or other objects that compromise air flow must be positioned in the vicinity. Do not position the module above equipment that generates heat; we recommend positioning the module in the lower part of the control panel or compartment. We recommend using the K-BUS power connector that eliminates the need to connect the power supply to each module.

Attaching the module to the rail



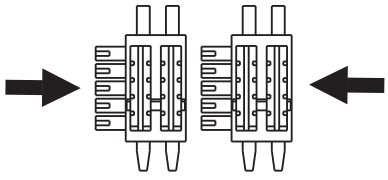
1 - Attach the module to the upper part of the rail.
2 - Press the module downwards.

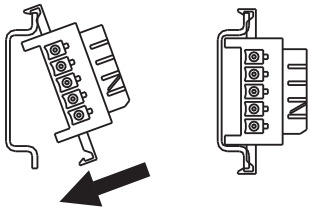
Removing the module from the rail



1 - Apply leverage using a screwdriver (as shown in the figure).
2 - Rotate the module upwards.

Using the K-BUS





1 - Assemble the K-BUS connectors as required in order to obtain the number of positions necessary (each K-BUS permits the insertion of two modules).
2 - Insert the K-BUS connectors in the rail by positioning them on the upper side of the rail and then rotating them downwards.
IMPORTANT: Pay particular attention to the position of the protruding terminals of the K-BUS. The K-bus must be inserted in the guide with the protruding terminals on the left (as shown in the figure).

- Never connect the power supply directly to the bus connector on the DIN rail.
- Never tap power supply from the bus connector either directly or by using the module's terminals.

SETTING THE DIP SWITCHES

Factory settings

All the module DIP switches are set to OFF as default configuration. This setting corresponds to the following default configuration:

Thermocouple Type :	J
Line Rejection :	50 Hz
Input Filter :	Present
Measurement Range :	0 to1000 °C
Output Signal :	4 to 20 mA
Output Signal in case of fault :	Upscale towards the top of the output range
Over-Range :	YES: a 2.5% over-range value is acceptable; a 5% over-range value is considered a malfunction.
Relay Output Threshold :	0% of the nominal scale

It is understood that this configuration is valid only with all the DIP switches at position 0. If also one switch is moved, it is necessary to set all the other parameters as indicated on the following tables.

The indication ● indicates that the DIP-switch is set in Position 1 (ON).

No indication is provided when the DIP-switch is set in Position 0 (OFF).

THERMOCOUPLE TYPE				
SW1	1	2	3	
				J
	●			K
		●		R
	●	●		S
			●	T
	●		●	B
		●	●	E
	●	●	●	N

LINE REJECTION		
SW1	4	
	●	60 Hz
		50 Hz

INPUT FILTER (*)		
SW1	5	
	●	Present
		Absent

(*) The filter increases line frequency rejection and stabilizes the reading reducing measurement noise. It is advisable to leave it on if maximum response time is not required.

MEASUREMENT RANGE START										
SW1	6	7	8	J Type	K Type	R Type	S Type	T Type	B Type	E Type	N Type
				Default *	0 °C	0 °C	0 °C	0 °C	0 °C	0 °C	0 °C
	●			0 °C	100 °C	100 °C	100 °C	50 °C	400 °C	100 °C	100 °C
		●		100 °C	200 °C	200 °C	200 °C	100 °C	500 °C	200 °C	200 °C
	●	●		200 °C	400 °C	300 °C	300 °C	200 °C	600 °C	300 °C	300 °C
			●	300 °C	600 °C	400 °C	400 °C	-50 °C	800 °C	400 °C	500 °C
	●		●	500 °C	800 °C	600 °C	600 °C	-150 °C	1000 °C	500 °C	700 °C
		●	●	-100 °C	-100 °C	800 °C	800 °C	-100 °C	1200 °C	-100 °C	-100 °C
	●	●	●	-200 °C	-200 °C	1000 °C	1000 °C	-200 °C	1400 °C	-200 °C	-200 °C

* If all the dip-switches are set to OFF position, the default configuration is valid; otherwise the value of this parameter is 0 °C, as for the other thermocouple types.

MEASUREMENT RANGE UPPER END											
SW2	1	2	3	J Type	K Type	R Type	Type S	T Type	B Type	E Type	N Type
				1200 °C	1350 °C	1750 °C	1750 °C	400 °C	1800 °C	1000 °C	1300 °C
	●			1000 °C	1200 °C	1500 °C	1500 °C	350°C	1600 °C	800 °C	1200 °C
		●		800 °C	1000 °C	1300 °C	1300 °C	300 °C	1500 °C	600 °C	1000 °C
	●	●		600 °C	800 °C	1100 °C	1100 °C	250 °C	1300 °C	500 °C	800 °C
			●	500 °C	700 °C	900 °C	900 °C	200 °C	1100 °C	400 °C	600 °C
	●		●	400 °C	500 °C	700 °C	700 °C	150 °C	900 °C	300 °C	500 °C
		●	●	300 °C	300 °C	500 °C	500 °C	100 °C	700 °C	200 °C	400 °C
	●	●	●	200 °C	200 °C	300 °C	300 °C	50 °C	500 °C	100°C	200 °C

OUTPUT				
SW2	4	5	6	
				4-20 mA
	●			0-20 mA
		●		20-4 mA
	●	●		20-0 mA
			●	0-10 V
	●		●	1-5 V
		●	●	10-0 V
	●	●	●	0-5 V

OUTPUT SIGNAL IN CASE OF FAULT		
SW2	7	
	●	Downscale burnout
		Upscale burnout

OVER-RANGE (*)		
SW2	8	
	●	NO: the malfunction alone causes a 2.5% over-range value.
		YES: a 2.5% over-range value is acceptable; a 5% over-range value is considered a malfunction.

(*) See the table below for the corresponding values.

Output Signal Limits

Nominal Value	Over-range ±2.5 %	Over-range ±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

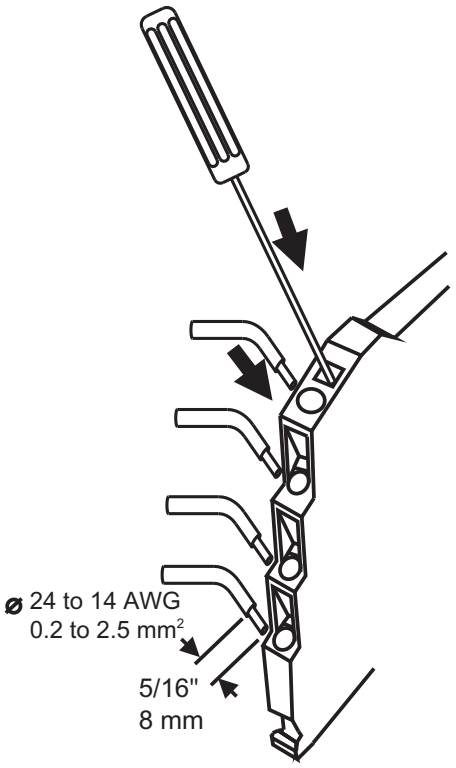
LED indications on the front

Red LED	Meaning	Output Fault
Fast flashing	Internal fault: power supply not sufficient, out of range offset or reference. Error on reading or writing in flash (at the start or on threshold setting)	YES
Slow flashing	DIP-switch setting error	YES
	Setting trip point in progress	NO (*)
Steady light	Disconnected thermocouple, out of range input or temperature compensation	YES
	Output limiting in progress	NO

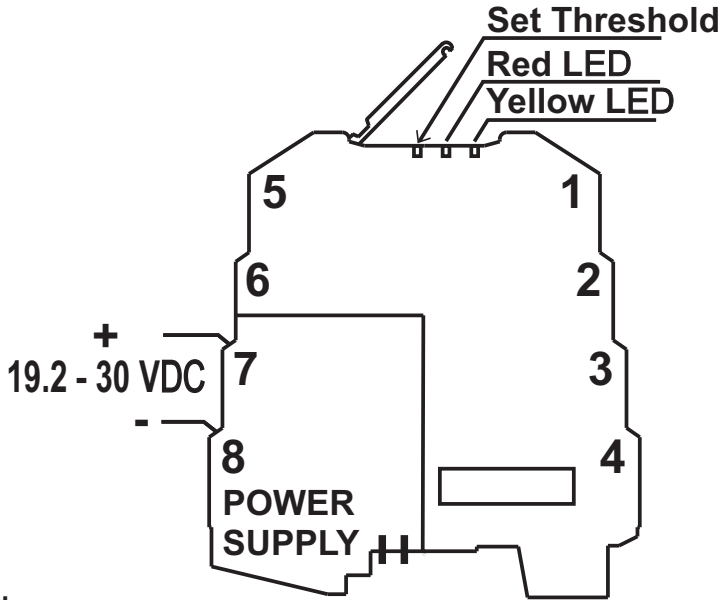
(*): In this mode the output signal represents the value of the threshold.

Yellow LED	Meaning
ON	The relay output is closed
OFF	The relay output is opened

Electrical Connections



The module has been designed for spring-type terminal electrical connections.
Proceed as follows to make the connections:
1 - Strip the cables by 5/16" (0.8 mm)
2 - Insert a screwdriver in the square hole and press it until the cable lock spring opens.
3 - Insert the cable in the round hole.
4 - Remove the screwdriver and make sure that the cable is tightly fastened in the terminal.



Power supply

There are various ways to provide the K Series modules with power.

1 - Direct power supply to the modules by connecting 24 VDC power supply directly to Terminals 7 (+) and 8 (–) of each module.

2 - Using the K-BUS connector for the distribution of power to the modules via the bus connector, eliminating the need to connect the power supply to each module.
The bus can be supplied from any of the modules; the total power consumption of the bus must be less than 400 mA. Higher power consumption can damage the module. An appropriately sized fuse must be connected in series with the power supply.

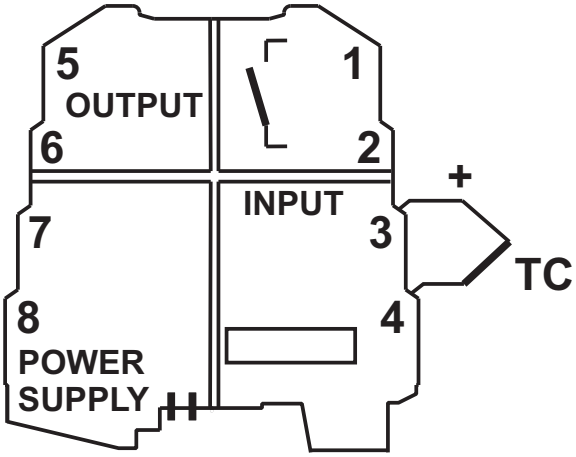
3 - Using the K-BUS connector for the distribution of power to the modules via the bus connector and the K-SUPPLY. The K-SUPPLY is a regulated power supply designed to protect the modules connected to the bus from voltage overloads.
The bus connector can be provided with power using the K-SUPPLY if the total power consumption of the bus is less than 1.5 A. Higher power consumption can damage both the module and the bus. An appropriately sized fuse must be connected in series with the power supply.

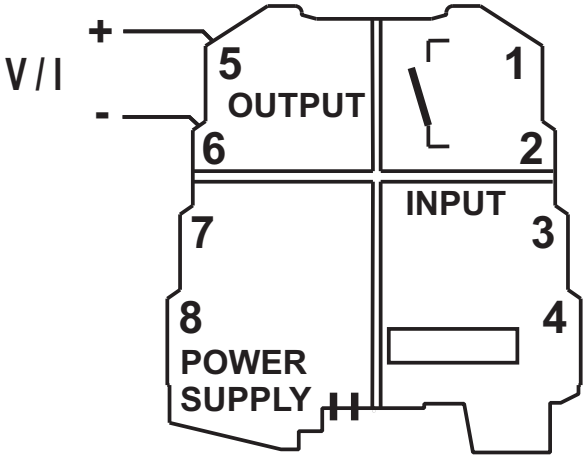
Input

Thermocouples: J, K, E, N, S, R, B, T.
The use of shielded cables is recommended for electronic connections.

Output

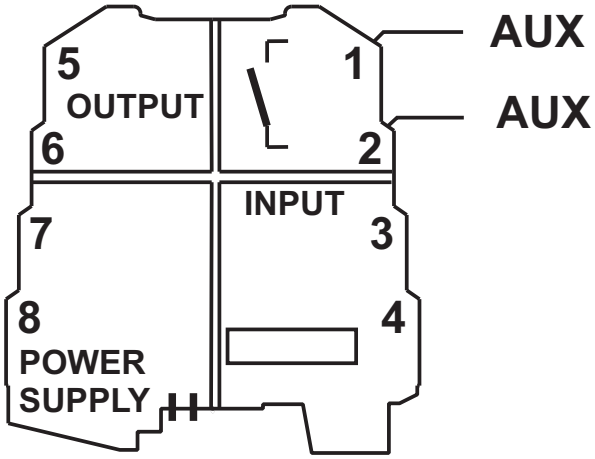
Voltage connection - Current connection (applied current)
The use of shielded cables is recommended for the electronic connections.





Relay Output

The relay output has been designed as a pilot type indicator, to operate a higher capacity relay, or as the input to a supervisory control system.



Disposal of Electrical & Electronic Equipment (Applicable throughout the European Union and other European countries with separate collection programs)
This symbol, found on your product or on its packaging, indicates that this product should not be treated as household waste when you wish to dispose of it. Instead, it should be handed over to an applicable collection point for the recycling of electrical and electronic equipment. By ensuring this product is disposed of correctly, you will help prevent potential negative consequences to the environment and human health, which could otherwise be caused by inappropriate disposal of this product. The recycling of materials will help to conserve natural resources. For more detailed information about the recycling of this product, please contact your local city office, waste disposal service or thè retail store where you purchased this product.

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