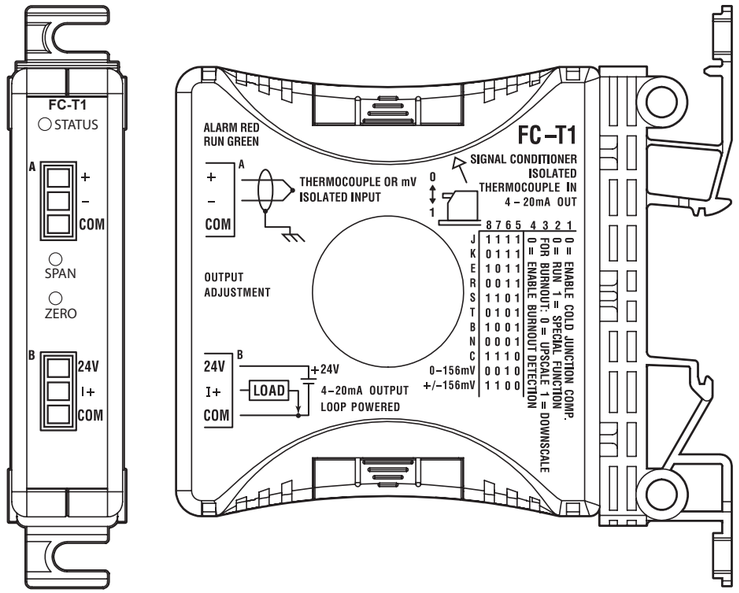
FC-T1 THERMOCOUPLE / mV INPUT ISOLATED 4-20 mA SIGNAL CONDITIONER

Product Guide

3505 HUTCHINSON ROAD
CUMMING, GA 30040-5860



Description:

The FC-T1 is a DIN rail or side mount, thermocouple / mV input signal conditioner with 1500VAC isolation between input and output. The field configurable input allows a wide ranging capability for J ,K,E,R,S,T,B,N,C type thermocouples and 0-156.25mV, ±156.25mV. The FC-T1 has built-in self-calibration, but also has OFFSET (zero) and SPAN (full scale) potentiometers for adjustment of the output signal. The FC-T1 is also equipped with cold junction compensation (CJC) circuitry to provide an internal ice-point reference. The temperature calculation and linearization are based on data provided by the National Institute of Standards and Technology (NIST).

Application

The FC-T1 field configurable thermocouple /mV input signal conditioner is useful in eliminating ground loops and interfacing sensors to our PLC analog input modules. If your requirements are just for one channel of temperature you can add the signal conditioner to your 4- 20mA input modules.

Or if your requirements are for a single millivolt input signal, you have the freedom of adding this input to your PLC analog module. The FC-T1 uses a combination of sophisticated circuitry to accomplish the conversion tasks, state of the art ADC and DAC chip. Upscale or downscale thermocouple burnout detection selection is also provided.

ALARM and RUN LED

This LED is bicolor (red and green). The red LED indicates a fault, with internal calibration or Thermocouple burnout condition. However, during power up initialization the red LED will be on, when process is complete the LED will turn green. The green LED indicates normal function. Green /Red flashing indicates out-of-range, over or under temperature / voltage for the selected range.

Input Selection

The signal conditioner can be configured for either thermocouple or DC millivolts. Thermocouple input types are J, K, E, R, S, T, B, N, C. DC millivolt ranges are 0 - 156.25mV and ± 156.25mV.

EXAMPLE:
Type J
Burnout Enabled
Upscale Burnout
Run Mode
Enable Cold Junction Compensation

Type	Ranges °C	Ranges °F	Resolution note 1	Switch Position 5	6	7	8	
J	-190 to 760	-310 to 1400	0.23°C	1	1	1	1	*
K	-150 to 1372	-238 to 2502	0.37°C	1	1	1	0	
E	-210 to 1000	-345 to 1832	0.295°C	1	1	0	1	
R	65 to 1768	149 to 3214	0.42°C	1	1	0	0	
S	65 to 1768	149 to 3214	0.42°C	1	0	1	1	
T	-230 to 400	-382 to 752	0.15°C	1	0	1	0	
B	529 to 1820	984 to 3308	0.315°C	1	0	0	1	
N	-70 to 1300	-94 to 2372	0.33°C	1	0	0	0	
C	65 to 2320	149 to 4208	0.55°C	0	1	1	1	
156.25 mV			0.038mV	0	1	0	0	
±156.25 mV			0.076mV	0	0	1	1	

Note 1: Based upon 12-bit (4095) analog input module
Note 2: Internal Analog convertor resolution is 12-bit.

Burnout Function

When thermocouple burnout occurs, the output current can be selected to provide either upscale (20mA.) or down scale (4mA.) detection. It maybe necessary to disable the burnout function if you are using a T/C calibrator that cannot handle the burnout detection pulse. Burnout detection must be disabled when using the millivolt mode.

Burnout Detection (for thermocouples only)	***Switch Position 4***	
Enable Burnout Detection	0	*
Disable Burnout Detection	1	

Burnout Function (for thermocouples only)	***Switch Position 3***	
Burnout Upscale (burnout = 20mA)	0	*
Burnout Downscale (burnout = 4mA)	1	

Adjustments

The FC-T1 has built-in self-calibration, but also has OFFSET (zero) and SPAN (full scale) potentiometers for adjustment of the output signal. If your application requires, different span or offset (i.e. 3.6mA offset and 19.6mA span) you can adjust accordingly.

To return to factory calibration

1. Turn off switches 1 thru 8
2. Turn on switch 2. Power cycle the signal conditioner.
3. Turn on switch 7, the output will change to downscale current, adjust the OFFSET potentiometer to 4.0000mA
4. Turn off switch 7. Turn on switch 8, the output will change to upscale current, adjust the SPAN potentiometer to 20.0000mA
5. Turn off switch 8. Power down the signal conditioner.
6. Configure switches 4 thru 8 for your selected range, turn switch 2 off.

   The signal conditioner is now ready for use. This calibration sequence requires an accurate digital multi meter, 6 or more digits, a handheld DMM that only has 4 1/2 digits is NOT accurate enough. It is suggested that if your application does not need modified OFFSET or SPAN do not perform factory re-calibration

Return to Factory Calibration (resetting offset and span adjustments)	***Switch Position 2***	
Run Mode (normal operation)	0	*
Special Function	1	

Cold Junction Compensation

The FC-T1 is also equipped with cold junction compensation (CJC) circuitry to provide an internal ice-point reference.

Cold Junction Compensation (for thermocouples only)	***Switch Position 1***	
Enable Cold Junction Compensation (when using T/C)	0	*
Disable Cold Junction Compensation or when using mV	1	

Input Power

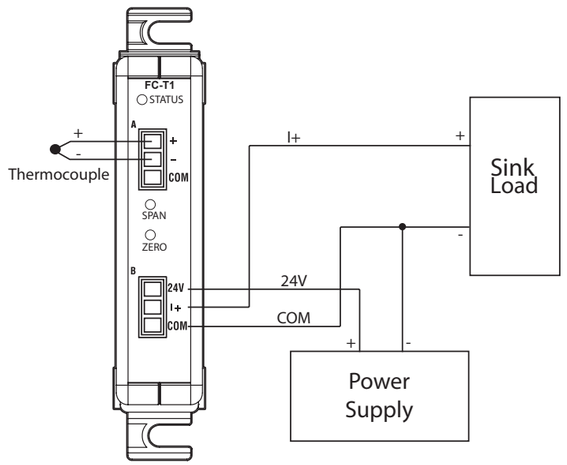
Input power requirements for load excitation is 22-26VDC @ 15mA.

* Indicates factory default settings.

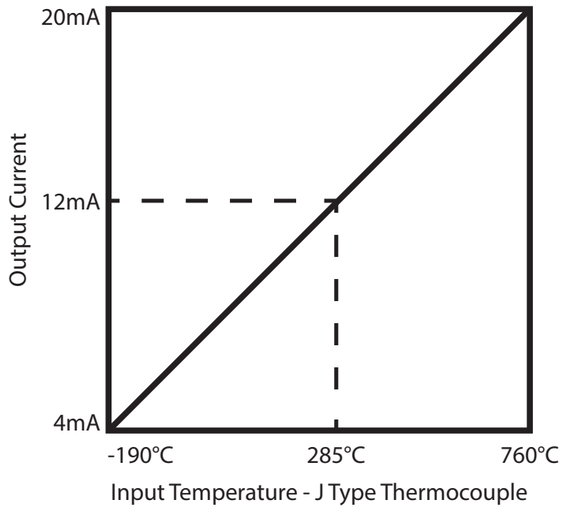
Specifications

Input Ranges	Ranges			Resolution (note 1)
	J	-190 to 760	-310 to 1400	0.23°C
	K	-150 to 1372	-238 to 2502	0.37°C
	E	-210 to 1000	-345 to 1832	0.295°C
	R	65 to 1768	149 to 3214	0.42°C
	S	65 to 1768	149 to 3214	0.42°C
	T	-230 to 400	-382 to 752	0.15°C
	B	529 to 1820	984 to 3308	0.315°C
	N	-70 to 1300	-94 to 2372	0.33°C
	C	65 to 2320	149 to 4208	0.55°C
	156.25mV			0.038mV
	±156.25mV			0.076mV
Output Range	4 to 20 mA Sinking			
External Power Supply	15mA, 22 to 26 VDC			
Input Impedance	>5MΩ			
Absolute Maximum Rating	Fault Protected Input ±50V			
Maximum Inaccuracy (includes offset, span, linearity)	±3°C Thermocouple Input (0° - 60°C) ±0.1% Voltage Input (0° - 60°C)			
Linearity Error	0.1%			
Over Temp, Error	0.1 X 10^{-5}% (10 ppm) / °C			
Insulation Resistance	≥100M with 500VDC (Input to Output Power)			
Isolation	1500VAC @ 1 Sec. (Input to Output Commons)			
Sample Duration Time	120mS Voltage Input 250mS Thermocouple Input			
Common Mode Rejection	-100dB@DC, -90dB@50/60Hz			
Input Filter (FIR)	-3dB@15Hz, -100dB@50Hz/60Hz			
Broken Thermocouple	Up / Down Scale Red / Green LED			
Over Range	Up Scale			
Under Range	Down Scale			
Burnout Time	≤ 3 Sec			
Cold Junction Compensation	Automatic			
Warm-up Time	30 min typical ±1°C repeatability			
Maximum Load/Power Supply	800Ω / 24V			
Operating Temperature	0 to 60°C (32 to 140°F)			
Storage Temperature	-20 to 70°C (-4 to 158°F)			
Relative Humidity	5 to 90% (non-condensing)			
Environmental Air	No corrosive gases permitted			
Vibration	MIL STD 810C 514.2			
Shock	MIL STD 810C 516.2			
Noise Immunity	NEMA ICS3-304			

Typical Connections



TC Signal Conditioner to 4-20mA Sinking



Min_{temp} - Max_{temp} = $Total_{temp}$ / Counts = resolution
-190° - 760° = 950° / 4095 = 0.23°C / count - resolution

$Actual_{temp}$ - Min_{temp} = $Total_{temp}$ / Resolution = Counts
500° - (-190°) = 690° / 0.23° = 2974 Counts

Counts X Resolution = $Total_{temp}$ + Min_{temp} = $Actual_{temp}$
2048 X 0.23° = 475.1° + -190° = 285.1°C

UL Information

USL: ANSI/ISA 12.12.01-2012 file E200031, USA

CNL: CSA22.2 No. 213 file E200031, Canada

CE EN61131-2

This equipment is suitable for use in Class 1, Division 2, Groups A, B, C and D or non-hazardous locations only.

A. THIS EQUIPMENT IS SUITABLE FOR USE IN CLASS I, DIVISION 2, GROUPS A, B, C AND D OR NON-HAZARDOUS LOCATIONS ONLY.

Cet équipement est conçu pour être utilisé dans des environnements de Classe I, Division 2, Groupes A, B, C, D ou non dangereux.

B. WARNING - EXPLOSION HAZARD - SUBTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2/ZONE 2.

AVERTISSEMENT : Risque d'explosion: la substitution de composants peut compromettre la convenance pour la Classe I, Division 2/Zone 2.

C. WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.

AVERTISSEMENT: Risque d'explosion: Ne pas déconnecter l'équipement à moins que l'alimentation soit coupée ou que la zone soit reconnue non dangereuse.