Space-saving Two-wire Signal Conditioners *B3-UNIT*

THERMOCOUPLE TRANSMITTER
(field-configurable)

MODEL **B3FT**

MODEL & SUFFIX CODE SELECTION

B3FT–❑❑

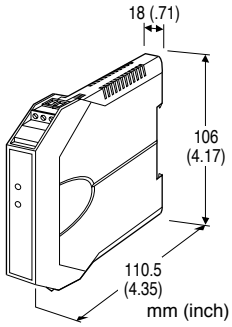
MODEL

INPUT THERMOCOUPLE
1 : K (CA), J (IC), T (CC)
2 : E (CRC), R, N

OUTPUT
4 – 20mA DC

SUPPLY VOLTAGE
12 – 45V DC

OPTIONS
/UL : UL approval



Functions & Features
- Converts a thermocouple input into an isolated, linearized 4 – 20mA DC signal
- DIP switch configurable input range
- Cold junction compensation, linearization and burnout
- Monitor terminals
- High-density mounting
- CE marking
- UL approval

ORDERING INFORMATION

Specify code number. If you need the transmitter to be calibrated to a specific range, please specify when ordering. Non-specified orders will be shipped at default factory setting (K, 0 – 300°C or E, 0 – 250°C).
- Code number (e.g. B3FT-1)
- Input range (e.g. J, 0 – 400°C)

GENERAL SPECIFICATIONS

Connection: Removable terminal block
Housing material: Flame-resistant resin (grey)
Isolation: Input to output
DIP switches: For input range calibration
Burnout protection: Upscale, downscale or no burnout selectable with DIP SW (default: upscale)
Linearization: Standard
Cold Junction Compensation: CJC sensor attached to the input terminals

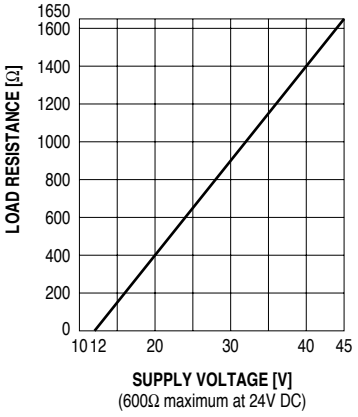
INPUT & OUTPUT

■ **INPUT**: Thermocouples
Input resistance: 20kΩ minimum
Burnout sensing: 0.1μA
Temperature range: See Tables 1 and 2.

■ **OUTPUT**: 4 – 20mA DC
Load resistance vs. supply voltage:

$$\text{Load Resistance } (\Omega) = \frac{\text{Supply Voltage (V)} - 12\text{ (V)}}{0.02\text{ (A)}}$$

(including leadwire resistance)



INSTALLATION

Supply voltage: 12 – 45V DC
Operating temperature: -40 to +85°C (-40 to +185°F)
Max. 55°C (131°F) for UL approval
Operating humidity: 0 to 95% RH (non-condensing)
Mounting: DIN rail
Dimensions: W18×H106×D110.5 mm (0.71"×4.17"×4.35")
See General Spec. Sheet Figure A-1.
Weight: 80 g (2.8 oz)
Terminal assignment: See General Spec. Sheet Figure B-2.

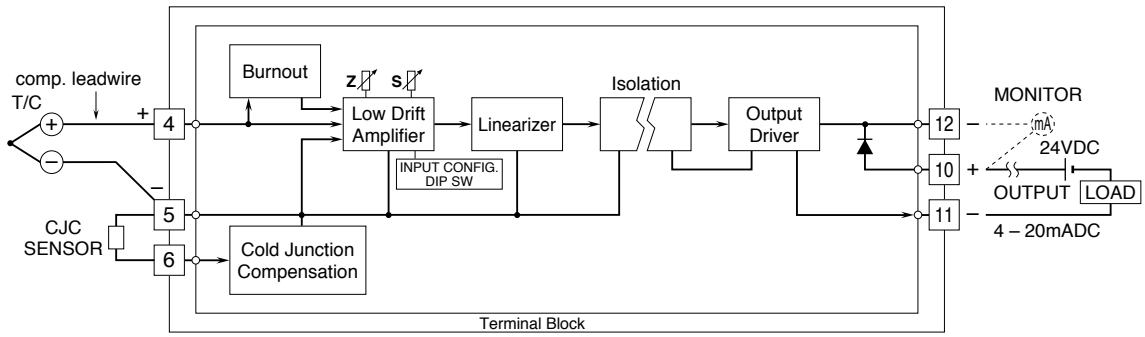
PERFORMANCE in percentage of span

Accuracy
K, J: ±0.2% of FS or ±0.3°C (±0.54°F), whichever is greater.
T, E, N: ±0.3% of FS or ±0.4°C (±0.72°F), whichever is greater.
R: ±0.4% of FS at ≥400°C or 752°F
Cold junction compensation error: ±0.5°C or ±0.9°F maximum for 0 – 55°C (32 – 131°F);
±2°C or ±3.6°F maximum for -40 – +85°C (-40 – +185°F)
Temp. coefficient: ±0.02%/°C (±0.01%/°F)
Response time: ≤0.5 second (0 – 90%)
Burnout response: ≤10 seconds
Insulation resistance: ≥100MΩ with 500V DC
Dielectric strength: 2000V AC @1 minute
(input to output to ground)

STANDARDS & APPROVALS

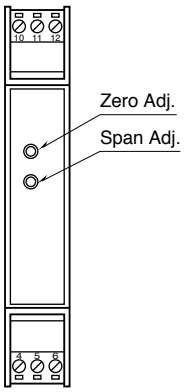
CE conformity: EMC Directive (2004/108/EC)
EN 61000-6-4 (EMI)
EN 61000-6-2 (EMS)
Approval: UL/C-UL general safety requirements
(UL 61010-1, CAN/CSA-C22.2 No.1010-1)

SCHEMATIC CIRCUITRY & CONNECTION DIAGRAM

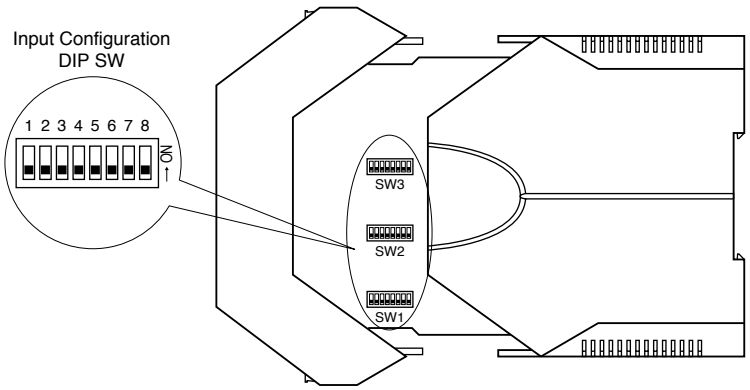


EXTERNAL VIEWS

■ **FRONT VIEW**



■ **SIDE VIEW**



RANGE CONFIGURATION

■ GENERAL PROCEDURE

First select a coarse range using the internal DIP switches (SW1, SW2 and SW3) according to Tables 1 through 6 below. Then apply simulated 0% and 100% inputs and fine-tune the output range to 4mA and 20mA using the front zero and span adjustments.

DIP SW setting can be changed while the power is applied to the transmitter. Linearization and zero/span adjustments will not perform correctly with inaccurate switch configuration but it will not damage the unit in anyway.

■ SELECTING DIP SW (coarse adjustment)

INPUT TYPE & RANGE

Choose the desired range (upper/usable range = highest span selectable) according to Table 1 (K, J, T: 1-1 for °C, 1-2 for °F) or Table 2 (E, R, N: 2-1 for °C, 2-2 for °F). The lower range (highest zero selectable) and the minimum span requirements in the table must be met when choosing the desired range.

Table 1-1. K, J, T thermocouple, Celsius ■ = ON

T/C	UPPER RANGE (usable range)	LOWER RANGE	MIN. SPAN	SW1						SW2						SW3					
				1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
K(CA)	-18 to +300°C	-18 to +190°C	75°C	■									■			■	■				
	-18 to +1370°C	-18 to +850°C	300°C		■					■			■			■	■				
J (IC)	-18 to +300°C	-18 to +190°C	70°C			■					■		■					■	■		
	-18 to +1200°C	-18 to +750°C	300°C				■			■	■		■					■	■		
T(CC)	-18 to +150°C	-18 to +75°C	75°C					■				■		■						■	■
	-18 to +400°C	-18 to +250°C	150°C						■	■		■		■						■	■

Table 1-2. K, J, T thermocouple, Fahrenheit ■ = ON

T/C	UPPER RANGE (usable range)	LOWER RANGE	MIN. SPAN	SW1						SW2						SW3					
				1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
K(CA)	0 to 572°F	0 to 374°F	135°F	■									■			■	■				
	0 to 2498°F	0 to 1562°F	540°F		■					■			■			■	■				
J (IC)	0 to 572°F	0 to 374°F	126°F			■					■		■					■	■		
	0 to 2192°F	0 to 1382°F	540°F				■			■	■		■					■	■		
T(CC)	0 to 302°F	0 to 167°F	135°F					■				■		■						■	■
	0 to 752°F	0 to 482°F	270°F						■	■		■		■						■	■

Table 2-1. E, R, N thermocouple, Celsius ■ = ON

T/C	UPPER RANGE (usable range)	LOWER RANGE	MIN. SPAN	SW1						SW2						SW3					
				1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
E(CRC)	-18 to +250°C	-18 to +120°C	60°C	■									■			■	■				
	-18 to +1000°C	-18 to +600°C	250°C		■					■			■			■	■				
R	-18 to +700°C	-18 to +340°C	360°C			■					■				■			■	■		
	-18 to +1760°C	-18 to +1060°C	700°C				■			■	■				■			■	■		
N	-18 to +400°C	-18 to +250°C	110°C					■				■		■						■	■
	-18 to +1300°C	-18 to +800°C	400°C						■	■		■		■						■	■

Table 2-2. E, R, N thermocouple, Fahrenheit ■ = ON

T/C	UPPER RANGE (usable range)	LOWER RANGE	MIN. SPAN	SW1						SW2						SW3					
				1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
E(CRC)	0 to 482°F	0 to 248°F	108°F	■									■			■	■				
	0 to 1832°F	0 to 1112°F	450°F		■					■			■			■	■				
R	0 to 1292°F	0 to 644°F	648°F			■					■				■			■	■		
	0 to 3200°F	0 to 1940°F	1260°F				■			■	■				■			■	■		
N	0 to 752°F	0 to 482°F	198°F					■				■		■						■	■
	0 to 2372°F	0 to 1472°F	720°F						■	■		■		■						■	■

BURNOUT

See Table 3.

Table 3 ■ = ON

BURNOUT	SW3	
	7	8
Upscale	■	
Downscale		■
No burnout		

GAIN

See Table 4 (K, J, E) or Table 5 (T, R, N).
The gain is defined by the following equation:

$$\text{Gain} = \frac{\text{[Span of usable range]}}{\text{[Span of calibration range]}} \times 100\ (\%)$$

where

[Span of usable range] (°C)
= [Max. value of usable range] – (-18)
[Span of calibration range] (°C)
= [100% input temp.] – [0% input temp.]

Table 4. K, J, E thermocouple ■ = ON

GAIN	SW2	
	7	8
260% < Gain ≤ 480%		■
150% < Gain ≤ 260%	■	
100% ≤ Gain ≤ 150%		

Table 5. T, R, N thermocouple ■ = ON

GAIN	SW2	
	7	8
240% < Gain ≤ 480%		■
140% < Gain ≤ 240%	■	
100% ≤ Gain ≤ 140%		

OFFSET

See Table 6.
The offset is defined by the following equation:

$$\text{Offset} = \frac{\text{[0\% input temp.] – (-18)}}{\text{[Span of calibration range]}} \times 100\ (\%)$$

Table 6 ■ = ON

OFFSET	SW1-7
Factory default setting	■
Offset ≥ 25% and when 0% output cannot be calibrated with zero adjustment	

EXAMPLE

K thermocouple, 0 – 90°C, Upscale burnout

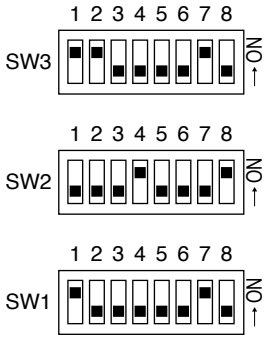
1) Sensor type and Range: According to Table 1-1, choose 'K, -18 – +300°C' range.
   ➠ Set SW1-1, SW2-4, SW3-1 and SW3-2 to ON.
2) Burnout: According to Table 3, choose 'Upscale.'
   ➠ Set SW3-7 to ON.
3) Gain

$$\frac{\text{[300 – (-18)]}}{\text{[90 – 0]}} \times 100 = 353\ (\%)$$

   ➠ According to Table 4, set SW2-8 to ON.
4) Offset

$$\frac{\text{[0 – (-18)]}}{\text{[300 – (-18)]}} \times 100 = 5.7\ (\%)$$

   ➠ According to Table 6, SW1-7 remains ON.



■ ZERO & SPAN ADJUSTMENTS (fine adjustments)

Referring to the instruction manual, apply 0% and 100% input signals and adjust the Zero to have 4mA output and Span to have 20mA output respectively.