INSTRUCTION MANUAL

THERMOCOUPLE TRANSMITTER
(field-configurable)

MODEL **B3FT**

BEFORE USE ....

Thank you for choosing M-System. Before use, please check contents of the package you received as outlined below.
If you have any problems or questions with the product, please contact M-System's Sales Office or representatives.

■ PACKAGE INCLUDES:

Signal conditioner (body + CJC sensor) ..... (1)

■ MODEL NO.

Confirm Model No. marking on the product to be exactly what you ordered.

■ INSTRUCTION MANUAL

This manual describes necessary points of caution when you use this product, including installation, connection and basic maintenance procedures.

POINTS OF CAUTION

■ CONFORMITY WITH UL

- This equipment is suitable for use in a Pollution Degree 2 environment.
- DO NOT connect the thermocouple to circuits greater than 30Vrms and 42.4Vpeak or 60V DC.
- This equipment is to be used with the maximum operating voltage 30Vrms and 42.4Vpeak or 60V DC.
- The equipment must be mounted inside a suitable fire enclosure.
- Operating temperature: -40 to +55°C (-40 to +131°F)

■ CONFORMITY WITH EC DIRECTIVES

- Functional insulation is maintained between the input and output.
- The equipment must be mounted inside a panel.
- Altitude up to 2000 meters
- Install lightning surge protectors for those wires connected to remote locations.
- The actual installation environments such as panel configurations, connected devices, connected wires, may affect the protection level of this unit when it is integrated in a panel system. The user may have to review the CE requirements in regard to the whole system and employ additional protective measures to ensure the CE conformity.

■ SAFETY PRECAUTION

- Before you remove the unit or mount it, turn off the power supply and input signal for safety.

■ ENVIRONMENT

- Indoor use
- When heavy dust or metal particles are present in the air, install the unit inside proper housing with sufficient ventilation.
- Do not install the unit where it is subjected to continuous vibration. Do not subject the unit to physical impact.
- Environmental temperature must be within -40 to +85°C (-40 to +185°F) with relative humidity within 0 to 95% RH in order to ensure adequate life span and operation.
- Be sure that the ventilation slits are not covered with cables, etc.

■ WIRING

- Do not install cables (power supply, input and output) close to noise sources (relay drive cable, high frequency line, etc.).
- Do not bind these cables together with those in which noises are present. Do not install them in the same duct.

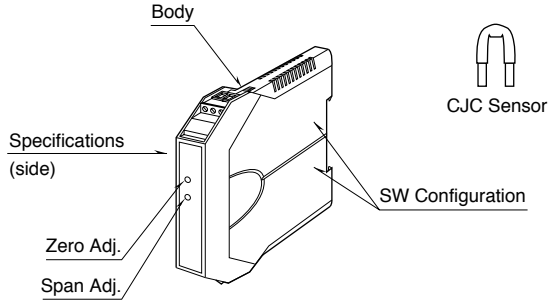
■ CJC SENSOR

- The CJC (Cold Junction Compensation) Sensor is not interchangeable with one for another transmitter, since each is calibrated to match a specific unit. When connecting the T/C's extension wires to the transmitter, loosen only the terminals 4 – 5. DO NOT loosen the terminal 6 in order not to separate the sensor from the transmitter.

■ AND ....

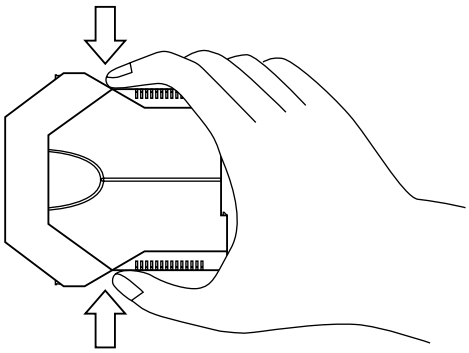
- The unit is designed to function as soon as power is supplied, however, a warm up for 10 minutes is required for satisfying complete performance described in the data sheet.

COMPONENT IDENTIFICATION

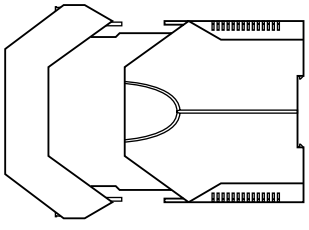


■ HOW TO OPEN THE COVER WHEN SETTING DIP SW

Hold at the top and bottom of the unit as shown below and slide the housing cover gently to open until it hits the latching inside the unit.



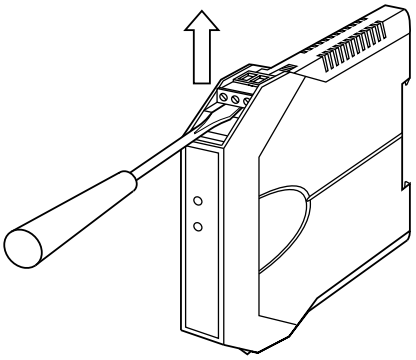
• Housing Cover Fully Opened



Caution: DO NOT PULL beyond where the housing cover is latched. The plastic housing may be damaged.

■ HOW TO SEPARATE THE TERMINAL BLOCKS

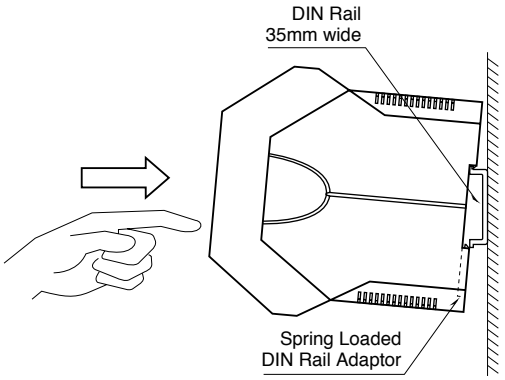
When you need to separate the terminal blocks from the transmitter body for wiring, insert a minus driver between the terminal block and the housing body, pull up the driver and pull out the terminal block.



INSTALLATION

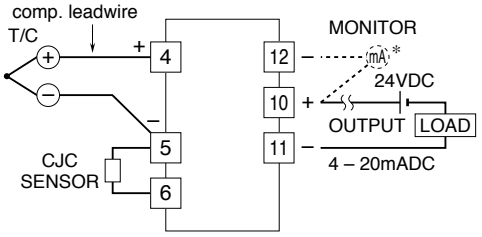
■ DIN RAIL MOUNTING

Set the unit so that its DIN rail adaptor is at the bottom. Position the upper hook at the rear side of the unit on the DIN rail and push in the lower. When removing the unit, push down the DIN rail adaptor utilizing a minus screwdriver and pull.



TERMINAL CONNECTIONS

Connect the unit as in the diagram below.
Tighten the CJC sensor together with input wiring to the input terminals. DO NOT loosen the terminal 6 in order not to separate the sensor from the transmitter since it is NOT interchangeable with one for another transmitter.



*DC ammeter's internal resistance 10 ohms max.

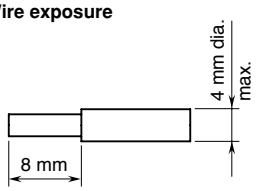
■ WIRING INSTRUCTIONS

- Applicable wire size
  - Solid: 0.2 to 2.5 mm² (0.55 to 1.75 dia.)
  - Stranded: 0.2 to 2.5 mm²
    Tinning wire ends may cause contact failure and therefore is not recommended.
  - Ferruled: 0.2 to 1.5 mm² (0.55 to 1.35 dia.)
    The following Phoenix Contact terminals are recommended:

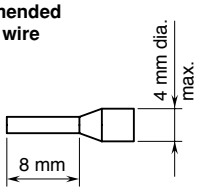
AI 0.25-8YE	0.2 to 0.25 mm²
AI 0.34-8TQ	0.25 to 0.34 mm²
AI 0.5-8WH	0.34 to 0.5 mm²
AI 0.75-8GY	0.5 to 0.75 mm²
AI 1.0-8RD	0.75 to 1.0 mm²
AI 1.5-8BK	1.0 to 1.5 mm²

- Expose wire conductors by 8 mm (0.31").

Wire exposure

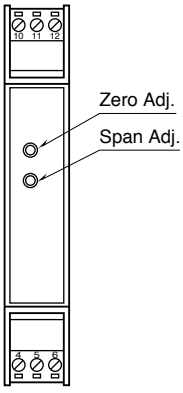


Recommended ferruled wire

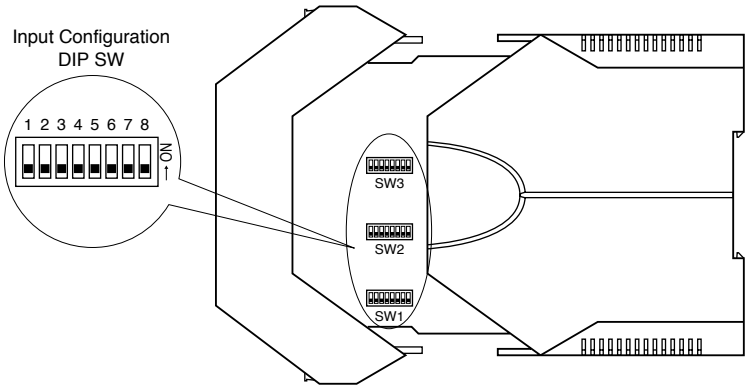


EXTERNAL VIEWS

■ 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

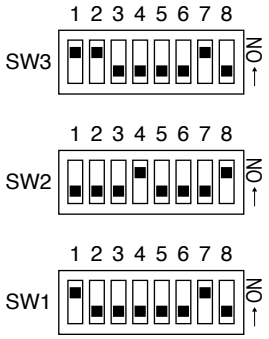
1) Sensor type and Range: According to Table 1-1, choose 'K, -18 – +300°C' range.
   ➠ Set SW1-1, SW2-4, SW3-1 and SW3-2 to ON.
2) Burnout: According to Table 3, choose 'Upscale.'
   ➠ Set SW3-7 to ON.
3) Gain

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

   ➠ 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 'ADJUSTMENT PROCEDURE' in the next page, apply 0% and 100% input signals and adjust the Zero to have 4mA output and Span to have 20mA output respectively.

CHECKING

1) Terminal wiring: Check that all cables are correctly connected according to the connection diagram.
2) DIP SW setting: Check that the switches are set to appropriate positions.
3) Input: Check that the input voltage is within 0 – 100% of full-scale.
   If the thermocouple or its extension wires are broken, the output goes over 100% (below 0% with downscale protection) due to burnout function. Check leadwires in such a case.
4) Output: Check that the load is within the permissible limit including wiring resistance.

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

(including leadwire resistance)

5) When you check the output signal, connect an ammeter of which the internal resistance is of 10Ω max. to the monitor terminals.

ADJUSTMENT PROCEDURE

This unit is calibrated at the factory to meet the ordered specifications, therefore you usually do not need any calibration.
For matching the signal to a receiving instrument or in case of regular calibration, adjust the output as explained in the following.

■ HOW TO CALIBRATE THE OUTPUT SIGNAL

Use a signal source and measuring instruments of sufficient accuracy level. Turn the power supply on and warm up for more than 10 minutes.
1) ZERO: Apply 0% input and adjust output to 0%.
2) SPAN: Apply 100% input and adjust output to 100%.
3) Check ZERO adjustment again with 0% input.
4) When ZERO value is changed, repeat the above procedure 1) – 3).

MAINTENANCE

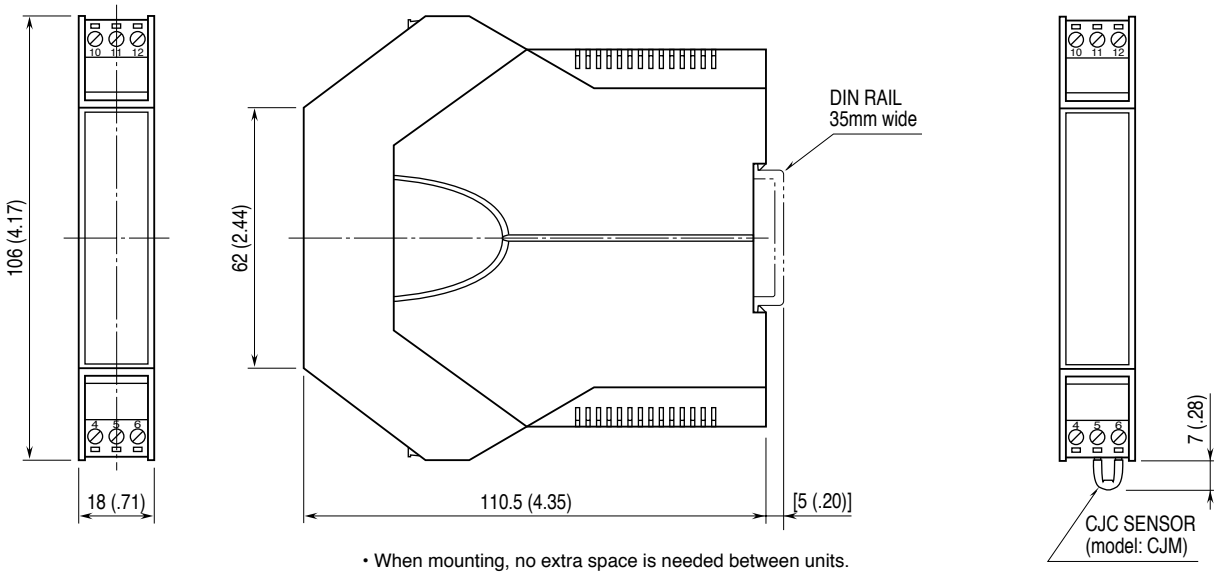
Regular calibration procedure is explained below:

■ CALIBRATION

Warm up the unit for at least 10 minutes. Apply 0%, 25%, 50%, 75% and 100% input signal. Check that the output signal for the respective input signal remains within accuracy described in the data sheet. When the output is out of tolerance, recalibrate the unit according to the "ADJUSTMENT PROCEDURE" explained earlier.

EXTERNAL DIMENSIONS mm (inch)

■ TERMINAL ASSIGNMENTS mm (inch)



• When mounting, no extra space is needed between units.

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