

RTD TRANSMITTER (field-configurable)

MODEL **B3FR**

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..... (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 RTD 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)
- Altitude up to 2000 meters

■ CONFORMITY WITH EC DIRECTIVES

- Functional insulation is maintained between signal input and output.
- The equipment must be mounted inside a panel.
- Install lightning surge protectors for those wires connected to remote locations.
- Insert a noise filter for input and output connected to the unit. TDK Noise Filter Model ZCAT 3035-1330 or equivalent is recommended.
- 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.

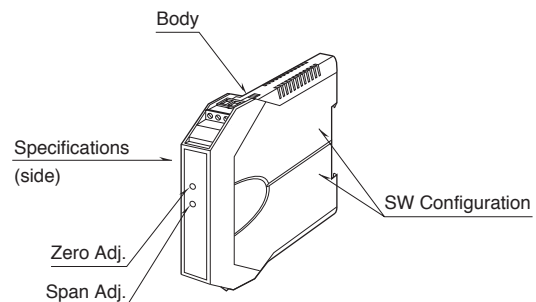
■ WIRING

- 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.

■ AND

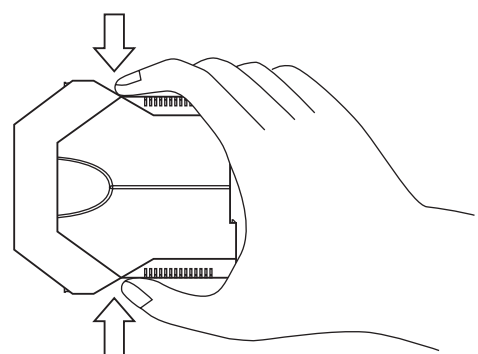
The unit is designed to function as soon as power is supplied, however, a warm up for 10 minutes is required for satisfying complete performance described in the data sheet.

COMPONENT IDENTIFICATION

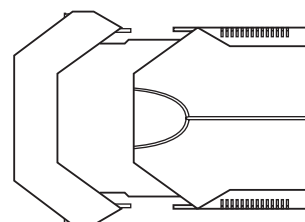


■ HOW TO OPEN THE COVER WHEN SETTING DIP SW

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.



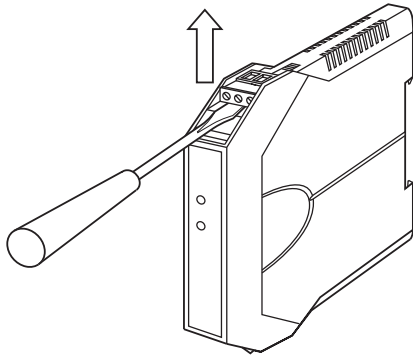
• Housing Cover Fully Opened



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

■ HOW TO SEPARATE THE TERMINAL BLOCKS

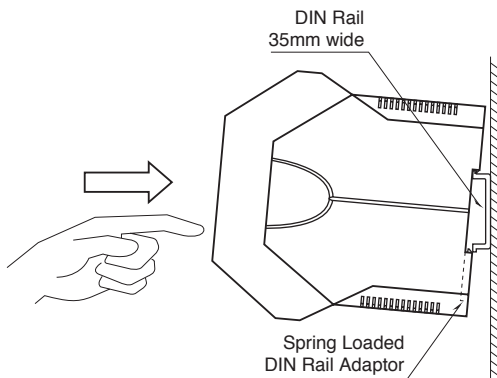
When you need to separate the terminal blocks from the transmitter body for wiring, insert a minus driver between the terminal block and the housing body, pull up the driver and pull out the terminal block.



INSTALLATION

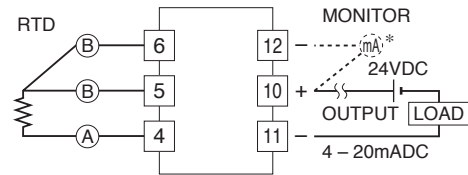
■ DIN RAIL MOUNTING

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 screw-driver and pull.



TERMINAL CONNECTIONS

Connect the unit as in the diagram below.



*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.

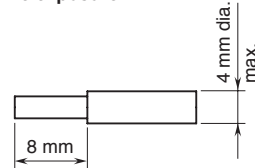
Ferruled: 0.2 to 1.5 mm² (0.55 to 1.35 dia.)

The following Phoenix Contact terminals are recommended:

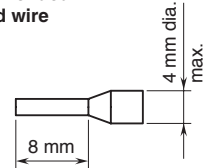
AI 0.25-8YE	0.2 to 0.25 mm ²
AI 0.34-8TQ	0.25 to 0.34 mm ²
AI 0.5-8WH	0.34 to 0.5 mm ²
AI 0.75-8GY	0.5 to 0.75 mm ²
AI 1.0-8RD	0.75 to 1.0 mm ²
AI 1.5-8BK	1.0 to 1.5 mm ²

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

Wire exposure

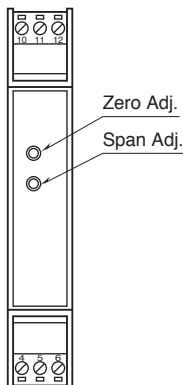


Recommended ferruled wire

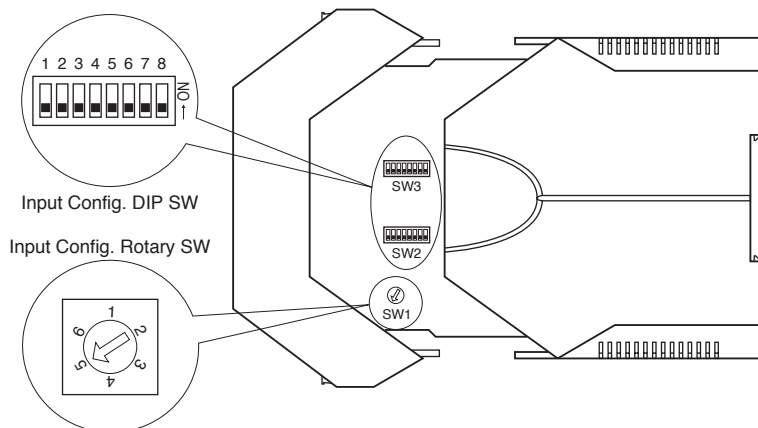


EXTERNAL VIEWS

■ 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 4 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 (usable range = highest span selectable) according to Table 1. The minimum span requirements in the table must be met when choosing the desired range.

Table 1

RTD	USABLE RANGE		MIN. SPAN		SW1	SW2							
						1	2	3	4	5	6	7	8
Pt 100 (JIS '97, IEC)	-50 to +750°C	-58 to +1382°F	300°C	540°F	1	■				■			
	-50 to +350°C	-58 to +662°F	100°C	180°F	2	■					■		
	-50 to +150°C	-58 to +302°F	50°C	90°F	3	■					■		
Ni 120	-50 to +200°C	-58 to +392°F	100°C	180°F	4		■					■	
	-50 to +100°C	-58 to +212°F	50°C	90°F	5		■					■	
Cu 10 (@25°C)	-50 to +250°C	-58 to +482°F	100°C	180°F	6			■			■		

BURNOUT

See Table 2.

Table 2

BURNOUT	SW3			
	5	6	7	8
Upscale	■		■	
Downscale		■		■
No burnout				

GAIN

See Table 3.

The gain is defined by the following equation:

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

where

$$[\text{Span of usable range}] (^\circ\text{C})$$

$$= [\text{Max. value of usable range}] - (-50^{*1})$$

$$[\text{Span of calibration range}] (^\circ\text{C})$$

$$= [100\% \text{ input temp.}] - [0\% \text{ input temp.}]$$

*1. -58 for °F

Table 3

GAIN	SW3		
	1	2	3
267% ≤ Gain ≤ 400%			■
167% ≤ Gain < 267%		■	
100% ≤ Gain < 167%	■		

OFFSET

See Table 4.

The offset is defined by the following equation:

$$\text{Offset} = \frac{[0\% \text{ input temp.}] - (-50^{*1})}{[\text{Span of calibration range}]} \times 100 (\%)$$

*1. -58 for °F

Table 4

OFFSET	SW3-4
Factory default setting	
Offset ≥ 26%*2 and when 0% output cannot be calibrated with zero adjustment. *2. 28% for Ni 120.	■

EXAMPLE

Pt 100, 0 – 90°C, Upscale burnout

1) Sensor type and Range: According to Table 1, choose 'Pt 100, -50 – +150°C' range.

⇒ Set SW1 to '3,' SW2-1 and SW2-6 to ON.

2) Burnout: According to Table 2, choose 'Upscale.'

⇒ Set SW3-5 and SW3-7 to ON.

3) Gain

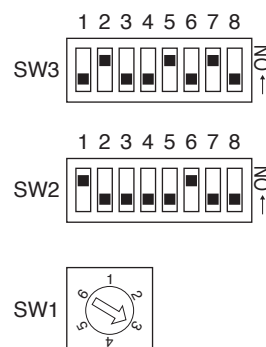
$$\frac{[150 - (-50)]}{[90 - 0]} \times 100 = 222 (\%)$$

⇒ According to Table 3, set SW3-2 to ON.

4) Offset

$$\frac{[0 - (-50)]}{[150 - (-50)]} \times 100 = 25 (\%)$$

⇒ According to Table 4, SW3-4 remains OFF.



■ 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 voltage across the terminal 4 – 5 with a sensitive voltmeter.
(With 20°C or 68°F, approx. 110mV with Pt 100, approx. 140mV with Ni 120, approx. 10mV with Cu 10.)
If the RTD 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).

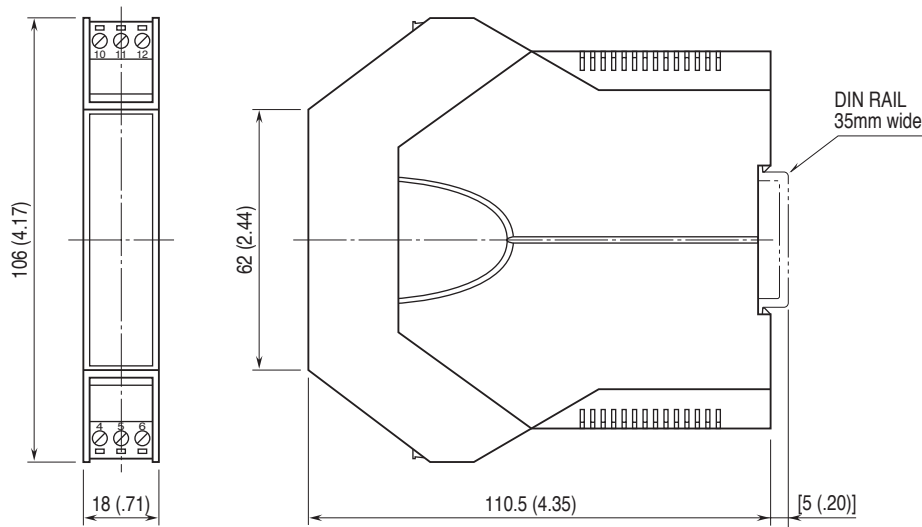
MAINTENANCE

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)



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

M-SYSTEM WARRANTY

M-System warrants such new M-System product which it manufactures to be free from defects in materials and workmanship during the 36-month period following the date that such product was originally purchased if such product has been used under normal operating conditions and properly maintained, M-System's sole liability, and purchaser's exclusive remedies, under this warranty are, at M-System's option, the repair, replacement or refund of the purchase price of any M-System product which is defective under the terms of this warranty. To submit a claim under this warranty, the purchaser must return, at its expense, the defective M-System product to the below address together with a copy of its original sales invoice.

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