

Space-saving Signal Conditioners M3-UNIT Series
THERMOCOUPLE TRANSMITTER
(field- and PC-configurable)

Model: M3LT

OPERATING MANUAL

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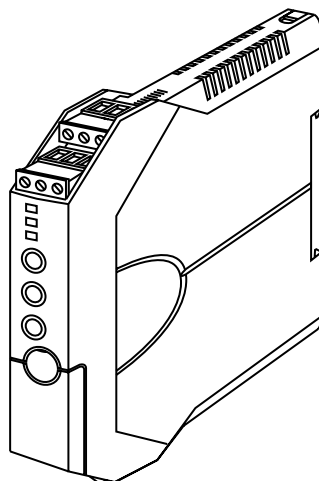
1. INTRODUCTION

Thank you for your choosing us. Read this manual carefully to ensure that you use the product correctly and safely.

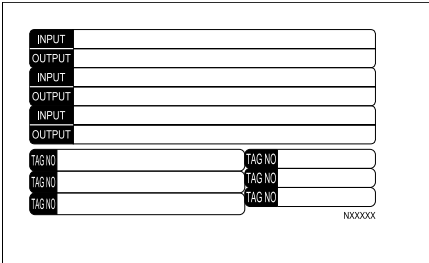
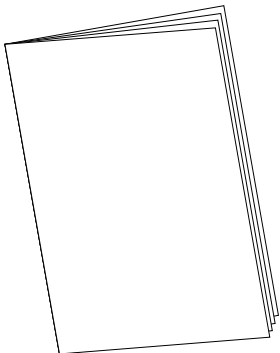
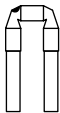
1.1 PACKAGE

Check contents of the package you received as outlined below.

- Signal conditioner








- Accessories












<p>I/O range and tag name label sheet</p> 	<p>Instruction manual</p> 	<p>CJC sensor</p>  <p>(mounted on the input terminals)</p> <p>Caution (in using CJC sensor)</p> <div><p>Caution</p></div>
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2. SAFETY PRECAUTIONS (that must be observed)

The following signs are used in this manual to provide precautions required to ensure safe usage of the unit. Please understand these signs and graphic symbols, read the manual carefully and observe the description.

The following signs show seriousness of safety hazard or damage occurred when used wrongly with the signs ignored.

 WARNING	Indicates a potentially hazardous situation which, if not avoided, may result in serious injury or death.	
 CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in injury or in property damage.	
 Indicates prohibitions.	 Indicates mandatory cautions.	 Indicates cautions.

 WARNING	
 CAUTION	For safety, make sure that wiring is performed by qualified personnel only. <ul style="list-style-type: none">• Failure to do so may result in a fire, electric shock or injury.
 CAUTION ELECTRIC SHOCK	Do not touch the terminals while the power is on. <ul style="list-style-type: none">• Doing so may result in electric shock.
 MANDATORY CAUTION	Check the connection diagram carefully before wire connection. <ul style="list-style-type: none">• Failure to do so may result in malfunction, a fire or electric shock.
 MANDATORY CAUTION	Tighten the terminal screws of the Euro type connector terminal blocks with a specified torque. <ul style="list-style-type: none">• Excessive fastening may result in damage of the screws and loose screws may occasionally result in ignition.
 PROHIBITION WET HANDS	Do not operate buttons with a wet hand or finger. <ul style="list-style-type: none">• Doing so may result in electric shock.
 PROHIBITION TO BE WET	Do not splash water on the unit. <ul style="list-style-type: none">• Doing so may result in a fire, electric shock or injury.
 MANDATORY CAUTION	Provide safety measures outside of the unit to ensure safety in the whole system if an abnormality occurs due to malfunction of the unit or another external factor affecting the unit's operation.
 MANDATORY CAUTION	Stop using the unit immediately if smokes, unusual smell or abnormal noises come(s) from it. <ul style="list-style-type: none">• Using the unit continuously may result in a fire or electric shock.
 MANDATORY CAUTION	Stop using the unit if it is dropped or damaged. <ul style="list-style-type: none">• Using the unit continuously may result in a fire or electric shock.
 PROHIBITION	Do not throw the unit into the fire. <ul style="list-style-type: none">• Doing so may result in rupture of the electronic component.

CAUTION



PROHIBITION
TO DISCOMPOSE

Never discompose or remodel the unit.

- Doing so may result in electric shock, malfunction or injury.



PROHIBITION

Do not connect or remove the unit while its power is on.

- Doing so may result in electric shock, malfunction or injury.



MANDATORY
CAUTION

Do not allow fine shavings or wire scraps to enter the unit in machining screws or wiring.

- Doing so may result in malfunction of the unit.



PROHIBITION

Do not open the housing cover while the power or the input is applied.

- Doing so may result in electric shock, malfunction or injury.



PROHIBITION
TO CONTACT

Do not touch the printed circuit board or the electronic components in opening the cover.

- Doing so may result in malfunction of the unit.



PROHIBITION

Do not connect other cables to the COMM (configurator jack) port than the dedicated one.

- Doing so may result in malfunction of the unit.



MANDATORY
CAUTION

Use a minus screwdriver and tweezers in setting the switches.

- Failure to do so may result in malfunction of the unit.



PROHIBITION

Do not press buttons with a pointed object.

- Doing so may result in malfunction of the unit.



PROHIBITION

Do not pull the wires to separate the Euro type connector terminal blocks from the body.

- Doing so may result in damage of the unit or injury.



PROHIBITION

Do not use the unit with the cover open.

- Doing so may result in malfunction of the unit.



PROHIBITION

Do not pull the wires connecting to the unit.

- Doing so may result in electric shock, damage of the unit or injury.



PROHIBITION

Do not use the unit in the atmosphere where combustible gas is present.

- Doing so may result in inflammation, ignition or smoke.



PROHIBITION

Do not cover the ventilation slits with cables, etc.

- Doing so may result in malfunction or heating.

3. POINTS OF CAUTION

3.1 BEFORE USE

The unit is for use in general industrial environments, therefore may not be suitable for applications which require higher level of safety (e.g. safety or accident prevention systems) or of reliability (e.g. vehicle control or combustion control systems).

For safety, installation and maintenance of this unit must be conducted by qualified personnel.

CAUTION

If the unit is used in a manner not specified by this manual, the protection provided by the equipment may be impaired.

3.2 CONFORMITY WITH UL

This product conforms to the following general safety requirements of UL/C-UL.

UL/C-UL general safety requirements
UL 61010-1, CAN/CSA-C22.2 No.1010-1

- This equipment is suitable for use in a Pollution Degree 2 environment.
- DO NOT connect the thermocouple to circuits greater than 30 V rms and 42.4 V peak or 60 V DC.
- This equipment is to be used with the maximum operating voltage 30 V rms and 42.4 V peak or 60 V DC.
- The equipment must be mounted inside a suitable fire enclosure.
- Operating temperature: -25 to +55°C (-13 to +131°F)

3.3 CONFORMITY WITH EU DIRECTIVES

- The equipment must be mounted inside a panel.
- Insert noise filters for the power source, input and output connected to the unit. COSEL Model NAC-04-472, TDK Model ZCAT 3035-1330 or equivalent is recommended.
- 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.

* For example, installation of noise filters and clamp filters for the power source, input and output connected to the unit, etc.

CAUTION

This product conforms to the EMC Directive for electrical and electronic apparatus intended for use in industrial environments. If it is used in the residential environments, it may cause radio interference, and the user is requested to take appropriate measures.

3.4 ENVIRONMENT

Install the unit within the installation specifications.

- Indoors use.
- Environmental temperature must be within -25 to +65°C (-13 to 149°F) with relative humidity within 0 to 95% RH without condensing.
- Provide sufficient space around the unit for heat dissipation.
- Install the unit in a well-ventilated place in order to prevent internal temperature rise.
- Refer to "Clustered mounting" to install several units. In mounting the unit with other equipment side by side, provide sufficient space between them, according to the dimensions in the clustered mounting.
- Do not use the unit under the following environments:
 - Where the unit is exposed to direct sunlight, rain or wind. (The unit is not designed for outdoor use.)

- Where condensation may occur due to extreme temperature changes.
- Where corrosive or flammable gas is present.
- Where heavy dust, iron powder or salt is present in the air.
- Where organic solvent such like benzine, thinner, and alcohol, or strong alkaline materials such like ammonia and caustic soda may attach to the unit, or where such materials are present in the air.
- Where the unit is subject to continuous vibration or physical impact.
- Where there are high-voltage lines, high-voltage equipment, power lines, power equipment, equipment with transmission unit such like a ham radio equipment, or equipment generating large switching surges around the unit.

3.5 WIRING

- In order to prevent potential electric shock, wire the unit after turning off the power supply and making sure that the power is not supplied to the cable.
- Be sure to confirm the name and polarity of each terminal before wiring to the Euro type connector terminal blocks.
- Do not connect anything to unused terminals.

3.6 HANDLING CAUTIONS

- 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.
- Use the unit within the noted supply power voltage and rated load.
- The last measured values are held in mode transition. Take this into consideration when configuring the control system.
- Clean the surface of the unit with wet soft cloth. Do not use organic solvent such like benzine, thinner and alcohol. Doing so may result in deformation or discoloration of the unit.
- When abnormality is found such like smokes, unusual smell and abnormal noises coming from the unit, immediately cut the power supply and stop using it.

4. FEATURES AND PREPARATION PROCEDURE OF M3LT

4.1 FEATURES OF M3LT

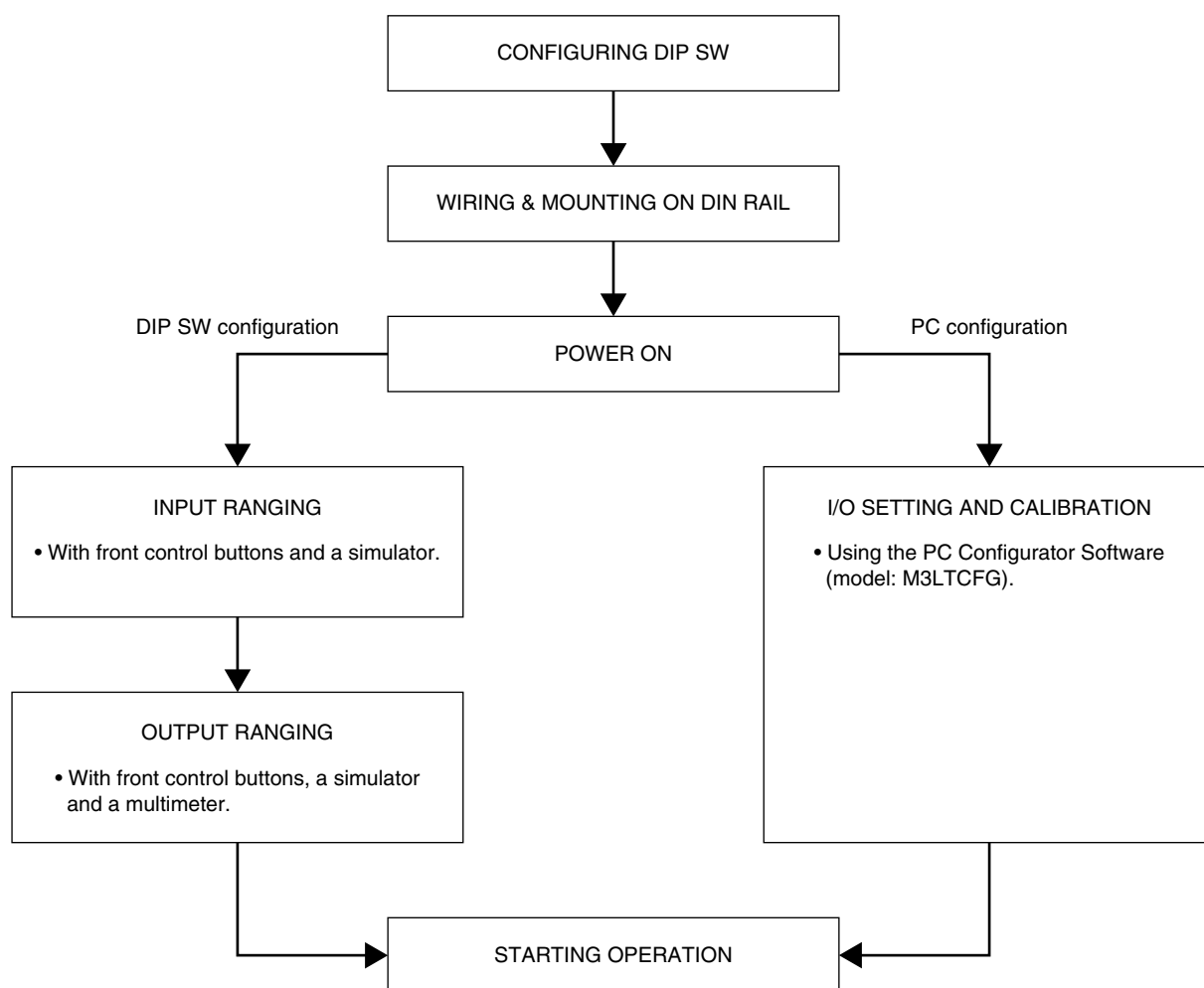
The M3LT is a field configurable signal transmitter using a simulator and an indicator, without a PC or a dedicated setting unit.

For instance, select an input type with the DIP switches on the unit to set input. Then apply a desired minimum or maximum input from the simulator and press a front button to memorize the value as minimum or maximum value. Easy and reasonable one-step calibration (hereafter called 'One-Step Cal') realizes automatic I/O ranging and calibration only by pressing a button once.

4.2 PREPARATION PROCEDURE

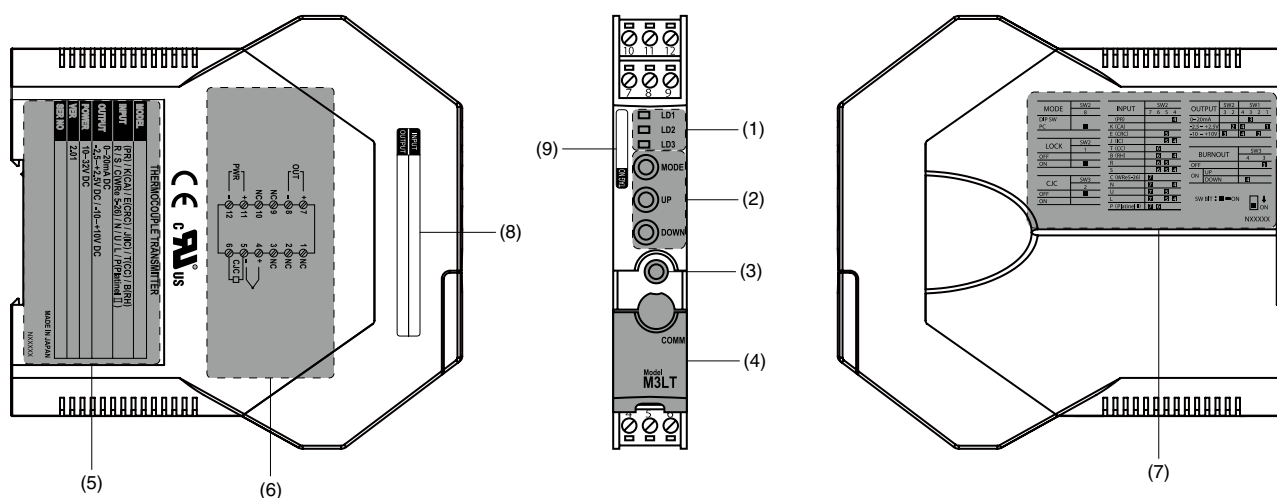
Before using the unit, perform the calibration according the following flow. The procedure depends on the configuration options or modes.

- Two configuration modes are available with the model M3LT-R4/A, field configuration using the DIP SW / control buttons (hereafter called 'DIP SW configuration') and the PC configuration.
- The model M3LT-R4/B is for the DIP SW configuration only.



5. COMPONENT IDENTIFICATION

5.1 FRONT AND SIDE VIEWS



(1) LED1 (LD1), LED2 (LD2) and LED3 (LD3)

The blinking pattern (ON/blink/OFF) of the tri-color (green/amber/red) LEDs indicates a mode or an operation status of the transmitter.

(2) MODE, UP and DOWN Buttons

Used for the I/O ranging and fine adjustments by 'One-Step Cal'. The functions of the buttons are shown in the following table.

BUTTON	FUNCTION
MODE	Used to move on to the I/O Ranging Mode, Fine Adjustment Mode and RUN Mode.
UP	Used to configure 100% input in the Input Ranging Mode and 100% output in the Output Ranging Mode, and to increase the output in the Fine Adjustment Mode.
DOWN	Used to configure 0% input in the Input Ranging Mode and 0% output in the Output Ranging Mode, and to decrease the output in the Fine Adjustment Mode.

(3) Configurator jack

Used to connect with a PC using the PC Configurator Software (model: M3LTCFG) for various settings, I/O ranging and fine adjustments.

Connect a dedicated cable between the configurator jack and the PC.

(4) Cover for configurator jack

Slide the cover to connect the cable to the configurator jack. Close the cover in the normal operation.

(5) Specification label

The model No., power input, serial No. (SER NO) and firmware version (VER) are printed on the label.

(6) Connection diagram

The connection diagram for each terminal is shown.

(7) DIP SW setting

The DIP switch settings are shown.

(8) I/O range label

When I/O range indication is necessary, write in the configured ranges on the I/O range label included in the product package and put it on the side of the unit.

(9) Tag name label




When a tag No. is specified, the unit(s) will be shipped with the tag name label put on the above position.

5.1.1 STATUS INDICATOR LED

Combinations of the three front LEDs (LD1, LD2 and LD3) indicates the transmitter's operating status by different blinking patterns. The patterns depend on the configuration modes, DIP SW configuration and PC configuration.

Examples are shown below.







LED COLOR	
Red	R
Amber	A
Green	G

PATTERN	
ON	
Blink	
OFF	

■ NORMAL OPERATION (RUN) MODE

Combination of the LEDs and their blinking patterns indicate normal or abnormal operation of the unit, and are useful to identify error modes.

• Normal operation (RUN) mode









DIP SW CONFIGURATION	PC CONFIGURATION
 LD1  LD2  LD3	 LD1  LD2  LD3

• Error mode

ERROR	DIP SW CONFIGURATION	PC CONFIGURATION	
Output saturated	<div><div><div><div>G</div><div>LD1</div></div><div><div></div><div>LD2</div></div><div><div>A</div><div>LD3</div></div></div></div>	<div><div><div><div>G</div><div>LD1</div></div><div><div></div><div>LD2</div></div><div><div>A</div><div>LD3</div></div></div></div>	The output is below -15% or above 115%. Check the setting and input.
Burnout	<div><div><div><div>G</div><div>LD1</div></div><div><div>A</div><div>LD2</div></div><div><div>A</div><div>LD3</div></div></div></div>	<div><div><div><div>G</div><div>LD1</div></div><div><div>A</div><div>LD2</div></div><div><div>A</div><div>LD3</div></div></div></div>	The sensor or the input wiring is disconnected. Check the sensor and wiring.
DIP SW error	<div><div><div><div>R</div><div>LD1</div></div><div><div>R</div><div>LD2</div></div><div><div>R</div><div>LD3</div></div></div></div>		DIP SW configuration is inappropriate. Check the SW settings.
System error	<div><div><div><div>A</div><div>LD1</div></div><div><div>A</div><div>LD2</div></div><div><div>A</div><div>LD3</div></div></div></div>		Indicates the CPU's communication error.

■ I/O RANGING MODE & FINE ADJUSTMENT MODE

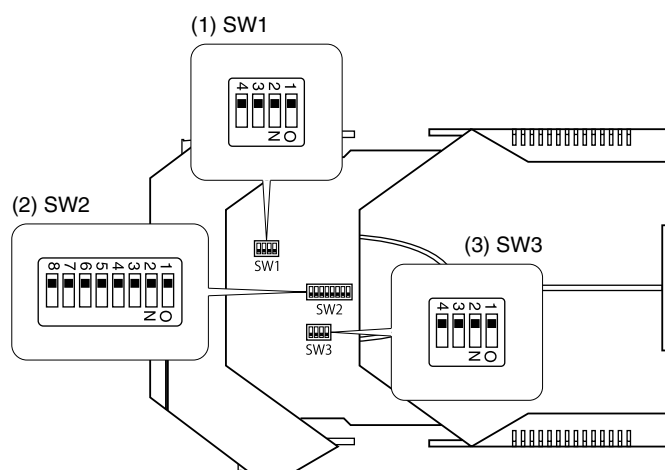
The LED status in the I/O ranging and fine adjustments using the 'One-Step Cal' is shown in the following tables.

MODE	LED	MODE	LED
Input ranging	<div> <div>R LD1</div> <div> LD2</div> <div> LD3</div> </div>	Fine zero adjustment	<div> <div>R LD1</div> <div> LD2</div> <div> LD3</div> </div>
Output ranging	<div> <div>R LD1</div> <div> LD2</div> <div> LD3</div> </div>	Fine span adjustment	<div> <div>R LD1</div> <div> LD2</div> <div> LD3</div> </div>

NOTE

In the I/O ranging and fine adjustments using the PC Configurator Software (model: M3LTCFG), the LEDs are not according to the above tables.

5.2 INTERNAL VIEW



(1) SW1

Sets output type.

(2) SW2

Sets thermocouple type, output type, front control button lock and configuration mode.

(3) SW3

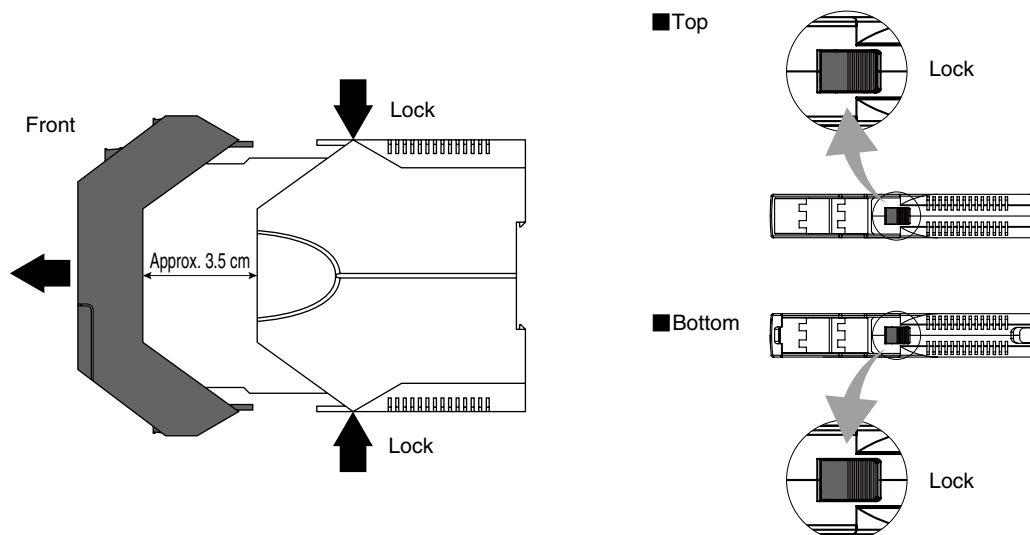
Sets cold junction compensation and burnout.

6. HOW TO OPEN THE COVER

Open the housing cover to set the DIP switches inside the cover.

■ HOW TO OPEN THE COVER

- (1) Hold the locks at the top and bottom of the unit.
- (2) Slide the housing cover gently to open until it hits the latching inside the unit (approx. 3.5 cm).

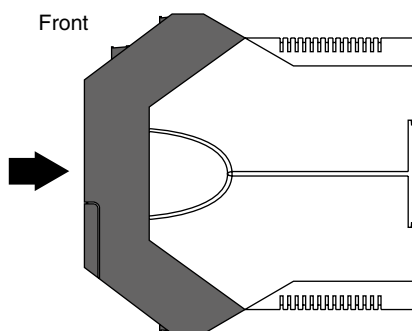


⚠ CAUTION

- Do not open the cover while the power or the input is applied.
- Do not touch the printed circuit board or the electronic components in opening the cover.
- Do not pull beyond where the cover is latched.

■ HOW TO CLOSE THE COVER

- (1) Push the front to close the cover.



⚠ CAUTION

- Before closing the cover, make sure that there is not a conductive foreign material attached on the printed circuit board.
- Be sure to close the cover after setting.
- Be careful not to get your hand or finger caught in the cover.
- Do not force the cover closed. Doing so may result in damage of the electronic components.

7. DIP SWITCH CONFIGURATION

This chapter describes the configuration of the I/O specifications and functions using the DIP switches.
For the PC configuration, some DIP switch settings are necessary.

7.1 DIFFERENCE BETWEEN DIP SW CONFIGURATION AND PC CONFIGURATION

The following table shows the difference between the DIP SW configuration and PC configuration.

CONFIGURATION ITEM	DIP SW CONFIGURATION	PC CONFIGURATION
Configuration mode	SW2-8 OFF	SW2-8 ON
Input type	Required	----
Output type	Required	Required for SW1-1 through 1-4
Front control button lock	As necessary	As necessary

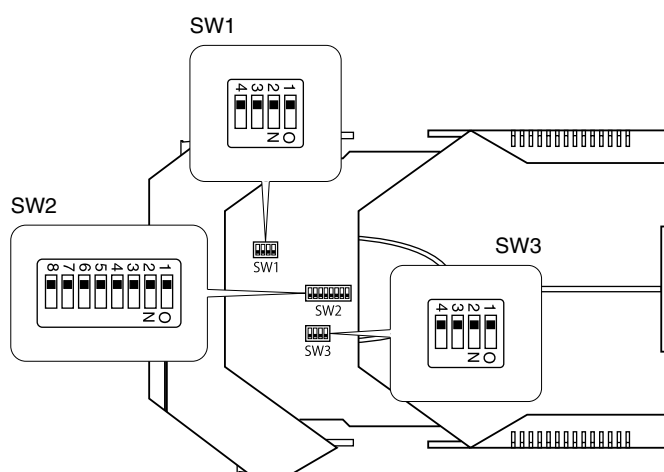
7.2 DIP SWITCH SELECTION PER I/O SPECIFICATION AND FUNCTION

Configure the DIP switches according to your I/O specifications and functions.

The unit reads the DIP-switch-calibrated configuration only once after the power supply is turned on. Set the switches with the power supply removed. Some tools are needed to set the DIP switches.

CAUTION

- Set the switches with the power supply removed.
- Use a minus screwdriver with the blade edge 0.8 mm (0.03") to set the DIP switches.
- Do not touch other electronic components except for the DIP switches.



7.2.1 CONFIGURATION MODE

With the model M3LT-R4/A, select the configuration mode (configuration method of I/O specifications), DIP SW configuration or PC configuration, as shown in the following table. With the model M3LT-R4/B, turn the SW2-8 OFF.

DIP SW configuration: sets I/O specifications with the DIP switches inside the cover and the front control buttons.

PC configuration: sets I/O specifications with the PC Configurator Software (model: M3LTCFG).

MODE	SW2-8
DIP SW	OFF
PC	ON

7.2.2 INPUT TYPE

Set the DIP switches (SW2-4 through 2-7, SW3-2 through 3-4) according to the thermocouple type, burnout and cold junction compensation settings. These settings are not required with the PC configuration.

■ THERMOCOUPLE TYPE

T/C	SW2-7	SW2-6	SW2-5	SW2-4
(PR)	OFF	OFF	OFF	ON
K (CA)	OFF	OFF	OFF	OFF
E (CRC)	OFF	OFF	ON	OFF
J (IC)	OFF	OFF	ON	ON
T (CC)	OFF	ON	OFF	OFF
B (RH)	OFF	ON	OFF	ON
R	OFF	ON	ON	OFF
S	OFF	ON	ON	ON
C (WRe 5-26)	ON	OFF	OFF	OFF
N	ON	OFF	OFF	ON
U	ON	OFF	ON	OFF
L	ON	OFF	ON	ON
P (Platinel II)	ON	ON	OFF	OFF

■ BURNOUT

BURNOUT	SW3-4	SW3-3
No burnout	OFF	ON
Upscale	OFF	OFF
Downscale	ON	OFF

■ COLD JUNCTION COMPENSATION

COLD JUNCTION COMPENSATION	SW3-2
Enable	OFF
Disable	ON

7.2.3 OUTPUT TYPE

Set the DIP switches (SW1-1 through 1-4, SW2-2 and 2-3) according to the output specifications.
The DIP switch settings (SW1-1 through 1-4) are required with the PC configuration.

7.2.3.1 DIP SW configuration

• DC current output

SW1-4	SW1-3	SW1-2	SW1-1	SW2-3	SW2-2
OFF	ON	OFF	OFF	OFF	OFF

• DC voltage output (narrow spans) [maximum range: -2.5 to +2.5 V DC]

SW1-4	SW1-3	SW1-2	SW1-1	SW2-3	SW2-2
ON	OFF	OFF	ON	OFF	ON

• DC voltage output (wide spans) [maximum range: -10 to +10 V DC]

SW1-4	SW1-3	SW1-2	SW1-1	SW2-3	SW2-2
ON	OFF	ON	OFF	ON	OFF

7.2.3.2 PC configuration

• DC current output

SW1-4	SW1-3	SW1-2	SW1-1
OFF	ON	OFF	OFF

• DC voltage output (narrow spans) [maximum range: -2.5 to +2.5 V DC]

SW1-4	SW1-3	SW1-2	SW1-1
ON	OFF	OFF	ON

• DC voltage output (wide spans) [maximum range: -10 to +10 V DC]

SW1-4	SW1-3	SW1-2	SW1-1
ON	OFF	ON	OFF

7.2.4 FRONT CONTROL BUTTON LOCK

You can lock the button operation on the front panel to prevent inadvertent operation.

This function is applicable to the firmware 2.01 or higher version. Confirm the firmware version on the specification label on the side of the transmitter.

LOCK	SW2-1
Unlock	OFF
Lock	ON

8. WIRING

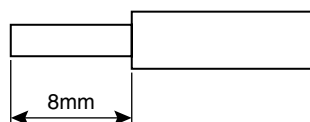
8.1 CAUTION IN WIRING

- For safety, make sure that wiring is performed by qualified personnel only.
- In order to prevent potential electric shock, wire the unit after turning off the power supply and making sure that the power is not supplied to the cable.
- Be sure to confirm the name and polarity of each terminal before wiring to the Euro type connector terminal blocks (hereafter called 'terminal block(s)').
- Take measures to reduce noise as much as possible, e.g. by using shielded twisted pair wires for the input signal. Ground the input shield to the most stable earth to prevent noise troubles.
- Do not connect anything to unused terminals.
- We offer a series of lightning surge protectors for protection against induced lightning surges. Please contact us to choose appropriate models.

8.2 WIRING INSTRUCTIONS

■ APPLICABLE WIRE SIZE

- Solid: 0.25 to 2.5 mm² (0.55 to 1.75 dia.)
- Stranded: 0.25 to 2.5 mm² (0.55 to 1.75 dia.)



! CAUTION

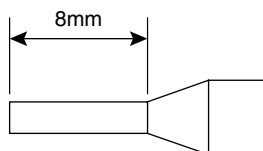
- Tinning wire ends may cause contact failure and therefore is not recommended.
- Expose wire conductors by 8 mm (0.31").

■ RECOMMENDED FERRULE

The following Phoenix Contact terminals are recommended.

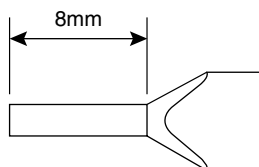
- For single-wire

CROSS-SECTION AREA	MODEL
0.2 to 0.25 mm ²	AI 0,25-8 YE
0.25 to 0.34 mm ²	AI 0,34-8 TQ
0.34 to 0.5 mm ²	AI 0,5-8 WH
0.5 to 0.75 mm ²	AI 0,75-8 GY
0.75 to 1.0 mm ²	AI 1,0-8 RD
1.0 to 1.5 mm ²	AI 1,5-8 BK



- For twin-wire

CROSS-SECTION AREA	MODEL
0.34 to 0.5 mm ²	AI-TWIN 2X 0,5-8 WH
0.5 to 0.75 mm ²	AI-TWIN 2X 0,75-8 GY
0.75 to 1.0 mm ²	AI-TWIN 2X 1,0-8 RD
1.0 to 1.5 mm ²	AI-TWIN 2X 1,5-8 BK

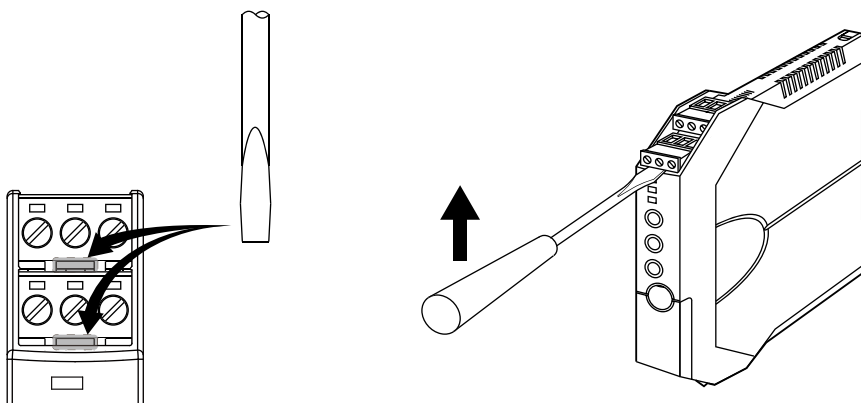


Recommended manufacturer: Phoenix Contact GmbH & Co., KG

■ INSTALLATION/SEPARATION OF TERMINAL BLOCK

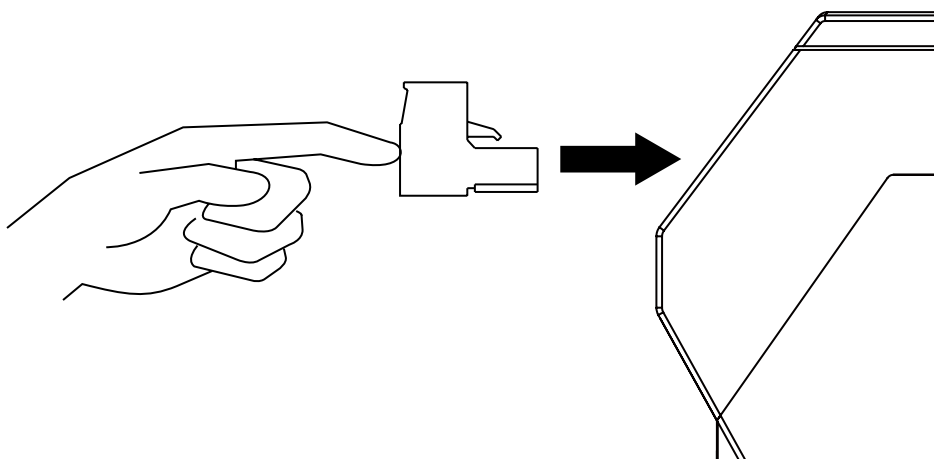
• Separation

Insert a minus screwdriver between the terminal block and the housing body, pull up the driver and pull out the terminal block.



• Installation

Push the terminal block until it clicks into place.



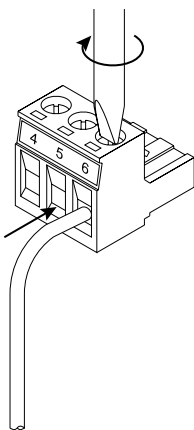
NOTE

Match the terminal numbers of the terminal blocks with those indicated on the transmitter body in installing the blocks (figure on the right).



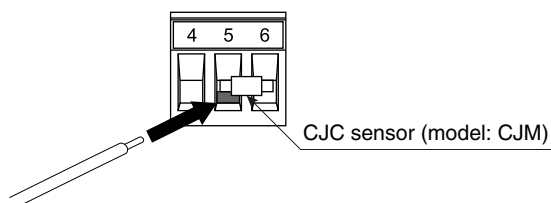
■ WIRING TO TERMINAL BLOCK

Insert a wire into the dead end of a terminal block and fix it with a minus screwdriver with the blade edge 0.6 mm (0.02") and the blade width 3.5 mm (0.14") (torque: 0.5 – 0.6 N·m).

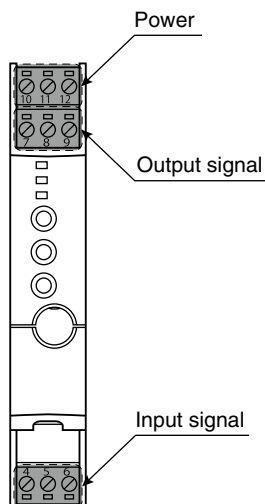


NOTE

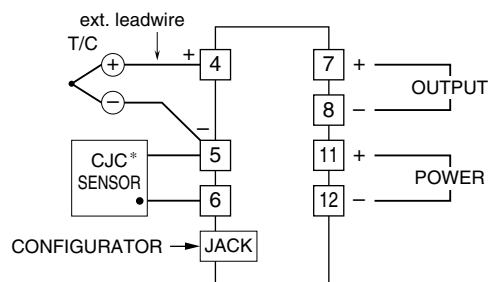
- Fasten the input wire and the CJC sensor together on the terminal 5.
- Do not use a ferrule with insulating sleeve.
- Insert a wire under the CJC sensor (figure on the right).



8.3 TERMINAL ASSIGNMENT



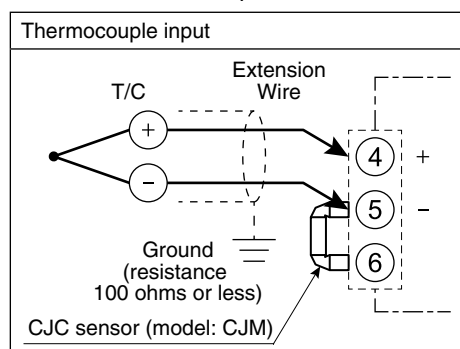
8.4 TERMINAL CONNECTIONS



* The CJC Sensor is secured to the terminal 6.
Loosen only the terminal 4 – 5 and connect the T/C extension wires.

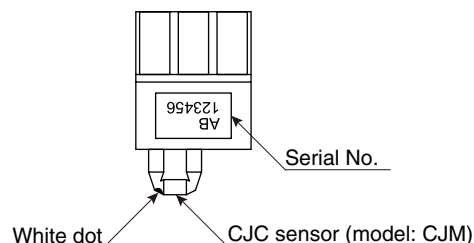
8.4.1 WIRING INPUT

Connect a thermocouple or extension wires.



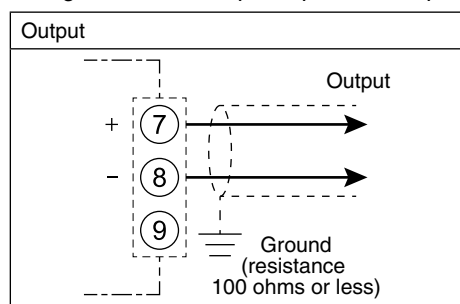
CAUTION

- Wire the unit with the thermocouple using the extension wires with the same characteristics as the thermocouple.
- The CJC sensor is calibrated to a particular unit and not interchangeable with another. Match the serial No. of the unit and the sensor (figure on the right).
- Be careful not to change the temperature around the terminal block. Take care that wind from a fan does not hit it directly.
- Be careful not to separate the CJC sensor from the terminal block. Do not loosen the screw on the terminal 6. If you did, connect the CJC leg marked with a white dot to the terminal 6 and the other leg to the terminal 5.



8.4.2 WIRING OUTPUT

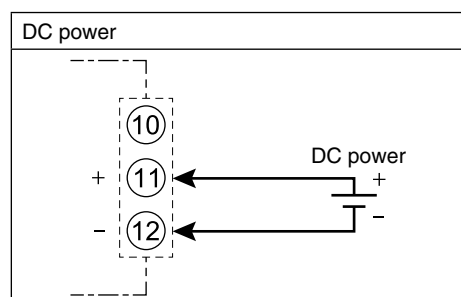
Voltage or current output is provided depending on the output setting.



8.4.3 WIRING POWER

Connect power according to the power input code. The power specifications are shown in the following table.

CODE	RATING	ALLOWABLE RANGE & POWER CONSUMPTION
R4	10 to 32 V DC	9 to 36 V DC, approx. 3 W



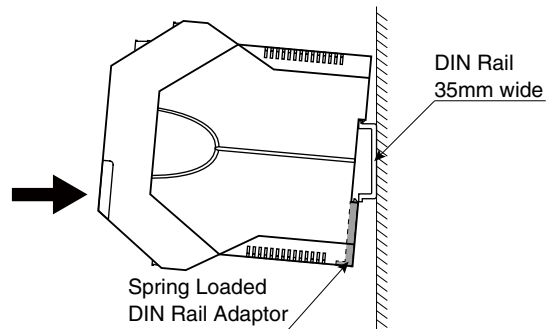
CAUTION

Confirm the polarity.

9. INSTALLATION

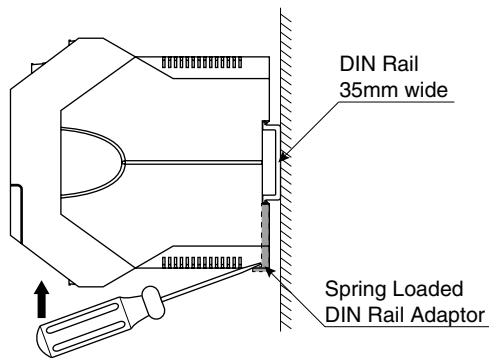
■ DIN RAIL MOUNTING

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.



■ REMOVAL

Push down the DIN rail adaptor utilizing a minus screwdriver and pull.



10. CALIBRATION

'Calibration' means I/O ranging or output fine adjustments using the front control buttons. The 'One-Step-Cal' calibration technique realizes automatic I/O ranging and adjustment.

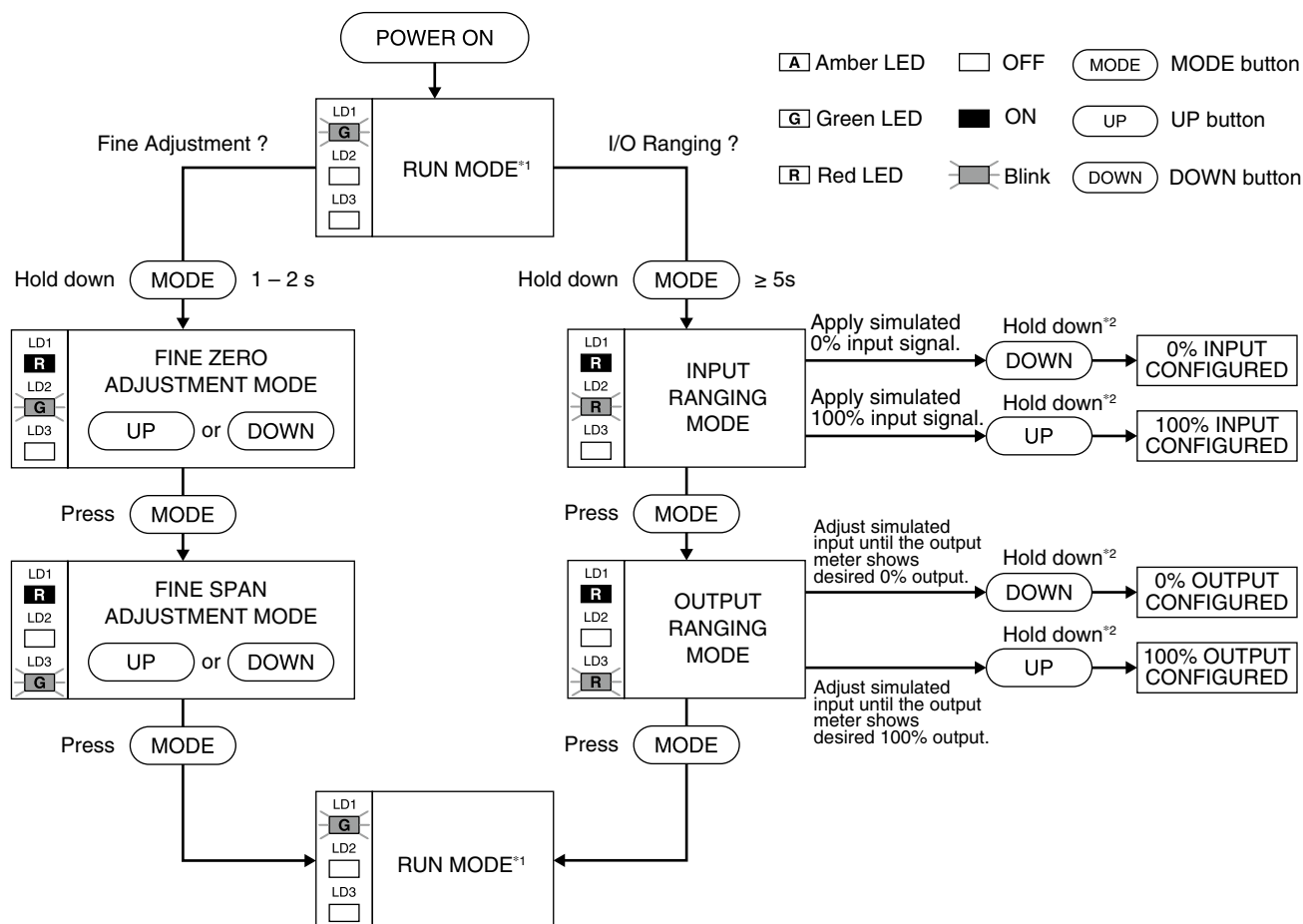
This chapter describes flow and operation procedure of the calibration.

You can also carry out the calibration using the PC Configurator Software (model: M3LTCFG). For detailed information, refer to the M3LTCFG users manual.

10.1 CALIBRATION FLOW

The calibration includes I/O Ranging Mode and Fine Adjustment Mode. Hold down the MODE button to shift each mode from the RUN Mode. The mode to shift depends on the time to hold down the button.

The following chart shows the calibration flow.



*1 In the RUN Mode, the green LD1 blinks (PC configuration), or turns on (DIP SW configuration).

*2 When you set 0% or 100% input/output ranges, keep pressing UP or DOWN button until the LD1 blinks for approx. 2 seconds and turns off, which indicates the setup is complete. When you release the button, the LD1 is returned to ON. Therefore hold down the button until the LD1 turns OFF.

10.2 INPUT & OUTPUT RANGING

After the DIP switch setting is complete, set up the precise input and output range using the front control buttons. Be sure that the front control button function is enabled with the DIP switch setting (SW2-1 OFF).

10.2.1 OUTLINE OF I/O RANGING

■ PREPARATION

Mount the DIP-SW-configured M3LT on to a DIN rail.

Connect the M3LT to a simulator and a multimeter and to a power source according to the terminal connections.

■ INPUT RANGING

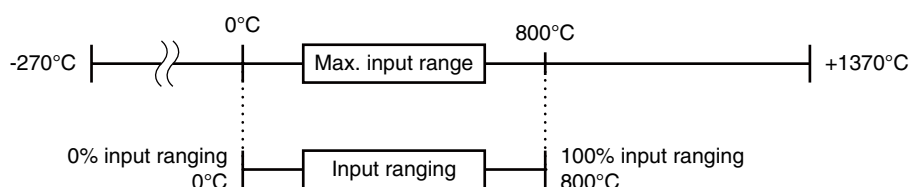
- In the Input Ranging Mode, apply the desired minimum input level from the simulator and hold down DOWN button until the LD1 blinks and then turns OFF.
- Then apply the desired maximum input level and hold down UP button until the LD1 blinks and then turns OFF.

[Example 1] Setting input to K thermocouple, 0 – 800°C

Maximum input range: -270 to +1370°C

0% input ranging: apply 0°C and hold down DOWN button

100% input ranging: apply 800°C and hold down UP button



NOTE

- Input ranging is not needed in using the default value.
- 100% input ranging value must be greater than 0% value.
- Set the input within the maximum range with the minimum span or more. With inappropriate input level, the input ranging is not carried out even in holding down UP or DOWN button. (The LD1 does not change.)
- There is no stated order of setting 0% and 100% levels or no limitations of entering values for multiple times within one step of Ranging Mode.
- Signal level is not stored when UP or DOWN button is released before the LD1 turns OFF.

■ OUTPUT RANGING

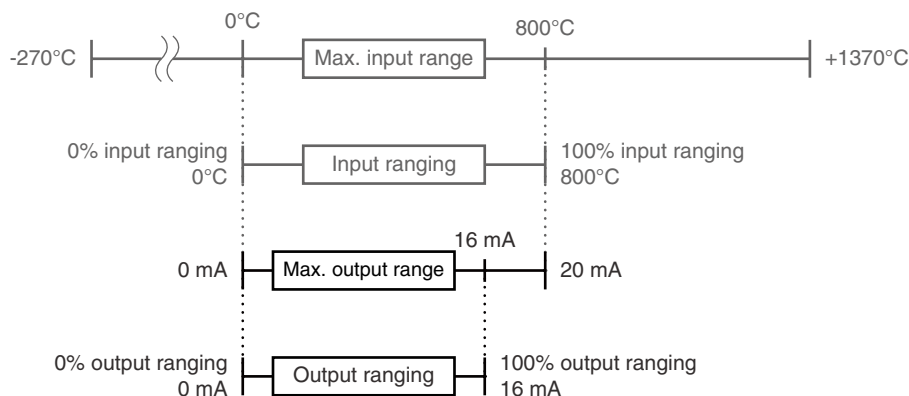
- In the Output Ranging Mode, increase or decrease the simulated input until the meter shows the desired minimum output level. Hold down DOWN button until the LD1 blinks and then turns OFF.
- Then increase or decrease the simulated input until the meter shows the desired maximum output level. Hold down UP button until the LD1 blinks and then turns OFF.

[Example 2] Setting output to 0 – 16 mA DC (input K thermocouple, 0 – 800°C [Example 1])

Maximum output range: 0 – 20 mA DC

0% output ranging: increase or decrease a simulated input until the meter shows 0 mA DC and hold down DOWN button.

100% output ranging: increase or decrease a simulated input until the meter shows 16 mA DC and hold down UP button.



IMPORTANT

- Use a simulator to adjust the desired output.
- A different signal from that in the input ranging may be applied.
- Increase or decrease a simulated input while confirming the output with a multimeter.
- Even if the input ranging is performed after the output ranging, another output ranging is not needed.

NOTE

- Output ranging is not needed in using the default value.
- 100% output ranging value must be greater than 0% value.
- Set the output within the maximum range with the minimum span or more. With inappropriate output level, the output ranging is not carried out even in holding down UP or DOWN button. (The LD1 does not change.)
- There is no stated order of setting 0% and 100% levels or no limitations of entering values for multiple times within one step of the Ranging Mode.
- Signal level is not stored when UP or DOWN button is released before the LD1 turns OFF.

10.2.2 MAXIMUM RANGE, MINIMUM SPAN AND DEFAULT VALUE OF INPUT

The maximum range, minimum span and default value of each thermocouple input are shown in the following table. The default value means initial 0% and 100% input when the DIP switch setting is changed.

Minimum span: 20°C (36°F)

Default value: same as maximum range in °C

THERMOCOUPLE	°C		°F	
	MAXIMUM RANGE	CONFORMANCE RANGE	MAXIMUM RANGE	CONFORMANCE RANGE
(PR)	0 to 1760	0 to 1760	32 to 3200	32 to 3200
K (CA)	-270 to +1370	-150 to +1370	-454 to +2498	-238 to +2498
E (CRC)	-270 to +1000	-170 to +1000	-454 to +1832	-274 to +1832
J (IC)	-210 to +1200	-180 to +1200	-346 to +2192	-292 to +2192
T (CC)	-270 to +400	-170 to +400	-454 to +752	-274 to +752
B (RH)	100 to 1820	400 to 1760	212 to 3308	752 to 3200
R	-50 to +1760	200 to 1760	-58 to +3200	392 to 3200
S	-50 to +1760	0 to 1760	-58 to +3200	32 to 3200
C (WRe 5-26)	0 to 2315	0 to 2315	32 to 4199	32 to 4199
N	-270 to +1300	-130 to +1300	-454 to +2372	-202 to +2372
U	-200 to +600	-200 to +600	-328 to +1112	-328 to +1112
L	-200 to +900	-200 to +900	-328 to +1652	-328 to +1652
P (Platinel II)	0 to 1395	0 to 1395	32 to 2543	32 to 2543

NOTE

The ex-factory setting is K thermocouple, 0 to 1000°C unless otherwise specified.

10.2.3 MAXIMUM RANGE, MINIMUM SPAN AND DEFAULT VALUE OF OUTPUT

The maximum range, minimum span and default value of the output are shown in the following tables. The default value means initial 0% and 100% output when the DIP switch setting is changed.

10.2.3.1 DC current output

MAXIMUM RANGE	MINIMUM SPAN	DEFAULT VALUE
0 to 20 mA DC	1 mA	4 to 20 mA DC

10.2.3.2 DC voltage output (narrow spans)

MAXIMUM RANGE	MINIMUM SPAN	DEFAULT VALUE
-2.5 to +2.5 V DC	250 mV	-1 to +1 V DC

10.2.3.3 DC voltage output (wide spans)

MAXIMUM RANGE	MINIMUM SPAN	DEFAULT VALUE
-10 to +10 V DC	1 V	1 to 5 V DC

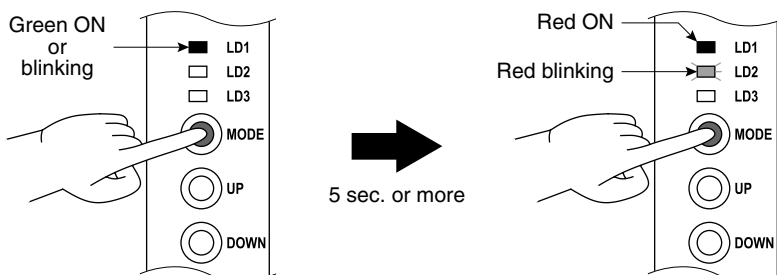
NOTE

The ex-factory setting is 4 – 20 mA DC unless otherwise specified.

10.2.4 OPERATION PROCEDURE OF I/O RANGING

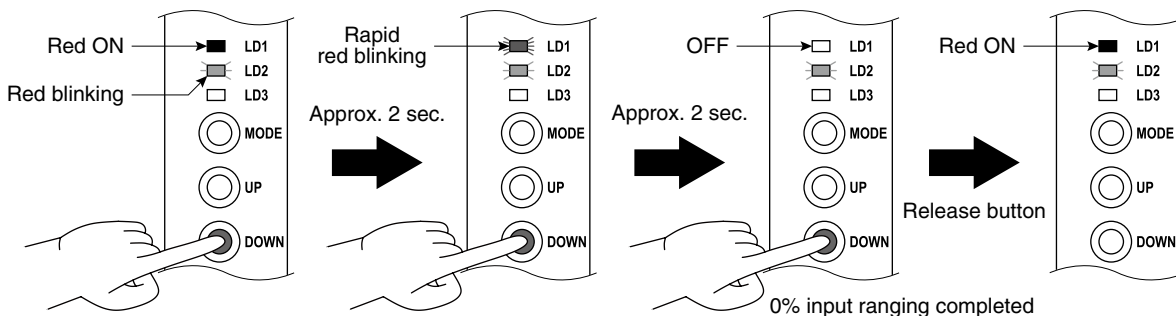
Perform the I/O ranging in the following procedure.

1 In the RUN Mode, hold down MODE button for 5 seconds or more until the LD1 red LED is ON.



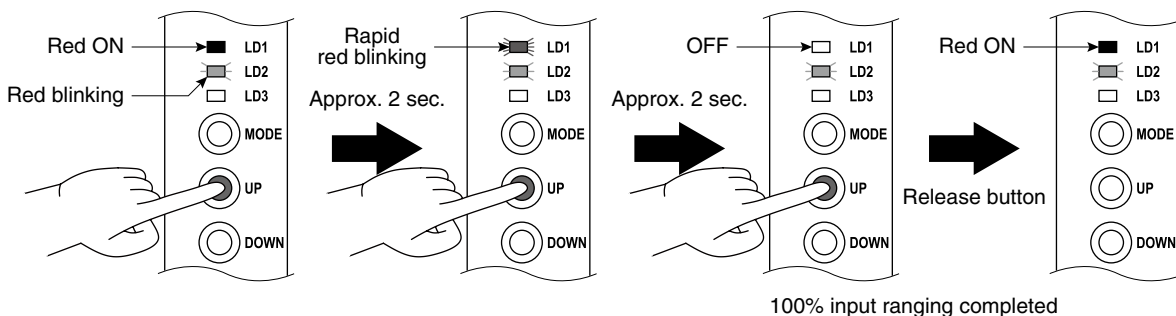
- Confirm that the LD1 green LED is ON (DIP SW configuration) or blinking (PC configuration). Then hold down MODE button for 5 seconds or more until the LD1 red LED is ON.
- The LD2 red LED starts blinking indicating the Input Ranging Mode.

2 Apply the desired minimum input level and hold down DOWN button until the LD1 turns OFF.



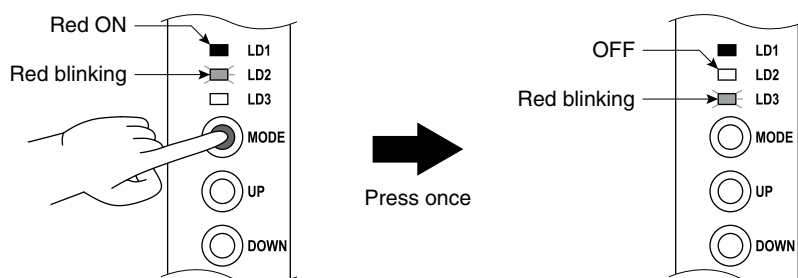
- Hold down DOWN button, and the LD1 red LED blinks in approx. 2 sec. and then turns OFF in approx. 2 sec.
- The LD1 turning OFF means completion of 0% input ranging. Hold down DOWN button until the LD1 turns OFF.
- Skip to the next procedure when 0% input ranging is not necessary.

3 Apply the desired maximum input level and hold down UP button until the LD1 turns OFF.



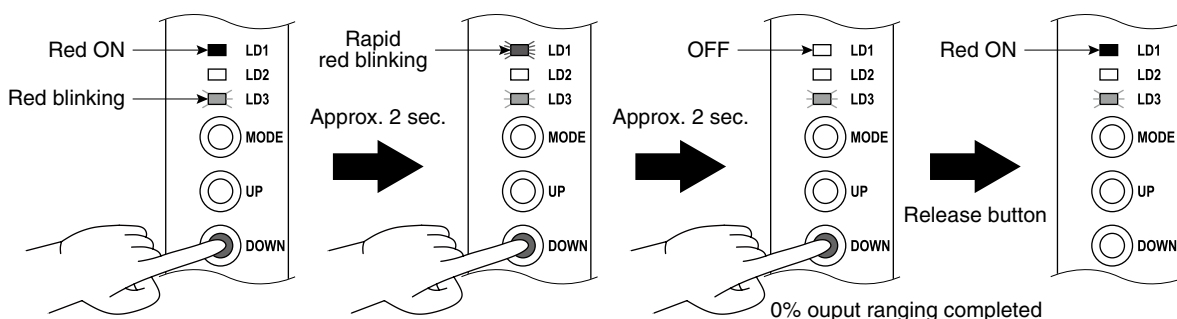
- Hold down UP button, and the LD1 red LED blinks in approx. 2 sec. and then turns OFF in approx. 2 sec.
- The LD1 turning OFF means completion of 100% input ranging. Hold down UP button until the LD1 turns OFF.
- Skip to the next procedure when 100% input ranging is not necessary.

4 Press MODE button to go on to the Output Ranging Mode.



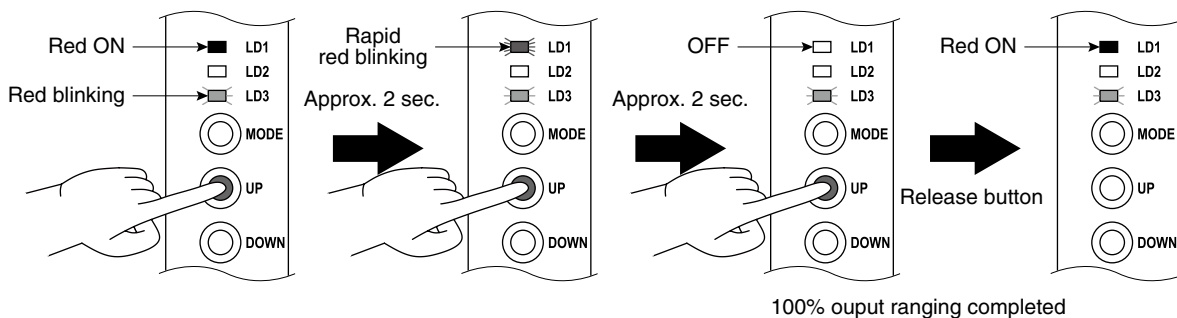
- Press MODE button once to go on to the Output Ranging Mode.
- The LD2 turns OFF and the LD3 red LED starts blinking indicating the Output Ranging Mode.

5 Increase or decrease the simulated input until the meter shows the desired minimum output level. Hold down DOWN button until the LD1 turns OFF.



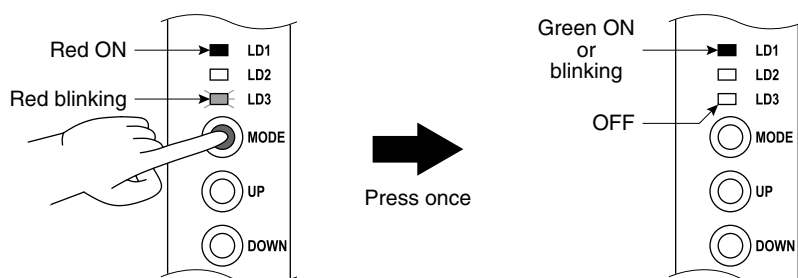
- Hold down DOWN button, and the LD1 red LED blinks in approx. 2 sec. and then turns OFF in approx. 2 sec.
- The LD1 turning OFF means completion of 0% output ranging. Hold down DOWN button until the LD1 turns OFF.
- Skip to the next procedure when 0% output ranging is not necessary.

6 Increase or decrease the simulated input until the meter shows the desired maximum output level. Hold down UP button until the LD1 turns OFF.



- Hold down UP button, and the LD1 red LED blinks in approx. 2 sec. and then turns OFF in approx. 2 sec.
- The LD1 turning OFF means completion of 100% output ranging. Hold down UP button until the LD1 turns OFF.
- Skip to the next procedure when 100% output ranging is not necessary.

7 Press MODE button to return to the RUN Mode.



- Press MODE button once to return to the RUN mode.
- The LD3 turns OFF and the LD1 green LED is ON (DIP SW configuration) or blinking (PC configuration).

10.3 FINE ADJUSTMENT MODE

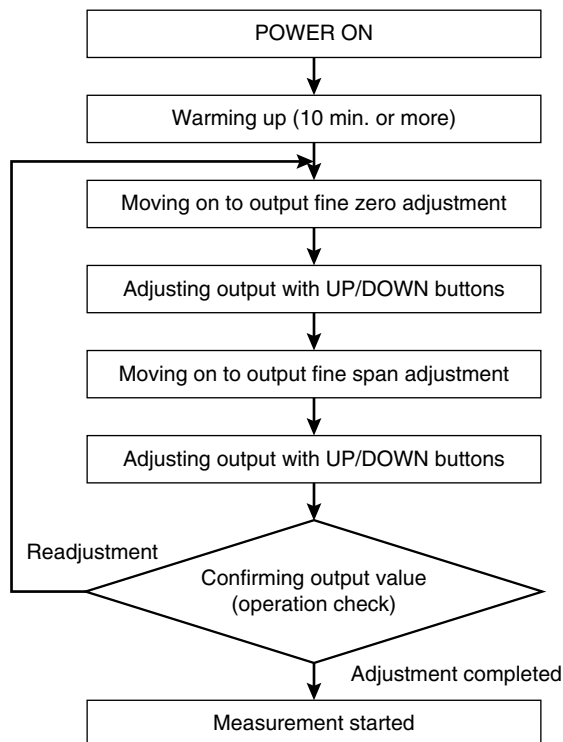
Perform the fine zero and span adjustments to correct the deviation between the output signal and a device on site. Be sure that the front control button function is enabled with the DIP switch setting (SW2-1 OFF).

Note that we do not warrant the adjustments by the customer.

Each time the adjustment is performed, signal level is overwritten and is stored even when the power is off.

10.3.1 OUTLINE OF FINE ADJUSTMENT

The following flowchart shows the fine zero/span adjustments.



NOTE

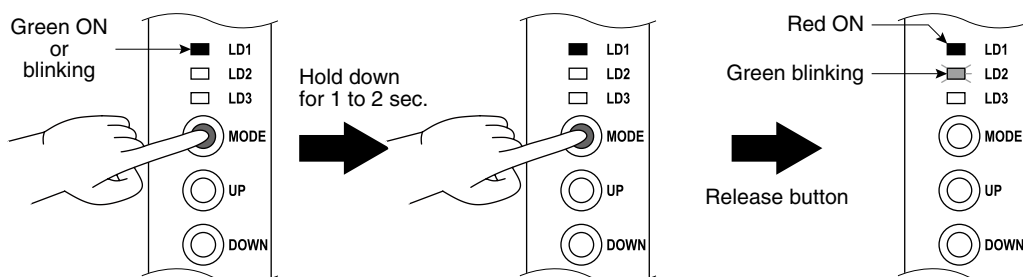
- Warm up measuring instruments, equipment and other devices on site for the time specified in each manual, and operate the unit in a stable condition.
- Adjustable ranges are as follows:

Fine zero adjustment	-15 to +15%
Fine span adjustment	85 to 115%

10.3.2 OPERATION PROCEDURE OF FINE ADJUSTMENT

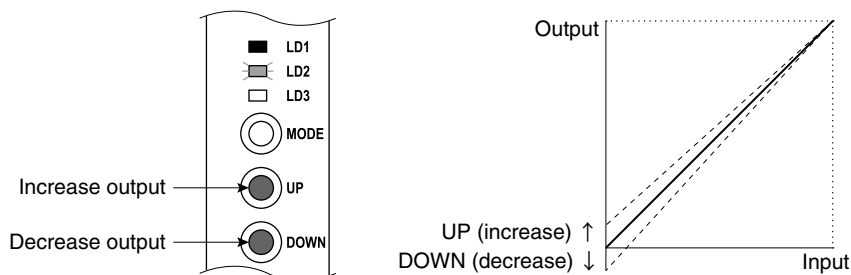
Perform the fine adjustment in the following procedure.

1 Hold down MODE button for 1 to 2 seconds and release the button to go on to the Fine Zero Adjustment Mode.



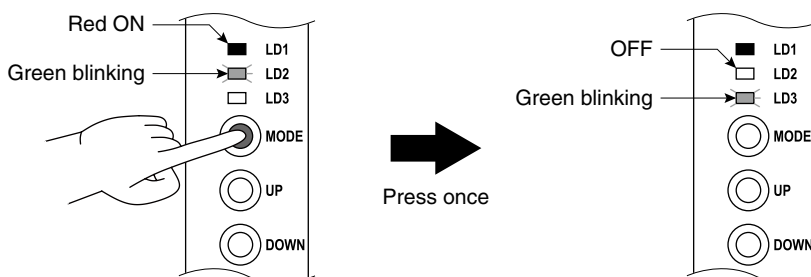
- Confirm that the LD1 green LED is ON (DIP SW configuration) or blinking (PC configuration). Then hold down MODE button for 1 to 2 seconds and release the button. The LD1 red LED will be ON.
- The LD2 green LED starts blinking indicating the Fine Zero Adjustment Mode.

2 Use UP (increase) and DOWN (decrease) buttons to adjust the output to 0%. Check the output with a multimeter.



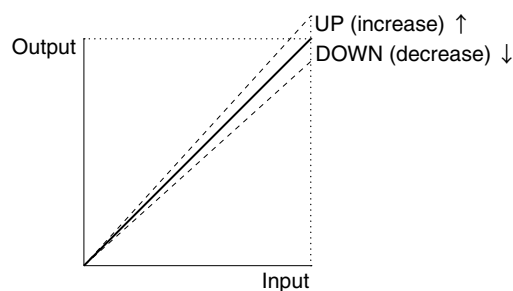
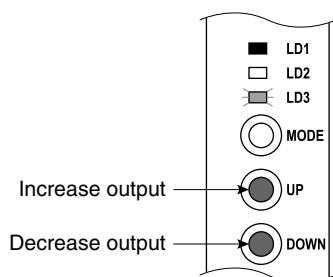
- Adjust the output value to 0% regardless of the input.
- Increase the output with UP button, and decrease with DOWN.
- Skip to the next procedure when fine zero adjustment is not necessary.

3 Press MODE button to go on to the Fine Span Adjustment Mode.



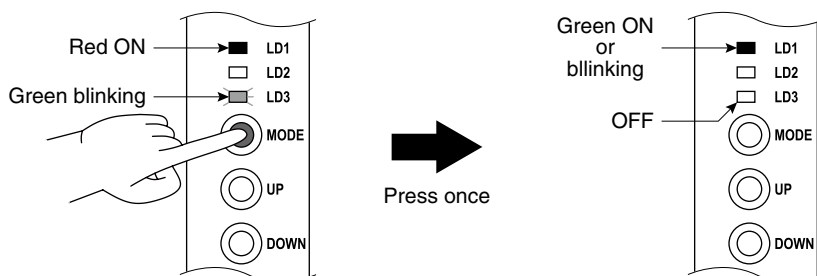
- Press MODE button once to go on to the Fine Span Adjustment Mode.
- The LD2 turns OFF and the LD3 green LED starts blinking indicating the Fine Span Adjustment Mode.

- 4** Use UP (increase) and DOWN (decrease) buttons to adjust the output to 100%. Check the output with a multimeter.



- Adjust the output value to 100% regardless of the input.
- Increase the output with UP button, and decrease with DOWN.
- Skip to the next procedure when fine span adjustment is not necessary.

- 5** Press MODE button to return to the RUN mode.



- Press MODE button once to return to the RUN Mode.
- The LD3 turns OFF and the LD1 green LED is ON (DIP SW configuration) or blinking (PC configuration).

11. CHECKING, MAINTENANCE

11.1 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) Power input voltage: Check voltage across the terminal 11 – 12 with a multimeter.
- (4) Input: Check that the input signal 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. Confirm the status indicator LED pattern and check leadwires in such a case.
- (5) Output: Check that the load resistance meets the described specifications.

11.2 MAINTENANCE

Perform the periodic calibration as stated below.

■ CALIBRATION

Warm up the unit for 10 minutes or more, apply 0, 25, 50, 75 and 100% input to the unit, and make sure that the output is 0, 25, 50, 75 and 100% respectively within the prescribed accuracy. In case the output is deviated from the accuracy, perform the fine zero/span adjustment.

12. APPENDICES

12.1 SPECIFICATIONS

12.1.1 GENERAL SPECIFICATIONS

Construction		Small-sized front terminal structure
Connection		Euro type connector terminal
Housing material		Flame-resistant resin (gray)
Isolation		Input to output to power
Overrange output		-15 to +115%
Zero adjustment		-15 to +15% (front)
Span adjustment		85 to 115% (front)
Burnout		Upscale (default), downscale or no burnout selectable
Linearization		Standard
Cold junction compensation		CJC sensor attached to the input terminals
Status indicator LED		Tri-color (green/amber/red) LED; Blinking patterns indicate operation status of the transmitter.
Configuration	DIP SW configuration	Thermocouple type, burnout action, cold junction compensation, output type, configuration mode, front control button lock
	PC configuration	Refer to 12.2 PC CONFIGURATOR SOFTWARE.
Calibration		I/O ranging and fine adjustment via 'One-Step Cal' calibration or PC
Configurator connection		2.5 dia. miniature jack; RS-232-C level

12.1.2 INPUT SPECIFICATIONS

Input types and ranges are shown in the following table.

Thermocouple	Input resistance: $\geq 1 \text{ M}\Omega$
	Maximum range: refer to Table 1
	Burnout sensing: $130 \text{ nA} \pm 10\%$
	Conformance range: refer to Table 1
	Minimum span: refer to Table 1

12.1.3 OUTPUT SPECIFICATIONS

Output types and ranges are shown in the following table.

DC current	Maximum range: 0 – 20 mA DC Minimum span: 1 mA Conformance range: 0 – 24 mA DC (Negative overrange current below 0 mA is not available.) Offset: Lower range can be any specific value within the output range provided that the minimum span is maintained. Load resistance: Output drive 12 V maximum
DC voltage	Narrow spans Maximum range: -2.5 – +2.5 V DC Minimum span: 250 mV Conformance range: -3 – +3 V DC Wide spans Maximum range: -10 – +10 V DC Minimum span: 1 V Conformance range: -11.5 – +11.5 V DC Offset: Lower range can be any specific value within the output range provided that the minimum span is maintained. Load resistance: Output drive 1 mA maximum

12.1.4 INSTALLATION

Power consumption	DC power	R4: 10 – 32 V DC	Operational voltage range 9 – 36 V DC Ripple 10% p-p max. Approx. 3 W
Operating temperature	-25 to +65°C (-13 to +149°F) Max. 55°C (131°F) for UL approval		
Operating humidity	0 to 95% RH (non-condensing)		
Mounting	DIN rail		
Weight	100 g (3.53 oz)		

12.1.5 PERFORMANCE

Accuracy	See Table 1.
Cold junction compensation error	±0.5°C at 25 ±10°C ±0.9°F at 77 ±18°F
Temp. coefficient	±0.015%/°C (±0.008%/°F) of max. span at -5 to +55°C [23 to 131°F]
Response time	≤ 0.9 sec. (0 – 90%)
Burnout response	≤ 10 sec.
Line voltage effect	±0.1% over voltage range
Insulation resistance	≥ 100 MΩ with 500 V DC
Dielectric strength	1500 V AC @ 1 minute (input to output or power to ground) 500 V AC @ 1 minute (output to power)

12.1.6 STANDARDS & APPROVALS

EU conformity	EMC Directive EMI EN 61000-6-4 EMS EN 61000-6-2 RoHS Directive
Approval	UL/C-UL general safety requirements UL 61010-1, CAN/CSA-C22.2 No.1010-1

12.1.7 I/O TYPE, MAXIMUM RANGE & ACCURACY

[Table 1] Thermocouple input

T/C	°C				°F			
	MIN. SPAN	MAXIMUM RANGE	ACCURACY*1	CONFORMANCE RANGE	MIN. SPAN	MAXIMUM RANGE	ACCURACY*1	CONFORMANCE RANGE
(PR)	20	0 to 1760	±1.00	0 to 1760	36	32 to 3200	±1.80	32 to 3200
K (CA)	20	-270 to +1370	±0.25	-150 to +1370	36	-454 to +2498	±0.45	-238 to +2498
E (CRC)	20	-270 to +1000	±0.20	-170 to +1000	36	-454 to +1832	±0.36	-274 to +1832
J (IC)	20	-210 to +1200	±0.25	-180 to +1200	36	-346 to +2192	±0.45	-292 to +2192
T (CC)	20	-270 to +400	±0.25	-170 to +400	36	-454 to +752	±0.45	-274 to +752
B (RH)	20	100 to 1820	±0.75	400 to 1760	36	212 to 3308	±1.35	752 to 3200
R	20	-50 to +1760	±0.50	200 to 1760	36	-58 to +3200	±0.90	392 to 3200
S	20	-50 to +1760	±0.50	0 to 1760	36	-58 to +3200	±0.90	32 to 3200
C (WRe 5-26)	20	0 to 2315	±0.25	0 to 2315	36	32 to 4199	±0.45	32 to 4199
N	20	-270 to +1300	±0.30	-130 to +1300	36	-454 to +2372	±0.54	-202 to +2372
U	20	-200 to +600	±0.20	-200 to +600	36	-328 to +1112	±0.36	-328 to +1112
L	20	-200 to +900	±0.25	-200 to +900	36	-328 to +1652	±0.45	-328 to +1652
P (Platinel II)	20	0 to 1395	±0.25	0 to 1395	36	32 to 2543	±0.45	32 to 2543

*1 [Accuracy + Cold Junction Compensation Error 0.5°C (0.9°F)] or ±0.1% of span, whichever is greater.
If the selected output span equals to or narrower than the one-tenth of the maximum span, add 0.2%.

12.1.8 CALCULATION EXAMPLES OF OVERALL ACCURACY

[Example 1]

Input: K thermocouple, 0 – 1000°C, Output: 4 – 20 mA DC

(1) Absolute value accuracy (Table 1): 0.25°C

(2) CJC error (0.5°C) added: 0.75°C

(3) $0.75^{\circ}\text{C} \div 1000^{\circ}\text{C} \times 100 = 0.075\%$

(4) $0.075\% < 0.1\%$ of span.

⇒ 0.1% is selected.

(5) Output span 16 mA (= 20 mA – 4 mA)

Max. span 20 mA

Output span $\geq 1/10$ of max. span

⇒ No need of adding 0.2%.

(6) Overall accuracy equals $\pm 0.1\%$ of span

[Example 2]

Input: K thermocouple, 50 – 150°C, Output: 2.0 – 2.5 V DC

(1) Absolute value accuracy (Table 1): 0.25°C

(2) CJC error (0.5°C) added: 0.75°C

(3) $0.75^{\circ}\text{C} \div (150^{\circ}\text{C} - 50^{\circ}\text{C}) \times 100 = 0.75\%$

(4) $0.75\% > 0.1\%$ of span.

⇒ 0.75% is selected.

(5) Output span 0.5 V (= 2.5 V – 2.0 V)

Max. span 5 V

Output span $\leq 1/10$ of max. span

⇒ Add 0.2%.

(6) Overall accuracy equals $\pm 0.95\%$ of span ($0.75\% + 0.2\%$)

12.2 PC CONFIGURATOR SOFTWARE

The I/O settings and calibration are configurable with the PC Configurator Software (model: M3LTCFG). It is convenient to set the same I/O specifications to several units or the items which are not available with the DIP SW configuration or 'One-Step Cal' calibration. Whether the I/O settings are available or not depends on the configuration option code and configuration mode.

A dedicated cable is required to connect the unit to the PC.

PORT	PC CONFIGURATOR CABLE MODEL NO.
RS-232-C	MCN-CON
USB	COP-US

The PC Configurator Software is freely downloadable at our web site.

Software download model No.: M3CFG

■ I/O CONFIGURATION

The following table shows configurable items with the PC Configurator Software. For detailed information on the PC configuration, refer to the M3LTCFG users manual (EM-9197-H).

ITEM	M3LT-R4/A		M3LT-R4/B
	PC CONFIGURATION (SW2-8 ON)	DIP SW CONFIGURATION (SW2-8 OFF)	
Input type	X	----	----
PV range (upper, lower)	X	----	----
PV damping (time constant)	X	X	----
Burnout	X	----	----
Cold junction compensation	X	----	----
AO type	X	----	----
AO range (upper, lower)	X	----	----
Custom TC	X	----	----

■ CALIBRATION

'One-Step Cal' calibration (I/O ranging) and DAC trimming (fine adjustments) are configurable with the PC Configurator Software regardless of the configuration option code and configuration mode.

■ REMARKS

For detailed information on the PC configuration, refer to the M3LTCFG users manual (EM-9197-H).

12.3 MODEL NUMBERING

Code number: **M3LT-R4/[1][2]**

INPUT – Field-selectable

Thermocouple

(PR), K, E, J, T, B, R, S, C (WRe 5-26), N, U, L, P (Platinel II)

OUTPUT – Field-selectable

Current

0 – 20 mA DC

Voltage

-2.5 – +2.5 V DC

-10 – +10 V DC

POWER INPUT

DC Power

R4: 10 – 32 V DC (operational voltage range 9 – 36 V, ripple 10% p-p max.)

[1] CONFIGURATION OPTIONS

A: PC and field configurable

B: Field configurable

[2] OPTIONS

Standards & Approvals

Blank: CE marking

/UL: UL approval, CE marking

Other Options

Blank: None

/Q: Option other than the above (specify the specification)

SPECIFICATIONS OF OPTION: Q

COATING (For the detail, refer to our web site.)

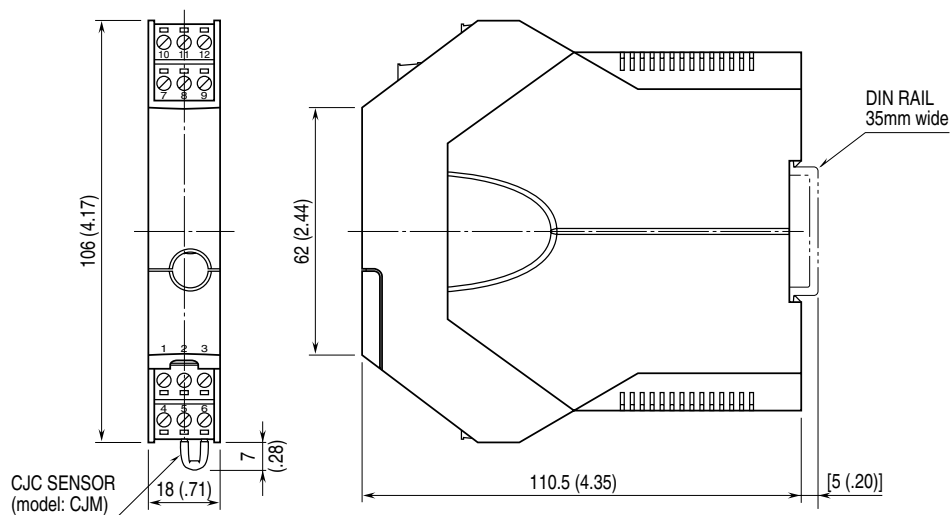
/C01: Silicone coating

/C02: Polyurethane coating

/C03: Rubber coating (UL not available)

12.4 EXTERNAL DIMENSIONS

mm (inch)



• When mounting, no extra space is needed between units