Space-saving Signal Conditioners M3-UNIT Series

SIGNAL TRANSMITTER

(field- and PC-configurable)

Model: M3LV

OPERATING MANUAL

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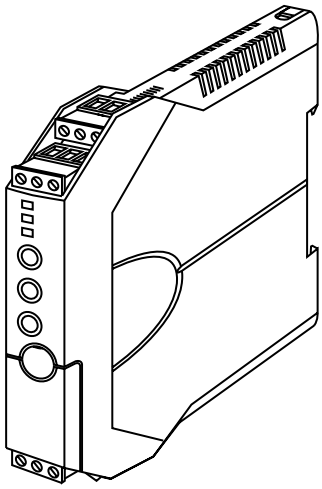
1. INTRODUCTION

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

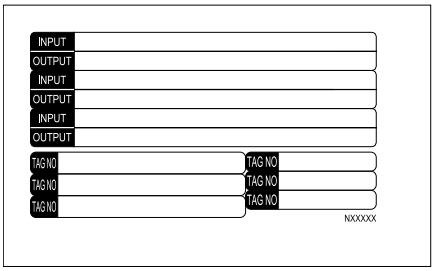
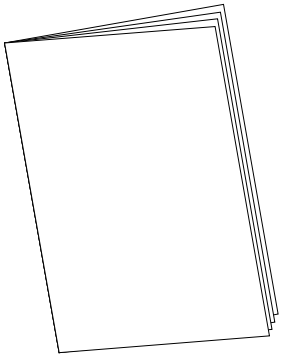
1.1 PACKAGE

Check contents of the package you received as outlined below.

• Signal conditioner



• Accessories

I/O range and tag name label sheet	Instruction manual
	

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.
- 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.
- Doing so may result in electric shock.

MANDATORY CAUTION
Check the connection diagram carefully before wire connection.
- 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.
- 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.
- Doing so may result in electric shock.

PROHIBITION TO BE WET
Do not splash water on the unit.
- 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.
- Using the unit continuously may result in a fire or electric shock.

MANDATORY CAUTION
Stop using the unit if it is dropped or damaged.
- Using the unit continuously may result in a fire or electric shock.

PROHIBITION
Do not throw the unit into the fire.
- 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 not used in a manner not specified by M-System, 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.
- 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.

⚠ 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 M3LV

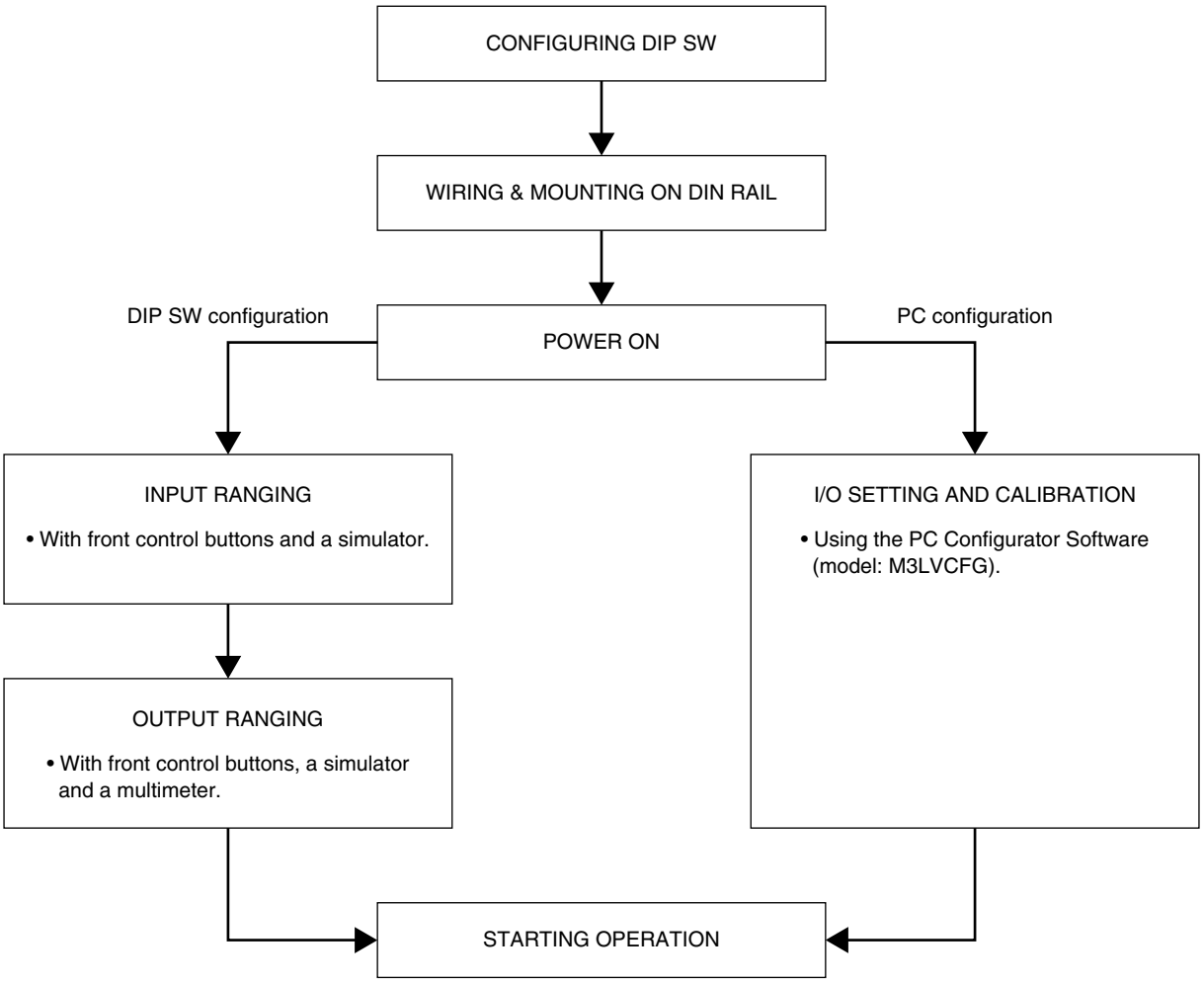
4.1 FEATURES OF M3LV

The M3LV 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 and range 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 M-System's 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

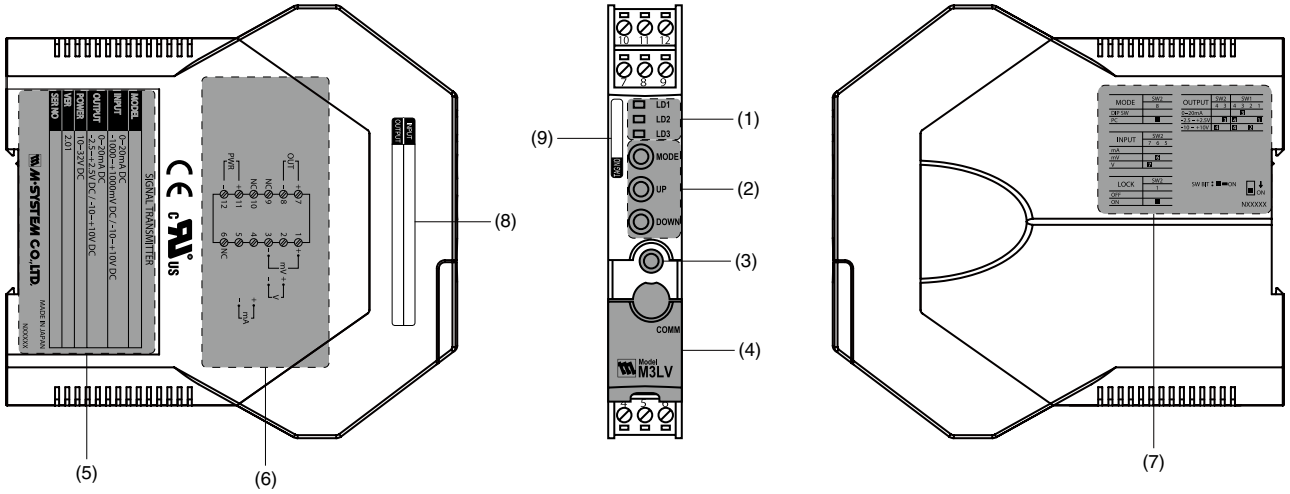
Before using the unit, perform the calibration according the following flow. The procedure depends on the configuration options or modes.

- Two configuration modes are available with the model M3LV-R4/A, field configuration using the DIP SW / control buttons (hereafter called 'DIP SW configuration') and the PC configuration.
- The model M3LV-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: M3LVCFG) 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.

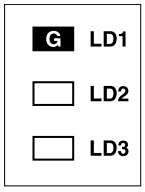
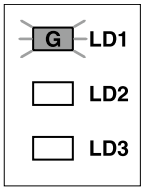
LED COLOR	
Red	**R**
Amber	**A**
Green	**G**

PATTERN	
ON	■
Blink	▭
OFF	□

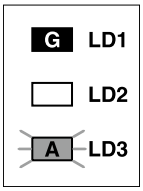
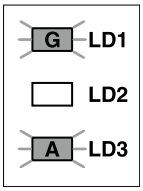
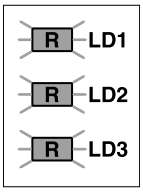
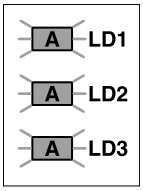
■ NORMAL OPERATION (RUN) MODE

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

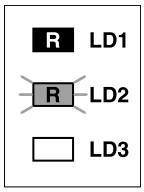
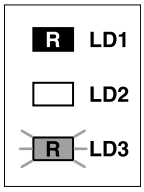
DIP SW CONFIGURATION	PC CONFIGURATION
	

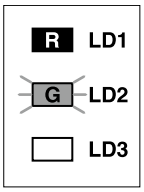
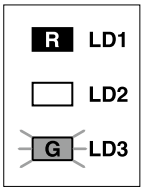
• Error mode

ERROR	DIP SW CONFIGURATION	PC CONFIGURATION
Output saturated		
	The output is below -15% or above 115%. Check the setting and input.	
DIP SW error		
	DIP SW configuration is inappropriate. Check the SW settings.	
System error		
	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.

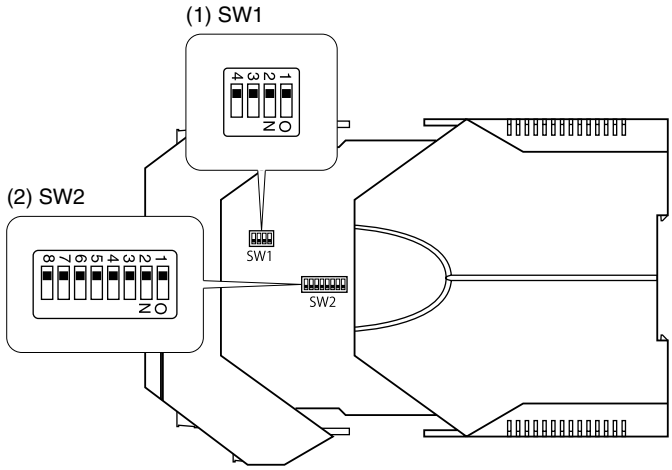
MODE	LED
Input ranging	
Output ranging	

MODE	LED
Fine zero adjustment	
Fine span adjustment	

NOTE

In the I/O ranging and fine adjustments using the PC Configurator Software (model: M3LVCFG), the LEDs are not according to the above tables.

5.2 INTERNAL VIEW



(1) SW1
Sets output type.

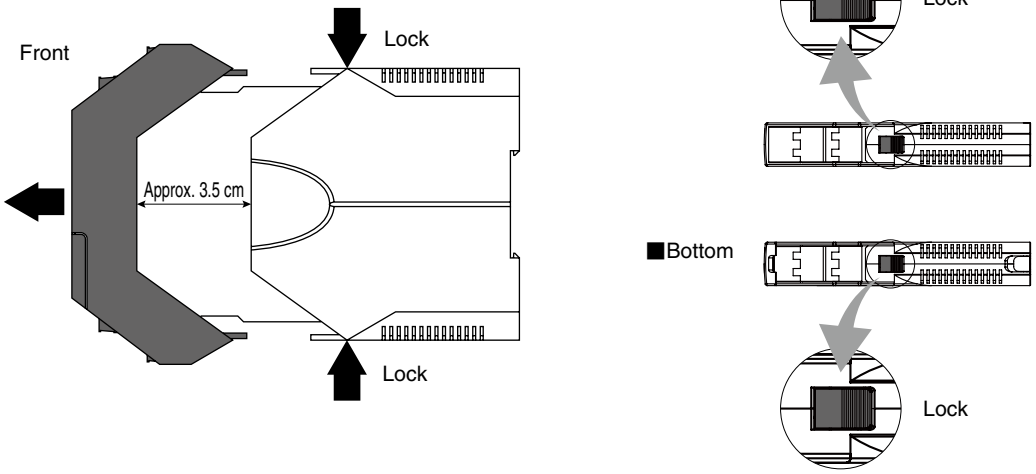
(2) SW2
Sets input type, output type, front control button lock and configuration mode.

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).

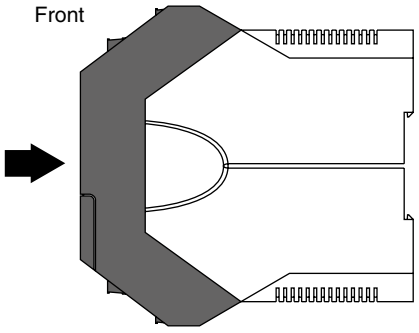


⚠ CAUTION

- 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 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.

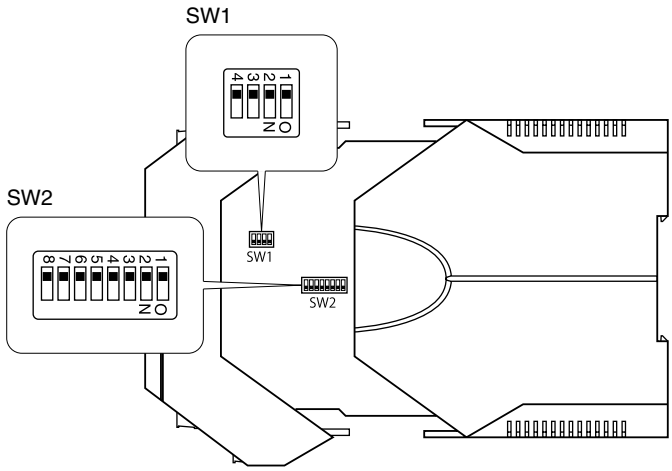
CONFIGURATION ITEM	DIP SW CONFIGURATION	PC CONFIGURATION
Configuration mode	SW2-8 OFF	SW2-8 ON
Input type	Required	----
Output type	Required	Required for SW1-1 through 1-4
Front control button lock	As necessary	As necessary

7.2 DIP SWITCH SELECTION PER I/O SPECIFICATION

Configure the DIP switches according to your I/O specifications.
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 M3LV-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 M3LV-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: M3LVCFG).

MODE	SW2-8
DIP SW	OFF
PC	ON

7.2.2 INPUT TYPE

Set the DIP switches (SW2-5 through 2-7) according to the input specifications. These settings are not required with the PC configuration.

7.2.2.1 DC current input

SW2-7	SW2-6	SW2-5
OFF	OFF	OFF

7.2.2.2 DC voltage input (mV) [maximum range: -1000 to +1000 mV DC]

SW2-7	SW2-6	SW2-5
OFF	ON	OFF

7.2.2.3 DC voltage input (V) [maximum range: -10 to +10 V DC]

SW2-7	SW2-6	SW2-5
ON	OFF	OFF

7.2.3 OUTPUT TYPE

Set the DIP switches (SW1-1 through 1-4, SW2-3 and 2-4) 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
OFF	ON	OFF	OFF

SW2-4	SW2-3
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

SW2-4	SW2-3
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

SW2-4	SW2-3
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

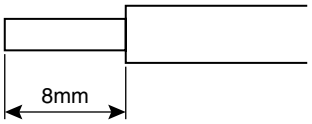
8.1 CAUTION IN WIRING

- 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.
- M-System offers a series of lightning surge protectors for protection against induced lightning surges. Please contact M-System to choose appropriate models.

8.2 WIRING INSTRUCTIONS

■ APPLICABLE WIRE SIZE

- Solid: 0.25 to 2.5 mm^2 (0.55 to 1.75 dia.)
- Stranded: 0.25 to 2.5 mm^2 (0.55 to 1.75 dia.)



⚠ CAUTION

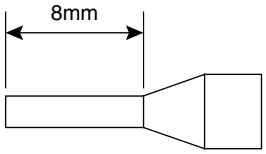
- Tinning wire ends may cause contact failure and therefore is not recommended.
- Expose wire conductors by 8 mm (0.31").

■ RECOMMENDED FERRULE

The following Phoenix Contact terminals are recommended.

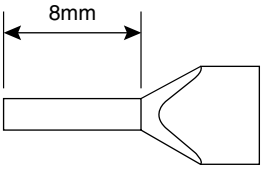
- For single-wire

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

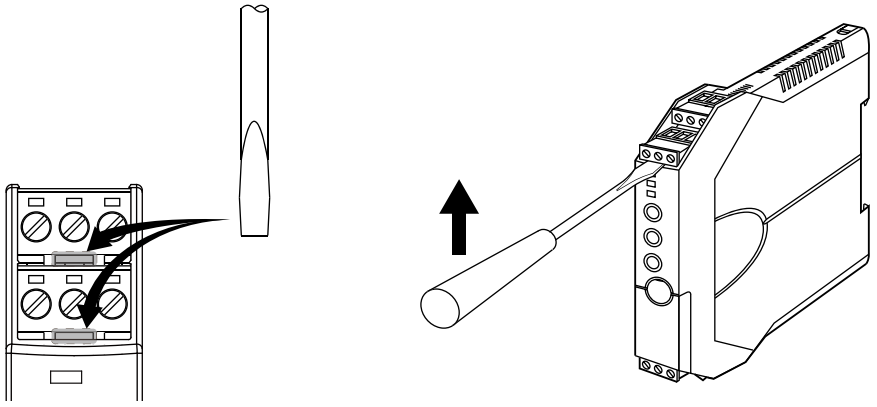


Recommended manufacturer: Phoenix Contact GmbH & Co., KG

■ INSTALLATION/SEPARATION OF TERMINAL BLOCK

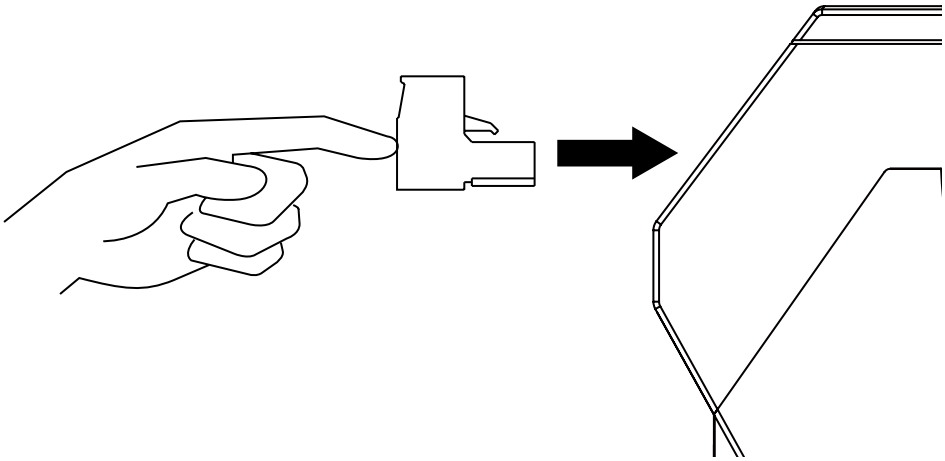
• Separation

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



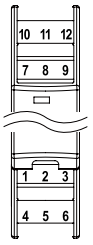
• Installation

Push the terminal block until it clicks into place.



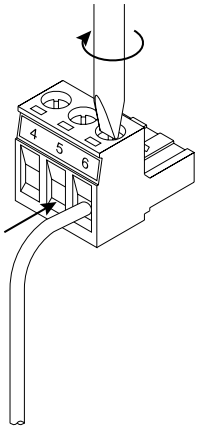
NOTE

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

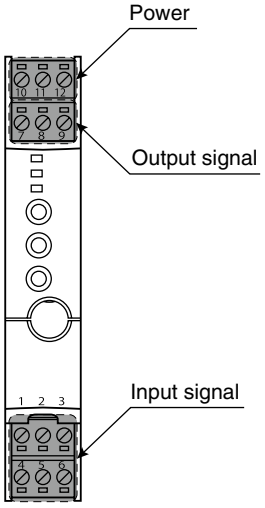


■ WIRING TO TERMINAL BLOCK

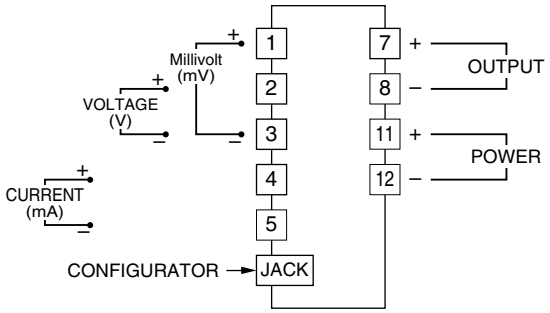
Insert a wire into the dead end of a terminal block and fix it with a minus screwdriver with the blade edge 0.6 mm (0.02”) and the blade width 3.5 mm (0.14”) (torque: 0.5 – 0.6 N·m).



8.3 TERMINAL ASSIGNMENT

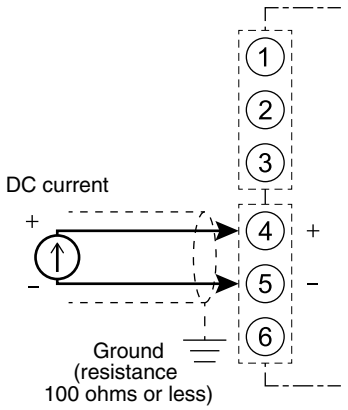
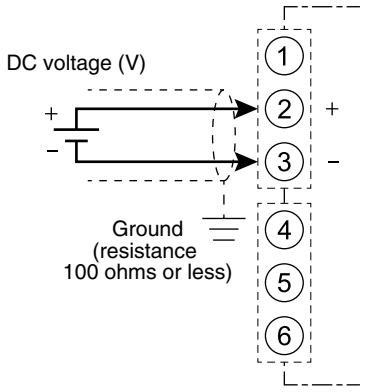
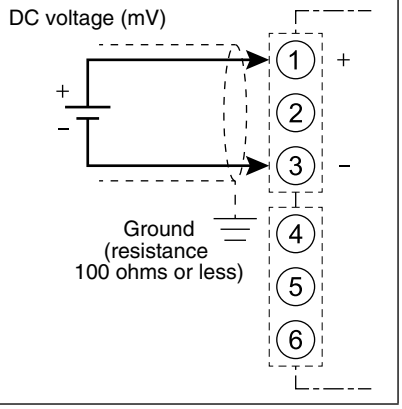


8.4 TERMINAL CONNECTIONS



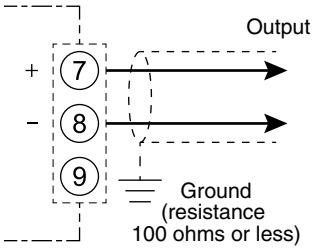
8.4.1 WIRING INPUT

Connect DC voltage or current wires.

DC current input	DC voltage input (V)	DC voltage input (mV)
Maximum range: 0 to 20 mA DC	Maximum range: -10 to +10 V DC	Maximum range: -1000 to +1000 mV DC
		

8.4.2 WIRING OUTPUT

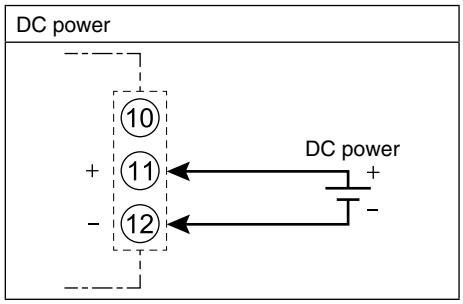
Voltage or current output is provided depending on the output setting.

Output


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



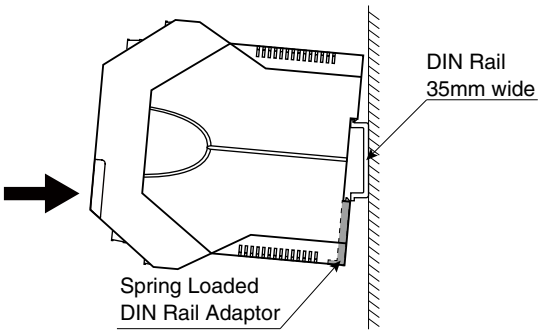
⚠ CAUTION

Confirm the polarity.

9. INSTALLATION

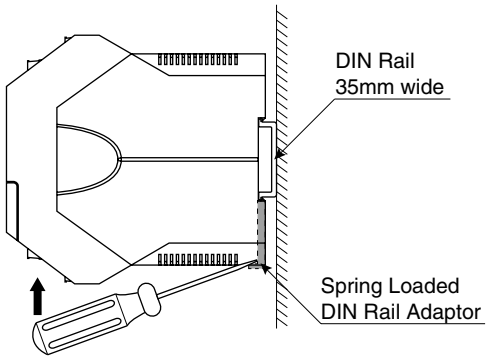
■ DIN RAIL MOUNTING

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.

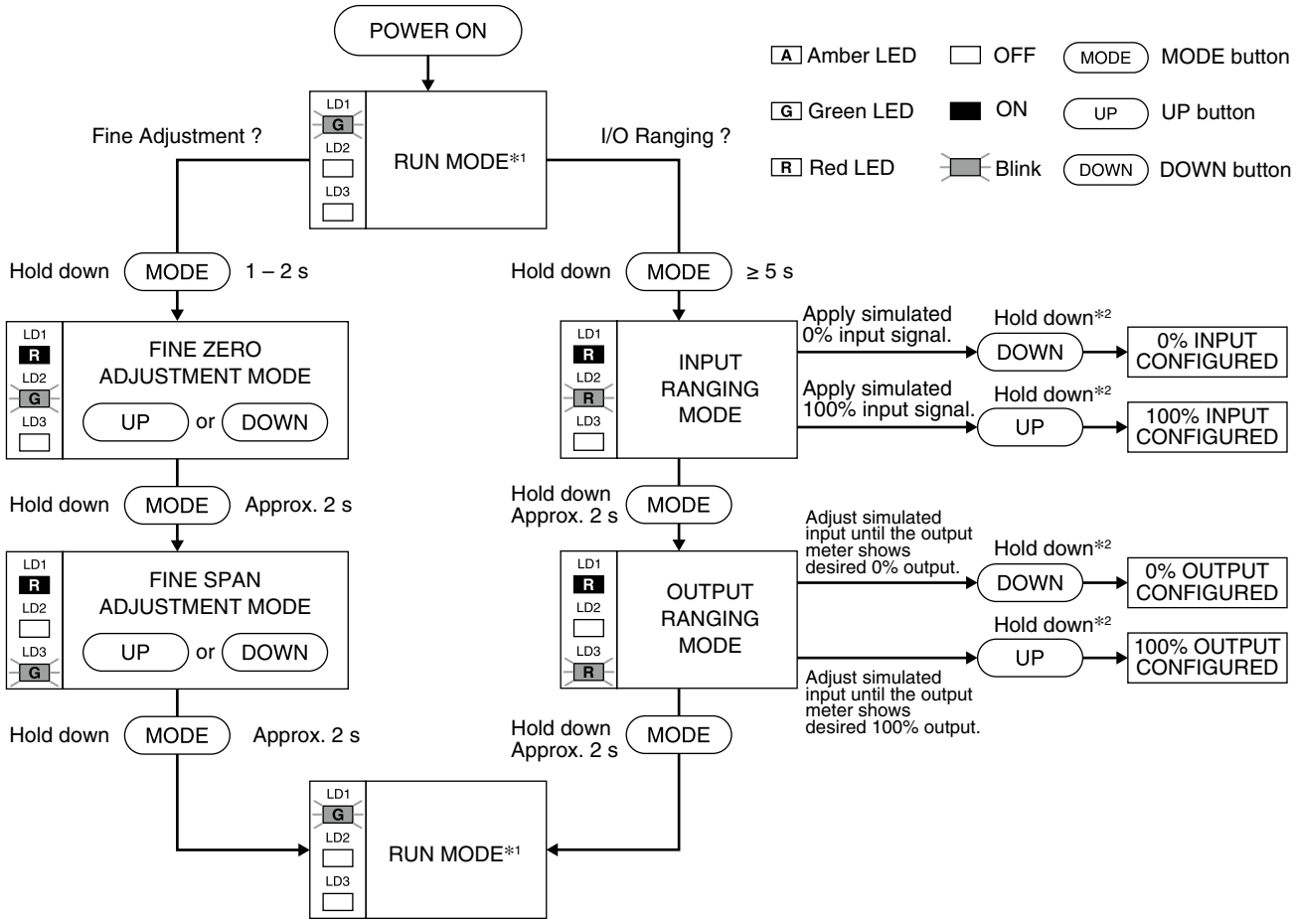


10. CALIBRATION

'Calibration' means I/O ranging or output fine adjustments using the front control buttons. M-System's '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: M3LVCFG). For detailed information, refer to the M3LVCFG 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

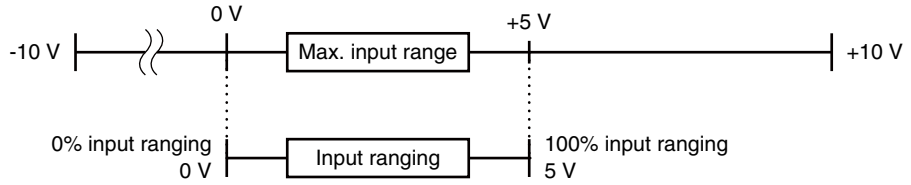
■ PREPARATION

Mount the DIP-SW-configured M3LV on to a DIN rail.
Connect the M3LV 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 0 – 5 V DC
Maximum input range: -10 to +10 V DC
0% input ranging: apply 0 V DC and hold down DOWN button
100% input ranging: apply 5 V DC 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**

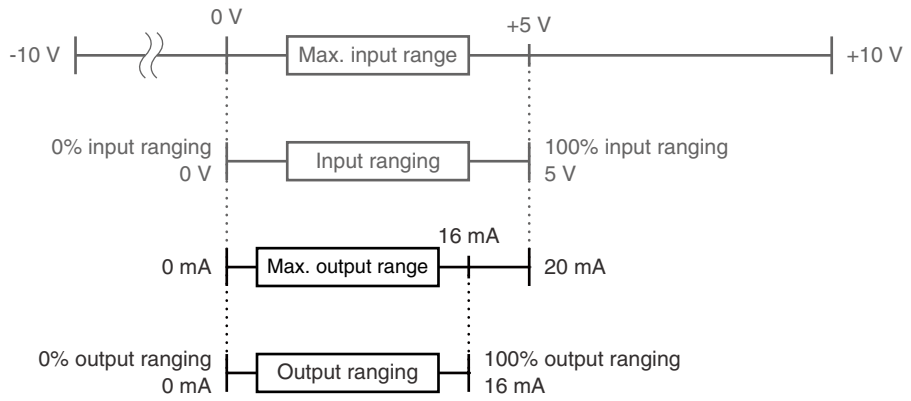
- In the Output Ranging Mode, increase or decrease the simulated input until the meter shows the desired minimum output level. Hold down DOWN button until the LD1 blinks and then turns OFF.
- Then increase or decrease the simulated input until the meter shows the desired maximum output level. Hold down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

[Example 2] Setting output to 0 – 16 mA DC (input 0 – 5 V DC [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 the input are shown in the following tables. The default value means initial 0% and 100% input when the DIP switch setting is changed.

10.2.2.1 DC current input

MAXIMUM RANGE	MINIMUM SPAN	DEFAULT VALUE
0 to 20 mA DC	2 mA	4 to 20 mA DC

10.2.2.2 DC voltage input (mV)

MAXIMUM RANGE	MINIMUM SPAN	DEFAULT VALUE
-1000 to +1000 mV DC	100 mV	-1000 to +1000 mV DC

10.2.2.3 DC voltage input (V)

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.

10.2.3 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

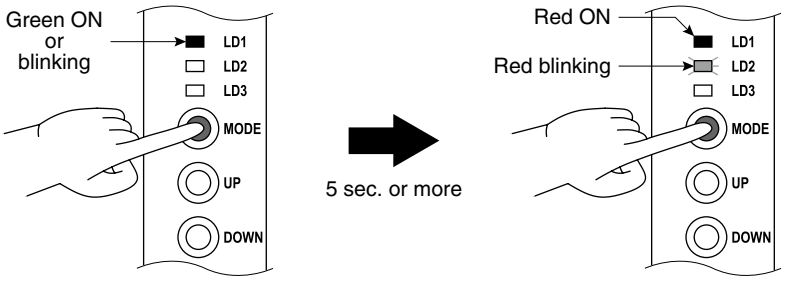
NOTE

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

10.2.4 OPERATION PROCEDURE OF I/O RANGING

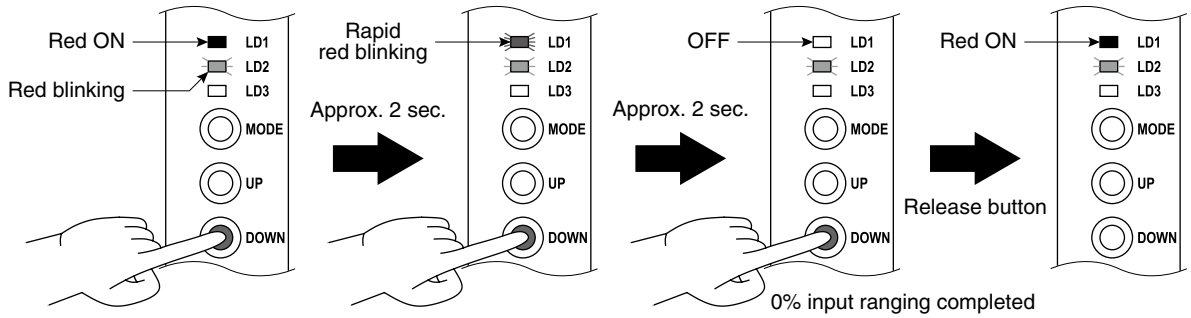
Perform the I/O ranging in the following procedure.

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



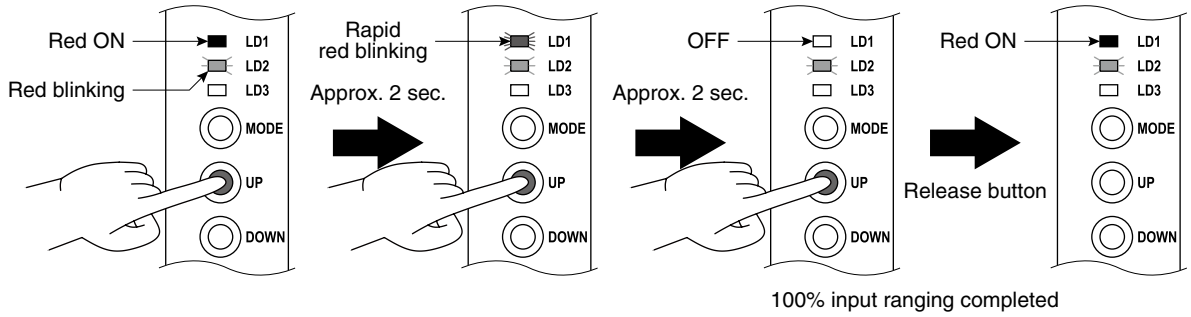
- Confirm that the LD1 green LED is ON (DIP SW configuration) or blinking (PC configuration). Then hold down MODE button for 5 seconds or more until the LD1 red LED is ON.
- The LD2 red LED starts blinking indicating the Input Ranging Mode.

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



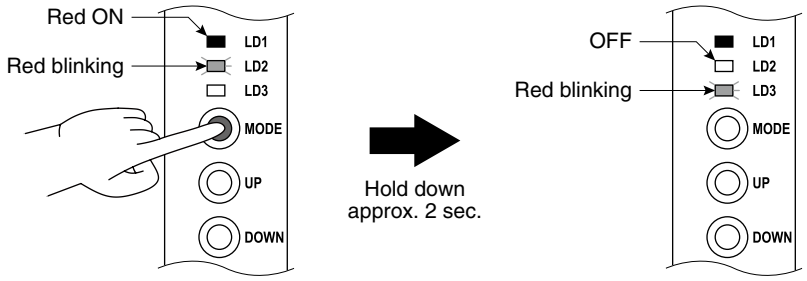
- Hold down DOWN button, and the LD1 red LED blinks in approx. 2 sec. and then turns OFF in approx. 2 sec.
- The LD1 turning OFF means completion of 0% input ranging. Hold down DOWN button until the LD1 turns OFF.
- Skip to the next procedure when 0% input ranging is not necessary.

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



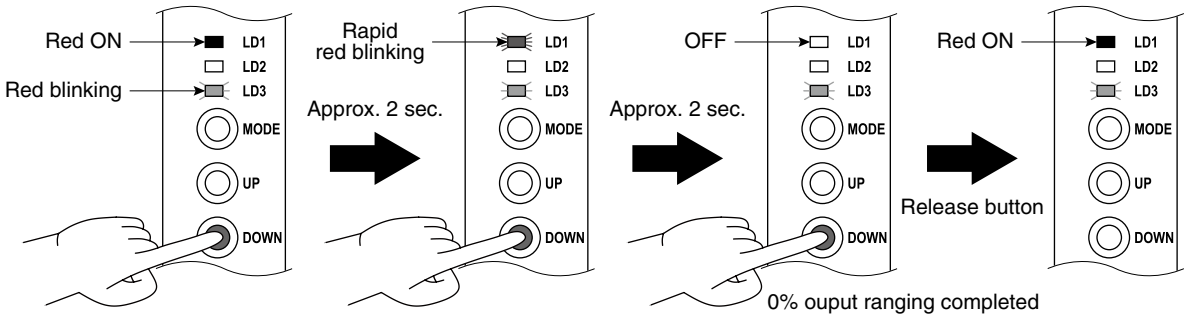
- Hold down UP button, and the LD1 red LED blinks in approx. 2 sec. and then turns OFF in approx. 2 sec.
- The LD1 turning OFF means completion of 100% input ranging. Hold down UP button until the LD1 turns OFF.
- Skip to the next procedure when 100% input ranging is not necessary.

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



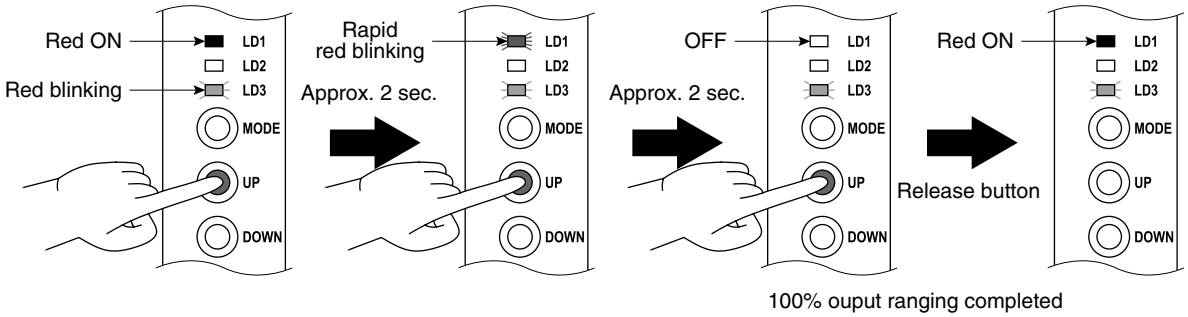
- Hold down MODE button for approx. 2 sec. to go on to the Output Ranging Mode.
- The LD2 turns OFF and the LD3 red LED starts blinking indicating the Output Ranging Mode.

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.



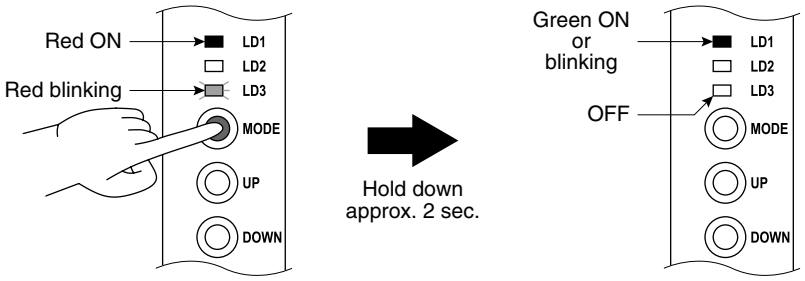
- Hold down DOWN button, and the LD1 red LED blinks in approx. 2 sec. and then turns OFF in approx. 2 sec.
- The LD1 turning OFF means completion of 0% output ranging. Hold down DOWN button until the LD1 turns OFF.
- Skip to the next procedure when 0% output ranging is not necessary.

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.



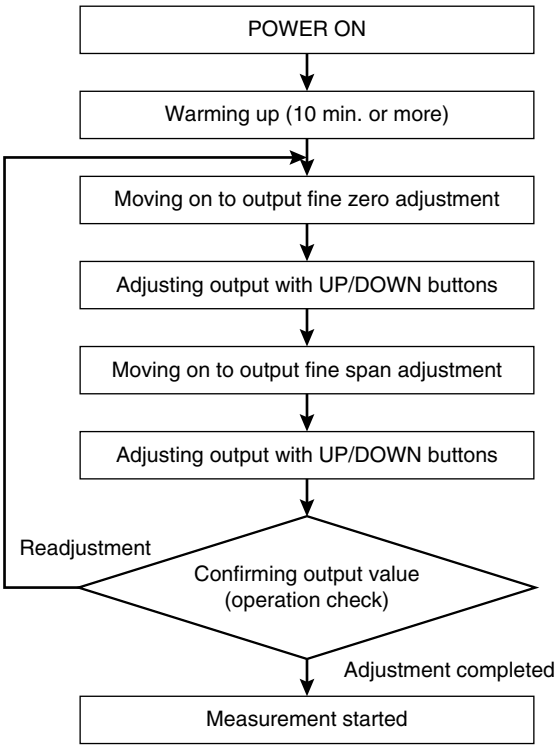
- Hold down MODE button for approx. 2 sec. to return to the RUN mode.
- The LD3 turns OFF and the LD1 green LED is ON (DIP SW configuration) or blinking (PC configuration).

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 M-System does 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

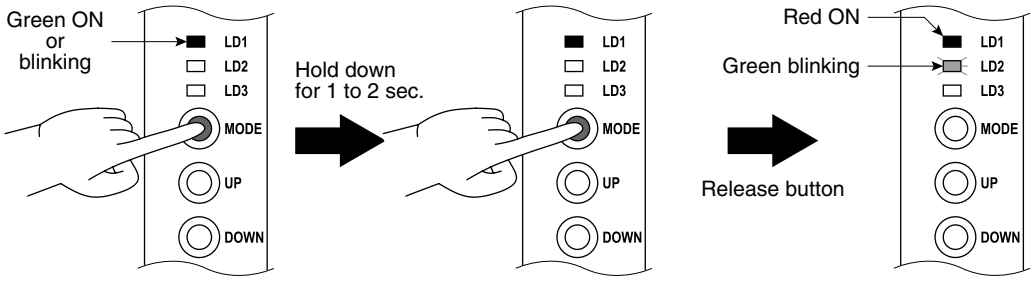
- Warm up measuring instruments, equipment and other devices on site for the time specified in each manual, and operate the unit in a stable condition.
- Adjustable ranges are as follows:

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

10.3.2 OPERATION PROCEDURE OF FINE ADJUSTMENT

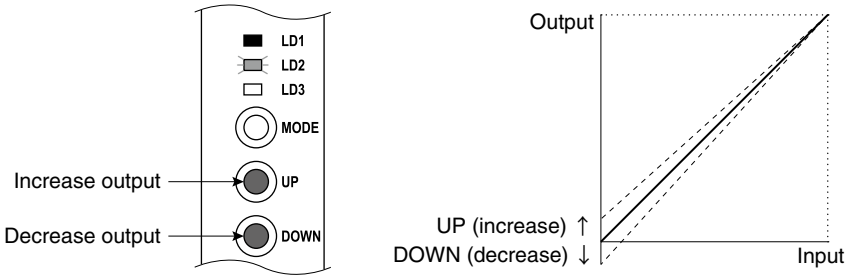
Perform the fine adjustment in the following procedure.

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



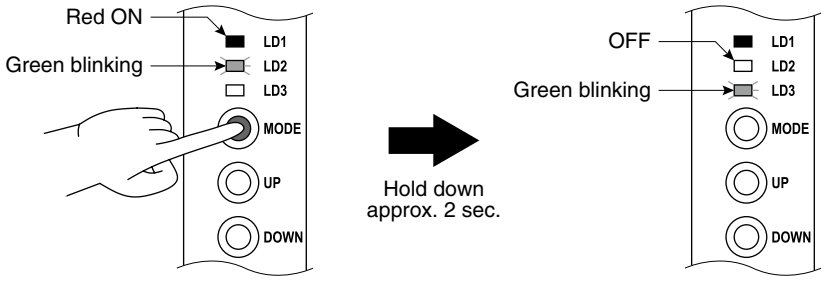
- Confirm that the LD1 green LED is ON (DIP SW configuration) or blinking (PC configuration). Then hold down MODE button for 1 to 2 seconds and release the button. The LD1 red LED will be ON.
- The LD2 green LED starts blinking indicating the Fine Zero Adjustment Mode.

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



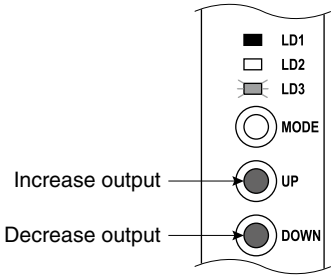
- Adjust the output value to 0% regardless of the input.
- Increase the output with UP button, and decrease with DOWN.
- Skip to the next procedure when fine zero adjustment is not necessary.

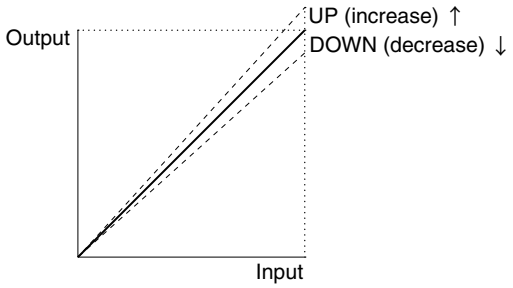
3 **Press MODE button to go on to the Fine Span Adjustment Mode.**



- Hold down MODE button for approx. 2 sec. 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.

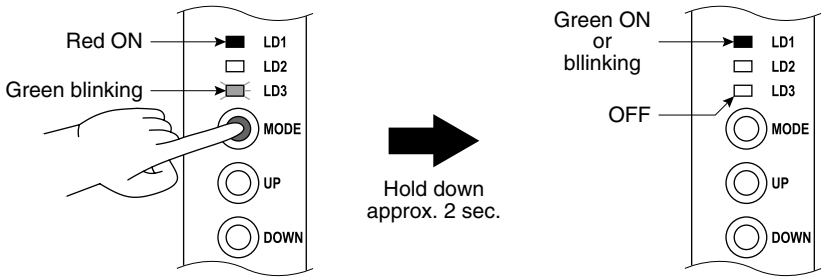
4 Use UP (increase) and DOWN (decrease) buttons to adjust the output to 100%. Check the output with a multimeter.





- 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.



- Hold down MODE button for approx. 2 sec. 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.
(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)
Status indicator LED		Tri-color (green/amber/red) LED; Blinking patterns indicate operation status of the transmitter.
Configuration	DIP SW configuration	Input type, output type, front control button lock, configuration mode
	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.

DC current	Input resistance: 49.9 Ω resistor incorporated Maximum range: 0 – 20 mA DC Minimum span: 2 mA Offset: Lower range can be any specific value within the input range provided that the minimum span is maintained.
DC mV & Voltage	Narrow Spans (mV) Maximum range: -1000 mV – +1000 mV DC Minimum span: 100 mV Wide Spans (V) Maximum range: -10 – +10 V DC Minimum span: 1 V Offset: Lower range can be any specific value within the input range provided that the minimum span is maintained. Input resistance: 1 MΩ minimum

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	Input Accuracy + Output Accuracy Input accuracy: (% of input range) (inversely proportional to the span) -1000 – +1000 mV DC : ±0.01 (%) -10 – +10 V DC: ±0.01 0 – 20 mA DC: ±0.02 (except the accuracy of input resistor) Output accuracy: (% of output range) (inversely proportional to the span) ±0.04% of output range
Temp. coefficient	±0.015%/°C (±0.008%/°F) of max. span
Response time	≤ 0.5 sec. (0 – 90%)
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 CALCULATION EXAMPLES OF OVERALL ACCURACY

(1) Input Range 1 – 5 V DC, Output Range 1 – 5 V DC
Max. Input Range (20 V) ÷ Span (4 V) × 0.01% + Max. Output Range (20 V) ÷ Span (4 V) × 0.04% = 0.25%

(2) Input Range 4 – 20 mA DC, Output Range 4 – 20 mA DC
Max. Input Range (20 mA) ÷ Span (16 mA) × 0.02% + Max. Output Range (20 mA) ÷ Span (16 mA) × 0.04% = 0.75%

12.2 PC CONFIGURATOR SOFTWARE

The I/O settings and calibration are configurable with the PC Configurator Software (model: M3LVCFG). 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 M-System's web site (https://www.m-system.co.jp/).
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 M3LVCFG users manual (EM-9197-J).

ITEM	M3LV-R4/A		M3LV-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	----
Transfer function	X	X	----
AO type	X	----	----
AO range (upper, lower)	X	----	----
Linearization table setting	X	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 M3LVCFG users manual (EM-9197-J).

12.3 MODEL NUMBERING

Code number: **M3LV–R4/[1][2]**

INPUT – Field-selectable

DC Current & Voltage

Current: 0 – 20 mA DC

Millivolt: -1000 – +1000 mV DC

Voltage: -10 – +10 V DC

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 M-System's web site.)

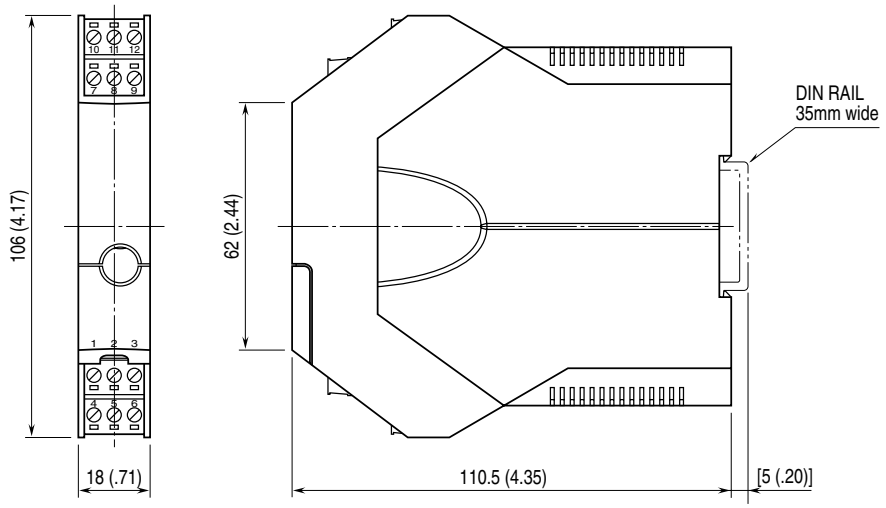
/C01: Silicone coating

/C02: Polyurethane coating

/C03: Rubber coating (UL not available)

12.4 EXTERNAL DIMENSIONS

mm (inch)



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