

## Single Loop Controller Series

### MANUAL LOADER

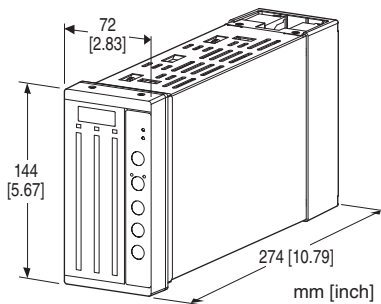
(with 4-digit digital meter, LED bar indicator)

#### Functions & Features

- Manual loader with backup
- Panel designed to match the SC series controllers
- Displays a process variable in graphic bargraph of 101 LED segments
- Control signal output at power failure (option /T)
- IP55 front cover
- Scale plate is easily replaceable

#### Typical Applications

- Panel operation for small-scale instrumentation
- Backup device for PID controller



### MODEL: SM10-[1][2][3][4][5][6]-[7][8]

#### ORDERING INFORMATION

- Code number: SM10-[1][2][3][4][5][6]-[7][8]
- Specify a code from below for each of [1] through [8].  
(e.g. SM10-RGB5WAA-M2/T/Q)
- Bargraph range (Refer to 'SCALE PLATE')
- Specify the specification for option code /Q  
(e.g. /C01/S01)

#### [1] BAR LED COLOR (PV)

- R: Red
- Y: Amber
- G: Green
- B: Blue

#### [2] BAR LED COLOR (CAS)

Same color availability as PV input

#### [3] BAR LED COLOR (MV)

Same color availability as PV input

#### [4] PV INPUT

Current

A: 4 - 20 mA DC (Input resistance 10 Ω)

D: 0 - 20 mA DC (Input resistance 10 Ω)

Voltage

4: 0 - 10 V DC (Input resistance 1 MΩ min.)

5: 0 - 5 V DC (Input resistance 1 MΩ min.)

6: 1 - 5 V DC (Input resistance 1 MΩ min.)

4W: -10 - +10 V DC (Input resistance 1 MΩ min.)

5W: -5 - +5 V DC (Input resistance 1 MΩ min.)

#### [5] CAS INPUT

Current

A: 4 - 20 mA DC (Input resistance 10 Ω)

For /T option, maximum input resistance 65 Ω

D: 0 - 20 mA DC (Input resistance 10 Ω)

Voltage

4: 0 - 10 V DC (Input resistance 1 MΩ min.)

5: 0 - 5 V DC (Input resistance 1 MΩ min.)

6: 1 - 5 V DC (Input resistance 1 MΩ min.)

4W: -10 - +10 V DC (Input resistance 1 MΩ min.)

5W: -5 - +5 V DC (Input resistance 1 MΩ min.)

#### [6] MV OUTPUT

Current

A: 4 - 20 mA DC (Load resistance 550 Ω max.)

D: 0 - 20 mA DC (Load resistance 550 Ω max.)

Voltage

4: 0 - 10 V DC (Load resistance 20 kΩ min.)

5: 0 - 5 V DC (Load resistance 10 kΩ min.)

6: 1 - 5 V DC (Load resistance 10 kΩ min.)

5W: -5 - +5 V DC (Load resistance 10 kΩ min.)

#### [7] POWER INPUT

AC Power

M2: 100 - 240 V AC (Operational voltage range 85 - 264 V, 47 - 66 Hz)

DC Power

R: 24 V DC

(Operational voltage range 24 V ±10 %, ripple 10 %p-p max.)

#### [8] OPTIONS (multiple selections)

MV Output at Power Down

blank: Output off

/T: CAS input

(Applicable CAS input and MV output: 4 - 20 mA DC)

Other Options

blank: none

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

## SPECIFICATIONS OF OPTION: Q (multiple selections)

COATING

/C01: Silicone coating

/C02: Polyurethane coating

/C03: Rubber coating

TERMINAL SCREW MATERIAL

/S01: Stainless steel

## SPARE PARTS

- Scale plate

## GENERAL SPECIFICATIONS

**Construction:** Panel flush mounting

**Degree of protection:** IP55; ensured for the front panel of the unit independently mounted to a panel

**Connection:** M3.5 screw terminals (torque 1.0 N·m)

**Screw terminal:** Nickel-plated steel (standard) or stainless steel

**Housing material:** Flame-resistant resin (gray), steel

### ■ CASCADE/MANUAL CONTROL SWITCHING

• Control mode is selectable with CAS/MAN (OUT) button from Cascade mode (CAS LED turns on) and Manual mode (MAN LED turns on). Between power on and the control mode starts, the unit keeps power failure status.

### ■ REMOTE CONTROL-MODE SWITCHING

• In cascade control mode (CAS LED turns on) switched with CAS/MAN (OUT) button, manual control mode is available with the discrete input (Manual Control).

### ■ RETROACTIVE TIME (switching CAS to MAN)

When the control mode is switched cascade to manual, the MV changes to the value corresponding to CAS input at the Retroactive Time before (except response time).

• Adjustable range: 0 to 30 sec., 1 sec. increments with front panel buttons

• Default setting: 0 sec.

### ■ TRANSITION RAMP RATE (switching MAN to CAS)

When the control mode is switched manual to cascade, the MV gradually changes to the value corresponding to CAS input. The time (transition ramp rate) is adjustable.

• Adjustable range: 0 to 30 sec./100 %, 1 sec. increments with front panel buttons

• Default setting: 1 sec./100 %

The output value at receiving MAN command during transition ramp period is different between commands.

• Front button: MV value

• Discrete input: CAS input

### ■ MANUAL OUTPUT OPERATION TIME (KEY SPEED)

In MAN mode

• Output variable time by operation of UP/DOWN button:

1% / 1 second

Transition time from 0 to 100% is 100 seconds.

• Output variable rate by acceleration button (FAST)

By pressing simultaneously with UP or DOWN button, variable rate is 10% / 1 second.

Transition time from 0 to 100% is 10 seconds.

### ■ ISOLATION

PV input to CAS input to MV output or re-transmitted output to manual mode status output to MAN command input to power to FG

(For /T option, non-isolated between CAS input and MV output and re-transmitted output)

### ■ SCALE PLATE: Flame resistant resin

(replaceable at the front; white scale & characters on black base)

**Scale:** Max. 4 characters including decimal point and negative sign

• **Divisions:** Min. 22, max. 100

• **Engineering unit:** Max. 6 characters (Unit other than % also can be specified)

### ■ LED INDICATOR

**PV selection indicator:** Turns green when the digital meter shows PV

**CAS selection indicator:** Turns green when the digital meter shows CAS

**MV selection indicator:** Turns green when the digital meter shows MV

**CAS indicator:** Turns green with CAS input

**MAN indicator:** Turns green with MAN input

**Retroactive time LED (RA):** Turns green while adjusting retroactive time and blinks while adjusting brightness.

**Transition ramp rate LED (RR):** Turns green while adjusting transition ramp rate

### ■ INDICATION SELECTOR

With the Input indication selector (IND) the value for PV input, CAS input and MV output is displayed on the digital meter LED. Turns on each selection indicator.

### ■ LED BRIGHTNESS ADJUSTMENTS

3 levels of brightness available for the bargraph and the digital meter. (except retroactive time LED, transition ramp rate LED, CAS/MAN indicator LED)

## BARGRAPH/DIGITAL DISPLAY

■ **BARGRAPH:** PV input, CAS input or MV output

**LED:** 101 segments, 100 mm (3.94") height, 3.0 mm (.12") width

**Display range:** 0 to 100 (scaling function not available)

■ **DIGITAL INDICATOR:** PV input, CAS input, MV output, retroactive time, transition ramp rate and LED brightness adjustments are displayed by switching.

**LED:** Red; 4 digits; 10 mm (0.39") height, 24 mm (0.94")

width

**Display range:**

**PV input, CAS input and MV output:** -15.0 to +115.0 % (0.1 % increments)

(scaling function not available)

**Transition ramp rate and retroactive time:** 0 - 30 sec. (1 sec. increments)

**Zero indication:** Higher-digit zeros are suppressed.

## INPUT SPECIFICATIONS

**PV input, CAS input:** -15.0 to +115.0 %

### ■ MAN COMMAND INPUT

**Sensing (open):** Approx. 12 V DC

**ON voltage:**  $\leq 2.3$  V DC (ON resistance:  $\leq 1.5$  k $\Omega$ /ON current:  $\geq 1.5$  mA)

**OFF voltage:**  $\geq 11.3$  V DC (OFF resistance:  $\geq 15$  k $\Omega$ /OFF current:  $\leq 0.75$  mA)

## OUTPUT SPECIFICATIONS

**MV output:** -15.0 to +115.0 %, 0.1 % increments

**MV Conformance range:** 0 - 100 %

### ■ RE-TRANSMITTED OUTPUT: 1 to 5 V DC output

**Load resistance:**  $\geq 10$  k $\Omega$

(No output at power failure)

### ■ MANUAL MODE STATUS OUTPUT

**Relay rating:**

240 V AC @ 1 A (cos  $\phi = 1$ )

30 V DC @ 1 A (resistive load)

**Maximum switching voltage:** 250 V AC or 30 V DC

**Maximum switching power:** 250 VA or 60 W

**Minimum load:** 5 V DC @ 10 mA

**Mechanical life:**  $2 \times 10^7$  cycles

## INSTALLATION

**Power consumption**

•AC:

Approx. 9 VA at 100 V

Approx. 12 VA at 200 V

Approx. 13 VA at 264 V

•DC: Approx. 4 W

**Operating temperature:** -5 to +55°C (23 to 131°F)

**Operating humidity:** 5 to 90 %RH (non-condensing)

**Mounting:** Panel flush mounting (high-density mounting in horizontal direction)

**Weight:** 1.8 kg (4.0 lb)

## PERFORMANCE in percentage of span

**Accuracy:** Input accuracy + output accuracy

• Input accuracy:  $\pm 0.1\%$

• Output accuracy:

$\pm 0.1$  % DC output

$\pm 1$  %  $\pm 1$  digit (bargraph)

$\pm 0.1$  %  $\pm 1$  digit (digital indicator)

**Temp. coefficient:**  $\pm 0.015$  %/°C ( $\pm 0.008$  %/°F)

**Manual output resolution:** 0.1 %

**Response time:**  $\leq 0.5$  sec. (0 - 90 %)

**Output memory at power OFF:** E<sup>2</sup>PROM (non-volatile memory)

**Line voltage effect:**  $\pm 0.1$  % over voltage range

**Insulation resistance:**  $\geq 100$  M $\Omega$  with 500 V DC

**Dielectric strength:**

### •With /T option

1500 V AC @ 1 minute (PV input or CAS input or MV output or re-transmitted output to manual mode status output to MAN command input to power to FG)

500 V AC @ 1 minute (PV input to CAS input)

### •Without /T option

1500 V AC @ 1 minute (PV input or CAS input to MV output or re-transmitted output to manual mode status output to MAN command input to power to FG)

500 V AC @ 1 minute (PV input to CAS input)

## SCALE PLATE

### ■ WHAT MUST BE SPECIFIED WHEN ORDERING

Following two methods can specify scale plate.

#### a) Using 'Scale Plate Designer'

Access 'Design Scale Plate' in the our web site. Scale plate can be designed in this web site.

By function below, it can be easy to create standard design or original design.

##### [Design Automatically]

Entering Minimum, Maximum, and Unit allows to create automatically a scale plate.

Maximum created scale division number is '54.9'. Use [Specify Division Number], if division number more than '54.9' is required (Maximum 100 division).

##### [Specify Division Interval]

Division Interval can be specified according to the application.

##### [Specify Division Number]

It is available to create originally with scale division number, length of line, position, character size, font and detailed position.

After designing is completed, register code is issued. Place the order with this code.

Once scale plate is designed, it is recorded. The register code can be used any number of times.

#### b) Specifying scale range and display unit when placing the order

It is available to create by specifying scale range and display unit for right and left.

Regarding design of scale plate such as division number, length of division number line, and character font, they are same as above [Design Automatically], we design them.

### ■ DESIGNING BY 'DESIGN AUTOMATICALLY'

How 'Design Automatically' creates scale design is described succinctly below.

#### ■ TYPES OF DIVISIONS

Five (5) types of divisions are used depending upon the scale span, which determined by the following equation:

Scale Span = (Max. range value – Min. range value) x 10

where n = integer (used to limit the calculated scale span to the minimum of 1.1, below 11.0.)

The number of divisions is automatically determined by the scale span.

#### • Type 1: 1.1 Scale Span < 1.3

Number of divisions: 22 to 25.9

Scale: Starts at 0, increments by 0.02 / 0.2 / 2 / 20 / 200. Min. and max. values indicated. 4 digits including negative sign and decimal point.

Division lines: Long, Short, Medium, Short, Long (4 divisions repeated)

#### • Type 2: 1.3 Scale Span < 2.0

Number of divisions: 26 to 39.9

Scale: Starts at 0, increments by 0.03 / 0.3 / 3 / 30 / 300. Min. and max. values indicated. 4 digits including negative sign and decimal point.

Division lines: Long, Short, Medium, Short, Medium, Short, Long (6 divisions repeated)

Minimum Divisions	Maximum Divisions	Bipolar Scale
11 —	1.29 —	600 —
10 —	1.2 —	400 —
8 —	1.0 —	200 —
6 —	0.8 —	0 —
4 —	0.6 —	-200 —
2 —	0.4 —	-400 —
0 —	0.2 —	-600 —

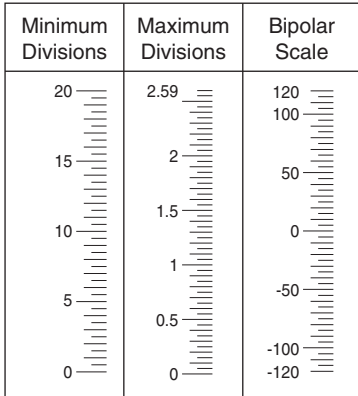
Minimum Divisions	Maximum Divisions	Bipolar Scale
130 —	1.99 —	0.8 —
120 —	1.8 —	0.6 —
90 —	1.5 —	0.3 —
60 —	1.2 —	0 —
30 —	0.9 —	-0.3 —
0 —	0.6 —	-0.6 —
	0.3 —	-0.8 —
	0 —	

• **Type 3: 2.0 Scale Span < 2.6**

Number of divisions: 40 to 51.9

Scale: Starts at 0, increments by 0.05 / 0.5 / 5 / 50 / 500. Min. and max. values indicated. 4 digits including negative sign and decimal point.

Division lines: Long, Short, Medium, Short, Medium, Short, Medium, Short, Medium, Short, Long (10 divisions repeated)

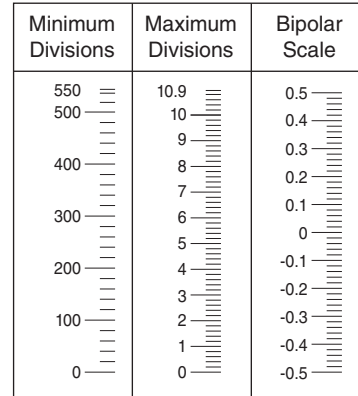


• **Type 5: 5.5 Scale Span < 11.0**

Number of divisions: 27.5 to 54.9

Scale: Starts at 0, increments by 0.01 / 0.1 / 1 / 10 / 100 / /1000. Min. and max. values indicated. 4 digits including negative sign and decimal point.

Division lines: Long, Medium, Medium, Medium, Medium, Long (5 divisions repeated)

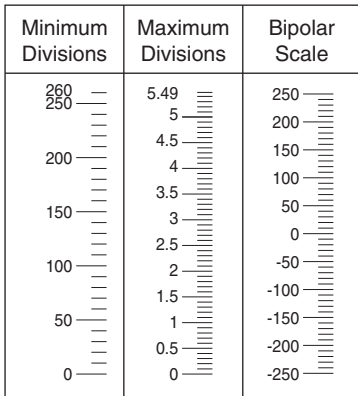


• **Type 4: 2.6 Scale Span < 5.5**

Number of divisions: 26 to 54.9

Scale: Starts at 0, increments by 0.05 / 0.5 / 5 / 50 / 500. Min. and max. values indicated. 4 digits including negative sign and decimal point.

Division lines: Long, Medium, Medium, Medium, Medium, Long (5 divisions repeated)

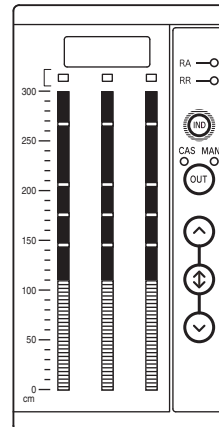


[Example] : Bargraph range 0 to 300 cm (Type 4)  
Digital indicator range 0.00 to 6.75 m<sup>3</sup> (Type 4)

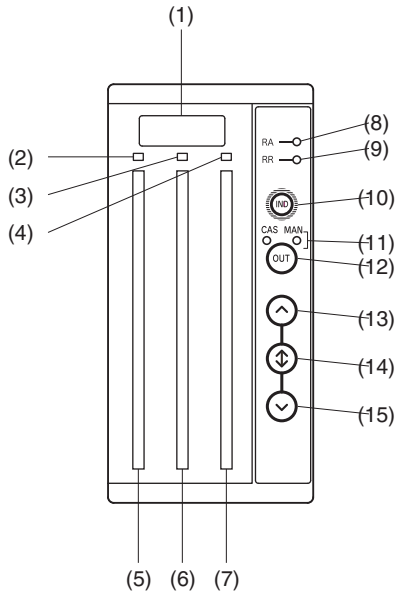
Left scale range: 0 – 300

Left scale unit (bargraph): cm

Center and right bar scale: None

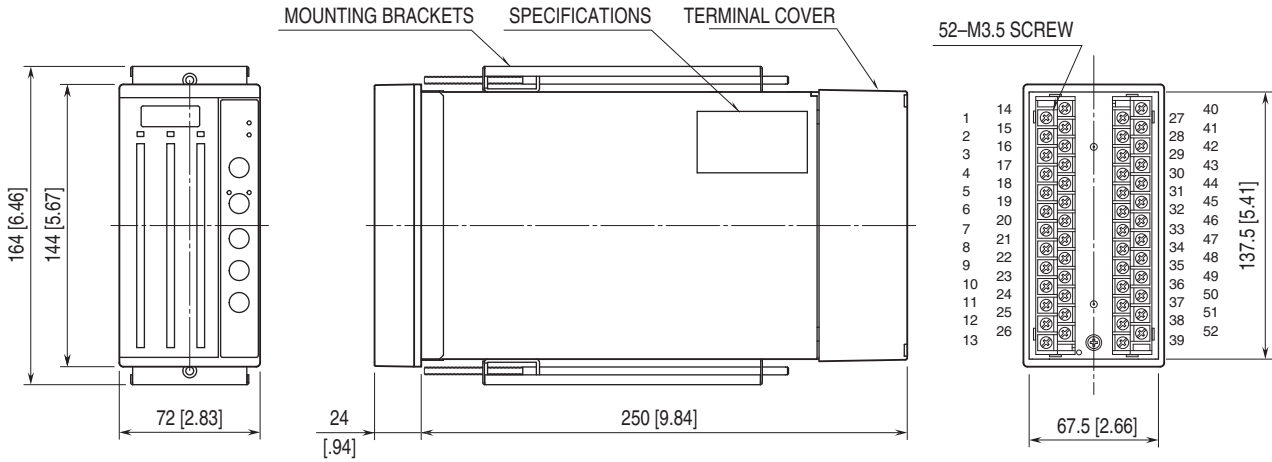


**EXTERNAL VIEW**



- 1. Digital meter
- 2. PV indicator (turns on when the digital meter shows PV)
- 3. CAS indicator (turns on when the digital meter shows CAS)
- 4. MV indicator (turns on when the digital meter shows MV)
- 5. PV bargraph meter
- 6. CAS bargraph meter
- 7. MV bargraph meter
- 8. Retroactive time LED (RA)
- 9. Transition ramp rate LED (RR)
- 10. Input indication selector (IND)
- 11. CAS/MAN indicator LED
- 12. CAS/MAN selector (OUT)
- 13. Manual operation button (UP)
- 14. Acceleration button (FAST)  
(Accelerates the operation by pressing simultaneously with UP or DOWN button)
- 15. Manual operation button (DOWN)

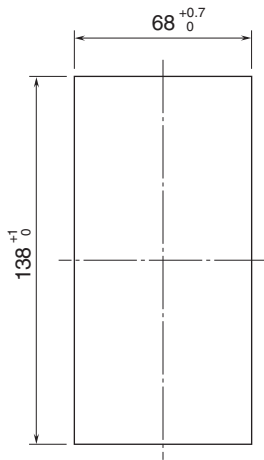
**EXTERNAL DIMENSIONS & TERMINAL ASSIGNMENTS unit: mm [inch]**



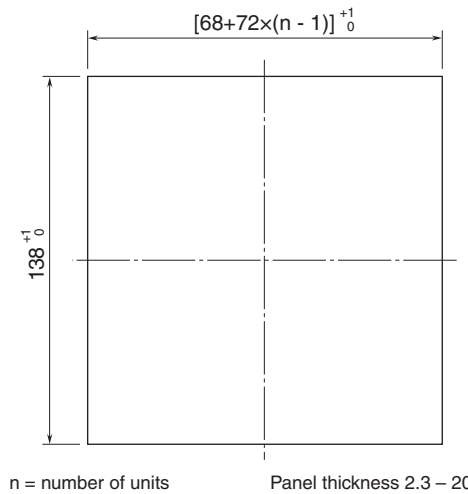
## PANEL CUTOUT unit: mm

### ■ PANEL CUTOUT unit: mm

#### • Single mounting



#### • Clustered mounting

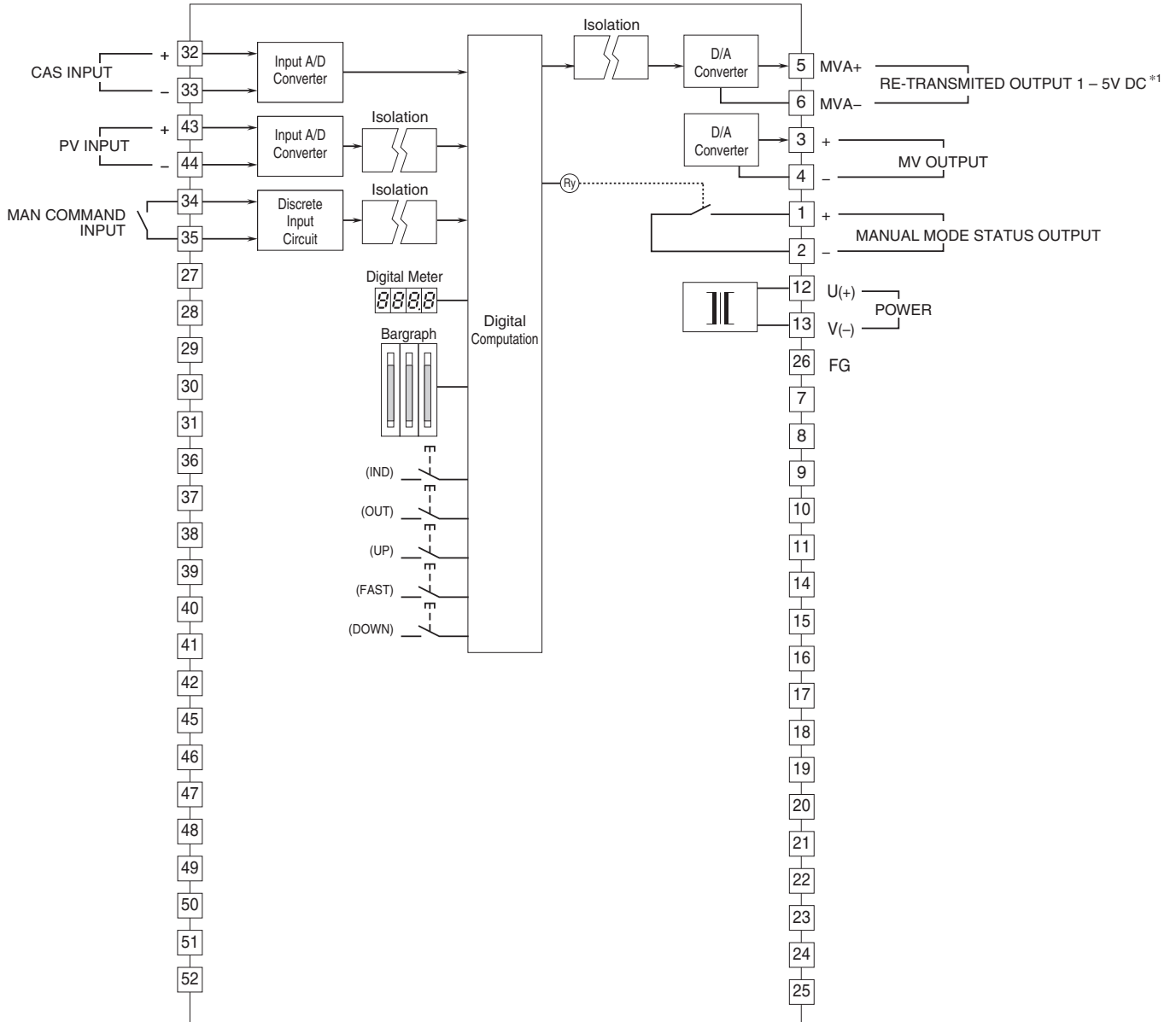


### ■ CAUTION

- IP55 is ensured for the front panel of the unit mounted independently according to a panel. Test the sealing at the mounting surface once the device is installed.
- Set the unit on a vertical surface with its digital meter is at the upper side. Mounting in other directions may cause heat built up inside the unit and shorten its life span or degrade its performance.
- Ensure that there is sufficient space for ventilation inside a panel. Do not install above the devices that generate high heat such as heaters, transformers or resistors. Leave at least 30 mm (1.2 inch) space above, below and behind the unit for maintenance purpose (e.g. wiring, removing or installing).

**SCHEMATIC CIRCUITRY & CONNECTION DIAGRAM**

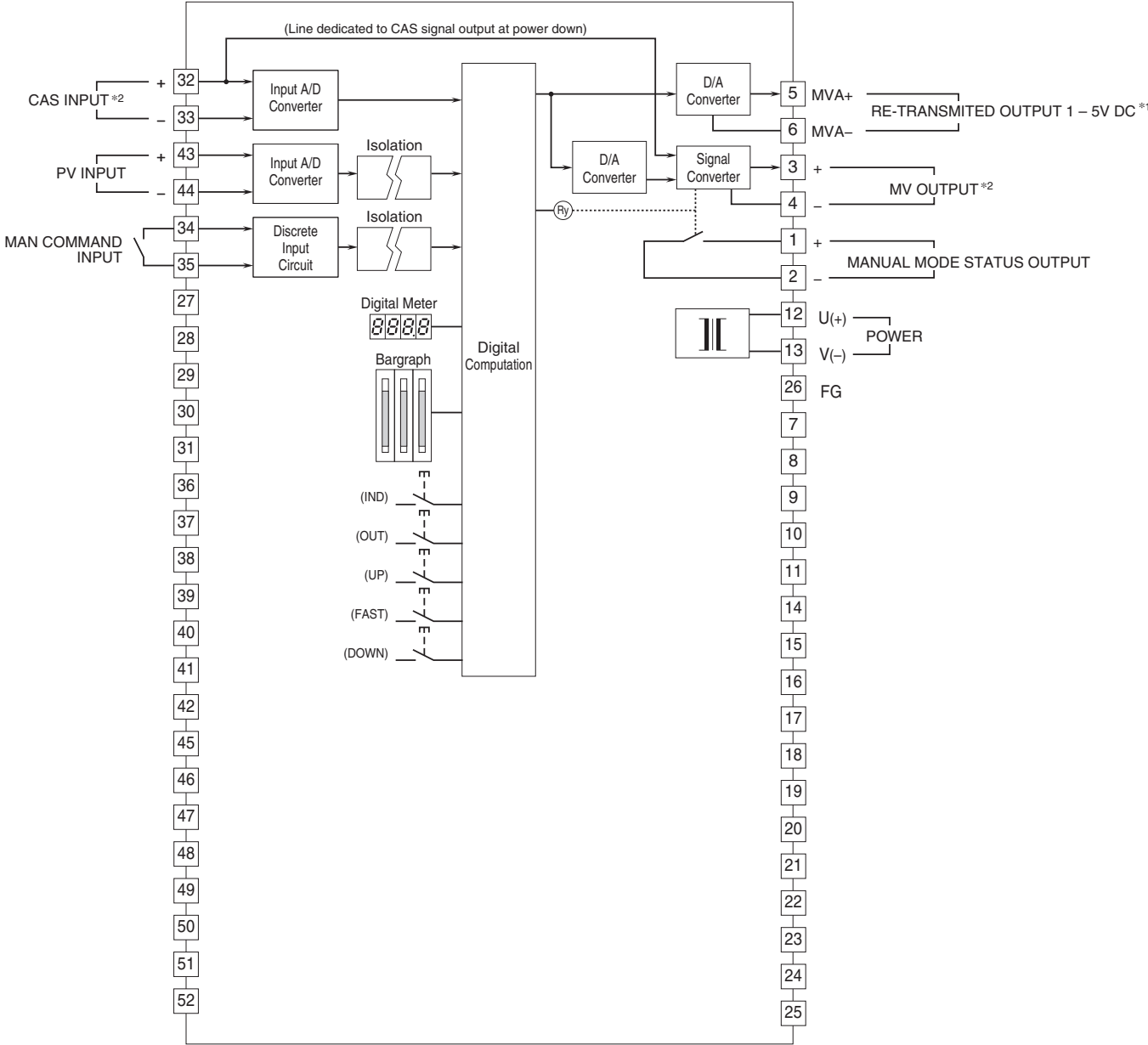
• 'MV Output off at Power Down' option without 'CAS input'




\*1. MV and Re-transmitted output circuits are not included in this schematic circuit diagram.  
Do not close across Re-transmitted (MVA-) and MV output(-) terminals.



• 'MV Output at Power Down' option with 'CAS input'



\*1. MV and Re-transmitted output circuits are not included in this schematic circuit diagram.  
Do not close across Re-transmitted (MVA-) and MV output(-) terminals.  
\*2. Only available with 4 – 20 mA DC.

 Specifications are subject to change without notice.