

Single Loop Controller Series

MANUAL LOADER

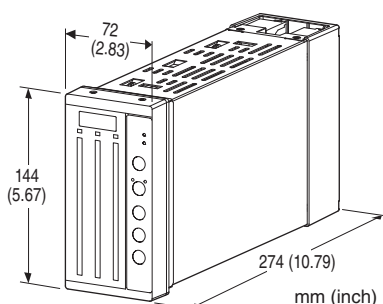
(with 4-digit digital meter, LED bar indicator)

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 [1] through [8].
(e.g. SM10-RGB5W5W5W-M2)
- Bargraph range (Refer to 'SCALE PLATE')

[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 M Ω min.)

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

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

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

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

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

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

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

5W: -5 - +5 V DC (Input resistance 1 M Ω 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 k Ω min.)

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

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

5W: -5 - +5 V DC (Load resistance 10 k Ω 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 \pm 10 %, ripple 10 %p-p max.)

[8] OPTIONS

MV Output at Power Down

blank: Output off

/T: CAS input

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

SPARE PARTS

- Scale plate

GENERAL SPECIFICATIONS

Construction: Panel flush mounting

Degree of protection: IP55; applicable to the front panel for single unit mounted according to the specified panel cutout

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

Screw terminal: Nickel-plated steel

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

Scale plate: Flame-resistant resin (black)

■ 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

■ 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)

■ BARGRAPH

Indicates PV input, CAS input and MV output.

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

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

Bargraph display scale plate:

• Detachable structure

• White characters on black base

• Max. 4 digits (including decimal point and negative sign)

• 22 - 100 divisions

• Engineering unit of 6 characters

■ DIGITAL DISPLAYS

Indicates PV input, CAS input, MV output, retroactive time, transition ramp rate and LED brightness adjustments.

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)

■ 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 indicator. (except retroactive time LED, transition ramp rate LED, CAS/MAN indicator LED)

INPUT SPECIFICATIONS

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

■ MAN COMMAND INPUT

Sensing (open): Approx. 12 V DC

ON voltage: ≤ 2.3 V DC (ON resistance: ≤ 1.5 k Ω /ON current: ≥ 1.5 mA)

OFF voltage: ≥ 11.3 V DC (OFF resistance: ≥ 15 k Ω /OFF current: ≤ 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: ≥ 10 k Ω

(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: 2×10^7 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 lbs)

PERFORMANCE in percentage of span

Accuracy: Input accuracy + output accuracy

• Input accuracy: $\pm 0.1\%$

• Output accuracy:

$\pm 0.1\%$ DC output

$\pm 1\%$ ± 1 digit (bargraph)

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

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

Manual output resolution: 0.1 %

Response time: ≤ 0.5 sec. (0 – 90 %)

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

Insulation resistance: $\geq 100\text{ M}\Omega$ 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

Please specify the bargraph scale range and engineering unit. The overall scale plate design including the number of divisions, division line length, character font is determined by M-System.

[Example] : Bargraph range 0 to 300 cm

Bargraph scale range: 0 – 300

Engineering unit for the bargraph: cm

■ TYPES OF DIVISIONS

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

$$\text{Scale Span} = (\text{Max. range value} - \text{Min. range value}) \times 10^n$$

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: $1.1 \leq \text{Scale Span} < 1.3$

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)

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 —
0 —	0 —	—

• Type 3: $2.0 \leq \text{Scale Span} < 2.6$

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, Long (10 divisions repeated)

Minimum Divisions	Maximum Divisions	Bipolar Scale
20 —	2.59 —	120 —
—	—	100 —
15 —	2 —	—
—	—	50 —
10 —	1.5 —	—
—	—	0 —
5 —	1 —	—
—	—	-50 —
0 —	0.5 —	—
—	—	-100 —
0 —	0 —	—
—	—	-120 —

• Type 2: $1.3 \leq \text{Scale Span} < 2.0$

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
130 —	1.99 —	0.8 —
120 —	1.8 —	—
—	—	0.6 —
90 —	1.5 —	—
—	—	0.3 —
60 —	1.2 —	—
—	—	0.0 —
30 —	0.9 —	—
—	—	-0.3 —
—	0.6 —	—
—	—	-0.6 —
—	0.3 —	—
—	—	-0.8 —
0 —	0.0 —	—

• Type 4: $2.6 \leq \text{Scale Span} < 5.5$

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.

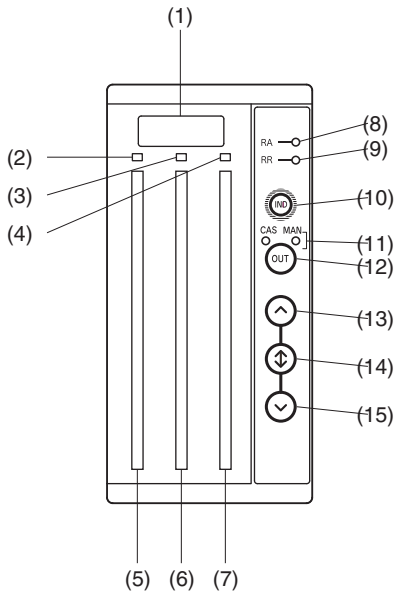
Division lines: Long, Medium, Medium, Medium, Medium, Long (5 divisions repeated)

Minimum Divisions	Maximum Divisions	Bipolar Scale
260 —	5.49 —	250 —
250 —	5 —	—
—	—	200 —
200 —	4.5 —	—
—	—	150 —
150 —	4 —	—
—	—	100 —
100 —	3.5 —	—
—	—	50 —
50 —	3 —	—
—	—	0 —
—	2.5 —	—
—	2 —	-50 —
—	—	-100 —
—	1.5 —	—
—	1 —	-150 —
—	—	-200 —
—	0.5 —	—
0 —	0 —	-250 —

- **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)

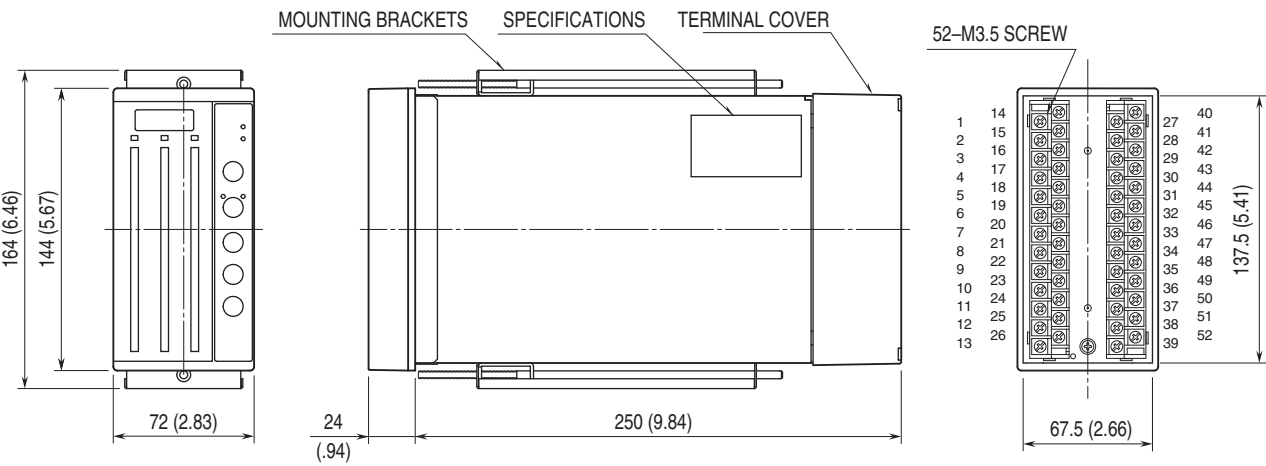
Minimum Divisions	Maximum Divisions	Bipolar Scale
550	10.9	0.5
500	10	0.4
	9	0.3
400	8	0.2
	7	0.1
300	6	0
	5	-0.1
200	4	-0.2
	3	-0.3
100	2	-0.4
	1	-0.5
0	0	

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)

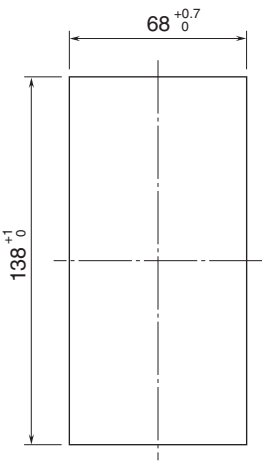
EXTERNAL DIMENSIONS & TERMINAL ASSIGNMENTS unit: mm (inch)



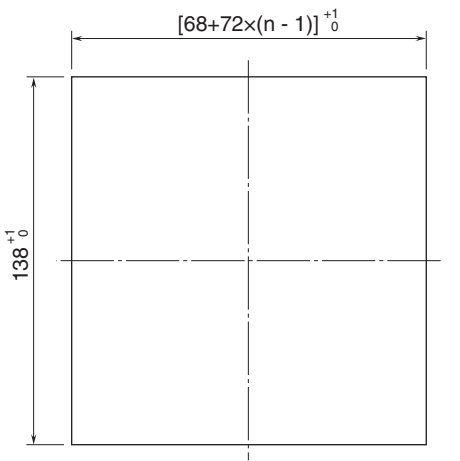
PANEL CUTOUT unit: mm

■ PANEL CUTOUT unit: mm

• Single mounting



• Clustered mounting



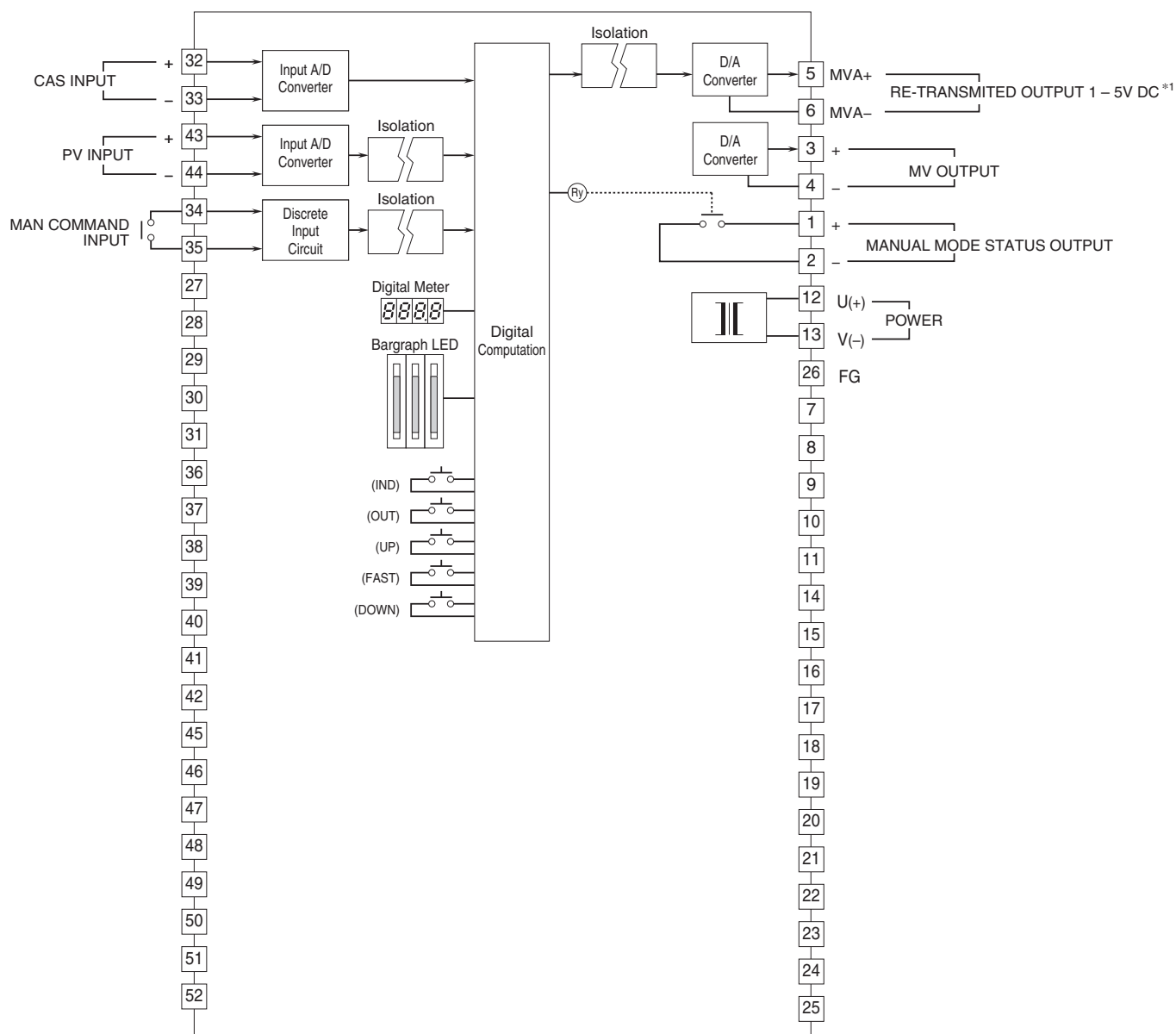
n = number of units Panel thickness 2.3 – 20

■ CAUTION

- Degree of protection, IP55 is applicable to the front panel of the unit with single mounting according to the specified panel cutout. Ensure that there is no compromise in the unit's protection against water and dust after installation.
- Install the unit to vertical panel so that its digital meter is at the upper side. Installing by other direction will cause degradation of life span or performance due to rise of the internal temperature.
- Ensure that there is sufficient space for ventilation inside a panel. Do not install above the devices that generate high temperature such as heaters, transformers or resistors. Observe at the minimum of 30 mm (1.2") in all directions for maintenance purpose.

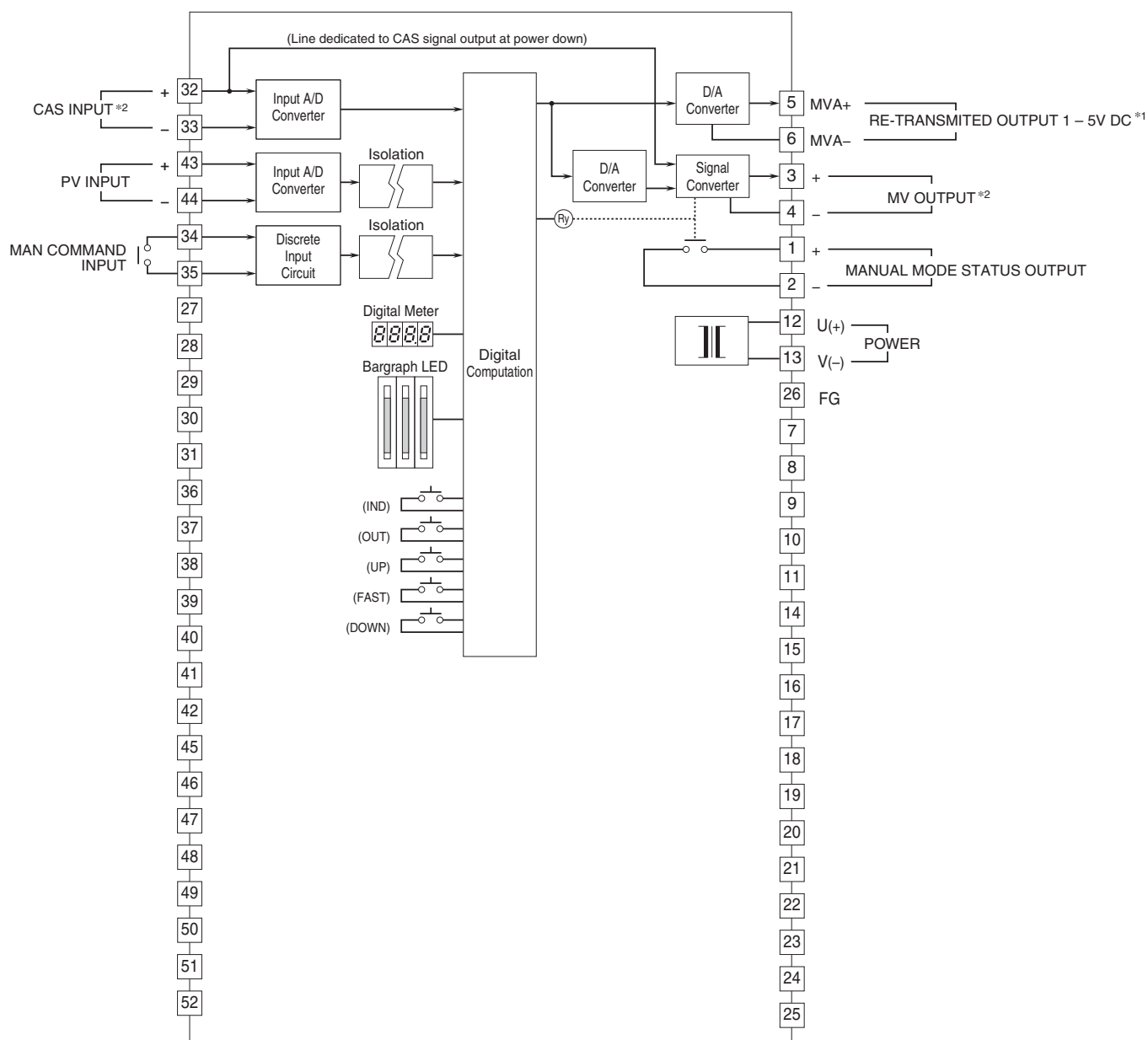
SCHEMATIC CIRCUITRY & CONNECTION DIAGRAM

• '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.