# Final Control Elements

ANALOG BACKUP STATION
(with bargraph/digital indicator)

Functions & Features
• Holds and manipulates control signals in case of computer or DCS failure
• Bargraph indicator
• Digital display indicating PV/CAS/MV selectable
• External contact closure to switch operation modes
• MV outputs CAS input signal at power down (for /T option)

Typical Applications
• Computer and DCS backup applications
• Used as manual-auto controller

48 (1.89)
96 (3.78)
98.5 (3.88)
mm (inch)
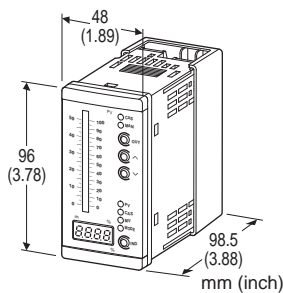
MODEL: ABF3-[1][2][3]-[4][5]

ORDERING INFORMATION
• Code number: ABF3-[1][2][3]-[4][5]
Specify a code from below for each of [1] through [5].
  (e.g. ABF3-AAA-M2/C/T)
• Scale (Refer to 'SCALE PLATE' section for details on the scale.)

[1] PV INPUT
Current
A: 4 – 20 mA DC (Input resistance 25 Ω)
D: 0 – 20 mA DC (Input resistance 25 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.)

[2] CAS INPUT
Current
A: 4 – 20 mA DC (Input resistance 25 Ω)
For /T option, maximum input resistance 80 Ω
D: 0 – 20 mA DC (Input resistance 25 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.)

[3] MV OUTPUT
Current
A: 4 – 20 mA DC (Load resistance 750 Ω max.)
(For /T option, the load resistance is 25 Ω less than the CAS input equipment's load resistance.)
D: 0 – 20 mA DC (Load resistance 750 Ω max.)
Voltage
4: 0 – 10 V DC (Load resistance 10 kΩ min.)
5: 0 – 5 V DC (Load resistance 5000 Ω min.)
6: 1 – 5 V DC (Load resistance 5000 Ω min.)
5W: -5 – +5 V DC (Load resistance 5000 Ω min.)

[4] POWER INPUT
AC Power
M2: 100 – 240 V AC (Operational voltage range 85 – 264 V, 50/60 Hz)
DC Power
R: 24 V DC
(Operational voltage range 24 V ±10 %, ripple 10 %p-p max.)

[5] OPTIONS (multiple selections)
Bargraph Indicator
blank: PV input
/C: CAS input
/M: MV output
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: IP65; applicable to the front panel for single unit mounted according to the specified panel cutout
Connection: M3 separable screw terminal (torque 0.6 N·m)
Solderless terminal: Refer to the drawing at the end of the section.
 Recommended manufacturer: Japan Solderless Terminal MFG.Co.Ltd, Nichifu Co.,ltd
 Applicable wire size: 0.25 to 1.65 mm^2 (AWG 22 to 16)

Screw terminal: Nickel-plated steel
Housing material: Flame-resistant resin (gray)

■ **BUTTONS**

Digital display selector (IND): Switches between PV input, CAS input, MV outout; Manual operation ramp rate, Retroactive time period, or Transition amp rate

Manual output switching: CAS (cascade)/MAN (manual) selector ('OUT'); the mode selected before power OFF is recovered when the power is turned on.

Remote output switching: External contact closure switches the ABF3 to MAN mode when the CAS/MAN selector is at CAS position; Not switched with MAN position.

■ **FUNCTIONS**

Manual status contact: Turns on when manual operation is available

Manual operation ramp rate: 15 sec./100 %. (Add 0.3 sec. for the total time required to go from 0 % to 100 %.) Adjustable up to 30 sec. in 1 sec. increments with front control buttons

Retroactive time period at switching CAS to MAN: 0 sec. plus response time. Adjustable up to 30 sec. in 1 sec. increments with front control buttons

When the loop has been turned to MAN control with remote outputs switching command, the MV output goes back by the preset time period and holds the output.

Ramp rate at switching MAN to CAS: 1 sec./100 %. Adjustable up to 30 sec. in 1 sec. increments with front control buttons

If the CAS control value at the moment of switching from MAN to CAS mode is deviated from the MV output value in MAN control, the ABF3 adjusts the difference gradually in the preset ramp rate.

Receiving MAN command during transition ramp period, the ABF3 turns to MAN mode after transition ramp function is completed.

Isolation: PV input to CAS input to MV output to MAN status contact output to remote output switching command input to power

(For /T option, non-isolated between CAS input and MV 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. 21, max. 43.9

• **Engineering unit**: Max. 4 characters (Unit other than % also can be specified)

■ **LEDs**

CAS output LED: Red LED turns on in CAS mode.
MAN output LED: Red LED turns on in MAN mode.
PV LED: Red LED turns on with PV indication at PV input.

Green LED turns on while setting the manual operation ramp rate.

CAS LED: Red LED turns on with CAS indication at CAS input.

Green LED turns on while setting the retroactive time period.

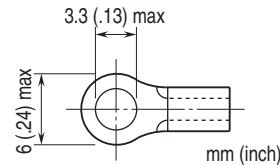**MV LED**: Red LED turns on with MV indication at MV output.

Green LED turns on while setting the transition ramp rate.

MODE LED: Red LED turns on with the firmware version indication.

Green LED turns on but Not Used.

EXTERNAL CONTACT	FRONT CAS-MAN SELECTOR	
	CAS	MAN
ON	MAN	MAN
OFF	CAS	MAN

■**Recommended solderless terminal**

3.3 (.13) max
6 (24) max
mm (inch)

BARGRAPH/DIGITAL DISPLAY

■ **BARGRAPH**: PV input, CAS input or MV output
LED: 55 segments, red, 55.5 mm (2.19") long, 3.0 mm (.12") wide

■ **DIGITAL INDICATOR**: PV input, CAS input, MV output; Setting values for Manual operation ramp rate, Retroactive time period, or Transition ramp rate are displayed by switching.
LED: 4 digits, red, 10 mm (.39") high, 24 mm (.94") wide
Decimal point position: One decimal places fixed
Scaling range: -15 to +115.0%
Zero indication: Higher-digit zeros are suppressed.

INPUT SPECIFICATIONS

PV input, CAS input: -15.0 to +115.0 %
■ **Remote Output Switching Command Input**
Sensing (open): Approx. 5 V DC
ON voltage: ≤ 2.3 V DC (ON resistance: ≤ 100 Ω/ON current: ≥ 2 mA)
OFF voltage: ≥ 0.75 V DC (OFF resistance: ≥ 1 kΩ/OFF current: ≤ 1.5 mA)

OUTPUT SPECIFICATIONS

MV output: -15.0 to +115.0 %, 0.1 % increments
MV Conformance range: 0 – 100 %
■ **Manual Status Contact Output**
Rated load: 120 V AC @ 1 A (cos ø = 1)
240 V AC @ 0.5 A (cos ø = 1)

30 V DC @ 1 A (resistive load)
Electrical life ≥ 10^5 cycles (rate 6 cycles/min.)
Minimum load: 5 V DC @ 24 mA (Approx. 120 mW)
Mechanical life: ≥ 5 × 10^6 cycles (rate 180 cycles/min.)

INSTALLATION

Power consumption
 •**AC**:
Approx. 4 VA at 100 V (For /T option, approx. 5 VA)
Approx. 6 VA at 264 V (For /T option, approx. 7 VA)
 •**DC**: Approx. 3.5 W
Operating temperature: -5 to +55°C (23 to 131°F)
Operating humidity: 30 to 90 %RH (non-condensing)
Mounting: Panel flush mounting
Weight: 300 g (0.66 lb)

PERFORMANCE in percentage of span

Accuracy: Input accuracy + output accuracy
•**Input accuracy**: ±0.2 % of input range
•**Output accuracy**: ±0.1 % of output range
Display accuracy:
•**Bargraph display**: ±2 %
•**Digital display**: ±0.3 % (including ±1 digit)
Temp. coefficient: ±0.02 %/°C (±0.01 %/°F)
Manual output resolution: 0.1 %
Response time: ≤ 0.5 sec. (0 – 90 %) with CAS input
Output memory at power OFF: E^2PROM (non-volatile memory)
Line voltage effect: ±0.1 % over voltage range
Insulation resistance: ≥ 100 MΩ with 500 V DC
Dielectric strength: 1500 V AC @ 1 minute (PV input to CAS input to MV output to MAN status contact output to remote output switching command input to power to ground)
(For /T option, non-isolated between CAS input and MV output)

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 M-System web site (http://www.m-system.co.jp/english). 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 '43.9'.

[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],
M-System designs them.

■ DESIGNING BY 'DESIGN AUTOMATIFICALLY'
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:

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

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

• Type 1: $1.1 \le$ Scale Span < 1.3
Number of divisions: 22 to 25.9
Scale: Starts at 0, increments in 0.02 / 0.2 / 2 / 20 / 200.
  Min. and max. values are indicated.
  4 digits including negative sign and decimal point.
Division lines: Long, Short, Medium, Short, Long
  (4 division lines repeating)

• Type 2: $1.3 \le$ Scale Span < 2.0
Number of divisions: 26 to 39.9
Scale: Starts at 0, increments in 0.03 / 0.3 / 3 / 30 / 300.
  Min. and max. values are indicated.
  4 digits including negative sign and decimal point.
Division lines: Long, Short, Medium, Short, Medium, Short, Long
  (6 divisions repeating)

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	

Minimum Divisions	Maximum Divisions	Bipolar Scale
130	1.99	0.8
120	1.8	0.6
90	1.5	0.3
	1.2	0.0
60	0.9	-0.3
30	0.6	-0.6
0	0.3	-0.8
	0.0	

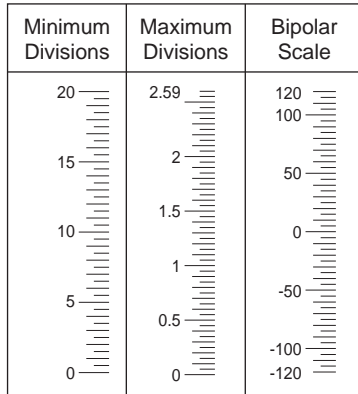**• Type 3: 2.0 ≤ Scale Span < 2.6**
Number of divisions: 32 to 41.9
Scale: Starts at 0, increments in 0.05 / 0.5 / 5 / 50 / 500.
    Min. and max. values are indicated.
    4 digits including negative sign and decimal point.
Division lines: Long, Short, Medium, Short, Medium,
       Short, Medium, Short, Long
       (8 divisions repeating)

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

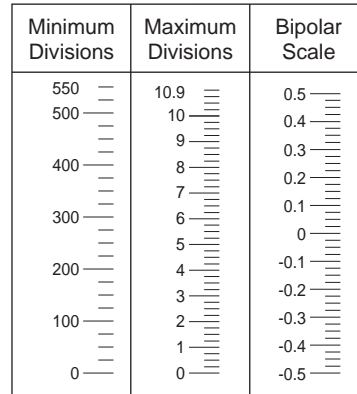**• Type 5: 5.5 ≤ Scale Span < 11.0**
Number of divisions: 22 to 43.9
Scale: Starts at 0, increments in 0.01 / 0.1 / 1 / 10 / 100 / 1000.
    Min. and max. values are indi-cated.
    4 digits including negative sign and decimal point.
Division lines: Long, Medium, Medium, Medium, Long
       (5 divisions repeating)

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	
	5	0
200	4	-0.1
	3	-0.2
100	2	-0.3
	1	-0.4
0	0	-0.5

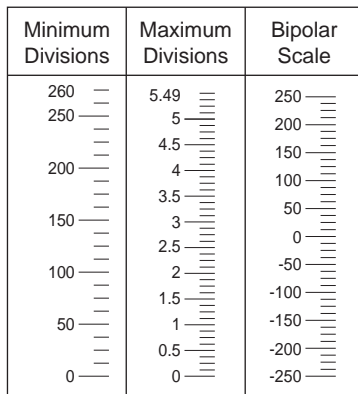**• Type 4: 2.6 ≤ Scale Span < 5.5**
Number of divisions: 26 to 43.9
Scale: Starts at 0, increments in 0.05 / 0.5 / 5 / 50 / 500.
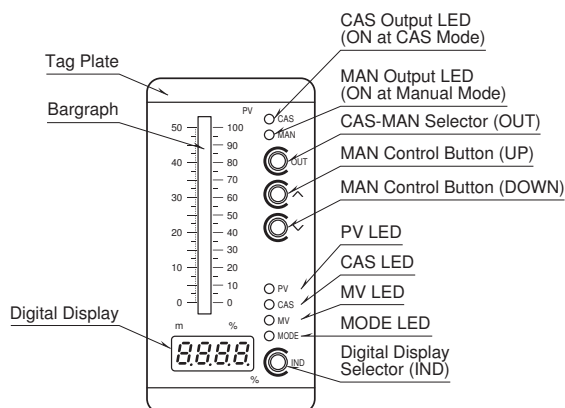   Min. and max. values are indicated.
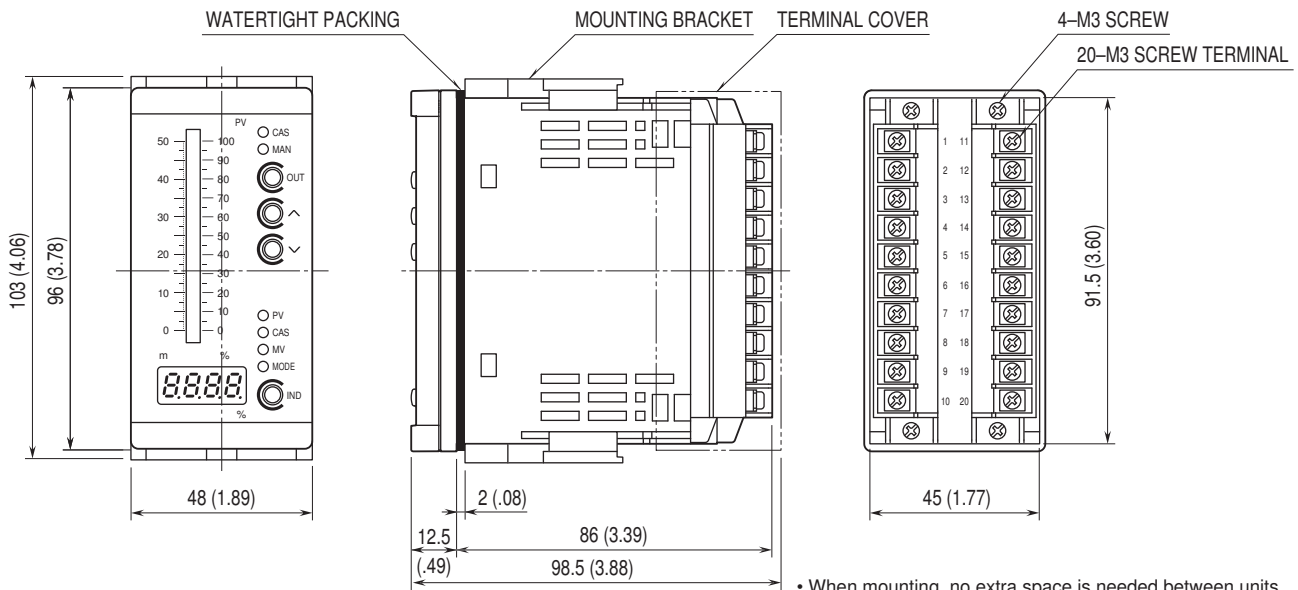   4 digits including negative sign and decimal point.
Division lines: Long, Medium, Medium, Medium, Long
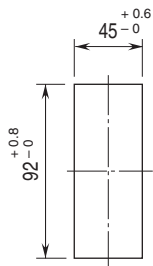   (4 divisions repeating)

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

EXTERNAL VIEW

- Tag Plate
- Bargraph
- Digital Display
- CAS Output LED (ON at CAS Mode)
- MAN Output LED (ON at Manual Mode)
- CAS-MAN Selector (OUT)
- MAN Control Button (UP)
- MAN Control Button (DOWN)
- PV LED
- CAS LED
- MV LED
- MODE LED
- Digital Display Selector (IND)

EXTERNAL DIMENSIONS & TERMINAL ASSIGNMENTS unit: mm (inch)

WATERTIGHT PACKING MOUNTING BRACKET TERMINAL COVER 4–M3 SCREW

20–M3 SCREW TERMINAL

103 (4.06) 96 (3.78)

PV
CAS
MAN
OUT
∧
∨
PV
CAS
MV
MODE
IND

48 (1.89)

2 (.08)

12.5 (.49)

86 (3.39)

98.5 (3.88)

91.5 (3.60)

45 (1.77)

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

PANEL CUTOUT unit: mm (inch)

• **Single Mounting**
  (Conform to degree of protection IP65)

$45^{+0.6}_{-0}$

$92^{+0.8}_{-0}$

Panel thickness: 1.6 – 8.0 mm

Observe at the minimum of 3 cm above and below the units for heat dissipation.

• **Clustered Mounting**
  (Not conform to degree of protection IP65)

L

$92^{+0.8}_{-0}$
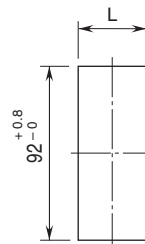
Panel thickness: 1.6 – 8.0 mm

$L = (45.5 + 48 \times (N - 1))^{+1}_{-0}$
(N : number of units)

MODEL: ABF3

SCHEMATIC CIRCUITRY & CONNECTION DIAGRAM

• 'MV output at power down' option with 'output off'
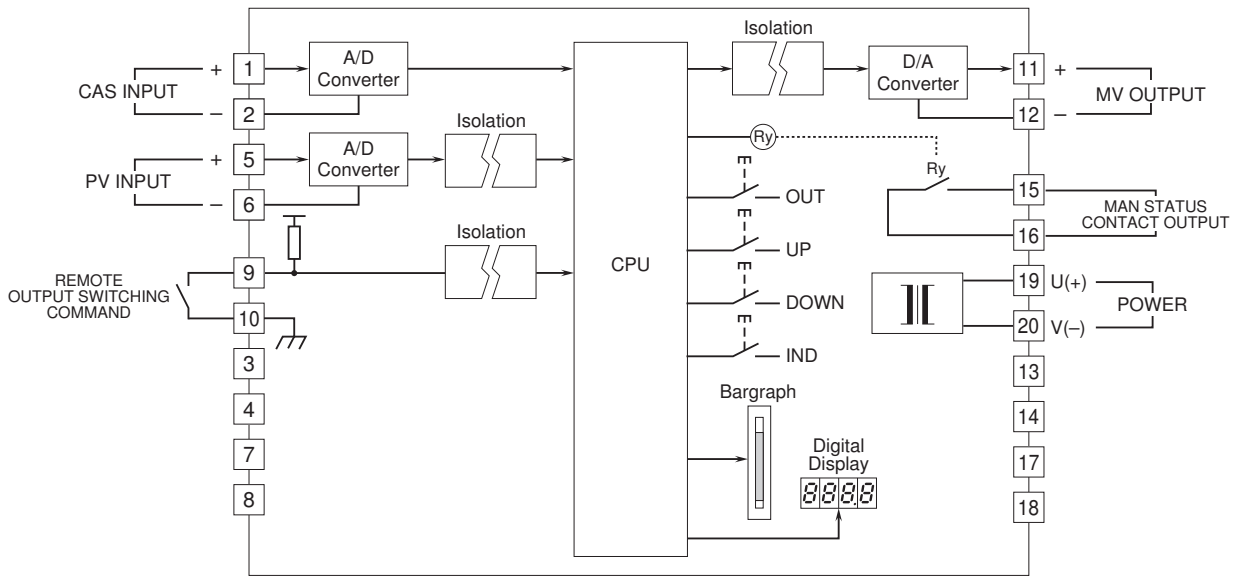
• 'MV output at power down' option with 'CAS input'
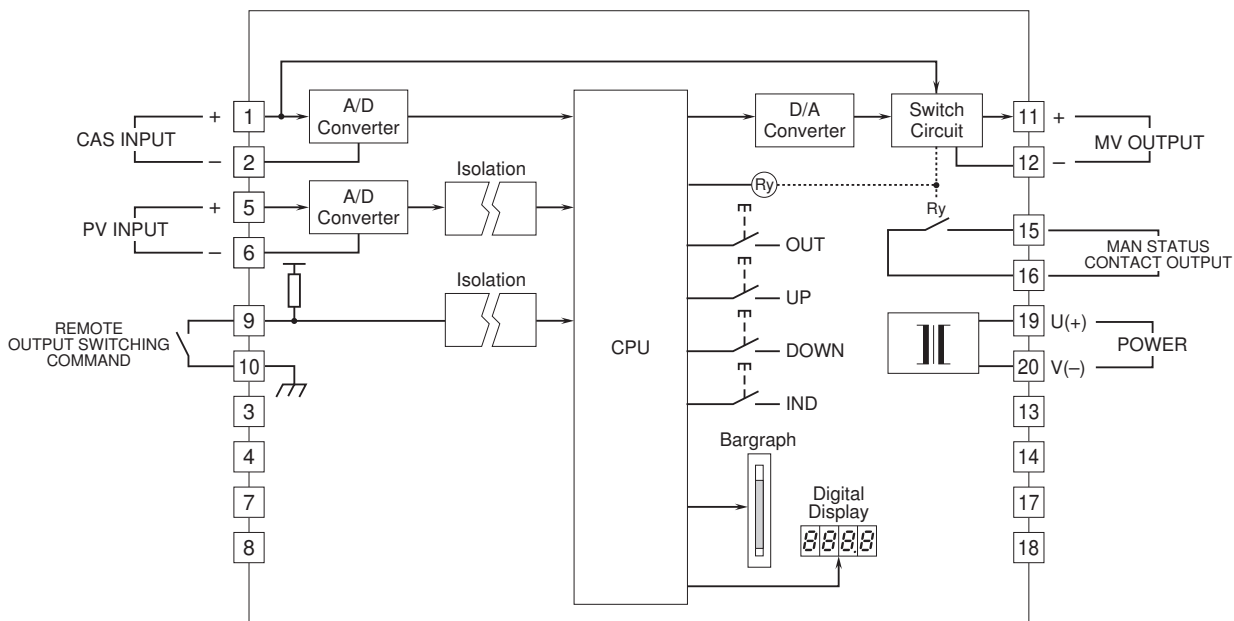
⚠ Specifications are subject to change without notice.

M-SYSTEM CO., LTD.
http://www.m-system.co.jp/