Super M-UNIT Series

MULTI-FUNCTION PID CONTROLLER

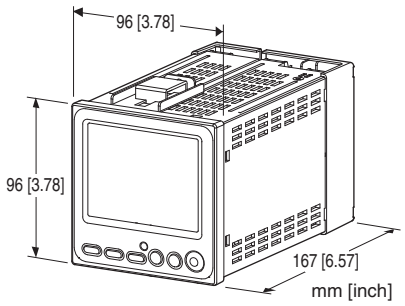
(color LCD display)

Functions & Features

• Multi-function controller with instruction/operation section of 1 control output
• Two loops can be switched and displayed by using loop switch button
• 3 analog input, 4 discrete input, 3 discrete output and 3 analog output
• Control cycle selectable between 100 msec. and 3 sec.
• Two PID function blocks
• Advanced computation and sequence control functions
• PID parameters can be automatically set with auto-tuning function
• Parameter input and changing with front button
• Function parameter setting, list printing and data downloading/uploading available with Loop Configuration Builder Software (model: SFEW3E)
• I/O can be expanded by NestBus
• Control and monitoring via Modbus-RTU

Typical Applications

• Boiler temperature control
• Controlling cascade of water level and flow rate
• Controlling ratio of chemical injection



MODEL: ABL-1111[1]-M2[2]

ORDERING INFORMATION

• Code number: ABL-1111[1]-M2[2]
Specify a code from below for each of [1] and [2].
(e.g. ABL-11111-M2/E)

ANALOG INPUT

1: Universal input, 1 point (DC, thermocouple, RTD)
DC input, 2 points (1 - 5 V DC, 4 - 20 mA DC)

ANALOG OUTPUT

1: DC output, 3 points (4 - 20 mA DC)

DISCRETE INPUT

1: Dry contact, 4 points

DISCRETE OUTPUT

1: Mechanical contact, 3 points (relay contact)

[1] EXTERNAL INTERFACE

0: none
1: Modbus-RTU, NestBus communication

POWER INPUT

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

[2] OPTIONS

Language
blank: Japanese
/E: English

RELATED PRODUCTS

• PC Configurator cable (model: COP-US)
• Loop configuration builder software (model: SFEW3E Ver. 1.108 or higher)
Builder software is downloadable at our web site.

PACKAGE INCLUDES...

• Mounting bracket: 1
• Resistor module (model: REM5): 3
• CJC sensor: 1

GENERAL SPECIFICATIONS

Construction: Panel flush mounting
Connection
Network (Modbus-RTU, NestBus):
Tension clamp terminal block
FMC1,5/4-STF-3,5 (Phoenix Contact)
Other than network:
Separable M3 screw terminals (torque 0.5 N·m)
Screw terminal: Nickel-plated steel
Housing material: Flame-resistant resin (black)
Mounting bracket material: Nickel-plated SPCC
Isolation: Pv1 to Ai1 to Ai2 to Di1 or Di2 or Di3 or Di4 to Mv1 to Ao1 to Ao2 to Do1 to Do2 to Do3 to RUN contact to NestBus to Modbus-RTU to power to FE

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PID control: Single loop, cascade, advanced
Proportional band (P): 1 to 1000 %
Integral time (I): 0.01 to 100 minutes
Derivative time (D): 0.01 to 10 minutes
Auto-tuning: Limit cycle method
Alarm: PV high & low, deviation, rate of change
Sequence operation: Logic sequence, step sequence (max. 1068 commands)
Control cycle: 100 msec. to 3 sec.
MV output range: -15 - +115 %
Parameters: Stored in E^2PROM (non-volatile memory); write/erase cycle endurance: less than 100 000
Parameter setting: With front buttons or Builder Software (model: SFEW3E)
Self diagnostics: CPU monitoring with a watchdog timer
RUN contact: OFF in error detected by diagnostic
Control operation at power recovery: hot start

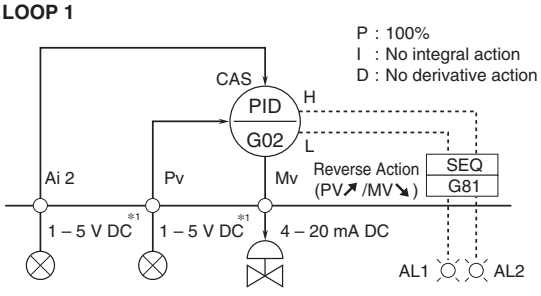
■ **DISPLAY**

Display device: 3.5-inch TFT LCD
Display colors: 256
Resolution: 320 × 240 pixels
Backlight *[1]: LED
Screen saver standby time: OFF, 1 to 99 min. *[2]
Scaling range: -32000 to +32000
Decimal point position: 10^{-1}, 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5} or none
Scale divisions: 2 to 10
Engineering unit indication: Max. 8 characters

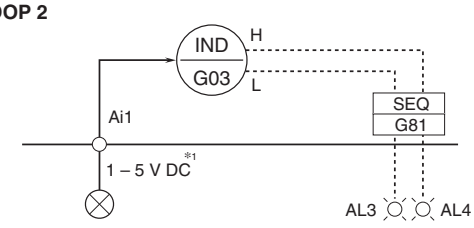
Note 1: Backlight life is approx. 50 000 hours (at 50 % brightness). The backlight can be replaced in our factory. The LCD must be replaced at the same time.
Note 2: Backlight brightness is reduced. Screen saver does not function when an error occurs.

FACTORY DEFAULT

■ **LOOP 1**



■ **LOOP 2**



*1. Factory default setting
Note: Use Bulider Software (model: SFEW3E) for changing loop etc.

EXTERNAL INTERFACE

■ **NestBus**

Configuration: Bus type multi-drop
Standard: Conforms to TIA/EIA-485-A
Transfer rate: 19.2 kbps
Protocol: NestBus (our own protocol)
Max. transmission distance: 1 kilometer
Transmission media:
Shielded twisted-pair cable (CPEV-S 0.9 dia.)
Terminating resistor: incorporated
Address setting: 0 - F (16 nodes)

■ **Modbus-RTU**

Configuration: Half-duplex, asynchronous, no procedure
Standard: Conforms to TIA/EIA-485-A
Max. transmission distance: 500 meters
Transfer rate: 4800, 9600, 19.2 k, 38.4 k bps
Data bit: 8
Parity bit: Odd, even, none
Max. node number: 15 (except the master)
Transmission media:
Shielded twisted-pair cable (CPEV-S 0.9 dia.)
Terminating resistor: incorporated
Node address setting: 1 - 247

INPUT SPECIFICATIONS

■ **Pv**

• **DC input:**
Input range
  • **Wide span voltage:** 0 – 10 V DC, 0 – 5 V DC, 1 – 5 V DC
  • **Narrow span voltage:** -1 – +1 V DC, 0 – 1 V DC
  • **Current:** 0 - 20 mA DC, 4 - 20 mA DC

Input resistance
  • **Wide span voltage:** ≥ 1 MΩ (≥ 500 kΩ for 0 - 10 V)
  • **Narrow span voltage:** ≥ 100 kΩ
  • **Current:** 250 Ω (Using resistor module)

• **Thermocouple input:** K, E, J, T, B, R, S, C, N, U, L, P, PR (See Table 1.)
Input resistance: ≥ 30 kΩ
Burnout sensing: ≤ 0.3 μA
Burnout indication: 115 % (upscale burnout) of the temperature range

• **RTD input:** Pt 100 (JIS '97, IEC), Pt 100 (JIS '89), JPt 100 (JIS '89) (See Table 2.)
Maximum leadwire resistance: ≤ 100 Ω per wire
Burnout indication: 115 % (upscale burnout) of the temperature range
Sensing current: ≤ 1 mA

■ **Ai1, Ai2**

Voltage input: 1 – 5 V DC, ≥ 1 MΩ
Current input: 4 – 20 mA DC with input resistance 250 Ω (Using resistor module)

■ **Di1, Di2, Di3, Di4**: Dry contact, 4 points

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Input resistance: Approx. 1.8 kΩ
Common: Negative common per 4 points
Sensing: 12 V DC
ON current/resistance: ≥ 1.5 mA, ≤ 1.5 kΩ
OFF current/resistance: ≤ 0.75 mA, ≥ 15 kΩ

[Table 1 (Thermocouple input)]

T/C	USABLE RANGE (°C)	CONFORMANCE RANGE (°C)
K (CA)	-272 to +1472	-150 to +1370
E (CRC)	-272 to +1100	-170 to +1000
J (IC)	-260 to +1300	-180 to +1200
T (CC)	-272 to +500	-170 to +400
B (RH)	24 to 1920	1000 to 1760
R	-100 to +1860	380 to 1760
S	-100 to +1860	400 to 1760
C (WRe 5-26)	-52 to +2416	100 to 2315
N	-272 to +1400	-130 to +1300
U	-252 to +700	-200 to +600
L	-252 to +1000	-200 to +900
P (Platinel II)	-52 to +1496	0 to 1395
(PR)	-52 to +1860	300 to 1760

Overrange input (out of the usable range) is handled as burnout.

[Table 2 (RTD input)]

RTD	USABLE RANGE (°C)	CONFORMANCE RANGE (°C)
Pt 100 (JIS '97, IEC)	-240 to +900	-200 to +850
Pt 100 (JIS '89)	-240 to +900	-200 to +660
JPt 100 (JIS '89)	-236 to +560	-200 to +510

Overrange input (out of the usable range) is handled as burnout.

OUTPUT SPECIFICATIONS

■ **Mv, Ao1, Ao2:** 4 - 20 mA DC
Load resistance: ≤ 500 Ω
■ **Do1, Do2, Do3, RUN contact**
• **Relay contact, RUN contact**
Relay rating: 250 V AC @ 1 A (cos ø = 1)
30 V DC @ 1 A (resistive load)
Maximum switching voltage: 250 V AC or 30 V DC
Maximum switching power: 250 VA (AC) or 60 W (DC)
Minimum load: 5 V DC @ 10 mA
Mechanical life: 2 × 10^7 cycles

INSTALLATION

Power consumption
•**AC**:
Approx. 9.2 VA at 100 V
Approx. 12.6 VA at 240 V
Operating temperature: -5 to +55°C (23 to 131°F)
Operating humidity: 30 to 90 %RH (non-condensing)
Mounting: Panel flush mounting (high-density mounting in horizontal direction)
Weight: 800 g (1.76 lb)

PERFORMANCE in percentage of span

Digital display accuracy: ± (0.1 % of rdg + 1 digit)
A/D Conversion accuracy: ≤ ±0.1 %
D/A Conversion accuracy: ≤ ±0.1 % (0 - 100%)
Thermocouple input: ±1°C ±1 digit (±2°C ±1 digit for B, R, S, C, PR)
RTD input: ±1°C ±1 digit
Resistor module (model: REM5): ±0.1 %
Cold junction compensation:
±2°C at 25°C ±10°C
±4°C for S, R and PR
Temp. coefficient:
• **DC input:** ±0.015 % /°C (±0.008 % /°F)
• **DC output:** ±0.015 % /°C (±0.008 % /°F)
• **Resistor module (model: REM5):** ±0.003 % /°C (±0.002 % /°F)
Line voltage effect: ±0.1 % over voltage range
Insulation resistance: ≥ 100 MΩ with 500 V DC
Dielectric strength:
1500 V AC @ 1 minute
(Pv1 to Ai1 or Ai2 to Mv1 to Ao1 or Ao2 to Di1 or Di2 or Di3 or Di4 to Do1 to Do2 to Do3 to RUN contact to NestBus to Modbus-RTU to power to FE)
500 V AC @ 1 minute
(Ai1 to Ai2)
500 V AC @ 1 minute
(Ao1 to Ao2)

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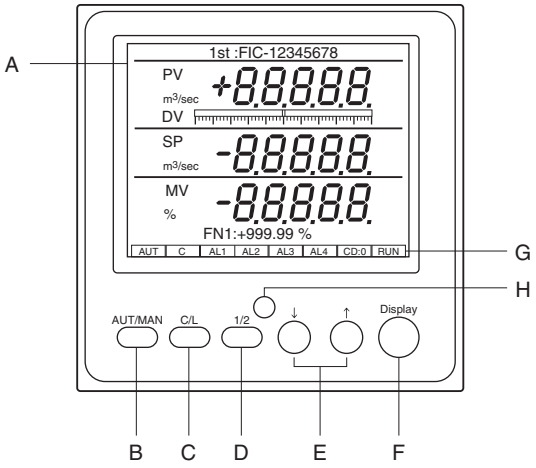
EXTERNAL VIEW



A. LCD display
TFT color display. Switch the view with [Display] button.

B. AUT/MAN
Used to switch MV between automatic and manual mode.

C. C/L
Used to switch SP between cascade and local.

D. 1/2
Used to switch the displayed/operated loop.

E. UP/DOWN
When the control mode is automatic (AUT) and local (L), SP value is changed.
When the control mode is manual (MAN), MV value is changed.
In tuning view, selected parameter is changed.

F. Display
Used to switch FN display. View is switched by holding-down the button.

G. Indicator

INDICATOR	EXPLANATION
AUT/MAN	AUT: Automatic (green) MAN: Manual (red)
C/L	C: Cascade (blue) L: Local (yellow)
AL1 to AL4	User setting indicator LED (controlled using sequential control block) Character strings can be set. (4 characters) On: red Off: gray
CD:N.	Card number is indicated. Monitor mode: gray Program mode: blue
RUN	Normal: green Abnormal: amber Stop: gray EEPROM database corruption: red

H. Configurator jack
Use the PC configurator cable (model: COP-US) to communicate with Loop Configuration Builder Software (model: SFEW3E) and configure various settings.

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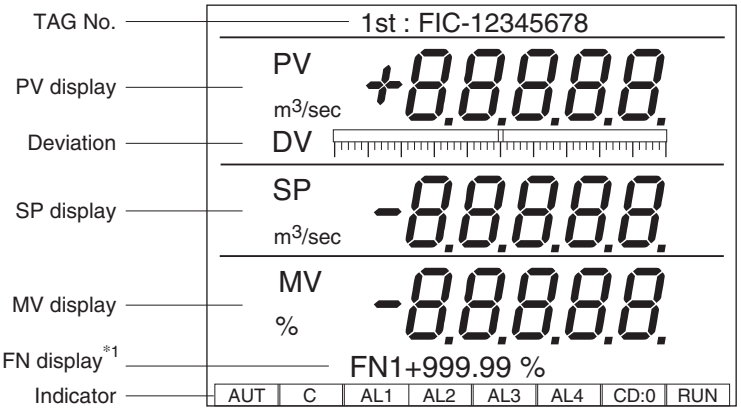
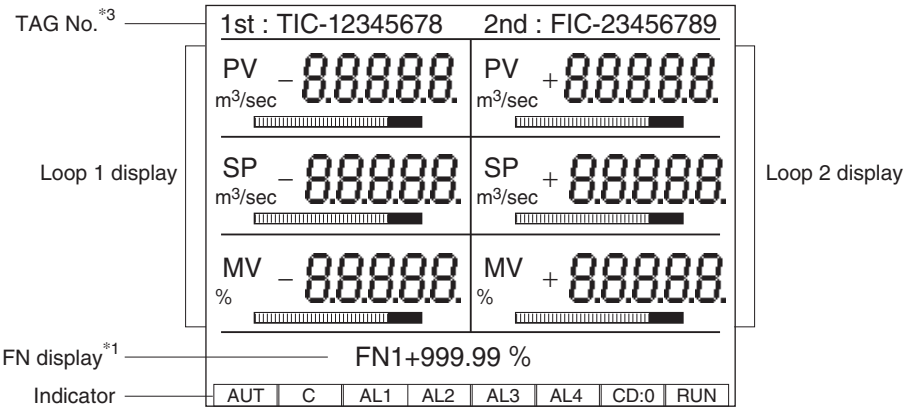
■ **LCD display**

The content differs depending on the resistered adjustment block type.
Refer to the section "■ LCD COLOR" for color.

• DIGITAL 1 LOOP VIEW



• DIGITAL 2 LOOP VIEW *2



Note 1: Internal analog signal that users can select. (If FN display is not registered, it will be skipped.)
Note 2: The digital 2 loop view is not displayed when 2nd loop is not resistered.
Note 3: A cursor appears on the selected TAG No.

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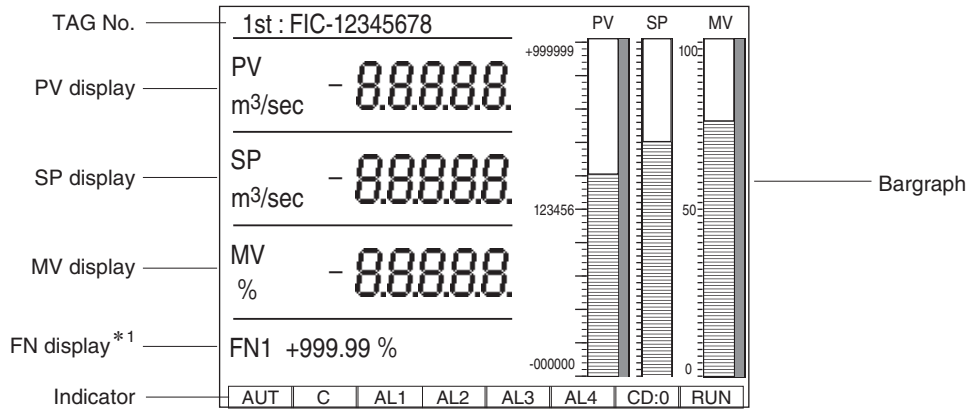
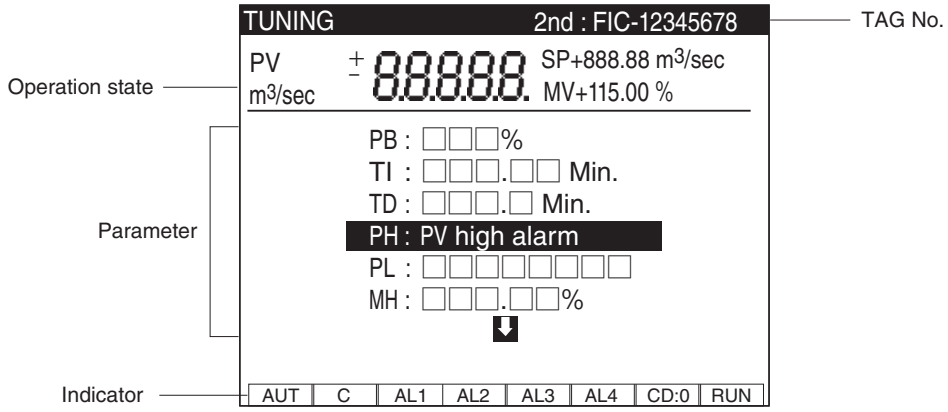
• DIGITAL + BARGRAPH VIEW

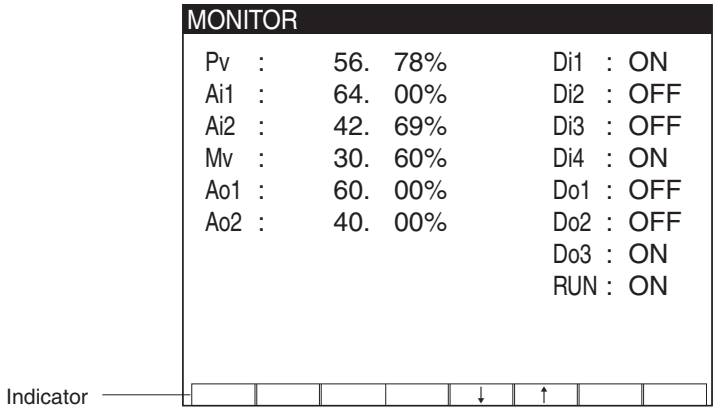


Note 1: Internal analog signal that users can select. (If FN display is not registered, it will be skipped.)

• TUNING VIEW



• MONITOR VIEW



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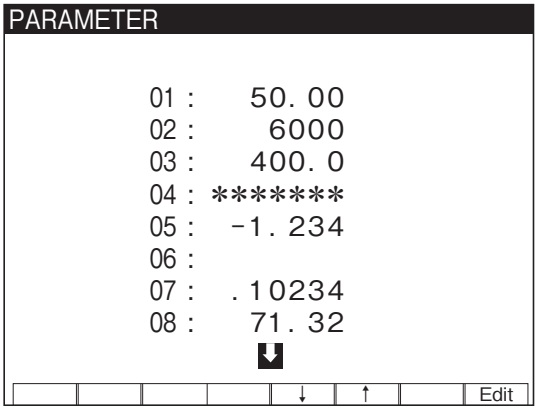
• PARAMETER LIST VIEW



■ LCD COLOR

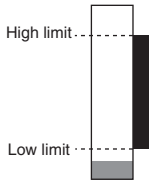
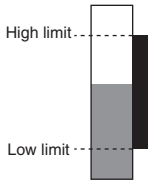
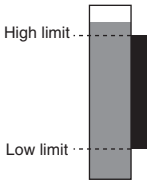
• PV display

Low limit error	Normal	High limit error
Amber	White	Red

• DV bargraph

≦2%	2.01～25%	25%＜
Green	Yellow	Red

• PV bargraph

Low limit error	Normal	High limit error
		
Amber	Green	Red

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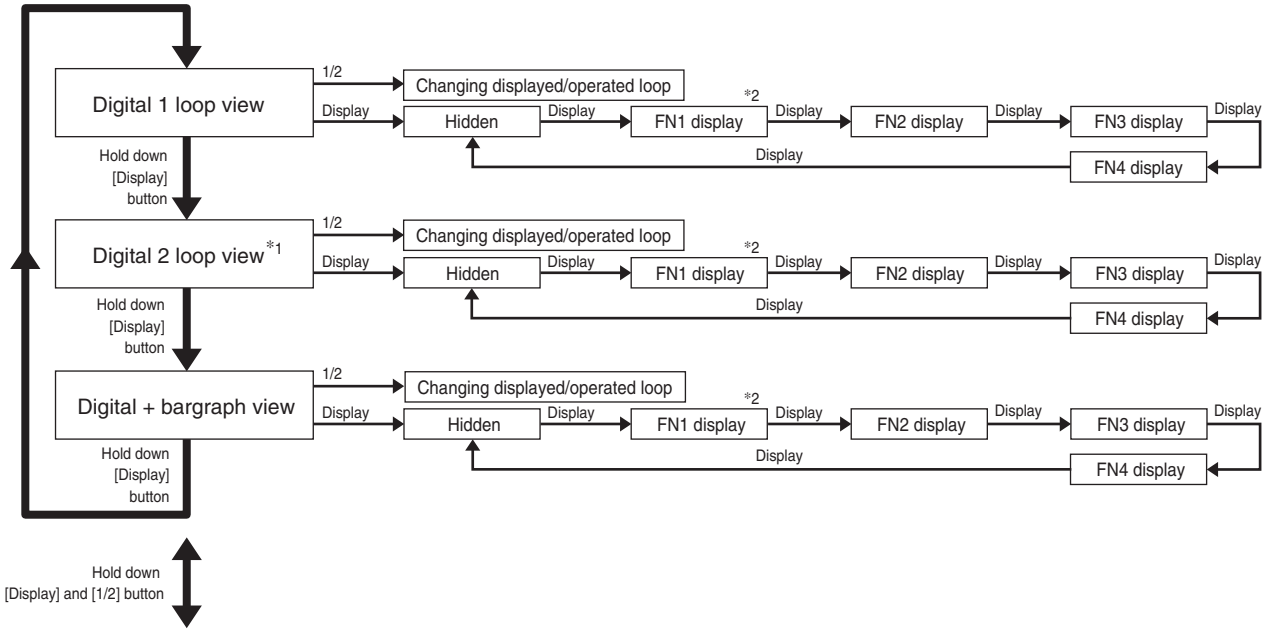
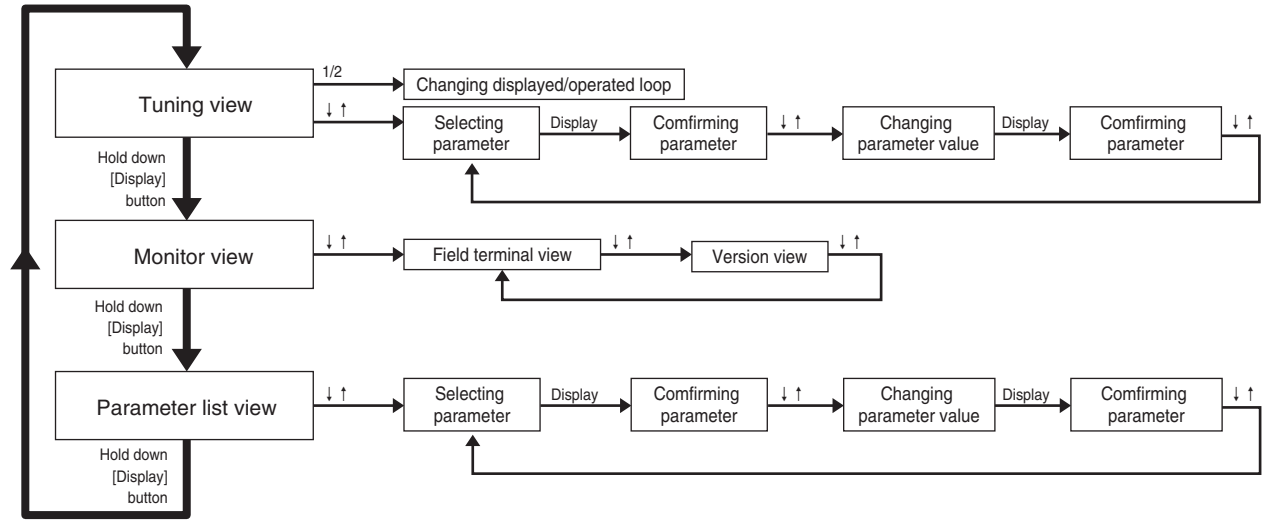
■ DISPLAY MODE FLOW CHART

Hold down [Display] button for 1 sec. or more to switch the views.
Hold down [Display] and [1/2] button for 3 sec. or more to switch between operation view and engineering view.

• OPERATION VIEW



• ENGINEERING VIEW



Note 1: The digital 2 loop view is not displayed when 2nd loop is not resistered.
Note 2: Internal analog signal that users can select. (If FN display is not registered, it will be skipped.)

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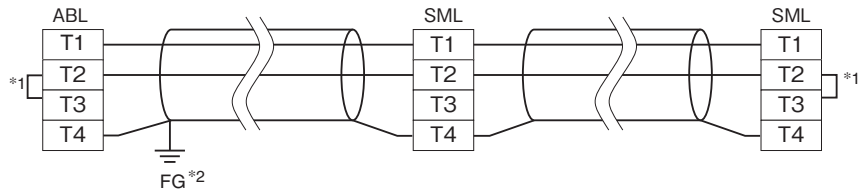
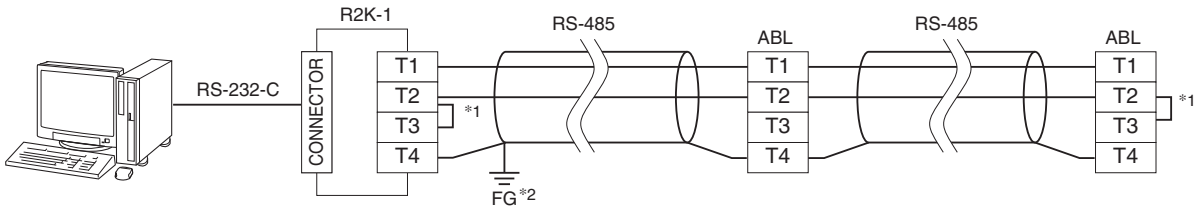
COMMUNICATION CABLE WIRING

■ **NestBus**

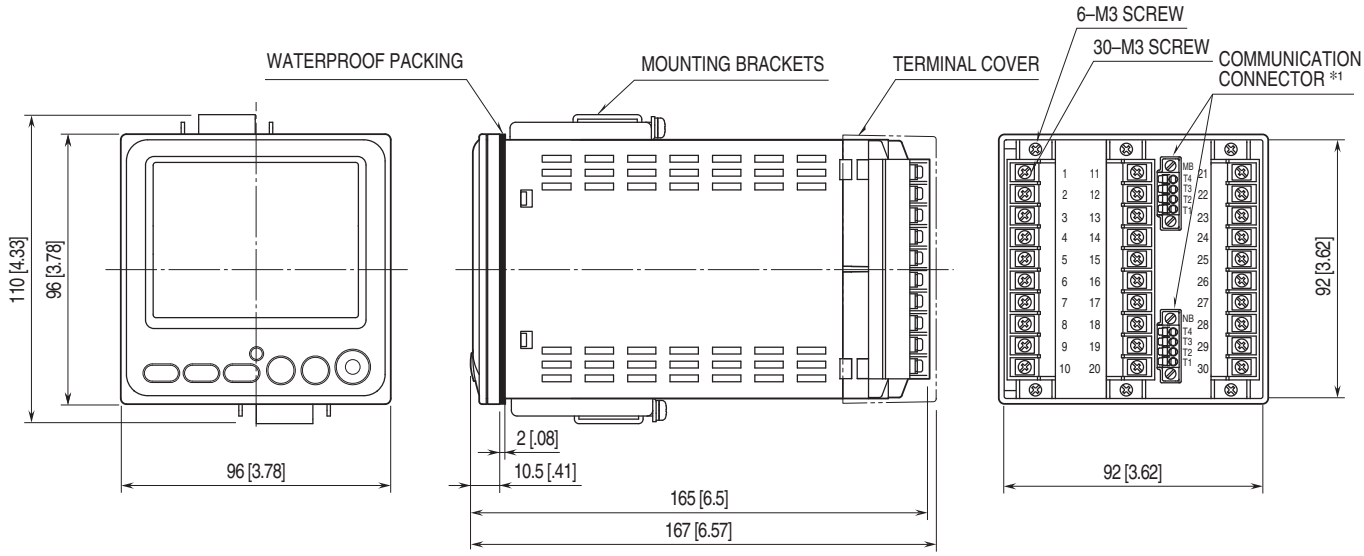


■ **Modbus-RTU**



*1. Internal terminating resistor is used when the device is at the end of a transmission line.
*2. Install shield cables to all sections and ground them at single point.

EXTERNAL DIMENSIONS & TERMINAL ASSIGNMENTS unit: mm [inch]



*1. Included only when the external interface code is "1: Modbus-RTU/NestBus communication".

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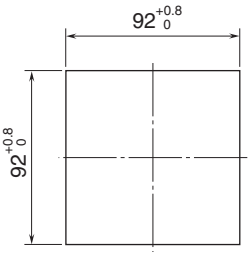
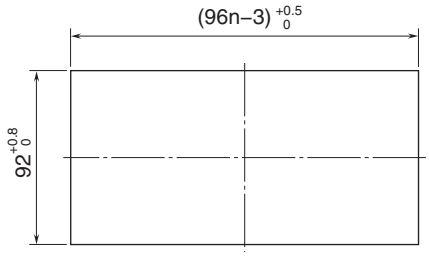
MOUNTING REQUIREMENTS unit: mm [inch]

■ **PANEL CUTOUT unit: mm**

• Single mounting



• Clustered mounting



n = number of units

Panel thickness 0.5 – 10

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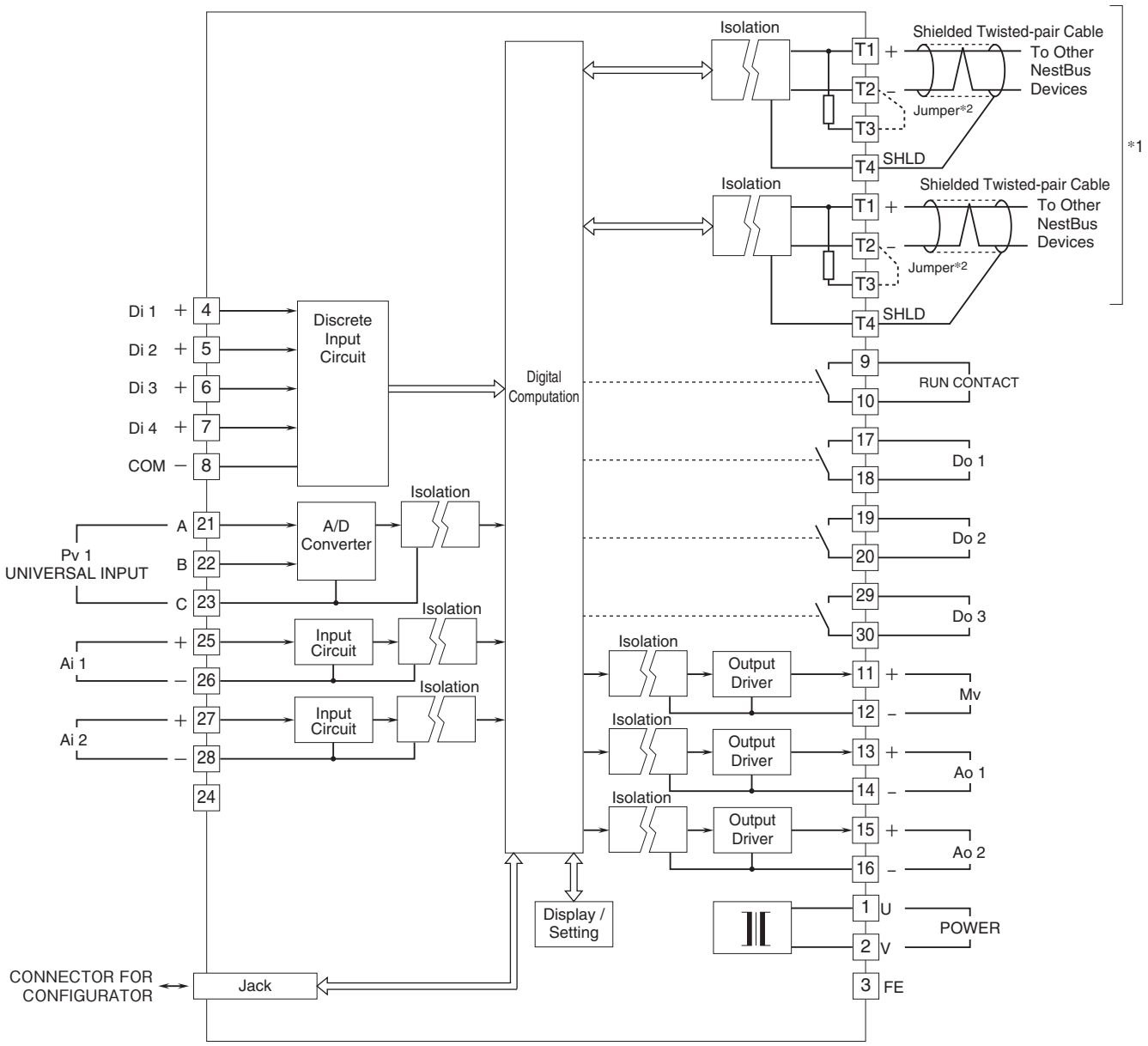
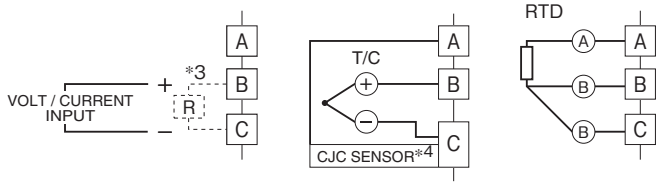
SCHEMATIC CIRCUITRY & CONNECTION DIAGRAM

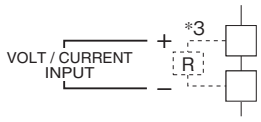


Note 1: Attached only when the external interface code is "1: Modbus-RTU, NestBus communication".
Note 2: Close across the T2 – T3 when the device is located at the end of a transmission line (= no cross-wiring).

■ **UNIVERSAL INPUT CONNECTION E.G.**



■ **DC INPUT CONNECTION E.G.**



*3. Connect input resistor module (model: REM5) for current input.
*4. Connect CJC sensor for thermocouple input.

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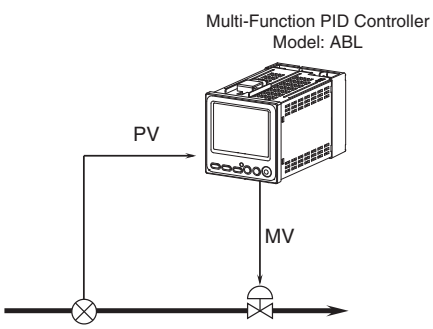
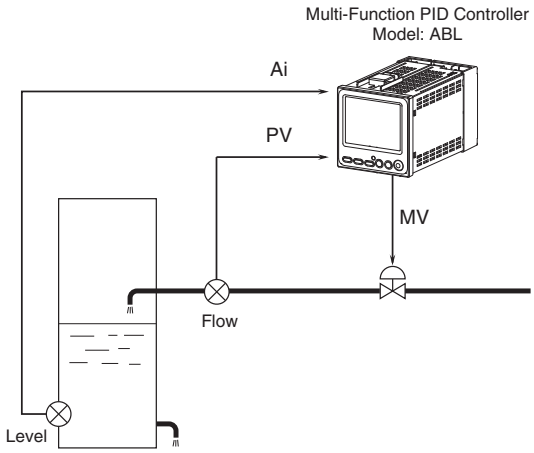
SYSTEM CONFIGURATION EXAMPLES

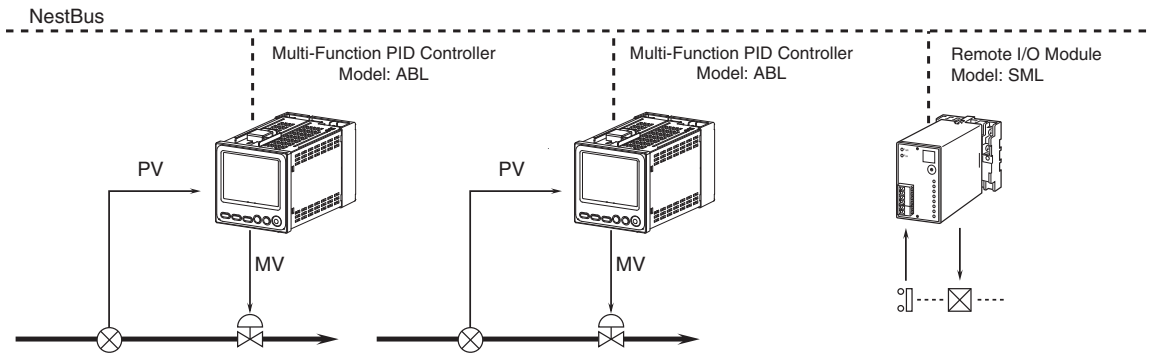
■ **SINGLE LOOP CONTROL**



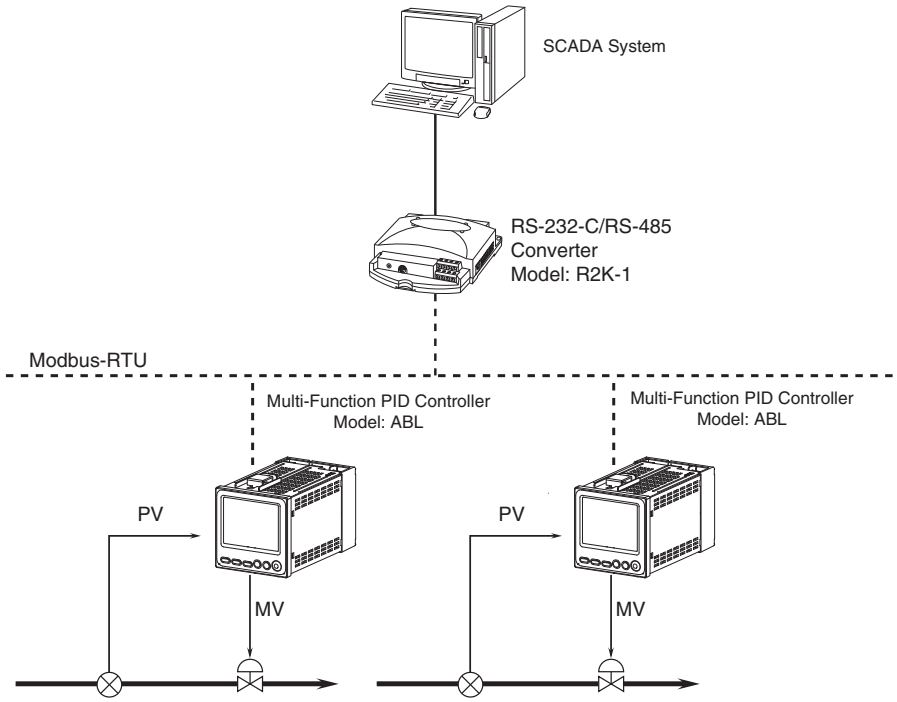
■ **CASCADE CONTROL**



■ **I/O EXPANDED VIA NESTBUS**



■ **CONTROL / SUPERVISION VIA MODBUS-RTU**



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⚠ Specifications are subject to change without notice.

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