

PUMA/B is a control module, which forms the core of PUM series. Each control module, 30mm wide, is equipped with PID control function for maximum 4 channels, 8 points of CT input/output, and high-speed RS-485 port. By connecting with PUM event input/output modules, it realizes a compact and high-performance system.



FEATURES

I. High-level control functions for various applications

1. Process value input, control output:
max. 4 points (4 channels independent control)
(Process value input: Insulation between channel,
All input/output and power supply: Insulation)
2. CT input: max. 8 points
One unit can detect three phase heater break for 4 channels
3. High-speed sampling: 100msec
(Resistance bulb type and Thermocouple type is 200msec)
4. Input measurement accuracy: $\pm 0.3\%FS$
5. Types of control output can be selected by 2 channels
(Relay contact/SSR drive/current linear output)
6. Analog re-transmission output function can be assigned to current output
7. ON/OFF control, PID control Fuzzy PID control, and Heat/Cool control and Valve control

II. User-friendly structure and functions

1. Lateral connection : Max.16 units (64 channels) + event input/output module 16 units = total 32 units
Simple wiring for power supply and communication
2. Detachable structure: Terminal block, main unit, and the base part
→ Easy wiring with detachable terminal block
→ Main units exchangeable without re-wiring
3. Status LED for each control channel
→ Easy to detect error channel
4. Smart loader communication: Connect one module and all connected modules are able to communicate using a loader software.

III. Large scale system using high speed RS-485

1. Modbus RTU protocol for large volume communication
2. High-speed communication: Maximum 115.2kbps
3. Highly-efficient communication: Parameters dispersed on the address map are re-allocated to contiguous address

IV. Various functions to realize high-performance system

1. Alarm function (output from event I/O module or the control output which is not used)
2. Power distribution function (with event I/O module):
Power ratio can be set to multiple point output by input/control calculation value of one channel
3. Operation mode control by digital input (with event I/O module): Run/Standby, etc.

4. Remote operation using input, and re-transmission output using output of connected analog input/output module (other stations)

SYSTEM SPECIFICATION

1. **Product type:** Multi-loop module type temperature controller
2. **Module type**
 - 1) Analog module: Total maximum 16 units
 - a) Control module (4 loop/unit)
 - b) Extended input/output (analog) module
 - Analog input/output module (Input/output 4 points/unit)
 - Analog input module (Input 4 points/unit)
 - Analog output module (output 4 points/unit)
 - 2) Extended input/output (digital) module:
 - Event input/output module (Input/output ; 8 points/unit)
 - 3) Enhanced communication module: 1 unit
3. **Connecting method:**
 - Lateral connecting with connectors
 - For power supply and RS-485 communication, any one of connected modules is required to be connected.
4. **No. of loop, input/output**
 - 1) Control loop: Max. 64
 - 2) No. of input/output: DI 128 points / DO 128 points

CONTROL MODULE SPECIFICATION

1. General specification

- (1) **Power supply:** 24V DC $\pm 10\%$
- (2) **Power consumption:** Max. 3.2 W (135 mA)
[when 24V DC is applied]
- (3) **Insulation resistance:** 20M Ω or more (500V DC)

(4) Withstand voltage:

| | |
|-------------------------------|-----------------|
| Power supply ↔ all terminals | 1000V AC 1 min. |
| Relay contact ↔ all terminals | 1500V AC 1 min. |
| Others | 500V AC 1 min. |

(5) Applied standards:

UL, C-UL, CE marking, RoHS directive
[Pending for UL, C-UL marking]

2. Input**2.1 Process value input****(1) No. of input:** 2 or 4 points (1 point/channel)**(2) Input setting:** Input code selection**(3) Input signal:** See table 1

Select from group I or II depending on the model code.

(setting can be done by channel within group)

[Group I] a) Thermocouple

b) Resistance bulb (3 wire)

[Group II] c) DC voltage, current

(4) Measurement range and input type: See table 1**(5) Measurement accuracy (Ta = 23°C)**

a) Thermocouple: $\pm 0.3\%FS \pm 1\text{digit} \pm 1^\circ\text{C}$
or $\pm 3^\circ\text{C}$ whichever is greater

*Unless;

B thermocouple 0 to 500°C: $\pm 5\%FS \pm 1\text{digit} \pm 1^\circ\text{C}$

R thermocouple 0 to 500°C: $\pm 1\%FS \pm 1\text{digit} \pm 1^\circ\text{C}$

T thermocouple -200 to 0°C: $\pm 0.5\%FS \pm 1\text{digit} \pm 1^\circ\text{C}$

b) Resistance bulb input: $\pm 0.3\%FS \pm 1\text{digit}$ or $\pm 1^\circ\text{C}$
whichever is greater

c) Voltage / Current input: $\pm 0.3\%FS \pm 1\text{digit}$

(6) Resolution: See table 1**(7) Temperature fluctuation:** $\pm 0.3\%FS/10^\circ\text{C}$ **(8) Input sampling cycle:** 100msec (Resistance bulb type and Thermocouple type is 200msec)**(9) Input impedance**

Thermocouple: 1M Ω or more

Current input: 250 Ω

Voltage input: approx. 1M Ω

(10) Influence of signal source resistance

Thermocouple: $\pm 0.3\%FS \pm 1\text{digit} / 100\Omega$

Voltage input: $\pm 0.3\%FS \pm 1\text{digit} / 500\Omega$

(11) Allowable wiring resistance

Resistance bulb: 10 Ω or less (per wire)

(12) Allowable input voltage

DC voltage input: within $\pm 15\text{V}$

Current input: within $\pm 25\text{mA}$

Thermocouple/resistance bulb: within $\pm 5\text{V}$

(13) Noise rejection ratio

Normal mode: 30dB or more (50/60Hz)

Common mode: 120dB or more (50/60Hz)

between process value input and earth, power supply, output 220V AC, 50/60Hz

(14) Input compensation

a) User adjustment: zero point, span point $\pm 50\%FS$

b) PV shift: $\pm 10\%FS$

c) First order lag filter: 0.0 to 120.0 sec.

(15) Overrange, underrange:

Out of range of -5 to 105%FS

(Accuracy cannot be ensured for -5 to 0, 100 to 105%FS)

(16) Insulation: Functional insulation between channels, and with any other input/output**2.2 Heater break detector (CT) input****(1) No. of input:** 4 or 8 points (2 points/loop)

(2) Input type: Single-phase type CT /point
1 to 30A: CTL-6-S-H
20 to 50A: CTL-12-S36-8

(3) Current detection accuracy:

Input value $\pm 10\%$ or $\pm 2\text{A}$, whichever is greater

(4) Time required for detection

- ON detection: 800ms or more

- OFF detection: 2 sec. or more

(5) Connection method:

Connector for heater break detector
[on the front of module]

(6) Insulation:

No insulation between channels

No insulation with communication port (RS-485, loader)

Functional insulation with any other input/output

3. Output**3.1 Control output****(1) No. of output:**

2 points (1 point/loop) or 4 points (2 points/loop)

(2) Control output behaviour:

Heat (reverse action) or cool (direct action), or heat/cool (control output 2 points/loop required), Valve (control output 2 points/loop required)

(3) Output type: Selected from a) to d) (by 2 channels)

a) Relay contact output

- Proportional cycle: 1 to 150 sec.

- Contact structure: SPST contact

- Contact capacity: 220V AC/30V DC, 3A (resistance load) 220V AC/30V DC, 1A (inductive load)

- Min. switching current: 100mA (24V DC)

- Mechanical life: 20,000,000 switching or more (100/min.)

- Electric life: 100,000 switching or more (rated load)

- Insulation: Basic insulation with any other input/output

b) SSR/SSC drive output

- Proportional cycle: 1 to 150 sec.

- Minimum resolution: 5ms

- ON voltage: 10V DC (8 to 12V DC)

- OFF voltage: 0.5V DC or less

- Max. current: 20mA DC (per point)

- Load resistance: 500 Ω or more

- Insulation: No insulation with any other output (excluding relay output)
Functional insulation with others than those above

c) Current output (4 to 20mA DC, 0 to 20mA DC)

- Actual output range: 0mA to 20.6mA DC

- Accuracy: $\pm 0.3\%FS$
(less than 1mA : $\pm 5\%FS$)

- Linearity: $\pm 0.3\%FS$
(less than 1mA : $\pm 5\%FS$)

- Resolution: 5,000 or more

- Ripple current: P-P 0.3mA or less

- Load resistance: 300 Ω or less

- Insulation: No insulation with any other output (excluding relay output)
Functional insulation with others than those above

(4) Optional functions:

Output limit, Soft start, power distribution, Output shutdown, output scaling (for current output only)

3.2 Analog re-transmission output

- (1) No. of output: 2 points (OUT3, OUT4 applied)
- (2) Output type: Current output (4 to 20mA DC, 0 to 20mA DC)
- (3) Option: Output scaling

4. Communication function

4.1 RS-485 interface

- (1) Communication standards: RS-485 compatible
- (2) No. of port: 1 port
- (3) Communication, synchro method: Two-wire, half-duplex, asynchronous cycle
- (4) Communication speed: 9.6k, 19.2k, 38.4k, 115.2kbps
- (5) Communication distance: 1km (38.4kbps or less), 250m (115.2kbps)
- (6) Recommended cable: KPEV-SB 0.5sq-equivalent
- (7) No. of connectable units: 33 units (master and slave) (32 units if any modules other than PUM series are included in slaves.)
- (8) Data format: Data bit; 8, parity; even / odd / none
- (9) Protocol: Modbus RTU compatible
- (10) Insulation: No insulation with loader communication port, CT input
Functional insulation with any other input/output

4.2 Loader communication (RS-232C) interface

- (1) Communication standards: RS-232C compatible
- (2) No. of port: 1 port
- (3) Communication, synchro method: Half-duplex, asynchronous cycle
- (4) Communication speed: 19.2kbps (fixed)
- (5) Data format: Data bit 8, no parity
- (6) Protocol: Modbus RTU compatible
- (7) Connection method: 2.5 diameter mini-plug/jack [on the front of the module] (Common cable with PXG, PXH)
- (8) Insulation: No insulation with RS-485, CT input
Functional insulation with any other input/output

5. Control functions

5.1 Control methods

- (1) PID control (including FUZZY PID control)
 - PID constant: Set by auto tuning
- (2) PID 2 (Heat/cool) control (including FUZZY PID control)
 - PID constant: Set by auto tuning
- (3) PID Valve (OPEN CLOSE) control (including FUZZY PID control)
 - PID constant: Set by auto tuning

5.2 Control parameter

- Proportional band (P): 0.0 to 999.9%, P=0: 2 position control ON
- Integration time (I): 0 sec to 3200 sec. I=0: Integration OFF

- Derivation time (D):

0.0 to 999.9 sec. D=0: Derivation OFF

- Control cycle: 100msec (Resistance bulb type and Thermocouple type is 200msec)

5.3 Control mode

- (1) Mode type: Auto / Manual / Remote
- (2) Mode switching: Auto ↔ Manual: balanceless / bumpless transfer
Auto/Manual ↔ Remote: balance/bumpless transfer
Auto/Manual ↔ Remote: balance/bumpless transfer

5.4 Digital input function

- (1) Operation control by digital input: Run/Standby switch, Auto/Manual switch, Local/Remote switch, Start auto tuning, Ramp SV ON/OFF, Ramp SV HOLD, DO latch release, Start timer, Output shutdown
- (2) Input method: Input using event input/output module

6. Alarm function

6.1 Alarm function

- (1) No. of alarm set-points: 5 points / control channel
- (2) Alarm type: PV value(Lower/upper limit, absolute/deviation value, range)
Loop burnout alarm, Error alarm, etc. (Non-excitation, delay, latch, timer function also available)
- (3) Alarm output: Data output via communication or output from event input / output module

6.2 Heater break alarm

- (1) No. of alarm set-points: 4 or 8 points (2 points/control channel)
- (2) Alarm type: Detect when output ON (break detection)
Detect when output OFF (leakage current detection) (setting can be done separately by point)
- (3) Heater current alarm
 - Detectable current range: 2A to 50A
 - Detected current resolution: 0.1A
 - Setting resolution: 0.1A
 - Operation dead band: 0.0 to 50.0A
- (4) Alarm output: Data output via communication or output from event input/output module

Current output model cannot output the HB alarm.

Current output model can perform the CT monitor only.

7 Display, configuration

7.1 Display

- (1) Display: Status display LED (2 colors × 6 points)
- (2) Display contents: RUN/FAULT, RS-485 TX/RX, OUT/ERR by loop (4 loops) (Functions are assigned to LED of each channel)

7.2 Setting device

- (1) Setting device: Rotary SW × 1
- (2) Set contents: RS-485 Station No. (Station No.= setting value + 1)

8. Power outage

- (1) **Impact of power outage:**
Outage of 2ms or less ; no impact
- (2) **Operation after power outage:**
Start from the first step (cold start)
- (3) **Memory backup:**
Nonvolatile memory (EEPROM)
No. of update ; 100,000

9. Self diagnosis

- Diagnosis method:**
Program error monitoring by watch dog timer

10. Structure

- (1) **Installation method:**
DIN rail mounting or mounting with M3 screws inside a cabinet
- (2) **Dimensions:** 30 (W) × 100 (H) × 85 (D) mm
(excluding terminal cover and projected part)
- (3) **Weight:** Approx. 200 g
- (4) **Extrenal terminal**
 - Process value input/control output:
Detachable terminal block
(M3 screw × 20 terminals)
 - Power supply connection:
Terminal block on the base part
(M3 screw × 2 terminals)
Power is supplied via side connectors in case of lateral connecting. (Max. 33 units)
 - RS-485 communication connection:
Terminal block on the base part
(M3 screw × 3 terminals)
RS-485 communication is connected via side connectors in case of lateral connecting.
 - CT input: Special connectors (8 pin × 2 pcs.)
[on the front of the module]
 - Loader communication port:
2.5 diameter mini-plug/jack
[on the front of the module]
- (5) **Case material:** Polyphenylene oxide
(flame retardant grade : UL94V-0 equivalent)
- (6) **Case color:** Case ; red
Terminal, base part ; black
- (7) **Protection**
 - Body: IP20 grade protection
(ventilation slits on the top and the bottom of the body)
 - Terminal: IP00 grade protection, terminal cover is available as an option

11. Normal operating condition

- (1) **Ambient temperature*:** -10 to 50°C
* "Ambient temperature" is the temperature underneath the controller inside the equipment or the cabinet where the controller is installed.
- (2) **Ambient humidity:**
90% RH or less (non condensing)
- (3) **Vibration:** 10 to 70Hz, 9.8m/s² (1G) or less
- (4) **Warmup time:** 30 min. or more

12. Transporting, storage condition (packing condition)

- (1) **Storage temperature:** -20 to 60°C
- (2) **Ambient humidity:** 90%RH or less (no condensing)
- (3) **Vibration:** 10 to 70Hz, 9.8m/s² (1G) or less
- (4) **Shock:** 294m/s² (30G) or less

13. Packing list

- Temperature controller:** 1unit
- Instruction manual:** 1 copy
- 250Ω resistance:** 0 or 2 or 4 pcs.
(For no. points of voltage/current input selected)

14. Loader software

- (1) **Distribution medium:**
Free download from Fuji Electric Systems HP (<http://www.fic-net.jp/eng/index.html>)
- (2) **Recommended operating environment**
 - PC: DOS/V (PC-AT compatible)
 - OS: Windows XP (operation confirmed in Japanese / English)
Windows 7 corresponds by Ver.2.0.0.
 - RAM: 256M bytes or more
 - Free space on the hardware: 500M bytes or more
 - Display resolution: 1024 × 768 or over
 - Serial interface: RS-232C 1 port
(without RS-232C, USB serial converter cable required)
- (3) **Connection with PUM**
Via loader interface on the front face of the module (special cable available from Fuji is required)

CODE SYMBOLS

[Control module (4 channels)]

| Digit | Description | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|
| 4 | < Module type > 4ch control module | P | U | M | | | | | 1 | - | 0 | | 0 | 0 |
| 5 | < Input type > Thermocouple / resistance bulb [all channels] Voltage / current [all channels] Thermocouple / resistance bulb [ch 1, 2], voltage / current [ch3, 4] | | | | | A | | | | | | | | |
| 6 | < OUT1, 2 output type > Relay output SSR drive output Current output | | | | | | | A | | | | | | |
| 7 | < OUT3, 4 output type > Relay output SSR drive output Current output | | | | | | | A | | | | | | |
| 10 | < Operation Manual > Japanese English | | | | | | | | | | | A | | |
| 11 | < Option 1 > Not fitted CT input (8 points) * | | | | | | | | | | | | Y | C |

* Current output model cannot output the HB alarm.
Current output model can perform the CT monitor only.

[Control module (2 channels)]

| Digit | Description | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|-------|-----------------------------------------------------------------------------------------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|
| 4 | < Module type > 2ch control module | P | U | M | | | | | 1 | - | 0 | | 0 | 0 |
| 5 | < Input type > Thermocouple / resistance bulb [all channels] Voltage / current [all channels] | | | | | B | | | | | | | | |
| 6 | < OUT1, 2 output type > Relay output SSR drive output Current output | | | | | | | A | | | | | | |
| 7 | < OUT3, 4 output type > Not fitted Relay output SSR drive output Current output | | | | | | | Y | | | | | | |
| 10 | < Operation Manual > Japanese English | | | | | | | | | | | A | | |
| 11 | < Option 1 > Not fitted CT input (4 points) * | | | | | | | | | | | | Y | C |

* Current output model cannot output the HB alarm.
Current output model can perform the CT monitor only.

[Accessories]

| Digit | Description | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-------|-----------------------------------------------------|---|---|---|---|---|---|---|---|
| 6 | RS-485 terminating resistance | P | U | M | Z | * | | | |
| 7 | DIN rail mounting end plate | | | | | | A | 0 | 1 |
| 8 | Side connecting terminal cover (right & left 1 set) | | | | | | A | 0 | 2 |
| | Front face screw terminal cover | | | | | | A | 0 | 3 |
| | Loader connecting cable (RS-232C) | | | | | | A | 0 | 4 |
| | CT input terminal cable (for 4 points) [l=1m] | | | | | | L | 0 | 1 |
| | CT input terminal cable (for 4 points) [l=3m] | | | | | | C | 0 | 1 |
| | CT input terminal cable (for 4 points) [l=5m] | | | | | | C | 0 | 3 |
| | CT for 1 to 30A (CTL-6-S-H) | | | | | | C | 0 | 5 |
| | CT for 2 to 50A (CTL-12-S36-8) | | | | | | C | T | 1 |
| | | | | | | | C | T | 2 |

[Table 1] Input type and standard nput range

| Input type | Input code | Measurement range | | Min. measurement unit | | |
|-----------------------|------------|-------------------|----------------------------------|-----------------------|------|-----|
| | | [°C] | [°F] | [°C] | [°F] | |
| Resistance bulb (IEC) | Pt100Ω | 2 | 0 to 150 | 32 to 302 | 0.1 | 0.1 |
| | | 3 | -150 to 300 | -238 to 572 | 0.1 | 0.1 |
| | | 4 | -150 to 850 | -238 to 1562 | 0.1 | 1 |
| Thermocouple | J | 5 | 0 to 400 | 32 to 752 | 0.1 | 0.1 |
| | | 6 | 0 to 800 | 32 to 1472 | 0.1 | 1 |
| | K | 7 | 0 to 400 | 32 to 752 | 0.1 | 0.1 |
| | | 8 | 0 to 800 | 32 to 1472 | 0.1 | 1 |
| | | 9 | 0 to 1200 | 32 to 2192 | 1 | 1 |
| | R | 10 | 0 to 1600 | 32 to 2912 | 1 | 1 |
| | B | 11 | 0 to 1800 | 32 to 3272 | 1 | 1 |
| | S | 12 | 0 to 1600 | 32 to 2912 | 1 | 1 |
| | T | 13 | -199 to 400 | -326 to 752 | 0.1 | 1 |
| | E | 14 | -199 to 800 | -326 to 1472 | 0.1 | 1 |
| | N | 18 | 0 to 1300 | 32 to 2372 | 1 | 1 |
| | PL-II | 19 | 0 to 1300 | 32 to 2372 | 1 | 1 |
| DC voltage * | DC0-5V | 21 | -1999 to 9999 (scaling range) | | - | - |
| | DC1-5V | 22 | | | | |
| | DC0-10V | 23 | | | | |
| | DC2-10V | 24 | | | | |
| | DC±5V | 25 | | | | |
| | DC±10V | 26 | | | | |
| No input | - | 30 | - | - | - | - |
| Resistance bulb (IEC) | Pt100Ω | 31 | -200 to 850 | -328 to 1562 | 1 | 1 |
| | | 32 | -200 to 800 | -328 to 1472 | 0.1 | 1 |
| Thermocouple | J | 35 | -200 to 850 | -328 to 1562 | 1 | 1 |
| | | 36 | -150 to 850 | -328 to 1562 | 0.1 | 1 |
| | | 37 | -200 to 800 | -328 to 1472 | 0.1 | 1 |
| | K | 38 | -200 to 850 | -328 to 1562 | 1 | 1 |
| | | 39 | -150 to 850 | -328 to 1562 | 0.1 | 1 |
| | | 40 | -200 to 800 | -328 to 1472 | 0.1 | 1 |

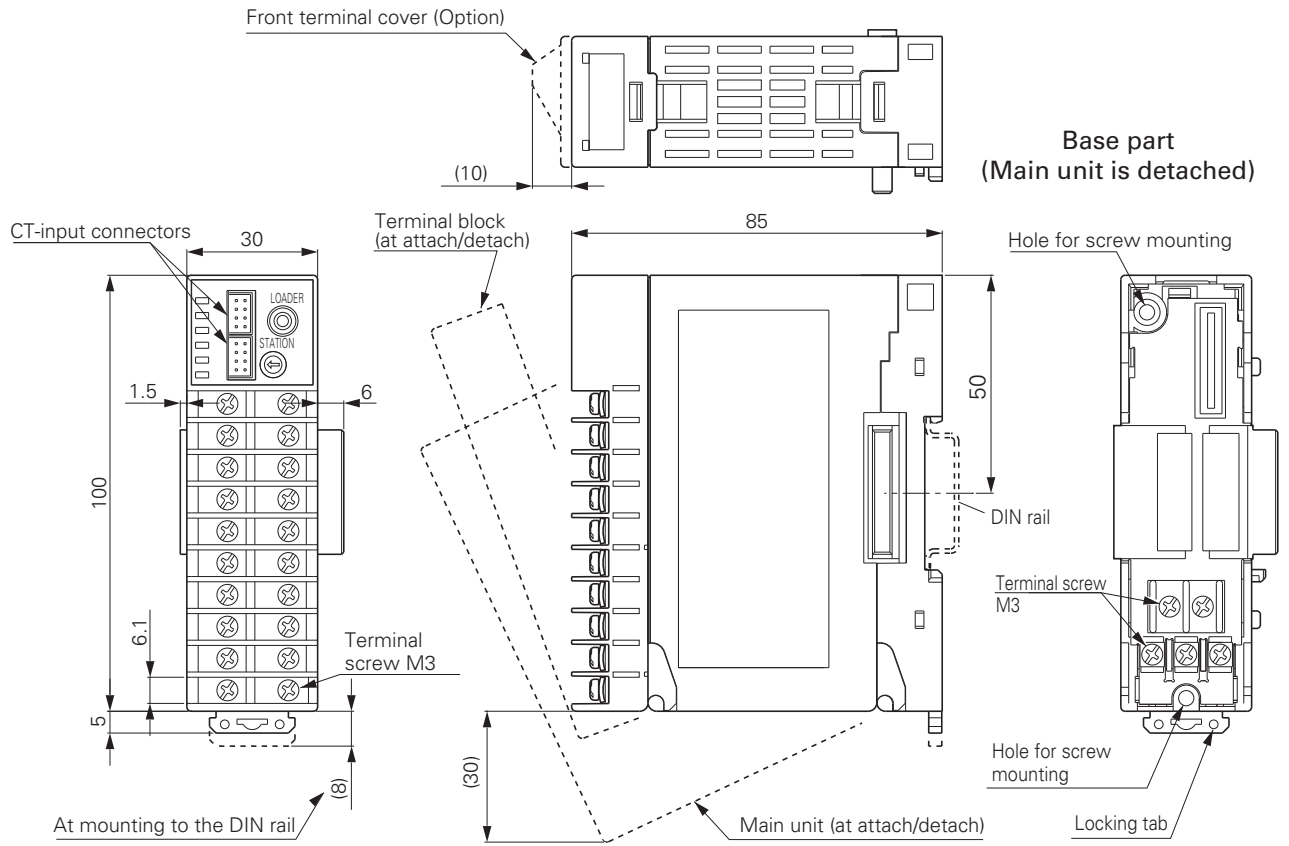
* In case of currenet input, attach I/V unit which comes with the controller to the voltage input terminal.

[Table 2] Insulation block diagram

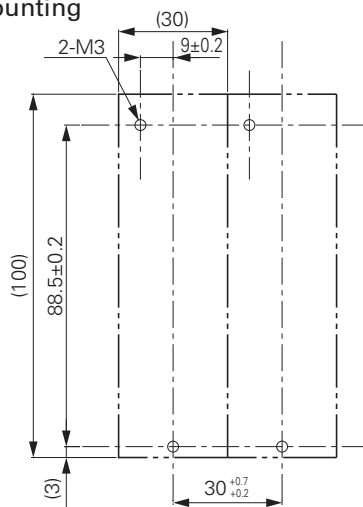
| | |
|-----------------------------|---------------------------|
| Power | PV1 |
| Loader communication port | PV2 |
| RS-485 communication port | PV3 |
| CT Input (CT1A, B - CT4A,B) | PV4 |
| OUT1 (relay contact output) | OUT1 (SSR drive, current) |
| OUT2 (relay contact output) | OUT2 (SSR drive, current) |
| OUT3 (relay contact output) | OUT3 (SSR drive, current) |
| OUT4 (relay contact output) | OUT4 (SSR drive, current) |

- Basic insulation (1500V AC)
- Functional insulation (1000V AC)
- Functional insulation (500V AC)

OUTLINE DIAGRAM (Unit : mm)

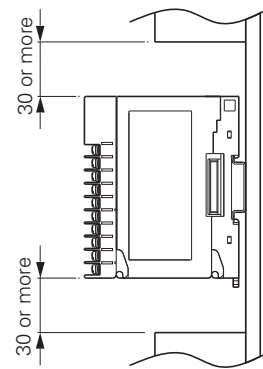


Dimensions for screw mounting



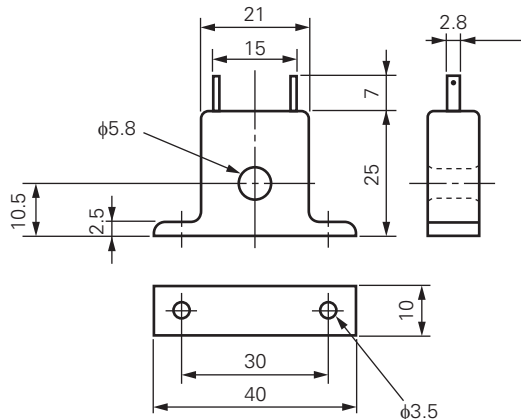
Notice at the installation

Please keep the distance of 30mm from this instrument to radiate.
[50mm is recommended]

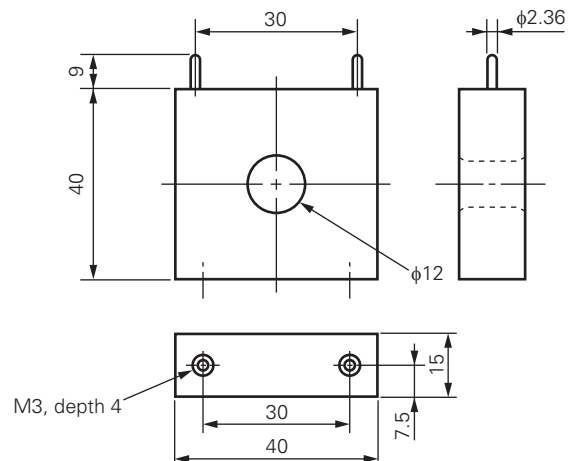


Heater current detector (CT)

Specification : 1 to 30 A
Type : CTL-6-S-H

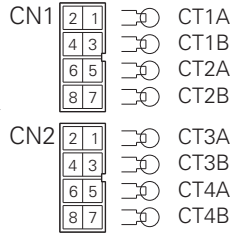


Specification : 20 to 50 A
Type : CTL-12-S36-8



TERMINAL CONNECTION DIAGRAM

CT input connector



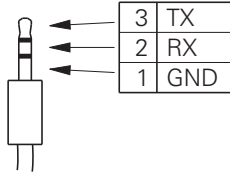
* No. 2, 4, 6 and 8 pins of CN1 and CN2 are connected in the instruments.

* CN2 is not available for model PUMB.

CT input cable connection table

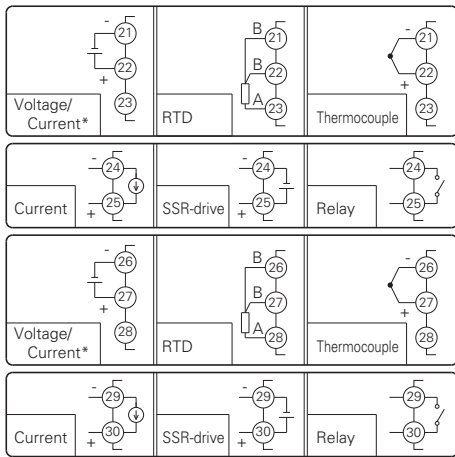
| Pin No. | Cable distinction color | |
|---------|-------------------------|-----------|
| | Cover color | Dot color |
| 1 | Yellow | Red |
| 2 | | Black |
| 3 | White | Red |
| 4 | | Black |
| 5 | Light-gray | Red |
| 6 | | Black |
| 7 | Orange | Red |
| 8 | | Black |

Loader interface plug (RS-232C)

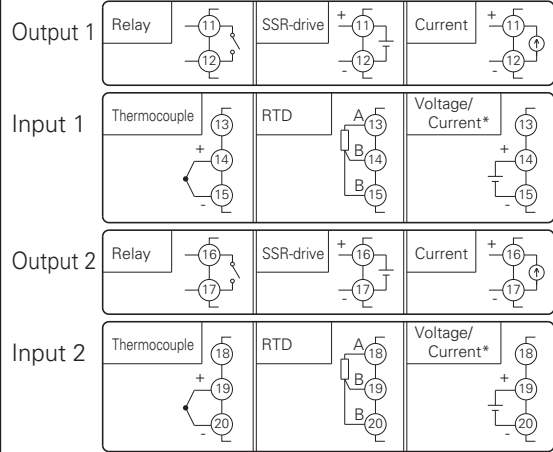
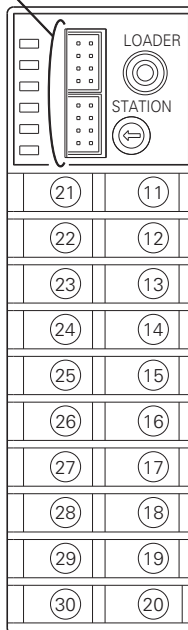


φ2.5 3-pole miniature plug

* Input 3 and Input 4 are not available for model PUMB.

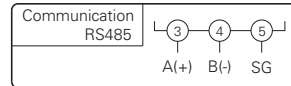
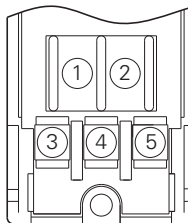


* In case of current input, attach I/V unit which comes with the controller to the voltage input terminal.



* In case of current input, attach I/V unit which comes with the controller to the voltage input terminal.

Base part



⚠ Caution on Safety

*Before using this product, be sure to read its instruction manual in advance.

F Fuji Electric Co., Ltd.

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