

PU23 Series

Three-Phase Power Controller

Overview

PU23 series is a Three-Phase Power Controller having compact size and lighter in weight.

There are two control systems, the phase control system and the zero-cross control system.

In the phase control systems, a type with the constant-voltage, constant-current and constant-power control systems and a type without those feedbacks are available according to the characteristics of heater used.

PU23 series is also capable of advanced three-phase control based on 6-arm control and fine control setting by the setting communications unit.

With the optional display unit (with communications), up to 31 PU23 can connect to a host device like a PC or PLC, allowing their settings and data to be collectively managed.



Features

- **Compact all-in-one configuration**

Narrow width unit enables a closed mounting.

- **Setting communications unit is prepared**

Displaying measured values of real time output voltage, current, electric power, resistances of heaters and also settings of each parameter, switching operation are available.

A unit having communications enable to monitor a data and to set up a parameter by the PC through RS-485.

- **Heater-burnout alarm and current limit are provided as a standard**

(Heater disconnection alarm function is not applicable for SiC heater.)

- **6-arm control employed as standard**

6-arm control is employed to all models to improve controllability.

6-arm control is effective handling imbalanced load, reducing harmonic noise and improving controllability in the transformer load.

- **Various protective functions**

- Thyristor-gate-off at over-current
- Shutting off the power by the rapid fuse at short-circuit
- Thyristor-gate-off at over-temperature of the heat-sink
- Phase-order alarm
- Open-phase alarm

Specifications

Item		Description
General specifications	Phase	Three-phases
	Rated voltage	200 Vac (200 V / 220 V / 240 V selectable by the switch) 400 Vac (380 V / 400V / 440 V selectable by the switch)
	Rated current	10, 20, 30, 50, 75, 100, 150, 200, 250, 300, 400, 500 A, to be specified
	Allowable voltage fluctuation	±10 % of rated voltage
	Rated frequency	50/60 Hz (Automatic setting)
	Allowable frequency fluctuation	±2 Hz of rated frequency
Control input	Control input signal	4 to 20 mAdc (input resistance approx. 100 Ω), 1 to 5 Vdc (input resistance approx. 50 kΩ)
	External setting input	Volume signal (10 kΩ)
	External contact input	External signal mechanical contact or open collector
	External setting types	Ramp(AI1), Output Bias(AI2), Current limit (AI3)
	External contact	Running status (DI1: Run / Stop) Output mode (DI2: Phase angle control / zero-cross firing) Setting method (DI3: Front panel / external setting)
	External CT input	0 to 5 Aac of the rated current (3 pcs of CT are required) Rated current 75 A or less: Selectable a CT built-in model.
Output	Control system	Phase angle firing control system and zero-crossing firing system
	Arms	6-arms
	Output range	Standard type (no feedback): Rated voltage 0 to 98 % Constant-voltage type: Rated voltage 0 to 98 % Constant-current type: Rated current 0 to 100 % Constant-power type: Rated voltage 0 to 98 % x Rated current 0 to 100 %
	Output accuracy	Standard type (no feedback) : Within ± 10 % of rated voltage Constant-voltage type: ±3 % of the rated voltage (Rated voltage is ±10 %, at 1 to 10 times variation load resistance) Constant-current type: Within ±3 % of rated current (Rated voltage is ±10 %, at 1 to 10 times variation load resistance) Constant-power type: Within ±3 % of the rated power (Rated voltage is ±10 %, at 1 to 3 times variation of load resistance) * This is applied when output is 10 to 90 %. This is not including the CT error.
Load specifications	Applicable load	Resistive load, inductive load (The inductive load is applicable only in the control of the primary side of a transformer in the phase angle control method. The flux density recommended for the transformer is 1.2 T or less.)
	Minimum load current	0.5 A or more (at 98 % output at the rated voltage)
Over current protection	Operating	Thyristor-gate-off (in over-current, 120 % or more of rated current. This function is required built-in or external CTs.) Protect by the built-in rapid fuses at short-circuit of load.
Alarm output	Alarmtypes	Over-current alarm (CT built - in or external): LED2 lighting, alarm contact output 1ON Rapid fuse melting alarm (more than 30 A): LED3 lighting, alarm contact output 1ON Heat-sink overheat alarm (more than 200 A): LED4 lighting, alarm contact output 1ON Heater burnout alarm: LED2 flashing, alarm contact output 2ON Abnormal thyristor alarm: LED3 flashing, alarm contact output 2ON Imbalance alarm : LED6 flashing, alarm contact output 2ON Phase-order alarm: LED5 lighting, alarm contact output 3OFF Open-phase alarm: LED5 flashing, alarm contact output 3OFF Frequency alarm: LED5 lighting, alarm contact output 3OFF Operation alarm: LED1 flashing
	Alarm outputs	3 outputs (AL1, AL2, AL3) Alarm output AL1, AL2 ... When the alarm is activated, the output is turned on. Alarm output AL3 ... When the alarm is activated, the output is turned off.
	Alarm output rating	Mechanical relay, Normally open Max. load : 240 Vac / 1 A, 30 Vdc / 1 A Min. load : 5 Vdc / 10 mA or more Electrical life : 100,000 cycle or more
Ramp	Set range	0 % to 100 % of the output range
Output bias	Set range	0 % to 100 % of the output range
Soft start time	Set range	Approx. 1 to 20 sec.
Current limit		0 % to 100 % of the rated current
Imbalance adjustment		Output can be balanced in a range of about ±10 %.
Over-current protection device		Rapid-break fuse is melted down when the load is short-circuited. Output 0 % (gate OFF) at approx. 120 % of the rated current The current limit function can set the upper current limit arbitrarily.
Run / Stop switching		Switching by contact signal
Phase angle control / zero-cross control switching		Switching by contact signal

General specifications	Operating temperature	-10 °C to 55 °C The following derating characteristic is applicable at 40 °C or more. <div style="text-align: center;"> </div>	
	Operating humidity	30 % to 90 % RH, Without condensation.	
	Insulation resistance	Between power supply terminal and protective conductor (GND) terminals: 500 Vdc / 50 MΩ or more	
	Withstanding voltage	Between power supply terminal and protective conductor (GND) terminals: 2000 Vac / 1 min. (200V type)	
	Power loss	Rated current	Max. Power loss
		10 A	40 W
		20 A	90 W
		30 A	140 W
		50 A	180 W
		75 A	260 W
	100 A	380 W	
	150 A	500 W	
	200 A	790 W	
	250 A	920 W	
	300 A	1100 W	
	400 A	1530 W	
	500 A	1980 W	
	Cooling system	Rated current 75 A or less: Natural air cooling Rated current 100 A or more: Forced air cooling	
Operating condition	Standard operating condition	Ambient temperature: 23 °C ±2 °C Operating humidity: 55 % ±5 %RH (No dew condensation) Power voltage: Rated voltage ±1 % Power frequency: Rated frequency	
	Operating condition	Ambient temperature: -10 to 55 °C Operating humidity: 30 % to 90 %RH (No dew condensation) Power voltage: Rated voltage ±10 % Power frequency: Rated frequency ±2 Hz	
		Note: Do not use in an environment where there is a large amount of dust or foreign matter (metal powder, metal chips, carbon fibers, carbon dust or etc.). Take dust-proof measures, if this unit is used with a carbon heater.	
	Weight	Approx. 5 kg (Rated current 10 A / 20 A types) Approx. 8 kg (Rated current 30 A / 50 A types) Approx. 13 kg (Rated current 75 A to 100 A types) Approx. 22 kg (Rated current 150 A to 250 A types) Approx. 36 kg (Rated current 300 A to 500 A types)	

Communication specification (Options)

● Communication protocol

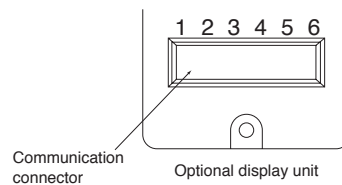
This unit is applied for either RTU mode or ASCII mode. Used mode is selectable by the display unit.

● Communication specification

Item		RTU mode	ASCII mode
Interfaces		RS-485	
Communication type		Half-duplex asynchronous type	
Transmission rate		9600 / 19200 bps	
Communication code		Binary (RTU mode)	ASCII (ASCII mode)
Error check	Vertical direction	Parity	
	Horizontal direction	CRC-16	LRC
Character configuration	Start bit	1-bit	
	Data length	8-bit	7-bit / 8-bit
	Parity bit	None / Even / Odd	None / Even / Odd
	Stop bit	1-bit / 2-bit	
Start code of message		None	: (Colon)
End code of message		None	CR, LF
Data time interval		28-bit time or less	1 sec. or less
Number of setting communication units		Max. 31 units	

● Communication connector

No.	RS-485
1	SA
2	SB
3	Connect to terminal 1
4	Connect to terminal 2
5	SG



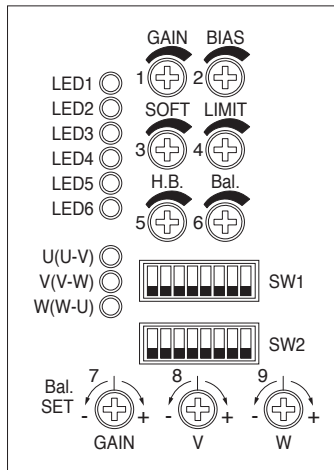
● Optional display unit

Capable of displaying outputs and alarms, setting a heater disconnection alarm, communicating with the host device, and executing other functions.

Item	Description
Setting items	Operation status (Run / Stop), Control type (Phase angle / Zero-cross), Output type (Auto / Manual), Alarm output (ON / OFF), Manual output value, Feedback type, Ramp, Output bias, Soft start, High limit, Low limit, Heater burn-out alarm (ON / OFF), Heater burn-out alarm setting, Heater burn-out alarm detection time, Current limit (ON / OFF), Current limit value, Imbalance alarm (ON / OFF), Imbalance alarm setting, Communication protocol, Communication address, Communication baud-rate, Communication character, Pulse frequency, Scaling, etc.
Measured value display	Output current, Output voltage, Output power, Load resistance value, etc.
Error and Alarm	Error status, Alarm activation display, etc.

Front Panel

● Front setup part



● Functions of the SET trimmers

Trimmer No.	Setting function
GAIN	Ramp (0 to 100 %)
BIAS	Output bias (0 to 100 %)
SOFT	Soft Start (Approx. 1 to 20 sec.)
LIMIT	Current Limit (0 to 100 %)
H.B.	Heater burn-out (0 to 100 %)
Bal.	Imbalance ratio of imbalance alarm (1-40 %)
7	Output gain of imbalance adjustment* : Approx ±40 % of firing
8	V phase output of imbalance adjustment* : Approx ±40 % of firing against gain
9	W phase output of imbalance adjustment* : Approx ±40 % of firing against gain

* It is not output adjustment range. Output adjustment range is approx 10 %.

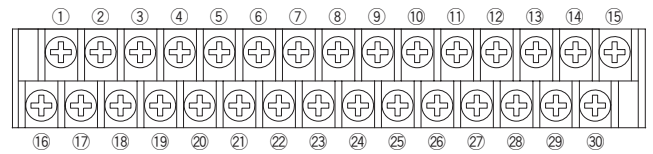
● Function of dipswitch SW1

Bit No.	Setting function
1	Current limit ON / OFF. ON to activate.
2	Heater burn-out alarm ON / OFF. ON to activate.
3	Storage of the initial resistance value for heater burn-out alarm. Initial resistance is measured, during SW is ON. Resistance is stored, when SW is changed to OFF.
4	Imbalance alarm ON / OFF. ON to activate.
5	Alarm output ON / OFF. ON to make the function OFF.
6	Feedback control ON / OFF. OFF to make the FB function OFF.
7	Imbalance adjustment ON / OFF. ON to activate.
8	(Unused)

● Function of dipswitch SW2

Bit No.	Setting function				
1	Logical switching of External contact input 1 (Run / Stop)				
2	Logical switching of External contact input 2 (Phase / Zero-cross)				
3	Logical switching of External contact input 3 (Front panel / Remote setting input)				
4	Individual selection of External setting input : Ramp				
5	Individual selection of External setting input : Elevation				
6	Individual selection of External setting input : Current limit				
7	Selection of power supply voltage	ON	ON	OFF	OFF
8		ON	OFF	ON	OFF
	200 V Line	240 V	220 V	200 V	(unused)
	400 V Line	(unused)	440 V	400 V	380 V

Terminals assignment

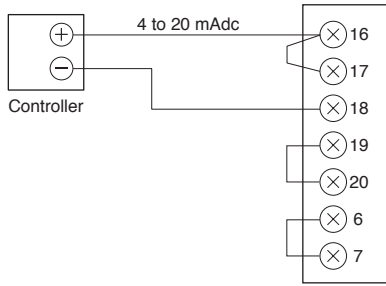


Bit No.	Terminal function
①	External setting input common (AI com)
②	External setting input ref. voltage (AI V-ref)
③	External setting input 1 (AI1)
④	External setting input 2 (AI2)
⑤	External setting input 3 (AI3)
⑥	External contact input common (DI com)
⑦	External contact input 1 (DI1)
⑧	External contact input 2 (DI2)
⑨	External contact input 3 (DI3)
⑩	N•C (Unused)
⑪	N•C (unused)
⑫	N•C (Unused)
⑬	Alarm output 1 (AL1)
⑭	Alarm output 2 (AL2)
⑮	Alarm output 3 (AL3)
⑯	Control input signal (+)
⑰	Control input signal selection (mA / V)
⑱	Control input signal (-)
⑲	Control signal output (OUT)
⑳	Control signal output (IN)
㉑	CT•U (K)
㉒	CT•U (L)
㉓	CT•V (K)
㉔	CT•V (L)
㉕	CT•W (K)
㉖	CT•W (L)
㉗	N•C (Unused)
㉘	Alarm output 1 (AL1)
㉙	Alarm output 2 (AL2)
㉚	Alarm output 3 (AL3)

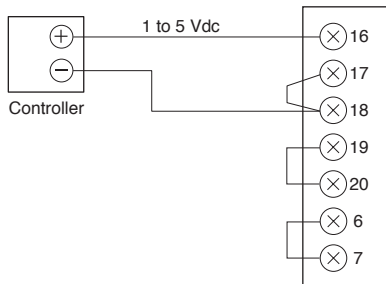
Connection of Setting Terminals

● Control input signal only

Current signal (4 to 20 mA_dc)

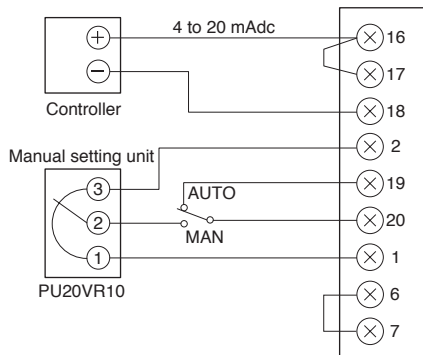


Voltage signal (1 to 5 V_dc)

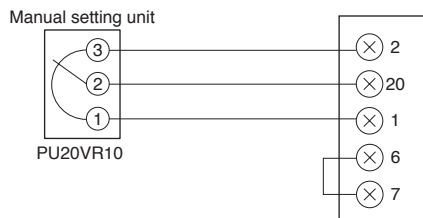


● Manual setting unit and with auto / man switching

Current signal (4 to 20 mA_dc)

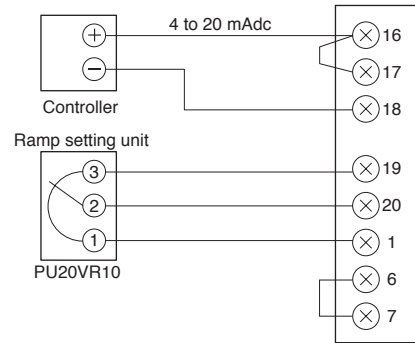


● Manual setting unit only



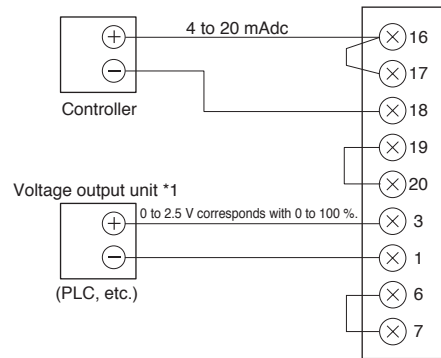
● With ramp setting unit (Ramp using control input signal)

Current signal (4 to 20 mA_dc)



● With ramp setting unit (Ramp using remote setting input)

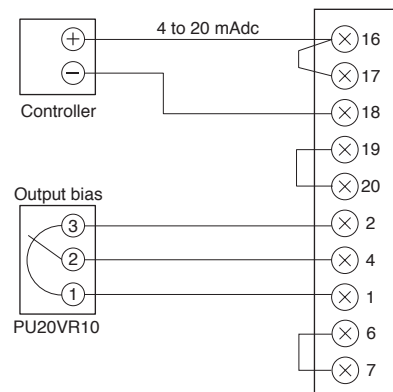
Current signal (4 to 20 mA_dc)



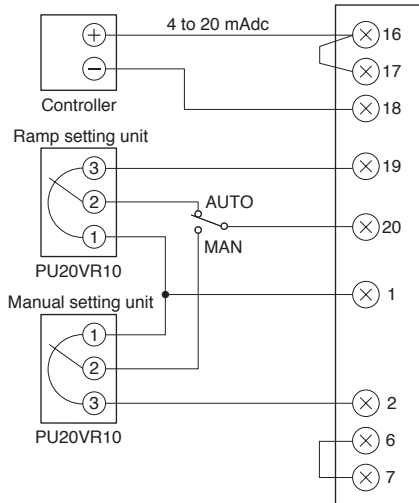
* Output of voltage output unit needs to be insulated to connect multiple units (PU23).
A voltage output unit can not be connected in parallel to multiple units.

● With output bias setting unit

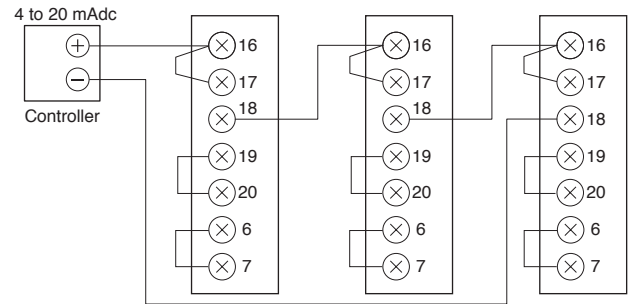
Current signal (4 to 20 mA_dc)



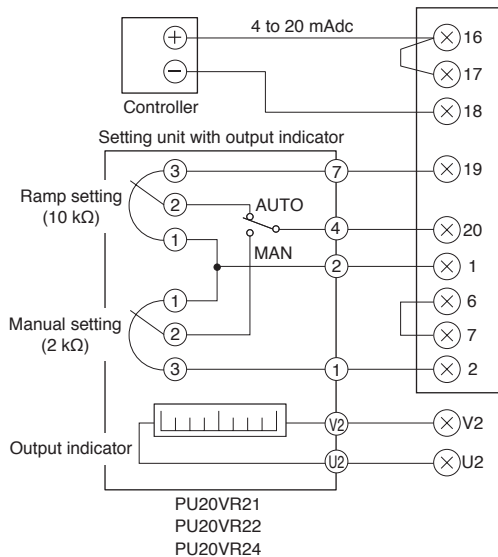
● **Manual setting unit, ramp setting unit with auto / Man switching Current signal (4 to 20 mAdc)**



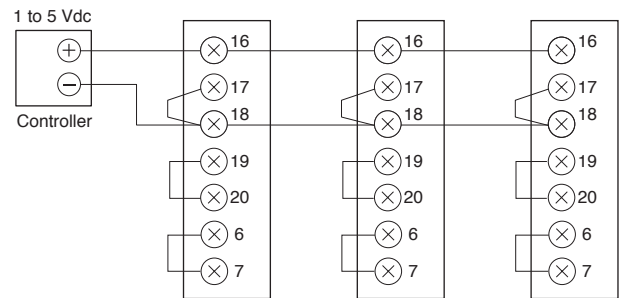
● **Operation of multiple instruments Current signal (4 to 20 mAdc)**



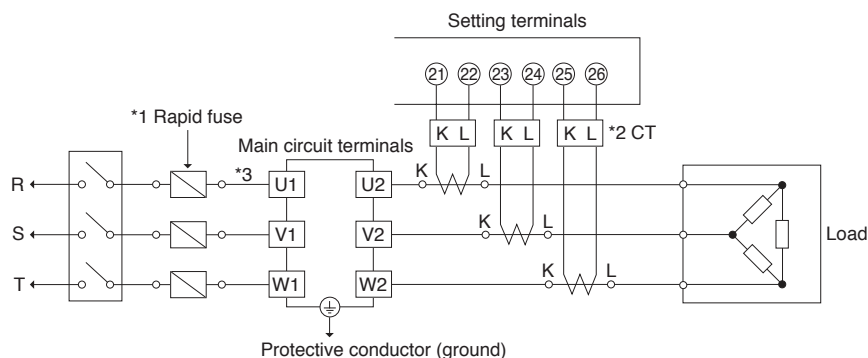
● **Setting unit with output indicator (Cannot be used in zero-cross control) Current signal (4 to 20 mAdc)**



● **Voltage signal (1 to 5 Vdc)**



Connection of external transformer terminals

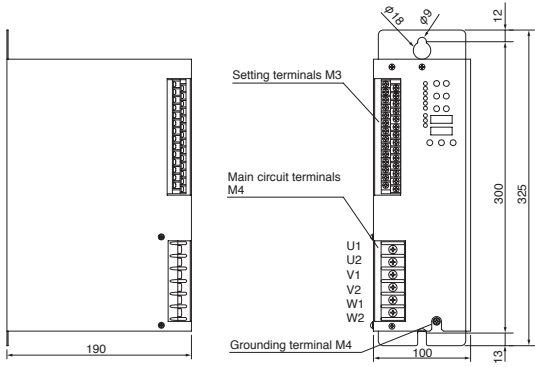


- *1 For models without the rapid-break fuse, make sure to connect a rapid-break fuse externally to protect a system.
- *2 When the CT is not built-in, connect a CT externally if necessary.
- *3 To protect the device from abnormal voltage, such as a surge that has built up in the power supply, connect an arrester or spark killer to the power controller.
- *4 To prevent such damages, connect dummy resistors across the phases on the primary side of the transformer. Use dummy resistors with resistance that can set currents between phases at 0.5 A or more.
- *5 Connect an electromagnetic switch so that the power can be cut off from the system when something is wrong, and use a fail-safe design for the end product.
- *6 This device has no power switch. Connect a rated overcurrent protector, such as a breaker, to the power supply.

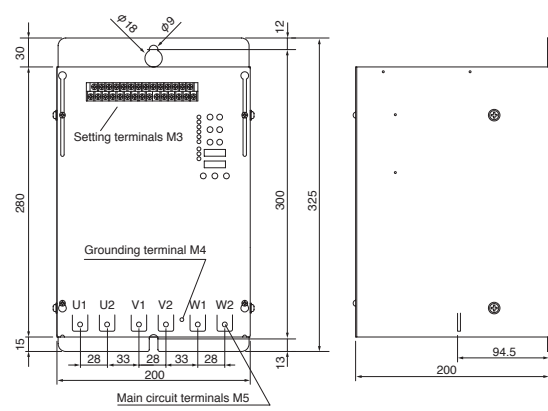
Dimensions

(Unit: mm)

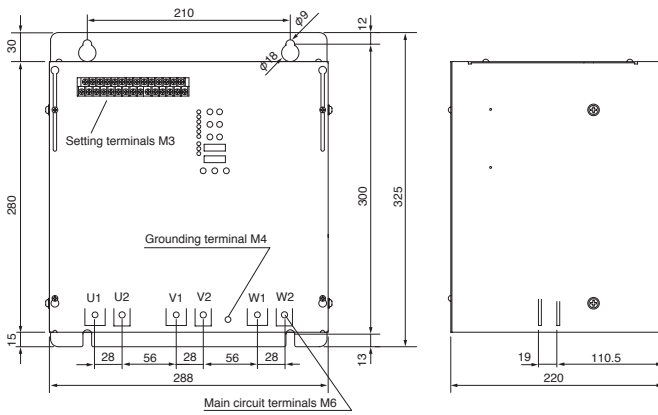
● 10A, 20A



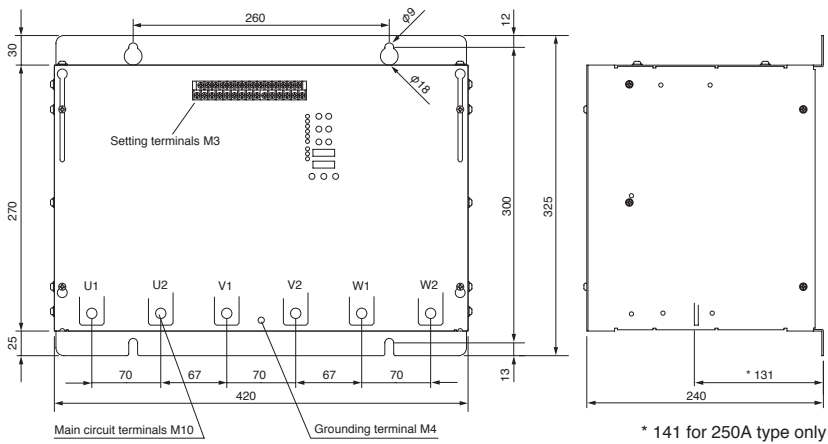
● 30, 50A



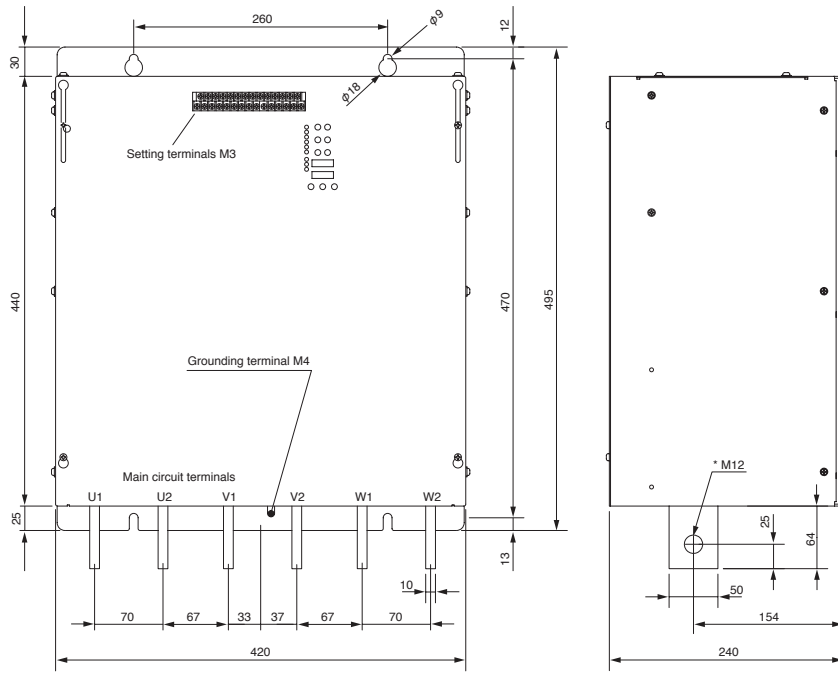
● 75A, 100A



● 150A, 200A, 250A



● 300A, 400A, 500A



* M16 for 500A type only

Model number composition

I II III IV V VI VII VIII Example: PU23A0120N3N1

I	II	III	IV	V	VI	VII	VIII	Description
Basic model No.	Control system	Rated current	Power voltage	Optional display unit	Option	Fuse / Current transformer	Additional processing	
PU23								Three phase power controller
	A							Phase angle control (No feedback) / Zero-cross control
	V							Phase angle control (Constant voltage) / Zero-cross control
	C							Phase angle control (Constant current) / Zero-cross control *3
	P							Phase angle control (Constant power) / Zero-cross control *3
		01						10 A *1
		02						20 A *1
		03						30 A
		05						50 A
		07						75 A
		10						100 A *2
		15						150 A *2
		20						200 A *2
		25						250 A *2
		30						300 A *2
		40						400 A *2
		50						500 A *2
			20					200 / 220 / 240 V
			40					380 / 400 / 440 V
				N				Non optional display unit
				A				Built-in optional display unit (with communication / main body installation)
					3			Heater burn-out alarm + current limit function *3 *4
						N		Fuse: None / CT: None
						F		Fuse: built-in / CT: None *1
						C		Fuse: None / CT: built-in *2
						D		Fuse: built-in / CT: built-in *1 *2
							0	None
							1	With inspection data

*1 When the rated current is 10A model or 20A model is not available built-in rapid fuses.

*2 When the rated current is 100 A or more, not available built-in CTs.

*3 Current transformers (three per Power controller) are required for models with current feedback, power feedback, and heater burn-out alarm + current limit function.

*4 Zero-cross control cannot be used with the current limit function.

Accessories

● Built-in rapid fuse

Basic model No.	Accessory type	Current capacity	Rated voltage	Single-phase / Three-phase	Description	Indication of the body
PU20					Accessories for PU23	
	FU				Fuse	
		000A	4	3	PU23 (Three phase), Fuse for power-input-board 75 to 500 A (3pcs) *1	500SF-4UL
		010A	4	3	PU23 (Three phase) 10 A, Rapid fuse for 200 / 400 V *1 *3	660CF-15UL
		020A	4	3	PU23 (Three phase) 20 A, Rapid fuse for 200 / 400 V *1 *3	660CF-30UL
		030A	1	0	PU23 (Three phase) 30 A, Rapid fuse for 100 / 200 V *2	250GH-50S
			4	0	PU23 (Three phase) 30 A, Rapid fuse for 400 V *2	660GH-50S
		050A	1	0	PU23 (Three phase) 50 A, Rapid fuse for 100 / 200 V *2	250GH-75S
			4	0	PU23 (Three phase) 50 A, Rapid fuse for 400 V *2	660GH-80S
		075A	1	0	PU23 (Three phase) 75 A, Rapid fuse for 100 / 200 V *2	250GH-100S
			4	0	PU23 (Three phase) 75 A, Rapid fuse for 400 V *2	660GH-100S
		100A	1	0	PU23 (Three phase) 10 A, Rapid fuse for 100 / 200 V *2	250GH-160S
			4	0	PU23 (Three phase) 100 A, Rapid fuse for 400 V *2	660GH-160S
		150A	1	0	PU23 (Three phase) 150 A, Rapid fuse for 100 / 200 V *2	250GH-200S
			4	0	PU23 (Three phase) 150 A, Rapid fuse for 400 V *2	660GH-200S
		200A	1	0	PU23 (Three phase) 200 A, Rapid fuse for 100 / 200 V *2	250GH-315S
			4	0	PU23 (Three phase) 200 A, Rapid fuse for 400 V *2	660GH-315S
		250A	1	0	PU23 (Three phase) 250 A, Rapid fuse for 100 / 200 V *2	250GH-350S
			4	0	PU23 (Three phase) 250 A, Rapid fuse for 400 V *2	660GH-350S
		300A	1	0	PU23 (Three phase) 300 A, Rapid fuse for 100 / 200 V *2	250GH-450S
			4	0	PU23 (Three phase) 300 A, Rapid fuse for 400 V *2	660GH-450S
		400A	1	0	PU23 (Three phase) 400 A, Rapid fuse for 100 / 200 V *2	250GHW-630S
			4	0	PU23 (Three phase) 400 A, Rapid fuse for 400 V *2	660GH-630S
		500A	1	0	PU23 (Three phase) 500 A, Rapid fuse for 100 / 200 V *2	250GHW-710S
			4	0	PU23 (Three phase) 500 A, Rapid fuse for 400 V *2	660GH-710S

*1 Rapid fuse only

*2 Rapid fuse and indicator fuse

*3 Cannot be inside the power controller. This is an external fuse. An externally mounted rapid fuse unit set is also available.

● External mounted rapid fuse unit set

Basic model No.	Accessory type	Current capacity	Description	Indication of the body
PU20			Accessories for PU23	
	FST		External mounted rapid fuse unit set (Fuse holder, fuse(3), cover(3))	
		010A	PU23 (Three phase) 10 A, External mounted rapid fuse unit for 200 / 400 V	-
		020A	PU23 (Three phase) 20 A, External mounted rapid fuse unit for 200 / 400 V	-

Accessories

● External current transformer

Basic model No.	Accessory type	Capacity	Description	Note	Indication of the body
PU20	CT		Accessories for PU23		
			Current transformer (CT) *1		
		100AT	For 10, 20, 50, 100 A *2		CPI-1TR 100AT
		150AT	For 30, 75, 150 A *3		CPI-1TR 150AT
		200AT	For 200 A		CPI-1TR 200AT
		250AT	For 250 A		CPI-1TR 250AT
		300AT	For 300 A		CPI-1TR 300AT
		400AT	For 400 A		CPI-1TR 400AT
500AT	For 500 A		CPI-1TR 500AT		

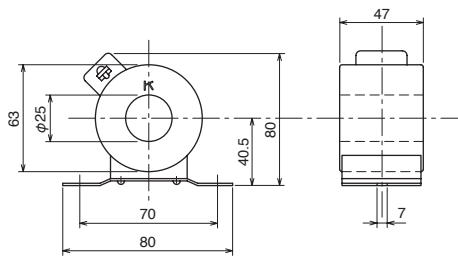
*1 Three current transformers are necessary for a PU23 power controller (three-phase).

*2 Use the power controller with the number of through-turns shown below, as appropriate for the rated current.
10 A : Through-holes 10, 20 A : Through-holes 5, 50 A : Through-holes 2, 100 A : Through-holes 1

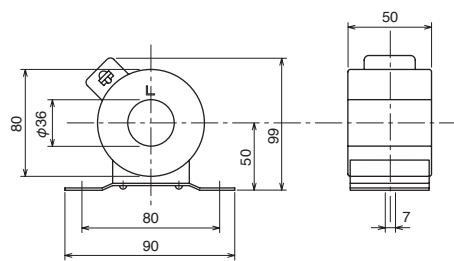
*3 Use the power controller with the number of through-turns shown below, as appropriate for the rated current.
30 A : Through-holes 5, 75 A : Through-holes 2, 150 A : Through-holes 1

(Unit: mm)

• For 10 to 300 A



• For 400 to 500 A

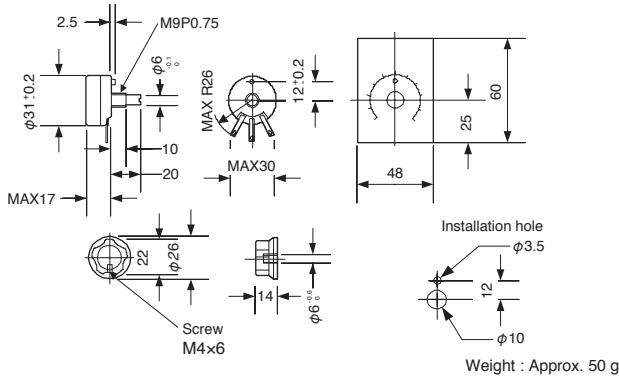


● External setting unit

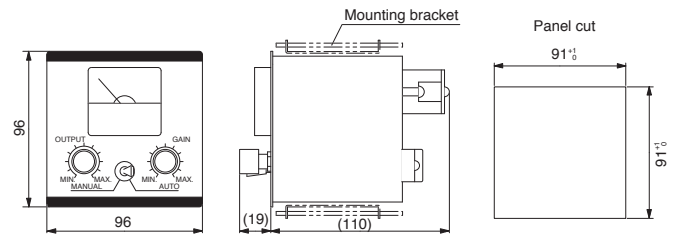
Basic model No.	Accessory type	Kind of the setting device	Rated voltage for indicator	Description	Indication of the body
PU20	VR			Accessories for PU23	
				External setting unit	
	1	0	Variable resistor 10 kΩ Ramp setting, output bias setting, manual setting, current limit setting	-	
	2	2	Voltage indicator (for 0 to 250 V), Manual setting, ramp setting, Auto / Manual selector switch	JAM	
		4	Voltage indicator (for 0 to 500 V), Manual setting, ramp setting, Auto / Manual selector switch	JAM	

(Unit: mm)

• PU20VR10



• PU20VR22, PU20VR24



● Terminal cover

Basic model No.	Accessory type	Three-phase	Type	Description	Indication of the body
PU20	CV			Accessories for PU23	
				Terminal cover	-
		3	1	PU23 (Three phase), Terminal cover for 300, 400, 500 A	-

● Cooling fan

Basic model No.	Accessory type	Type	Description	Indication of the body
PU20	FM		Accessories for PU23	
			Cooling fan	
		002	PU23 (Three phase), Cooling fan for 100 to 200 A	UP12B22
		003	PU23 (Three phase), Cooling fan for 250 to 500 A	UP12D22

Please read the "Terms and Conditions" from the following URL before ordering or use:

<http://www.azbil.com/products/bi/order.html>

Specifications are subject to change without notice.

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