CÔNG TY CỔ PHẦN CÔNG NGHỆ HỢP LONG

Digital Power Controllers

▣ Features

- High speed and high accuracy by digital control using high speed CPU
- Various controls
  - Phase control, feedback control (constant voltage/constant current/constant power)
  - Zero crossing cycle control (fixed/variable cycles)
  - Zero crossing ON/OFF control
- Improved maintainability with built-in fast-acting fuse and easy fuse replacement
- Communication output model: RS485 (Modbus RTU)
- Various control inputs and DI inputs
  - control input: analog (current, voltage), ON/OFF (voltage pulse, no voltage), communication (RS485), potentiometer
  - DI input: AUTO/MAN switching, RUN/STOP switching, Reset, output holding, SP designation (6 setting points can be customized)
- Various alarm output
  - Overcurrent, overvoltage, fuse break, heat sink overheat, device fault, heater break alarm (partial heater break detection)
- Improved convenience by separating operation part
- Applicable load
  - Supercantal, platinum, molybdenum, carbon, halogen lamps, chrome, nickel, etc.

Please read "Safety Considerations" in the instruction manual before using.

▣ Ordering Information

DPU	1	2	A	—	025	R

Option

R	RS485 communication
D	Remote Display Unit
A	Remote Display Unit + RS485 communication
N	No option

Rated load current

025	25A	180	180A
040	40A	200	200A
050	50A	250	250A
070	70A	350	350A
080	80A	400	400A
100	100A	500	500A
120	120A	600	600A
150	150A		

Size

	Single-phase	3-phase
A	0 to 70A	0 to 50A
B	80 to 200A	70 to 200A
C	250 to 350A	
D	400 to 600A	
E	Option	

Power supply

1	110VAC
2	220VAC
3	380VAC
4	440VAC

Control phase

1	Single-phase
3	3-phase

Item

DPU	Digital Power Controller

◎ Size type

• DPU1 Series

(unit: mm)

Size	Current capacity	W	H	D	P1	P2	Allowable cable thickness
A	0 to 70 A	97	260	170	82	150	Min. AWG 4
B	80 to 200 A	140	280	174	127	150	Min. AWG 4/0
C	250 to 350 A	213	338	179	193	200	Min. AWG 300MCM
D	400 to 600 A	278	418	212	261	200	Min. AWG 500MCM

• DPU3 Series

(unit: mm)

Size	Current capacity	W	H	D	P1	P2	Allowable cable thickness
A	0 to 50A	140	306	200	127	150	Min. AWG 4
B	70 to 200A	213	365	217	195	200	Min. AWG 4/0
C	250 to 350A	278	450	227.5	261	200	Min. AWG 300MCM
D	400 to 600A	427	528	275.5	405	330	Min. AWG 500MCM

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■ Specifications

Series	DPU1		DPU3	
Control phase	Single-phase		3-phase	
Power supply	110VAC~ / 220VAC~ / 380VAC~ / 440VAC~ (FAN and control power 220VAC~ 50/60Hz separately)			
Allowable voltage range	90 to 110% of rated voltage		85 to 115% of rated voltage	
Rated frequency	50/60Hz (auto recognition), allowable frequency range: ±2Hz			
Min. load current	1A			
Output range	Phase control: 5 to 98%, Z.C. control: 0 to 100%			
Control method※1	• Phase control: Normal control (non-Feedback), constant voltage/constant current/constant power control (Feedback) • Cycle control (Z.C.): Fixed cycle control, Variable cycle control • ON/OFF control (Z.C.)			
Applied load	• Phase control: resistance load, inductive load • ON/OFF, Cycle control: resistance load			
Power consumption	Max. 7W (except FAN operation power)		Max. 10W (except FAN operation power)	
Display method	• Display value and SV display: 7-segment 4-digit • Status display: 4 LED • Display value percentage display: 11 LED Bar		• Display value and SV display: 7-segment 4-digit • Status display: 6 LED • Display value percentage display: 11 LED Bar	
Output accuracy	• Constant voltage feedback control: Within ±3% F.S. of rated voltage (within variable ±10% F.S. of rated voltage) • Constant current feedback control: Within ±3% F.S. of rated voltage (within variable 1 to 10 times of rated resistance) • Constant power feedback control: Within ±3% F.S. of rated voltage (within variable ±10% F.S. of rated voltage and within variable 1 to 10 times of rated resistance) • Normal control: within ±10% F.S. of rated voltage			
Set method	By front keys, By communication			
Control input	• Auto: 4-20mA / 0-20mA / 0-5VDC⎓ / 1-5VDC⎓ / 0-10VDC⎓ / voltage pulse (0/12VDC⎓ (24VDC⎓)) / no-voltage input (ON/OFF) / communication input (RS485) • Manual: inside 10kΩ adjuster, outside 3 to 10kΩ adjuster (min. 2W)			
Digital input (DI)	AUTO/MAN switching, RUN/STOP switching, RESET, Output holding, SP setting (SP1 to 6)			
Display content	Control input, load voltage, load current, load power, load resistance, power supply frequency			
Min. display output	Min. 2.5% of rated voltage/current			
Option output	RS485 communication output (Modbus RTU method), [max. 32 units]			
Dielectric strength	2,000VAC 50/60Hz for 1 min (between input terminal and power terminal)			
Vibration	0.75mm amplitude at frequency of 5 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Insulation resistance	Over 200MΩ (at 500VDC megger)			
Noise immunity	±2kV the square wave noise (pulse width 1μs) by the noise simulator			
Environment: Ambient temp.	-10 to 50°C, storage: -20 to 80°C			
Environment: Ambient humi.	5 to 90%RH, storage: 5 to 90%RH			
Approval	CE			
Weight※2	• A size : approx. 3.2kg (approx. 3.0kg) • C size : approx. 12.1kg (approx. 11.0kg)	• B size : approx. 5.6kg (approx. 3.0kg) • D size : approx. 19.3kg (approx. 11.0kg)	• A size : approx. 7.6kg (approx. 6.5kg) • C size : approx. 21.1kg (approx. 20.0kg)	• B size : approx. 13.0kg (approx. 11.5kg) • D size : approx. 35.7kg (approx. 30.8kg)

※1. Variable cycle control is only for single-phase model.
※2. The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

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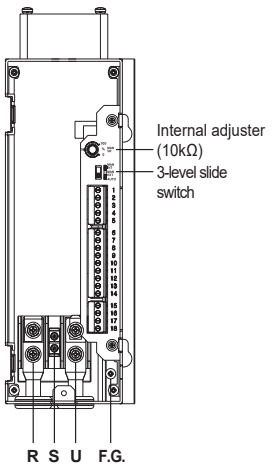
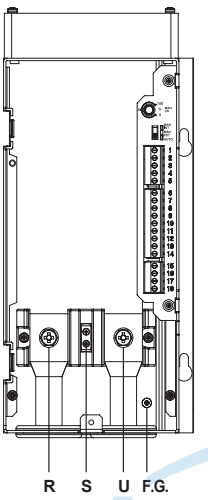
▣ Connections

◎ DPU1 Series

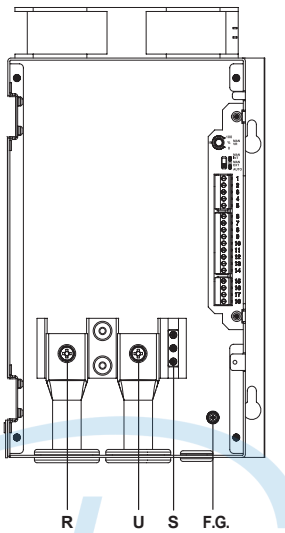
• A Size



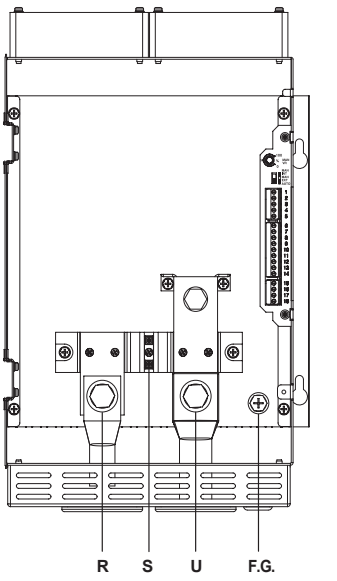
• B Size

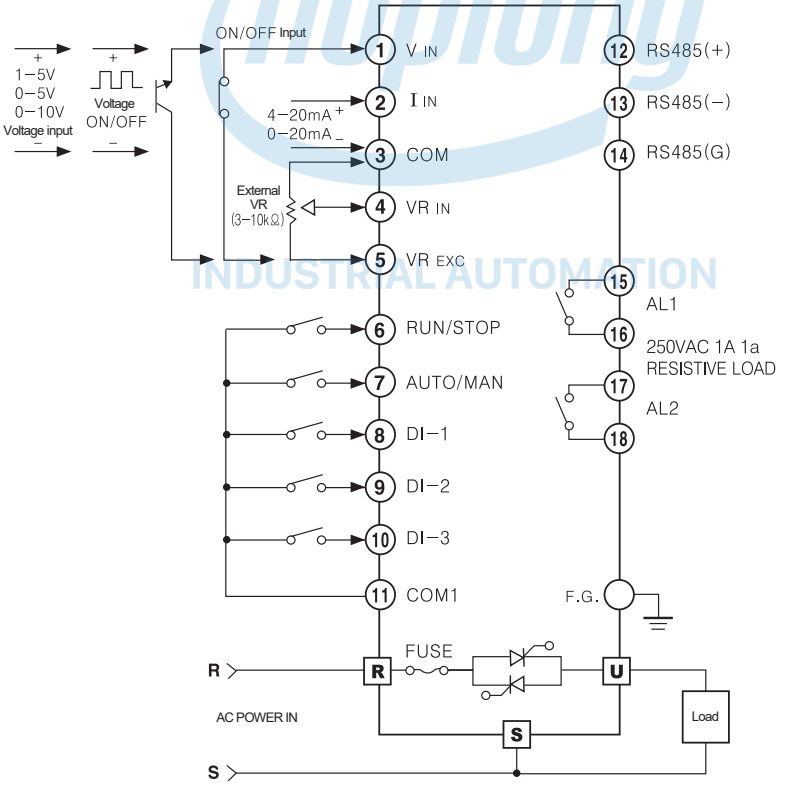


• C Size



• D Size





- Do not mix noise to input cable. It is recommended to use shield cable, twisted cable as input cable for effective noise.
- If there is possible to affect inductive noise, it is recommended to use shielded cable at high-frequency power for effective noise.
- DI input switch should be for low current and ON resistance should be max. 20Ω (including cable resistance).
- DI input terminals are COM, DI-1 to 3, RUN, AUTO.
- For remote display unit option model, use connection cable as our standard cable.
- When connecting ⑥, ⑪ , it operates as MANUAL. When connecting, ⑥, ⑦, ⑪, it operates AUTO.

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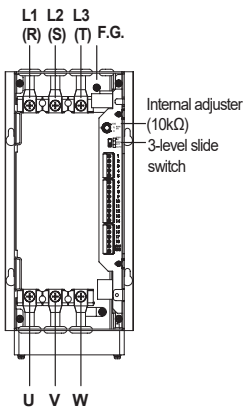
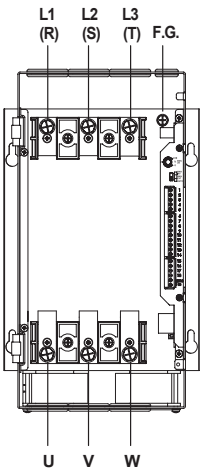
◎ DPU3 Series

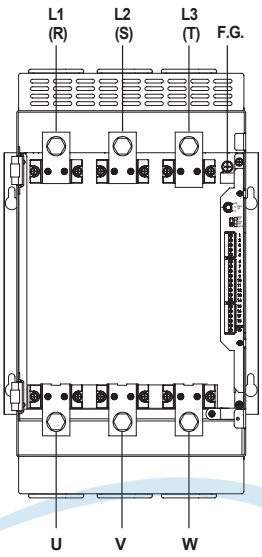
• A Size



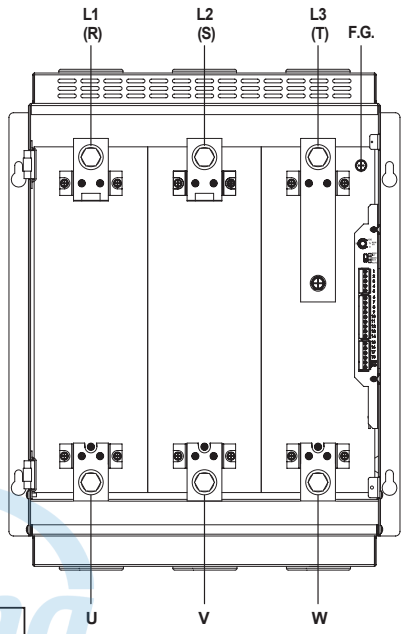
• B Size

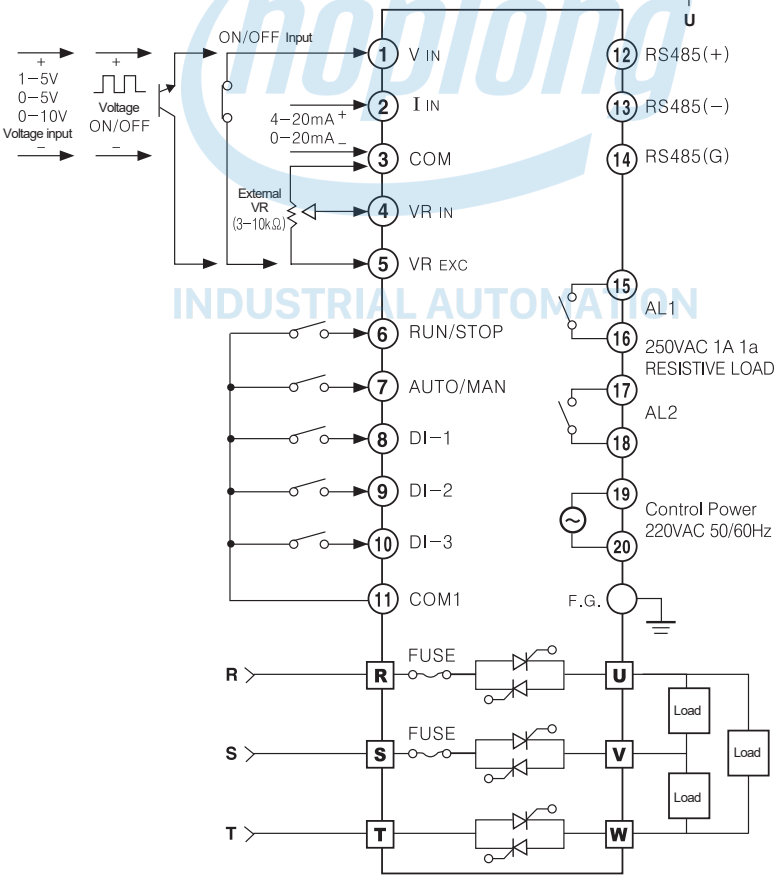


• C Size



• D Size





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- Do not mix noise to input cable. It is recommended to use shield cable, twisted cable as input cable for effective noise.
- If there is possible to affect inductive noise, it is recommended to use shielded cable at high-frequency power for effective noise.
- DI input switch should be for low current and ON resistance should be max. 20Ω (including cable resistance).
- DI input terminals are COM, DI-1 to 3, RUN, AUTO.
- For remote display unit option model, use connection cable as our standard cable.
- When connecting ⑥, ⑪ , it operates as MANUAL. When connecting, ⑥, ⑦, ⑪, it operates AUTO.

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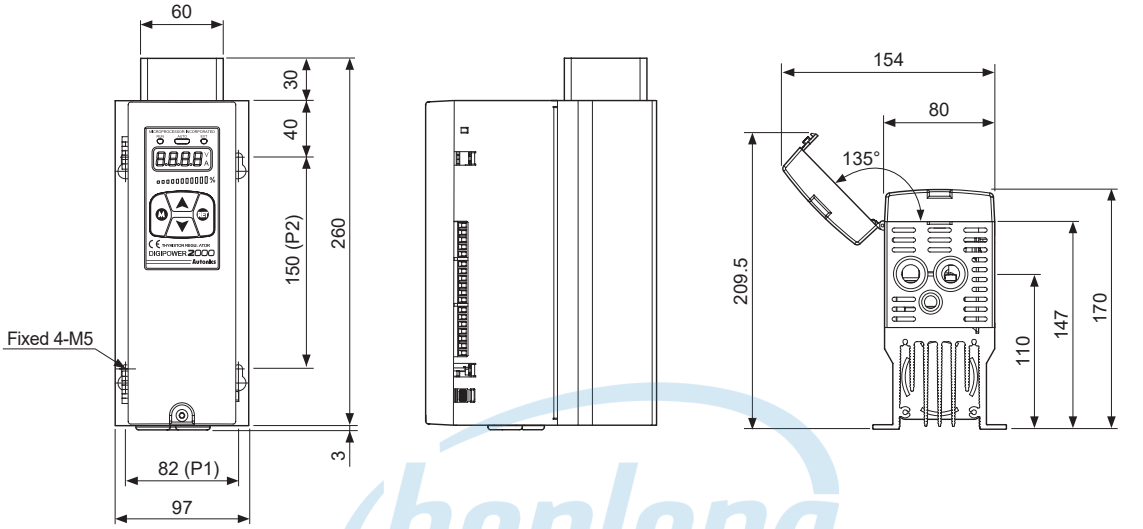
▣ Dimensions

(unit: mm)

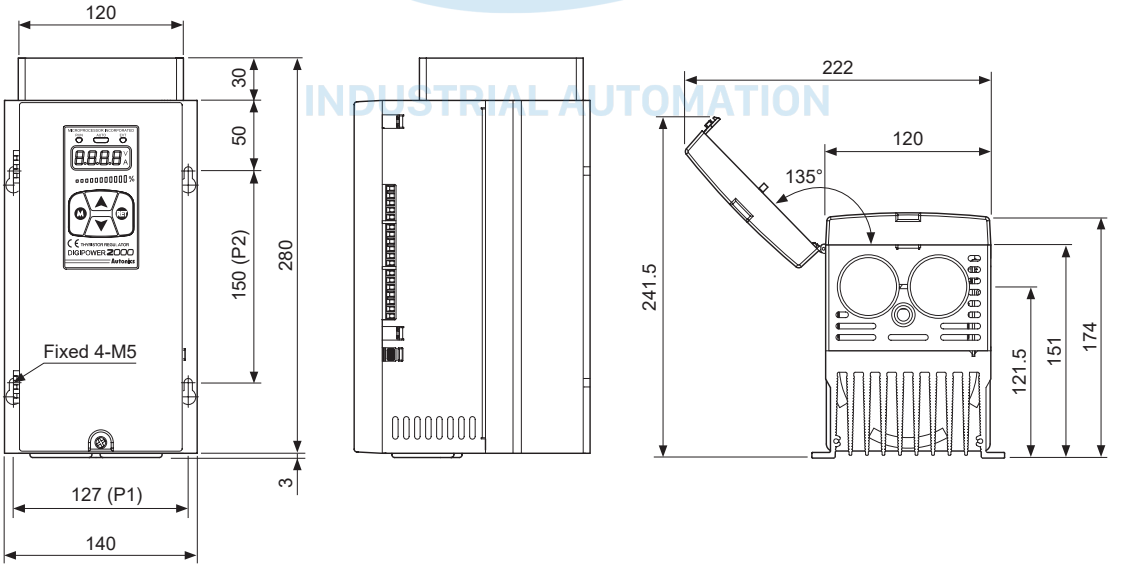
◎ DPU1 Series

- **A Size: DPU1☐A-025/040/050/070**

※25A, 40A, 50A are not attached a fan.



- **B Size: DPU1☐B-080/100/120/150/180/200**



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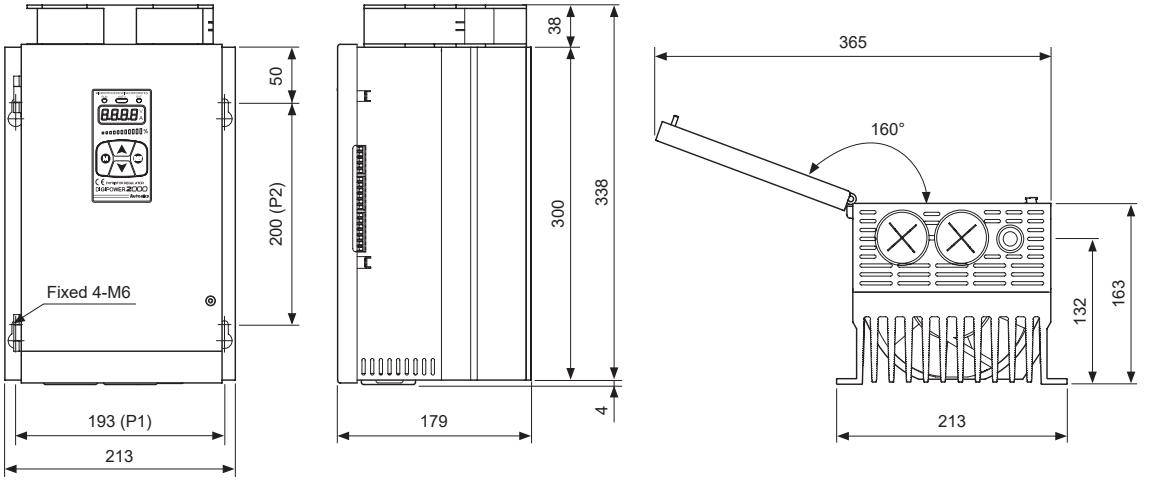
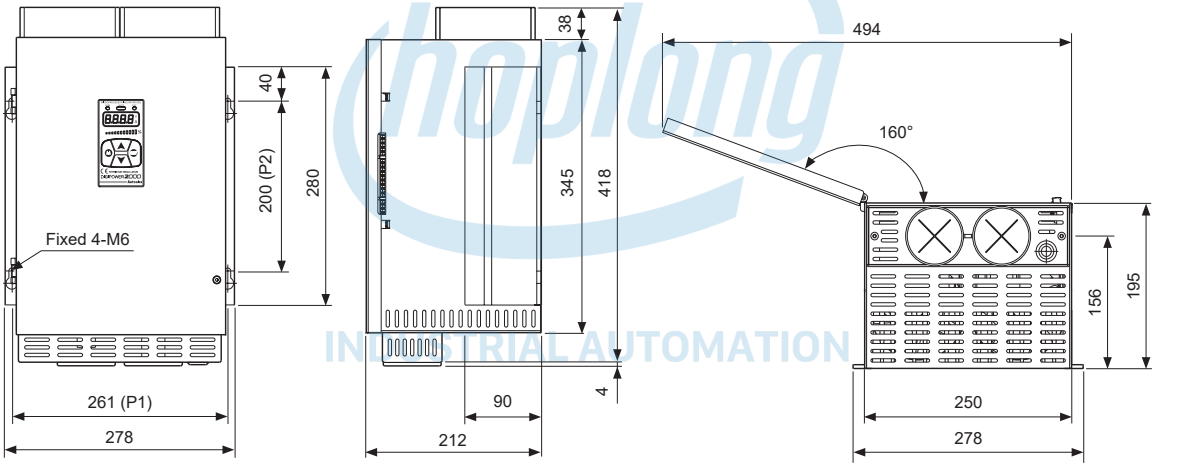
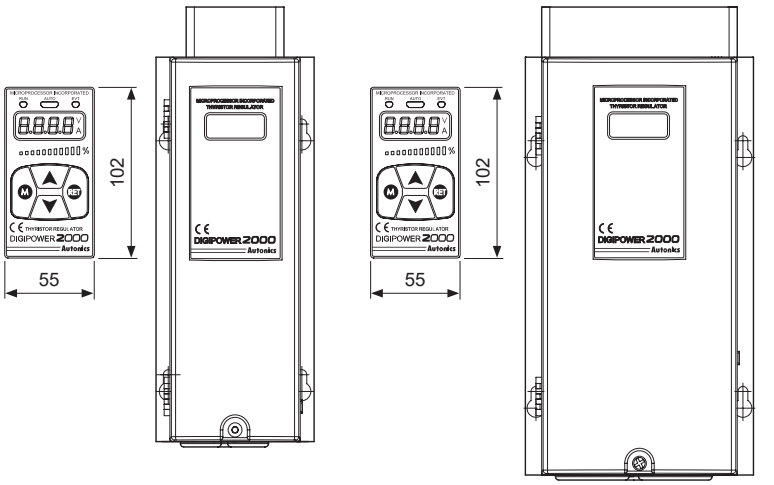
● **C Size: DPU1□C-250/350**



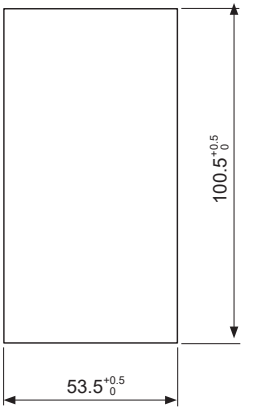
● **D Size: DPU1□D-400/500/600**



◎ **In case of remote display unit + RS485 communication option**



● **Panel cut-out of the display model**



※It is recommended for remote panel cable to use max. 5 m to prevent noise. (Check the length when ordering it.)

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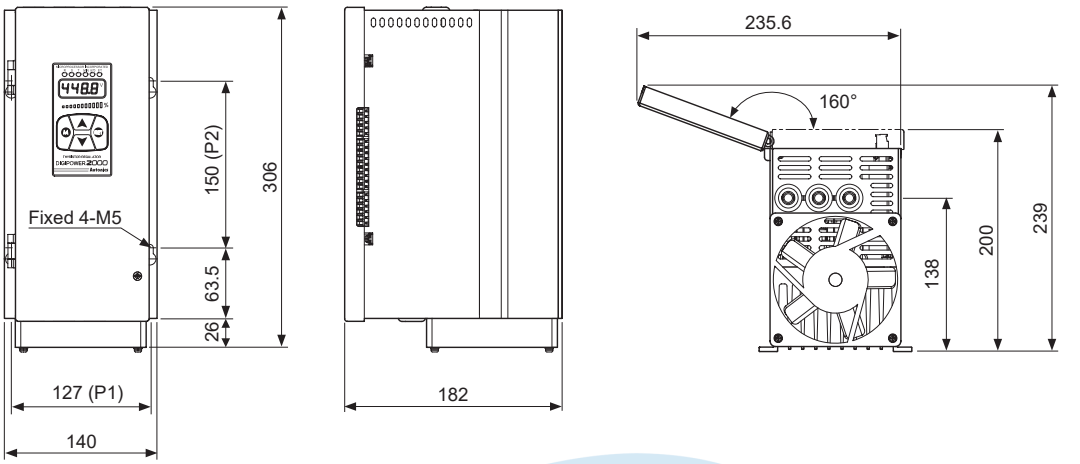
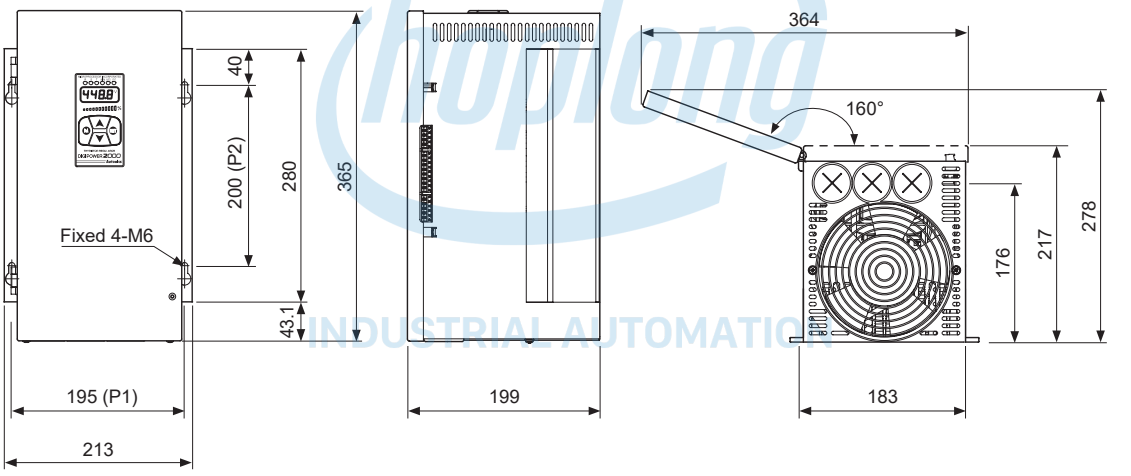
◎ DPU3 Series

(unit: mm)

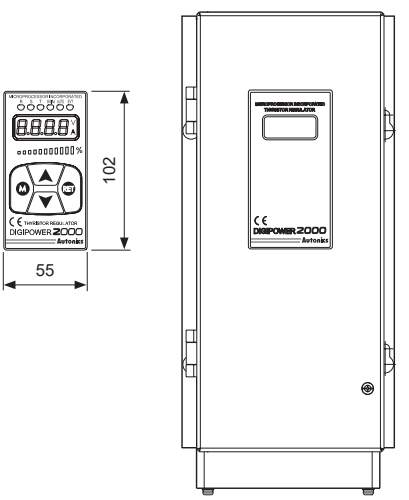
• A Size: DPU3□A-025/040/050



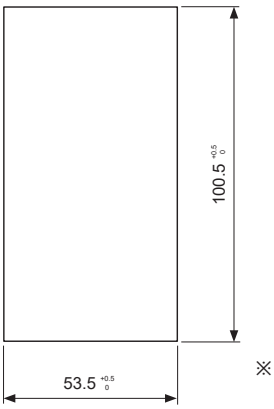
• B Size: DPU3□B-070/080/100/120/150/180/200



◎ In case of remote display unit + RS485 communication option



• Panel cut-out of the display model



※ It is recommended for remote panel cable to use max. 5m to prevent noise. (Check the length when ordering it.)

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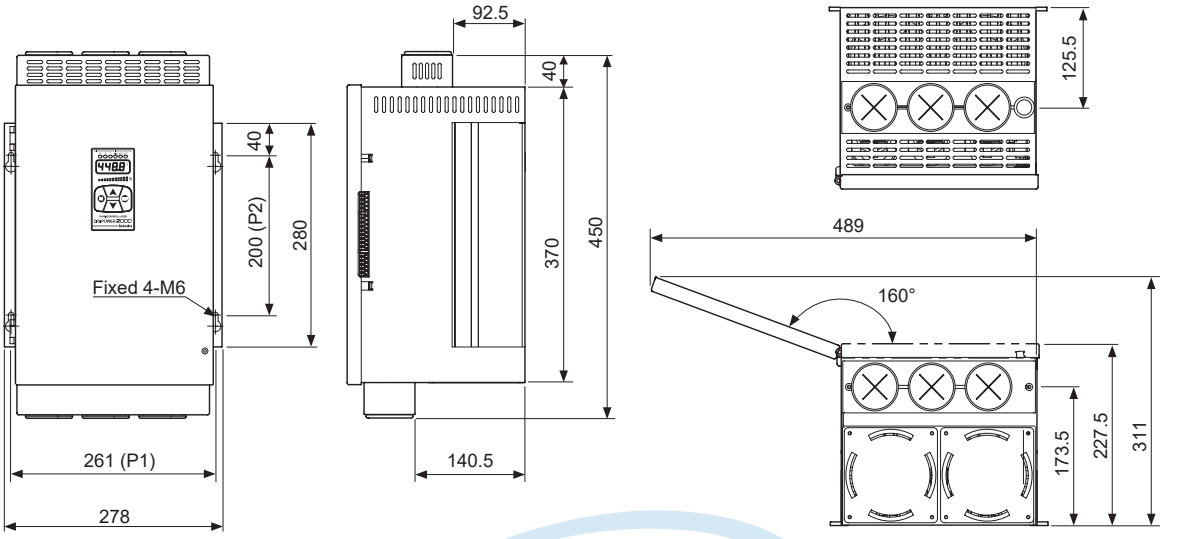
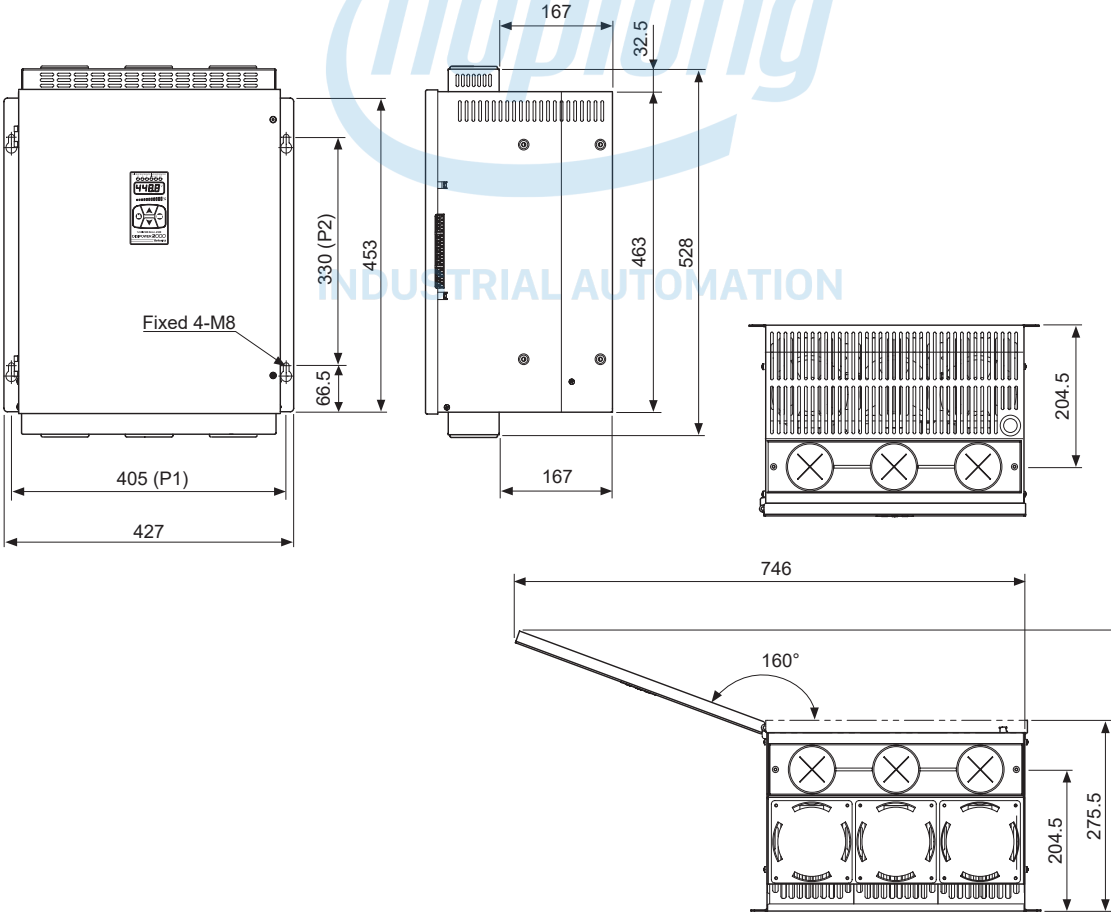
● **C Size: DPU3□C-250/350**



● **D Size: DPU3□D-400/500/600**



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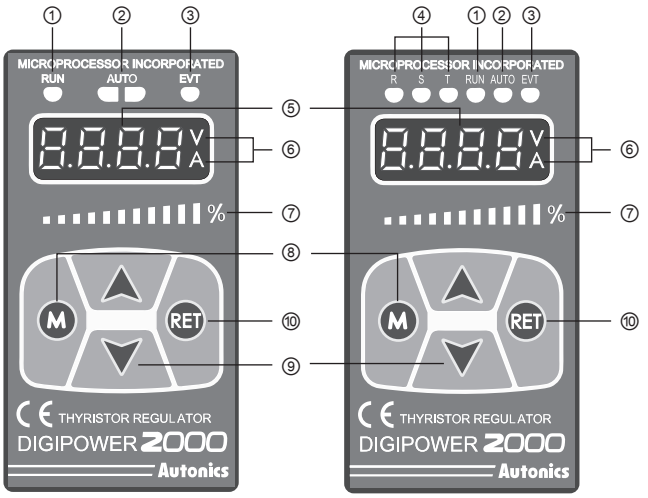
▣ Unit Description



<single-phase> <3-phase>

① RUN indicator: Turns ON in RUN, turns OFF in STOP
② AUTO indicator: Turns ON in AUTO, turns OFF in MANUAL
③ EVT indicator: Turns ON in Digital Input (DI-1 to 3) ON, flashes in alarm output
④ R, S, T indicators: Turns ON differently by displayed value in display part
E.g.) When R, S turn ON, it displays voltage between R-S line
⑤ Display part: Displays selected display value content in RUN mode, displays parameter and set value in SET mode
⑥ V, A indicators
: The V indicator turns ON when displaying voltage.
The A indicator turns ON when displaying current.
The V, A indicators turn ON when displaying power.
The V, A indicators turn OFF when displays resistance and input value.
⑦ Bar display: Turns ON as 0 to 100% ratio for selected display value
⑧ M key: Used to enter parameter mode, monitoring mode and to move between parameters
⑨ ▲,▼ key: Used to move setting modes and to set parameters.
⑩ RET key: Used to return to RUN mode from SET mode

▣ Control Input

◎ Input type

Type					Parameter
AUTO input	Analog input	Current	4-20mA	Input impedance 100Ω	4-20
			0-20mA		0-20
		Voltage	1-5VDC	Input impedance 25Ω	1-5
			0-5VDC		0-5
			0-10VDC		0-10
	ON/OFF input	Voltage pulse	0/12VDC		SSr
		No-voltage pulse	ON/OFF	—	
	Comm. input	RS485	—	—	Con
MANUAL input		Internal adjuster	10kΩ	—	—
		External adjuster	3 to 10kΩ	—	—

◎ Input selection

In AUTO input, select it at control input type[In-P] at setting mode1.
In MANUAL input, set output slope manual adjustment [A-GA] in operating mode as OFF and select the input by the inside 3-level slide switch.

• Output slope manual adjustment [A-GA] as oFF
: Select the input by the inside 3-level slide switch

Type		Description
MAN INT / MAN EXT / AUTO	MAN INT	Adjust output slope with the inside adjuster
	MAN EXT	Adjust output slope with an outside adjuster
	AUTO	No function

◎ AUTO/MANUAL selection by terminal input (DI) [terminal 7 and 11]

When the AUTO/MAN terminal input is ON (close), it is AUTO input operation. When it is OFF (open), it is MAN (manual) input operation.
When the AUTO/MAN terminal input is OFF (open) (MANUAL operation), only INT or EXT input selected by the 3-level slide switch is available.

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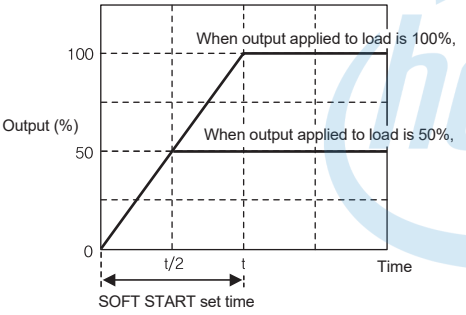
▣ Functions

◎ SOFT START [SF-t]

When controlling the load which has inrush current (platinum, molybdenum, tungsten, infrared lamp, etc) in power ON, or when control input changes rapidly, it prevents the load to increase output gradually within the set time. Set the time for soft start.
Regardless of control method setting (phase control or cycle control), it operates as phase control.
Set the time to reach output from 0 to 100%.
It operates when it is RUN mode from STOP status after supplying power or reset. When it reaches to the target output value, soft start function ends.
Soft start set time (t) is the time up to 100% increase of output applied to load. When the final target output value is 50%, taken time to reach is t/2.
Reaching time to the final target output value = Target output (%)× t

※ E.g.) SOFT START time: 25 sec, final target output: 80%
0.8×25 = 20 sec

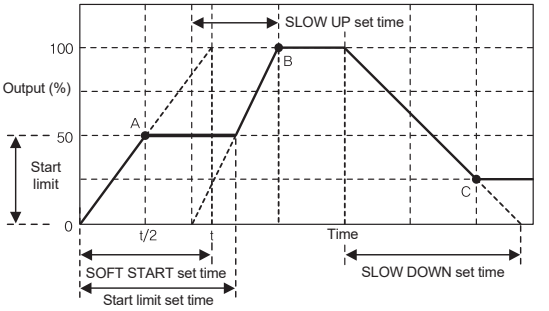
- Setting range: 0 to 100 sec (0 sec: not using this function)



◎ Start limit [SLn] and start limit time [SLt]

When power is ON, changing to RUN status from STOP status, or alarm reset, set limit output value and time to prevent the inrush current or error current.
Regardless of control method setting (phase control or cycle control), it operates as phase control.

- Setting range for start limit: 0 to 110% of output
- Setting range for start limit time: 0 to 100 sec
(0 sec: not using this function)

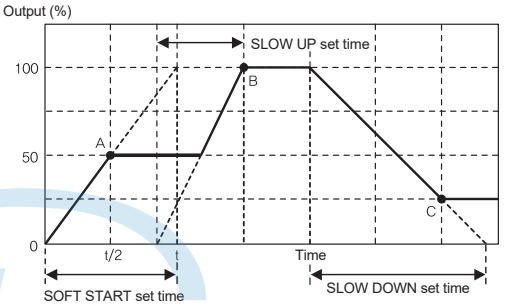


- A: SOFT START function ends
- B: SLOW UP function ends
- C: SLOW DOWN function ends

◎ SLOW UP / SLOW DOWN [UP-t / dn-t]

It is same purpose as soft start function. Soft start starts only one time at first but slow up/slow down function start during operation.
Regardless of control method setting (phase control or cycle control), it operates as phase control.
When it reaches to the target output value, slow up/slow down functions end.

- Setting range: 0 to 999 sec
(0 sec: not using this function)

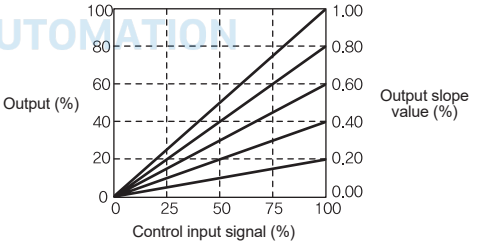


- A: SOFT START function ends
- B: SLOW UP function ends
- C: SLOW DOWN function ends

◎ Output slope setting [SLoP]

This function is to set output changed ratio by control input from 0.00 to 1.00 range.

- Output value when setting slope: Input (%)×Slope value



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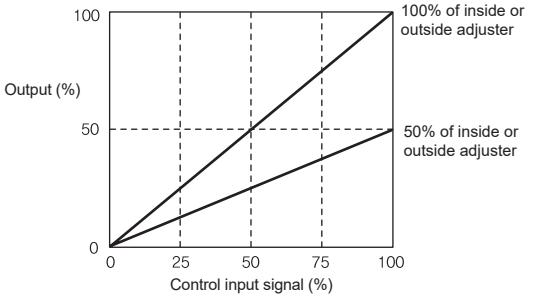
▣ Functions

◎ Output slope manual adjustment [A-GA]

This function is to adjust manually (inside or outside adjuster) output value ratio for control input.
When AUTO operation and output slope manual adjustment [A-GA] is set as ON, [SLoP] is not able to set.
It displays slope value by the inside or outside adjuster input.



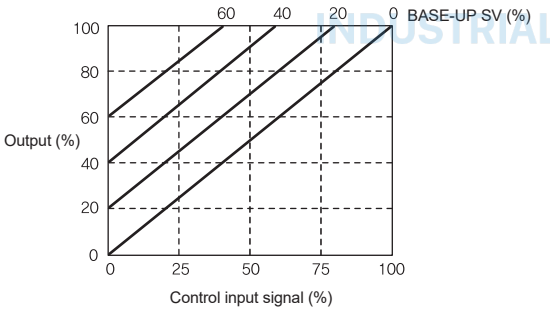
● **Output slope manual adjustment [A-GA] as oN**
: Set output slope by the inside 3-level slide switch

Type		Description
MAN INT / MAN EXT / AUTO	MAN INT	Adjust output slope with the inside adjuster
	MAN EXT	Adjust output slope with an outside adjuster
	AUTO	No function

◎ BASE-UP [b-UP]

This function is to add base-up set value to input signal.
It is available only when output low-limit value is 0%.
It is limited by start limit value at initial start.

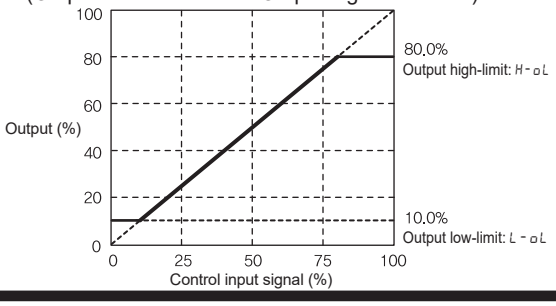
- Setting range: BASE-UP SV (%) < Output high-limit value
- Output value for BASE-UP setting
  : Input (%)×Slope value+ BASE-UP SV



◎ Output high limit value [H-oL], Output low limit value [L-oL]

This function is to limit output range to protect load.

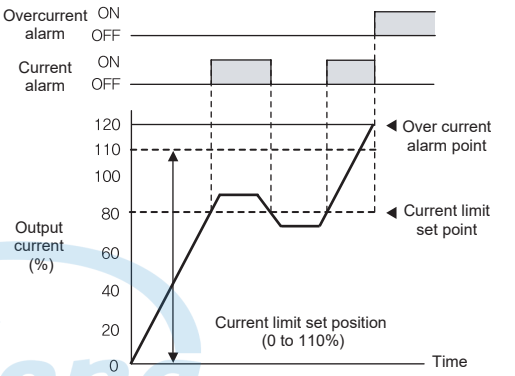
- Setting range: 0 to 110%
  (Output low limit value < Output high limit value)



◎ Current limit [C-Lm]

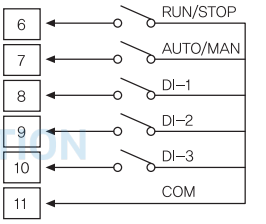
It operates when normal, constant voltage, constant current mode of phase control.
When using the load which has high inrush current, it restrains the current to protect thyristor.
Especially, in case of voltage feedback, only voltage current, it may over the rated current of thyristor because current flows by resistance value of the load. To prevent over the rated current, limit the current.

- Setting range: 0 to 110% of rated current



◎ Digital input (DI)

Below functions are available by terminal input.
Digital input has five terminals; AUTO/MANUAL terminal, RUN/STOP terminal, and DI-1 to 3 terminals.
Select the function for each input terminal of DI-1 to 3.



● **AUTO/MANUAL selection [terminal 7 and 11]**

Select AUTO (close)/MANUAL (open) input by terminal input.
AUTO mode controls output according to control input as analog input (voltage, current) or ON/OFF input (including SSR pulse input).
MANUAL mode controls according to control input as the inside adjuster adjustment or an outside adjuster adjustment.
When selecting AUTO (close), the front AUTO indicator turns ON or selecting MANUAL (open), the front AUTO indicator turns OFF.

● **RUN/STOP switching [terminal 6 and 11]**

Select RUN (close)/STOP (open) operation status by terminal input.

RUN mode operates as the set contents by control input.
STOP mode is standby status.

When selecting RUN (close), the front RUN indicator turns ON or selecting STOP (open), the front RUN indicator turns OFF.

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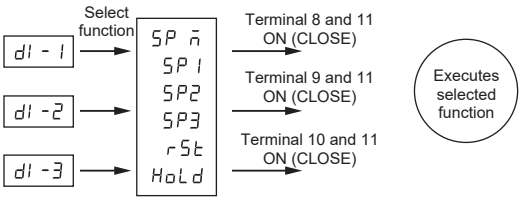
• Digital input (DI-1 to DI-3) setting [terminal 8, 9, 10 and 11 (COM)]

Select the each function for each digital input at parameters [dI - 1, dI - 2, dI - 3].
When setting ON (close) to DI input, the front EVT indicator turns ON or setting OFF (open), the front EVT indicator turns OFF.
As below, there are 6 functions to select.
※ SP n is available only in dI - 1.



• RESET [rSt]

After selecting RESET function, turn digital input ON (close) and open, this unit resets and re-starts.

• HOLD [HoLd]

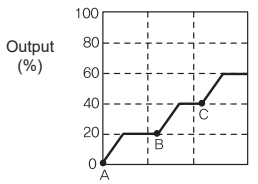
After selecting HOLD function and digital input is ON (close), output and display value of this unit is hold. (it operates hold when digital input maintains ON (close) status.)

• Single SP [SP 1, SP2, SP3]

Set [SP 1, SP2, SP3] to each digital input for output to reach to the relevant SP.
It is available to set individually at [dI - 1, dI - 2, dI - 3], and duplicated setting is allowed.
When setting SP 1, SP1 is displayed in operating mode, same as SP2 and SP3.
When this function is not set, the parameters to set SP in operating mode are not displayed.

※E.g.)

dI - 1	dI - 2	dI - 3	Operating Mode SP value set parameter
SP 1	SP2	SP3	SP 1 (e.g.: 20%)
			SP2 (e.g.: 40%)
			SP3 (e.g.: 60%)



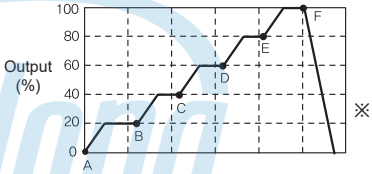
- A: When dI - 1 is ON
- B: When dI - 2 is ON
- C: When dI - 3 is ON

• Multi SP [SP n]

It is available to set total 6 SPs and to control output depending on 3 digital inputs' setting.
This function is selectable only in [dI - 1]. When selecting [SP n] at [dI - 1], [dI - 2, dI - 3] parameters are not displayed.
When selecting [SP n] at [dI - 1], 6 parameters to set SPs are displayed in operating mode.
(SP 1, SP2, SP3, SP4, SP5, SP6)

※E.g.) ※ ○: Close, ×: Open

	dI - 1	dI - 2	dI - 3	Operating Mode SP value set parameter
A	○	×	×	SP 1 (e.g.: 20%)
B	×	○	×	SP2 (e.g.: 40%)
C	○	○	×	SP3 (e.g.: 60%)
D	×	×	○	SP4 (e.g.: 80%)
E	○	×	○	SP5 (e.g.: 100%)
F	×	○	○	SP6 (e.g.: 0%)
G	○	○	○	—



※ A, B, C, D, E, F : Close/Open status of Digital Input

◎ Proportional and integral constant set of feedback control

Proportional Integral Control:
This is the combination of proportional control and integral control. Proportional control operates soft control without overshoot and hunting for the set value. Integral control modifies offset automatically to reach the set value stably. The optimal values of proportional constant and integral constant are set as factory defaults. When changing proportional constant and integral constant, it may cause response delay in feedback control or overshoot or hunting.

• Proportional constant set [P]

It compensates error from the target value proportionally. If proportional constant value is small, response is fast and it may cause overshoot or hunting. If proportional constant value is big, response is slow.
- Setting range: 1 (0%) to 2000 (100%)

• Integral constant set [I]

It compensates cumulative error from the target value. The set integral constant is the time when proportional value and integral value are equal.
If integral constant value is small, response is fast and it may cause overshoot or hunting. If integral constant value is big, response is slow.
- Setting range: 0.1 to 999.9 sec

※P, I parameters are displayed when control mode is constant voltage, constant current, constant power mode in phase control.

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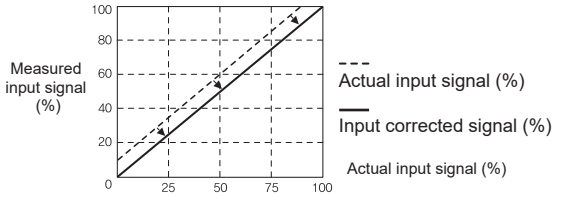
▣ Functions

◎ Input correction [I n-b]

It compensates the offset between actual input value and measured input value.

- Setting range: -99.9 to 99.9%

※E.g.) Input type is 4-20mA,
When 4mA is applied and the input monitor value displays, set [I n-b] as -0.5 and the input monitor value displays as 0.0%.

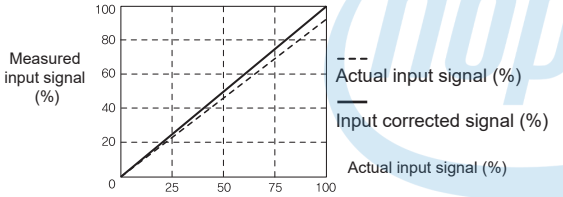


◎ Input slope correction [SPAn]

It compensates the gain of the measured 100% input for actual 100% input value.

- Setting range: -99.9 to 99.9%

※E.g.) Input type is 4-20mA,
When 20mA is applied and the input monitor value displays 99.5%, set [SPAn] as 0.5 and the input monitor value is 100.0%.



◎ Display value content selection [d ISP]

You can select display value content for the display part in RUN mode.

- Display range
  - Single-phase: [Ld-u], [AnAP], [PU], [rEF]
  - 3-phase: [U-u], [u-V], [V-U], [LA-U], [LA-u], [LA-V], [PU], [rEF]

◎ Bar graph content selection [bAr]

You can select display value content for the bar graph.

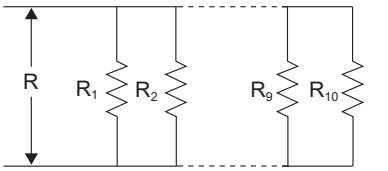
- Display range
  - Single-phase: [Ld-u], [AnAP], [PU], [rEF]
  - 3-phase: [U-u], [u-V], [V-U], [LA-U], [LA-u], [LA-V], [PU], [rEF]

◎ Load resistance display method [drES]

This function is for display load resistance [rES] into a percentage in monitoring mode when disconnecting the parallel load. You can select this value as increase rate of load resistance [UP] or as decrease rate of number of loads [doWn].

※Decrease rate of number of loads [doWn] displays correct decrease rate only when the connected each load resistance is same.

E.g.)Each of R_1 to R_{10} is 10Ω and load resistance (R) is 1Ω,
When disconnecting R_1 to R_5,



① Increase rate of load resistance[UP]
It is based on 100% of load resistance (R), 1Ω. When disconnected R_1 to R_5, load resistance is 2 Ω and load resistance [rES] in monitoring mode displays 200%.

② Decrease rate of number of loads [doWn]
It is based on 100% of 10 loads (R_1 to R_{10}). When disconnected R_1 to R_5, the number of load are 5 (R_6 to R_{10}) and load resistance [rES] in monitoring mode displays 50%.

◎ Alarm

Alarm	Parameter	Operation	Clear alarm
Overcurrent alarm	o-C	Stops output (SCR OFF)	· Re-supply the power. · RESET (RET key) · Switch to STOP mode
Overvoltage alarm	o-u		
Fuse break alarm	FUSE	※1	
Heatsink overheat alarm	tEnP	Stops output (SCR OFF)	
Element error alarm	SCr		
Heater break alarm	HbE	Continues operation	Automatically cleared within the setting range

※1: For single-phase model, output stops.
For 3-phase model, when 1-phase break, it maintains output and when 2-phase break, it stops output.

◎ Lock [LoCK]

This function is to limit parameter set value check and change.
Set this parameter lock function to enter setting mode1.
When setting this parameter lock as LoC2 or LoC3, only parameter lock is displayed in setting mode 1.

Parameter	oFF	LoC1	LoC2	LoC3
Operating Mode set group	●	●	●	◐
Setting Mode 2 set group	●	●	◐	◐
Setting Mode 1 set group	●	◐	○	○

●:Enable to check and set, ◐:Enable to check/Disable to set,
○: Disable to check

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◎ Heater disconnection alarm [Hb-A]

When load resistance display method is set as [UP], it is over the set value, this alarm occurs.
[H-bE] and display value flashes for 2 sec in turn in the display part and EVT lamp flashes for 0.5 sec.
Even though heater disconnection alarm occurs, control operation continues.
It is cleared automatically when the value is below the SV of heater disconnection alarm value.

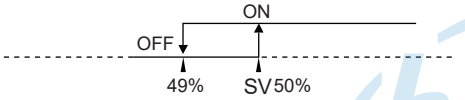
● Heater disconnection alarm value setting [Hb-u]

Regardless of control method (phase control, cycle control), it operates. For the accurate operation, over 10% of control output (phase control, cycle control) and over 30% of rated current are required.

- Setting range: 10 to 500%

Hysteresis of heater disconnection alarm is fixed as 1% for ON/OFF interval.

E.g.)When SV for heater disconnection alarm is 50%, alarm turns ON at 50%, alarm turns OFF at 49%.



◎ Full load auto recognition [F-Ld]

When operating load recognition function, it outputs 100% for 3 sec. Do not use this unit to the device which has problem 100% output of load.
Set [F-Ld] as on in setting mode 1 [St-1] group and press the M key, load auto recognition function operates.
According to secular changes of the load, execute this function regularly.

※Be sure that when auto recognition starts, it operates 100% output for 3 sec.

※Caution

Do not execute this function as on without profession's consultations. When executing this function, voltage, current outputs fully. Be sure that it may cause damage to the load.

When using special load using low voltage and high current such as (super)tantalum, SiC, molybdenum, tungsten, etc, it may cause heater break alarm [H-bE]. This alarm does not have problem in operation but it occurs when it does not detect the load when using as low voltage. Set the below notes to clear the alarm.

Note>When using special load such as (super) tantalum, SiC, molybdenum, tungsten, H-bE alarm clear method:

- Set load resistance display method [drES] as UP in setting mode 1 [St-1].
- Set heater break alarm value [Hb-u] as 500 in setting mode 2 [St-2].

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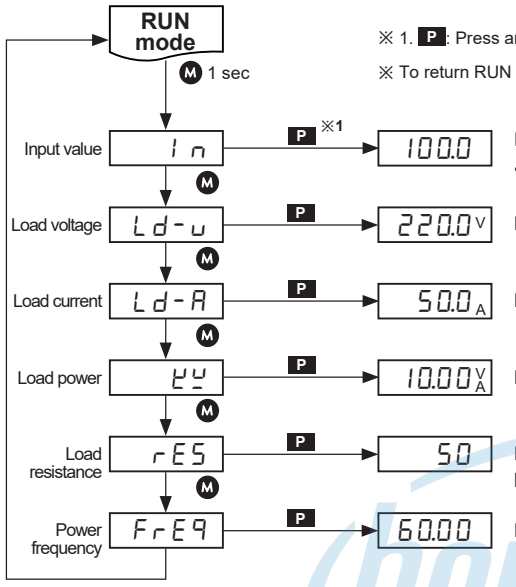
▣ Monitoring Mode

Monitoring mode can monitor measured several physical quantities of this unit, not set parameters.

◎ DPU1 Series



※ 1. P: Press any key among ▲, ▼.

※ To return RUN mode, press the RET key at any parameter, or not to operate any keys in 30 sec.

For ON/OFF input, or SSR pulse input, it displays 0 or 100.
• Setting range: Within 0.0 to 100.0%

Monitors measured voltage at load within the rated voltage range.

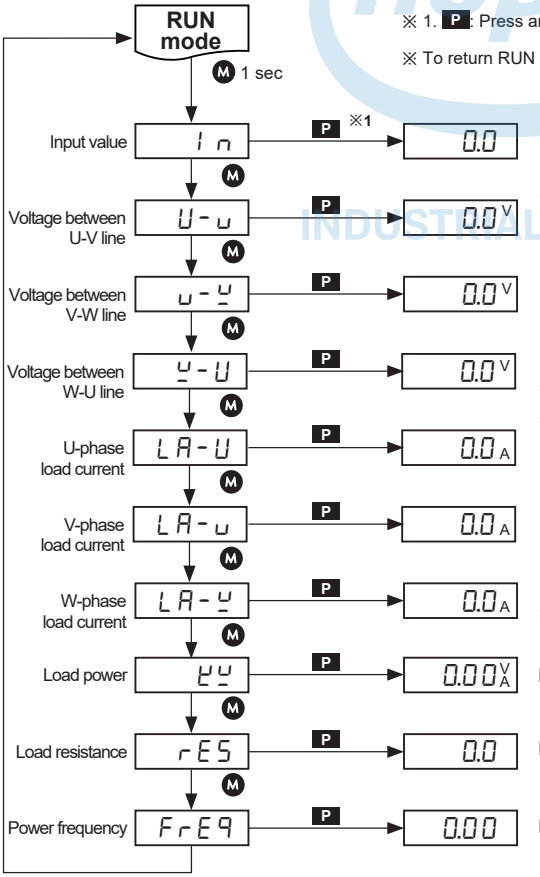
Monitors measured current at load within the rated current range.

Monitors measured power at load within the rated power range.

Displays measured resistance at load for initial set resistance as percentage

Displays frequency of power

◎ DPU3 Series



※ 1. P: Press any key among ▲, ▼.

※ To return RUN mode, press the RET key at any parameter, or not to operate any keys in 30 sec.

For ON/OFF input, or SSR pulse input, it displays 0 or 100.
• Setting range: Within 0.0 to 100.0%

Monitors measured voltage at load within the rated voltage range.

Monitors measured current at load within the rated current range.

Monitors load power output at 3-phase.

Displays LLLL, 10 to 500%, HHHH.

Displays frequency of power within 45.0 to 65.0Hz range

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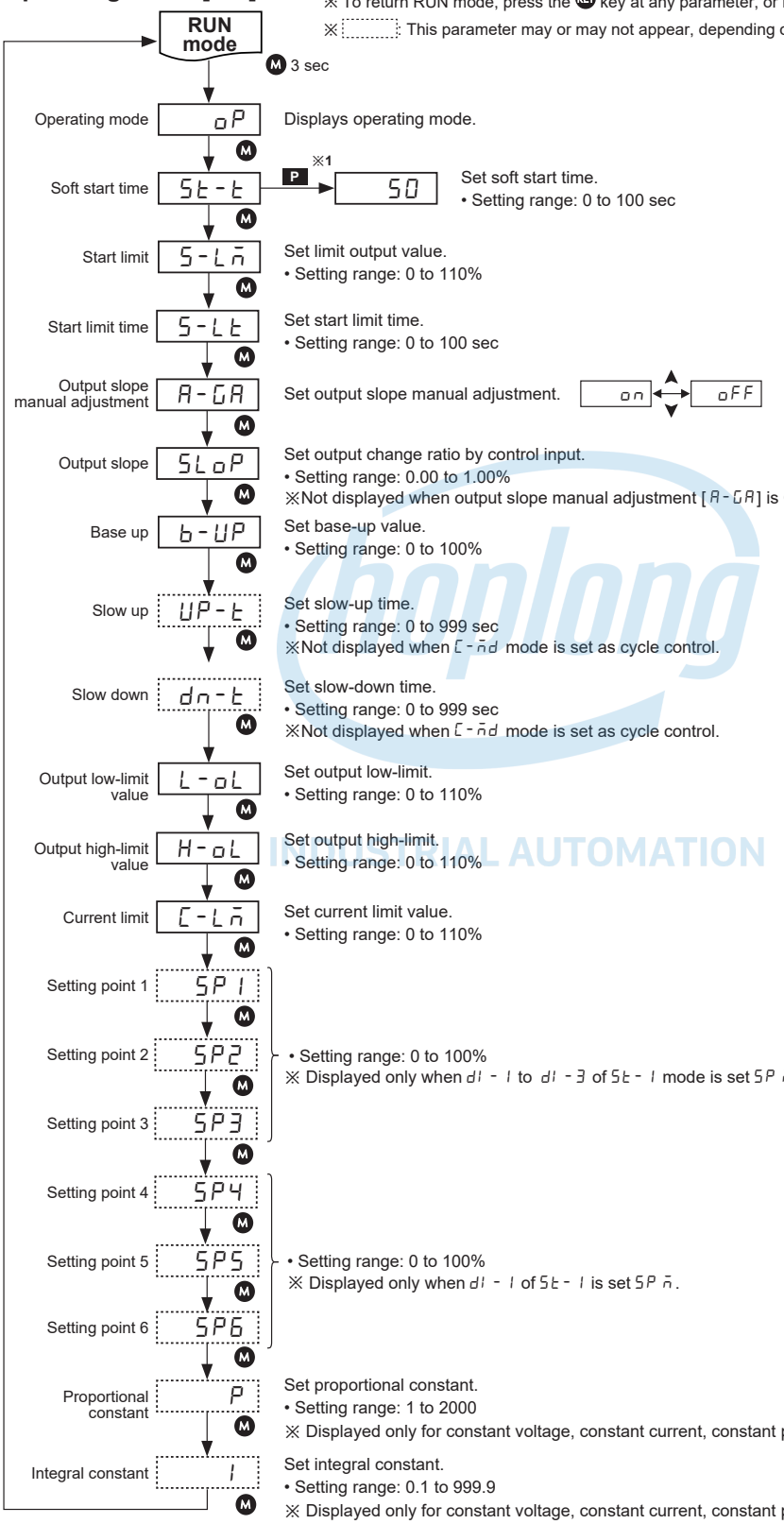
▣ Parameter Mode

◎ Operating Mode [oP]

※ 1. P: Press any key among ▲, ▼.
※ To return RUN mode, press the RET key at any parameter, or not to operate any keys in 30 sec
※ [ ]: This parameter may or may not appear, depending on the other parameter settings.



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◎ Setting Mode 1

※ 1. P: Press any key among ▲, ▼.
※ If there is no operation any keys in 30 sec, it returns to RUN mode.
※ Press the RET key when entering 5t-1 setting mode in any parameters, it moves to 5t-1.
Press the RET key once more, it returns to RUN mode.
※ When setting [LoCK] as LoC2 or LoC3, and entering 5t-1, it displays only [LoCK] parameter.
※ ..... This parameter may or may not appear, depending on the other parameter settings.

RUN mode
M 3 sec

Operating Mode: oP
Setting Mode 1: 5t-1 — Displays setting mode 1.

Control input type: In-P — P → 4-20 (※1) — Select input type.

Control method: C-md — Select control method.
※ Variable cycle control[u-CY] is only for single-phase model.
PA ↔ u-Fb ↔ C-Fb ↔ Y-Fb ↔ F-CY ↔ u-CY ↔ onoF

DI-1 function: dI-1
DI-2 function: dI-2
DI-3 function: dI-3
Select digital input.
※ Multi SP function [SPn] is available only in dI-1.
SPn ↔ SP1 ↔ SP2 ↔ SP3 ↔ rSt ↔ Hold

Input correction: In-b — Set input correction value.
• Setting range: -99.9 to 99.9%

Input slope correction: SPAn — Set input slope correction value.
• Setting range: -99.9 to 99.9%

Display value content: dI SP — Select display value content.
1-phase: Ld-u ↔ AnP ↔ YY ↔ rEF
3-phase: U-u ↔ u-V ↔ V-U ↔ LA-U ↔ rEF ↔ YY ↔ LA-V ↔ LA-u

Bar graph content: bAr — Select bar graph display content.

Load resistance display method: drES — Select display method of load resistance value.
doYn ↔ UP

Full load auto recognition: F-Ld — Select full load auto recognition enable/disable.
oFF ↔ on

※ Displayed only for RS485 communication option model.

Com. address: Addr — Set communication address.
• Setting range: 1 to 99

Com. speed: bAUd — Select communication speed (baud rate).
48 ↔ 96 ↔ 192 ↔ 384

Com. write: ComY — Select communication write enable/disable.
(EnA: Enables to write, dI SA: Disables to write)
EnA ↔ dI SA

Lock: LoCK — Select lock function.
oFF ↔ LoC1 ↔ LoC2 ↔ LoC3

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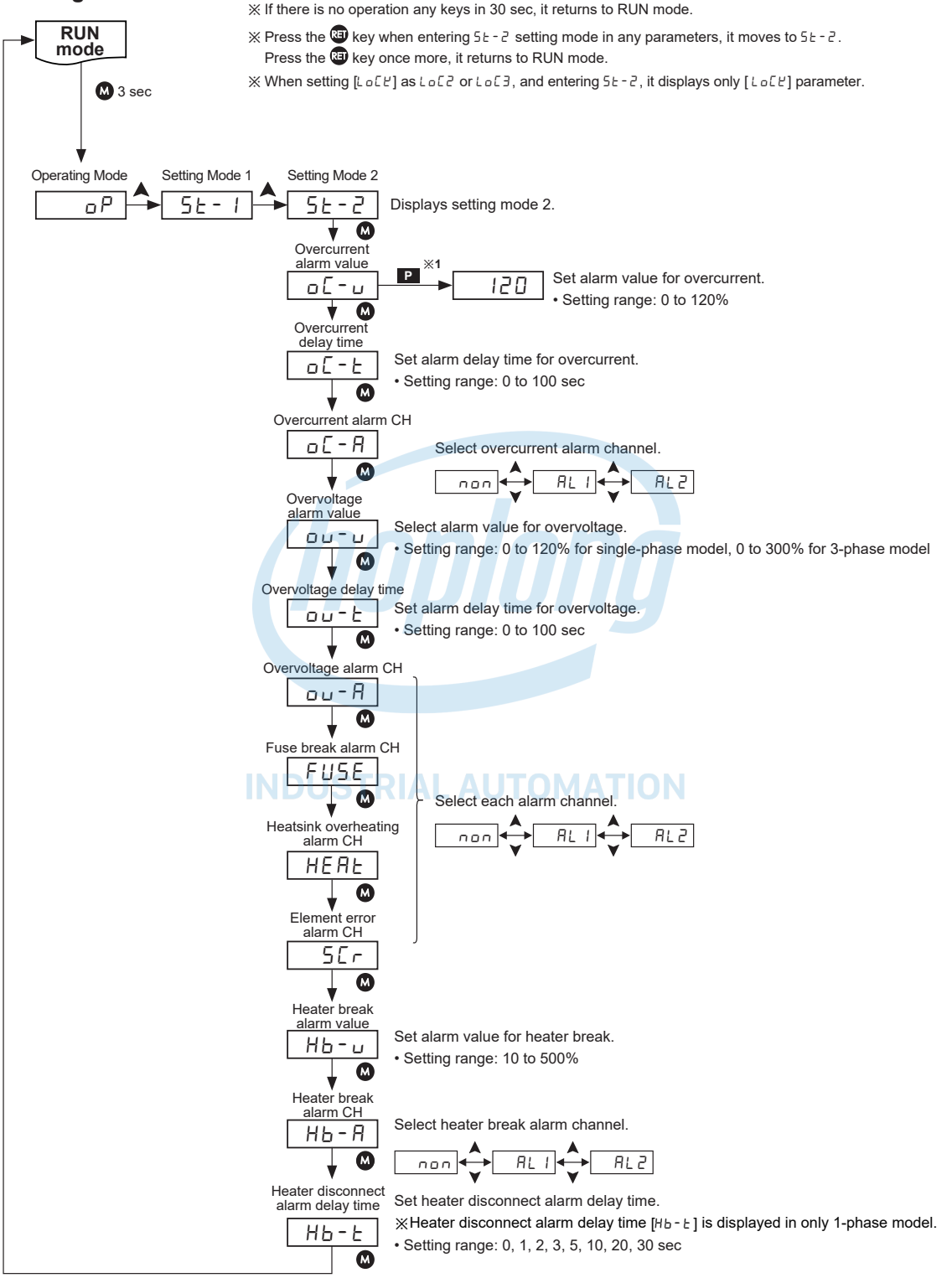
◎ Setting Mode 2

※ 1. P: Press any key among ▲, ▼.
※ If there is no operation any keys in 30 sec, it returns to RUN mode.
※ Press the RET key when entering 5t-2 setting mode in any parameters, it moves to 5t-2.
Press the RET key once more, it returns to RUN mode.
※ When setting [LoCK] as LoC2 or LoC3, and entering 5t-2, it displays only [LoCK] parameter.



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▣ Factory Default

◎ Operating Mode

Parameter	Default	Parameter	Default	Parameter	Default	Parameter	Default
St-t	0000	b-UP	000.0	C-LA	110.0	SP5	000.0
S-LA	110.0	UP-t	0003	SP1	000.0	SP6	000.0
S-Lt	0000	dn-t	0003	SP2	000.0	P	0150
A-GA	oFF	L-oL	000.0	SP3	000.0	I	020.0
SLoP	1.000	H-oL	110.0	SP4	000.0		

◎ Setting Mode 1

Parameter	Default	Parameter	Default	Parameter	Default	Parameter	Default
In-P	4-20	In-b	000.0	bAr	Single-phase Ld-u	CoMY	EnA
C-Ad	PA	SPAn	000.0		3-phase U-u	LoCt	oFF
dI-1	SP A	dI SP	Single-phase Ld-u	F-Ld	oFF		
dI-2	SP1		3-phase U-u	Addr	0001		
dI-3	SP1	drES	doYn	bAUd	384		

◎ Setting Mode 2

Parameter	Default	Parameter	Default	Parameter	Default	Parameter	Default
oC-u	110.0	ou-u	110.0	FUSE	AL1	Hb-u	0 10.0
oC-t	0005	ou-t	0005	HEAt	AL1	Hb-A	AL2
oC-A	AL1	ou-A	AL1	SCr	AL1	Hb-t	Single-phase 30

▣ Communications

◎ Communication specification

Protocol	Modbus RTU
Connection type	RS485
Application standard	Compliance with EIA RS485
Max. connection	32 units (address: 01 to 64)
Synchronization method	Asynchronous
Communication method	2-wire half duplex
Communication distance	Max. 800m
Communication speed	4800, 9600, 19200, 38400bps
Communication response wait time	5 to 99ms
Data bit	8-bit (fixed)
Parity bit	Even (fixed)
Stop bit	1-bit (fixed)

◎ Function code format

● Function code 3 (0×03) = Read holding registers

• Request (Master → Slave)

0×01	0×03	0×00	0×00	0×00	0×16	××	××
Add.	Com-mand	Start add.		Number of data		CRC 16	
		High	Low	High	Low	High	Low

• Response (Slave → Master)

0×01	0×03	0×10	0×03	0×E8	...	0×03	0×E8	××	××
Add.	Response command	Number of data	1st data		...	16th data		CRC 16	
			High	Low	...	High	Low	High	Low

• Error (Slave → Master)

0×01	0×83	××	××	××
Address	Response command	Exception code	CRC 16	

● Function code 4 (0×04) = Read input registers

• Request (Master → Slave)

0×01	0×04	0×00	0×00	0×00	0×10	××	××
Add.	Com-mand	Start add.		Number of data		CRC 16	
		High	Low	High	Low	High	Low

• Response (Slave → Master)

0×01	0×04	0×10	0×03	0×E8	...	0×03	0×E8	××	××
Add.	Response command	No. of data	1st data		...	16th data		CRC 16	
			High	Low	...	High	Low	High	Low

• Error (Slave → Master)

0×01	0×84	××	××	××
Address	Response command	Exception code	CRC 16	

● Function code 6 (0×06) = Write single registers

• Request (Master → Slave)

0×01	0×06	0×00	0×00	0×03	0×E8	××	××
Add.	Com-mand	Address		Number of data		CRC 16	
		High	Low	High	Low	High	Low

• Response (Slave → Master)

0×01	0×06	0×00	0×00	0×03	0×E8	××	××
Add.	Response Command	Address		Data		CRC 16	
		High	Low	High	Low	High	Low

• Error (Slave → Master)

0×01	0×86	××	××	××
Address	Response command	Exception code	CRC 16	

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● Function code 16 (0×10) = Write multiple registers

● Request (Master → Slave)

0×01	0×10	0×00	0×00	0×00	0×10	0×20	××	××
Add.	Com-mand	Start add.		Number of data		Num-ber of byte	CRC 16	
		High	Low	High	Low		High	Low

● Response (Slave → Master)

0×01	0×10	0×00	0×00	0×03	0×E8	××	××
Add.	Response command	Start add.		Number of data		CRC 16	
		High	Low	High	Low	High	Low

● Error (Slave → Master)

0×01	0×90	××	××	××
Address	Response Command	Exception code	CRC 16	

※ Exception code
- 0×01: Not supported command code
- 0×02: Starting address of required data and transmittable address are different.
- 0×03: The number of required data is over than the number of transmittable data.
- 0×04: Transmittable data does not process properly.

◎ Address mapping table

● Input registers [DPU1 Series]

No. (address)	Item	Factor
300001 (0000)	Output voltage	*0.1
300002 (0001)	Load current	*0.1
300003 (0002)	Power	*0.1
300004 (0003)	Load resistance	*0.1
300005 (0004)	Power frequency	*0.01
300101 (0064)	Product No. H	00
300102 (0065)	Product No. L	00
300103 (0066)	Hardware version	10
300104 (0067)	Software version	10
300105 (0068)	Model name 1	"DP"
300106 (0069)	Model name 2	"2-"
300107 (006A)	Model name 3	"00"
300108 (006B)	Model name 4	" "
300109 (006C)	Model name 5	" "
300110 (006D)	Model name 6	" "
300111 (006E)	Model name 7	" "
300112 (006F)	Model name 8	" "
300113 (0070)	Model name 9	" "
300114 (0071)	Model name 10	" "
300115 (0072)	Reserved	Reserved
300116 (0073)	Reserved	Reserved
300117 (0074)	Reserved	Reserved
300118 (0075)	Coil start address	0
300119 (0076)	Coil quantity	0
300120 (0077)	Input start address	0
300121 (0078)	Input quantity	0
300122 (0079)	Holding reg start address	0
300123 (007A)	Holding reg quantity	32
300124 (007B)	Input reg start address	0
300125 (007C)	Input reg quantity	5

● Input registers [DPU3 Series]

No. (address)	Item	Factor
300001 (0000)	Load voltage between U-V line (Vrms)	*0.1
300002 (0001)	Load voltage between V-W line (Vrms)	*0.1
300003 (0002)	Load voltage between W-U line (Vrms)	*0.1
300004 (0003)	U-phase load current (Arms)	*0.1
300005 (0004)	V-phase load current (Arms)	*0.1
300006 (0005)	W-phase load current (Arms)	*0.1
300007 (0006)	Power	*0.01
300008 (0007)	Load resistance (% display for initial load)	*0.1
300009 (0008)	Power frequency	*0.01
300101 (0064)	Product No. H	00
300102 (0065)	Product No. L	00
300103 (0066)	Hardware version	10
300104 (0067)	Software version	10
300105 (0068)	Model name 1	"DP"
300106 (0069)	Model name 2	"2-"
300107 (006A)	Model name 3	"00"
300108 (006B)	Model name 4	" "
300109 (006C)	Model name 5	" "
300110 (006D)	Model name 6	" "
300111 (006E)	Model name 7	" "
300112 (006F)	Model name 8	" "
300113 (0070)	Model name 9	" "
300114 (0071)	Model name 10	" "
300115 (0072)	Reserved	Reserved
300116 (0073)	Reserved	Reserved
300117 (0074)	Reserved	Reserved
300118 (0075)	Coil start address	0
300119 (0076)	Coil quantity	0
300120 (0077)	Input start address	0
300121 (0078)	Input quantity	0
300122 (0079)	Holding reg start address	0
300123 (007A)	Holding reg quantity	32
300124 (007B)	Input reg start address	0
300125 (007C)	Input reg quantity	5

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◎ Address mapping table

● Holding registers [DPU1 Series]

No. (address)	Item		Factor
400001 (0000)	Reference Value	—	*0.1 (0 to 1000)
400002 (0001)	Start Limit Time	S-Lt	0 to 100
400003 (0002)	Start Limit	S-Ln	*0.1 (0 to 1100)
400004 (0003)	Soft Start Time	St-t	0 to 100
400005 (0004)	Output High-Limit	H-oL	*0.1 (0 to 1100)
400006 (0005)	Output Low-Limit	L-oL	*0.1 (0 to 1100)
400007 (0006)	Remote SP1	SP1	*0.1 (0 to 1000)
400008 (0007)	Remote SP2	SP2	*0.1 (0 to 1000)
400009 (0008)	Remote SP3	SP3	*0.1 (0 to 1000)
400010 (0009)	Remote SP4	SP4	*0.1 (0 to 1000)
400011 (000A)	Remote SP5	SP5	*0.1 (0 to 1000)
400012 (000B)	Remote SP6	SP6	*0.1 (0 to 1000)
400013 (000C)	Slow Up Time	UP-t	0 to 999
400014 (000D)	Slow Down Time	dn-t	0 to 999
400015 (000E)	Current Limit	C-Ln	*0.1 (0 to 1100)
400016 (000F)	Over current value	oC-u	*0.1 (0 to 1200)
400017 (0010)	Over current time	oC-t	0 to 100
400018 (0011)	Over voltage value	ou-u	*0.1 (0 to 1200)
400019 (0012)	Over voltage time	ou-t	0 to 100
400020 (0013)	Load detector alarm value	Hb-u	*0.1 (100 to 5000)
400021 (0014)	Display selected contents	dISP	0 to 3 0: Ld-u, 1: AnP, 2: UU, 3: rEF
400022 (0015)	Bar graph's content	bAr	0 to 3 0: Ld-u, 1: AnP, 2: UU, 3: rEF
400023 (0016)	Control integer KP value	P	1 to 2000
400024 (0017)	Control integer KI value	I	*0.1 (1 to 9999)
400025 (0018)	Control Method	C-nd	0 to 6 0: F-CY, 1: u-CY, 2: onoF, 3: PA, 4: u-Fb, 5: C-Fb, 6: Y-Fb
400026 (0019)	Digital input 1	dI-1	0 to 5 0: SPn, 1: SP1, 2: SP2, 3: SP3, 4: rSt, 5: HoLd
400027 (001A)	Digital input 2	dI-2	
400028 (001B)	Digital input 3	dI-3	
400029 (001C)	Auto ref input selector	In-P	0 to 6 0: 4-20, 1: 0-20, 2: 1-5, 3: 0-5, 4: 0-10, 5: SSr, 6: Con
400030 (001D)	Load resistance display method	drES	0 to 1 0: doYn, 1: UP
400031 (001E)	Operation	—	Bit0... Fault, Bit1... I-OC, Bit2... Over current, Bit3... Over volt, Bit4... Over temp, Bit5... Fuse cut, Bit6... Phase loss, Bit7... Load open, Bit8... SCR error, Bit9... Freq error, Bit10... Run/Stop, Bit11... Auto/Manual, Bit12... EMS Power
400032 (001F)	Output slope	SLoP	*0.001 (0 to 1000)
400033 (0020)	Base Up	b-UP	*0.1 (0 to 1000)
400034 (0021)	Input correction	In-b	*0.1 (-999 to 999)
400035 (0022)	Input slope correction	SPAn	*0.1 (-999 to 999)
400036 (0023)	Overcurrent alarm output	oC-A	0 to 2 0: non, 1: AL1, 2: AL2
400038 (0025)	Overvoltage alarm output	ou-A	
400039 (0026)	Fuse alarm	FUSE	
400041 (0028)	Alarm heat sink temperature alarm	HEAt	
400042 (0029)	SCR error alarm	SCr	
400043 (002A)	Heater break alarm	Hb-A	
400044 (002B)	Auto Gain	A-GA	0 to 1 0: oFF, 1: on
400045 (002C)	Heater Break Time	Hb-t	0 to 7 0: 0, 1: 1, 2: 2, 3: 3, 4: 5, 5: 10, 6: 20, 7: 30

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● Holding registers [DPU3 Series]

No. (address)	Item		Factor
400001 (0000)	Reference Value	—	*0.1 (0 to 1000)
400002 (0001)	Start Limit Time	S-Lt	0 to 100
400003 (0002)	Start Limit	S-Ln	*0.1 (0 to 1100)
400004 (0003)	Soft Start Time	St-t	0 to 100
400005 (0004)	Output High-Limit	H-oL	*0.1 (0 to 1100)
400006 (0005)	Output Low-Limit	L-oL	*0.1 (0 to 1100)
400007 (0006)	Remote SP1	SP1	*0.1 (0 to 1000)
400008 (0007)	Remote SP2	SP2	*0.1 (0 to 1000)
400009 (0008)	Remote SP3	SP3	*0.1 (0 to 1000)
400010 (0009)	Remote SP4	SP4	*0.1 (0 to 1000)
400011 (000A)	Remote SP5	SP5	*0.1 (0 to 1000)
400012 (000B)	Remote SP6	SP6	*0.1 (0 to 1000)
400013 (000C)	Slow Up Time	UP-t	0 to 999
400014 (000D)	Slow Down Time	dn-t	0 to 999
400015 (000E)	Current Limit	C-Ln	*0.1 (0 to 1100)
400016 (000F)	Over current value	oC-u	*0.1 (0 to 1200)
400017 (0010)	Over current time	oC-t	0 to 100
400018 (0011)	Over voltage value	ou-u	*0.1 (0 to 1200)
400019 (0012)	Over voltage time	ou-t	0 to 100
400020 (0013)	Load detector alarm value	Hb-u	*0.1 (100 to 5000)
400021 (0014)	Display selected contents	diSP	0 to 3 0: U-u, 1: u-Y, 2: Y-U, 3: LA-U, 4: LA-u, 5: LA-Y, 6: YY, 7: rEF
400022 (0015)	Bar graph's content	bAr	0 to 3 0: U-u, 1: u-Y, 2: Y-U, 3: LA-U, 4: LA-u, 5: LA-Y, 6: YY, 7: rEF
400023 (0016)	Control integer KP value	P	1 to 2000
400024 (0017)	Control integer KI value	I	*0.1 (1 to 9999)
400025 (0018)	Control Method	C-nd	1 to 6 1: F-CY, 2: onoF, 3: PA, 4: u-Fb, 5: C-Fb, 6: Y-Fb
400026 (0019)	Digital input 1	di-1	0 to 5 0: SPn, 1: SP1, 2: SP2, 3: SP3, 4: rSt, 5: HoLd
400027 (001A)	Digital input 2	di-2	
400028 (001B)	Digital input 3	di-3	
400029 (001C)	Auto ref input selector	In-P	0 to 6 0: 4-20, 1: 0-20, 2: 1-5, 3: 0-5, 4: 0-10, 5: SSr, 6: Con
400030 (001D)	Load resistance display method	drES	0 to 1 0: doYn, 1: UP
400031 (001E)	Operation	—	Bit0... Fault, Bit1... I-OC, Bit2... Over current, Bit3... Over volt, Bit4... Over temp, Bit5... Fuse cut, Bit6... Phase loss, Bit7... Load open, Bit8... SCR error, Bit9... Freq error, Bit10... Run/Stop, Bit11... Auto/Manual, Bit12... EMS Power
400032 (001F)	Output slope	SLoP	*0.001 (0 to 1000)
400033 (0020)	Base Up	b-UP	*0.1 (0 to 1000)
400034 (0021)	Input correction	In-b	*0.1 (-999 to 999)
400035 (0022)	Input slope correction	SPAn	*0.1 (-999 to 999)
400036 (0023)	Overcurrent alarm output	oC-A	0 to 2 0: non, 1: AL1, 2: AL2
400038 (0025)	Overvoltage alarm output	ou-A	
400039 (0026)	Fuse alarm	FUSE	
400041 (0028)	Alarm heat sink temperature alarm	HEAt	
400042 (0029)	SCR error alarm	SCr	
400043 (002A)	Heater break alarm	Hb-A	
400044 (002B)	Auto Gain	A-GA	0 to 1 0: oFF, 1: on

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▣ Proper Usage

- Follow instructhions in 'Cautions during Use'.
  Otherwise, it may cause unexpected accidents.
- Keep away from high voltage lines or power lines to prevent inductive noise.
  Do not use near the equipment which generates strong magnetic force or high frequency noise.
- Install a power switch or circuit breaker in the easily accessible place for supplying or disconnecting the power.
- Do not wire the unused terminals.
- Resuply the power after the product is completely discharged.
  Failure to follow this instruction may result in malfunction of the product.
- Wetted product may cause the electric leakage or fire, the inspection must be required.
  Use safety equipment for installation.
  Do not raise leg or sit on the product.
- Prevent the product cover from automatically opening for transporting.
- In case of temporary storage, fix the product with transporting screw.

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