

# DPU Series

## Features

- Fast response speed and high accuracy by high-speed CPU
- Accurate feedback control (static current, static voltage, static power) by RMS measurement
- Phase control and zero-crossing cycle control (fixed/variable cycle) method for various load control
- Protects inner circuit by built-in rapid fuse
- Remote monitoring and remote control Supports Modbus RTU protocol by RS485 communication
- Built-in customizable 6 digital inputs
- Basic variable alarm outputs; current error, heater part (parts of heater break detection), etc.
- Supports multi input of control input signal (current, voltage, potentionmeter, etc)
- Enables to install control part separately
- Applicable load : all loads such as super kanthal, platinum, molybdenum, carbon, halogen lamp, chrome, nickel, etc.

CE



Please read "Caution for your safety" in operation manual before using this unit.

## Ordering information

DPU	1	2	A	-	025	R																																					
Option				<table border="1"><tr><td>R</td><td>RS485 communication</td><td></td><td></td></tr><tr><td>D</td><td>Remote Display Unit</td><td></td><td></td></tr><tr><td>A</td><td>Remote Display Unit + RS485 communication</td><td></td><td></td></tr><tr><td>N</td><td>No option</td><td></td><td></td></tr></table>				R	RS485 communication			D	Remote Display Unit			A	Remote Display Unit + RS485 communication			N	No option																						
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Rated current capacity				<table border="1"><tr><td>025</td><td>25A</td><td>200</td><td>200A</td></tr><tr><td>040</td><td>40A</td><td>250</td><td>250A</td></tr><tr><td>050</td><td>50A</td><td>350</td><td>350A</td></tr><tr><td>070</td><td>70A</td><td>400</td><td>400A</td></tr><tr><td>080</td><td>80A</td><td>500</td><td>500A</td></tr><tr><td>100</td><td>100A</td><td>600</td><td>600A</td></tr><tr><td>120</td><td>120A</td><td></td><td></td></tr><tr><td>150</td><td>150A</td><td></td><td></td></tr><tr><td>180</td><td>180A</td><td></td><td></td></tr></table>				025	25A	200	200A	040	40A	250	250A	050	50A	350	350A	070	70A	400	400A	080	80A	500	500A	100	100A	600	600A	120	120A			150	150A			180	180A		
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Power supply				<table border="1"><tr><td>1</td><td>110V</td><td></td><td></td></tr><tr><td>2</td><td>220V</td><td></td><td></td></tr><tr><td>3</td><td>380V</td><td></td><td></td></tr><tr><td>4</td><td>440V</td><td></td><td></td></tr></table>				1	110V			2	220V			3	380V			4	440V																						
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# Digital Thyristor Unit

## ■ Size type

### ◎ 1-phase

(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

### ◎ 3-phase

(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

## Specifications

A. Recorders
B. Indicators
C. Converters
D. Controllers
E. Thyristor units
F. Pressure transmitters
G. Temperature transmitters
H. Accessories

DPU

Series	DPU		
Number of phases	1-phase                    3-phase		
Power supply	110VAC / 220VAC / 380VAC / 440VAC (FAN and control power 220VAC 50/60Hz separately)		
Allowable voltage	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%	Phase control : 3 to 98%, Z.C. control : 0 to 100%	
Control method <sup>※1</sup>	<ul style="list-style-type: none"> <li>• Phase control : Normal control(Non-Feedback), static voltage/static current/static power control(Feedback)</li> <li>• Cycle control(Z.C.): Fixed cycle control, Variable cycle control</li> <li>• ON/OFF control(Z.C.)</li> </ul>		
Load	<ul style="list-style-type: none"> <li>• Phase control : resistance load, inductive load</li> <li>• ON/OFF, Cycle control : resistance load</li> </ul>		
Power consumption	Max. 7W (except FAN operation power)	Max. 10W (except FAN operation power)	
Display method	<ul style="list-style-type: none"> <li>• Display value and SV display : 7 Segment 4 digit</li> <li>• Status display : 4 LED</li> <li>• Display value percentage display : 11 LED Bar</li> </ul> <ul style="list-style-type: none"> <li>• Display value and SV display : 7 Segment 4 digit</li> <li>• Status display : 6 LED</li> <li>• Display value percentage display : 11 LED Bar</li> </ul>		
Output accuracy	<ul style="list-style-type: none"> <li>• Static voltage feedback control : Within ±3% F.S. of rated voltage(within variable ±10% F.S. of rated voltage)</li> <li>• Static current feedback control : Within ±3% F.S. of rated voltage(within variable 1 to 10 times of rated resistance)</li> <li>• Static 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)</li> <li>• Normal control : within ±10% F.S. of rated voltage</li> </ul>		
Set method	By front keys, By communication		
Control input	<ul style="list-style-type: none"> <li>• Auto: 4-20mA / 0-20mA / 0-5VDC / 1-5VDC / 0-10VDC / voltage pulse(0/12VDC) / no-voltage input(ON/OFF) / communication input(RS485)</li> <li>• Manual: inside 10kΩ VR, outside 3 to 10kΩ VR (min. 2W)</li> </ul>		
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	2000VAC 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	Min. 200MΩ(at 500VDC megger)		
Noise resistance	Square shaped noise by noise simulator (pulse width 1μs) ±2kV		
Environment	Ambient temperature	-10 to 50°C, storage : -20 to 80°C	
	Ambient humidity	5 to 90%RH	
Approval	<b>CE</b>		
Unit weight	<ul style="list-style-type: none"> <li>• A Size : 3.0kg</li> <li>• B Size : 5.5kg</li> </ul>	<ul style="list-style-type: none"> <li>• C Size : 11.0kg</li> <li>• D Size : 17.5kg</li> </ul>	<ul style="list-style-type: none"> <li>• A Size : 6.5kg</li> <li>• B Size : 11.5kg</li> </ul> <ul style="list-style-type: none"> <li>• C Size: 20.0 kg</li> <li>• D Size: 35.5 kg</li> </ul>

※ 1. Variable cycle control is only for 1-phase model.

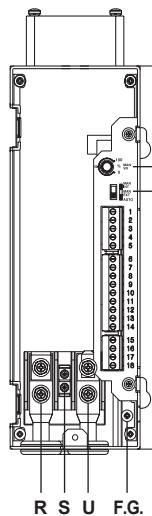
※ Environment resistance is rated at no freezing or condensation.

# DPU Series

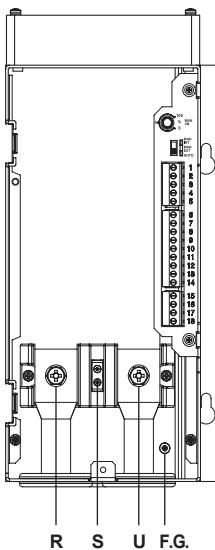
## Connections

### ■ 1-phase

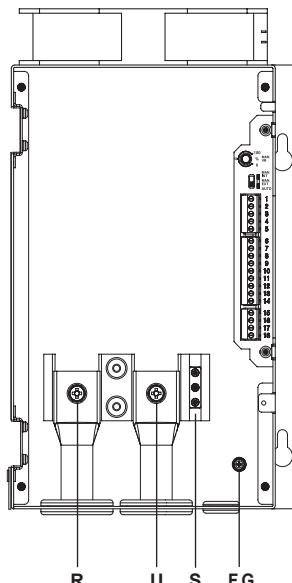
#### • A Size



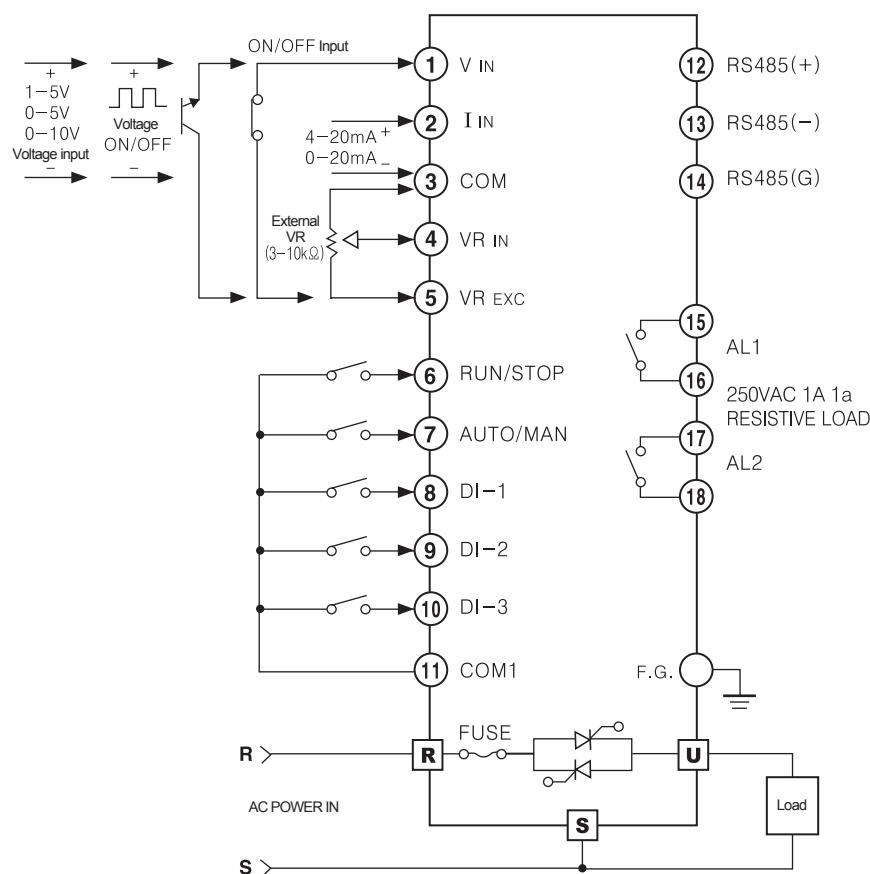
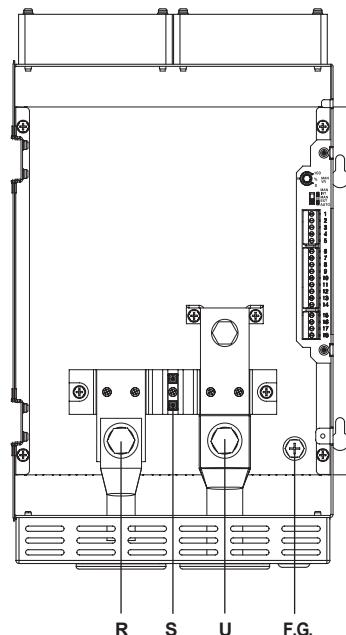
#### • B Size



#### • C Size



#### • D Size



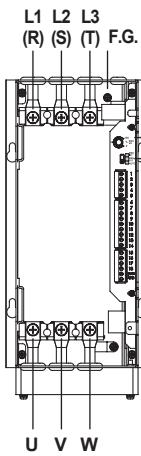
- Do not mix noise to input cable. It is recommended to use shield cable, twisted cable as input cable for effective noise.
- If there is possible to affect inductive noise, it is recommended to use shielded cable at high-frequency power for effective noise.
- DI input switch should be for low current 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.

# Digital Thyristor Unit

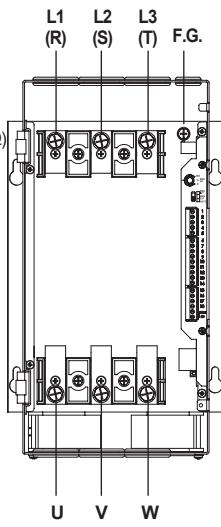
A. Recorders
B. Indicators
C. Converters
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F. Pressure transmitters
G. Temperature transmitters
H. Accessories

## ■ 3-phase

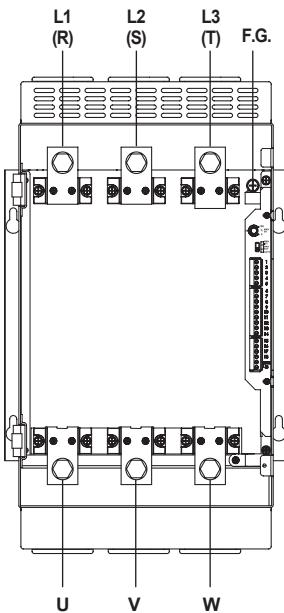
### • A Size



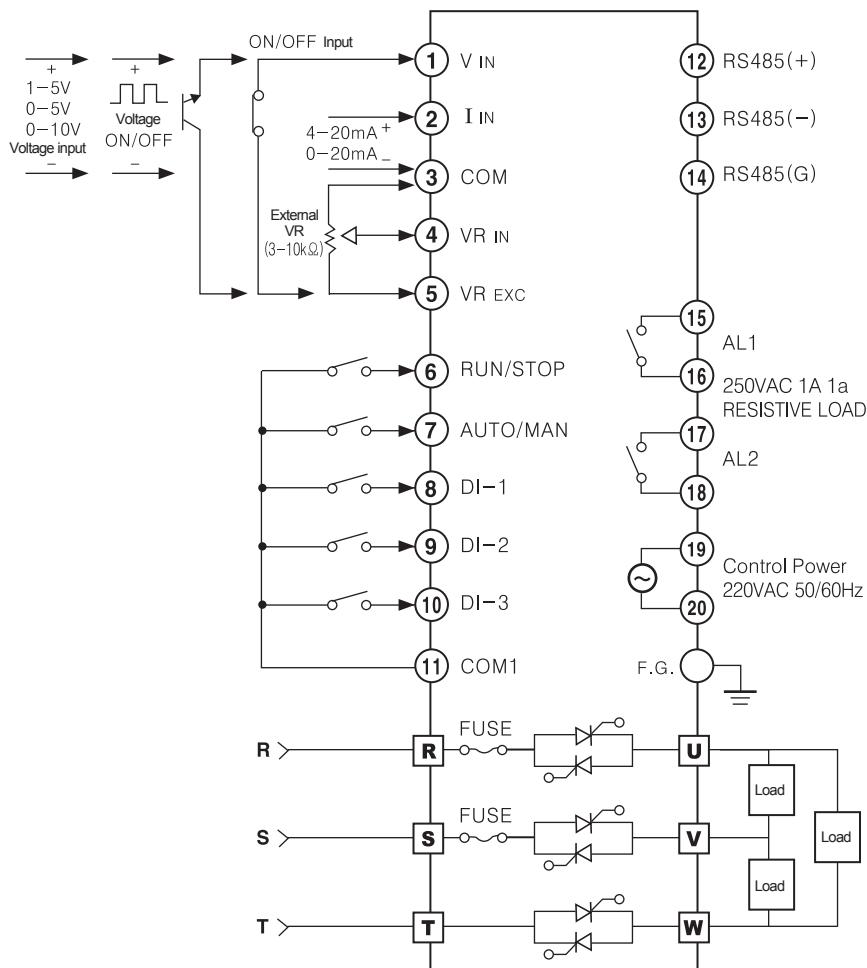
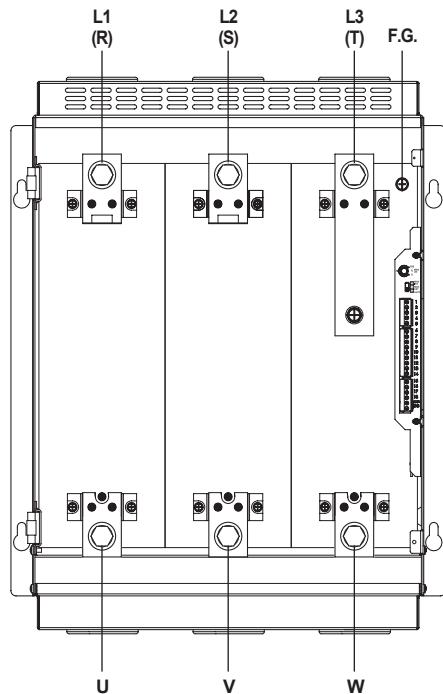
### • B Size



### • 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.
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DPU

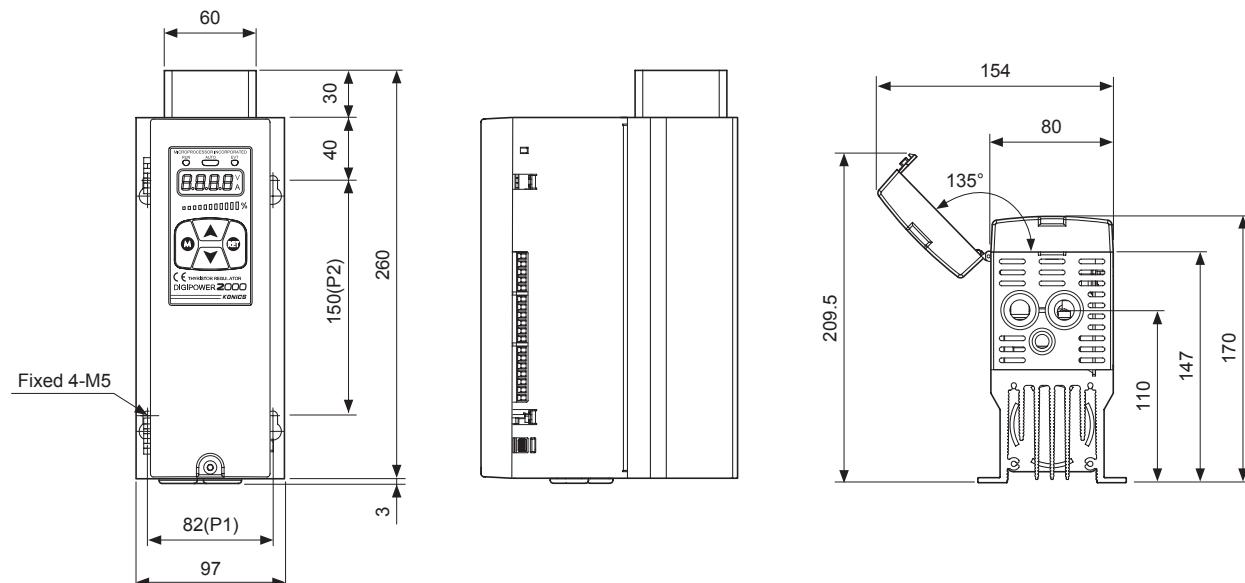
# DPU Series

## Dimensions

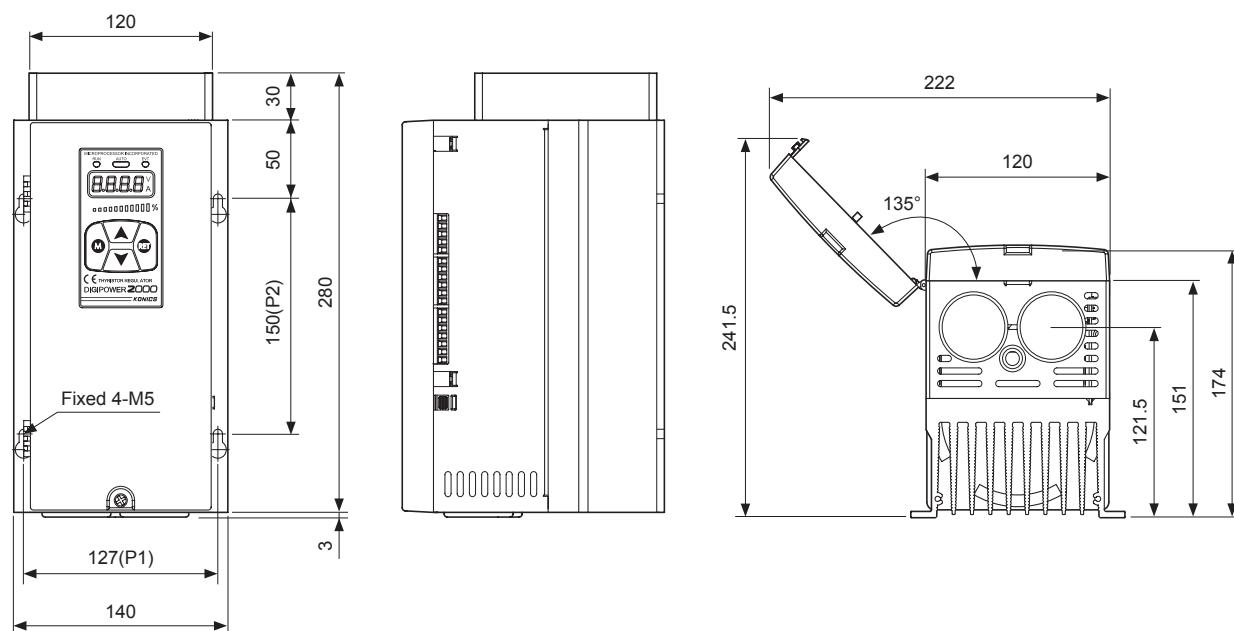
### ■ 1-phase

- A Size : DPU1□A-25 / 40 / 50 / 70

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

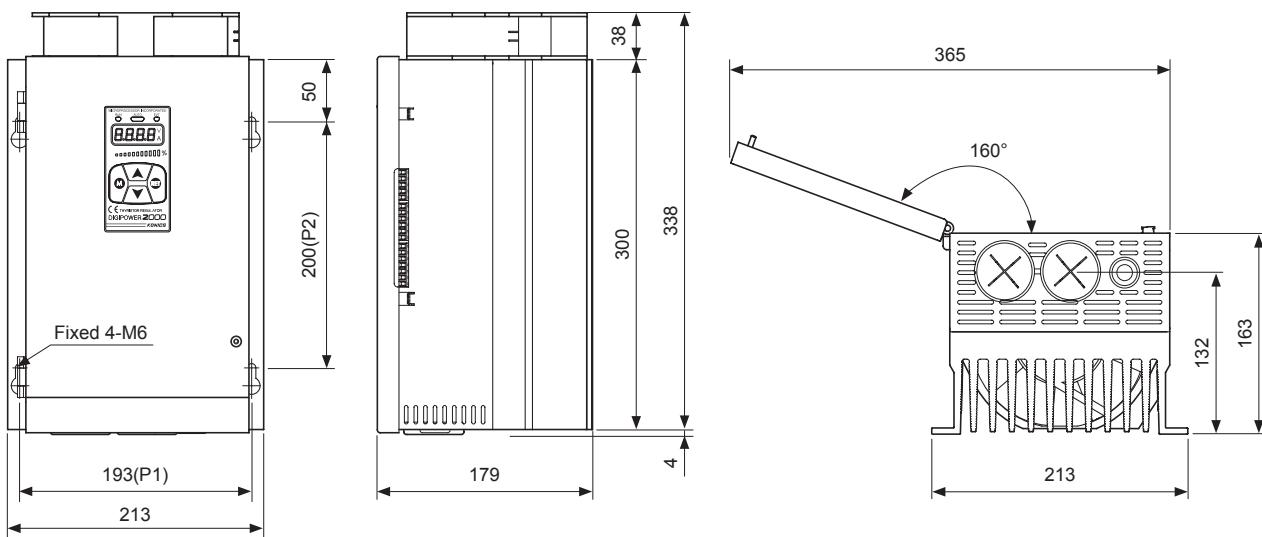


- B Size : DPU1□B - 80 / 100 / 120 / 150 / 180 / 200



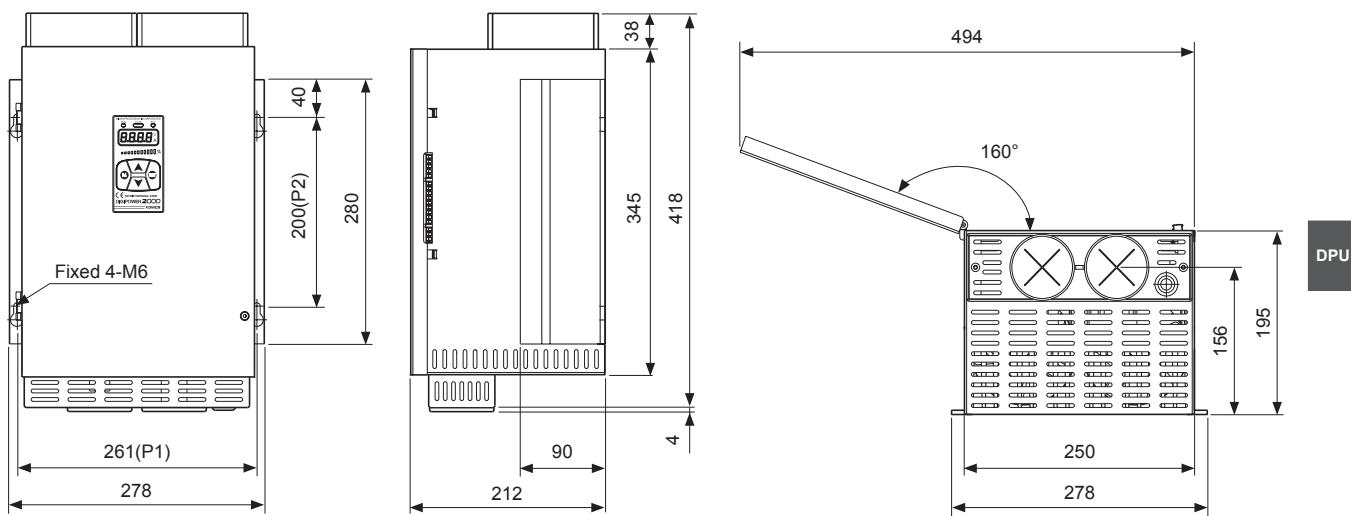
# Digital Thyristor Unit

• C Size : DPU1□C - 250 / 350

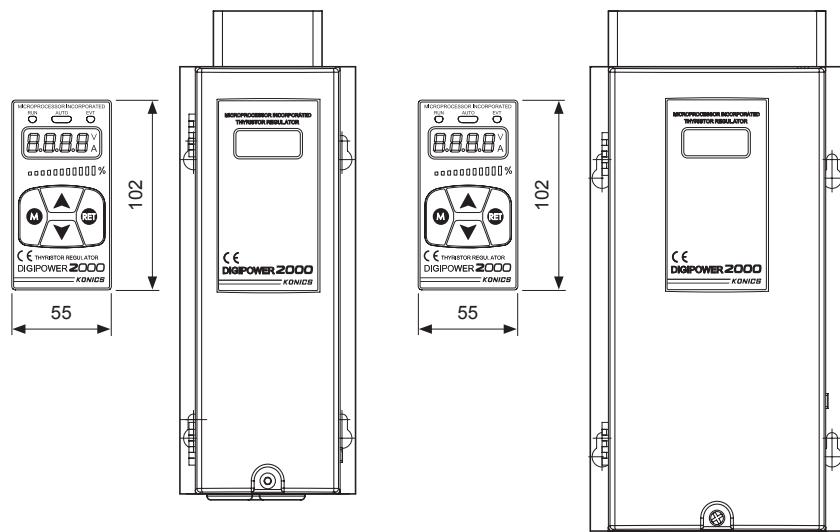


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• D Size : DPU1□D - 400 / 500 / 600



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



• Panel cut-out

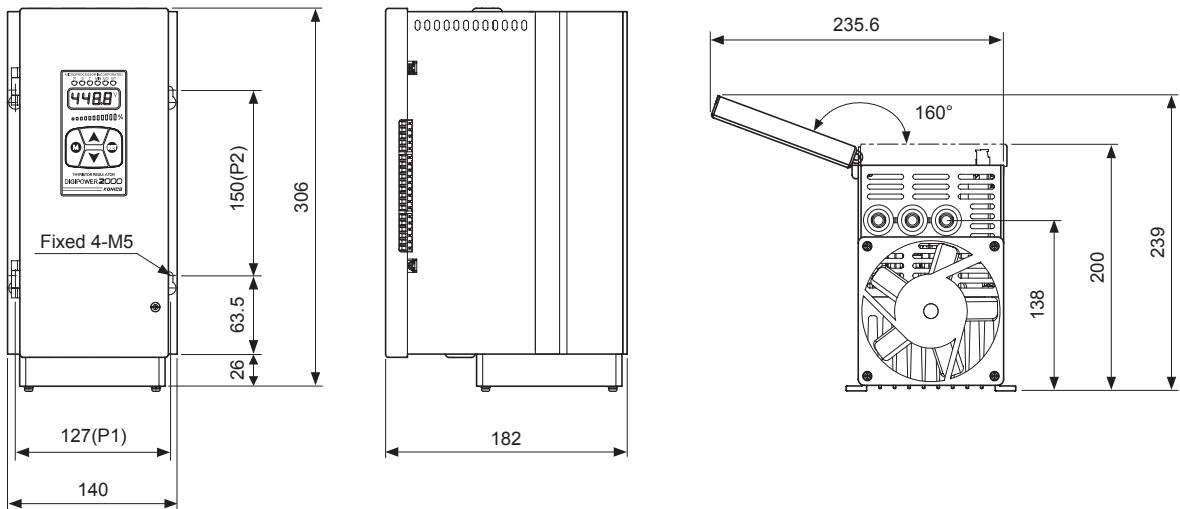
※ It is recommended for remote panel cable to use max. 5 m to prevent noise. (Check the length when ordering it.)

# DPU Series

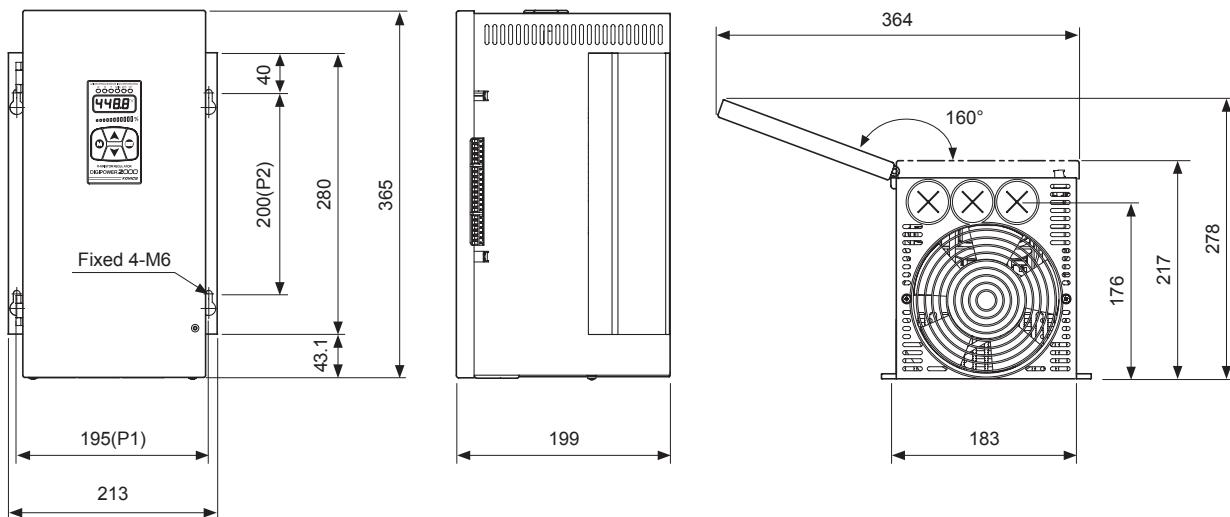
## ■ 3-phase

- A Size : DPU3□A - 25 / 40 / 50

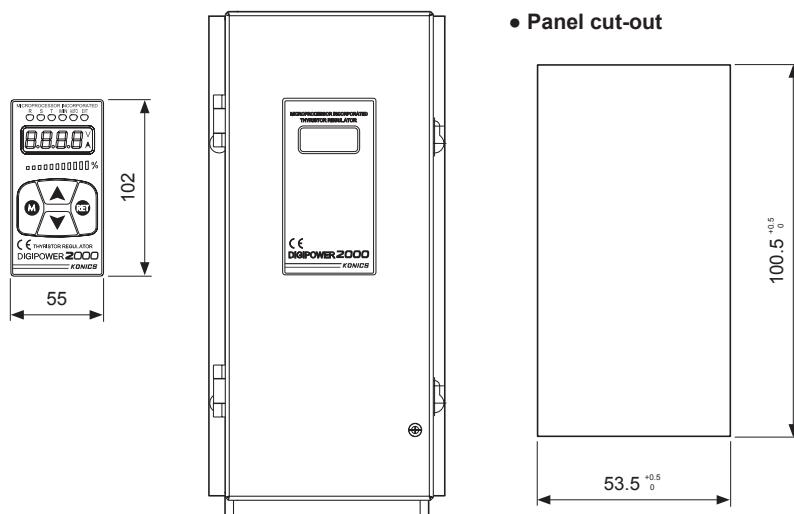
(unit:mm)



- B Size : DPU3□B - 70 / 80 / 100 / 120 / 150 / 180 / 200



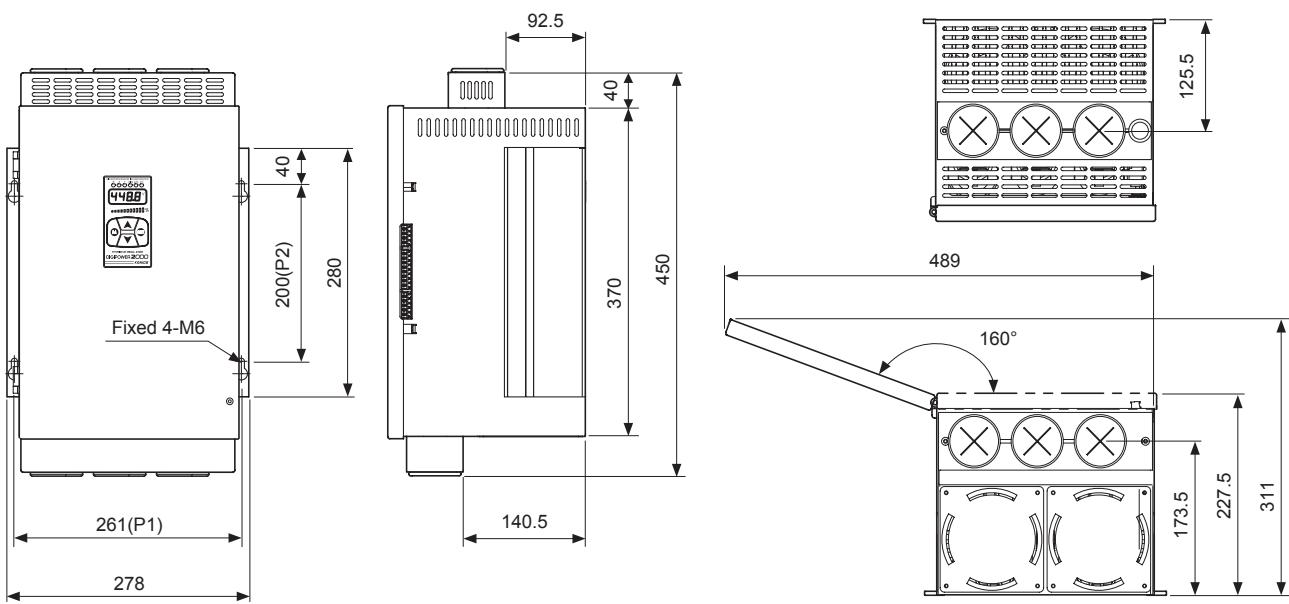
## ◎ In case of remote display unit + RS485 communication option,



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

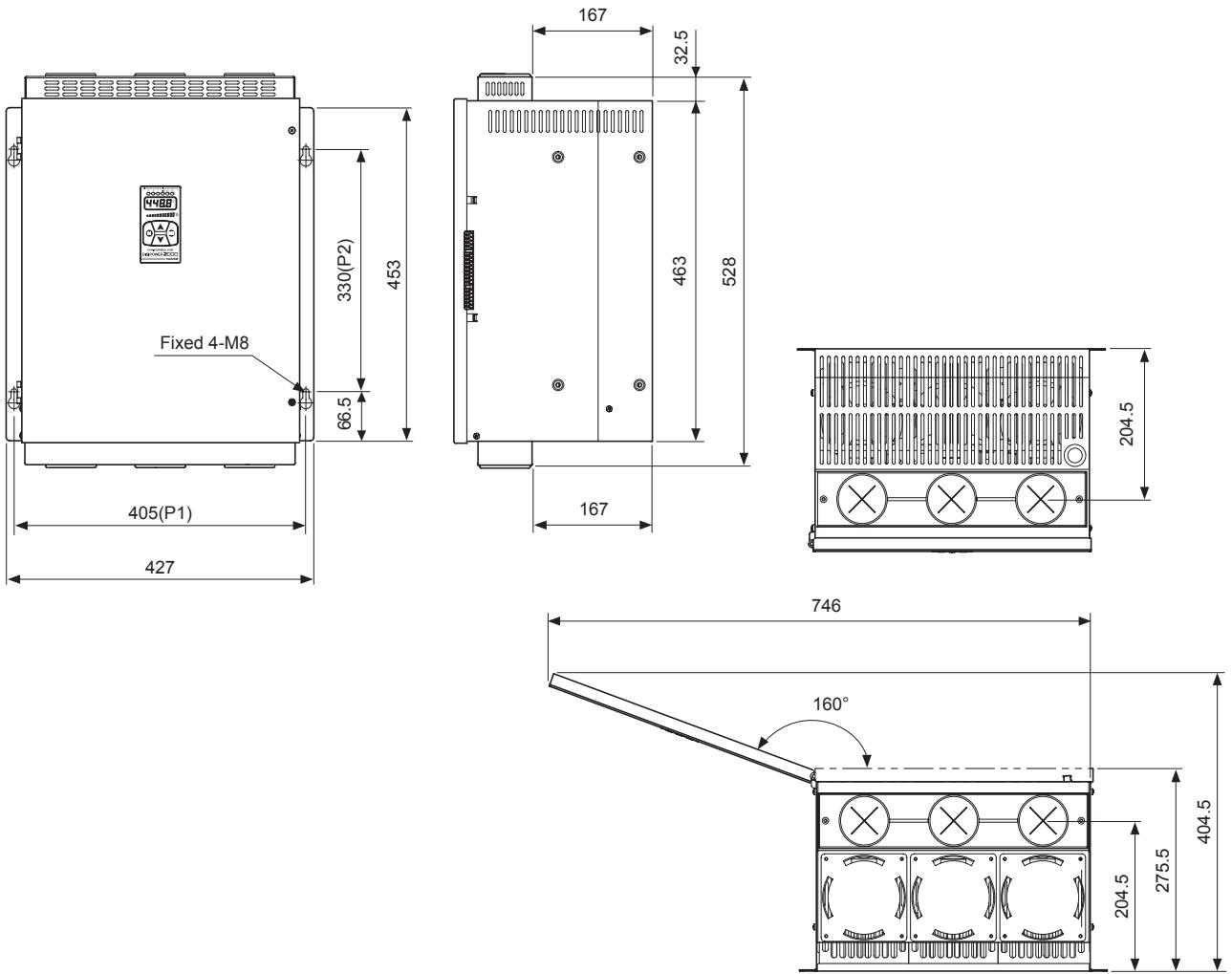
# Digital Thyristor Unit

• C Size : DPU3□C - 250 / 350



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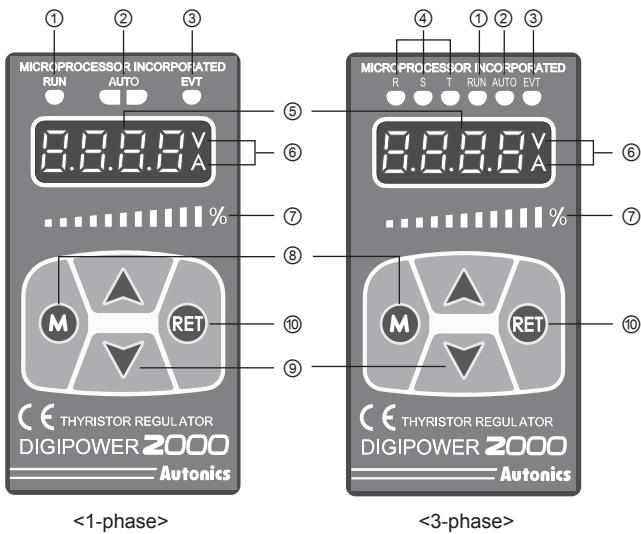
• D Size : DPU3□D - 400 / 500 / 600



DPU

# DPU Series

## Part descriptions



- 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  
Ex) 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	4-20
			0-20mA	0-20
		Voltage	1-5VDC	1-5
			0-5VDC	0-5
	ON/OFF input	Voltage pulse	0-10VDC	0-10
			0/12VDC	55r
	Com. input	No-voltage pulse	ON/OFF	-
		Com. input	RS485	[ ]
MANUAL input	Internal VR		10kΩ	-
	External VR		3 to 10kΩ	-

### ■ RMS display

This unit measures and displays RMS for accuracy.

※ Ex) At pure resistance load, in normal control, when input is 4-20mA and rating is 220V,

Input	4mA	8mA	12mA	16mA	20mA
MV	0%	25%	50%	75%	100%
Display voltage	0.0V	70V	155.5V	209.7V	220.0V

In case of static voltage or static current, voltage and current displays as below.

※ Ex) At pure resistance load, in feedback control, when input is 4-20mA and rating is 220V or 50A,

Input	4mA	8mA	12mA	16mA	20mA
MV	0%	25%	50%	75%	100%
Display voltage (static voltage control)	0.0	55.0	110.0	165.0	220.0
Display voltage (static current control)	0.0	12.5	25.0	37.5	50.0

### ■ Input selection

In AUTO input, select it at control input type [ I - □ - P ] at setting mode1.

In MANUAL input, set output slope manual adjustment [ F - G R ] in operating mode as OFF and select the input by the inside 3-level slide switch.

◎ Output slope manual adjustment [ F - G R ] as OFF  
: Select the input by the inside 3-level slide switch

MAN INT	Type	Description
MAN EXT	MAN INT	Adjust output slope with the inside VR
AUTO	MAN EXT	Adjust output slope with an outside VR
	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.

## Functions

### ■ Soft Start [S<sub>t</sub>-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.

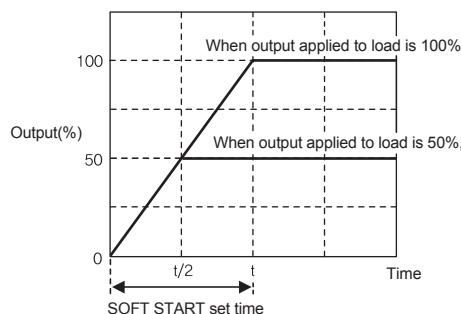
Soft start set time ( $t$ ) is the time up to 100% increase of output applied to load. When the final target output value is 50%, taken time to reach is  $t/2$ .

Reaching time to the final target output value = Target output (%)  $\times t$

※ Ex) SOFT START sec., final target output : 80%

$$0.8 \times 25 = 20\text{sec}$$

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

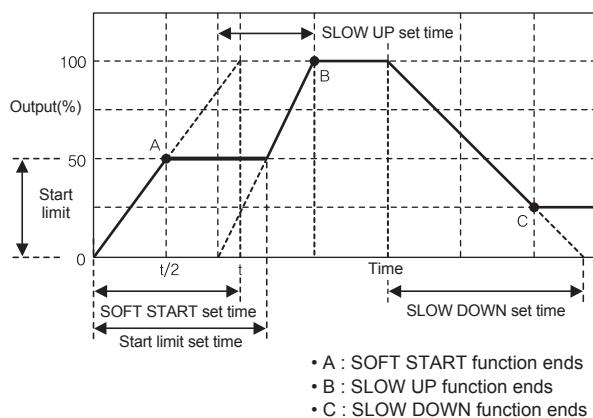


### ■ Start limit [S-L<sub>n</sub>] and start limit time [S-L<sub>t</sub>]

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.

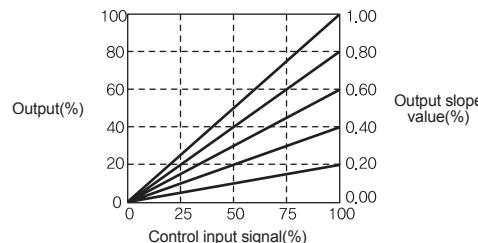
- Set range for start limit: 0 to 110% of output
- Set range for start limit time : 0 to 100 sec.  
(0 sec.: not using this function)



### ■ Output slope setting [SL<sub>oP</sub>]

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

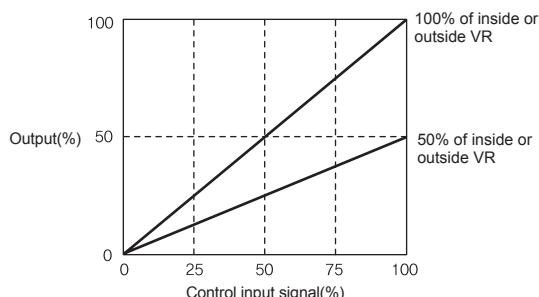
- Output value when setting slope : Input(%)  $\times$  Slope value



### ■ Output slope manual adjustment [R-GA]

This function is to adjust manually (inside or outside VR) output value ratio for control input.

When AUTO operation and output slope manual adjustment [R-GA] is set as ON, [SL<sub>oP</sub>] is not able to set. It displays slope value by the inside or outside VR input.



### ◎ Output slope manual adjustment [R-GA] as on : Set output slope by the inside 3-level slide switch

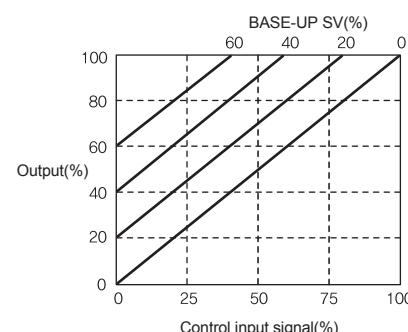
	Type	Description
MAN INT	MAN INT	Adjust output slope with the inside VR
MAN EXT	MAN EXT	Adjust output slope with an outside VR
AUTO	AUTO	No function

### ■ 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.

- Set range : BASE-UP SV(%) < Output high-limit value
- Output value for BASE-UP setting  
: Input(%)  $\times$  Slope value + BASE-UP SV



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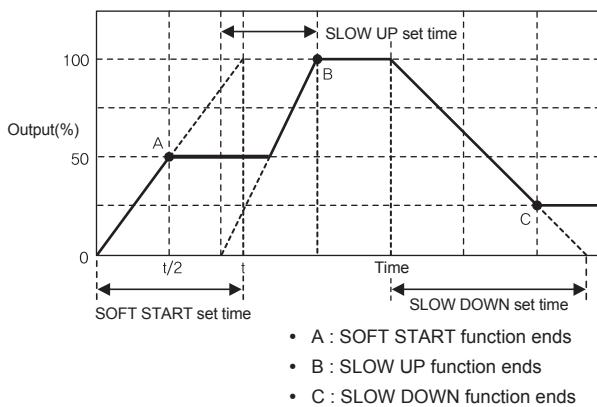
## SLOW UP / SLOW DOWN [UP-t/dn-t]

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.

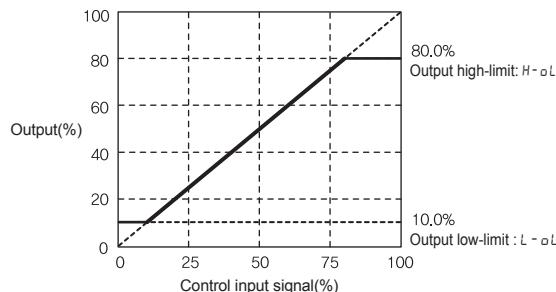
- Set range : 0 to 999 sec. (0 sec.: not using this function)



## Output high limit value [H- $\alpha$ L], Output low limit value [L- $\alpha$ L]

This function is to limit output range to protect load.

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



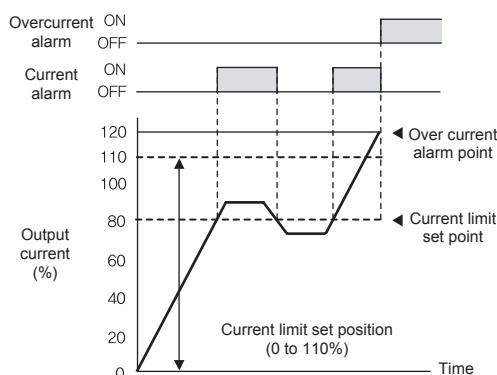
## Current limit [ $C-L\bar{n}$ ]

It operates when normal, static voltage, static 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.

- Set range : 0 to 110% of rated current

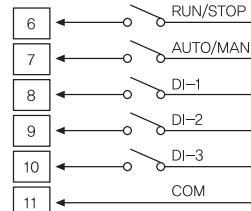


## Digital input(DI)

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 VR adjustment or an outside VR 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.

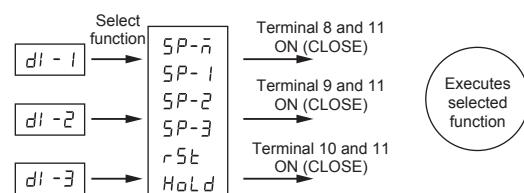
### Digital input(DI-1 to DI-3) setting [terminal 8, 9, 10 and 11(COM)]

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- $\bar{n}$  is available only in dI-1.



### RESET [rSE]

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, SP-2, SP-3]

Set [SP-1, SP-2, SP-3] to each digital input for output to reach to the relevant SP.

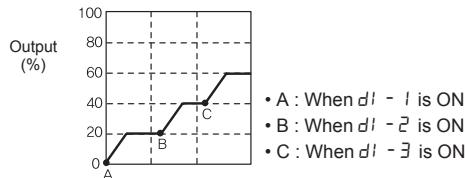
It is available to set individually at [dI-1, dI-2, dI-3], and duplicated setting is allowed.

When setting SP-1, SP1 is displayed in operating mode, same as SP-2 and SP-3.

When this function is not set, the parameters to set SP in operating mode are not displayed.

※Ex)

dI-1	dI-2	dI-3	Operating Mode SP value set parameter
SP-1	SP-2	SP-3	SP-1(ex: 20%)
			SP-2(ex: 40%)
			SP-3(ex: 60%)



## • Multi SP [SP-n]

It is available to set total 6 SPs and to control output depending on 3 digital inputs' setting.

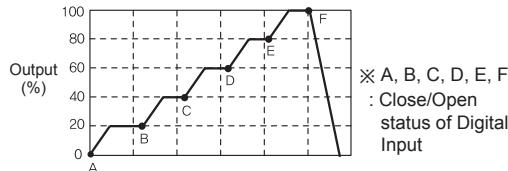
This function is selectable only in [dI-1]. When selecting [SP-n] at [dI-1], [dI-2, dI-3] parameters are not displayed.

When selecting [SP-n] at [dI-1], 6 parameters to set SPs are displayed in operating mode.

(SP-1, SP-2, SP-3, SP-4, SP-5, SP-6)

※Ex) ○: Close, ×: Open

	dI-1	dI-2	dI-3	Operating Mode SP value set parameter
A	○	×	×	SP-1(ex: 20%)
B	×	○	×	SP-2(ex: 40%)
C	○	○	×	SP-3(ex: 60%)
D	×	×	○	SP-4(ex: 80%)
E	○	×	○	SP-5(ex: 100%)
F	×	○	○	SP-6(ex: 0%)
G	○	○	○	—



## ■ 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.

- Set range : 0(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.

- Set range : 0.1 to 999.9 sec.

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

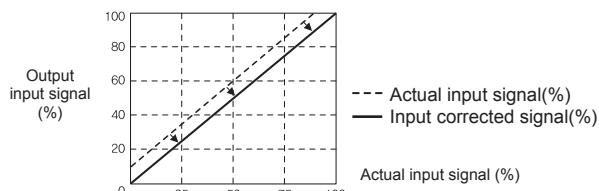
## ■ Input correction [In-b]

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

- Set range : -99.9 to 99.9%

※Ex) Input type is 4-20mA,

When 4mA is applied and the input monitor value displays, set [In-b] as -0.5 and the input monitor value displays as 0.0%.



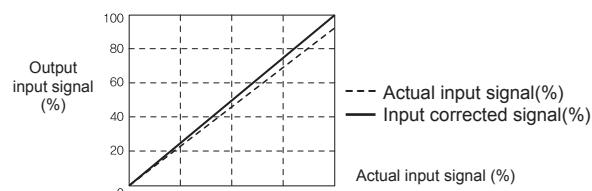
## ■ Input slope correction [SPRn]

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

- Set range : -99.9 to 99.9%

※Ex) Input type is 4-20mA,

When 20mA is applied and the input monitor value displays 99.5%, set [SPRn] as 0.5 and the input monitor value is 100.0%.



## ■ Display value content selection [d1SP]

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

- Selectable display value content :

load voltage [ $U_u$ ,  $U_d$ ,  $U_s$ ], load current [ $I_R-U$ ,  $I_R-u$ ,  $I_R-d$ ], power [ $P_U$ ], control input [ $rEF$ ]

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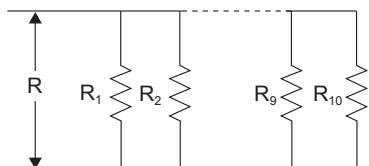
# DPU Series

## ■ Load resistance display method [*drE5*]

This function is for display load resistance [*rE5*] 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 [*doUn*].

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

Ex) Each of  $R_1$  to  $R_{10}$  is  $1\Omega$  and load resistance ( $R$ ) is  $1\Omega$ , When disconnecting  $R_1$  to  $R_5$ ,



### ① Increase rate of load resistance [*UP*]

It is based on 100% of load resistance ( $R$ ),  $1\Omega$ . When disconnected  $R_1$  to  $R_5$ , load resistance is  $2\Omega$  and load resistance [*rE5*] in monitoring mode displays 200%.

### ② Decrease rate of number of loads [*doUn*]

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 [*rE5*] in monitoring mode displays 50%.

## ■ Bar Graph display value content selection [*bAr*]

You can select display value content for the bar graph.

- Selectable display value content :
  - load voltage [*U-U*, *u-U*, *U-U*], load current [*LA-U*, *LA-u*, *LA-U*], power [*Pw*], control input [*rEF*]

## ■ Alarm

Alarm	Parameter	Operation	Clear alarm
Overcurrent alarm	<i>o-C</i>	※1	·Re-supply the power. ·RESET( <i>RET</i> key) ·Switch to STOP mode
Oversupply alarm	<i>o-u</i>		
Fuse break alarm	<i>FUSE</i>		
Heatsink overheat alarm	<i>E-EHP</i>		
Element error alarm	<i>SEr</i>		
Heater break alarm	<i>HbH</i>	Continues operation	Automatically cleared within the set range

※1: For 1-phase model, output stops.

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

## ■ Lock [*LoC*]

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	<i>oFF</i>	<i>LoC1</i>	<i>LoC2</i>	<i>LoC3</i>
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

## ■ Heater disconnection alarm [*Hb-A*]

When load resistance display method is set as [*UP*], it is over the set value, this alarm occurs.

[*Hb-A*] 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.

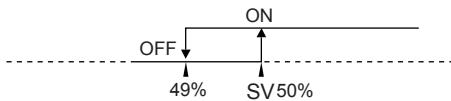
### ◎ Heater disconnection alarm value setting [*Hb-u*]

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.

- Set range : 10 to 500%

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

Ex) 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 [*5E-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 [*HbH*]. 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, *HbH* alarm clear method:

· Set load resistance display method [*drE5*] as *UP* in setting mode 1 [*5E-1*].

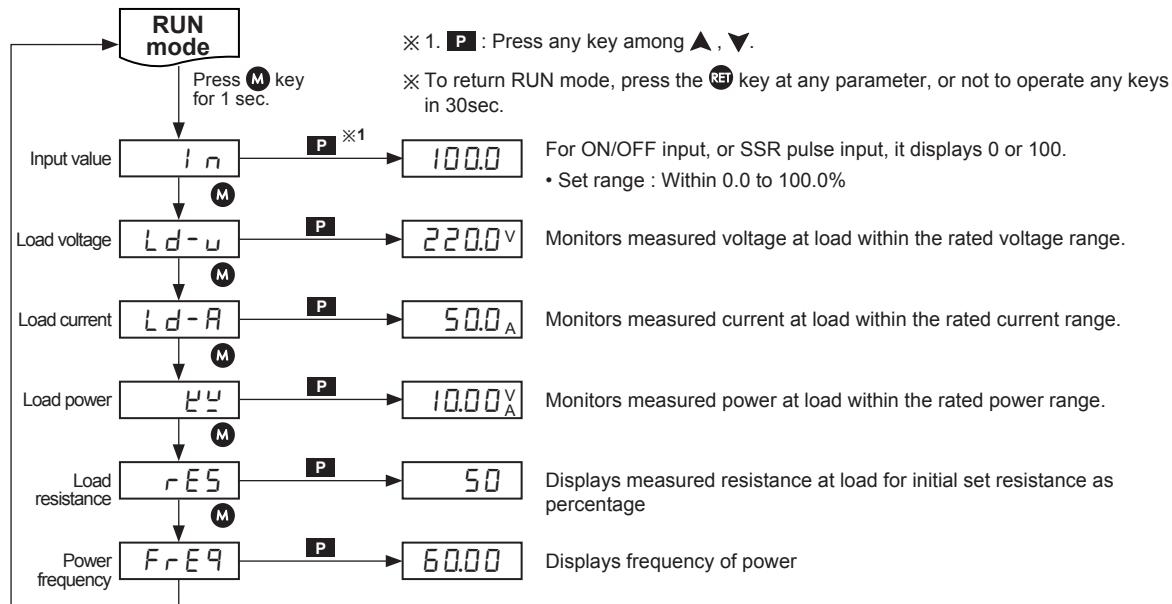
· Set heater break alarm value [*Hb-u*] as *500* in setting mode 2 [*5E-2*].

# Digital Thyristor Unit

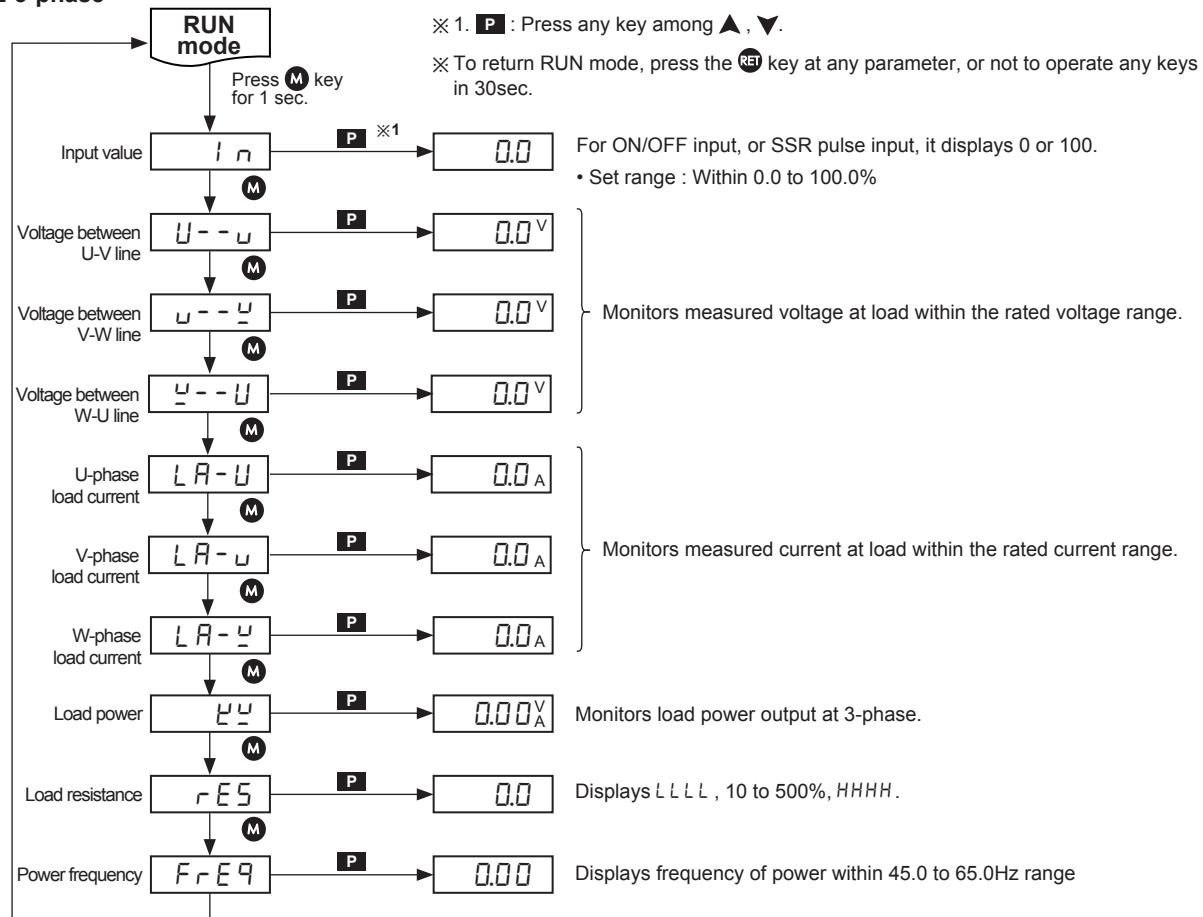
## Monitoring mode

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

### ■ 1-phase



### ■ 3-phase



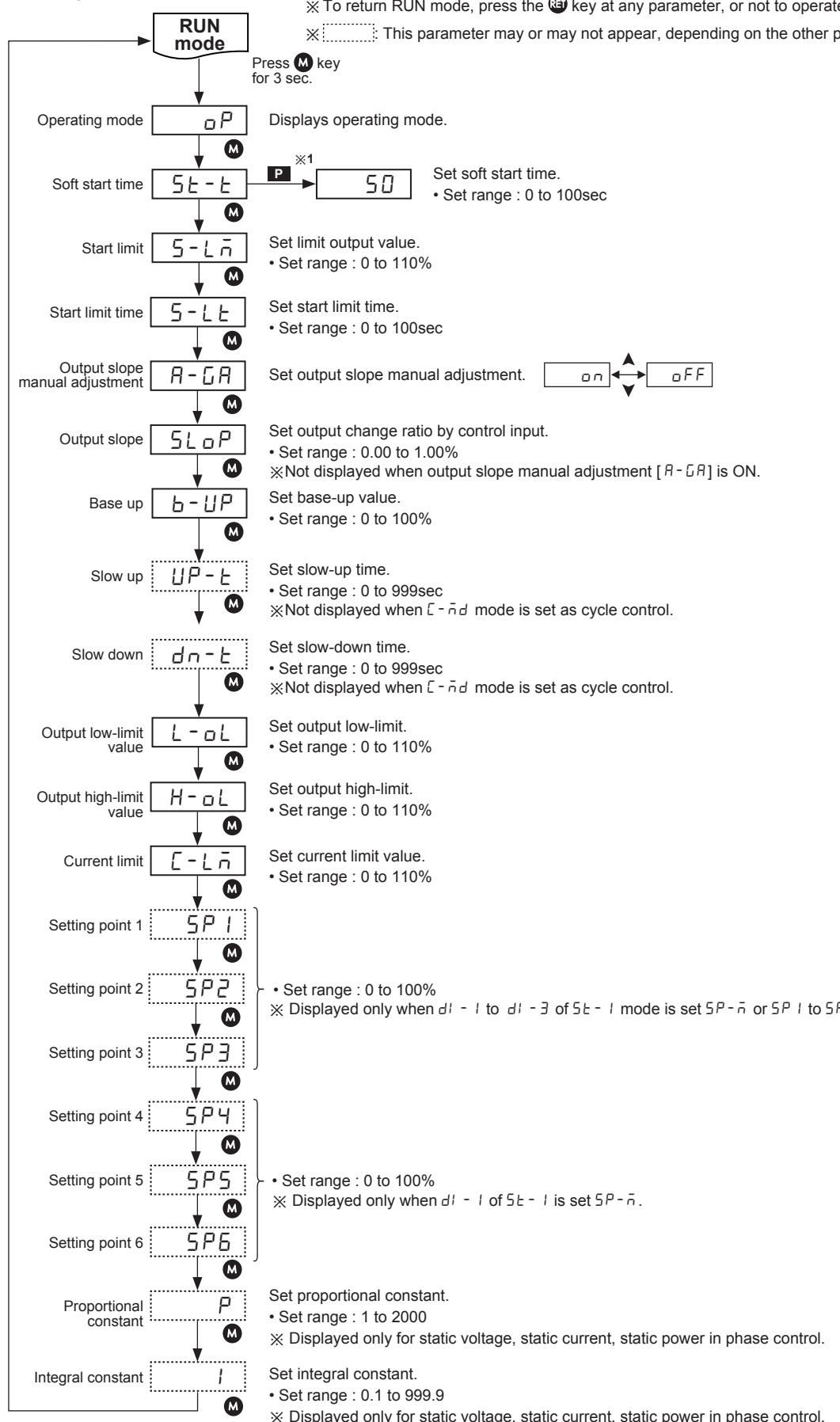
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DPU

# DPU Series

## Parameter mode

### ■ Operating Mode [ $\square P$ ]

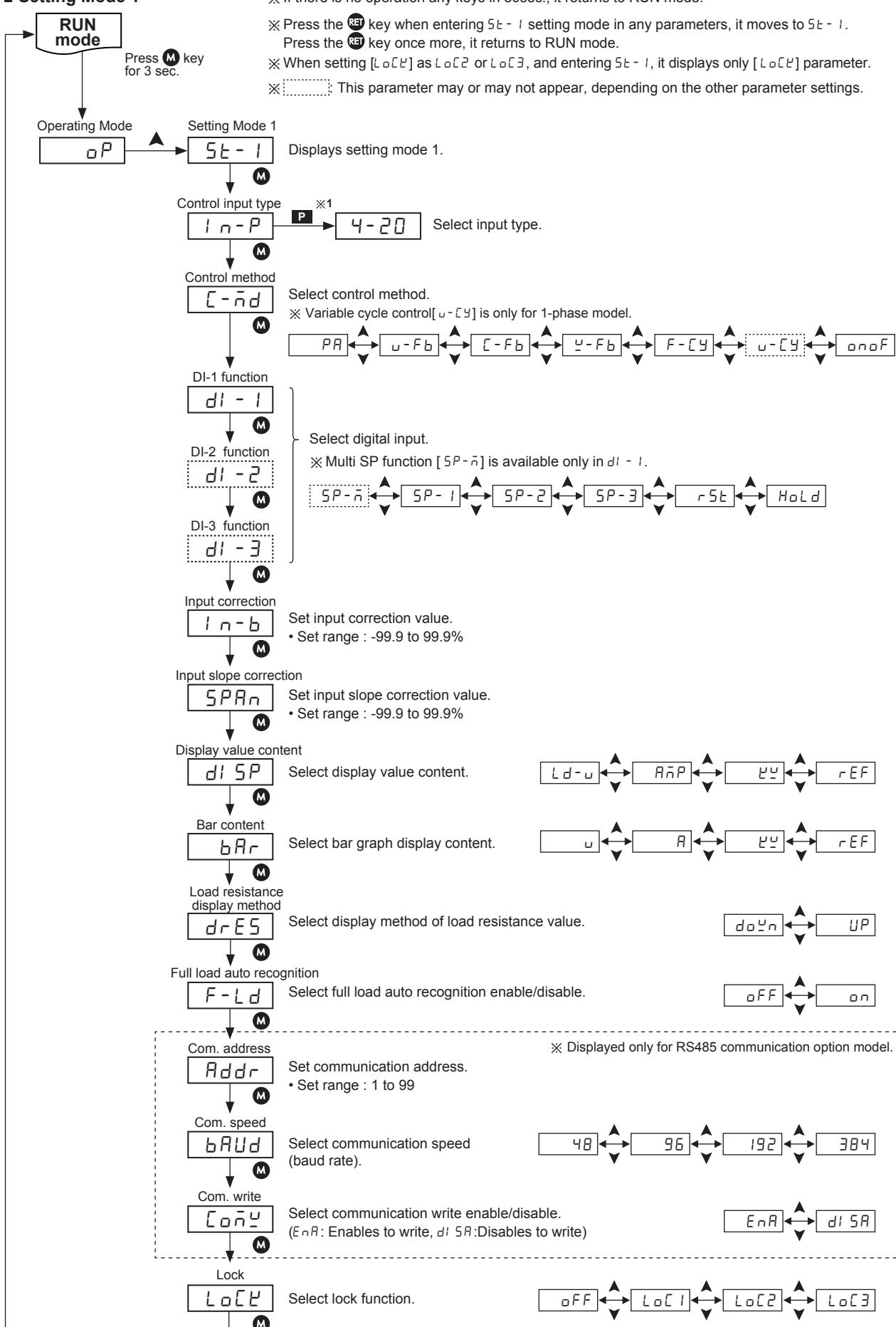


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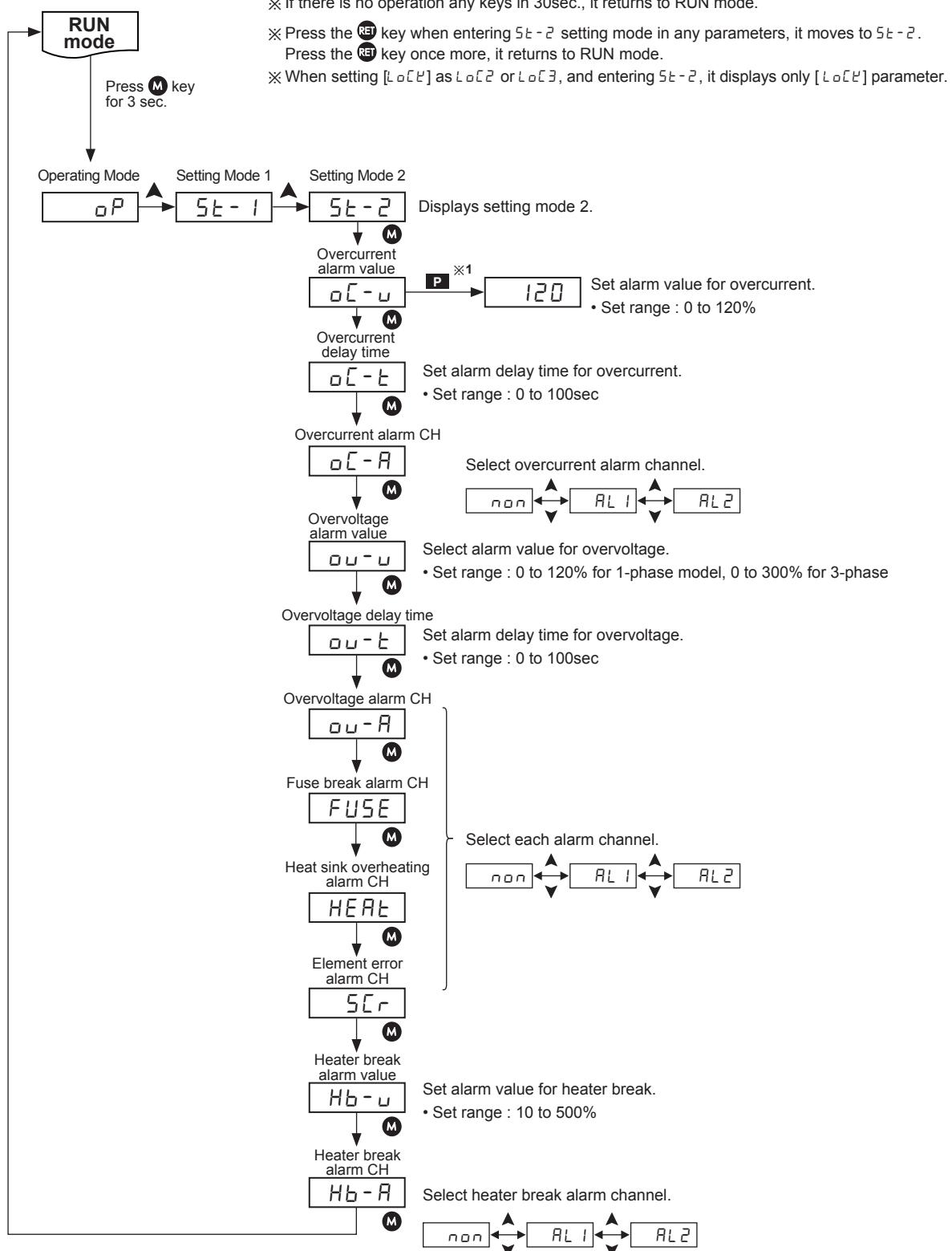
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## ■ Setting Mode 1



# DPU Series

## ■ Setting Mode 2



# Digital Thyristor Unit

## Factory default

### ■ Operating Mode

Parameter	Default	Parameter	Default	Parameter	Default	Parameter	Default
5t-t	0000	b-UP	0000	C-Ln	1100	SPS	0000
5-Ln	1100	UP-t	0003	SP1	0000	SP6	0000
5-Lt	0000	dN-t	0003	SP2	0000	P	0150
A-GA	0FF	L-oL	0000	SP3	0000	I	0200
SLoP	1000	H-oL	1100	SP4	0000		

A. Recorders

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### ■ Setting Mode 1

Parameter	Default	Parameter	Default	Parameter	Default	Parameter	Default
I-n-P	4-20	I-n-b	0000	bRr	(1-phase) u	CoNv	EnR
C-nd	PR	SPAn	0000		(3-phase) U-u	LoCE	0FF
di-1	SP-ñ	di SP	(1-phase) Ld-u		F-Ld	0FF	
di-2	SP-1		(3-phase) U-u		Addr	0001	
di-3	SP-1	drES	down		bRUD	384	

DPU

### ■ Setting Mode 2

Parameter	Default	Parameter	Default	Parameter	Default	Parameter	Default
oC-u	1100	ou-u	1100	FUSE	RL1	Hb-u	0100
oC-t	0005	ou-t	0005	HERE	RL1	Hb-R	RL2
oC-R	RL1	ou-R	RL1	SCR	RL1		

## Communications

### ■ Communication specification

Item	Specifications	
Com. method	RS485 2-wire half duplex	
Com. speed	4800, 9600, 19200, 38400bps (default 38400)	
Data length	8Bit	
Stop Bit	1Bit	
Parity	Even	
Max. connections	32 units	
Protocol	MODBUS 1.1 RTU	

### ◎ Function code 4(0x04) = Read input registers

#### • Request (Master → Slave)

0x01	0x04	0x00	0x00	0x00	0x10	xx	xx
Add.	Com- mand	Start add. High	Number of data Low		CRC 16		

#### • Response (Slave → Master)

0x01	0x04	0x10	0x03	0xE8	...	0x03	0xE8	xx	xx
Add.	Response command	Number of data	1st data High	...	16th data Low			CRC 16	

### ◎ Function code 3(0x03) = Read holding registers

#### • Request (Master → Slave)

0x01	0x03	0x00	0x00	0x00	0x00	xx	xx
Add.	Com- mand	Start add. High	Number of data Low		CRC 16		

#### • Response (Slave → Master)

0x01	0x03	0x10	0x03	0xE8	...	0x03	0xE8	xx	xx
Add.	Response command	Number of data	1st data High	...	16th data Low			CRC 16	

#### • Error (Slave → Master)

0x01	0x83	xx	xx	xx			
Address	Response command	Exception code	CRC 16				

### ■ Function code format

#### • Request (Master → Slave)

0x01	0x04	0x00	0x00	0x00	0x10	xx	xx
Add.	Com- mand	Start add. High	Number of data Low		CRC 16		

#### • Response (Slave → Master)

0x01	0x04	0x10	0x03	0xE8	...	0x03	0xE8	xx	xx
Add.	Response command	Number of data	1st data High	...	16th data Low			CRC 16	

#### • Error (Slave → Master)

0x01	0x86	xx	xx	xx			
Address	Response command	Exception code	CRC 16				

# DPU Series

## ◎ Function code 16(0x10) = write multiple registers

### • Request

(Master → Slave)

0x01	0x10	0x00	0x00	0x00	0x10	0x20	xx	xx
Add.	Com- mand	Start add.	Number of data	Number of byte	CRC 16			
		High	Low	High	Low	High	Low	

### • Response

(Slave → Master)

0x01	0x10	0x00	0x00	0x03	0xE8	xx	xx
Add.	Response command	Start add.	Number of data	CRC 16			
		High	Low	High	Low	High	Low

### • Error

(Slave → Master)

0x01	0x90	xx	xx	xx
Address	Response Command	Exception code	CRC 16	

※ Exception code

- 0x01 : Not supported command code
- 0x02 : Starting address of required data and transmittable address are different.
- 0x03 : The number of required data is over than the number of transmittable data.
- 0x04 : Transmittable data does not process properly.

## ■ Address mapping table

### ◎ Input registers [1-phase]

Address	Item	Factor
30001(0000)	Output voltage	*0.1
30002(0001)	Load current	*0.1
30003(0002)	Power	*0.1
30004(0003)	Load resistance	*0.1
30005(0004)	Power frequency	*0.01
30006(0005)	W-phase load current display(Arms)	*0.1
30101(0064)	Product No. H	00
30102(0065)	Product No. L	00
30103(0066)	Hardware version	10
30104(0067)	Software version	10
30105(0068)	Model name 1	"DP"
30106(0069)	Model name 2	"2-"
30107(006A)	Model name 3	"00"
30108(006B)	Model name 4	" "
30109(006C)	Model name 5	" "
30110(006D)	Model name 6	" "
30111(006E)	Model name 7	" "
30112(006F)	Model name 8	" "
30113(0070)	Model name 9	" "
30114(0071)	Model name 10	" "
30115(0072)	Reserved	Reserved
30116(0073)	Reserved	Reserved
30117(0074)	Reserved	Reserved
30118(0075)	Coil start address	0
30119(0076)	Coil quantity	0
30120(0077)	Input start address	0
30121(0078)	Input quantity	0
30122(0079)	Holding reg start address	0
30123(007A)	Holding reg quantity	32
30124(007B)	Input reg start address	0
30125(007C)	Input reg quantity	5

### ◎ Input registers [3-phase]

Address	Item	Factor
30001(0000)	Load voltage between U-V line display(Vrms)	*0.1
30002(0001)	Load voltage between V-W line display(Vrms)	*0.1
30003(0002)	Load voltage between W-U line display(Vrms)	*0.1
30004(0003)	U-phase load current display(Arms)	*0.1
30005(0004)	V-phase load current display(Arms)	*0.1
30006(0005)	W-phase load current display(Arms)	*0.1
30007(0006)	Power display(kw)	*0.01
30008(0007)	Load resistance display(% display for initial load)	*0.1
30009(0008)	Power frequency display	*0.01
30101(0064)	Product No. H	00
30102(0065)	Product No. L	00
30103(0066)	Hardware version	10
30104(0067)	Software version	10
30105(0068)	Model name 1	"DP"
30106(0069)	Model name 2	"2-"
30107(006A)	Model name 3	"00"
30108(006B)	Model name 4	" "
30109(006C)	Model name 5	" "
30110(006D)	Model name 6	" "
30111(006E)	Model name 7	" "
30112(006F)	Model name 8	" "
30113(0070)	Model name 9	" "
30114(0071)	Model name 10	" "
30115(0072)	Reserved	Reserved
30116(0073)	Reserved	Reserved
30117(0074)	Reserved	Reserved
30118(0075)	Coil start address	0
30119(0076)	Coil quantity	0
30120(0077)	Input start address	0
30121(0078)	Input quantity	0
30122(0079)	Holding reg start address	0
30123(007A)	Holding reg quantity	32
30124(007B)	Input reg start address	0
30125(007C)	Input reg quantity	5

# Digital Thyristor Unit

## ■ Address mapping table

### ◎ Holding registers [1-phase]

Address	Item	Factor
40001(0000)	Reference value	* 0.1(1 to 1000)
40002(0001)	Start Time	0 to 99
40003(0002)	Start limit	* 0.1(1 to 1000)
40004(0003)	Soft Start Time	0 to 99
40005(0004)	Output high-limit limit	* 0.1(1 to 1100)
40006(0005)	Output low-limit limit	* 0.1(1 to 1000)
40007(0006)	Remote Sp1 value	* 0.1(1 to 1000)
40008(0007)	Remote Sp2 value	* 0.1(1 to 1000)
40009(0008)	Remote Sp3 value	* 0.1(1 to 1000)
40010(0009)	Remote Sp4 value	* 0.1(1 to 1000)
40011(000A)	Remote Sp5 value	* 0.1(1 to 1000)
40012(000B)	Remote Sp6 value	* 0.1(1 to 1000)
40013(000C)	Slow up time	0 to 99
40014(000D)	Slow stop time	0 to 99
40015(000E)	CL value	* 0.1(1 to 2000)
40016(000F)	OC value	* 0.1(1 to 1100)
40017(0010)	OC time	0 to 99
40018(0011)	OV value	* 0.1(1 to 1100)
40019(0012)	OV time	0 to 99
40020(0013)	Load detector alarm value	* 0.1(1 to 2000)
40021(0014)	Display content selection	0 to 3
40022(0015)	Bar display mode	0 to 3
40023(0016)	Control integer KP value	0 to 9999
40024(0017)	Control integer KI value	* 0.1(1 to 999.9)
40025(0018)	Output control mode	0 to 6
40026(0019)	Event input 1 mode	0 to 4
40027(001A)	Event input 2 mode	0 to 4
40028(001B)	Event input 3 mode	0 to 4
40029(001C)	Auto ref input selector	0 to 3
40030(001D)	Load resistance display method	0 to 1
40031(001E)	Operation status 0x0000	Bit0... Fault Bit1... I-OC Bit2... Over current Bit3... Over volt Bit4... Over temp Bit5... Fuse cut Bit6... Phase loss Bit7... Load open Bit8... Over SCR Bit9... Over Fred Bit10... Run/Stop Bit11... Auto/Manual Bit12... EMS Power Bit13... Not Load
40032(001F)	Output slope(%)	0 to 2
40033(0020)	Output for 0% input(%)	0 to 2
40034(0021)	Input correction	0 to 2
40035(0022)	Input slope correction	0 to 2
40036(0023)	Overcurrent alarm output	0 to 2
40038(0025)	Oversupply alarm output	0 to 2
40039(0026)	Fuse break alarm output	0 to 2
40040(0027)	Frequency error alarm output	0 to 2
40041(0028)	Heatsink overheat alarm output	0 to 2
40042(0029)	Element error alarm output	0 to 2
40044(002A)	Heater break alarm output	0 to 2

A. Recorders
B. Indicators
C. Converters
D. Controllers
E. Thyristor units
F. Pressure transmitters
G. Temperature transmitters
H. Accessories

DPU

# DPU Series

## ■ Address mapping table

### ◎ Holding registers [3-phase]

Address	Item	Parameter	Factor
40001(0000)	Reference value	<i>i_n</i>	0.0 to 100.0 (*0.1)
40002(0001)	Soft start time	<i>St-t</i>	0 to 100 (*1)
40003(0002)	Start limit	<i>S-Ln</i>	0.0 to 110.0 (*0.1)
40004(0003)	Start limit time	<i>S-Lt</i>	0 to 100 (*1)
40005(0004)	High output limit	<i>H-oL</i>	0.0 to 110.0 (*0.1)
40006(0005)	Low output limit	<i>L-oL</i>	0.0 to 110.0 (*0.1)
40007(0006)	SP1	<i>SP-1</i>	0.0 to 100.0 (*0.1)
40008(0007)	SP2	<i>SP-2</i>	0.0 to 100.0 (*0.1)
40009(0008)	SP3	<i>SP-3</i>	0.0 to 100.0 (*0.1)
40010(0009)	SP4	<i>SP-4</i>	0.0 to 100.0 (*0.1)
40011(000A)	SP5	<i>SP-5</i>	0.0 to 100.0 (*0.1)
40012(000B)	SP6	<i>SP-6</i>	0.0 to 100.0 (*0.1)
40013(000C)	Slow up	<i>UP-t</i>	0 to 999 (*1)
40014(000D)	Slow down	<i>dn-t</i>	0 to 999 (*1)
40015(000E)	Current limit	<i>C-Ln</i>	0.0 to 110.0 (*0.1)
40016(000F)	Over current value	<i>oC-u</i>	0.0 to 120.0 (*0.1)
40017(0010)	Over current time	<i>oC-t</i>	0 to 100 (*1)
40018(0011)	Over voltage value	<i>ou-u</i>	0.0 to 300.0 (*0.1)
40019(0012)	Over voltage time	<i>ou-t</i>	0 to 100 (*1)
40020(0013)	Heater break value	<i>Hb-u</i>	10.0 to 500.0 (*0.1)
40021(0014)	Display selected contents	<i>d1 SP</i>	0 to 7 (*1) 0: U-V 1: V-W 2: W-U 3: LA-U 4: LA-V 5: LA-W 6: KW 7: REF
40022(0015)	Bar graph's content	<i>bRr</i>	
40023(0016)	Proportional value	<i>P</i>	1 to 2000 (*1)
40024(0017)	Integral value	<i>i</i>	0.1 to 999.9 (*0.1)
40025(0018)	Control method	<i>C-nd</i>	1 to 6 (*1) 1: F-CY 2: PA 3: C-FB 4: V-FB 5: W-FB
40026(0019)	Digital input 1	<i>dI - 1</i>	0 to 5 (*1) 0: SP-M 1: SP-1 2: SP-2 3: SP-3 4: RST 5: HOLD
40027(001A)	Digital input 2	<i>dI - 2</i>	1 to 5 (*1) 1: SP-1 2: SP-2 3: SP-3 4: RST
40028(001B)	Digital input 3	<i>dI - 3</i>	5: HOLD
40029(001C)	Control input type	<i>i_n-P</i>	0 to 6 (*1) 0: 4-20 1: 1-5 2: 0-10 3: 0-5 4: SSR 5: COM
40030(001D)	Load resistance display method selection	<i>drE5</i>	0 to 1(*1) 0: DOWN 1: UP
40031(001E)	Operation status	-	Bit0... Fault Bit1... I-OC Bit2... Over current Bit3... Over volt Bit4... Over temp Bit5... Fuse cut Bit6... Phase loss Bit7... Load open Bit8... Over SCR Bit9... Over Freq Bit10... Run/Stop Bit11... Auto/Manual Bit12... EMS Power
40032(001F)	Output slope	<i>SLoP</i>	0.000 to 1.000 (*0.001)
40033(0020)	Base up setting	<i>b-UP</i>	0.0 to 100.0 (*0.1)
40034(0021)	Input correction	<i>i_n-b</i>	-99.9 to +99.9 (*0.1)
40035(0022)	Span	<i>SPRn</i>	-99.9 to +99.9 (*0.1)
40036(0023)	Over current alarm	<i>oC-R</i>	0 to 2 (*1) 0: NON 1: AL1 2: AL2
40038(0025)	Over voltage alarm	<i>ou-R</i>	
40039(0026)	Burn out fuse alarm	<i>FUSE</i>	
40041(0028)	Heat sink temperature abnormal condition alarm	<i>HERt</i>	
40042(0029)	Thyristor abnormal condition alarm	<i>SCR</i>	
40044(002B)	Heater break alarm	<i>Hb-R</i>	

## Proper usage

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DPU

- Do not use the unit outdoors. Failure to follow this instruction may result in electric shock or shorten the life cycle of the unit.
- Caution for usage (Do not install this unit at the following places.)

The place where ambient temperature is over -10 to 50°C range.

The place where ambient humidity is over 5 to 90%RH.

The place where temperature changes are rapid and there is dew condensation.

The place where there is corrosive gas (especially oil gas, ammonia, etc), or flammable gas.

The place where there is vibration or shock to the unit.

The place where there is water, oil, drug, or steam.

The place where there is lots of dust and dirt, salinity, or iron.

The place where big induction malfunction, static, or magnetism noise occurs easily.

The place where there is direct ray of the sun.

The place where thermal heat builds up by radiant heat.

Do not open the cover automatically to move this unit.

- Installations

Tighten this unit with bolts as accessories on the panel.

If water enters this unit, you must inspect this unit. It may cause short circuit, or a fire.

When installing this unit, use safety protections such as safety shoes, and helmet, etc and be sure that the safety.

Be sure that not to put the legs or sit on this unit.

- Temporary storage

Fix this unit with transportation screws to store this unit temporarily.

Store this unit as below environments.

The place where there is no dregs, flammable gas, explosive gas (SO<sub>2</sub>, H<sub>2</sub>SO, etc).

The place where there is no vibration, shock.

The place where there is no steam or not too much hot humidity (95%RH).

The place where it is not extreme low temperature (below -20°C).

- Caution for wiring

Do not use empty terminals during wiring I/O to other usage.

Consider a countermeasure for lots of noises.

- Cleaning

In cleaning the unit, use dry cloth.

Do not use organic solvent.

Turn off the power to clean this unit.