Multi-channel Power Controllers

SPRM Series

INSTRUCTION MANUAL

TCD210002AF

Autonics

Thank you for choosing our Autonics product.
Read and understand the instruction manual and manual thoroughly before using the product.
For your safety, read and follow the below safety considerations before using.
For your safety, read and follow the considerations written in the instruction manual, other manuals and Autonics website.
Keep this instruction manual in a place where you can find easily.
The specifications, dimensions, etc. are subject to change without notice for product improvement. Some models may be discontinued without notice.
Follow Autonics website for the latest information.

Safety Considerations

- Observe all 'Safety Considerations' for safe and proper operation to avoid hazards.
- ⚠ symbol indicates caution due to special circumstances in which hazards may occur.

⚠ Warning Failure to follow instructions may result in serious injury or death.

01. Fail-safe device must be installed when using the unit with machinery that may cause serious injury or substantial economic loss.(e.g. nuclear power control, medical equipment, ships, vehicles, railways, aircraft, combustion apparatus, safety equipment, crime / disaster prevention devices, etc.)
Failure to follow this instruction may result in personal injury, economic loss or fire.
02. Do not use the unit in the place where flammable / explosive / corrosive gas, high humidity, direct sunlight, radiant heat, vibration, impact or salinity may be present.
Failure to follow this instruction may result in explosion or fire.
03. Install on the device panel, and ground to the bolt for grounding separately.
Failure to follow this instruction may result in fire or electric shock.
04. Do not connect, repair, or inspect the unit while connected to a power source.
Failure to follow this instruction may result in fire or electric shock.
05. Check 'Connections' before wiring.
Failure to follow this instruction may result in fire.
06. Do not disassemble or modify the unit.
Failure to follow this instruction may result in fire or electric shock.

⚠ Caution Failure to follow instructions may result in injury or product damage.

01. Use the unit within the rated specifications.
Failure to follow this instruction may result in fire or product damage.
02. Use a dry cloth to clean the unit, and do not use water or organic solvent.
Failure to follow this instruction may result in fire or electric shock.
03. Keep the product away from metal chip, dust, and wire residue which flow into the unit.
Failure to follow this instruction may result in fire or product damage.
04. Since leakage current still flows right after turning off the power or in the output OFF status, do not touch the load terminal.
Failure to follow this instruction may result in electric shock.
05. Be careful not to injure the edges of the heat sink.

Cautions during Use

- Follow instructions in 'Cautions during Use'. Otherwise, it may cause unexpected accidents.
- Power supply should be insulated and limited voltage / current or Class 2, SELV power supply device.
- Use the product, after 3 sec of supplying power.
- Before use, set the mode and function according to the specification. Since changing the mode / parameter during operation may result in malfunction, set the mode and function after disconnecting load output.
- Re-supply the power to the unit after 3 sec of turning off the power. Failure to follow this instruction may result in malfunction.
- To ensure the reliability of the product, install the product on the panel or metal surface vertically to the ground.
- Install the unit in the well ventilated place.
- While supplying power to the load or right after turning off the power of the load, do not touch the body and heat sink. Failure to follow this instruction may result in a burn due to the high temperature.
- Install a power switch or circuit breaker in the easily accessible place for supplying or disconnecting the power.
- Do not wire to terminals which are not used.
- Use twisted pair wire for communication line.
- When connecting the display module and the main body with a LAN cable (direct / cross cable), be careful not to generate excessive tension. Poor contact may cause malfunction of the display.
- Since inter element can be damaged when using with coil load, inductive load, etc., the inrush current must be under the rated load current.
- To prevent product malfunction due to noise, wire power, control input, communication, and load cables separately.
- When installing close to the load line, use a line filter for the power line and use a shield wire.
- For stable operation, use shield wire for control, alarm, and communication wires. Use a ferrite core on the shield wire to cope with EMC.
- Do not use near the equipment which generates strong magnetic force or high frequency noise.
- This unit may be used in the following environments.
  - Indoors (in the environment condition rated in 'Specifications')
  - Altitude max. 2,000 m
  - Pollution degree 2
  - Installation category III

Ordering Information

This is only for reference, the actual product does not support all combinations.
For selecting the specified model, follow the Autonics website.

SPRM ❶ - ❷ ❸ ❹

❶ Control phases
3: 3-phase
❷ Rated load voltage
F: Free voltage
❸ Rated load current
Number: Rated load current (unit: A)
❹ Communication
R: RS485
EC: EtherCAT

Product Components

- Product
- Instruction manual
- Display blank panel × 1
- RS485 communication connector × 1
- Control input connector × 1
- Power input / Alarm output connector × 1
- Feedback control connector × 1

Manual

For proper use of the product, refer to the manuals and be sure to follow the safety considerations in the manuals.
Download the manuals from the Autonics website.

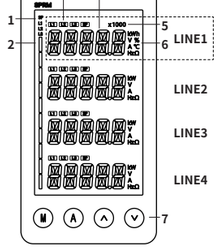
Software

Download the installation file and the manuals from the Autonics website.

■ DAQMaster

It is the comprehensive device management program for Autonics' products, providing parameter setting, monitoring and data management.

Display Module



1. BAR output phase (orange)
: Turns ON L1, L2, L3, or 3P phase of output BAR display.
2. Output BAR (orange)
: 10 bars for output percentage.
Turns ON from the bottom bar. About 10 % of output displays per one bar.
3. Control / Monitor phase (green)
: Turns ON L1, L2, L3, or 3P phase of control or monitor phase.
4. PV / SV display part (white)
: 0000.0 to 9999.9 (fixed decimal point)
LINE 1 to 4 are available to set the desired monitoring value for each line at the setting check mode.
5. × 1000 indicator (green) (only LINE1)
: Turns ON for over 6 digit accumulated power.
Multiply 1000 times for PV / SV display part value.
E.g.) PV/SV display part is 1, Unit indicator is kWh and ×1000 indicator turns ON, it means 1,000 kWh.

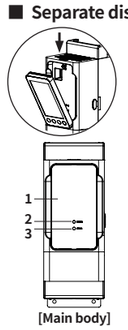
6. Unit indicator (green)

Unit	kWh 01)	kW 02)	V	% 01)	A	°C 01)	Hz	Ω
Load	Accumulated power	Power	Load voltage	Output	Load current	Heatsink temp.	Input power freq.	Load resistance

01) Only LINE1
02) For LINE2 to 4

7. Setting keys (M, A, ▲, ▼)

■ Separate display module



[Main body]

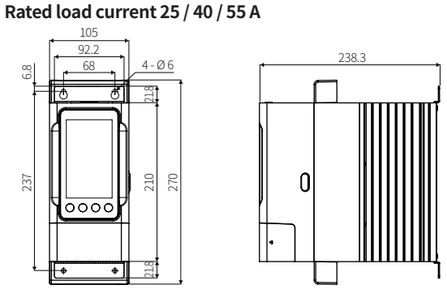
- Press the display module removal button on the top of the unit.
- The separated display module is available to install on a remote panel for convenient load monitoring.
- Connect the RJ45 cable between the display module and main body. This cable should be within 5 m length for prevent noise.

1. Display blank panel
: Attach this for prevent dust from entering the product.
2. Power indicator (POWER, green)
: Turns ON for stable operation after power input
3. Alarm indicator (ERROR, red)
: Flashes for alarm occur

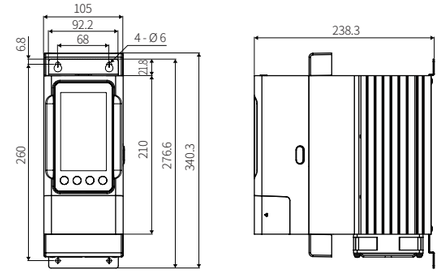
Dimensions

- Unit: mm, For the detailed drawings, follow the Autonics website.

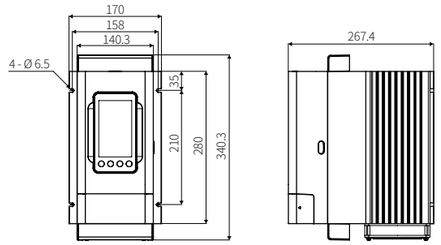
■ Rated load current 25 / 40 / 55 A



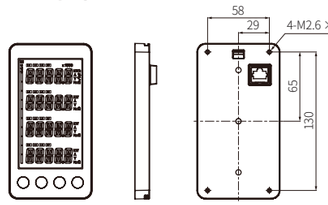
■ Rated load current 70 A



■ Rated load current 90 / 110 / 160 A

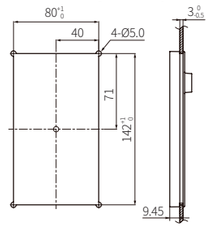


■ Display module

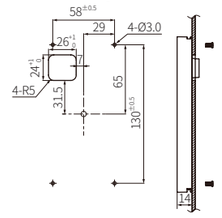


■ Panel cut-out of display module

- Panel flushing mounting



- Bolts fastening



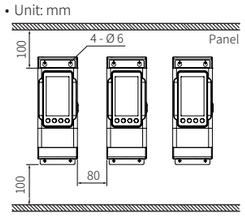
Cautions during Installation

⚠ High Temperature Caution
While supplying power to the load or right after turning off the power of the load, do not touch the body and heatsink.
Failure to follow this instruction may result in a burn due to the high temperature.

■ Mount space

- When installing multiple power controllers, keep space between power controllers for heat radiation.
  Horizontal: ≥ 80 mm, vertical: ≥ 100 mm

- Unit: mm



Specifications

Model	SPRM3-F□R	SPRM3-F□EC
Control phases	Single phase 3 Ch or 3-phase	
Rated load voltage	Free voltage 220 - 440 VAC~ 50 / 60 Hz	
Rated load current 01)	25 / 40 / 55 / 70 / 90 / 110 / 160 A	
Display method	5 digit 11 segment LCD (white) × 4, Output BAR	
Auto control input	DC 4 - 20 mA × 3 Ch, 0 - 5 / 1 - 5 / 0 - 10 VDC⎓, External adjuster (10 kΩ), RS485, EtherCAT	
Manual control input	Parameter setting	
Digital input (DI)	RUN / STOP selectable, AUTO / MANU selectable, RESET	
Alarm output	250 VAC~ 2 A, 30 VDC⎓ 2 A, 1c resistance load	
Comm. output	RS485	RS485, EtherCAT
Cooling method	Rated load current 25 / 40 / 55 A: natural cooling Rated load current 70 / 90 / 110 / 160 A: forced air cooling (with cooling fan)	
Unit weight (packaged)	Rated load current 25 / 40 / 55 A: ≈ 4.75 kg (≈ 5.75 kg) Rated load current 70 A: ≈ 4.8 kg (≈ 5.8 kg) Rated load current 90 / 110 / 160 A: ≈ 9.42 kg (≈ 10.55 kg)	
Approval	CE, cULus LISTED, EAC	

01) It is the rated load current of each channel in single-phase operation.

Control method	Phase control	Cycle control
Control mode	Normal / Constant current feedback / Constant voltage feedback / Constant power feedback	Fixed cycle / Variable cycle
Applied load	Resistance load, inductive load	Resistance load
Output range	Resistance load: 0 to 98 % Inductive load: 5 to 98 %	0 to 100 %
Output accuracy	Varies by control mode	
Normal	Within ± 10 % F.S. of rated load voltage	-
Constant current / voltage / power feedback	Within ± 3 % F.S. of rated load current / voltage / power	-

Power supply	24 VDC⎓ ± 10 %
Min. load current	1 A
Power consumption	≤ 15 W
Insulation resistance	≥ 200 MΩ (500 VDC⎓ megger)
Dielectric strength	Between the charging part and the case: 3,000 VAC~ 50 / 60 Hz for 1 min
Output leakage current	≤ 10 mArms
Noise immunity	± 500 V square wave noise (pulse width: 1 μs) by the noise simulator
Memory retention	≈ 10 years (when using non-volatile semiconductor memory type)
Vibration	0.5 mm double amplitude at frequency of 5 to 55 Hz in each X, Y, Z direction for 2 hours
Vibration (malfunction)	0.5 mm double amplitude at frequency of 5 to 55 Hz in each X, Y, Z direction for 10 min
Ambient temperature	-10 to 40 °C, storage: -20 to 80 °C (no freezing or condensation)
Ambient humidity	35 to 85 %RH, storage: 35 to 85 %RH (no freezing or condensation)

Communication Interface

■ RS485

Comm. protocol	Modbus RTU (16 bit CRC), Modbus ASCII
Application standard	Compliance with EIA RS485
Max. connection	31-unit (address: 1 to 99)
Comm. synchronous method	Asynchronous
Comm. method	2-wire half duplex
Comm. distance	≤ 800 m
Comm. speed	2,400 / 4,800 / 9,600 (default) / 14,400 / 19,200 / 38,400 / 57,600 / 115,200 bps
Comm. response time	0 to 9999 ms (default: 0 ms)
Start bit	-
Data bit	8 bit (fixed)
Parity bit	None (default), Even, Odd
Stop bit	1 bit (default), 2 bit
EEPROM life cycle	≈ 50,000 operations (Erase / Write)

■ EtherCAT

Comm. specifications	EtherCAT
Association approval 01)	EtherCAT
Connection cable	CAT5e class or over (Shield type: SF/FTP, S/FTP, SF/UTP)
Max. comm. distance	Within 100 m distance between nodes
Max. baud rate	10 / 100 Mbps
Topology	Star, Line, Tree

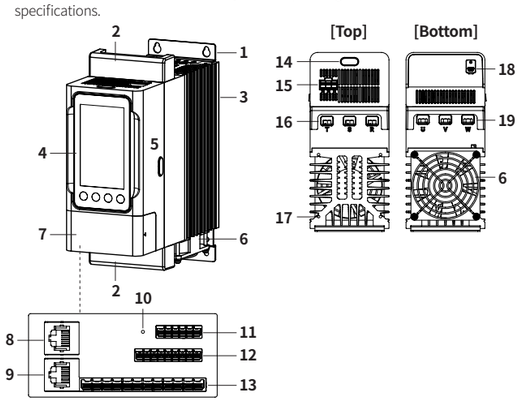
01) EtherCAT® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

Load Output Formula

Type	Input		Formula
Auto control (AUTO)	Current	DC 4 - 20 mA	Load output [%] = (Control input [%] × Output slope [%]) + Offset
	Voltage	1 - 5 VDC⎓	
		0 - 5 VDC⎓	
		0 - 10 VDC⎓	
	RS485 / EtherCAT	0 to 100.0 %	
	External adjuster	0 to 10 kΩ	
Manual control (MANU)	Parameter	0 to 100.0 %	Load output [%] = Parameter SV [%]

Unit Descriptions

- The configuration of each model may differ depending on the supported specifications.

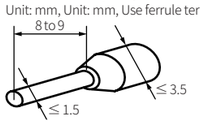


1. Bracket [Rated load current: 25 / 40 / 55 / 70 A model]
2. Load power terminal protection cover
3. Heatsink: Rated load current 90 / 110 / 160 A models have left / right mounting holes.
4. Display module: For more information, refer to Display Module.
5. Case open button
6. Cooling fan [Rated load current: 70 / 90 / 110 / 160 A model]
7. I / O terminal cover
8. EtherCAT communication connector (IN) [Communication: EtherCAT model]
9. EtherCAT communication connector (OUT) [Communication: EtherCAT model]
10. RESET switch: Reset for operation / alarm
11. RS485 communication connector
12. Control input connector
13. Power input / Alarm output connector
14. Display module remove button
15. Feedback control connector
16. R, S, T load input terminal
17. Bolt for grounding (M4)
18. USB connector
: Do not use this connector. It may cause product failure. This connector is used for firmware upgrade, operation mode change, and A/S.
19. U, V, W load output terminal

Cautions during Wiring

■ RS485 communication connector, Control input connector, Power input / Alarm output connector

Unit: mm, Unit: mm, Use ferrule terminal of size specified below.



■ Load Input / Output Connector

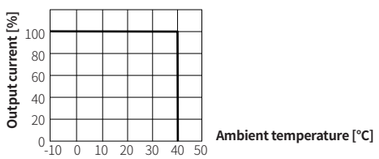
- Unit: mm, Use crimp terminals of size specified below.
  Be sure to use crimp terminals with insulating sleeves (tubes).

Rated load current	A	B
25 / 40 / 55 / 70 A	≥ 6.0	≤ 16.0
90 / 110 / 160 A	≥ 8.0	≤ 26.0

- Cable / screw / tightening torque spec. is different depending on the load current. Be sure to the below before connection.

Rated load current	Spec.	Power input / Alarm output	Control input / Comm. input	Feedback	Load input / output
25 / 40 / 55 / 70 A	Wiring	AWG 24 to 16	AWG 26 to 16	AWG 30 to 8	AWG 10 to 4
	Screw	-	-	-	M6
	Tightening torque	-	-	-	5.5 to 6.0 N m
90 / 110 / 160 A	Wiring	AWG 24 to 16	AWG 26 to 16	AWG 30 to 8	AWG 3 to 2 / 0
	Screw	-	-	-	M8
	Tightening torque	-	-	-	6.5 to 7.0 N m

Derating Curve



Connections

- The configuration of each model may differ depending on the supported specifications.

■ EtherCAT communication connector

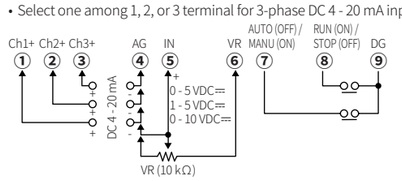
Pin layout		Pin	Function	Pin	Function
LED1 LED2 1 8	IN	1	TD +	5	-
		2	TD -	6	RD -
LED1 LED2 1 8	OUT	3	RD +	7	-
		4	-	8	-

- LED1 (green): Turns ON for data input, LED2 (yellow): Turns ON for data output

■ RS485 communication connector

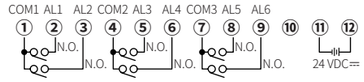
■ Control input Connector

- Select one among 1, 2, or 3 terminal for 3-phase DC 4 - 20 mA input.



■ Power input / Alarm output connector

Alarm output 1 to 6
250 VAC~ 2A 1a, 30 VDC⎓ 3A 1a
Resistive Load



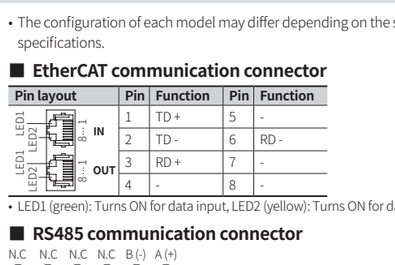
■ Feedback control connector

Pin layout	Pin	Function
L3 L2 L1	L1	R input feedback
	L2	S input feedback
	L3	T input feedback

This is the connection for measuring the load voltage and controlling (constant voltage / constant power) feedback.
If it is not connected, it is impossible to measure the load voltage, and the feedback control and alarm related to the load voltage may be limited.

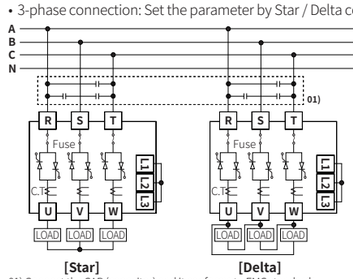
■ Load input / output, feedback terminal connection

- A, B, C = R, S, T = U, V, W = L1, L2, L3 3-phase line
  N = neutral line
  The voltage is applied by combining the 3-phase line, and the neutral line.
- Single-phase connection: Three-channel operation or each phase input power can be applied with one input power.



01) Connect the CAP (capacitor) and it conforms to EMC standards.
- FILM CAPACITOR: ≥ 1μF / 500 VAC~

- 3-phase connection: Set the parameter by Star / Delta connection.



01) Connect the CAP (capacitor) and it conforms to EMC standards.
- FILM CAPACITOR: ≥ 1μF / 500 VAC~

■ Suitable specifications

- The following connectors can be used with equivalent or substitute.

Connector	Connector specifications	Manufacture
EtherCAT communication	RJ45 connector 01)	-
RS485 communication	0225-0806	Dinkle
Control input	0225-0809	
Power input / Alarm output	0226-0812	
Feedback control	EC762HV-03P-BK	

01) EtherCAT dedicated cable must be used and the performance can not be guaranteed when using other cables.

Initial Display When Power is ON

When power is supplied, after all display will flash for 1 sec, model specification is displayed sequentially. After this, enter into RUN mode.
- Model specification: rated current, communication type, firmware version
- Example of SPRM3-F160EC model,

	1. All displays	2. Model spec.	3. Run mode
LINE1	8888.8	ModEL	0.0
LINE2	8888.8	16DEC (rated current + comm. type)	0.0
LINE3	8888.8	FW	0.0
LINE4	8888.8	V01 (firmware version)	0.0

Alarm

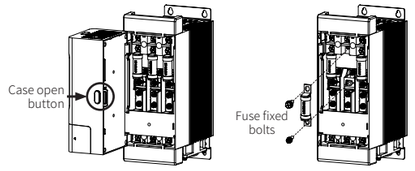
- Parameter setting is available to set alarm usage, alarm delay time, relay output, auto release,etc.

Alarm	Display	Operation		Alarm release 01)
		Alarm	Output (default)	
Overcurrent	oC	Error display flashes at LINE1	Stop (SCR OFF)	• Re-supply power. • Press [RESET]. 02) • Press [▼] for over 2 sec. • Set parameter A-RCY as ON by each alarm
Overvoltage	oV			
Heatsink over heat	otW		Maintain (normal operation)	
Heatsink over heat protection	otP		Stop (SCR OFF)	
Heater break	Ht-bk			
Partial heater break	dLF-A		Maintain (normal operation)	
Load unbalance	UL			
SCR error	SCR-A		Stop (SCR OFF)	
Fuse break	FUSE			
FAN error	FAN		Maintain (normal operation)	
Frequency error	FRQY		Stop (SCR OFF)	

01) If the alarm occurrence condition is not removed, the alarm is re-occur even if the alarm release method is applied.
02) The power is reapplied.

Replacement of Fuse

- Open the case by pressing the case open button on the right side of the product.
- The performance of the product is guaranteed only when using the fuse provided by us. For replacing the fuse, use the recommended fuse.



Rated load current	Recommended fuse	Manufacturer
25 A	50FE	BUSSMANN
40 A	63ET	
55 A	80ET	
70 A	100FE	
90 / 110 A	660GH-160	HINODE
160 A	660GH-200	

■ Bolt specification

Rated load current	Fuse fixed bolt
25 / 40 / 55 / 70 A	M6
90 / 110 A	Top: M8 Bottom: M6
160 A	M8

Mode Setting

RUN	[M + ▲] 2 sec	→	Setting check mode	[M] 2 sec	→ RUN
	[M] 2 sec	→	Program setting mode	[M] 2 sec	→
	[A + ▼] 2 sec	→	Manual control input 01)	[M] 2 sec	→
	[M + A] 2 sec	→	Alarm setting mode	[M] 2 sec	→
	[M] 02)	→	BAR output phase setting	Auto	→
	[A] 02)	→	LINE1 control / monitor phase setting	Auto	→
	[▲]	→	LINE1 load type setting 03)	Auto	→
	[▼]	→	Input amount check 04)	Auto	→
	[M + ▼] 2 sec	→	EtherCAT status monitoring mode	[M] 2 sec	→
	7-9 terminal external contact of control input connector	→	RUN / STOP	Auto	→
	8-9 terminal external contact of control input connector	→	Auto / Manual control	Auto	→
	[▼] 2 sec	→	Alarm reset	Auto	→
	Reset switch of I/O terminal	→	Operation reset 05)	Auto	→

01) This parameter is in program setting mode. It operates when manual control mode.
02) It is available when 3-phase setting as OFF at single-phase / 3-phase parameter setting of Program setting mode.
03) Load type of LINE1 is selectable by the [▲] key in RUN mode or at setting check mode.
Load type of LINE 2 to 4 is selectable at setting check mode.
04) Press the [▼] key when LINE1 displays output and the input amount check is displayed with flashing.
05) In the event of system anomalies and alarms, RESET input restarts the power controller. (parameters are not reset.)

Parameter Setting

- Some parameters are activated / deactivated depending on the model or setting of other parameters.
- For more information, refer to the manuals.

■ Setting check mode

Parameter	LINE1
LINE1 monitor setting	LINE1
LINE2 monitor setting	LINE2
LINE3 monitor setting	LINE3
LINE4 monitor setting	LINE4
Parameter copy	PCoPY
Current time check	tIM-C
Alarm history	ALM-d

■ Alarm setting mode

Parameter	LINE1
Overcurrent alarm	oC
Overvoltage alarm	oV
Heatsink over heat alarm	otW
Heatsink over heat protection alarm	otP
Heater break alarm	Ht-bk
Partial heater break alarm	dLF-A
Load unbalance alarm	UL
SCR error alarm	SCR-A
Fuse break alarm	FUSE
FAN error alarm	FAN
Frequency error alarm	FRQY
Alarm save	ALM-S
Time setting	t-SEt

■ Program setting mode

Parameter	LINE1
Single-phase / 3-phase	oP-S
Control input	INPUt
Load type	LoAd
Control mode	oPER
Feedback control	Fb-S
Soft start / up / down	SoF-t
Output high / low limit	oUt-L
Output current limit	C-LM
Input slope correction	SLoPE
Input offset	oFSEt
Partial heater break	dLF
Power distribution control	PdC
RS485 communication	RS485
Parameter reset	RSt-P
Reset check	RSt
Lock	LoCK
Manual control input	MANU

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