July 18, 2006

DC Power Supply Unit

GEXUS 13

Operation Manual

(Third Edition)

Please read this operation manual and understand its contents before running, inspecting, and maintaining this product.

Operators and controllers of this product must not allow anyone to operate this product unless the latter understands the contents of this product.

Manufactured by: Origin Electric Co., Ltd.

<table>
<tr><th>No.</th><th>Date</th><th>Page</th><th>Change made</th></tr>
<tr><td>1</td><td>Nov. 21, 2005</td><td>5-9</td><td>① Concerning item 5-6 1) “Functions of dip switch 1,” the functions of switch Nos. 5 and 7 were incorrectly specified. The correct specifications are: “No. 5: Reserved” and “No. 7: Prohibits alarm detection.”
② Table 5-4 “Switchover of control modes by using dip switch 1 and external remote signal” was incorrectly specified. The correct specifications are as follows:
<table><tr><th colspan="2">Dip switch 1 (②)</th><th colspan="2">External remote signal CN4 (⑤)</th><th rowspan="2">Operation control mode</th></tr><tr><th>No. 1</th><th>No. 3</th><th>Constant voltage (between 4 and 23)</th><th>Constant power (between 5 and 24)</th></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>Constant power</td></tr><tr><td>0</td><td>1</td><td>0</td><td>0</td><td>Constant voltage</td></tr><tr><td>1</td><td>0</td><td>1</td><td>0</td><td>Constant voltage</td></tr><tr><td>1</td><td>0</td><td>0</td><td>1</td><td>Constant power</td></tr><tr><td>0</td><td>1</td><td>1</td><td>0</td><td>Constant voltage</td></tr><tr><td>0</td><td>1</td><td>0</td><td>1</td><td>Constant power</td></tr></table>
③ This function is factory-configured to constant-voltage control mode. The settings are therefore “No. 1 (OFF), No. 2 (OFF), and No. 3(ON).”</td></tr>
<tr><td>2</td><td>July 18, 2006</td><td>5-8</td><td>① The factory settings were deleted from Table 5-2 “Names and functions of the back panel connectors.” (Because the same thing is specified in 5-6.)</td></tr>
</table>

Contents

Introduction

Thank you very much for purchasing our DC Power Supply Unit.

* This manual guides you to use this product safely.
* Before using this product, please be sure to read this manual and understand the operation, inspection, and maintenance procedures fully.
* Any operation deviating from the specifications of this manual may cause a serious accident.
* Remodeling or otherwise modifying this product without our consent may cause an unexpected accident. Please be sure to consult us beforehand.
* Precautions as shown below are given in various parts of this manual. These notes are particularly designed to ensure safety. Please understand them fully before doing any work.

Warning

Careless use of this product may cause serious injury or major accident.

Operators and maintenance personnel must read this manual before operating or maintaining this product.

Please store this manual close to the product for ready reference at any time.

Please do not operate or maintain this product until you have a complete understanding of this manual.

If you lose or damage this manual, please place an order for a replacement with us or our dealership promptly.

In transferring this product to anyone, please attach this manual to this product for the next owner.

1. Classification of warning displays

To allow you to better understand this operation manual and the warning labels attached to the product, the warning displays are sorted as follows. Please understand these contents and follow the instructions.

Danger

This word is used in safety precautions and on warning labels in places subject to imminent danger where failure to avoid such danger is expected to cause death or serious injury.
These safety precautions include preventive measures to be taken to avoid such danger.

Warning

This word is used in safety precautions and warning labels in places subject to potential danger where failure to avoid such danger may cause death or serious injury.
These safety precautions include preventive measures to be taken to avoid such danger.

Caution

This word is used in safety precautions and warning labels in places subject to potential danger where failure to avoid such danger may cause slight or medium-degree injury.
These safety precautions include preventive measures to be taken to avoid such danger.

These warning labels must be kept clearly visible. The label locations are indicated in the external view of the equipment in an attachment. If any label becomes loose, dirty, otherwise damaged, or illegible, replace it with a new one.

2. Environment for using this system

Warning

Do not use this product in an atmosphere of flammable gas. Any such practice may cause an explosion or fire.

Caution

Do not use this product in an enclosed space. Any such practice may raise the atmospheric temperature, resulting in stoppage.

Do not install this product in a place exposed to much water, moisture, steam, dust, clouds of steam, corrosive gas, or something similar. Any such practice may cause a breakdown or accident.

Do not install this product with its back panel blocked by a wall or something similar. Any such practice may raise the internal temperature, resulting in stoppage.

* The maximum operating atmospheric temperature of this product is 40°C. Any ambient temperature exceeding 40°C may stop this product.
* The distance between the front and the back panel of this product, and that between the wall surface and shelter, must be long enough for the flow rate of suction and exhaust air to this product to become harmless to this product.

3. Cautions on using this product

Warning

Make sure that the PE line and FG terminal of the input cable of this product are connected to an external grounding conductor, thus establishing a ground.

Failure to establish a ground or inappropriate grounding may cause a product breakdown, operator electric shock, or noise-induced malfunction.

Danger

Electric shock: 300 V DC inside the power supply

Before maintenance work, turn off the input power supply of the equipment and wait for three minutes.

Danger

Electric shock: Maximum residual voltage in the power supply, 1,500 V

Before opening the output protection cover, turn off the input power supply of this product and wait for 30 seconds.

Warning

Install an earth leakage protector.

The circuit breaker of this power supply does not come equipped with an earth leakage protector. Provide an earth leakage breaker or something similar which detects earth leakage and shuts down the input and which has an appropriate rating.

Warning

High-voltage danger, output voltage: 1,000 V
(Ignition voltage: 1,500 V)

Getting into contact with the equipment may give you an electric shock or burn.
Before maintenance work, turn off the input power of the equipment and lock it out.

Warning

Heavy object: 32 kg

Inappropriate work may cause you to sprain a muscle or injure your back.
In removing or replacing this product, use an appropriate suspending device or method.

Chapter 1. Product overview

1.1 Overview

This product is a DC power supply for sputtering equipment of 13.5 kW output. The input is 3 phase, 200 V AC, 55 A. The output is 1,000 V DC, 13.5 kW (30 A maximum).

1.2 Product characteristics

1) Constant-power control
   Control modes are switched over for constant-power control so that the output power will constantly remain at a certain level according to the power setting signal entered from outside.
2) Constant-voltage control
   Control modes are switched over for constant-voltage control so that the output voltage will constantly remain at a certain voltage according to the voltage setting signal entered from outside.
3) Frequency modulation control
   The internal inverter of this product is controlled in frequency modulation to ensure an appropriate output voltage and current for a wide range of impedance loads.
4) Remote operation
   Remote signals from outside can be used for operation, control, interlocking, and monitoring (of output voltage, output power, and output current).
5) Use of a rack
   This product can be housed in a 19-inch standard rack (JIS).

1.3 System configuration example

Connect this product to a chamber and a remote interface. You can then start to use this product. See Chapter 5 “Preparations.”

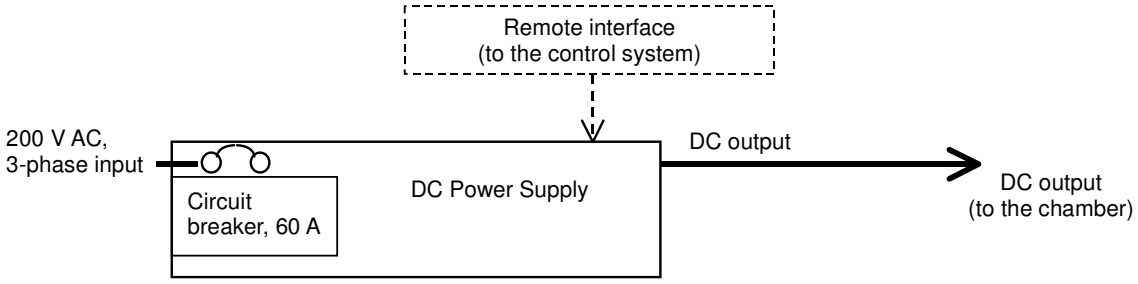


Fig. 1-1 System configuration

Chapter 2. Specifications

2.1 Input power supply

1)	Number of phases	: 3 + PE (3-wire + protection ground)
2)	Rated voltage	: 200 V AC
3)	Voltage fluctuation range	: 180 V to 220 V
4)	Rated frequency	: 47 to 63 Hz
5)	Input current	: 55 A or less

2.2 Characteristics

1)	Rated output	: 13.5kW
2)	Power factor	: 90% or more (at rated input/output)
3)	Efficiency	: 80% or more (75% to 100% of the rated output)
4)	No-load voltage	: -1,500 V DC (power control setting, ignition setting)
5)	Maximum output current	: 30A
6)	Output voltage range	: -50V to -1000V

Warning

Do not use this product under a condition exceeding its ratings.
A condition exceeding its ratings may cause a serious accident.

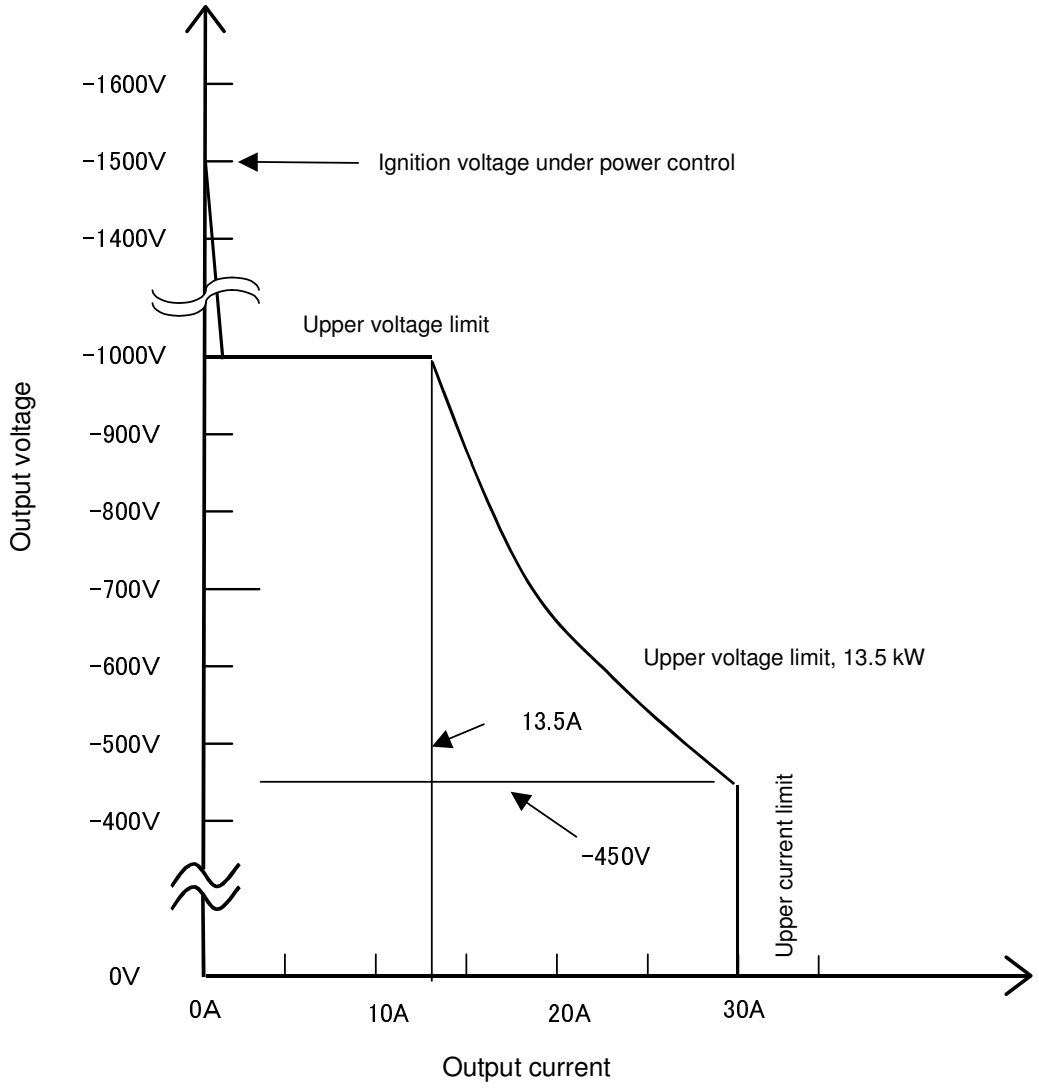


Fig. 2-1 Output range

2.3 Outside dimensions and weight

Weight: About 32 kg

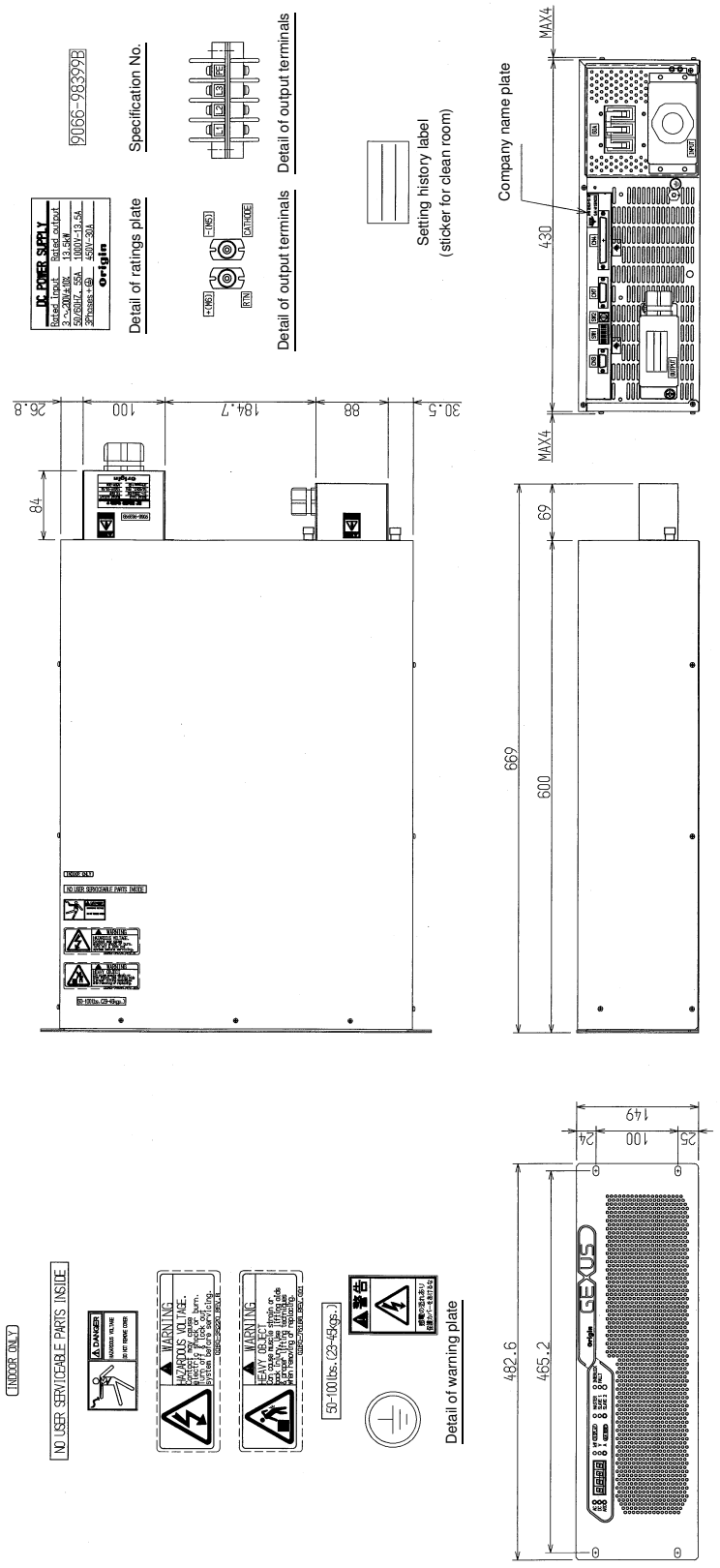
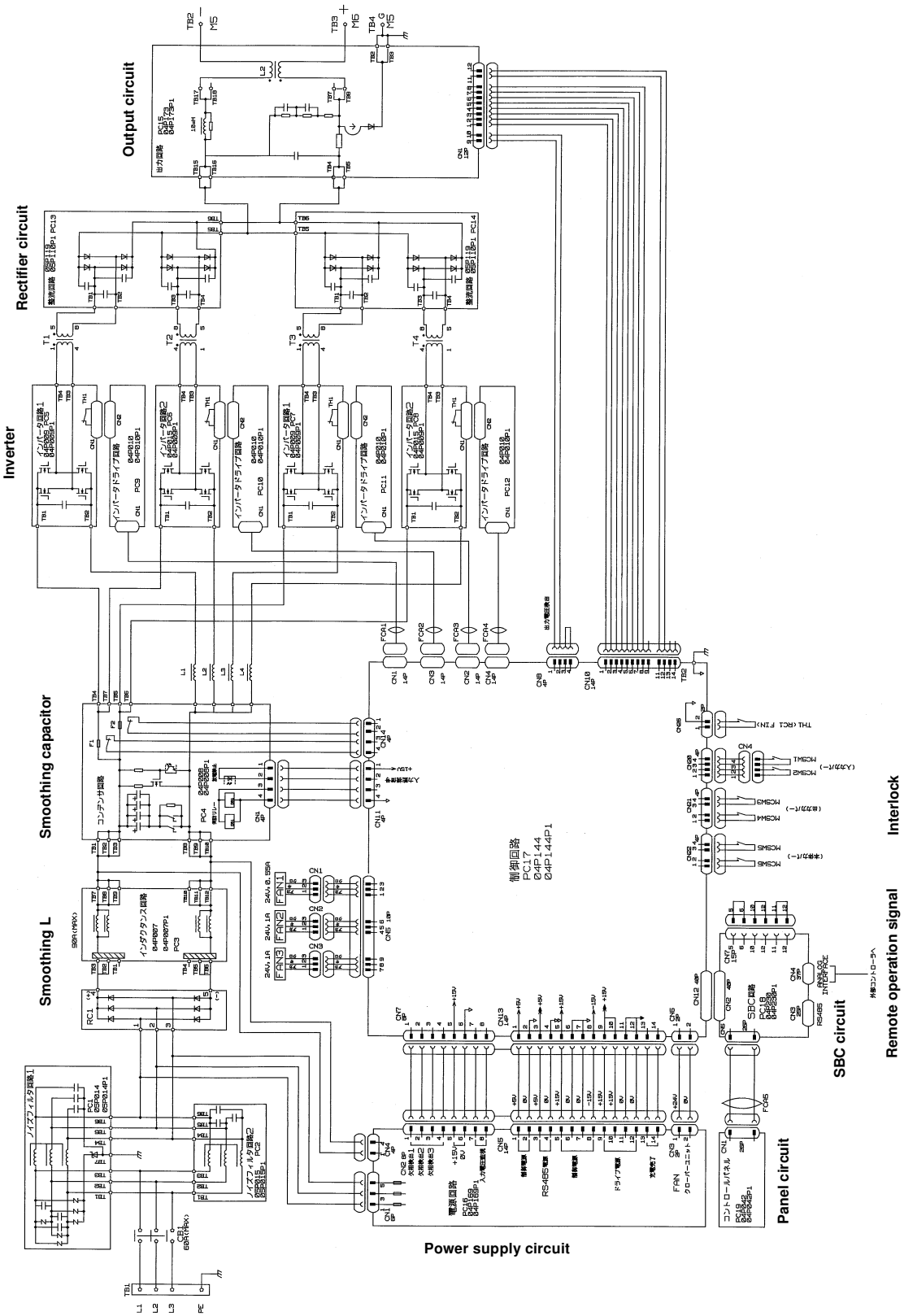


Fig. 2-2 Diagram of outside dimensions

2.4 Block diagram



Chapter 3. Names and functions of components

3.1 Diagram of the front panel

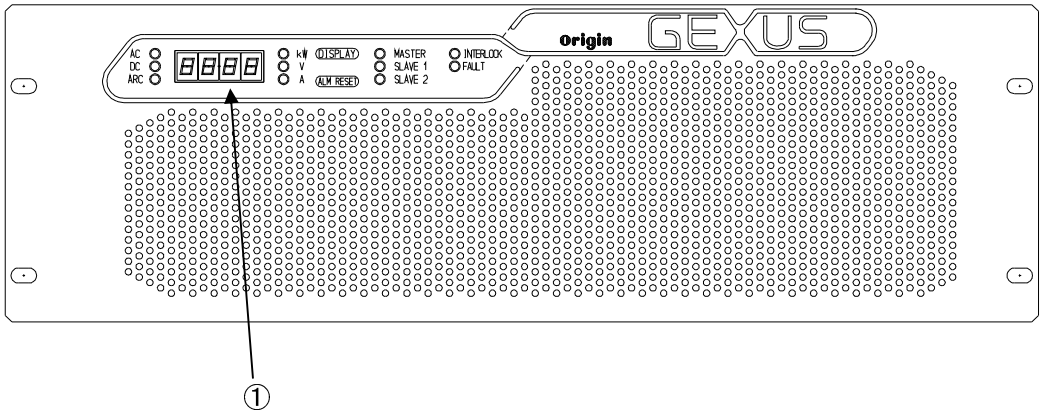


Fig. 3-1 Front view

① Operation panel

This panel displays the output statuses (power, voltage, and current) and operation states and provides the DISPLAY/ALARM switch.

3.2 Diagram of operation panel

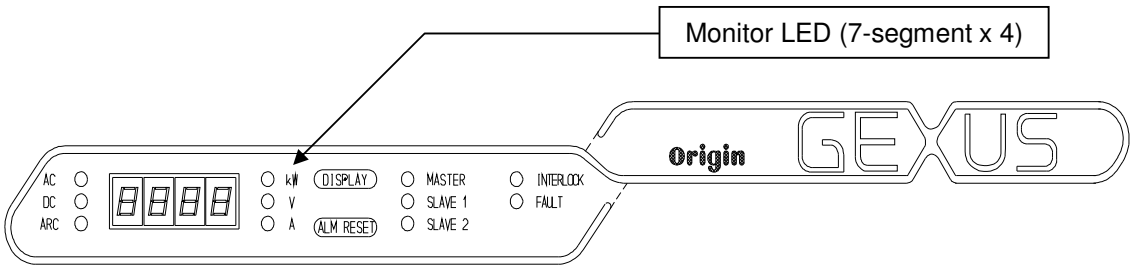


Fig. 3-2 Operation panel

Table 3.1 Description of the operation panel

No.	Name	Function	
1	AC LED (Green)	LED ON: AC power incoming	LED OFF: Phase failure, input OFF
2	DC LED (Green)	LED ON: Output (ON)	LED OFF: Output (OFF)
3	Monitor LED (Green)	Displays power, voltage, current and settings	ALARM ON: Displays an alarm code.
4	kW LED (Green)	LED ON: The number display LED displays a power value. (The V and A LEDs are OFF.)	
5	V LED (Green)	LED ON: The number display LED displays a voltage value. (The kW and A LEDs are OFF.)	
6	A LED (Green)	LED ON: The number display LED displays a current value. (The kW and V LEDs are OFF.)	
7	FAULT LED (Orange)	LED ON: Output impossible	LED OFF: Output possible
8	INTERLOCK FAULT (Orange)	LED ON: Interlock “open”	LED OFF: Interlock “closed”
10	ARC (Orange)	LED ON: Arc detected	LED OFF: Arc undetected
11	MASTER (Green)	LED ON: The product is set to run in isolation or master unit is set to run.	LED OFF: The slave unit is set to run.
12	SLAVE 1 (Green) SLAVE 2 (Green)	LED ON: The slave unit is set to run.	LED OFF: The master unit is set to run.
13	DISPLAY switch	Every push of the switch changes the monitor LED display. (When in ALARM mode, it displays an alarm code.)	
		Output kW/V/A/Setting kW (blinking)/300/100/10 After a specified time, the switch automatically displays the output voltage (power) (V, kW).	
		Alarm 1 → Alarm 2 → Alarm 3 When three alarms occur	
14	RESET switch	Pressing the switch cancels the alarm generated.	

*1) Monitor LED and its displays

When in its initial state, the monitor LED displays a power value. Every push of the DISPLAY switch changes the display from No. 1 to No. 2, etc. to No. 5 to No. 1. After a specified time, the LED automatically displays the monitor (voltage or power) in setting control mode.

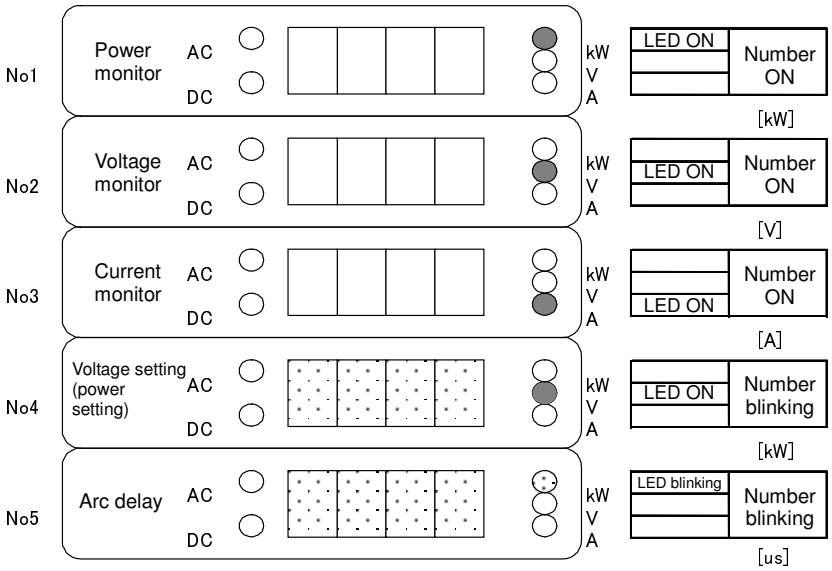


Fig. 3-6 Monitor LED and its displays

3) Alarms and operation panel LEDs

Following is the correspondence of alarm codes, fault LEDs, and monitor LEDs. For the details of the alarms, see Chapter 7.

Table 3-3 Alarm codes and operation panel LEDs

ALARM CODE	Overview	FAULT	Monitor
AL-01	Master slave communication error	○	AL-01
AL-02	Phase failure alarm	○	AL-02
AL-04	Fan alarm	○	AL-04
AL-05	Overpower, overvoltage, overcurrent	○	AL-05
AL-06	High temperature alarm, internal fuse blown out	○	AL-06
AL-07	Output wiring error alarm	○	AL-07
AL-08	Momentous stop alarm	○	AL-08
AL-09	Output decline, short-circuit	○	AL-09
AL-11	Electricity protection cover interlock	○	AL-11
AL-12	Detection miswiring alarm	○	AL-12
AL-13	Control circuit power decline alarm	○	AL-13
AL-14	Master/slave connector unconnected	○	AL-14

*The “○” in the above table means that the particular LED is ON.
*The Arc LED is not ON.
*Fault: Fault LED
*Monitor: Displayed this way on the monitor LED (7-segment LED).

3.3 Diagram of the back panel

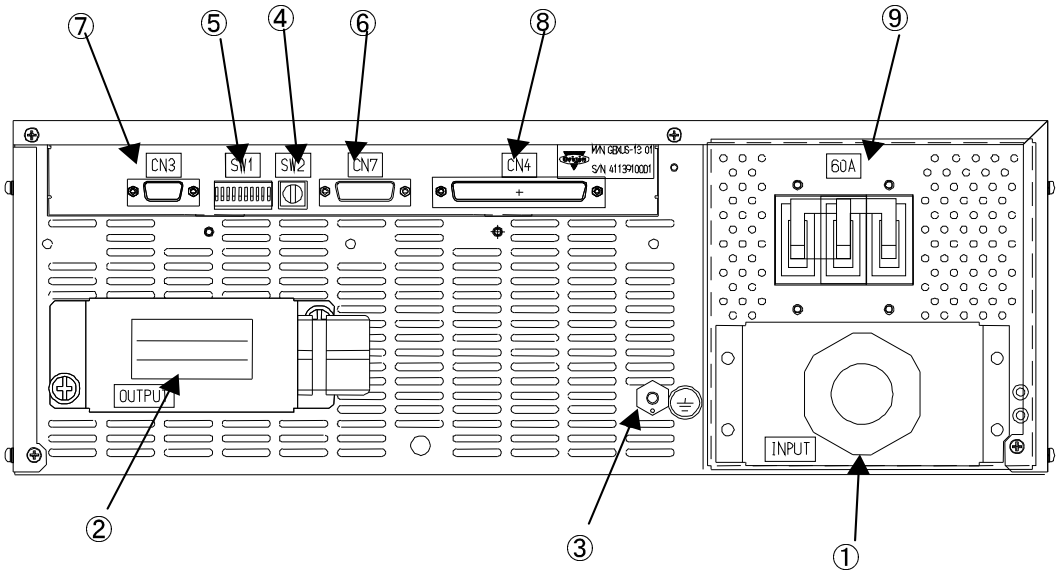


Fig. 3-4 Back panel

① Input terminal (electricity protection cover)
This is a terminal block for the main power input. All input lines are for M6.

② Output terminal
The negative output is an M5 terminal, while the positive output is an M6 terminal.

③ These are grounding terminals FG and M5. Connect them to the grounding conductor of the rack.

④ Rotary switch
This is for setting a master/slave status. Reserved.

⑤ Dip switch 1
This selects a control mode.

⑥ D-sub connector (15-pin)
Install accessory connectors.

⑦ D-sub connector (9-pin)
RS485. Reserved.

⑧ D-sub connector (37-pin)
Remote operation connector.

⑨ Circuit-breaker
This has a rated current of 60 A. It does not have earth leakage detection capability.

Chapter 4. Installation

4.1 Transportation

When transporting this product, please use its package case and a pallet.

1) Means of transportation
   ① Motor vehicle
   ② Freight train
   ③ Ship, etc.
2) Cautions
   ① Do not give excessive vibration or impact.
   ② Do not lay this product down.
   ③ Do not wet this product with water.
   ④ Do not put anything on this product.

4.2 Unpacking

1) Cautions
   ① Take enough care not to damage the electronic controller.
   ② Check this product for part damage, loose screws, or missing parts.
   ③ If any damage from transport is found, contact us immediately. At that time, store the package case and other objects furnished with this product so that you can file your claim.

4.3 Installation

1) How to install this product
   ① To assemble this product on its rack

   The rack needs firm rails or a stand on which to place the power supply. Place the power supply, as laid down, on rails or a stand, and fasten it firmly with four screws (M5 x 15) on the front panel.

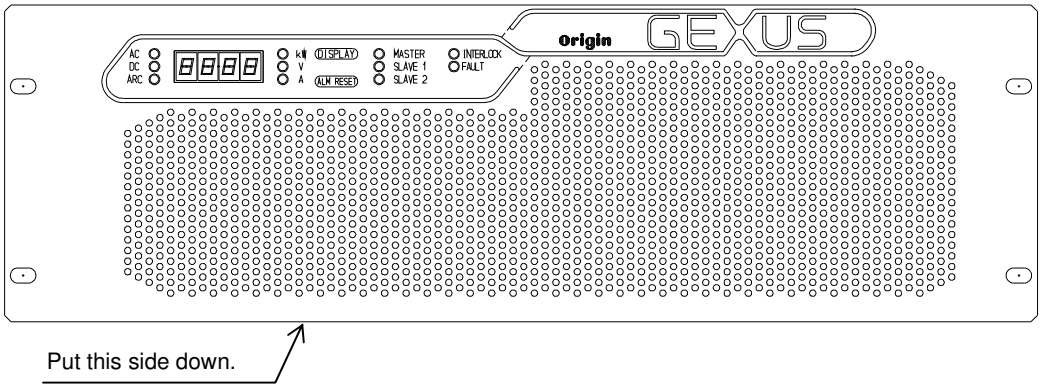


Fig. 4-1 Installation diagram

2) Cautions

① Either fasten this product on a non-vibrating, firm stand or install it on a level surface.

② Install this product in a place free of moisture, dust, and corrosive gas.

③ Do not block the air supply and exhaust ports of the cooling fan with a wall or other object. Exhaust the gas from inside the rack sufficiently to prevent the stagnation of hot air exhausted from the DC power supply into the rack.

4.4 Operating environment

1) Temperature

Operating : 0 to 40℃

Storage : -25 to 55℃

Transport : -25 to 55℃

2) Humidity:

Operating : 5 to 85%RH (non-condensing)

Storage : 5 to 85%RH (non-condensing)

Transpor : 95%

Chapter 5. Preparations

5.1 How to connect the wiring

1) Turn off the main power supply of 200 V AC, thus shutting down the power.
2) Connect the FG ground wiring for ③ (the recommended wire diameter is AWG6 or 14 mm² or more).
3) Remove the input protection cover from ①) and connect the AC input wiring. Be sure to connect the grounding conductor.
4) Install the input cover from ①.
5) Remove the output protection cover mentioned in ② and connect the output wiring.
6) Install the output protection cover from ②.
7) Be sure to connect the interface signal cable from ④.
8) Connect the attached connectors to ⑤.
9) Turn on the circuit-breaker from ⑥ (by raising the lever up).

Note: For the connectors to be used and the wire numbers, see the next clause.

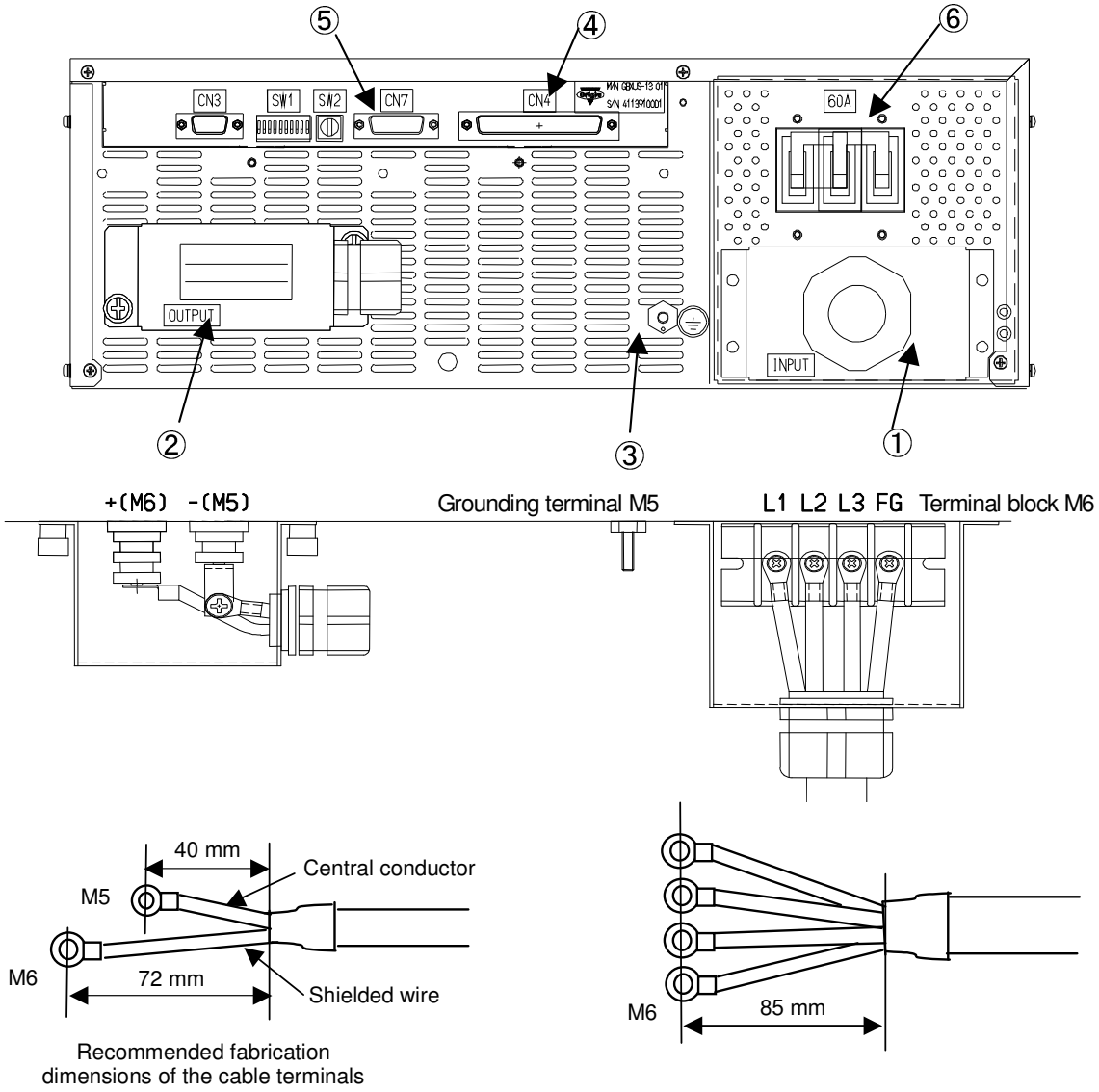


Fig. 5-1 How to connect the wiring

Caution

Do not use this product in an atmosphere of flammable gas.
Do not use this product in an enclosed space. Any such practice may raise the atmospheric temperature, resulting in stoppage.
Do not install this product in a place exposed to much water, moisture, steam, dust, clouds of steam, corrosive gas, or something similar. Any such practice may cause a breakdown or accident.
Do not install this product with its back panel blocked by a wall or something similar. Any such practice may raise the internal temperature, resulting in stoppage.

Warning

Make sure that the PE line and FG terminal of the input cable of this product are connected to an external grounding conductor, thus establishing a ground.
Failure to establish a ground or inappropriate grounding may cause a product breakdown, operator electric shock, or noise-induced malfunction.

Warning

Using this product under any condition deviating from the specified input power supply specifications may cause a serious accident.
Before making or changing the connections, be sure to turn off the input power supply of this product.

5.2 Connecting the chamber

GEXUS 13 produces a negative output voltage. Be sure to ground the anode of the chamber.

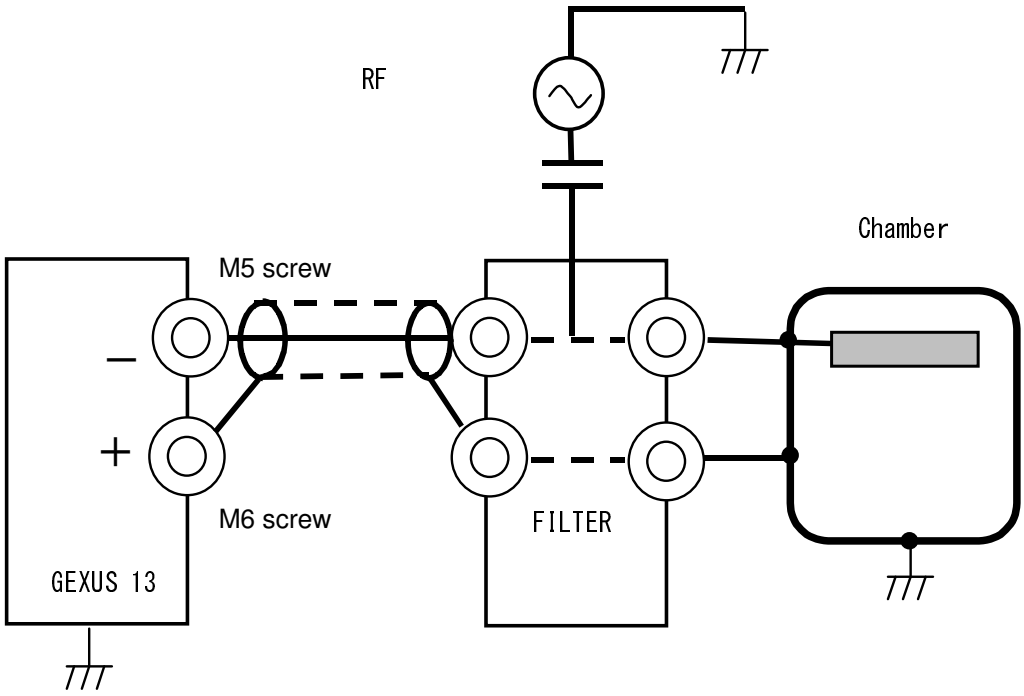


Fig. 5-2 Connecting the chamber

5.3 Connecting the external input and output signals

Please refer to the following example where external units and operation panel are connected.

1) Interface

This interface is used to interlock and control this product.

The connectors for use in connecting the interface to this product is a (D-sub connector 37-pin, male, lock M2.6) photocoupler (H, 24 V; L, 0 V) (the output and input are as viewed from the power supply. The logic and contacts are during operation or in a normal state).

Table 5-1 Pin assignment

Pin	Signal name	Output/ input	Logic/ contacts	Signal description
1	Reset signal	Input	L	External reset signal received
2	ON command	Input	L	Output ON command signal received
3	External protection	Input	L	External protection signal received
4	Voltage control mode	Input	L	Power control mode signal received
5	Power control mode	Input	L	Power control mode signal received
6	Momentous stop signal	Output	L	Signal transmitted at momentous stoppage
7	Output voltage check signal	Output	Close	Signal transmitted when an output in the output-enabled range is produced
8	24 V (strap terminal)	Input		Power voltage strap terminal for external protection
9	Arc signal	Output	L	Signal transmitted when an arc is generated
10	Alarm signal	Output	Close	Signal shut down when an alarm is generated (signal transmitted in a normal state)
11				
12	24 V (internal voltage)	Output		Internal power voltage transmitted
13	Ground	Output		24 V ground
14	Power/voltage setting	Input		Power/voltage setting (10V/13.5kW, 10V/1000V)
15	24 V (internal interlock)	Output		Power voltage for internal interlock
16	Voltage monitor	Output		Output voltage monitor (10V/1000V)
17	Power monitor	Output		Output power monitor (10V/13.5kW)
18	Current monitor	Output		Output current monitor (10V/50A)
19				
20	COM (reset signal)			COM for reset signal
21	COM (ON command)			COM for ON command signal
22	COM (external protection)			COM for external protection signal
23	COM (voltage control mode)			COM for voltage control mode signal
24	COM (power control mode)			COM for power control mode signal
25	COM (momentous stop signal)			COM for momentous stoppage signal
26	COM (output voltage check signal)			COM for output voltage check signal
27	24 V (external protection)	Input		Power voltage for external protection signal
28	COM (arc signal)			COM for arc signal
29	COM (alarm signal)			COM for alarm signal
30				
31	24V (external control input)	Input		External control input (strap terminal for internal control voltage)
32	GND	Input		External control input ground (strap terminal for internal control voltage)
33	COM (power/voltage setting)			COM for power/voltage setting
34	Internal interlock	Output	Close	Interlock signal transmitted for the top plate and the input and output covers
35	COM (voltage monitor)			
36	COM (power monitor)			COM for power monitor
37	COM (current monitor)			COM for current monitor

*1: In the switchover of control modes, priority is given to the digital input and output. When both are at a high level, DIP switches will be used.

5.4 Interface circuit

1) Digital interface 1

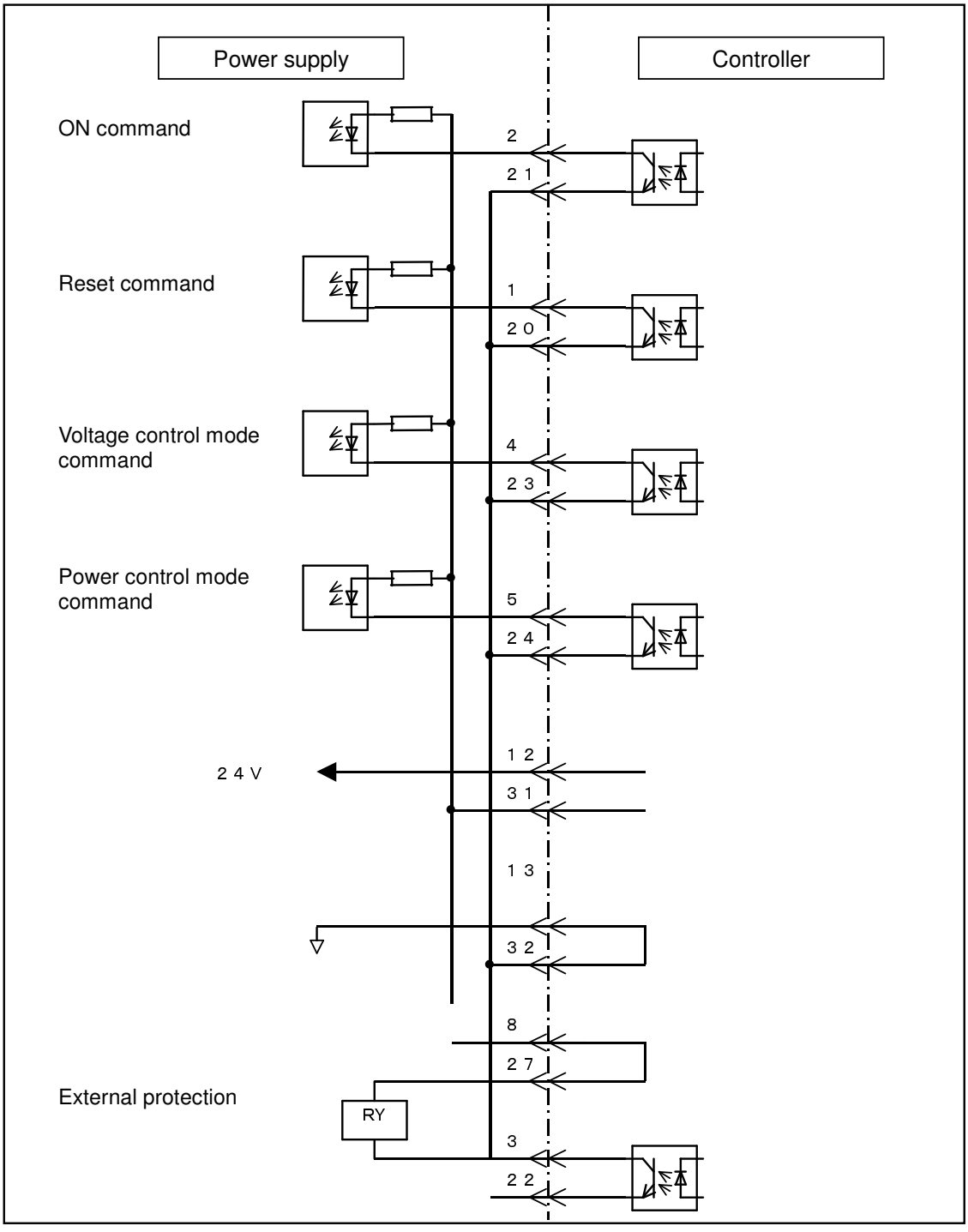


Fig. 5-3 Digital interface 1

2) Digital interface 2

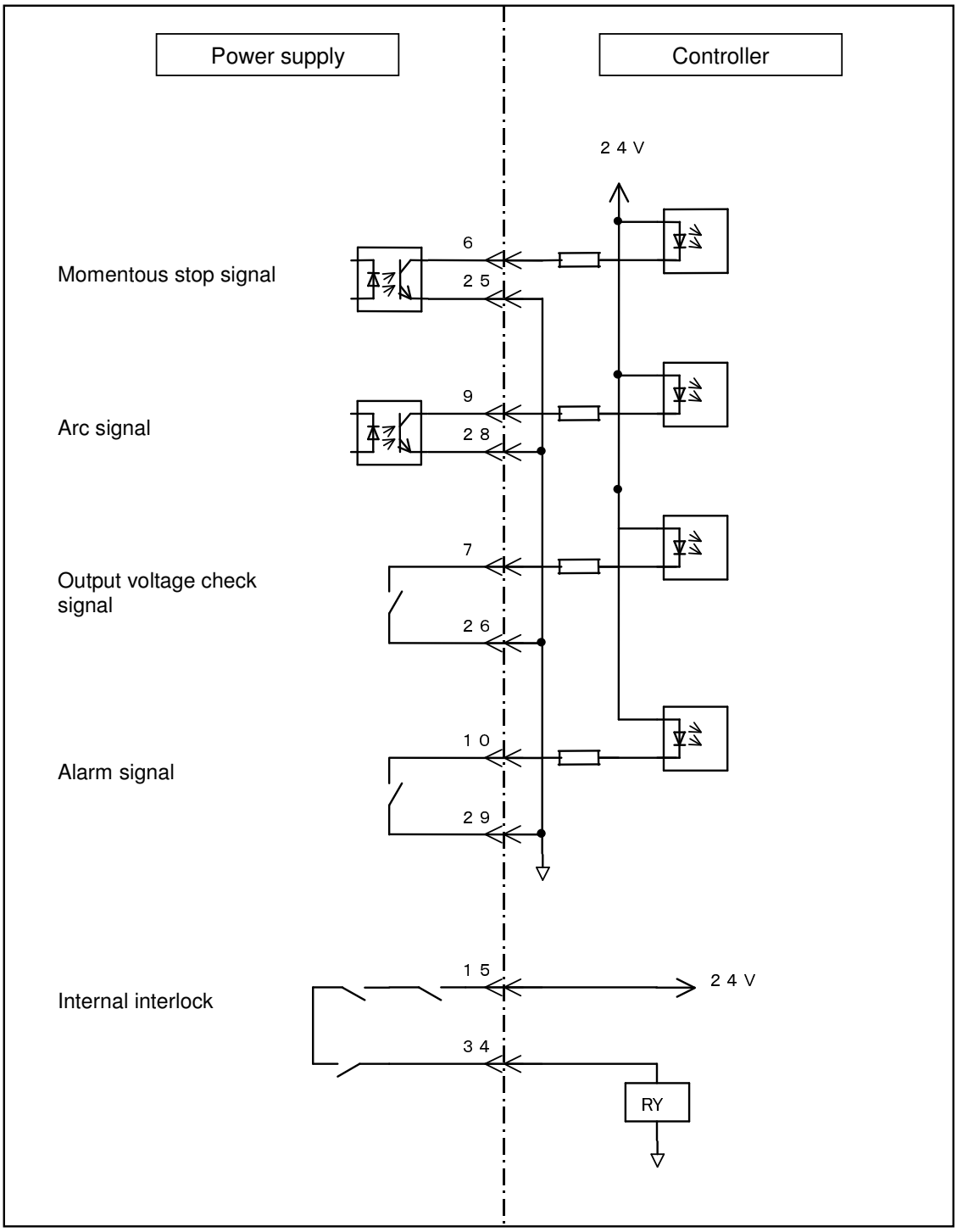


Fig. 5-4 Digital interface 2

3) Analog interface 1

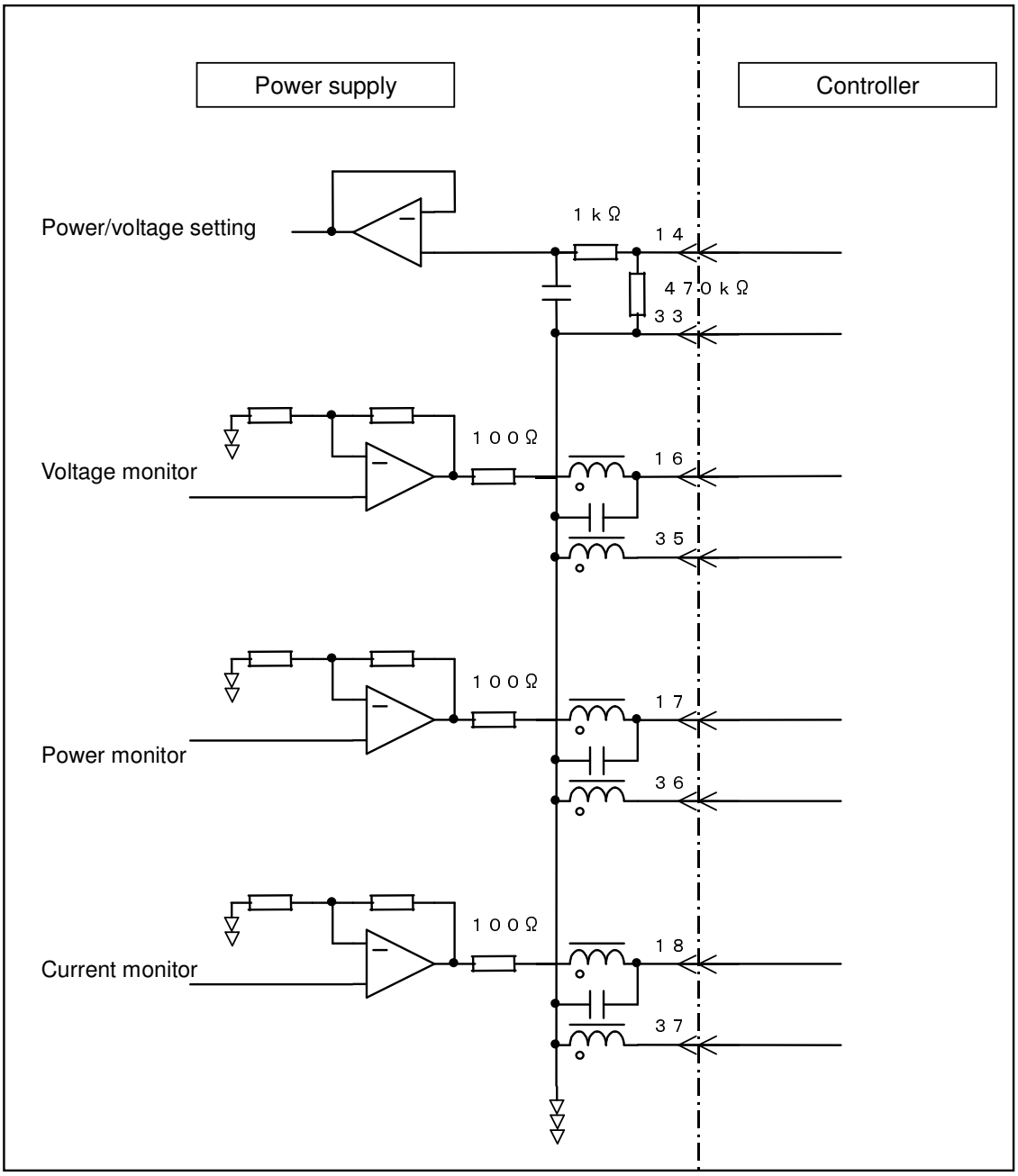


Fig. 5-5 Analog interface 1

5.5 Back panel connector functions of this product

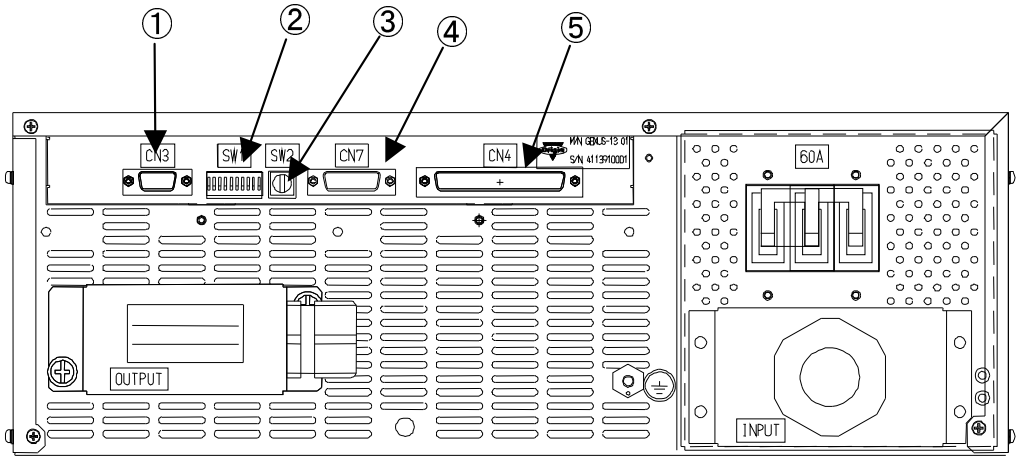


Fig. 5-6 Arrangement of the back panel connectors

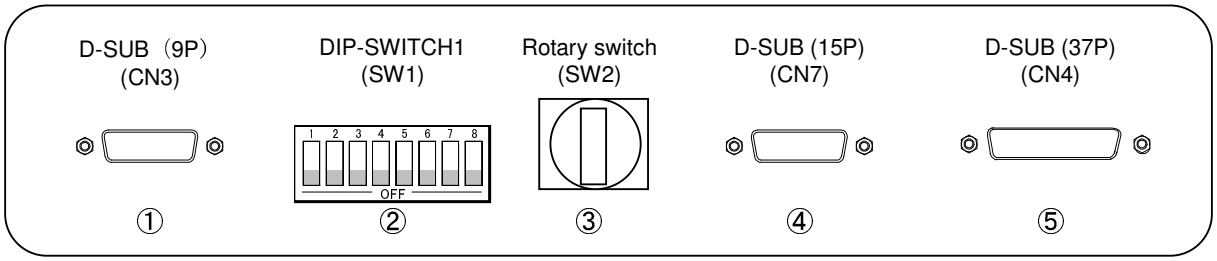


Fig. 5-7 Enlarged view of the back panel connectors

Table 5-2 Names and functions of the back panel connectors

No	Name	Function
①	RS485 (CN3)	For software programming (not used in operation)
②	Dip switch (SW1)	Control mode switchover
③	Rotary switch (SW2)	For setting unit numbers in master/slave mode (set to 0 in isolated operation)
④	Master/slave connector (CN7)	Connects dummy connectors for the master and slave.
⑤	Interface connector (CN4)	Remote operation connectors (see Table 5-1 and Figs. 5-3. 5-4, and 5-5)

5.6 Setting the functions of dip switches

Changing the settings of the dip switches in the back of the product selects an operation mode. Before switching over the dip switches, be sure to turn off the input main power of this product. Use tweezers or a small flathead screwdriver to operate the switchover lever. Raise the switchover lever to turn the switch on. Lower it to turn it off.

1) Functions of dip switch 1

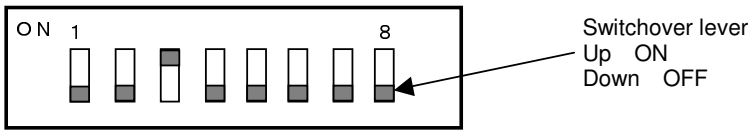


Table 5-3 Dip switch 1 (No. 1 to 8)

Switch No.	Function	ON side	OFF side
1	Sets a control mode	As per Table 5-4	
2	Switches over ignition when setting a constant-power mode	Ignition voltage occurs	Ignition voltage does not occur.
3	Sets a control mode	As per Table 5-4	
4	Reserved	Disabled	Normal
5	Reserved	Disabled	Normal
6	Initializes the EEP ROM	Disabled	Normal
7	Prohibits alarm detection	Disabled	Normal
8	Reserved	Disabled	Normal

The switches are factory-configured as follows: No. 1 (OFF), No. 2 (OFF), No. 3 (ON).

Table 5-4 Switchover of control modes by using dip switch 1 and external remote signal

Dip switch 1 (②)		External remote signal CN4 (⑤)		Operation control mode
No. 1	No. 3	Constant voltage (between 4 and 23)	Constant power (between 5 and 24)	
1	0	0	0	Constant power
0	1	0	0	Constant voltage
1	0	1	0	Constant voltage
1	0	0	1	Constant power
0	1	1	0	Constant voltage
0	1	0	1	Constant power

Warning

Before setting the dip switches, be sure to shut down the input main power.
Please understand the functions fully before operating the dip switches.
Operating them carelessly may cause a serious accident.

Chapter 6. Product operation

6.1 Product operation

1) Turning on the power

① Make sure that this product is correctly connected to the power input wiring, output terminals, and external devices. Make sure particularly that the power supply is securely grounded.

② Supply input power.

6.2 Confirming readiness for output

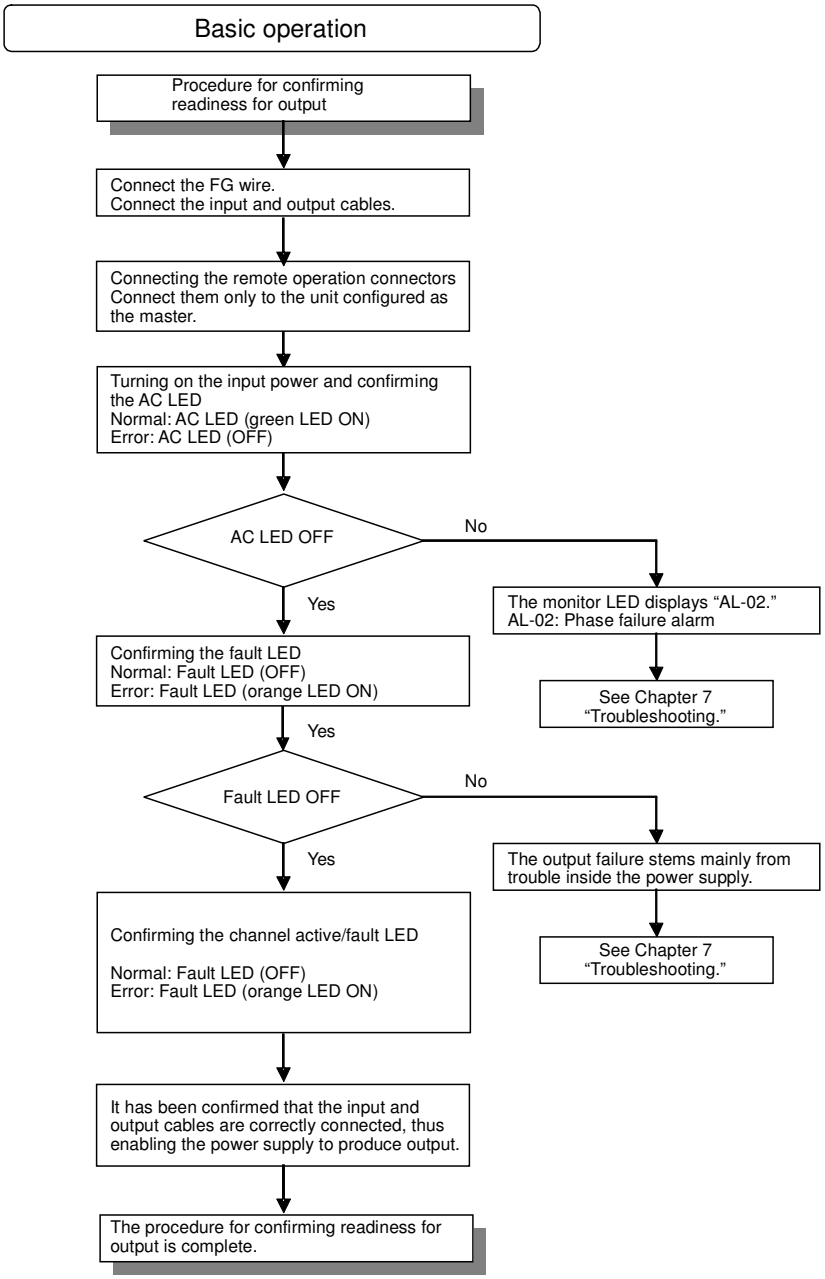


Fig. 6-1 Procedure for confirming readiness for output

6.3 Setting output preparations

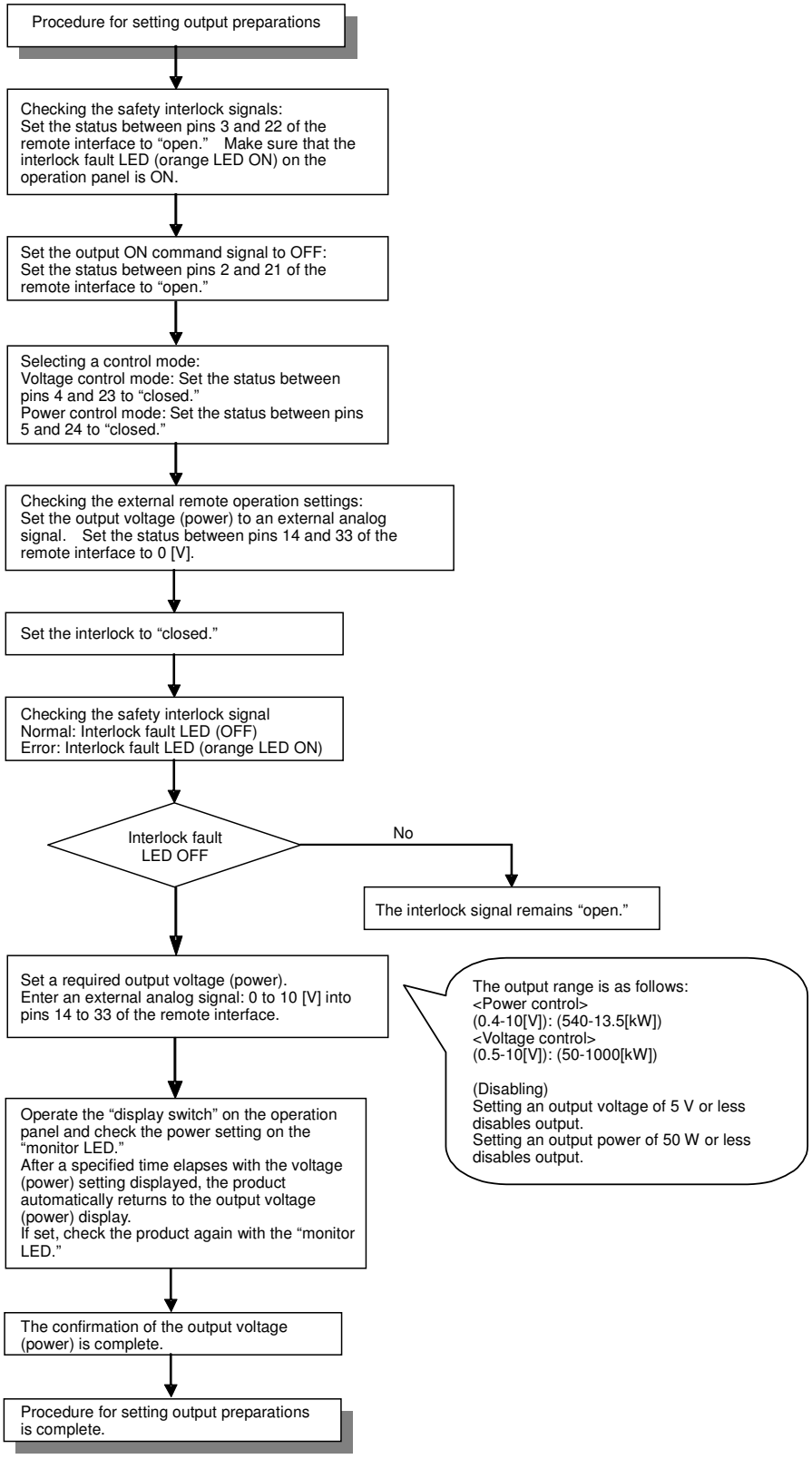


Fig. 6-2 Procedure for setting output preparations

6.4 Output procedure

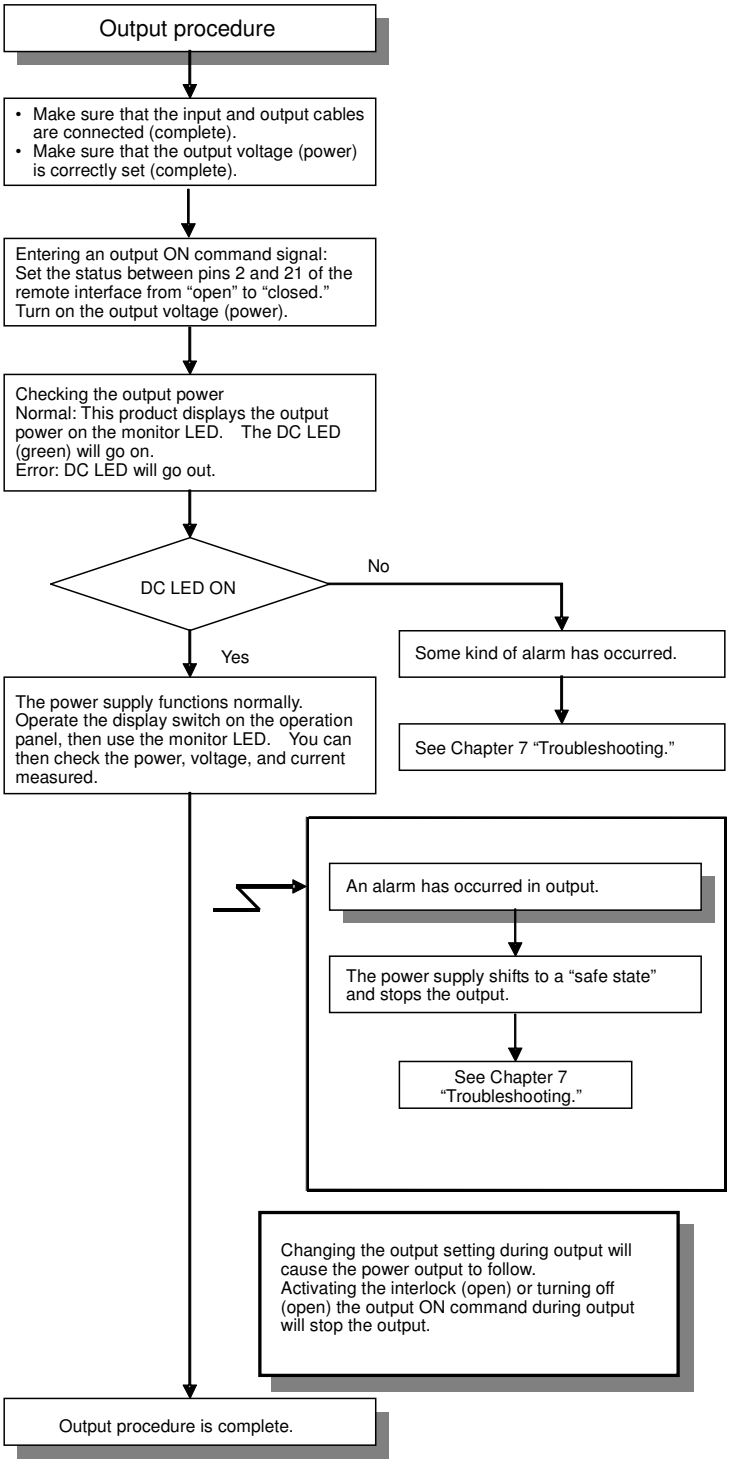


Fig. 6-3 Output procedure

Chapter 7. Troubleshooting

7.1 Error messages and actions to be taken

Fig. 7-1 Error messages (alarm codes) and actions to be taken

ALM Code	Name	Description	Action
01	Master/slave communication error	Incorrectly set rotary switch on the back panel	Set the number setting to 0.
02	Phase failure alarm	AC input phase failure detected	The AC input may have undergone phase failure. Check the main AC input wiring.
03	Vacant		
04	Fan alarm for cooling	Error (low fan speed) or stop of the cooling fan	Check if the cooling fan is operating normally. If it is stopped, either the fan or the fan power supply may be defective. Or the fan may be at the end of its service life. Contact our department responsible.
05	Excessive output alarm	Overvoltage (1,100 V) When the ignition is activated (1,750 V) Overcurrent (33 A) Overpower (14.85 W)	Make sure that the correct signal setting is entered. If this alarm occurs again, the power supply should be defective. Contact our department responsible.
06	Excessive heat-up alarm	① Heat-up inside the power supply (inverter FET 100℃, input rectification diode fin 100℃) ② Inverter fuse blown out	① The semiconductor in the power supply may be abnormally hot. Without producing an output, cool down the semiconductor while keeping the main AC in the input mode. Also check the suction and exhaust ports of this product for dirt or other foreign matter. ② After action ①, push the alarm reset button. If the alarm persists, the inverter may be out of order. Contact our department responsible.
07	Output miswiring alarm	Output miswired or unconnected	Be sure to stop the main power supply and check the output wiring for a loose or erroneous wire. Conditions for alarm detection ① Connector unconnected: When in constant-power mode and when ignition does not occur 15 seconds after the output ON command ② If the FG undergoes a current flow due to a wire break in the return wire (shielded wire)
08	Momentous stop alarm	Momentous stop of the input power supply (if a power failure occurs for 50 ms or more, and if power returns before the control power supply declines)	Check the input voltage when such a momentous stop occurs.
09	Output voltage/power decline alarm	① Low output voltage detected: In power control mode: If the output voltage does not reach 10 V or more) ② Low output power detected (In voltage control mode: If the output power is a quarter of the setting or less)	The power output may be short-circuited. Be sure to stop the main power supply and check the output wiring, chamber terminals, and other components for trouble.
10	Vacant		

ALM Code	Name	Description	Action
11	Input/output cover alarm	Input/output connector cover and top plate open	Make sure that the input and output connectors, protection cover, and top plate are correctly installed.
12	Detection wire connection error alarm	Detection wire connection error	The detection cable in the power supply may be loose. Contact our department responsible.
13	P/S ALM	Control power decline	Turn the main AC input back on. If it will not be restored, the power supply may contain some problem. Contact our department responsible.
14	Master/slave connector unconnected	Alarm regarding a loose CN7	Make sure that the dummy connector for CN7 is connected.

7.2 When the circuit-breaker trips

① Turn the power back on. If the circuit-breaker trips, the main circuit may be defective (short-circuited). Turn off the circuit-breaker and contact our department responsible.

② Turn the power back on. If the power is successfully restored, the input current should have risen due to overpower or a decline in input voltage. Check the signal setting and input voltage for trouble.

Chapter 8. Maintenance and inspection

8.1 Cautions on power shutdown

If you touch the charger in the power supply within three minutes after the input main power supply is shut down, an electric shock or other serious accident may occur. Before maintenance or inspection work, be sure to shut down the input main power supply of this product. Wait for three minutes before beginning the maintenance or inspection.

Before detaching the output protection cover, stop the power supply and wait for at least 30 seconds to eliminate the residual charge.

8.2 Daily inspection

Inspect the following:

① Make sure that the grounding terminal of the grounding conductor is tight enough.

② Make sure that the input and output cables are firmly clamped.

③ Make sure that the fan is free of abnormal noises.

④ Check the front panel display for anomalies.

8.3 Periodic replacement parts

The DC power supply of the inverter type consists of a number of electronic parts and components. The parts listed below deteriorate with time. Deterioration of parts has ripple effects, resulting in a breakdown of any electronic controller. To allow the power supply to display its performance, periodic replacement is recommended. For details, consult the dealership from whom you bought this product.

Table 8-1 Periodic replacement parts

Part name	Model	Standard replacement interval	Method of replacement
Cooling fan	9GL224J101 9G0924G101 (SANYO)	About 3 years	By a designated service person.
Aluminum electrolytic capacitor	LGNW6471HMLC40 (Nichicon)	About 5 years	By the dealership from whom you bought this product.

Caution

Before replacing any part, be sure to shut down the input main power supply of this product. In opening the cover, be sure to wait at least three minutes after shutting down the input main power supply of this product. Failure to observe this precaution may cause an electric shock or other serious accident.

Chapter 9. Accessories

D-sub connector 15-pin Q'ty, 1 pce (for CN7)