ASAHI SUNAC

Operation and Maintenance Manual

Electrostatic controller

BPS300

This manual contains important warnings and cautions.
Read the manual thoroughly before use of the equipment.
Keep the manual handy until the equipment is no longer used. If your manual is lost or worn badly, do not hesitate to contact our agency or the Asahi Sunac Corporation, directly, and ask us to send you a new one.

7th Edition, August 23, 2022

Preface

Thank you very much for choosing our Electrostatic controller (BPS300).

In order to keep the equipment in the best condition for an extended period, please carefully read this manual before use. Above all, the specifications, warnings and prohibitory or cautionary instructions shown herein shall be fully understood and observed during the use of the equipment.

The equipment covered by this manual is designed for industrial coating work. **It shall be used by those who have been duly trained** regarding the handling and scope of application and **have an understanding of the operating procedure**.

If you need further information about this manual, please contact any of our offices and branches listed on the back cover with the “model” and “serial No.” of your equipment specified.

7th Edition, August 23, 2022

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1 For Safety and Correct Use

Contents of this instruction manual shall be fully understood and the instructions shown herein strictly observed.
Using the equipment without following instructions in this manual may lead to **bodily injury or damage to properties**.

The safety measures described herein are the minimum requirements and additional measures may also be required. All requirements provided by laws and legislations as well as rules and guidelines laid by your company or office shall also be observed.

The cautionary instructions shown below shall be construed as minimum basic requirements for safety in the use of our product.

- **Cautionary instructions are shown in three levels as defined below.**

⚠ WARNING	Calls the user's attention to a situation that may lead to bodily injury and describes how to avoid that situation.
⚠ CAUTION	Calls the user's attention to a situation that may lead to damage or breakdown to the equipment and describes how to avoid that situation.
NOTE	Gives important or helpful information.

* Please remember that the situation mentioned under CAUTION may also lead to a serious disaster under certain circumstances.
All instructions are important for your safety and prevention of machine disorder and shall be strictly observed.

This manual only describes the BPS300.

For the electrostatic gun and coating equipment to be connected with it, see the respective instruction manuals.

⚠ WARNING

Adequate conditions of use for the product

The product covered by this instruction manual consists of a controller specially designed to supply a high-frequency power to the automatic electrostatic gun contained in a high-voltage generator and control high-voltage charges on the gun.

The product is not explosion-proof. Do not use it in a hazardous area.

If you have any doubt about the intended use of the product or materials used for it, please consult us.

Please note that using the product under conditions other than specified above will be considered as abuse unless specially approved by us and may lead to an accident.

Danger from abuse

<General Cautionary Instructions>

- Thoroughly check the supply voltage before use. The input voltage to the controller shall be 100 to 240 VAC. Applying a voltage other than specified may lead to a failure and/or fire.
- The controller uses a high voltage and must be correctly grounded.
  Failure to do this may lead to a failure, electric shock, injury and/or fire.
  Always ground the grounding terminal (with class A grounding work).
  Do not fail to tighten the terminal block mounting screws and attach the connectors.
- Do not modify the wiring when it is alive.
- **The controller is not explosion-proof. Do not use it in a hazardous area.**
  Only explosion-proof controllers are allowed to be used in a hazardous area.
- Avoid using the product in a place where it will be subject to a higher temperature or humidity or excessive vibration. Doing so may lead to a failure.
- If the controller fails, immediately stop and turn it off. After checking that the controller has been discharged, short the charging terminal to the ground.
  If the protector is activated or a fuse is blown, do not turn on the power switch.
- Do not operate the controller with the door open. Do not touch the charger and hot parts inside the controller. Doing so may lead to a burn, injury and/or electric shock.
- Continuously supply and exhaust air properly through the ventilation system so that vaporized organic solvent etc. will not remain in the environment where the product is used.
- Before operating the product, examine the installation status of the devices and check for damaged or chipped parts.
- Always ground the product to be coated. Do not use a non-conductive hanger. Be sure to check the conveyor for proper grounding before starting operation. If grounding is incomplete, static electricity charged in the product being coated or the hanger may cause spark discharge, leading to a fire.

⚠ WARNING

- Ground all conductive objects and thinner containers in the coating booth. The floor shall be entirely antistatic with a resistance of 1 MΩ or lower and kept clean. If grounding is incomplete, static electricity charged in conductive objects or the thinner containers may cause spark discharge, leading to a fire.
- Periodically clean the air intake and exhaust system (duct, fan, etc.) installed in the operating environment of the product to keep it clean. If the air intake and exhaust system does not operate normally, harmful substances may cause serious diseases such as inflammation or toxic symptom.
- Parameters must be set so that the tip of the electrostatic spray gun connected with the equipment will be kept **at least 200 mm** apart from the product being coated. If this distance is not secured, the equipment may not operate normally due to high-voltage leakage.
- A periodically-inspected extinguisher with a sufficient capacity must be provided in case of an emergency.
- The coating machine may only be operated by those who have completed a training course for safe operation of the coating machine and devices applicable to the system including this product.

  Operation performed by those who have not completed the training course for safety may lead to explosion, fire, electrical shock, or damage to the equipment, thereby resulting in damage to the human health, including death and serious injury, and/or serious damage to the plant and its periphery. The Company will not be liable for any above-mentioned troubles caused by operation in an incorrect manner.
- When the operator's intervention is required during use of the product, take a safety measure to inform that peripheral machines and devices that may cause danger to human body have been brought to a halt, and install an emergency shutdown button for avoiding unexpected danger. Failure to do so may result in death, serious injury, fire, or broken equipment.
- Install a safety interlocking system when incorporating the product into a system.

  The interlocking system must be designed so that the high-voltage generator, paint feeder, cleaning solvent supply and air supply will stop automatically when it is activated. Otherwise, death, serious injury, fire or damaged equipment may result.

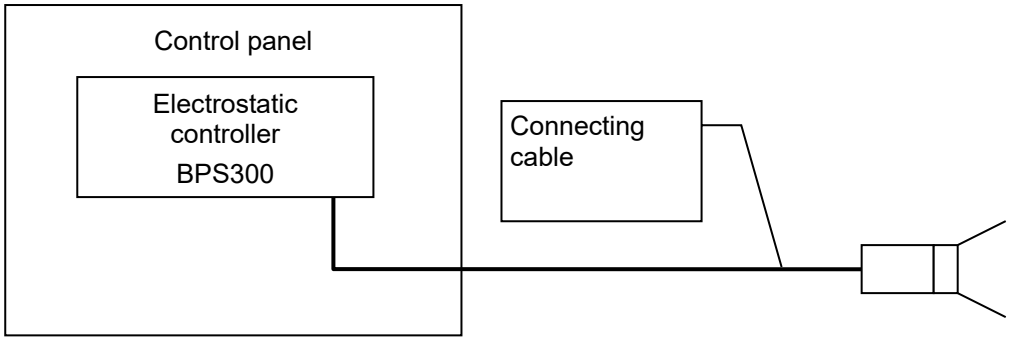
  <Recommended safety Interlocks>

  - Detection of control errors
  - High voltage fault detection
  - Detection of unusual air pressure drops
  - Detection of irregular bell cup rotating speeds
  - Detection of air intake and exhaust system faults
  - Detection of fire
  - Detection of unauthorized entry into coating booth
  - Detection of transfer system faults
- The equipment shall be serviced and inspected at regular intervals regardless of the operating conditions.

2 Overview

The equipment consists of a controller that supplies power to the electrostatic generator (cascade) built in the Sun Bell and Sun Bell Eco to control high-voltage charging and contains a microcomputer for multi-functional control.

The main unit has a panel-mounted structure and controls a single cascade. A Touch-panel display is provided at the front of the controller panel to ensure easy and proper operation and surveillance.

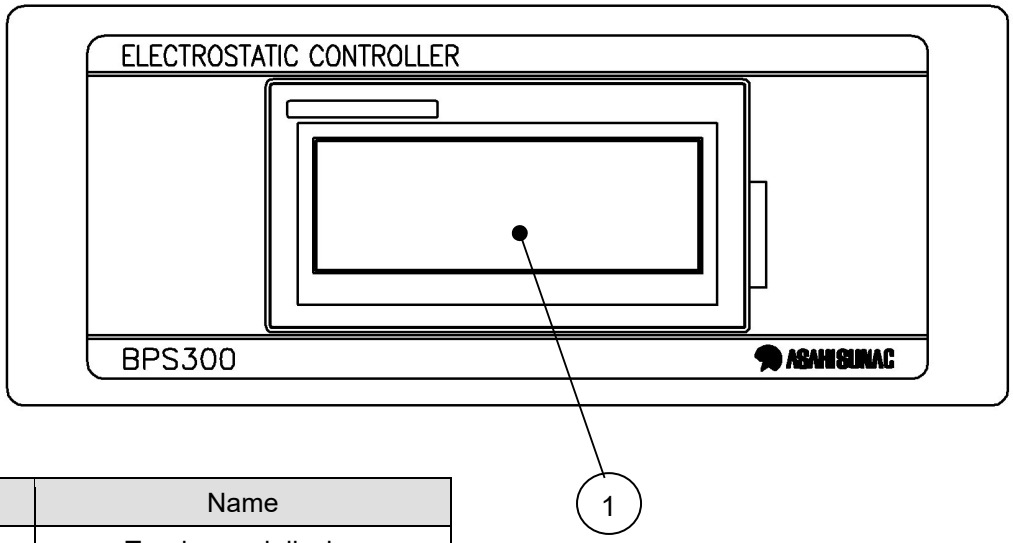


3 Specifications

Item	Specification
Product name	Electrostatic controller
Model	BPS300
Type of connected gun	ESA120, ESA200, ESA200VP or ESA210
Number of connected guns	1
Safety device	Constant current protection circuit Absolute over-current detection and shut-down circuit (OCL) Variable over-current detection and shut-down circuit (di/dt, WAOCL) Transmitted current alarm circuit Return current alarm circuit High-voltage output alarm circuit
Voltage generated under no load	80 kVDC
Rated output current	150 μA
Output voltage adjustment range	-5 to -80 kV (at increments of 1kV)
Operating conditions	Ambient temperature range: 0 to 45°C Humidity range: 20% to 85% (no condensation allowed) Shall not be exposed to corrosive gases, dust, vapors, water drops and direct rays of the sun.
Input voltage	100-240VAC+/-10%
Power supply frequency	50/60 Hz
Current consumption	0.6-0.4 A
Mass	Approx. 4.0 kg
Dimensions (mm)	120 (height) × 300 (width) × 215.5 (depth)
Panel cut dimensions (mm)	112 (height) × 262 (width)
Protection class	IP54 for front panel or IP10 for panel inside
Memory backup	2 weeks with super-capacitor

4 Name and Function of Component

4.1 Name of component



No.	Name
(1)	Touch-panel display

Note: The controller shape and specifications may be changed without notice to reflect improvements, etc.

4.2 Function of component

(1) Touch-panel display
Indicates the state of the gun, an error record, system parameter settings, etc. and used for operating the equipment.

5 Operating Procedures

5.1 Operating Procedures

(1) Check for proper electric wiring before starting.

- Check that the equipment has been grounded (with class A grounding work).

⚠ WARNING

Incomplete grounding may lead to a failure, electric shock, injury, fire and/or explosion.

- Check the supply voltage.

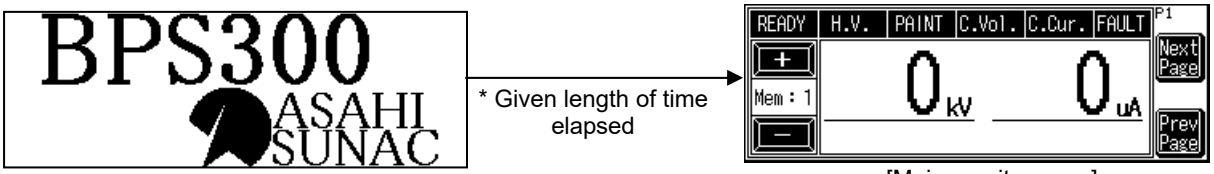
⚠ WARNING

Applying a voltage other than specified may lead to a failure and/or fire.

(2) Supply power.

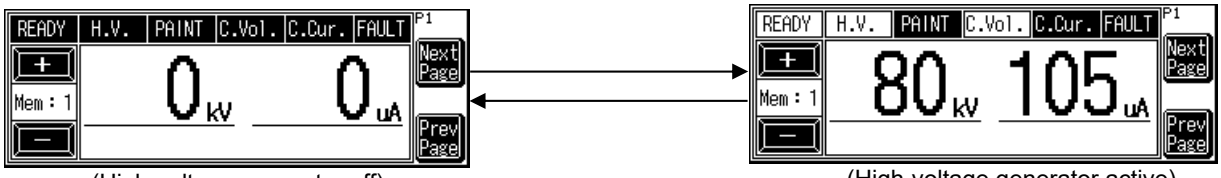
(3) The Touch-panel display shows the model number and the logo of Asahi Sunac for about seven seconds and then switches to the main monitor page.

(Example)



[Start-up logo] [Main monitor page]

(4) High-frequency power is transmitted to the high-voltage generator while both "BYP" and "RHV" input signals are on. (See 11.2.2 “Functions of components" and 11.3 “Example of wiring".)



(High-voltage generator off) (High-voltage generator active)

(5) As the nozzle gets too close to a grounded object, the safety device is activated to stop the high-voltage generator.

(6) Turn off the power supply when finishing the work.

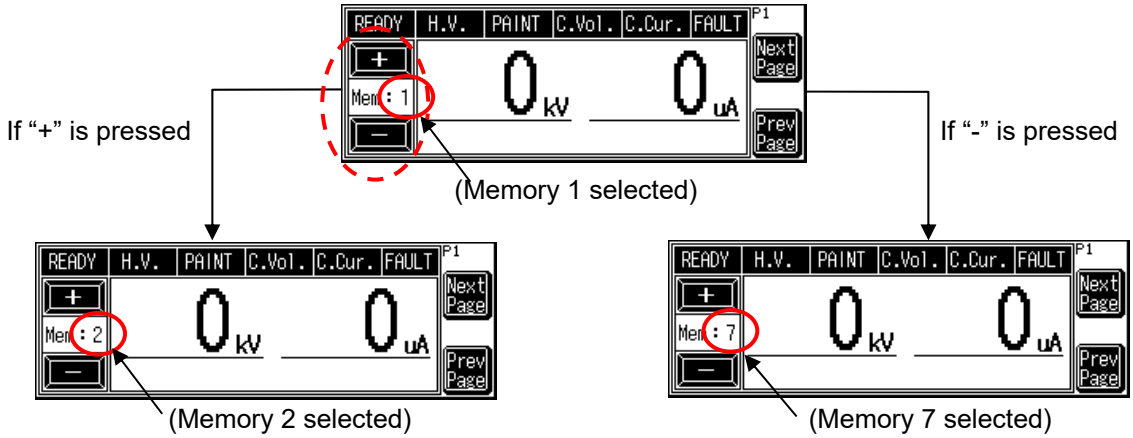
5.2 Memory selection procedures

- When the memory number is changed, each fault detection is slowed down.
- Memory No. 0 is only selectable when using the optional link circuit board.

5.2.1 Memory selection from the control panel

Select a desired memory No. using the [+] or [-] key on the main monitor page.

(Only with external memory selectors set to "000")



* The [+] and [-] keys do not appear when the control panel operation is prohibited.

(See 9.1 “Prohibition of control panel operation" for the procedure to permit the control panel operation.)

5.2.2 External memory selection

- A memory can be selected by shorting any or all of the external memory selectors, SH, SM and SL, on the I/O terminal block, TB2, to COM1.
- If all external memory selectors (SH, SM and SL) are all open, a memory can be selected from the control panel.

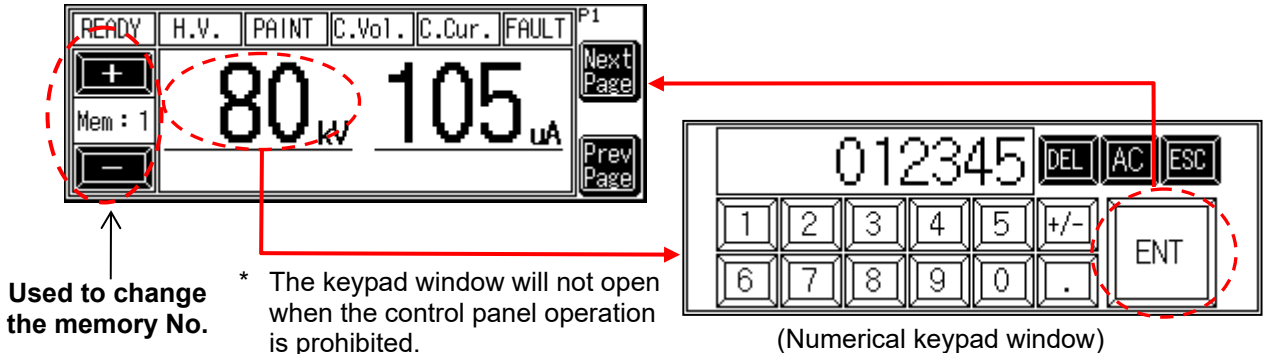
	Memory selection from the control panel	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7
SL	0	1	0	1	0	1	0	1
SM	0	0	1	1	0	0	1	1
SH	0	0	0	0	1	1	1	1

5.3 Output voltage setting procedure

5.3.1 Setting the output voltage from the main monitor page

Touch the indicated output voltage value. Then, it can be changed to a desired value.
You can change the output voltage for the in-use memory number. This is possible with the high-voltage generator on or off.

1. Touch the indicated voltage value to open a numerical keypad window.
2. Enter a desired value and press the ENT key to change the preset voltage value.



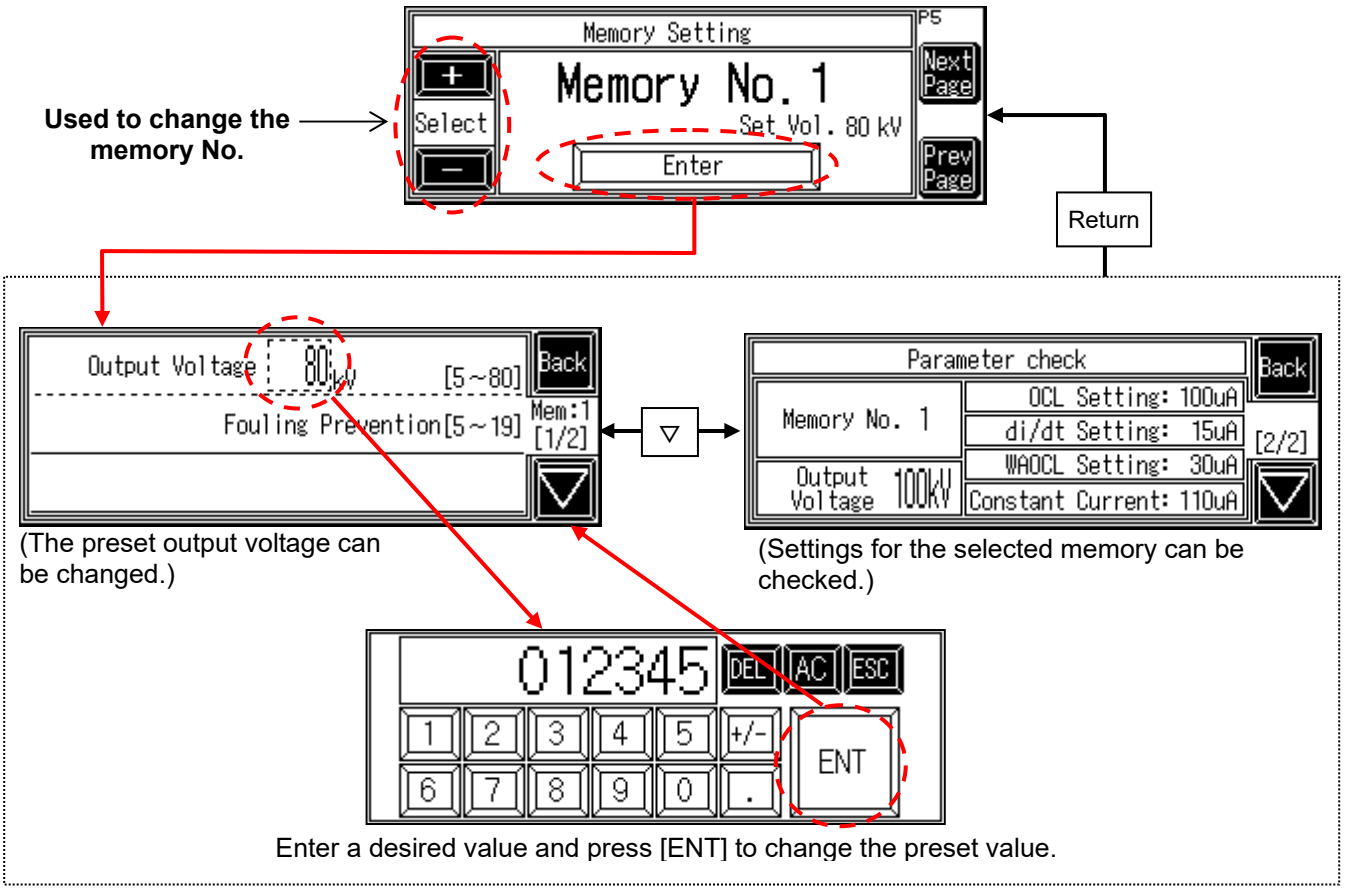
Used to change the memory No.

* The keypad window will not open when the control panel operation is prohibited.

(Numerical keypad window)

5.3.2 Setting the output voltage from the memory settings editing page

The presset output voltage for the selected memory No. can be changed.



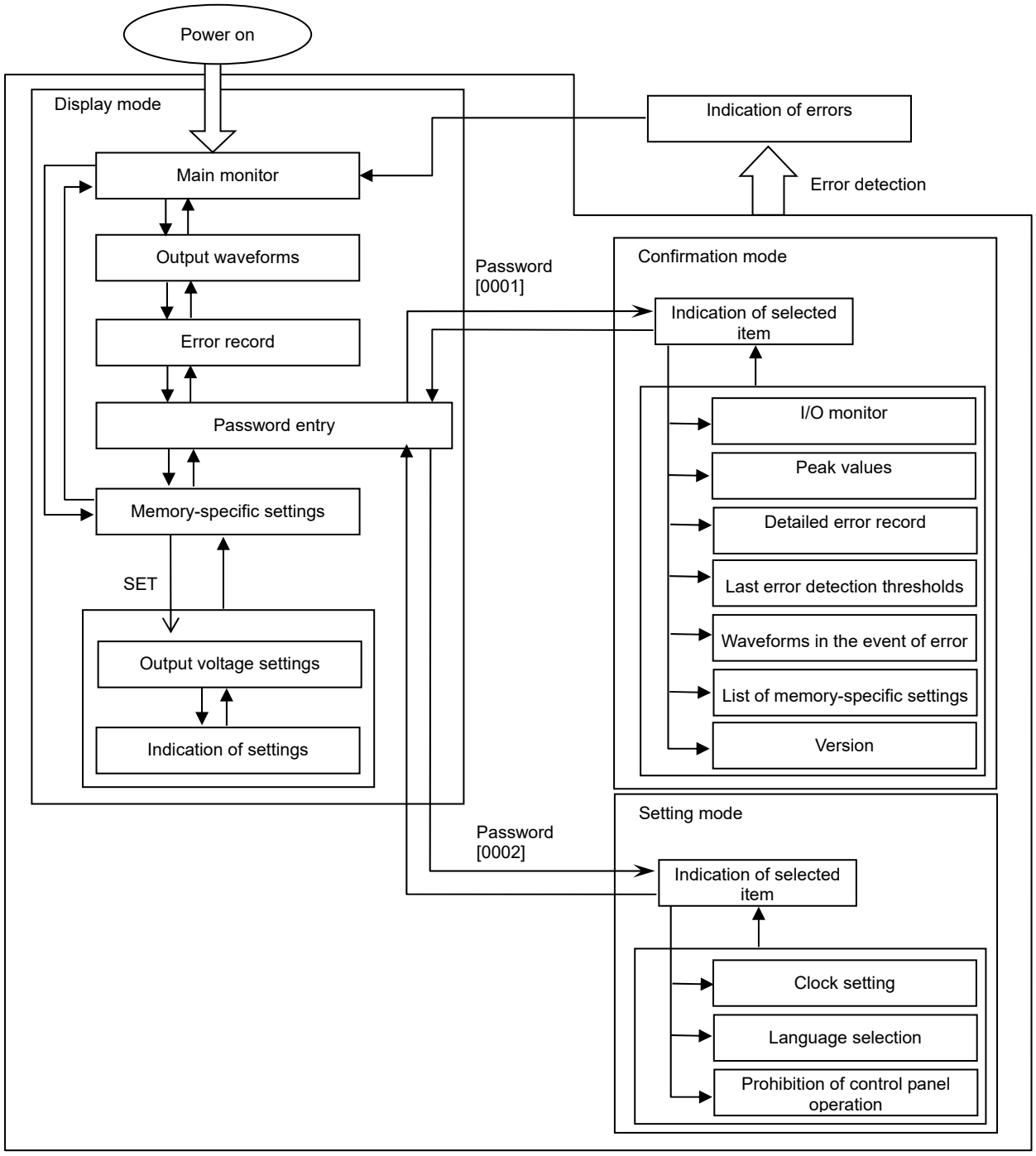
(The preset output voltage can be changed.)

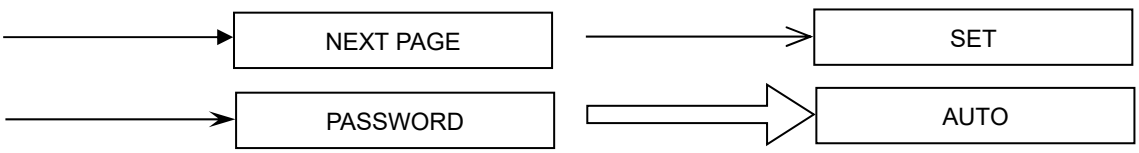
(Settings for the selected memory can be checked.)

Enter a desired value and press [ENT] to change the preset value.

6 Touch-panel display

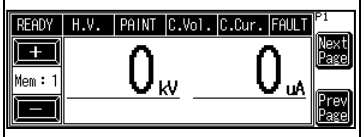
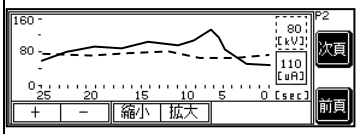
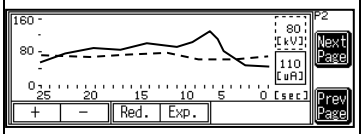
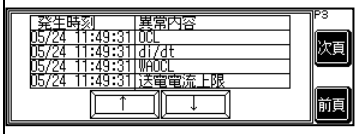
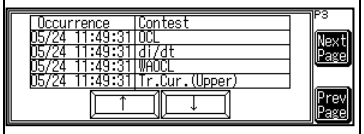
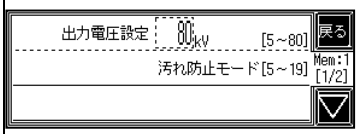
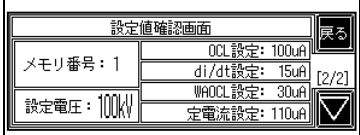
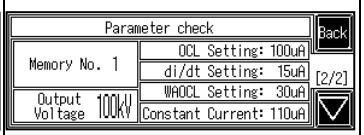
6.1 General structure



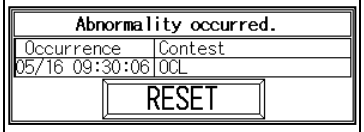


6.2 Bilingual description of pages

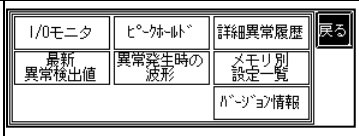
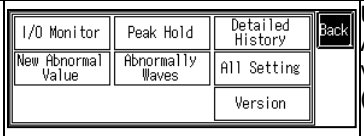
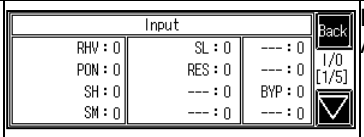
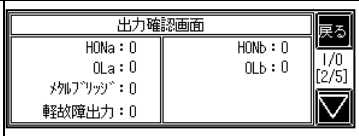
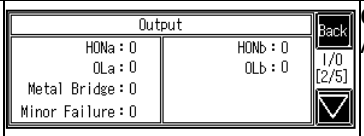
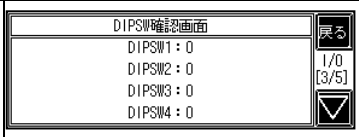
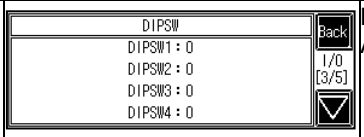
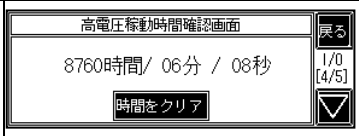
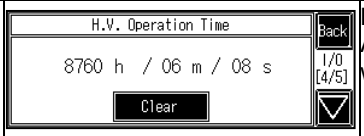
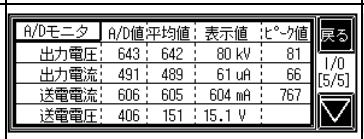
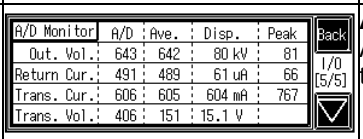
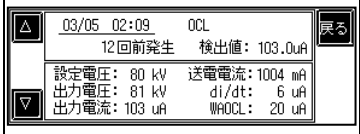
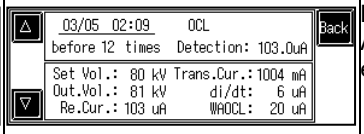
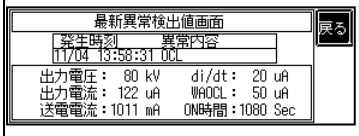
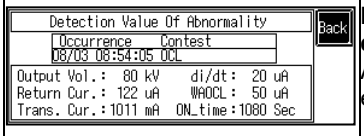
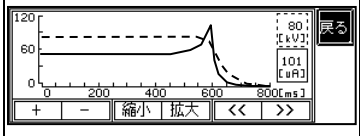
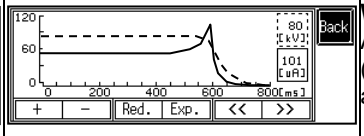
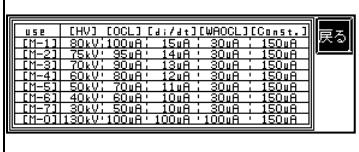
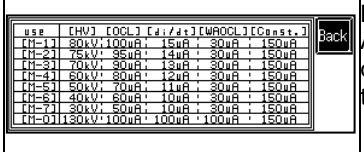
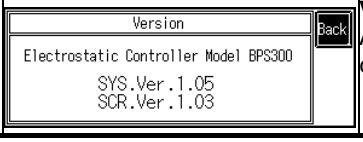
6.2.1 Display mode

No.	Japanese	English	Description
1.			**Opening page** The start-up log appears for about seven seconds after power-up.
2.			**Main monitor page** Allows you to check the output voltage and current and operation status. (See 6.4.1.) The in-use memory can be changed. (See 5.2.1.) The preset output voltage can be changed. (See 5.3.1.)
3.			**Roll mode page** Allows you to check changes in output voltage (broken line) and output current (continuous line) in a graphic form. **+** / **-**: Used to change the maximum value for the vertical axis **Red.** / **Exp.**: Used to change the updating frequency for the horizontal axis.
4.			**Error history page** Allows you to check the error history. ↑ / ↓: Used scroll over recorded errors.
5.			**Password page** Allows you to go to the page corresponding to the entered number. (See 6.4.1.)
6.			**Memory settings editing page** Allows you to change settings for the selected memory No. (See 5.3.2.) * It is not possible to change the in-use memory No.
7.			**Memory-specific parameter setting page 1** Allows you to change the preset output voltage. (See 5.3.2.)
8.			**Memory-specific parameter setting page 2** Allows you to change the preset output voltage, OCL, di/dt, WAOCL and fixed current settings. (See 5.3.2.)

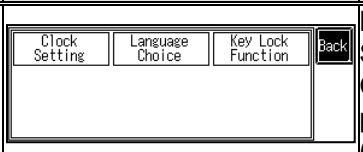
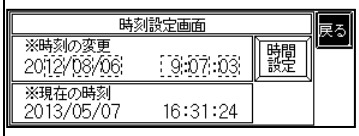
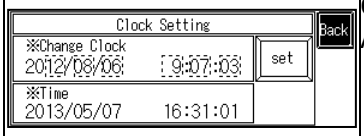
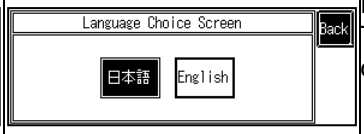
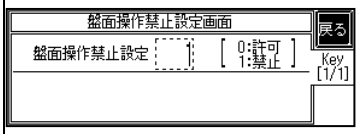
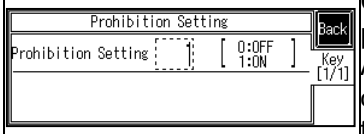
6.2.2 Indication of errors

No.	Japanese	English	Description
9.			**Error occurrence page** Allows you to check for pending errors. (See 6.4.2.)

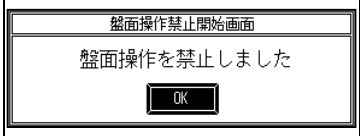
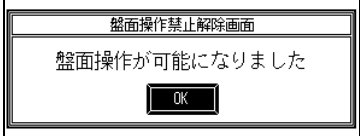
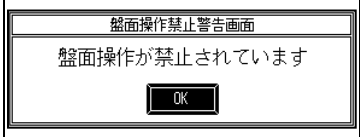
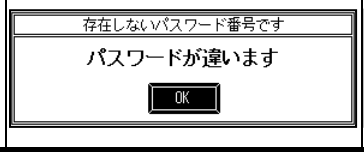
6.2.3 Confirmation mode

No.	Japanese	English	Description
10.			**User selection page** Allows you to check the I/O monitor, peak hold values, detailed error history, etc. (For the transition of the screen, see 6.3.2.)
11.			**Input check page** Allows you to check external input signals.
12.			**Output check page** Allows you to check external output signals.
13.			**DIPSW check page** Allows you to check the dip switch status.
14.			**H. V. Operation Time page** Allows you to check the cumulative time for which the high-voltage generator has worked. Clear: Press to reset the operation time to zero.
15.			**A/D monitor page** Allows you to check A/D and indicated values of the output voltage and current.
16.			**Peak Hold page** Indicates the maximum detected values. (The maximum values over the period excluding slow-down time are shown in parentheses.) Clear: Press to clear the peak hold values.
17.			**Detailed error history page** Allows you to check the detected values in the event of error. △ ▽: Press to scroll to the previous or next error. (For detail, see 5.3.)
18.			**Detected values at the occurrence of last error** Allows you to check the detected values in the event of error.
19.			**Waveforms in the event of error** Allows you to check changes in output voltage (broken line) and output current (continuous line) at the occurrence of the last error as waveforms.
20.			**Memory-specific settings listing page** Allows you to check a list of memory-specific detection thresholds, which change according to the preset output voltage.
21.			**Version information page** Allows you to check the program version of the controller (system and display).

6.2.4 Setting mode

No.	Japanese	English	Description
22.			**Detailed setting selection page L** Select “Clock Setting” or “Language Choice” to open the corresponding setting page. (For the screen transition, see 6.3.3.)
23.			**Clock Setting page** Allows you to change the time. (See 9.2.)
24.			**Language Choice page** The language used on the Touch-panel display can be changed. Japanese: Press to switch to Japanese. English: Press to switch to English.
25.			**Control panel operation prohibiting page** Allows you to permit the control panel operation, which has been prohibited since the start-up. (See 9.1.)

6.2.5 Other pages

No.	Japanese	English	Description
26.			**Control panel operation prohibited mode page** Appears when the control panel operation prohibited mode is initiated using the password.
27.			**Control panel operation permitted mode page** Appears when the control panel operation prohibited mode is exited using the password.
28.			**Control panel operation prohibited mode warning screen** Appears when any value other than the password for permitting the control panel operation is entered when it is prohibited.
29.			**Password error page** Appears when a password other than specified is entered.

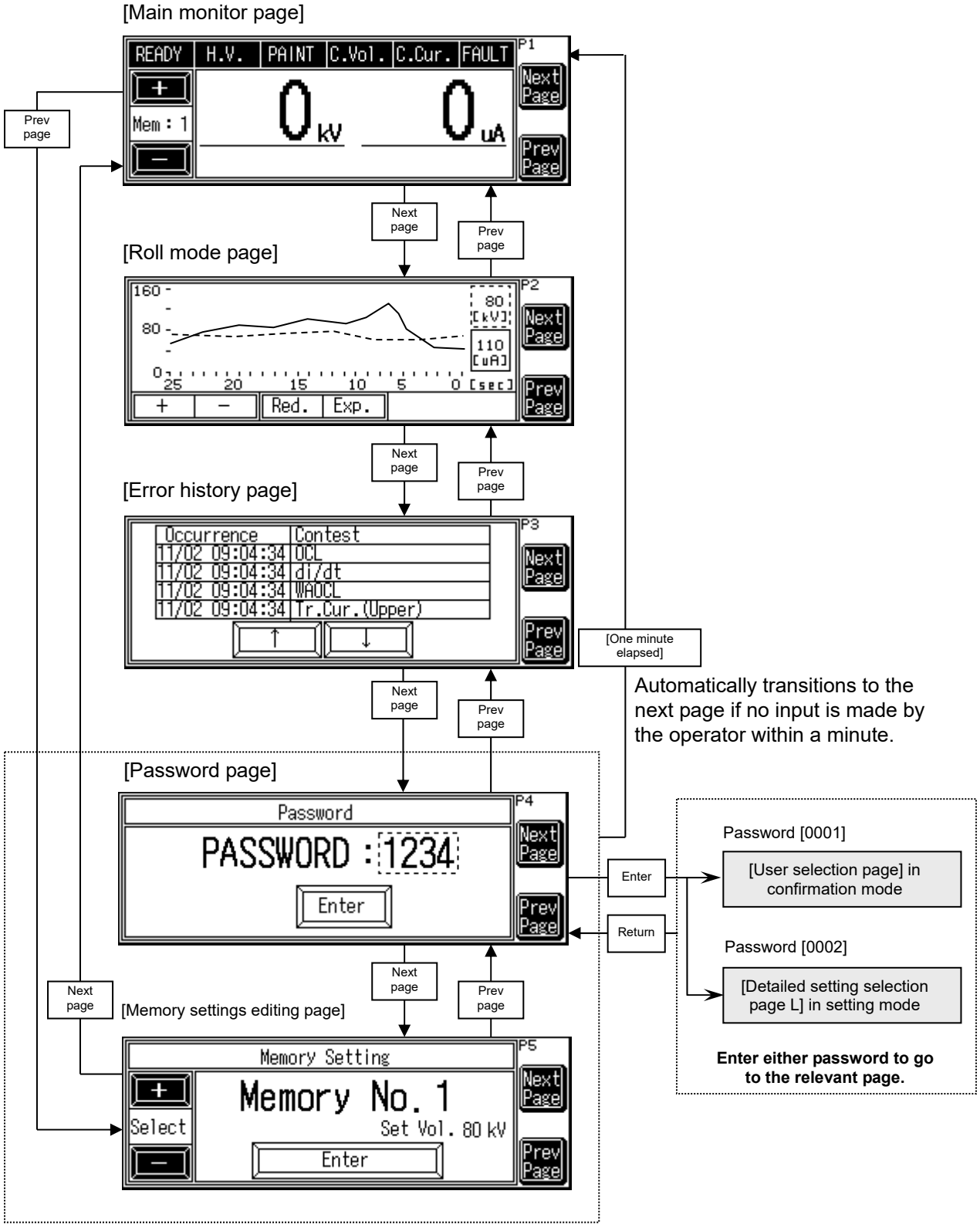
6.3 Screen transition

The screen shows the start-up log for about seven seconds after the power-up and then switches to the main monitor page.

6.3.1 Display mode

● **Main loop**

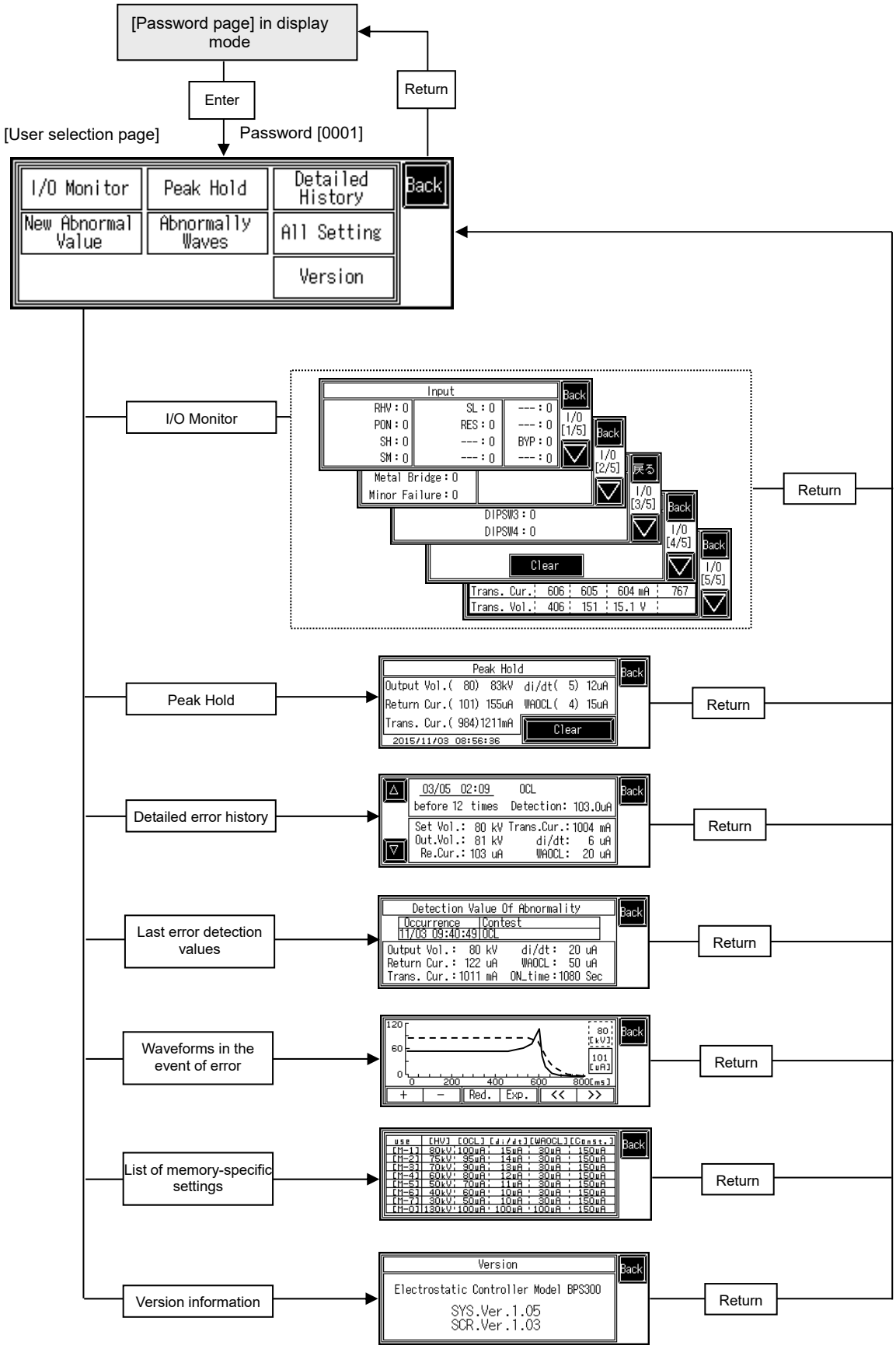
Press [Next Page] or [Prev Page] to return or proceed.



6.3.2 Confirmation mode

● **User selection page**

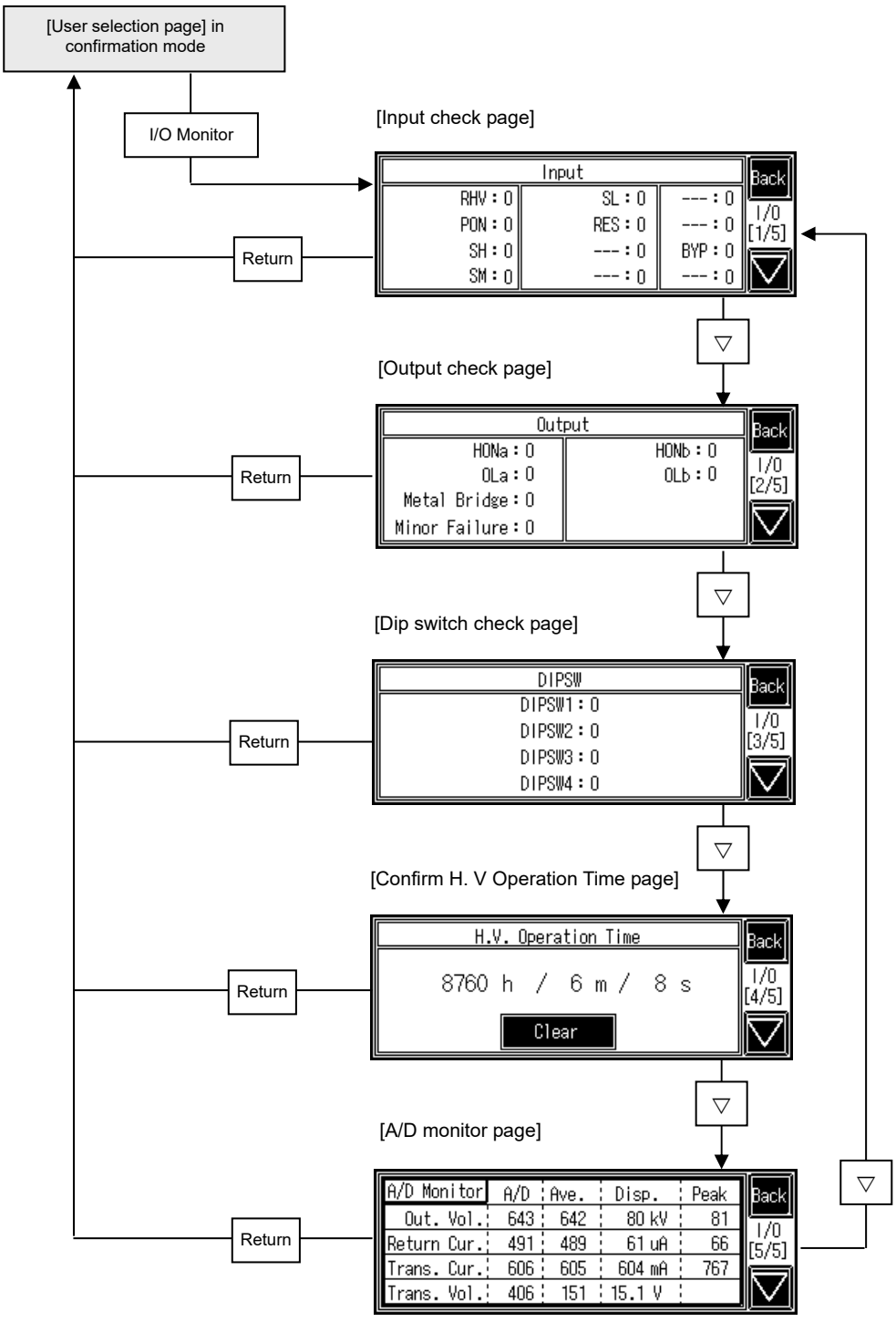
Allows you to check the data for the selected item.



● I/O monitor

Press "I/O monitor" on the user selection page to open the input confirmation page.

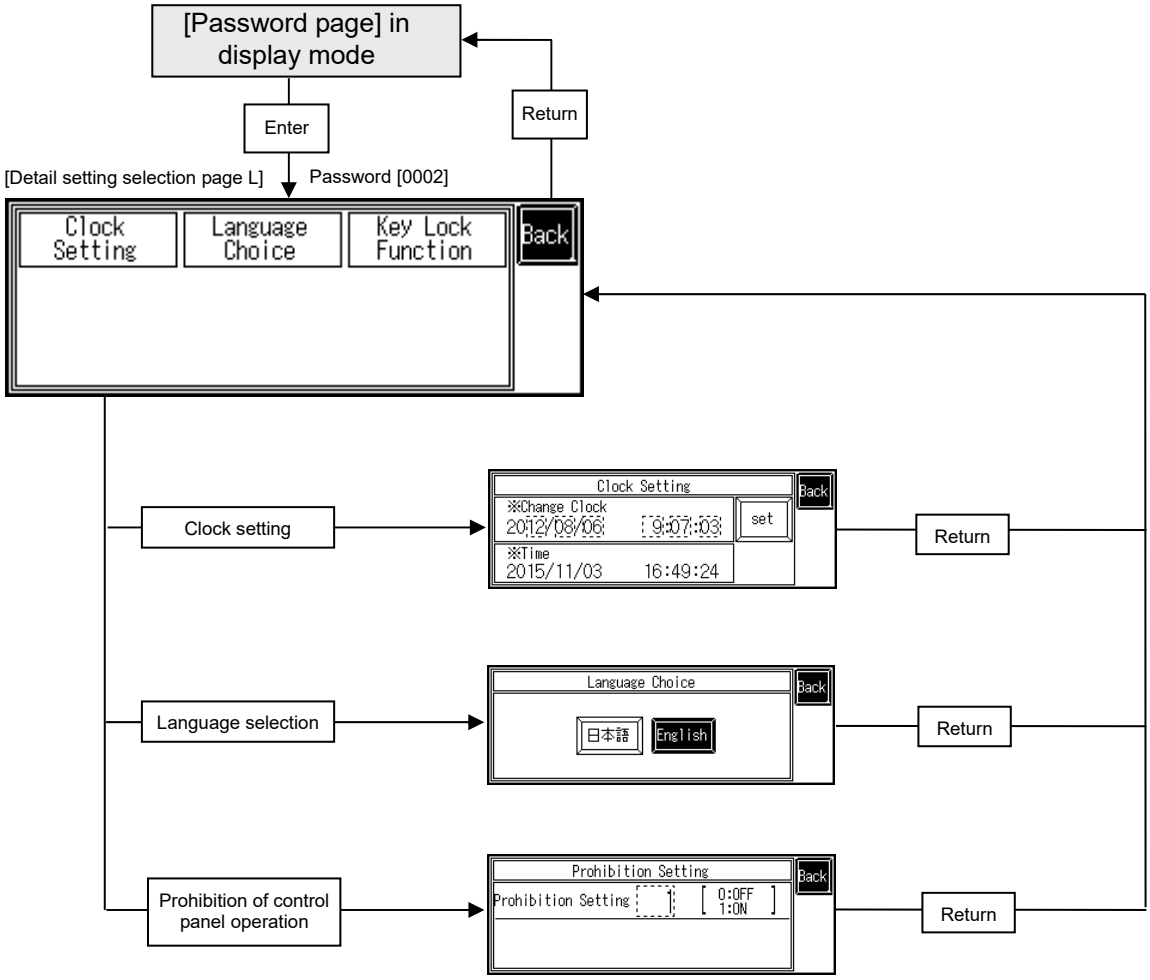
Press [▽] to proceed to the next page in the shown order.



6.3.3 Setting mode

● **Detail setting selection page L**

Allows you to set the data for the selected item.



6.4 Detailed description of pages

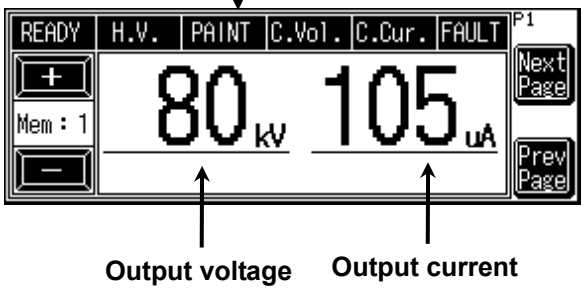
Some pages are described in detail below:

6.4.1 Display mode

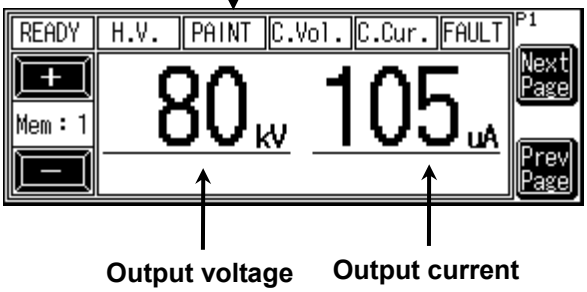
● **Main monitor page**

- Allows you to check the output voltage, output current, and the state of the gun.
- Allows you to manually change the in-use memory. (See 5.2.1.)
- The preset output voltage for the in-use memory No. can be changed. (See 5.3.1.)

Gun state (* with lamps off)



Gun state (* with lamps on)

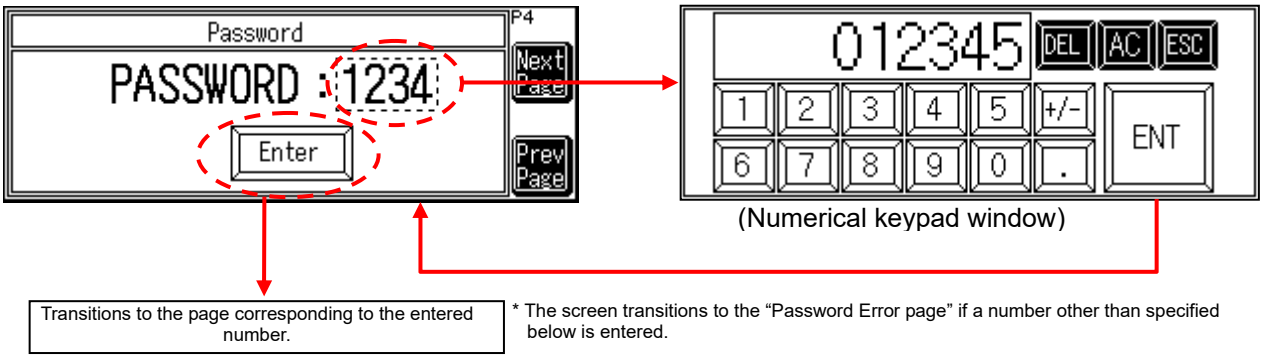


The lamps show black when they are off state and white when they are on.

Lamp	Condition for turning on the lamp
[READY]	Turns on when the ready signal, BYP, is on.
[H.V.]	Turns on when the high-voltage generator is active.
[PAINT]	Turns on when paint signal, PON, is on.
[FIXED VOLTAGE]	Turns on during fixed voltage control.
[FIXED CURRENT]	Turns on during fixed current control.
[ERROR]	Turns on when any error is pending.

● **Password page**

Allows you to go to another page, initialize settings or otherwise according to the entered number.

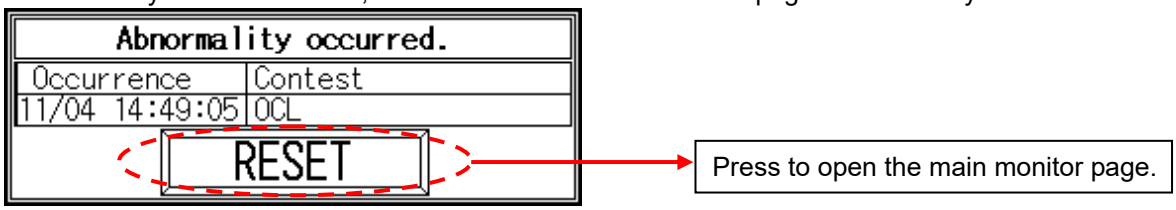


Password	Description
0001	Transitions to the selection menu page in confirmation mode. **“User selection page”**
0002	Transitions to the selection menu page in setting mode. **[Detailed setting selection page L]**

6.4.2 Indication of errors

● **Error page**

When any error is detected, the screen switches to the error page automatically.

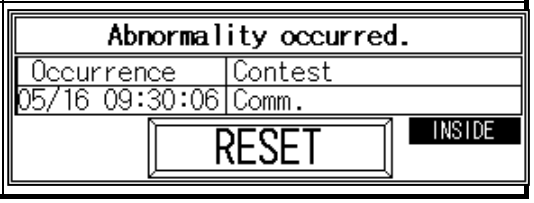


* When a clock fault occurs, the screen switches to the Time Setting page.

(2) Supplementary messages in the event of "communication fault"

○ The message shown on the screen depends on the communication fault type.

○ It is shown below the right bottom of the "Content" column.

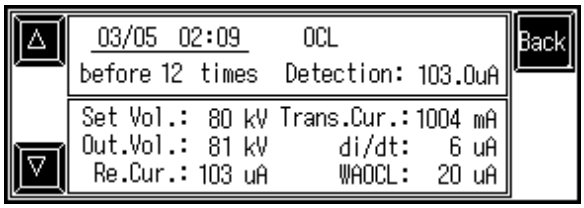
Error type	Japanese	English
External communication OUTSIDE		
Internal communication INSIDE		

6.4.3 Confirmation mode

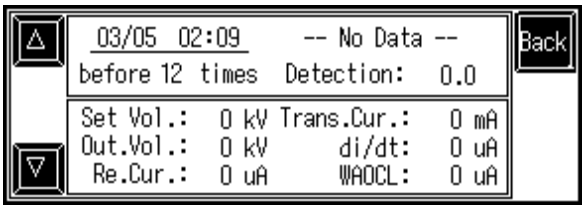
● **Detailed error history page**

Allows you to check the detected values in the event of error.

- The indicated errors are the same as on the error page. (See 6.4.2.)
- The last error and older 99 ones can be checked. (100 errors in total) → The errors other than the last ones are identified as “the ○○th last.”
- If the content of the error is not recorded, a message “-- No Data --” appears.



If OCL occurred as the 13th last error:



If the content of the error is not recorded:

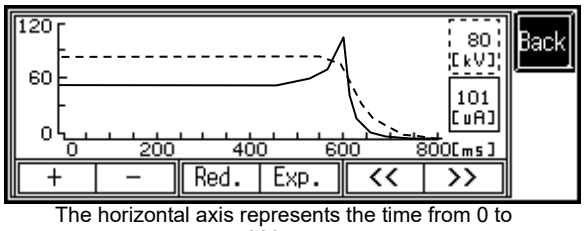
* Contents of the detailed error history are erased if the machine is left de-energized for an extended time.

△ ▽	Used to scroll over errors (from the last one to 100th last one).

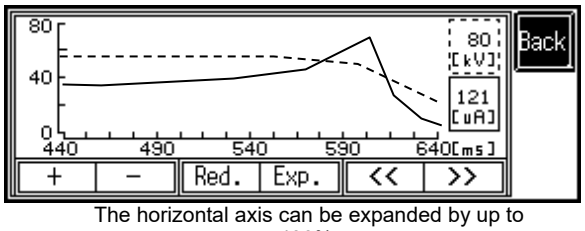
● **Waveforms in the event of error**

This page shows the output voltage and current waveforms recorded when the last error occurred.

- They are recorded 600 ms before and 200 ms after the error occurs.



The horizontal axis represents the time from 0 to 800 ms.



The horizontal axis can be expanded by up to 400%.

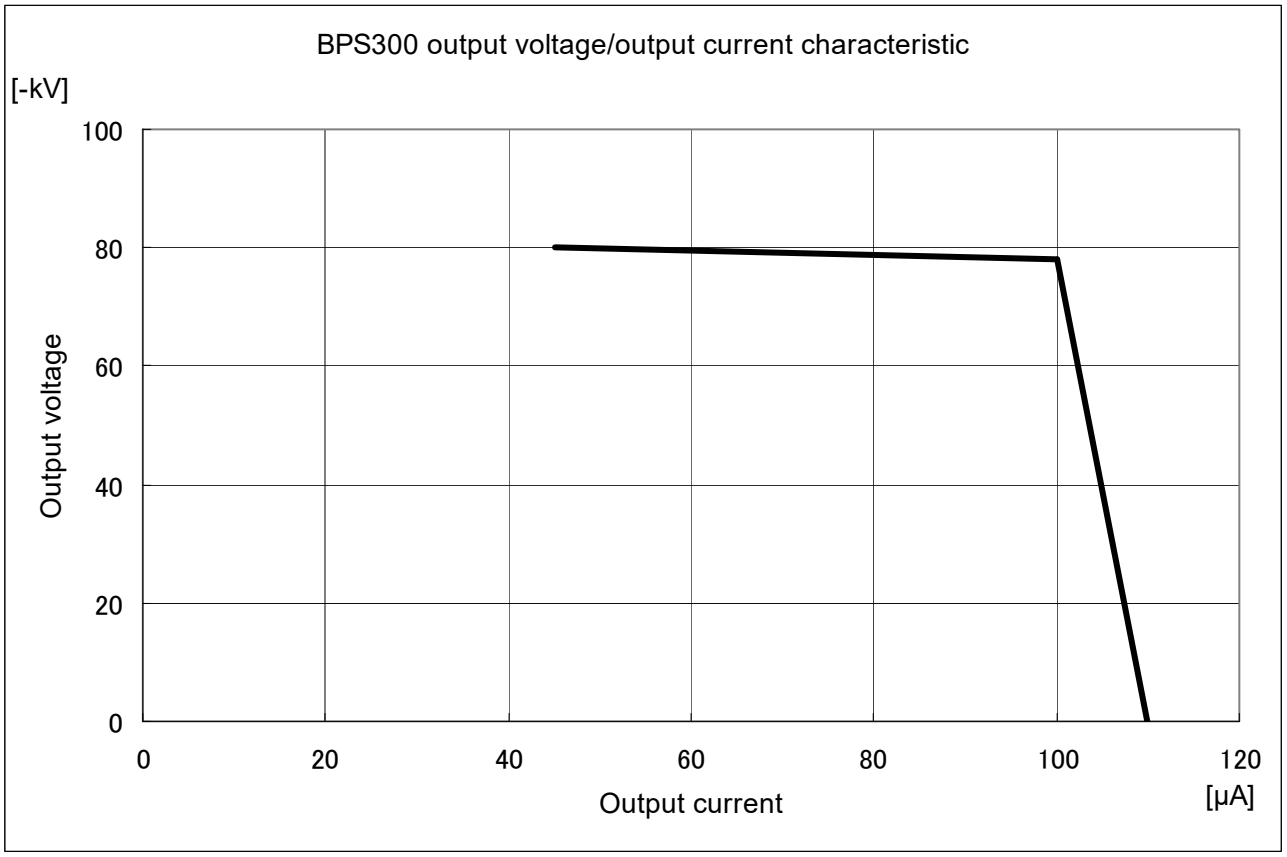
+	Used to change the maximum value for the vertical axis
-	
Red.	Press to expand the waveforms.
Exp.	Press to reduce the waveforms.
<<	Press to shift the waveforms to the right or left (by +/-20 ms).
>>	

7 Error types

Error type	Detailed description	Supposed causes	Remedies
Output over-current fault “OCL”	The output voltage exceeds the OCL detection threshold.	(1) Gun and ground too close to each other (2) Internal contamination of gun (3) Condensation on gun (4) Water intrusion into air circuit (5) Low paint resistance (6) Metal bridge (7) Faulty gun	(1) Increase the spray distance. (2) Clean the gun. (3) Dry the gun. (4) Drain water from the air circuit. (5) Adjust the paint resistance. (6) Clean the paint circuit. Lower the preset voltage. (7) Replace the gun with a new one.
Excessive output current variation “di/dt”	The output current changes by the value exceeding the di/dt detection threshold.	(1) Gun and ground rapidly getting close to each other (2) Vibration of product being coated (3) Water intrusion into air circuit	(1) Increase the spray distance. (2) Control the product vibration. (3) Drain water from the air circuit.
Weighted average OCL “WAOCL”	When the difference between the output current and the weighted average output current exceeds the memory-specific WAOCL detection threshold (WAOCL detection threshold during communication when communication is active), which results in an increase in output current.	(1) Gun and ground rapidly getting close to each other (2) Vibration of product being coated (3) Water intrusion into air circuit	(1) Increase the spray distance. (2) Control the product vibration. (3) Drain water from the air circuit.
Current transmission fault “Tr. Cur. (Upper Limit)” “Tr. Cur. (Lower Limit)” “Tr. Cur. (Off)”	The transmitted current rises over or drops below the current transmission fault detection threshold.	(1) Poorly connected cable (2) Cut wire in connecting cable (3) Faulty gun (4) Faulty controller	(1) Reconnect the connecting cable. (2) Replace the connecting cable with a new one. (3) Replace the gun with a new one. (4) Replace the controller with a new one.
Return current fault “Re. Cur. (Lower Limit)”	The output current rises over or drops below the return current fault detection threshold.	(1) Poorly connected cable (2) Cut wire in connecting cable (3) Faulty gun (4) Faulty controller	(1) Reconnect the connecting cable. (2) Replace the connecting cable with a new one. (3) Replace the gun with a new one. (4) Replace the controller with a new one.
Return current fault “Re. Cur. (Off)”	The output current is detected when the high-voltage generator is off.	(1) Adjacent gun too close	(1) Reserve an adequate interval between guns.

Error type	Detailed description	Supposed causes	Remedies
High voltage output fault “H.V. (Upper Limit)” “H.V. (Lower Limit)”	The output voltage rises over or drops below the high voltage fault detection threshold.	(1) Poorly connected cable (2) Cut wire in connecting cable (3) Faulty gun (4) Faulty controller	(1) Reconnect the connecting cable. (2) Replace the connecting cable with a new one. (3) Replace the gun with a new one. (4) Replace the controller with a new one.
High voltage output fault “H.V. (OFF)”	The output voltage is detected when the high-voltage generator is off.	(1) Adjacent gun too close	(1) Reserve an adequate interval between guns.
Voltage transmission fault “Tr. Vol. (Upper Limit)”	The transmitted voltage exceeds the voltage transmission fault detection threshold.	(1) Poorly connected cable (2) Cut wire in connecting cable (3) Faulty gun (4) Faulty controller	(1) Reconnect the connecting cable. (2) Replace the connecting cable with a new one. (3) Replace the gun with a new one. (4) Replace the controller with a new one.
Clock fault “Clock”	Oscillation stop of the clock IC is detected during start-up.	(1) Extended power-off	(1) Set the clock.
Memory cleared “Memory cleared”	The content of RAM is erased.	(1) Extended power-off	(1) Use after selecting a memory.
Communication fault “Comm.”	A communication fault occurs with communication ON/OFF set to ON.	(1) Poorly connected communication cable (2) Cut wire in communication cable (3) Faulty communication circuit board (4) Faulty controller	(1) Reconnect the communication cable. (2) Replace the communication cable with a new one. (3) Replace the communication circuit board with a new one. (4) Replace the controller with a new one.

8 Output Voltage vs Output Current

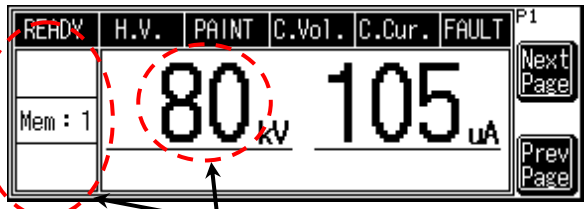


9.1 Prohibition of control panel operation

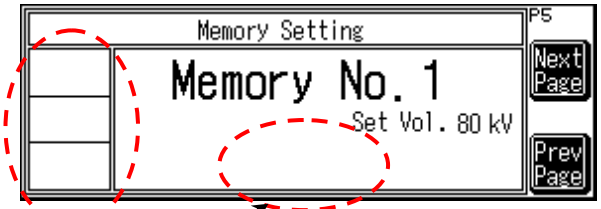
● Control panel operation prohibited mode

In control panel operation prohibited mode
• The in-use memory cannot be changed from the Touch-panel display.
• The preset output voltage cannot be changed from the Touch-panel display.
• The memory-specific settings cannot be changed from the Touch-panel display.
• No password other than for permitting the control panel operation is accepted.

[Main monitor page]



[Memory settings editing page]



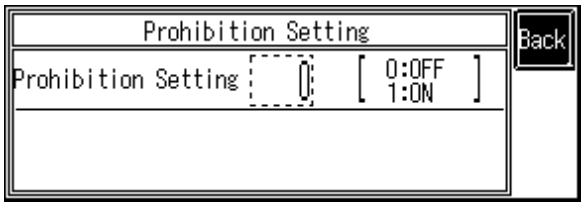
When the control panel operation is prohibited, no button is shown on the Touch-panel display.

When the control panel operation is prohibited, the numerical keypad window does not open if the output voltage value is touched.

To prohibit the control panel operation	**Password “2468”**
To permit the control panel operation	**Password “1234”**

● Specifying the controller state at the start-up

Specify on the control panel operation prohibiting page.



Setting	State at the start-up
0: Permitted	**The control panel operation is permitted.**
1. Prohibited	**The control panel operation is prohibited.**

- It is possible to program the controller to start with the control panel operation permitted or prohibited.
- If “1: Prohibited” is selected, the control panel operation is automatically prohibited when no input is made by the operator within a given time.

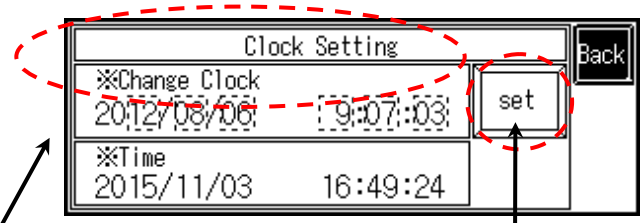
* If the controller is started with the control panel operation prohibited, all you can do is to view pages within the main loop until the prohibition is canceled from the password page.

9.2 Clock setting

It is possible to set the controller internal clock by synchronizing the CPU and Touch-panel display clocks.
When you want to correctly record the times in the error history, be sure to set the clock.

When a clock fault is detected upon the power-up, press the reset button on the error page to open the clock fault page.
Clock fault occurs when the memory is cleared after the machine is left de-energized for an extended time.
First of all, set the clock.

[Clock setting page]



1. Change the values enclosed by broken lines.

2. Set the SPU and Touch-panel display clocks.

10 Parameters

10.1 Memory-specific setting

[Parameter]

No.	Parameter	Unit of measurement	Maximum	Minimum	Resolution
1.	Output voltage	kV	80	5	1

[Default]

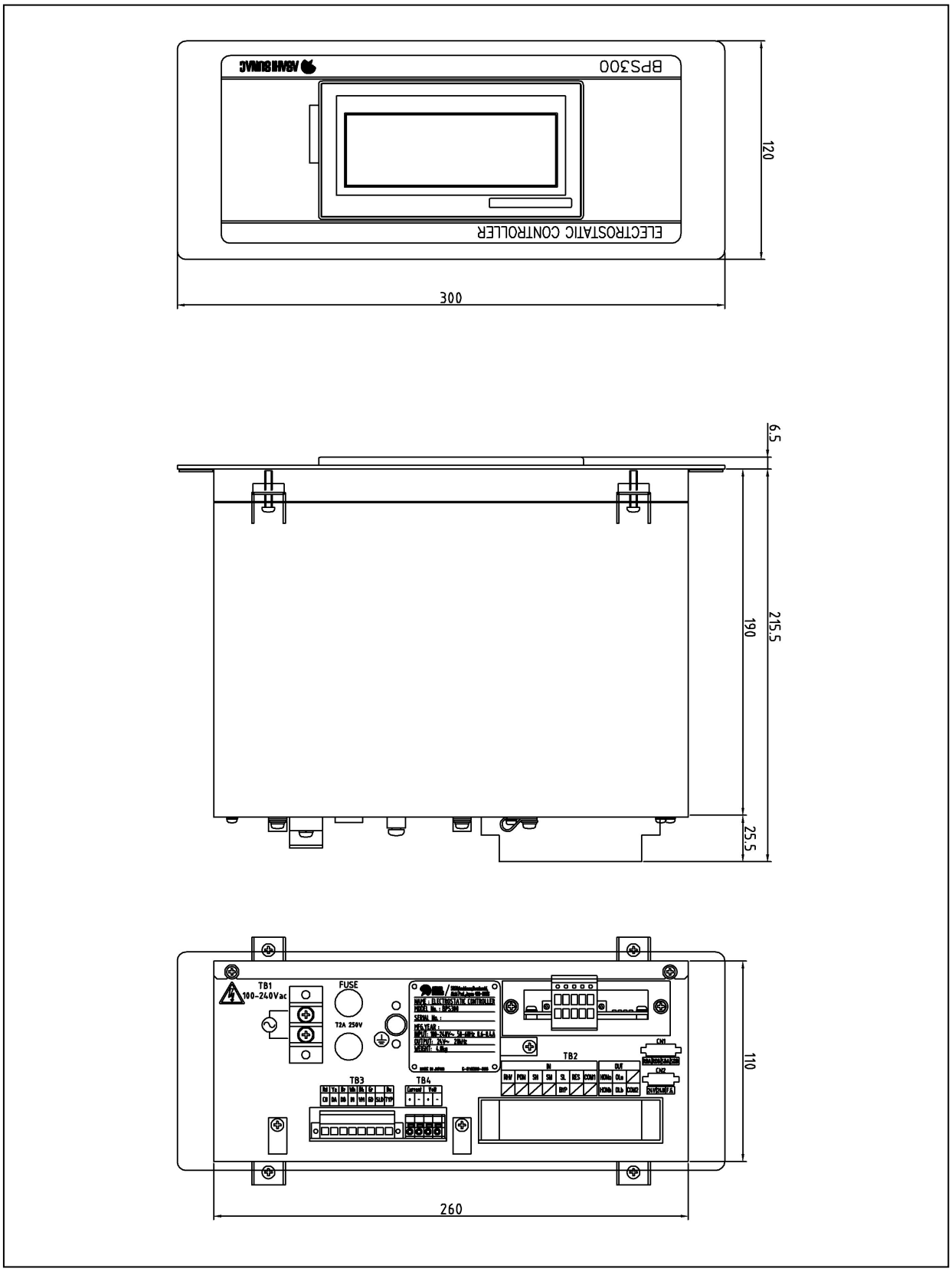
No. / Parameter	1	2	3	4	5	6	7	0 *
Output voltage [kV]	80	75	70	60	50	40	30	-

* Memory No. 0 is only selectable when using the optional link circuit board.

10.2 Detailed settings L

No.	Parameter	Unit of measurement	Default	Maximum	Minimum	Setting
1.	Clock setting	Year	2001	2079	1980	
		Month	1	12	1	
		Date	1	31	1	
		Hour	1	23	0	
		Minute	1	59	0	
		Second	1	59	0	
2.	Language selection (1 for Japanese or 2 for English)		1	2	1	
3.	Prohibition of control panel operation		0	1	0	

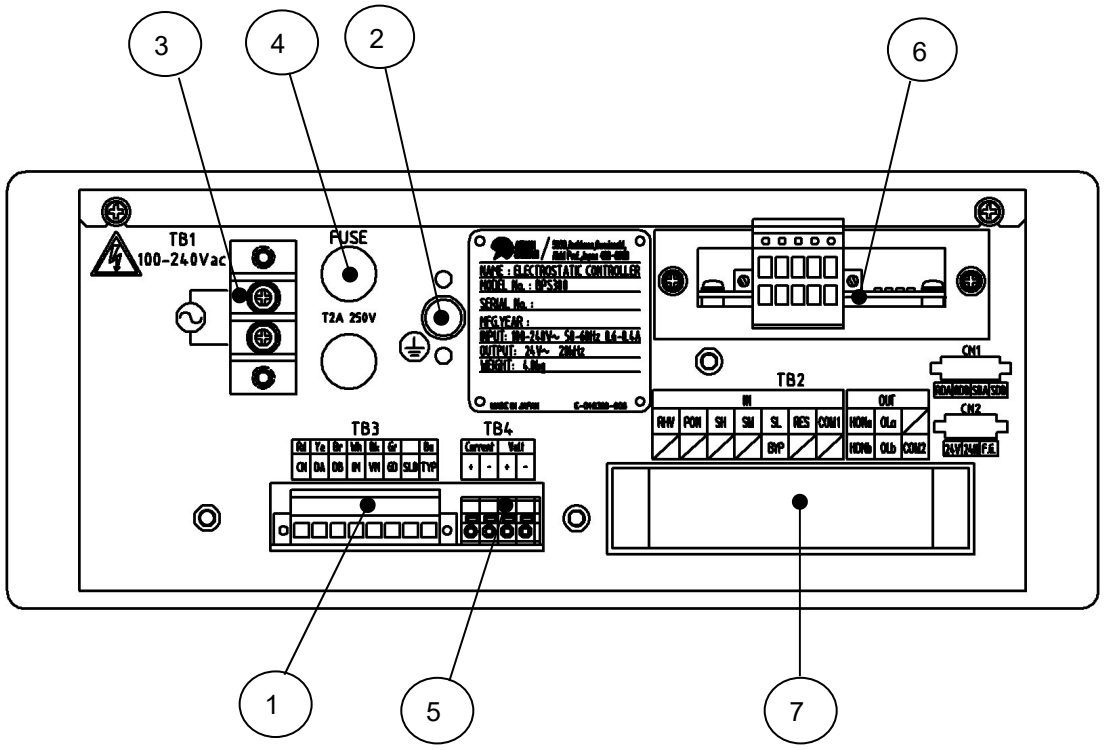
11.1 Outside Dimensions (mm)



11.2 Names and functions of components

11.2.1 Names of components

<Rear panel>



No.	Name	No.	Name
(1)	Terminal block for high-voltage generator “TB3”	(2)	Grounding terminal “⏚”
(3)	Input power terminal block “~”	(4)	Fuse holder “FUSE”
(5)	Output voltage/current monitor terminal block “TB4”	(6)	Link circuit board * Optional
(7)	I/O terminal block “TB2”		

Note: The controller shape and specifications may be changed without notice to reflect improvements, etc.

11.2.2 Functions of components

<Rear panel>

(1) Terminal block for high-voltage generator “TB3”

Terminal number	Name	Remarks
1	CN	DC power supply
2	DA	Power switching, phase A
3	DB	Power switching, phase B
4	IM	Current detection (20 [μA/V])
5	VM	Voltage detection (8.89 [kV/V])
6	GND	Ground (analog ground)
7	SLD	Shield (frame ground)
8	TYP	For cascade identification

(2) Grounding terminal “⏚”

A grounding terminal for BPS300.

The controller uses a high voltage and, therefore, requires class A grounding work (10Ω or less).

(Small, round) screw with spring and washer, M5 x 8L

⚠ WARNING

Incomplete grounding may lead to a failure, electric shock, injury, fire and/or explosion.

(3) Input power terminal block “~”

A terminal block for input power. Supply 100 to 240 VAC power. Using a power supply other than specified may lead to a failure and/or fire. Wire BPS300 separately from other machines, and install an appropriate circuit breaker to each.

(Small, round) screw with spring and washer, M5 x 8L

⚠ WARNING

Applying a voltage other than specified may lead to a failure and/or fire.

⚠ WARNING

Touching the terminal block when it is alive may lead to electric shock.

(4) Fuse holder “FUSE”

A 2-amp (T2A250V) glass tube fuse has been inserted into each line. If the fuse is blown, do not turn on the power switch until the cause is removed.

(5) Output voltage/current monitor terminal block “TB4”

The output voltage and current of each electrostatic spray gun can be monitored as analog outputs between 0 V and 5 V. The output voltage is monitored as 4 V at -100 kV and the output current as 2 V at 100 μA.

<Compatible wire sizes and insulation strip length>

Rated wire sizes	φ1.2 mm (AWG16) for single wires or 1.25 mm² (AWG16) for stranded wires with a strand diameter of 0.18 mm or more
Usable wire sizes	Single wires: φ0.4 mm (AWG26) to φ1.2 mm (AWG16) Stranded wires: 0.2 mm² (AWG24) to 1.25 mm² (AWG16) with a strand diameter of 0.18 mm or more
Standard strip length	11 mm

<Terminal block layout>

1	2	3	4
CURRENT		VOLT	
+	-	+	-

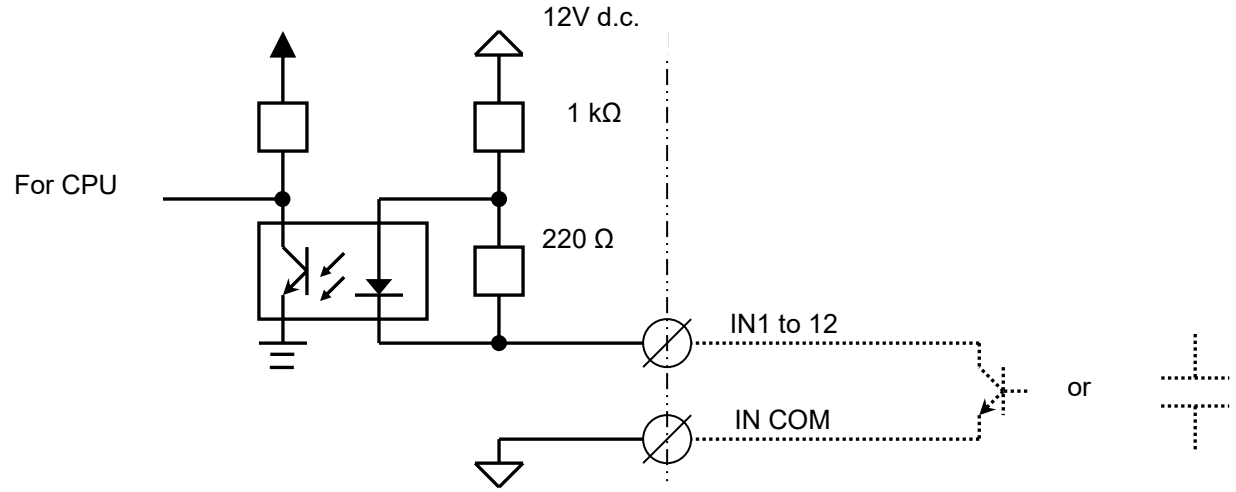
<Names and description>

Code	Name	Description
CURRENT	External output current monitor	0-5 V output, 1 V at 50 μA
VOLT	External output voltage monitor	0-5 V output, 1 V at -25 kV

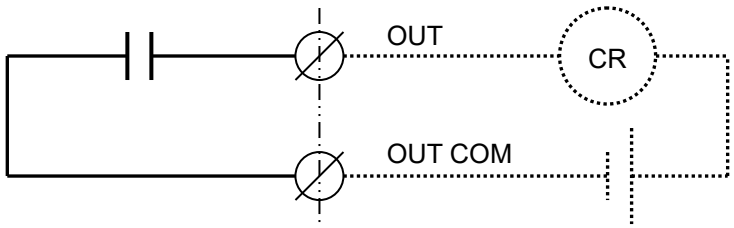
(6) I/O terminal block “TB2”

Cross-recessed head screw with square washer, M3

<Input circuit>



<Output circuit>



30 VAC/VDC, 0.5 A or less

<Terminal block layout>

IN						INCOM	OUT		
A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
RHV	PON	SH	SM	SL	RES	COM1	HONa	OLa	
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
				BYP			HONb	OLb	COM2
IN						OUT			OUTCOM

* HONb and Olb are operated just as B contacts using software. (Open when the power supply is off.)

<Names and description>

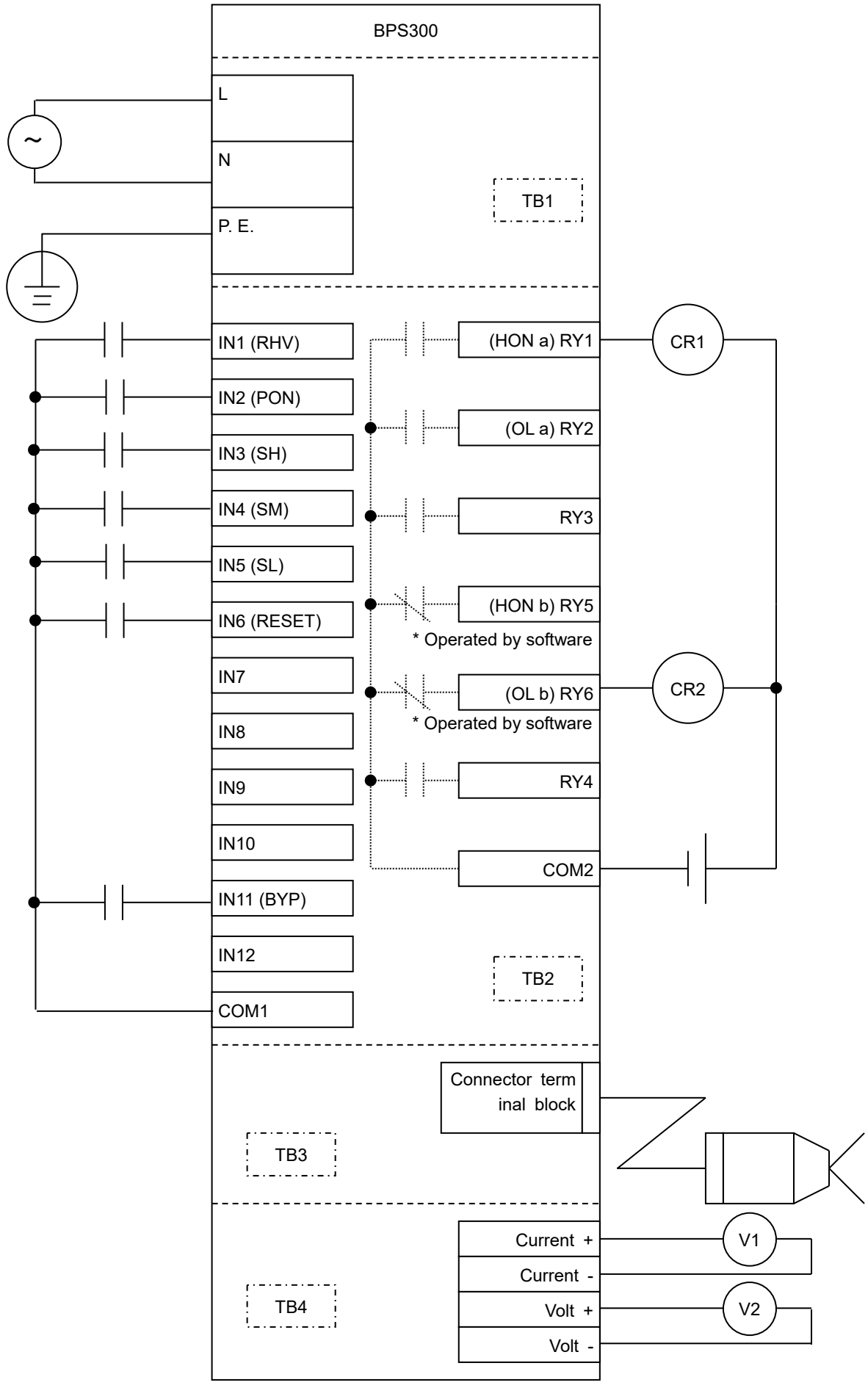
1) Inputs

Code	Terminal block number	Name	Description
RHV	A1	Remoter ON signal	Remote signal input
PON	A2	Paint ON signal	Paint signal input
SH	A3	External memory selection 1	External memory selection signal input SH:BIT2 SM:BIT1 SL:BIT0
SM	A4	External memory selection 2	
SL	A5	External memory selection 3	
RES	A6	Error reset	Error reset signal input
	B1		
	B2		
	B3		
	B4		
BYP	B5	Master on	Master on signal input
	B6		
COM1	A7	Common to inputs	A common terminal for inputs

2) Outputs

Code	Terminal block number	Name	Description
HONa	A8	High-voltage generator active	On when the high-voltage generator is active (A-contact)
OLa	A9	Error pending	On when any error is pending (A-contact)
	A10		
	B7		
HONb	B8	High-voltage generator active	On when high-voltage generator is off (B-contact)
OLb	B9	Error pending	On when no error is pending (B-contact)
COM2	B10	Common to outputs	A common terminal for outputs

11.3 Example of wiring



11.4 Optional devices

11.4.1 Optional external monitor

Name	Model	Part No.	Remarks
Monitor cable	—	E-010260-120	

12 Consumable Part List

Usable life of BPS300 is 10 years except for its consumable parts.

The usable life of the following consumable parts vary depends on the environment of usage.

Its recommend for replace them as for the following reference value of usable life.

The exclusive knowledge and the skill are necessary for the replacement of parts.
Please consult our company or the agency when you exchange it.

Part No.	Part name	Qty.	Durable life	Remarks
E0D2010064100	Switching power supply	1	5 years	
E0QX040010500	Battery	1	5 years	For Touch-panel display

13 Appendix

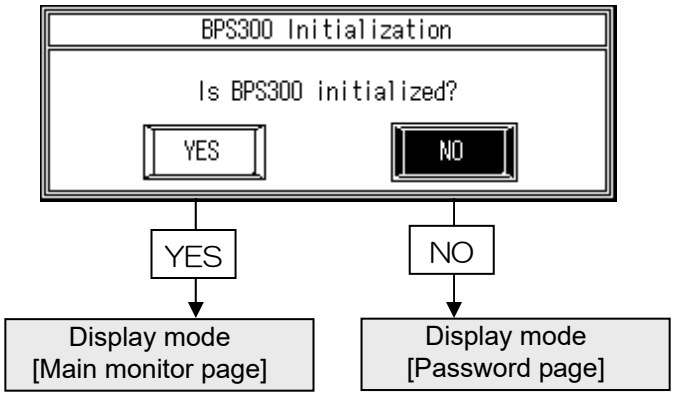
13.1 Password page

- By entering any of the following passwords, you can change or initialize system parameter settings.

Password	Description	See section
0300	For initializing BPS300 **"BPS300 Initialization page"**	13.2
0001	For transition to the selection menu page in confirmation mode **"User selection page"**	6.3.2
0002	For transition to the selection menu page in setting mode **"Detailed setting selection page L"**	6.3.3
5280	For transition to the selection menu page for system parameter settings **"Detail setting selection page M1"**	13.3
1234	For exiting the control panel operation prohibited mode	9.1
2468	For entering the control panel operation prohibited mode	

13.2 Parameter initialization

- Key in "0300" on the password page to open the **BPS300 Initialization page**.
- Press [YES] to initialize parameters to the factory default values. (For default values, see 10.1, 10.2 and 13.3.3.)



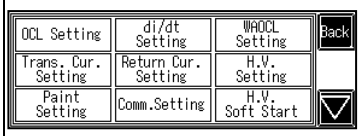
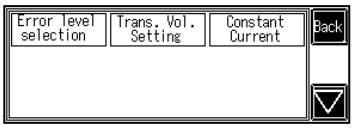
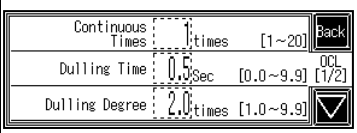
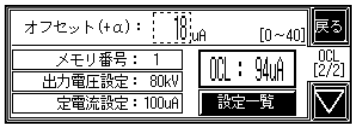
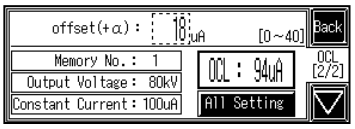
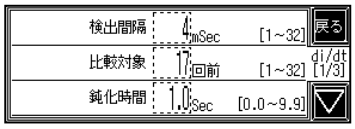
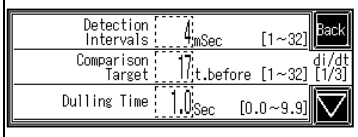
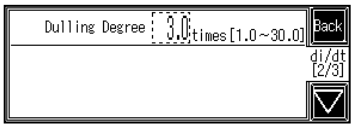
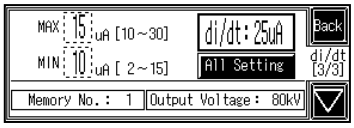
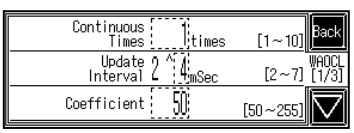
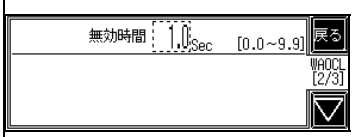
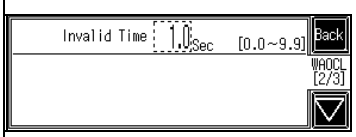
13.3 Setting the system parameters

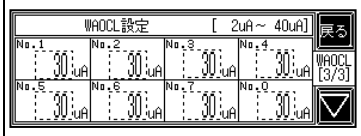
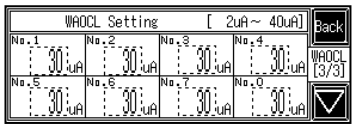
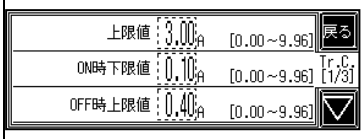
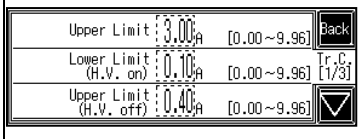
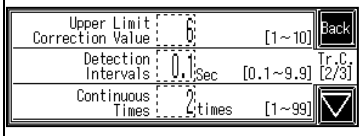
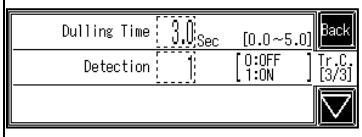
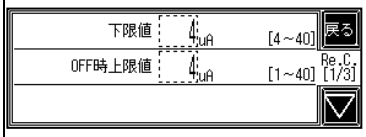
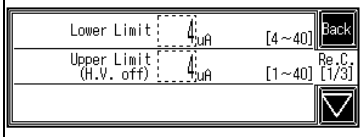
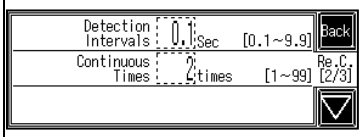
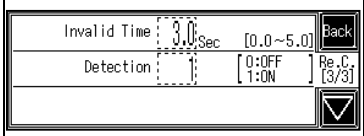
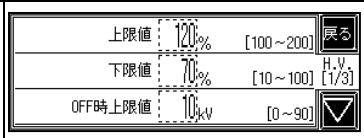
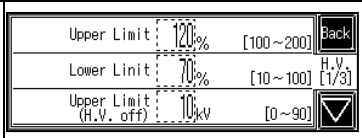
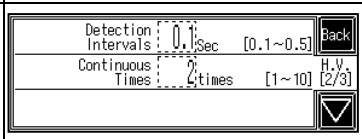
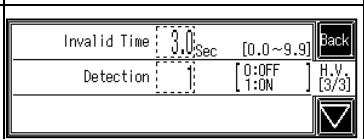
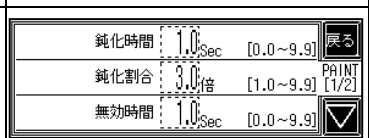
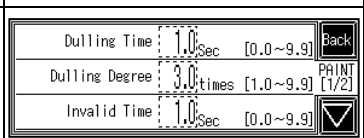
- Key in "5280" on the password page to open the detail setting selection page M1.

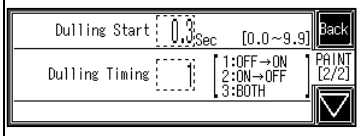
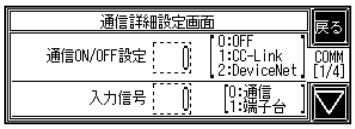
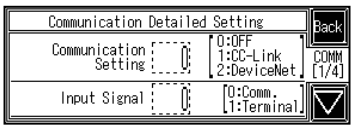
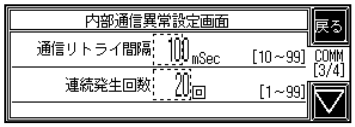
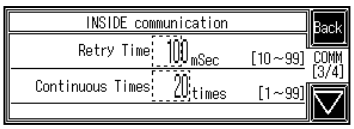
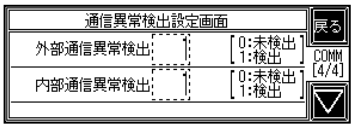
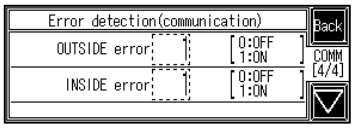
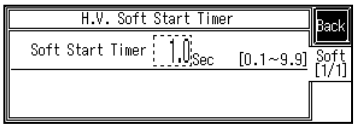
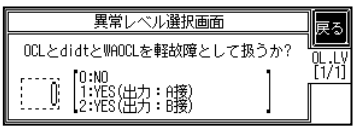
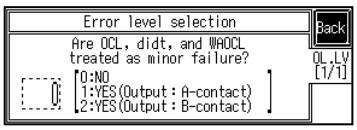
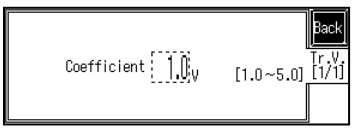
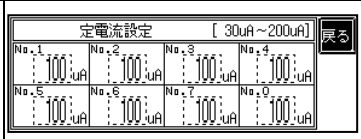
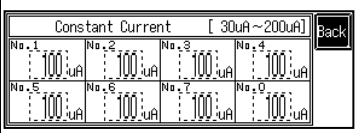
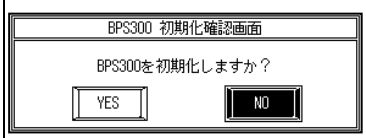
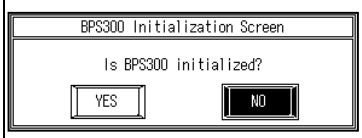
⚠ WARNING

Changing any system parameter setting may lead to a failure, electric shock, injury, fire and/or explosion.
Please contact the staff at Asahi Sunac.

13.3.1 Bilingual description of pages

No.	Japanese	English	Description
1.			**Detailed setting selection page M1** Touch “OCL setting,” “di/dt setting,” etc. to open the relevant setting page.
2.			**Detailed setting selection page M2** Touch “Error level section,” “Trans. Vol. Setting,” etc. to open the relevant setting page.
3.			**OCL setting page 1** You can change the number of successive occurrence times, slowdown time and slowdown rate.
4.			**OCL setting page 2** You can change the offset value, α. (See 13.3.5.)
5.			**Di/dt setting page 1** You can change the detection interval, comparison subject and slowdown time.
6.			**Di/dt setting page 2** You can change the slowdown rate.
7.			**Di/dt setting page 3** You can change the maximum and minimum thresholds. (See 13.3.6.)
8.			**WAOCL setting page 1** You can change the number of successive occurrence times, updating interval and permissible deviation.
9.			**WAOCL setting page 2** You can change the dead time.

No.	Japanese	English	Description
10.			**WAOCL setting page 3** You can change the memory-specific detection thresholds.
11.			**Current transmission fault setting page 1** You can change the upper limit, ON-time lower limit and OFF-time upper limit.
12.			**Current transmission fault setting page 2** You can change the upper limit correction value, detection interval and number of successive occurrence times. (See 13.3.3.)
13.			**Current transmission fault setting page 3** You can change the slowdown time and choose to or not to detect errors.
14.			**Return current fault setting page 1** You can change the lower limit and OFF-time upper limit.
15.			**Return current fault setting page 2** You can change the detection interval and number of successive occurrence times.
16.			**Return current fault setting page 3** You can change the dead time and choose to or not to detect errors.
17.			**High voltage fault setting page 1** You can change the upper limit, lower limit and OFF-time upper limit.
18.			**High voltage fault setting page 2** You can change the detection interval and number of successive occurrence times.
19.			**High voltage fault setting page 3** You can change the dead time and choose to or not to detect errors.
20.			**Paint slowdown setting page 1** You can change the slowdown time, slowdown rate and dead time.

No.	Japanese	English	Description
21.			**Paint slowdown setting page 2** You can change the slowdown start time and slowdown timing.
22.			**Detailed communication setting page** You can change the communication ON/OFF and input signal modes. (See 13.3.7.)
23.			**External communication fault setting page** You can change the number of successive occurrence times.
24.			**Internal communication fault setting page** You can change the communication retry frequency and number of successive occurrence times.
25.			**Communication fault detection setting page** You can choose to or not to detect communication faults.
26.			**High voltage soft start setting page** You can change the soft start time.
27.			**Error level selection page** You can choose to or not to issue an error output signal in the event of OCL, di/dt or WAOCL. 0: NO (no signal output for slight failures) 1: YES (signal output for slight failures (A-contact)) 2: YES (signal output for slight failures (B-contact))
28.			**Voltage transmission fault setting page** You can specify the permissible deviation for voltage transmission faults. (See 13.3.4.)
29.			**Fixed current setting page** You can specify the memory-specific fixed current value.
30.			**Initialization page** A confirmation page for initialization of parameters. (See 13.2.)

13.3.2 Detailed settings M

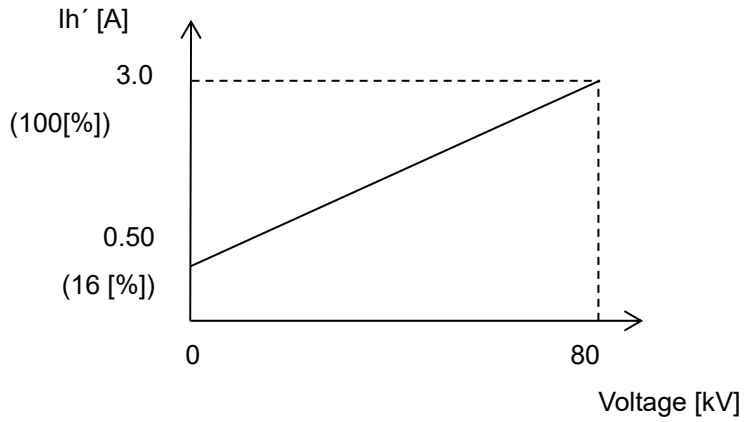
No.	Parameter	Unit of measurement	Default	Maximum	Minimum	Setting
1.	OCL: Number of successive occurrence times	Times	1	20	1	
2.	OCL: Slowdown time	Second	3.0	9.9	0.0	
3.	OCL: Slowdown rate	Times	2.0	9.9	1.0	
4.	ODL: Offset value	µA	18	40	0	
5.	di/dt: Detection interval	Millisecond	4	32	1	
6.	di/dt: Comparison subject		30	32	1	
7.	di/dt: Slowdown time	Second	3.0	9.9	0.0	
8.	di/dt: Slowdown rate	Times	10.0	30.0	1.0	
9.	di/dt: Maximum detection threshold	µA	15	30	2	
10.	di/dt: Minimum detection threshold	µA	10	30	2	
11.	WAOCL: Number of successive occurrence times	Times	1	10	1	
12.	WAOCL: Weighted average updating interval (2^n milliseconds)		4	7	2	
13.	WAOCL: Average weighting factor		50	255	50	
14.	WAOCL: Dead time	Second	1.0	9.9	0.0	
15.	WAOCL: Detection threshold (memory-specific)	µA	30	40	2	
16.	Current transmission fault: Upper limit	A	3.00	9.96	0.00	
17.	Current transmission fault: Lower limit	A	0.10	9.96	0.00	
18.	Current transmission fault: Upper limit with high voltage generator off	A	0.40	9.96	0.00	
19.	Current transmission fault: Upper correction value		6	10	1	
20.	Current transmission fault: Detection interval	Second	0.1	9.9	0.1	
21.	Current transmission fault: Number of successive occurrence times	Times	2	99	1	
22.	Current transmission fault: Slowdown time	Second	3.0	5.0	0.0	
23.	Current transmission fault: Fault detection (0 for no detection or 1 for detection)		1	1	0	
24.	Return current fault: Lower limit	µA	4	40	4	
25.	Return current fault: Upper limit with high-voltage generator off	µA	4	40	1	
26.	Return current fault: Detection interval	Second	0.1	9.9	0.1	
27.	Return current fault: Number of successive occurrence times	Times	2	99	1	
28.	Return current fault: Dead time	Second	3.0	5.0	0.0	
29.	Return current fault: Fault detection (0 for no detection or 1 for detection)		1	1	0	
30.	High voltage output fault: Upper limit	%	120	200	100	
31.	High voltage output fault: Lower limit	%	70	100	10	
32.	High voltage output fault: Upper limit with high-voltage generator off	kV	10	90	0	
33.	High voltage output fault: Detection interval	Second	0.1	0.5	0.1	
34.	High voltage output fault: Number of successive occurrence times	Times	2	10	1	
35.	High voltage output fault: Dead time	Second	3.0	9.9	0.0	
36.	High voltage output fault: Fault detection (0 for no detection or 1 for detection)		1	1	0	
37.	Communication: ON/OFF mode (0: OFF, 1-2:Unused)		0	2	0	
38.	Communication: Input signal mode (0 for communication or 1 for terminal block)		0	1	0	
39.	Communication - External communication: Number of successive occurrence times	Times	3	99	1	
40.	Communication - Internal communication: Communication retry intervals	Millisecond	100	990	100	
41.	Communication - Internal communication: Number of successive occurrence times	Times	20	99	1	
42.	Communication - External communication: Error detection (0 for no detection or 1 for detection)		1	1	0	
43.	Communication - Internal communication: Error detection (0 for no detection or 1 for detection)		1	1	0	
44.	di/dt slowdown time at the time of paint ON/OFF	Second	1.0	9.9	0.0	
45.	di/dt with paint ON/OFF: Slowdown rate	Times	3.0	9.9	1.0	
46.	WAOCL with paint ON/OFF: Dead time	Second	1.0	9.9	0.0	
47.	Slowdown start time with paint ON/OFF	Second	0.3	9.9	0.0	
48.	Paint slowdown timing		2	3	1	
49.	Soft start timer	Second	1.0	9.9	0.1	
50.	Error level selection (0: No output, 1: A-contact output, 2: B-contact output)		0	2	0	
51.	Voltage transmission fault: Permissible deviation	V	1.0	5.0	1.0	
52.	Fixed current setting (memory-specific)	µA	100	200	30	

13.3.3 Setting the Upper limit for current transmission faults

The maximum transmitted current, Ih', corresponding to the preset voltage is calculated proportionately using "Current transmission fault: Upper limit" and "Current transmission fault: Correction value" on the current transmission fault detailed setting page.

The rate at 0 kV shall be defined using the maximum transmitted current and correction value as shown below:

Correction value	[%]	
1	100 (1)	
2	50 (1/2)	
3	33 (1/3)	
4	25 (1/4)	
5	20 (1/5)	
6	16 (1/6)	← Default
7	14 (1/7)	
8	12 (1/8)	
9	11 (1/9)	
10	10 (1/10)	



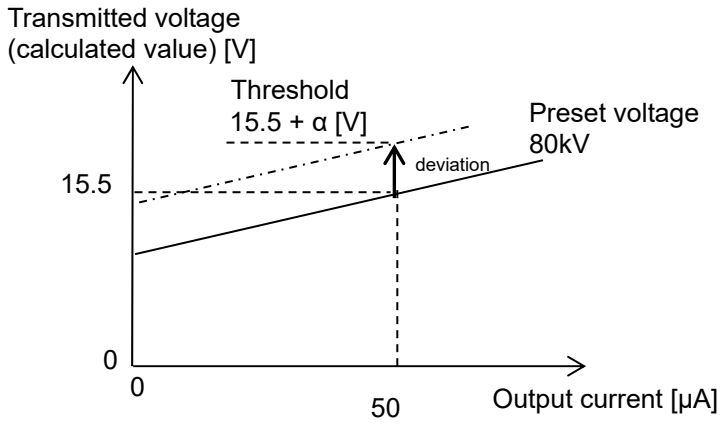
* With the default correction value, the maximum transmitted current, 1h', is 1.43 [A] at the preset voltage of 30 kV.

13.3.4 Setting the permissible deviation for voltage transmission faults

The voltage transmission fault detection threshold is calculated from the preset voltage, output current and permissible deviation.

Deviation α (1.0 to 5.0 V)

* The default value is 1.0 V.

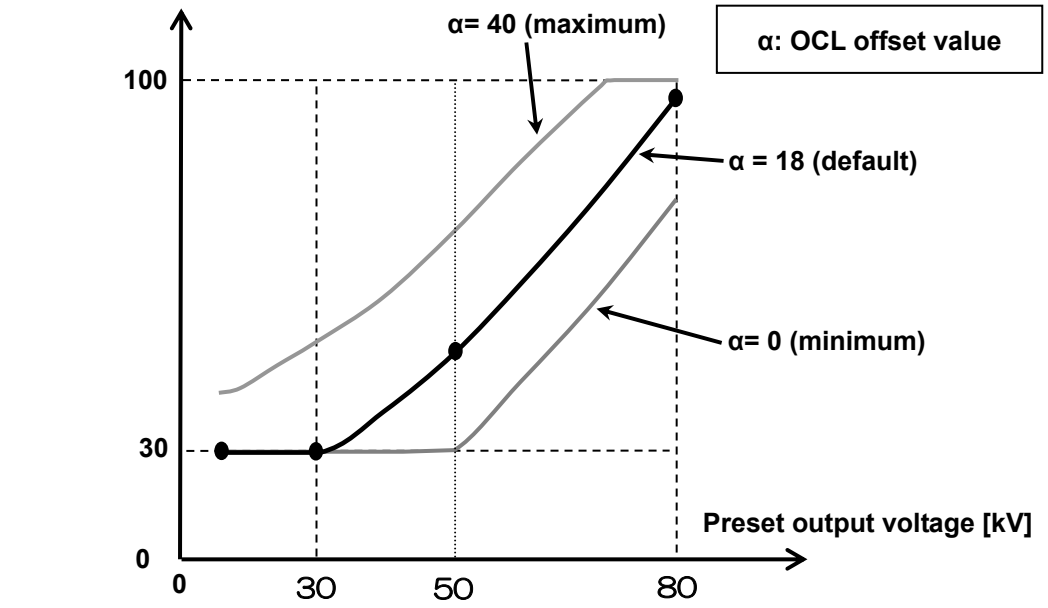


13.3.5 Automatically setting the OCL detection threshold

The OCL detection threshold is determined from the preset output voltage and OCL offset value for the in-use memory No.

The OCL detection threshold is calculated and specified in the following cases:

The preset output voltage is changed.	• Main monitor page • Memory-specific setting page (for the in-use memory No.)
The in-use memory No. is changed.	• Main monitor page • Change by external memory selection
The OCL offset value is changed.	• OCL setting page 2
BPS300 is initialized.	• Password page
Upon the power-up (start-up)	-



The OCL detection threshold shall be specified between 30 and 100 µA. If the calculated value is higher or lower than this range, it is regarded as 100 µA or 30 µA respectively.

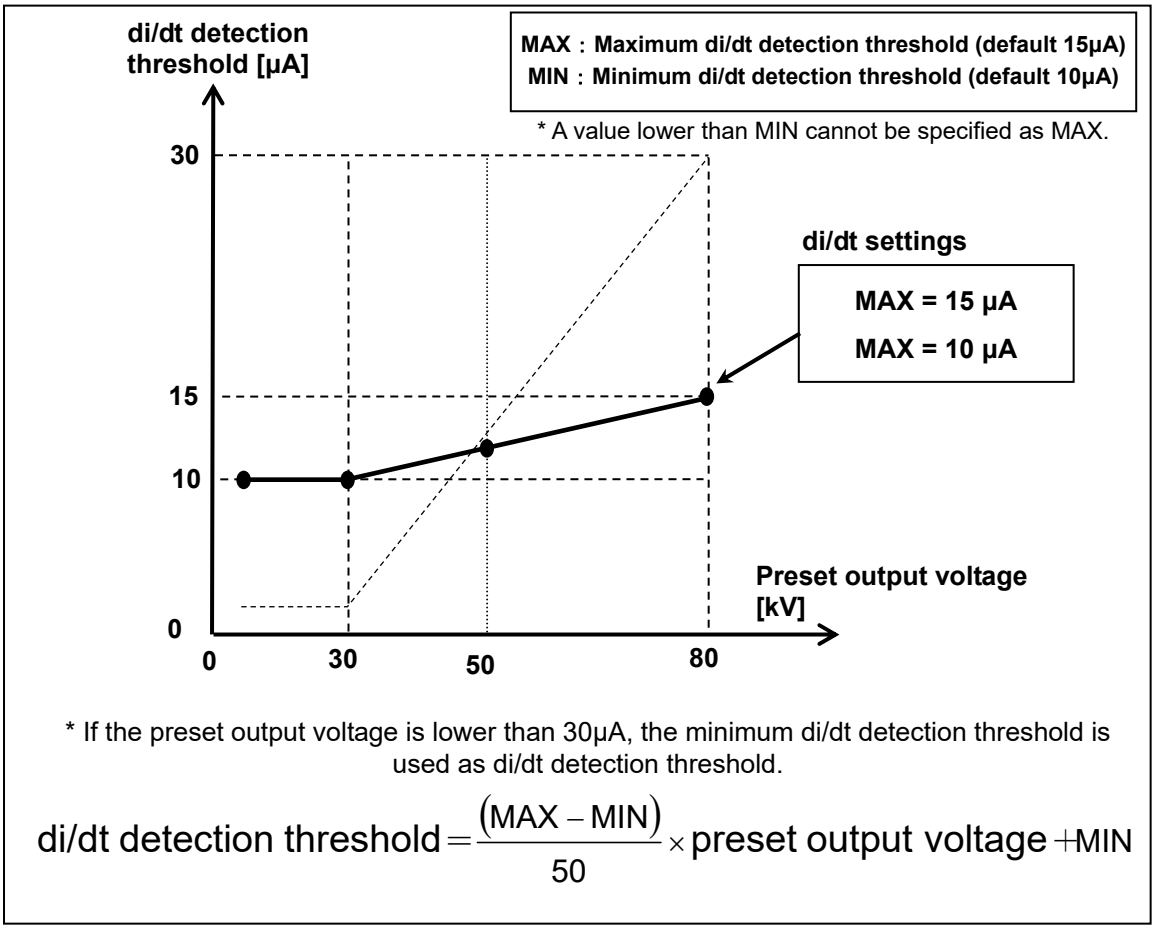
OCL detection threshold = 0.012 x (preset output voltage)2 + offset valueα

13.3.6 Automatically setting the di/dt fault detection threshold

The di/dt fault detection threshold is determined from the preset output voltage and maximum and minimum di/dt detection thresholds for the in-use memory No.

The di/dt detection threshold is calculated and specified in the following cases:

The preset output voltage is changed.	• Main monitor page • Memory-specific setting page (for the in-use memory No.)
The in-use memory No. is changed.	• Main monitor page • Change by external memory selection
The maximum di/dt detection threshold is changed.	• di/dt setting page 3
The minimum di/dt detection threshold is changed.	
BPS300 is initialized.	• Password page
Upon the power-up (start-up)	-



* If the preset output voltage is lower than 30μA, the minimum di/dt detection threshold is used as di/dt detection threshold.

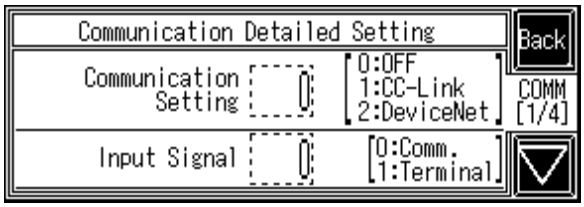
$$\text{di/dt detection threshold} = \frac{(\text{MAX} - \text{MIN})}{50} \times \text{preset output voltage} + \text{MIN}$$

13.3.7 Communication setting & communication fault detection settings

When the communication is enabled, the communication fault detection is also enabled.

○ Communication setting

1. Press “Communication setting” on the detailed setting selection page M1.
   -> The detailed communication setting page opens.
2. Change the values on the detailed communication setting page.

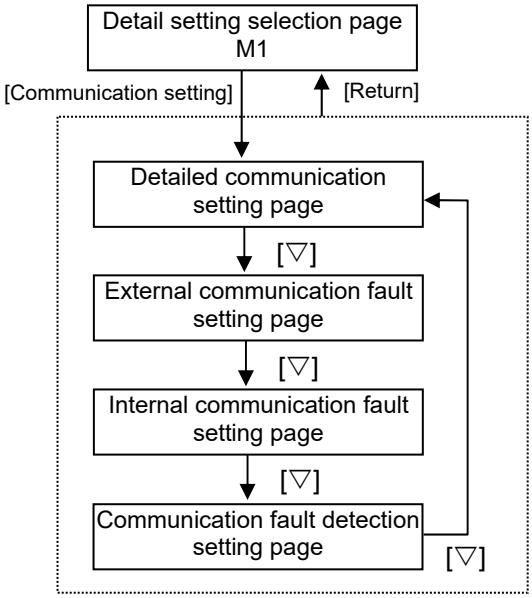


Communication setting	Detailed Communication Settings			communication fault detection
	Communication on/off setting	Input signal	Precondition	
Enabled	1- 2: Unused	0: Communication (default)	AND	Enabled
Disabled	0: Off (default)	1: Terminal block	OR	Disabled

* The communication is disabled at the time of delivery from factory or initialization.

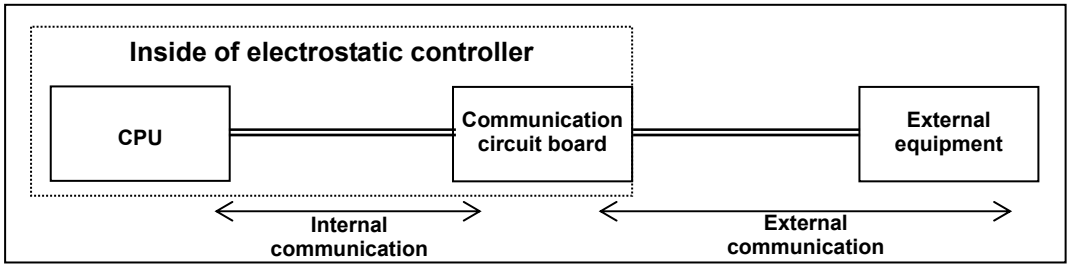
○ Communication fault detection settings

1. Press “Communication setting” on the detailed setting selection page M1.
   -> The detailed communication setting page opens.
2. Press “▽” to proceed to the next page.
   -> Proceed to the pages for communication fault detection settings.
3. Change values on each page.



○ Classification of communication faults

Causes of communication faults are external or internal to the controller. (See 6.4.2, (2).)



Fault type	Cause
Internal communication faults	1. Poor connection between CPU and communication circuit board (cut wires in connecting cables, disconnected cables, etc.)
External communication faults	1. Poor connection between external equipment and communication circuit board (cut wires in connecting cables, disconnected cables, etc.) 2. Faulty communication circuit board 3. Faulty external equipment or system

14 Repair Record

It is strongly recommended to record details in the following table when any part is replaced or the machine is overhauled, cleaned, failed or repaired. This will help maintain the product afterwards.

Machine name			Electrostatic controller (BPS300)		Purchased on xx xx, 20xx	
Repair date			Part repaired	Description	Result	Repaired by
						In-house / Agency / Asahi Sunac
						In-house / Agency / Asahi Sunac
						In-house / Agency / Asahi Sunac
						In-house / Agency / Asahi Sunac
						In-house / Agency / Asahi Sunac

Note: The controller shape and specifications may be changed without notice to reflect improvements, etc.

15 Revision Record

Edition	Date	Content of revision	Program version
1st	August 29, 2011	–	Ver 1.00
2nd	May 29, 2012	Modified the program (changed default values and maximum and minimum limits for parameters)	Ver 1.01
3rd	July 12, 2013	Modified the program (changed default values and maximum and minimum limits for parameters)	Ver 1.05
4th	October 27, 2014	Serial gateway abolition	Ver 1.05
5th	October 30, 2015	Postscript	Ver 1.05
6th	August 26, 2020	Change of sentence	Ver 1.05
7th	August 23, 2022	Warranty revision	Ver 1.05

16 Warranty

ASAHI SUNAC CORPORATION (the “Company”) shall provide the original purchaser (the “Purchaser”) with warranty service for a period of one (1) year from the date of purchase of the product, as follows:

- Should you find defects in design or workmanship with regard to parts, ship them back to the Company, with freight prepaid. The Company shall repair or replace the parts free of charge and reimburse the freight charges, provided that, as a result of an inspection and investigation of the parts conducted by the Company, the defects are deemed to be to attributable to the factors within the Company’s responsibility.

- In the following cases, free after-sales service is not provided.

  1. Failure resulting from an inappropriate method of installing this equipment.
  2. Failure resulting from a use method not conforming to this instruction manual or mishandling.
  3. Failure resulting from insufficient maintenance management of this equipment and incorrect handling such as non-conformance to the procedures specified in this instruction manual.
  4. Failure resulting from unauthorized alteration or structure change of this equipment without the Company’s consent.
  5. Failure due to force majeure such as earthquake, disaster, flood disaster or lightening.
  6. Warranty for consumables worn or deteriorated even in the case where this equipment is used correctly.
  7. Repair after the machine has been used outside Japan, and shipping cost.
  8. In addition to the above, failure due to circumstances beyond our control.

- As for items such as parts purchased by the Company from another manufacturer, the warranty of that manufacturer shall apply.

- As for any parts deemed to be defective, the Company shall not be held liable for any expenses beyond the provision of repair or replacement parts free of charge.

- The Company shall not be held liable for any damage to the Purchaser caused by factors not attributable to the Company, such as misuse of product, etc.

- When a transfer of title of this equipment takes place, please see to it that the Operation and Maintenance Manual will be handed over to the new owner.
- This equipment is manufactured in compliance with the Laws and Regulations of Japan.
  In the rare eventuality of this equipment being used outside Japan, compliance with the safety standards of the relevant countries is of course mandatory.

7th Edition, August 23, 2022

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