ASAHI SUNAC

Operation and Maintenance Manual

Electrostatic Controller

TPS200

(Ver. 1. 02)

Ec'Coater™ エコーター

This manual contains important information on warnings and cautions.
Read the manual thoroughly before starting to operate the equipment, and follow the instructions.
Always keep the manual handy until such time as the product is no longer being used. If your manual is lost or worn badly, do not hesitate to contact our agency which is closest to you, or Asahi Sunac Corporation directly, and ask us to send you a new one.

5th Edition: November 9, 2023

Introduction

Thank you very much for choosing our Rotation controller (TPS200).

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 call any of our branches listed on the back cover by specifying the “model” and “serial No.” of your equipment.

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1 For Your Safety

Contents of this instruction manual shall be fully understood and the instructions shown herein shall be strictly observed. Using the machine 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 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.

Please refer to individual instruction manuals for the electrostatic gun and coating machine connected to this equipment.

⚠ WARNING

Suitable range of use of the product

The product covered by this instruction manual is a controller specially designed to supply a high-frequency power to the hand-held electrostatic gun contained in the specifications and to control high-voltage charges on the gun.

The product is not explosion-proof. It is not applicable in explosion-proof areas.

For further information on the purpose of the product and the materials used, please consult us.

Please well note that any use under conditions other than specified above is considered misuse unless specially approved by us as it may lead to an unexpected accident.

Danger of the misuse

《General safety notes》

- ●Thoroughly check the supply voltage before use. Applying a voltage other than selected may lead to a failure and/or fire. For how to switch the voltage between 100-240VAC, see the installation manual.
- ●Make sure to earth properly as this control device handles high voltage. Failure to do so may result in failure, electric shock, injury, or fire. Make sure to earth the grounding terminal (class A grounding). Ensure that terminal block screws are tightened and the connector is installed.
- ●Do not rearrange wiring during energization.
- ●The control device is not explosion-proof and is not applicable in explosion-proof areas.
- ●This control device is not waterproof, so do not pour water into it. Do not use it outdoors.
- ●Avoid using in high temperature, high humidity, or frequently vibrated areas.
- ●Stop operation as soon as a failure is detected. Turn off the power and confirm electric discharge. Then, short-circuit ground the charging terminal.
  Do not turn on the power again if the protection device or fuse is activated.
- ●The cooling fan on the back heatsink rotates while the power is on. Do not operate the machine when the cooling fan is stopped. Also, do not touch the heat sink or cooling fan, as the heat sink becomes hot. Touching it may cause burns or injury.

2 Outline

The unit controls the high-voltage charge by supplying power to the static electricity generator (cascade) in Sun Bell or Sun Bell Eco. It has a microcomputer and provides multifunctional controls.
The main body has a panel, and controls a cascade. The operation condition can be checked on the front controller panel. Operation switches are also placed on the panel for easy and secure operation and monitoring.

(1) Features

(1) The cascade is built in the coating machine. Because the high-voltage cable is not used, the operation safety is high.

(2) The high-voltage output control has “constant voltage output characteristics” to keep the output voltage constant even if the high voltage current varies (increases/decreases).

(3) Three high-voltage level setting are available. The high-voltage value can be changed depending on the section to be coated.

(4) The safe sensitivity for failure detection can be set for each high-voltage set value to ensure high safety.

(5) The following safety functions for electrostatic coating machine control are provided.

1) Failure detection of high-voltage current
   - Detection of absolute value of high-voltage current (OCR):
     The absolute value of the high-voltage output current is monitored.
   - Detection of changed amount of high-voltage current (di/dt):
     The amount of increase of the high-voltage output current is monitored over time.

2) Failure detection of high-voltage level
   - Detection of overvoltage (OV):
     The amount of increase from the high-voltage output voltage set value is monitored.
   - Detection of undervoltage (UV):
     The amount of decrease from the high-voltage output voltage is monitored.

3) Failure current detection of transformer
   - Detection of over-current of transformer: The current that is supplied to the transformer is monitored.

4) Failure detection of transmission cable
   - Detection of cable failure: Occurrence of transmission cable breakage and short-circuit are monitored.

Concerning 1), the alarm detection value in addition to the failure detection set value can be set.

(6) The maintainability is improved by various monitors, alarms, and error log displays.

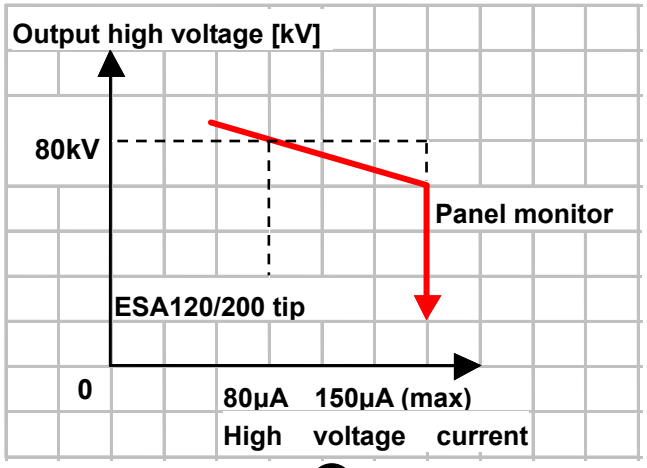
(7) Compatibility with external control is provided by voltage, current, and various external display outputs.

3 Specification

(1) Product name : Electrostatic coating control device
(2) Model : TPS200
(3) External
  1) Structure : Panel mount type
  2) Dimension : 300 (W) x 120 (H) x 207.8 (L)
  3) Weight : 3.6 kg
(4) High-voltage output (Cascade output)
  1) Connection electrostatic gun : ESA120, ESA200
  2) High voltage : -30 kV ~ -80 kV
  3) High-voltage current : 8 μA ~ 150 μA
  4) Number of output : 1 (One control device controls one cascade.)
  5) High-voltage setting : 3 levels (H(1), M(2), L(3))
  6) Transmission cable length : 20 m standard
  7) Condition of parallel mounting : If multiple cascades are mounted in parallel, the high-voltage application sections must be apart by 200 mm or more with one another, and the difference in the set high-voltage level between coating machines must be within ±2 kV.
(5) Power input
  1) Voltage : 100 Vac ~ 240 Vac (100Vac±10% ~ 240 Vac±10%)
  2) Capacity : 120 VA
  3) Frequency : 50 ~ 60 Hz
  4) Grounding wire : Type A grounding
(6) Input signal (Contact capacity: 12 Vdc/ 5mA)
  1) High-voltage remote ON: Contact signal to turn ON or OFF external high-voltage
  2) High-voltage level change: Contact signal (binary code) for switching the high-voltage level H(1), M(2), and L(3)
  3) Paint ON/OFF: Timing signal to lower the safety sensitivity when the paint ON/OFF current changes
  4) Error reset: Contact signal for resetting the error signal
  5) Preparation for operation: Signal for enabling high-voltage ON
(7) Output signal (Max. contact capacity: 120 Vac/ 24Vdc, 0.1A)
  1) High-voltage ON : The contact signal is “closed” when high-voltage is ON. It is “open” when high-voltage is OFF.
  2) Error OL operation 1 : The contact output is “open” when error OL functions. It is normally “closed”.
  3) Error OL operation 2 : The transistor output is “open” when error OL functions. It is normally “closed”.
(8) Communication I/O (for universal local network: One of the following systems)
  1) CC-Link : For optional board
  2) D-net : For optional board
(9) Operating condition
  1) Ambient temperature : 0 ~ 40°C
  2) Humidity : 20 ~ 85% RH, no dewing
  3) Atmosphere : Mounted outside of the indoor coating booth
    Do not expose to direct sunlight.
    Free from corrosive gas, flammable gas, oil mist, or dust
    Free from water drops or steam
(10) Output characteristics

[Output characteristic chart]

◇ Cascade for ESA120/ESA200



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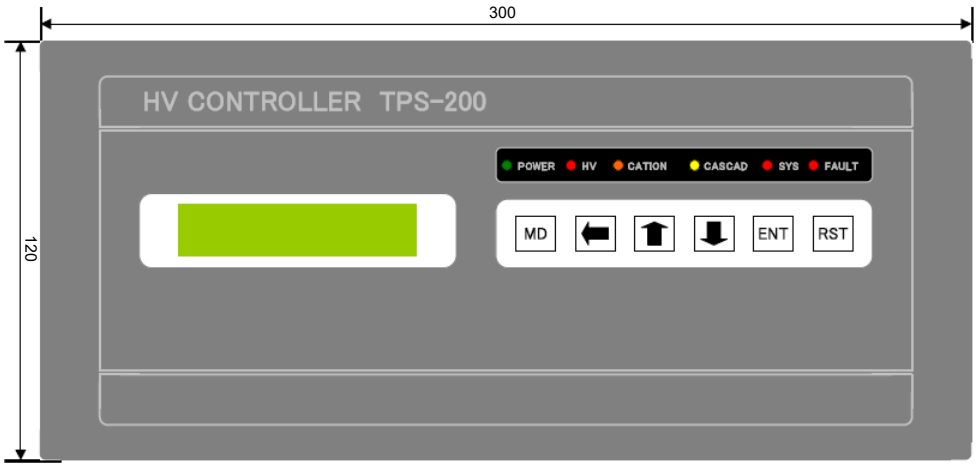
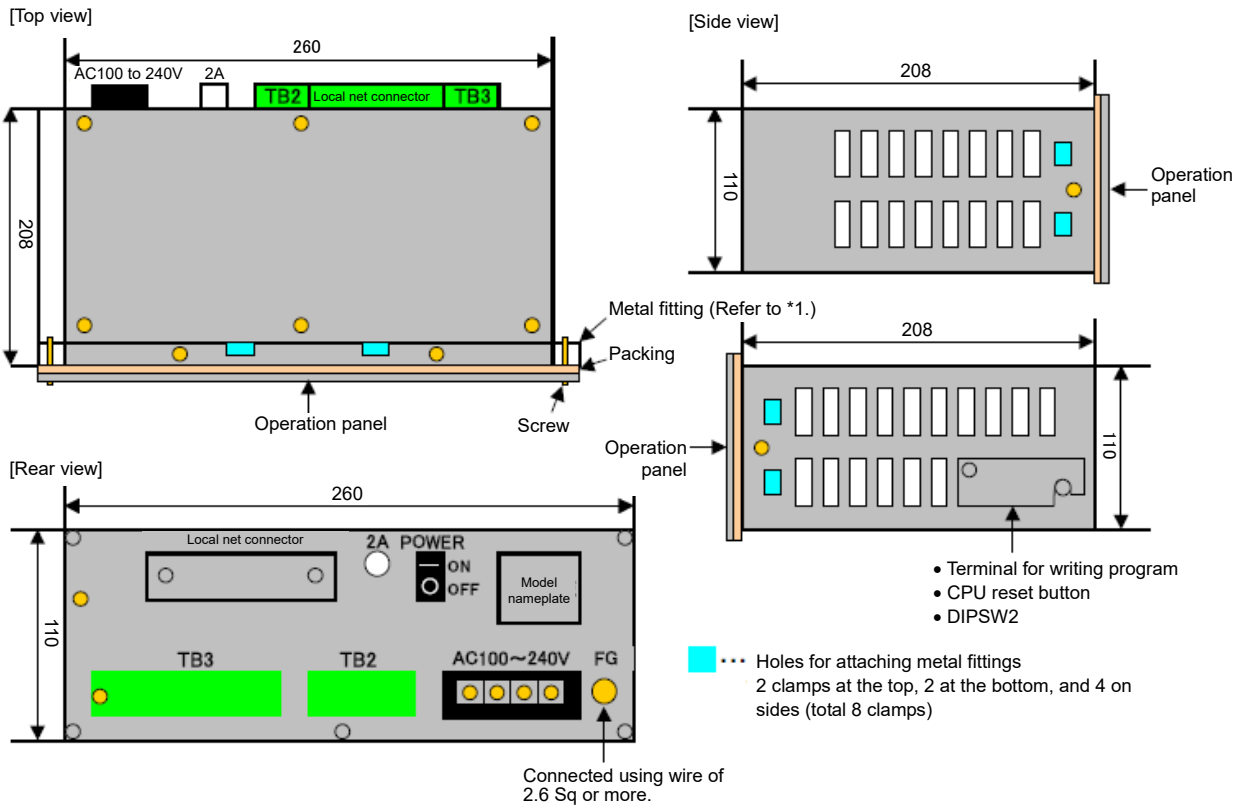
4 Output Characteristic Chart

(1) Main body





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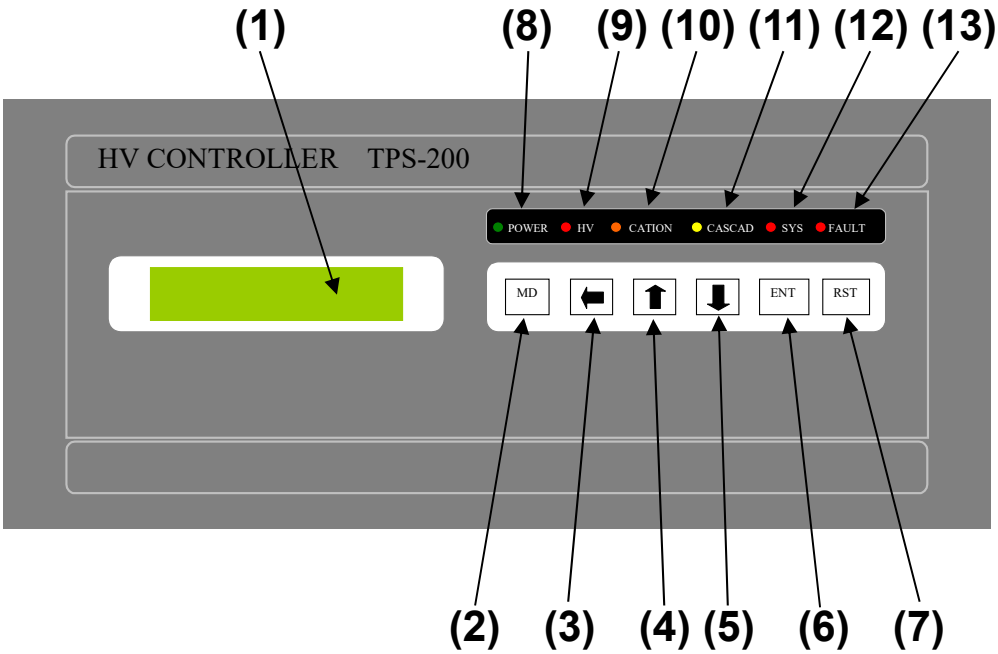
5 Names and Functions of Each Part

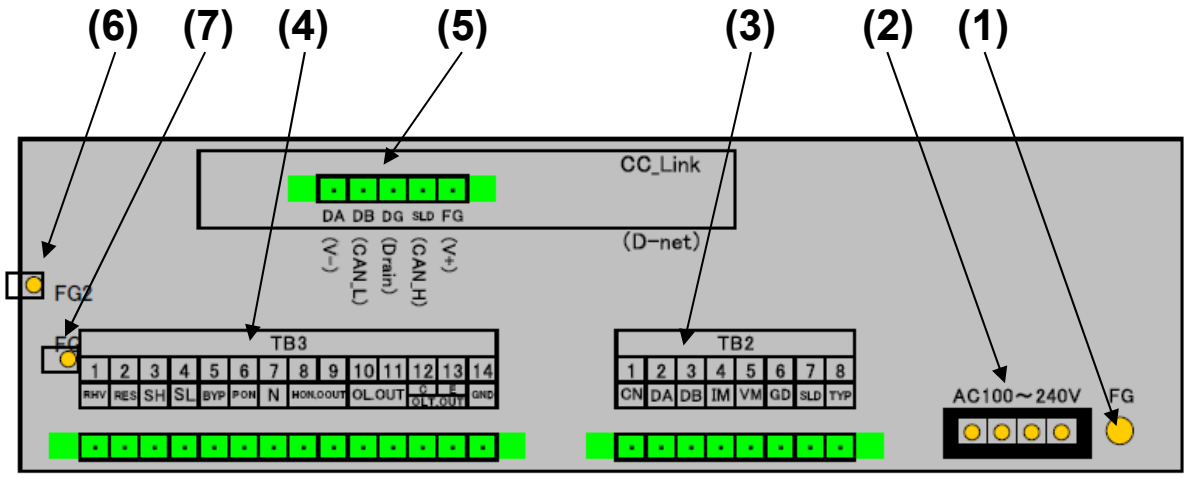
(1) Front side



Item		Usage
(1)	(Display)	High-voltage value and high-current value are displayed on the normal screen.
(2) MD	(Mode)	The classified function mode is set.
(3) ←	(Left)	Used to move the data digit and mode No. On the normal screen, the check menu screen is displayed if this button is pressed.
(4) ↑	(Up)	Used to change (forward, add) the data or mode
(5) ↓	(Down)	Used to change (backward, subtraction) the data or mode
(6) ENT	(Entry)	The setting change mode is set.
(7) RST	(Reset)	Errors are reset.
(8) POWER	(Green)	Status display: Lighted when Power is ON.
(9) HV	(Red)	Status display: Lighted when high-voltage is ON (during operation)
(10) CATION	(Orange)	Status display: Lighted when the current exceeds the alarm set value.
(11) CASCAD	(Yellow)	Error display: Lighted when the cascade error occurs.
(12) SYS	(Red)	Error display: Lighted when the system error occurs.
(13) FAULT	(Red)	Error display: Lighted when the absolute sensitivity error occurs.

	MODENo.	Outline
High-voltage setting	H01～H03	High-voltage value is set for each level.
Safety sensitivity	S01～S14	Sensitivity for high-voltage current and high-voltage error detection
Maintenance	M01～M06	Password setting, log clearance, frequency adjustment, etc.
Password	P01	Password check
Check menu	C01-1～C04	Safety sensitivity, time setting, log display, etc. for specified high-voltage
Initial setting	I01～I02	Initialization, change of cascade mode (for maker)

(2) Rear side



Item	Usage
(1) FG (Grounding)	For grounding of main body
(2) Power terminal block	The power source is connected. Power source: 100 Vac ~ 240Vac ± 10%, 50/60 Hz (Capacity 120 VA)
(3) TB2 Cascade terminal block	The connection cable for power transmission to the cascade in the coating machine is connected. Recommended cable model: AIO.34-8TQ (PHENIX) Product No. 32 00 86 5
(4) TB3 I/O terminal block	Various I/O connection cables are connected. Recommended cable model: AIO.25-12BU (PHENIX) Product No. 32 00 63 2
(5) CC-link (D-net)	The optional communication cable is connected. CC-link: Twist cable with shield conforming to EIA standard RS485 D-net: 5-wire cable exclusive for D-net
(6) FG2 (Grounding)	Earth plug for cable shield
(7) FG3 (Grounding)	Earth plug for cable shield

(1) Outline of TB2

No.	Symbol	Terminal symbol	Outline
(1)	CN	2, 3	DC voltage required for high-voltage output
(2)	DA, DB		Power switching phase with different phase by 180°
(3)	IM, VM	4, 5	Current IM and voltage VM for feedback control
(4)	GD	6	Cascade reference potential
(5)	SLD	7	Shield
(6)	TYP	8	Type resistance measurement value

(2) Outline of TB3

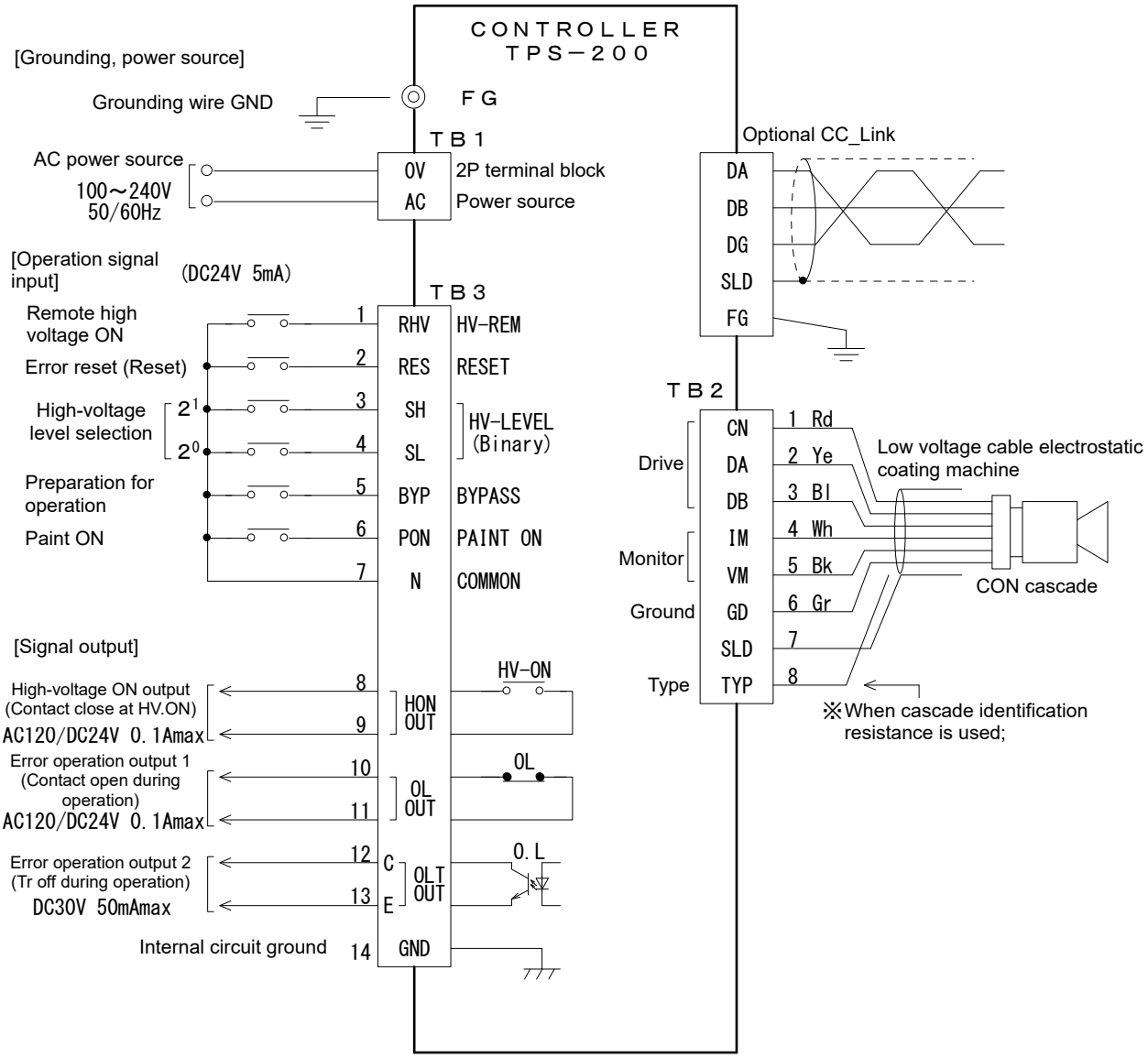
No.	Symbol	Terminal symbol	Outline
(1)	RHV	1	Remote high-voltage ON
(2)	RES	2	Error reset (Reset)
(3)	SH、SL	3、4	High-voltage level selection
(4)	BYP	5	Preparation for operation
(5)	PON	6	Paint ON
(6)	N	7	Common
(7)	HON.OUT	8, 9	High-voltage ON output
(8)	OL.OUT	10, 11	Error operation output 1
(9)	OLT.OUT	12, 13	Error operation output 2
(10)	GND	14	Internal circuit ground

(3) Outline of CC-Link

No.	Symbol	Outline
(1)	DA	Differential signal A (Non-reverse: DA)
(2)	DB	Differential signal B (Reverse: DB)
(3)	DG	Signal ground
(4)	SLD	Shield
(5)	FG	Frame ground

(4) Outline of D-net

No.	Symbol	Outline
(1)	V-	Communication power cable; – side
(2)	CAN_L	Communication data; low side
(3)	Drain	Shield
(4)	CAN_H	Communication data; high side
(5)	V+	Communication power cable; + side



NOTE

(1) Input power source : 100Vac ~ 240 Vac, 50/60 Hz, power capacity 120 VA

(2) Grounding wire : Connect the controller earth with the booth conveyor of the reference potential of the electrostatic coating at the minimum distance using wire of 2.0 sq or more.

(3) Interlock : Use a noise suppressor for the external device for signal communication.

(4) Measures for failures : The external “remote high-voltage ON” signal must be set to OFF when any error, etc. occurs. The error output remains until the error is reset.

(5) High-voltage level : The high-voltage level must be changed when the high-voltage setting is OFF.

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6 Installation

(1) Place of installation of controller

1) The controller has the non-explosion-proof construction. It must be installed outside of the coating booth.
2) The ambient temperature shall be 0 ~ 40 °C, and the humidity shall be 30 ~ 85% RH. (No dewing range)
3) The controller must be installed at the place free from the paint mist, vapor solvent, water, water vapor, or corrosive gas.
4) The installation place must not vibrate.
5) Set the cascade mode depending on the coating machine used.

⚠ WARNING

If the cascade setting is not proper, there is a danger that the coating machine burns.

(2) Controller I/O cable

1) Refer to the connection example on page 9 for the external wiring of input and output.
2) There are connection terminals on the back of the controller. The wires except for the power source and grounding wire are connected to the terminal block.
3) Select the wire diameter, considering the power capacity and machine strength.

(3) Power source

1) Voltage: Single phase 100Vac ~ 240 Vac (100V±10% ~ 240V±10%), Frequency: 50 ~ 60 Hz,
   Capacity: 120VA
2) Connect the grounding wire to “E” terminal for ground backup.
3) If the power wire is long, select the wire thickness, considering the voltage drop.
   (The wire thickness shall be 1.25mm^2 or more.)

(4) Grounding wire

1) Type A grounding is required for ground terminal GND.
2) Select the wire of 2.0 mm^2 thick or more.

⚠ WARNING

Connect the grounding wire correctly to prevent failures, electric shock, injury, and fire. The grounding wire is required to secure the reference zero potential of the electrostatic coating. If no grounding wire is connected, errors, controller functional damages, or unpredictable failure phenomena might occur.

(5) Operation signal input

1) The input signal must be equivalent to the dry contact signal or open collector signal that can drive the device of 15Vdc/5mA specification.
2) Connect the contact or open collector (“N” emitter) with the input common “N”.
3) “Close” of the open collector means “Turn ON”.
4) The wire thickness must be 0.5 mm^2 or more.
5) Signals
   i) High-voltage remote ON : RHV ~ N; High-voltage ON at “close”
   ii) High-voltage level selection : SH, SL ~ N; Binary code 1=H(1), 2=M(2), 3=L(3)
   iii) Paint ON : PON ~ N; Paint ON at “close”
   iv) Error reset : RES ~ N; Error reset at “close”
   v) Preparation for operation : BYP ~ N; High-voltage ON possible at “close”

(6) Signal output

1) The signal output from the controller consists of the contact outputs. The max. contact capacity is 120Vac/0.1A or 24Vdc/0.1A.
2) The analog monitor current is DC4 ~ 20mA. The high voltage and high-voltage current is supplied to the external monitor.
3) The wire thickness must be 0.5 mm^2 or more.
4) Signals
   i) High-voltage ON (A contact) : HON OUT; Output contact is “close” during operation.
   ii) Error OL operation 1 (B contact) : OL OUT; Output contact is “open” when error OL functions.
   iii) Error OL operation 2 (Always ON at transistor output) : OLT OUT C-E; OFF when error OL functions.

(7) Cascade drive output

1) The output/monitor drives the cascade in the electrostatic coating machine through the exclusive low-voltage cables (twist, 3-pairs, shield cable).
2) Only the specified cable can be used.
3) Details
   i) Drive line : CN; Supply of DC voltage required for high-voltage output
   DA, DB; Supply of power switching phase
   ii) Monitor line : IM, VM; Current and voltage of feedback control phase
   iii) Reference zero potential and protection shield : GD, SLD; Cascade reference zero potential and shield potential

(8) Connection of low-voltage cable

1) Install the electrostatic coating machine. Connect the connector at the back of the coating machine, connector at the end of the low-voltage cable, and relay connector of the low-voltage cable. Connect the cable lead wire to the terminal block at the back of the controller.

(9) Check of wire connection

1) Check wire connection, referring to the connection diagram.
2) Check the following points:
   i) Grounding wire ii) Power input (including grounding wire) iii) Drive signal input
   iv) Signal output v) Cascade drive output

(10) Grounding wire

(1) The grounding wire is especially important to secure the reference zero potential of the electrostatic coating. Check if the conveyor and the booth of the reference zero potential is connected at the minimum distance with “GND” terminal properly.
(2) Check if the grounding wire is connected to “E” terminal of the power input as backup.

⚠ WARNING

Check that only the specified voltage is applied to external cables.

If unspecified voltage is applied, there is a fear of damages or burnout.

7 Trial Operation

⚠ CAUTION

The operation method using the default value at shipment is explained.

(1) Safety check of high-voltage operation

1) Before starting the high-voltage operation, confirm that the area (at least 3 meters) of the electrostatic coating machine in the booth is safe even if high-voltage is applied.

(2) Check of power source, I/O signal, and cascade drive output

1) Turn ON the power switch.
   - i) Display on the panel : Immediately after the power switch is set to ON, the model "TPS-200" is displayed at the upper left of LCD (liquid crystal display), and the version and date are displayed at the bottom. After approx. 3 seconds, the cascade name is displayed at the lower left of LCD screen, and the high-voltage value and high-current value are displayed at the bottom.
   - ii) Power source : POWER lamp is lighted.
2) Check of operation input signal
   - i) High-voltage level display : Check that "H1, H2, H3" is displayed on LCD screen by signal operation of SH or SL.
   - ii) Paint ON : "P" is displayed on LCD screen by paint ON signal input.
3) Check the cascade drive output in "Frequency adjustment" in the section below.

(3) Frequency adjustment

1) Oscillation frequency must be adjusted for matching of the optimum frequency of the controller and coating machine (built-in cascade). Consequently, the frequency is adjusted when the controller or coating machine (including the cascade unit) are exchanged or newly installed. Adjustment is not required before starting the regular operation.

⚠ WARNING

Automatic frequency adjustment must be executed before the first operation after installation and before the first operation after exchange of the controller or coating machine; otherwise, the coating machine (cascade) longevity is affected.

2) Operation before frequency adjustment
   - i) The high-voltage level (External or internal) is selected in HV3 state.
   - ii) Check that the area around the coating machine is safe even if high-voltage is applied.
3) Operation of automatic frequency adjustment and transition to frequency adjustment mode
   - i) Check the password.
   - ii) Press [ENT] when the cursor is placed on "mai" (maintenance) on the main menu screen to transit to the maintenance mode.
   - iii) Press [←] four times. Place the cursor on "FRQ".
   - iv) Press [ENT]. Check that the frequency setting screen is displayed.
   - v) Check that the cursor is placed on "aut". Press [ENT] to start the automatic frequency adjustment.
4) Remarks on frequency adjustment
   - i) The frequency adjustment can be executed only during high-voltage operation. If high-voltage is OFF when executing the adjustment, data error "ERR2" is displayed and the buzzer sounds.
   - ii) The frequency can also be adjusted during coating with high-voltage applied.

(4) Preparation for high-voltage operation

1) Check of safety	:	Before starting high-voltage operation, check that the area around the electrostatic coating machine is safe even if high-voltage is applied. Check the distance from the coating machine. If there is an object that can be charged within the electric field of 3 meters from the coating machine, it must be connected to the grounding wire for grounding.
2) Check of combination between controller and coating machine	:	Check the combination between the controller and cascade. If the combination is not proper, the cascade might be damaged.
3) Check of frequency adjustment	:	Check that the automatic frequency adjustment is executed.
4) Check of distance between coating machines	:	If multiple coating machines are used, the distance between the high-voltage application sections must be 200 mm or more. Check that the difference between the high-voltage levels of multiple coating machines is within ±2 kV.
5) Check of high-voltage setting	:	Check that the high-voltage level and high-voltage level set values for high voltage operation are as specified.
6) Check of safety sensitivity	:	Check that the safety sensitivity set values in the mode list are below the initial values in the list. The initial value of the safety sensitivity is very low for the high-voltage operation of the coating machine. Unless there are any special reasons, operation can be started at the initial value or lower level.

⚠ WARNING

Do not lower the absolute value sensitivity and changed value sensitivity due to the reason such as frequent detection of OCR error or di/dt error; otherwise, there is a fear of fire.

(5) High-voltage operation

(1) Turn ON and OFF the high-voltage, and continue the operation to check that no errors occur. If any error is indicated even if there are no errors including contaminations in and outside of the coating machine, contaminations on the insulation supporting members, dewing, and abnormal closeness of the grounded material, change the safety sensitivity or timer to the optimum value depending on the error type.

"Example 1" The error of the changed value di/dt occurs at high-voltage ON instant

Lower the sensitivity of the changed amount of S08-2 high-voltage ON instant, or increase the reduction time (HONT) of S08-1 high-voltage ON instant.

"Example 2" The error of the changed value di/dt occurs during operation

Check that the coating machine is not abnormally close to the coated material, floor (duckboard, etc.), drive machine, etc. If there are charged objects that are not grounded near the coating machine, di/dt error might occur due to the charge and discharge of the materials.

"Example 3" Absolute value OCR error occurs during operation

If there are no errors including abnormal closeness with the coated materials, high humidity that almost causes dewing, or humidity or air or paint, lower S01 absolute value sensitivity.

"Example 4" The error occurs at the paint ON/OFF position

Check the electric signal of the paint ON/OFF solenoid valve and the paint discharge timing from the coating machine tip. Change sensitivity S09 and S13.

(2) Alarm of absolute value sensitivity and changed amount sensitivity "Caution"

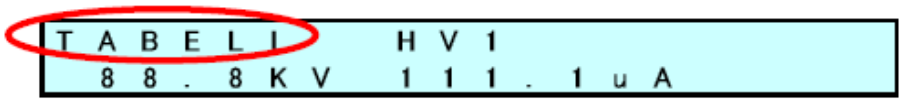
1) The alarm monitor "Caution" can be used to investigate the allowance of the absolute value OCR sensitivity with respect to errors. If CAUTION on the panel is lighted or "W1" is displayed on LCD screen, it can be determined that the degree of high-voltage current reached with respect to the absolute value sensitivity in the current alarm percentage. For example, if the absolute value sensitivity is 130 μA and alarm percentage is 80%, it is regarded that the high-voltage current reached to 104 μA. The sensitivity allowance can be investigated by changing the alarm % set value and investigating the percentage of high-voltage current.
2) The allowance of di/dt sensitivity can be investigated by the same operation. The di/dt sensitivity alarm is displayed as "W2" on the LCD screen.
3) Check that the area around the coating machine is safe even if high-voltage is applied.

(3) Restricted items on safety sensitivity setting

1) The safety sensitivity setting can be changed within the setting range of the mode list. If a value outside of the range is attempted to be set, buzzer sounds and the value change is not accepted.
2) If H value (-90kV) and L value (-30kV) are set, H must be equal to or larger than L. If H is smaller than L, error occurs and the value is not accepted (except for low-current CIH/L).

(4) Remarks on operation

1) The controller is not explosion-proof. Install the controller at the area where paint mist or steam is not applied from the coating booth. Check that the combination of the coating machine and controller is proper on LCD screen.



LCD screen display model	Bell gun model
TAR80	ESA120, ESA200
TABELL	Unused
TKGUN	Unused

⚠ CAUTION

Set the cascade according to the coating machine used.

2) The controller grounding wire is the reference zero potential of the electrostatic coating machine. Connect the grounding wire at the minimum distance from the coating booth and the conveyor. If the reference zero potential is not secured, unexpected abnormal phenomena including errors and controller failures might occur. (Use the wire of 2.6 sq or more: Equivalent to type A)
3) Automatic frequency adjustment must be executed to obtain the optimum frequency matching when the controller or the coating machine (including the cascade unit) is exchanged or newly installed.
4) If the coating condition, coating materials, or ambient conditions are changed, review of the safety sensitivity setting may be needed.
5) When the safety sensitivity is changed or the counter data is cleared, it is recommended to control the setting with the person in charge. If the safety sensitivity setting is not proper, accidents might occur. Set and control the data very carefully.

8 Operation Method

(1) Mode change

1) Regular monitoring mode

Cascade name (ex: TAR 80)	
High voltage [kV] (ex: 60 kV)	High-voltage current [μA] (ex: 0.0 μA)

High-voltage ON

Cascade name (ex: TAR 80)	High-voltage level (ex: 60 HV1)
High voltage [kV] (ex: 60 kV)	High-voltage current [μA] (ex: 0.0 μA)

2) Function mode

If [MD] switch is pressed, the main menu selection screen is displayed.
Press [←] switch to select the item. Use [ENT] switch to transit the screen.

	MODE No.	Outline
High-voltage setting	H01 ~ H03	High-voltage value is set for each level.
Safety sensitivity	S01 ~ S14	Sensitivity for high-voltage current and high-voltage error detection
Maintenance	M01 ~ M06	Password setting, log clearance, frequency adjustment, etc.
Password	P01	Password check
Check menu	C01-1 ~ C04	Safety sensitivity and time setting for setting high-voltage, log display, etc.
Initial setting	I01, I02	Initialization, change of cascade mode (exclusive for makers)

Refer to the mode list for the detailed contents of the mode.
The initialization mode cannot be used usually. Special operations are required.

3) Press [MD] switch on the main menu selection screen to return to the monitor mode.

(2) High-voltage setting mode

1) There are three high-voltage levels for setting and registration: H(1), M(2), and L(3)
2) Change of HV voltage set value (in the case of HV1 change)
   - i) Password : Input the password for passing.
   - ii) Transit to the main menu selection screen.
   - iii) Press [←]. : The cursor moves to “HV”.
   - iv) Press [ENT]. : HV voltage selection screen is displayed. (Check that # is displayed at the upper right of the LCD screen.)
   - v) Press [ENT]. : HV1 setting screen is displayed.
   - vi) Numeric setting : A number is selected by [↑] or [↓]. The digit is selected by [←]. Fix the data by pressing [ENT].

(3) Safety sensitivity setting mode

1) The safety sensitivity is mainly set in this mode. The setting must be changed very carefully. “H setting” in the mode list indicates the setting sensitivity at -90 kV. “L setting” indicates the setting sensitivity at -30 kV. The sensitivity at -90 kV is connected with the sensitivity at -30 kV by a straight line, and the safety sensitivity automatically follows the set high-voltage.
2) Safety sensitivity with set high-voltage following function
   - i) S01 OCH/L : Max. and min. values of absolute value sensitivity OCR
   - ii) S02 S-diH/L : Max. and min. values of S-di/dt
   - iii) S04 OVH/L : Max. and min. values of overvoltage sensitivity (Added value) OV
   - iv) S05 UVH/L : Max. and min. values of undervoltage sensitivity (Subtracted value) UV
   - v) S06 CIH/L/M : Max. value, absolute restriction current, min. value of constant electric amount CI

3) Sensitivity of set high-voltage not-following safety

i) S03-1	C-di/dt	: Sensitivity value and reduction current value of C-di/dt
ii) S07	TOL	: Over-current of pressure ascending transformer in cascade
iii) S08-1	HOND	: Absolute value sensitivity reduction amount at high-voltage ON instant
iv) S08-1	HONT	: High-voltage ON instant reduction time
v) S08-2	DOND	: Changed amount sensitivity reduction amount at high-voltage ON instant
vi) S09-1	POND	: Changed amount sensitivity reduction amount at paint ON/OFF
vii) S09-1	PONT	: Changed amount sensitivity reduction time at paint ON/OFF
viii) S09-2	POST	: Changed amount sensitivity reduction start time at paint ON/OFF
ix) S10	HCND	: Absolute value and changed amount sensitivity reduction amount at high voltage L → H instant
x) S10	HLHT	: Reduction time at high-voltage L → H change
xi) S11	CW	: Constant power set value
xii) S12	CTN	: High-voltage current absolute value error alarm OC-Caution %
xiii) S12	DIN	: High-voltage current changed amount error alarm OC-Caution %
xiv) S13	PSL	: Reduction timing PSL at paint ON
xv) S14	HONS	: High-voltage starting time

4) Change of safety sensitivity (in the case of OCH/L change)

i) Password	: Input the password for passing.
ii) Transit to the main menu selection screen.	
iii) Press [←] twice.	: The cursor moves to “cont”.
iv) Press [ENT].	: The safety sensitivity setting screen is displayed.
v) Press [ENT].	: OCR setting screen is displayed. (Check that # is displayed at the upper right of LCD screen.)
vi) Numeric setting	: A number is selected by [↑] or [↓]. The digit is selected by [←]. Fix the data by pressing [ENT].

(4) Maintenance mode

1) Contents of maintenance mode

i) M01	: Password setting
ii) M02	: Log clearance
iii) M03-1	: Automatic frequency adjustment
iv) M03-2	: Manual frequency adjustment
v) M04	: ROM version indication
vi) M05	: Lamp test (All LEDs in the display section are lighted.)
vii) M06	: Manual operation

2) Monitor of maintenance mode

i) Modes M03-1 and M04 are exclusive for the monitor.

ii) When the lamp test screen (M05) is displayed, the lamp test is automatically started. By exiting the lamp test screen, monitoring is ended.

3) Execution of maintenance mode (Log clearance)

i) The main menu selection screen is displayed.	
ii) Press [ENT].	: The maintenance screen is displayed.
iii) Press [←] twice.	: The cursor moves to “CLG”.
iv) Press [ENT].	: The log clearance screen is displayed.
v) Log clear	: Press [←] to move the cursor to “Y”. The log is cleared by [ENT].

(5) Password

1) Function of password

To control the set values, after the password is input and authenticated, the set values can be changed. The safety sensitivity setting is especially important for securing safe operation. The password consists of 4-digit numbers. If a new password is set, the password can be changed from the initial value.

2) Password input method (The initial value of the password is “0000”.)

i) Press [MD].	: The main menu selection screen is displayed.
ii) Press [ENT].	: The maintenance screen is displayed.
iii) Press [ENT].	: The password check screen is displayed.
iv) Numeric setting	: The numbers are selected by [↑] or [↓]. The digit is selected by [←]. Fix the data by pressing [ENT].
v) Check	: Check OK → The main menu selection screen is displayed. Check NG → Error occurs.

3) Password setting method (The password needs to have been authenticated.)

i) Press [MD].	: The main menu selection screen is displayed.
ii) Press [ENT].	: The maintenance screen is displayed.
iii) Press [←].	: The cursor moves to “PAS”.
iv) Press [ENT].	: The password setting screen is displayed.
v) Numeric setting	: The number(s) are selected by [↑] or [↓]. The digit is selected by [←]. Fix the data by pressing [ENT].

4) After the above-mentioned operations, the set values can be changed. The authentication status is effective until the normal screen is displayed again. In this state, # is displayed at the upper right of the setting screen.

(6) Check mode

1) Contents of check mode

<Reference of A/D conversion values>

i) C01-1	TEMP	: Internal temperature
ii) C01-2	DCP	: Internal DC voltage
iii) C01-3	TYPE	: Type resistance measurement value

<Reference of sensitivity values during operation>

iv) C02-1	OCR, S-didt	: OCR for high-voltage, di/dt sensitivity
v) C02-2	OV	: OV sensitivity for high-voltage
vi) C02-3	UV	: UV sensitivity for high-voltage

<Time>

vii) C03	: Display of current time
viii) C03-1	: Calibration of time

<Log display>

2) Monitor of check mode

i) The check mode is exclusive for monitoring except for the time calibration (C03-1).

ii) C02 is effective only when high-voltage is ON. The value immediately before high-voltage OFF is displayed on the monitor when high-voltage is OFF.

iii) In other cases, the current value is displayed regardless of high-voltage ON or OFF.

3) Time calibration procedure

i) The normal screen is displayed.

ii) Press [←].	: The check menu selection screen is displayed.
iii) Press [←] twice.	: The cursor moves to “TIME”.
iv) Press [ENT].	: The current time display screen is displayed.
v) Press [ENT].	: The time calibration screen is displayed. (Check that # is displayed at the upper right of LCD screen.)
vi) Time setting	: The numbers are selected by [↑] or [↓]. The digit is selected by [←]. Fix the data by pressing [ENT].

(7) Error code

If any error occurs when operating the password or adjusting the frequency, the buzzer sounds and the error code is displayed at the upper right of LCD screen.

No.	Error code	Contents of error
(1)	ERR0	Password input error
(2)	ERR1	Improper set value (H value < L value)
(3)	ERR2	Breakage of high-voltage during automatic frequency adjustment
(4)	ERR3	Failure in automatic frequency adjustment

(8) Error screen

1) If any error occurs, the error screen is displayed. The error message “ERROR!”, contents of error, item No., high-voltage value, and current when the error occurred are displayed on the screen.
2) “ERROR!”, contents and item No. of the error blink.
3) The item No. and detailed contents of errors are shown in [Appendix] TPS-200 error list.
4) The normal screen is displayed again if either of [MD], [↑], [↓], [←], and [ENT] is pressed. Only the item No. blinks after the normal screen is displayed.
5) Press “RST” to reset the error and return to the normal screen.

(9) Mode list

1) HV voltage setting

Mode No.	Mode name	ESA120 ESA200 TRA80	Unit	Contents
H01	HV1	80	kV	Set value of high-voltage selection No. 1 [LEVEL H(1)]
H02	HV2	70	kV	Set value of high-voltage selection No. 2 [LEVEL H(2)]
H03	HV3	60	kV	Set value of high-voltage selection No. 3 [LEVEL H(3)]
	Set range	28 ~ 82	Absolute value and changed amount sensitivity reduction amount at high-voltage L → H instant	

2) Safety sensitivity setting

Mode No.	Mode name	ESA120 ESA200 TRA80	Unit	Contents
S06	CIM	150	μA	Absolute restriction current setting
	Set range	10 ~ 160		

Mode No.	Mode name	Set range	ESA120 ESA200 TRA80	Unit	Contents
S01	OCH	10 ~ 200	130	μA	Absolute value sensitivity H setting
S01	OCL	10 ~ 200	50	μA	Changed amount sensitivity L setting
S02	S-diH	5 ~ 40	25	μA	Changed amount sensitivity H setting
S02	S-diL	5 ~ 20	10	μA	Changed amount sensitivity L setting
S03-1	NP3	100 ~ 999	400	MA/s	C-didt sensitivity
S03-1	IP3	20 ~ 99	40	μA	C-didt reduction current
S04	OVH	1 ~ 10	6	kV	Overvoltage sensitivity H setting (Added value)
S04	OVL	1 ~ 6	5	kV	Overvoltage sensitivity L setting (Added value)
S05	UVH	1 ~ 50	20	kV	Undervoltage sensitivity H setting (Subtracted value)
S05	UVL	1 ~ 15	10	kV	Undervoltage sensitivity L setting (Subtracted value)
S06	CIH	10 ~ 400	140	μA	Constant current H setting
S06	CIL	10 ~ 400	140	μA	Constant current L setting
S07	TOC	0.1 ~ 1.5	1.5	A	Transmission center line over-current
S08-1	HOND	10 ~ 100	50	μA	Absolute value sensitivity reduction amount at high-voltage ON instant
S08-1	HONT	0.1 ~ 3.0	1.5	sec	High-voltage ON instant reduction time
S08-2	DOND	10 ~ 50	50	μA	Changed amount sensitivity reduction amount at high-voltage ON instant
S09-1	POND	10 ~ 40	20	μA	Changed amount sensitivity reduction amount at paint ON/OFF instant
S09-1	PONT	0.1 ~ 3.0	0.6	sec	Changed amount sensitivity reduction time at paint ON/OFF
S09-2	POST	0.1 ~ 3.0	0.3	sec	Changed amount sensitivity reduction start time at paint ON/OFF
S10	HCND	10 ~ 100	30	μA	Absolute value and changed amount sensitivity reduction amount at high-voltage L → H instant
S10	HLHT	0.1 ~ 3.0	1.0	sec	Reduction time at high-voltage L → H change
S11	CW	1 ~ 99	50	W	Constant current setting
S12	CTN	30 ~ 90	80	%	High-voltage current absolute value error alarm OC-Caution%
S12	DIN	30 ~ 90	80	%	High-voltage current changed amount error alarm DI-Caution%
S13	PSL	1 ~ 6	1		Paint reduction timing
S14	HONS	0.1 ~ 9.9	1.0	sec	HV starting time

3) Maintenance

Mode No.	Mode name	Set range	Default	Unit	Contents
M01	PAS	0000 ~ 9999	-	-	Password setting
M02	CLG	-	N	-	Log clearance
M03-1	FRQ	-	-	KHz	Automatic frequency adjustment
M03-2	FRQ	15 ~ 30	20.0	KHz	Manual frequency adjustment
M04	VER	-	-	-	Version display
M05	LMP	-	-	-	Lamp test
M06	MAN	-	-	-	Manual operation

4) Password

Mode No.	Mode name	Default	Contents
P01	APP	0000	Password input

5) Check menu

Mode No.	Mode name	Unit	Contents
C01-1	TEMP	°C	Internal temperature
C01-2	DCP	V	Internal DC voltage
C01-3	TYPE	Ω	Type resistance measurement value
C02-1	OCR	μA	OCR sensitivity for high-voltage
C02-1	Sdi	μA	di/dt sensitivity for high-voltage
C02-2	OV	kV	OV sensitivity for high-voltage
C02-3	UV	kV	UV sensitivity for high-voltage
C03	TIME	-	Current time display
C03-1	TIME	-	Time calibration
C04	LOG	-	Reference of error log

6) Initial setting

Mode No.	Mode name	Default	Contents
I01	ALC	N	All clear
I02	CAS	TABELL	Cascade selection

(10) Explanation of safety functions

1) Safety sensitivity of high-voltage current

The sensitivity related to high current automatically follows the change of the set voltage level.

There are two current sensitivities:

i) Absolute value OCR sensitivity [μA] ([1] in right graph)

ii) Changed amount di/dt sensitivity [μA] ([3] in right graph)

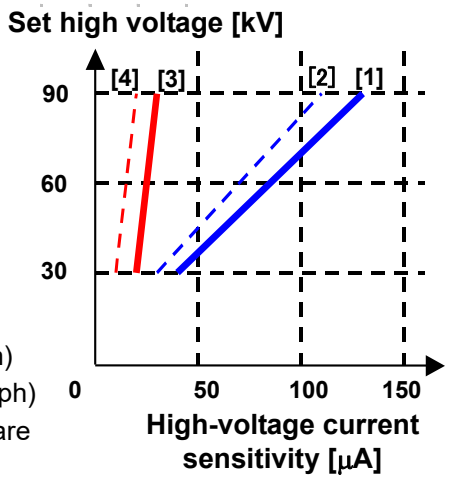
The alarms related to safety sensitivity for the above two sensitivities are provided.

iii) Absolute value alarm Caution-OCR [%] ([2] in right graph)

iv) Changed amount alarm Caution-di/dt [%] ([4] in right graph)

Condition of the set high-voltage level and sensitivity following are shown in the right figure.

<Caution = abbreviated as CTN>



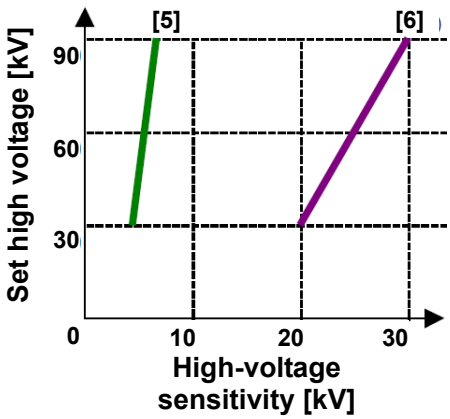
2) Safety sensitivity of high-voltage

Sensitivity related to the output high-voltage level automatically follows the change of the set high-voltage level. There are two high-voltage sensitivities:

i) Overvoltage OV sensitivity [kV] ([5] in right graph)

ii) Undervoltage sensitivity [kV] ([6] in right graph)

Conditions of the set high-voltage level and sensitivity following are shown in the right figure.



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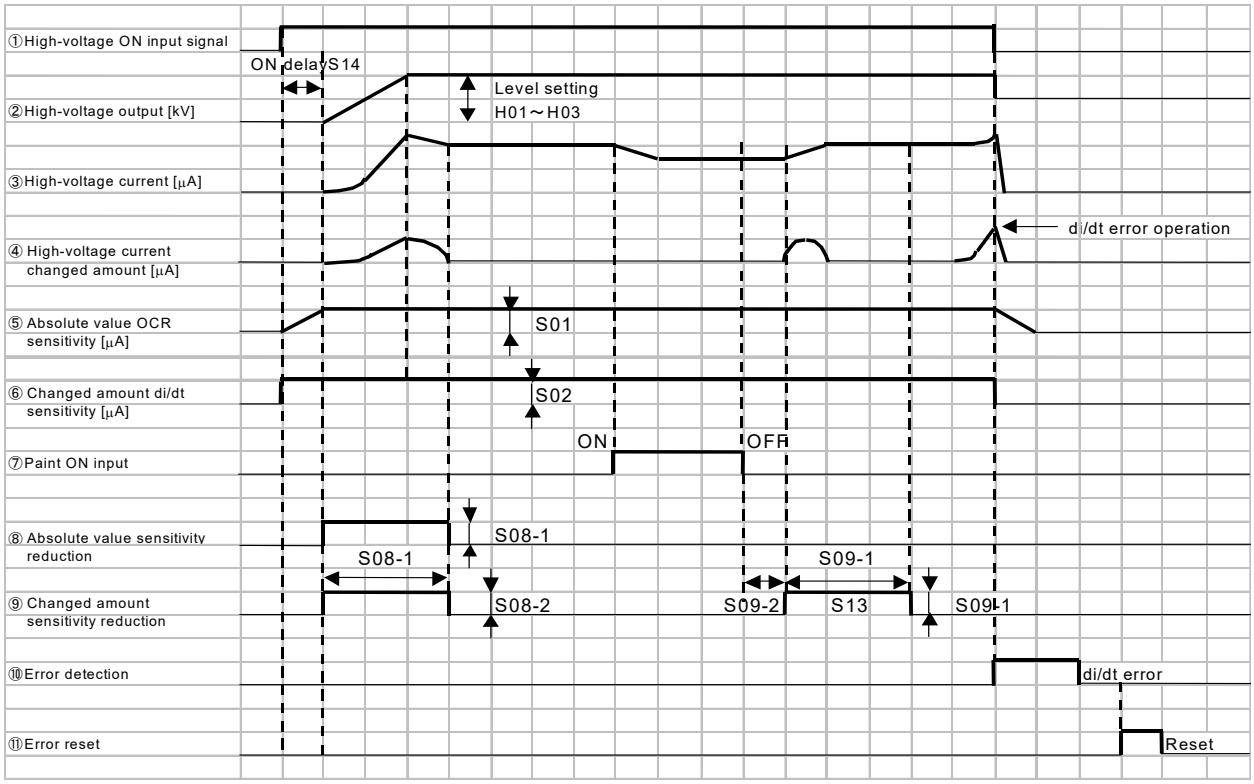
3) Time chart of high-voltage operation

(Refer to “8. Operation method” (9) Mode list for detailed contents of the mode.)



9 Safety Control

TPS-200 uses the built-in high-voltage generator (cascade) and has the protection resistance at the tip of the coating machine to improve safety. However, it is used in places where “flammable gas exists”. The high-voltage controller must therefore be handled very carefully.
Be especially careful to the following points.

(1) Grounding

1) Connect the grounding wire to the controller grounding terminal; otherwise, failures might occur.
2) Coated materials must always be grounded. The coated materials are grounded by the hanger and conveyor in general. If paints are fixed at the contact area between the hanger and coated materials or between the hanger and conveyor, continuity failures occur and coated materials are charged, resulting in spark and fire. Peel off the adhered paints on the hanger and the conveyor periodically to secure conductivity.
3) All conductive materials such as metals in the coating chamber must be grounded. If the conductive materials are not grounded, they are charged by the ionized air, resulting in spark and fire.

(2) Do not contact the tip of the coating machine with the grounded materials.

If the tip of the automatic electrostatic coating machine (atomizing cup) contacts with the grounding materials such as coated materials due to machine malfunctions or displacement of coated materials, spark and fire might occur.

(3) Antistatic shoes

Operators must wear antistatic shoes (electric resistance 0.1 ~ 100 MΩ or less). If operators wear rubber-soled shoes or insulation synthetic resin shoes, human bodies are charged and operators might be shocked electrically when touched the grounded materials. Sparks and fire might also occur.

(4) Others

Operate the machine safely, referring to the contents of the safety control items in the operation and instruction manual of the electrostatic coating machine Sun Bell and Sun Bell Eco.

10 Maintenance and inspection

(1) Monitoring of daily operation

It is recommended to monitor the coating operation condition on the operation panel of the controller. By monitoring, it can be judged whether the operation is in the proper condition, or in a rather inadequate condition, or in almost abnormal condition. It is recommended that the cycle and monitoring items are determined and the daily operation condition are monitored and recorded. The “Mode data recording table” is attached.

(1) Monitoring of high-voltage level and high-voltage current:

The high-voltage [kV] in the left column and high-voltage current [μA] in the right column should be recorded in the regular monitoring mode. If multiple high-voltage levels are selected, check and record the high-voltage [kV] and high-voltage current [μA] in each level.

(2) Change of setting

Refer to “8. Operation Method” for details of the setting change procedure. Change of setting is very important to secure the coating quality and maintain safety. Consequently, the setting must be changed very carefully. The contents of each function mode are explained below. A part of them is the same as “8. Operation Method”. Also refer to “Mode list”.

1) Password

To change the setting, input the password in P01. After authentication, the setting can be changed. For monitoring, the password needs not be input.

2) High-voltage setting

The value between -28 kV and -82 kV can be set to the high-voltage output level for the 3 high-voltage setting levels. There is no restriction on the priority of levels H(1), M(2), and L(3) for H01, H02, and H03.

3) Sensitivity setting

i) Absolute value sensitivity

H setting is for -80 kV, and L setting is for -30 kV. At the intermediate potential between -80 kV and -30 kV, the value between H and L is calculated by linear interpolation. The sensitivity is automatically transited to cope with the set voltage level. If S01 H setting is OCH and L setting is OCL, they are called H/L setting and OCH/L sensitivity. Hereinafter, the same designations are used. To secure safety, OCH/L must be below the constant current set value.

ii) Other H/L settings

H must be larger than L for H/L setting sensitivity for S01 absolute sensitivity OCH/L, S02 changed amount DIH/L, S04 overvoltage OCH/L, and S05 undervoltage UVH/L.

iii) % alarm sensitivity

There are two types of % alarm sensitivity. One is S12 absolute % alarm that is output when high-voltage current increases more than % setting alarm sensitivity. The other is the changed amount % alarm that is output when the differential increase of high-voltage current is more than % alarm sensitivity.

iv) Over-current of transformer

This is S07 over-current detection function with respect to the pressure ascending transformer drive current of the cascade. The main purpose of this function is error detection such as mixed contact of the low-voltage cable cores.

v) Sensitivity reduction at high-voltage ON instant

High-voltage current causes overshoot at high-voltage ON instant. The reduced sensitivity is added to this part to prevent errors. There are two types of reductions: S08-1 absolute sensitivity reduction at ON instant and S08-2 changed amount sensitivity reduction.

vi) Sensitivity reduction at high-voltage level change and paint ON/OFF instant

When the high-voltage level is changed from “Low” to “High”, both the absolute sensitivity and the changed amount sensitivity are reduced by S10. At paint ON/OFF instant, the changed amount sensitivity is reduced by S09-1.

vii) High-voltage reduction time

The sensitivity reduction time at high-voltage ON instant is displayed in S08-1. The reduction time when the high-voltage level is changed from “Low” to “High” is displayed in S10.

viii) Reduction timing at paint ON/OFF instant

The changed amount sensitivity reduction amount at paint ON/OFF instant and changed amount sensitivity reduction time at paint ON/OFF instant are displayed in S09-1. In most cases, the paint ON/OFF input signal is synchronized with the solenoid valve drive signal. The time difference of the actual paint discharge from the tip of the coating machine is adjusted in S09-2. Consequently, it is necessary to set the reduction time, considering the diameter and length of the tube between the solenoid and paint valve, air pressure, etc.

ix) Paint ON/OFF reduction timing

It is decided whether either of paint ON or OFF is reduced or both ON and OFF are reduced. In general, high-voltage current increases at paint OFF. However, it depends on the coating machine and paint type. The reduction timing is selected depending on the actual coating condition.

4) Other settings

i) Frequency adjustment

M03 automatic frequency adjustment must be executed when the controller or coating machine (including the cascade unit) is newly installed or exchanged. (Refer to “7-3 Frequency Adjustment”.)

ii) Setting of password

The password can be changed by inputting a 4-digit number in M01. (The changed value must be recorded.) Only the persons in charge who know the password can change the setting or adjust/clear the frequency, and the set values can be strictly controlled. If the operator does not know password, no changing operation including setting and password can be performed.

(3) Operation check of safety sensitivity

Before starting the operation check of safety sensitivity, confirm that the coating machine and the area around the coating machine are safe even when high-voltage is applied. Be sure that people near the machine do not receive electric shock or get injured when high-voltage is applied. Check the operation with high-voltage ON. When the grounded material is moved close to the tip of the printing machine, do not make the grounded material directly contact with the cascade. Move the grounded material close to the metal section of the electrostatic coating machine. After checking the operation, reset the error. If the setting is changed for the check, restore the setting when all check operations are completed. Check that normal high-voltage operation is available by turning ON and OFF high-voltage.

1) Operation check of absolute sensitivity OCR and OCR alarm

i) Record the current value of the absolute sensitivity of S01 in the safety sensitivity mode, and return to the normal screen.

ii) Move the grounded material (grounding bar, etc.) to the coating machine slowly at the speed of 0.1 m/sec or less.

iii) If the absolute sensitivity exceeds the alarm value, “W1” is displayed on the LCD screen. If the sensitivity exceeds the absolute sensitivity set value, OCR error occurs.

iv) Press [RST] to reset the data. Move the grounding material apart from the coating machine sufficiently.

2) Operation check of changed amount sensitivity di/dt and di/dt alarm

i) Record the current value of the changed amount sensitivity of S02 in the safety sensitivity mode, and return to the normal screen.

ii) Move the grounded material (grounding bar, etc. (It functions remarkably if it has the needle-like shape.)) to the coating machine at the speed of 1.0 m/sec quickly.

iii) If the changed amount sensitivity exceeds the alarm value, “W2” is displayed on the LCD screen. If the sensitivity exceeds the absolute sensitivity set value, di/dt error occurs.

iv) Press [RST] to reset the data. Move the grounding material apart from the coating machine (by 500 mm or more) completely.

3) Check of error detection of low-voltage cable

i) Pull out the relay connector of the low-voltage cable or the connector at the back of the coating machine. (Artificially cause a batch wire breakage.)

ii) Check that the error occurs. (High-voltage is set to OFF, and the error lamp is lighted.) There is a high possibility that the type of errors in this case is one of the absolute value OCR, changed amount di/dt, overvoltage OV, etc. Even if there is a possibility of multiple errors, only the error that is detected first is output. The errors including the undervoltage UV, cable error WT, and transformer over-current TOC occur when the error such as partial breakage of low-voltage cable core and mixed contact of core wires is detected.

iii) Connect (engage) the removed connector.

iv) Reset the error.

4) Other errors

i) The cable error cable functions when the core wire breakage or mixed contact is detected. The error can be confirmed by contact or release of core wires by the cable connection terminal on the back of the controller.

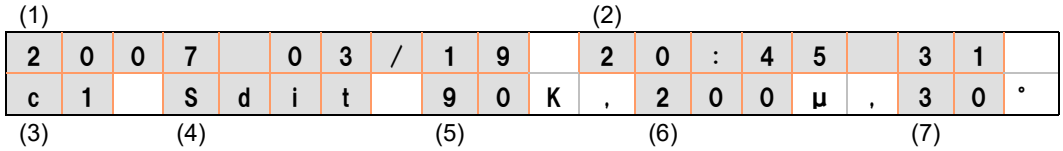
ii) The operation of the transformer over-current TOC can be checked by the following step: After decreasing the set value S07 of the transformer over-current in the safety sensitivity, move the earth bar slowly close to the tip of the coating machine.

iii) Return the set value of the transformer over-current S07 to the original one.

iv) Reset the error.

(4) Log (controller process record) output after high-voltage error

If high-voltage error occurs, the following contents are written in the log.



[Contents of display]

(1) Error occurrence date
(2) Error occurrence time
(3) Channel No.
(4) Error item
(5) KV when error occurred
(6) IM when error occurred
(7) Temperature when error occurred

The log can be checked on the check menu selection screen. The movement method is shown below.

1) Move to the normal screen.
2) Press [←]. ····· The check menu selection screen is displayed.
3) Press [←] three times.···· The cursor moves to "LOG".
4) Press [ENT]. ····· The log display screen is displayed. (The latest contents are displayed automatically. Every time [ENT] key is pressed, the past data is displayed.)

If the number of logs exceeds 500, recording is stopped, and "*" is output to the lower right of LCD.

(5) Insulation resistance check

1) Range of insulation resistance check

Do not check the controller insulation resistance. Check the insulation resistance of the low-voltage cable and cascade only. Be careful that the megger tester (insulation resistance gauge) potential is not applied to the controller.

⚠ CAUTION

If the megger tester potential is applied to the controller, the controller might be damaged. Do not execute the megger test.

2) Insulation resistance check method

i) Check the insulation resistance of the coating machine including the low-voltage cable, or the cascade unit. Remove the low-voltage cable from the controller (Remove the cable connector at the back of the coating machine, or remove the relay connector) so that the megger tester potential is not applied to the controller.

ii) Use the megger tester of "500V" specifications to check the insulation resistance. 1,000V tester should not be used.

iii) The following wire symbols are written at the lead edge of the low-voltage cables connected to the controller.

1. Drive line : CN, DA, DB
2. Monitor line : IM, VM
3. Standard line : GD

iv) Resistance check on cascade low-voltage side

1. CN ~ DA, DB : Resistance 0MΩ
2. CN ~ IM, VM, GD : Resistance 500MΩ or more (Instant 100M ~ 500 MΩ)
3. DA, DB ~ IM, VM, GD : Resistance 500MΩ or more (Instant 100M ~ 500 MΩ)
4. IM ~ VM : Resistance in the case of bell 250 MΩ (0 for megger tester)
   Resistance in the case of gun 450 MΩ (0 for megger tester))
5. IM ~ GD : Resistance in the case of bell 200 MΩ (0 for megger tester)
   Resistance in the case of gun 400 MΩ (0 for megger tester)
6. VM ~ GD : Resistance in the case of bell 200 MΩ (0 for megger tester)
   Resistance in the case of gun 400 MΩ (0 for megger tester)

v) Resistance check on high-voltage side and low-voltage side of cascade (The value depends on the megger tester polarity (+, -).

1. HV. OUT ~ CN·GD : 500MΩ or more (if megger tester lead is "Line –";)
2. HV. OUTCN, DA, DB : 500MΩ or more (Instant 100M ~ 500 MΩ)
   (if megger tester lead is "Earth+";)
3. HV. OUT ~ IM, VM : 50 ~ 100MΩ (if megger tester lea is "Earth+";)
   This value is equivalent to the measurement of the potential in the forward direction of the high-voltage diode in the pressure ascending section. It depends on the cascade due to the difference in the element characteristics.

(6) Adjustment procedure after exchange

If the coating machine is exchanged (including exchange of the cascade unit), the frequency must be re-adjusted. (Refer to (3) Frequency adjustment in “7. Trial operation”.)

High-voltage controller TPS-200
Mode data recording table

⚠ CAUTION

(Combination condition)

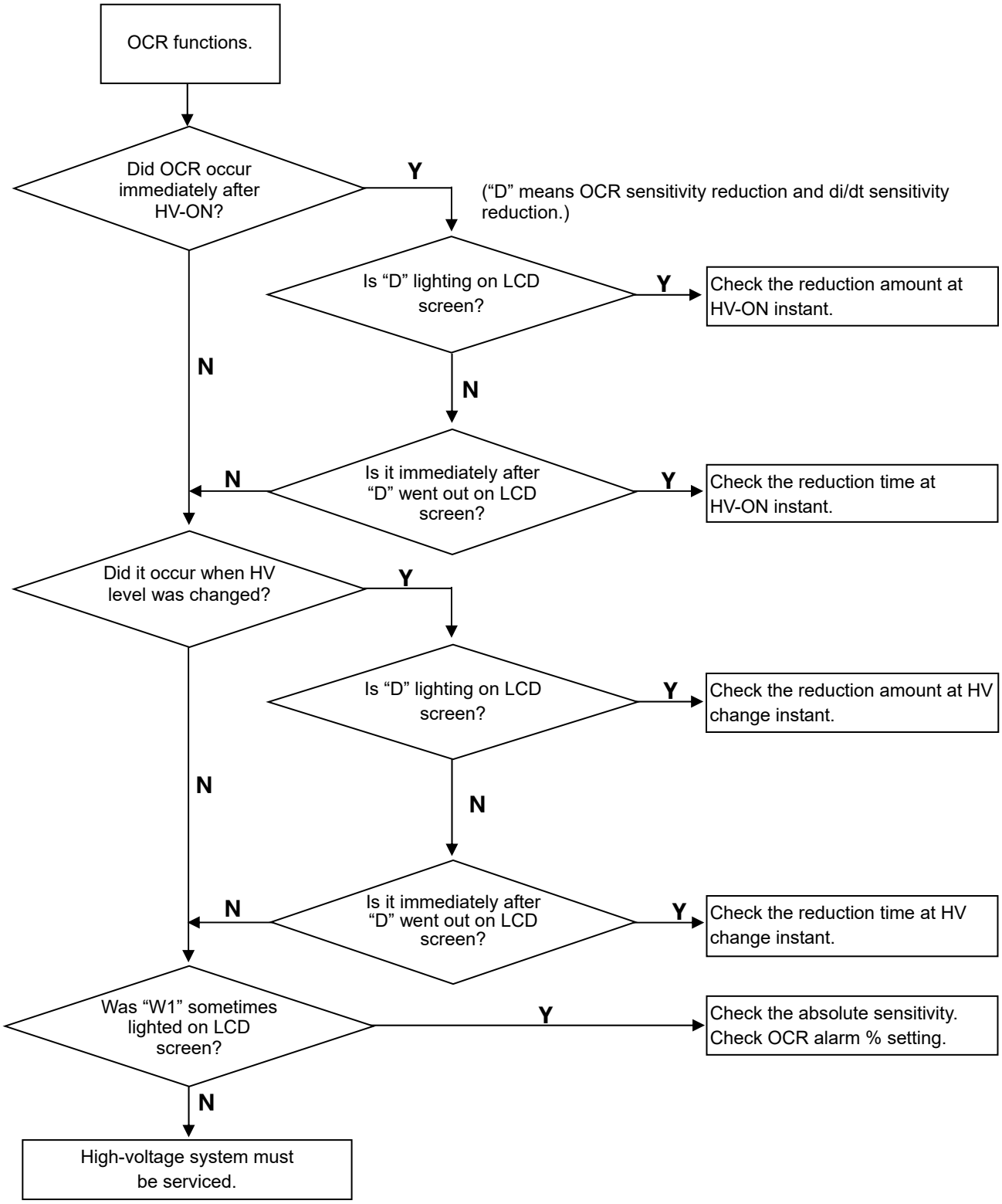
The cascade mode must be set depending on the coating machine used.

		Software version	Software version	Software version	Software version
		Cascade used	Cascade used	Cascade used	Cascade used
		Date tested	Date tested	Date tested	Date tested
Mode No.	Mode name	Value	Value	Value	Value
H01	HV1				
H02	HV2				
H03	HV3				
S01	OCH				
S01	CCL				
S02	S-diH				
S02	S-diL				
S03-1	NP3				
S03-1	IP3				
S04	OVH				
S04	OVL				
S05	UVH				
S05	UVL				
S06	CIH				
S06	CIL				
S06	CIM				
S07	TOL				
S08-1	HOND				
S08-1	HONT				
S08-2	DOND				
S09-1	POND				
S09-1	PONT				
S09-2	POST				
S10	HCND				
S10	HLHT				
S11	CW				
S12	CTN				
S12	DIN				
S13	PSL				
S14	HONS				
M03-2	FRQ				
P01	APP				
C01-1	TEMP				
C01-2	DCP				
C01-3	TYPE				
C02-1	OCR				
C02-1	Sdi				
C02-2	OV				
C02-3	UV				

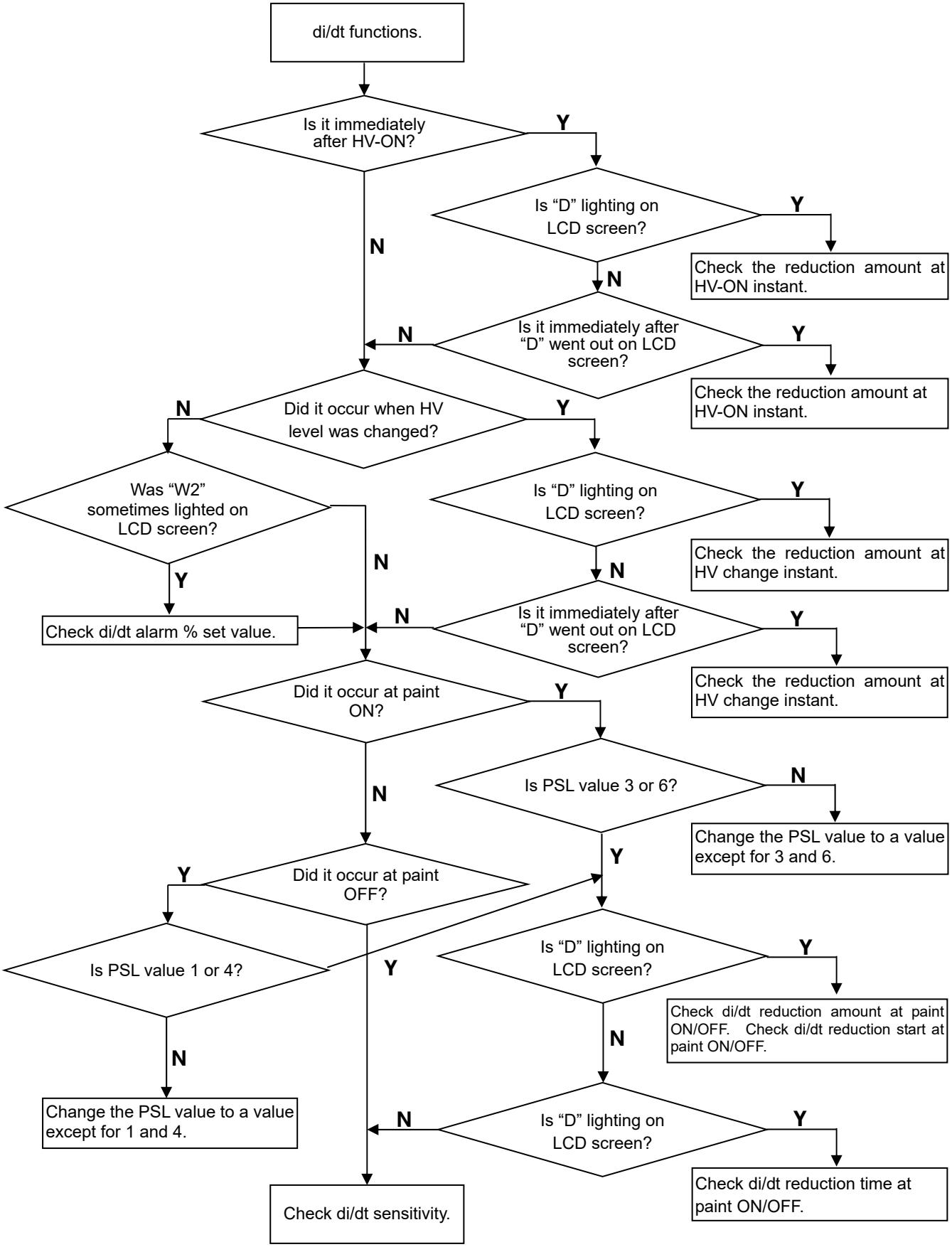
(1) General

(Refer to the operation and instruction manual of the gun or bell type coating machine for details.)

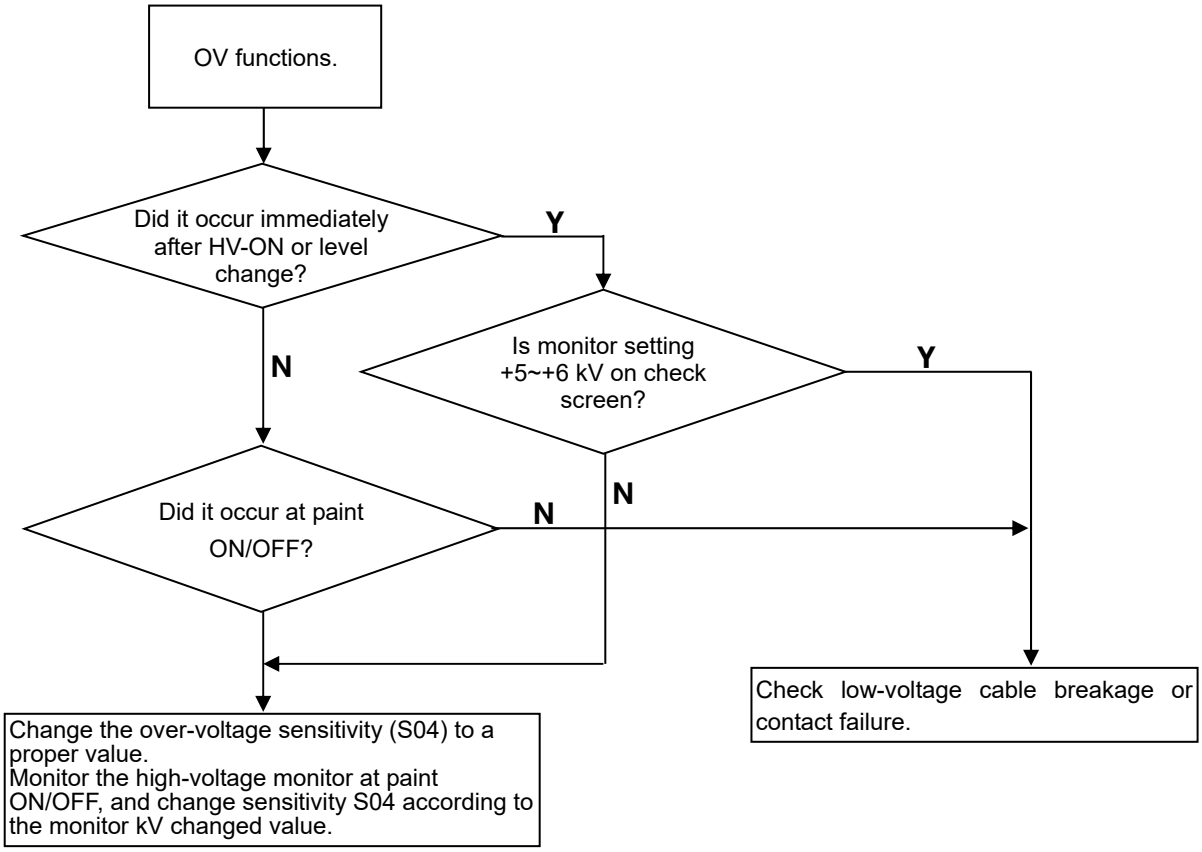
(2) Operation of absolute value sensitivity OCR



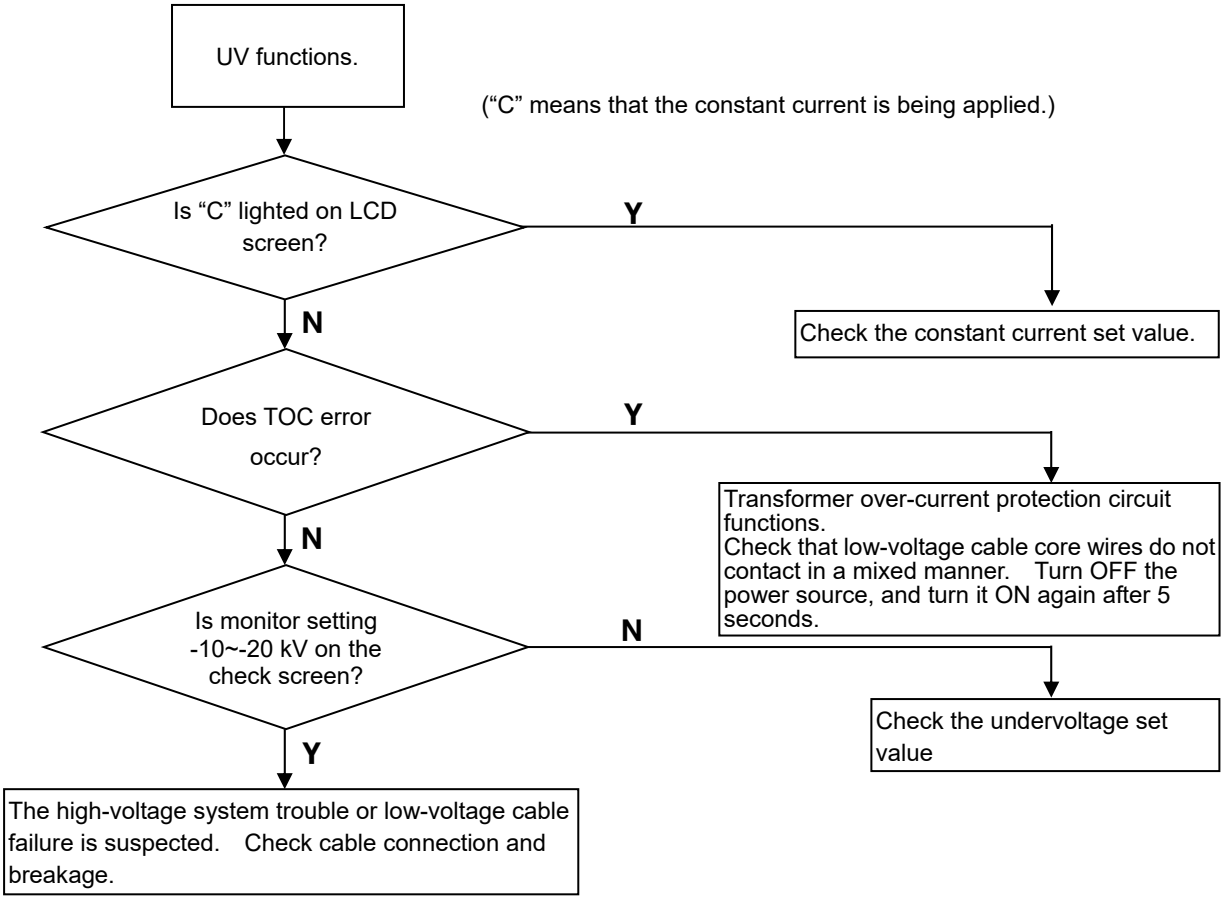
(3) Changed amount sensitivity di/dt functions.



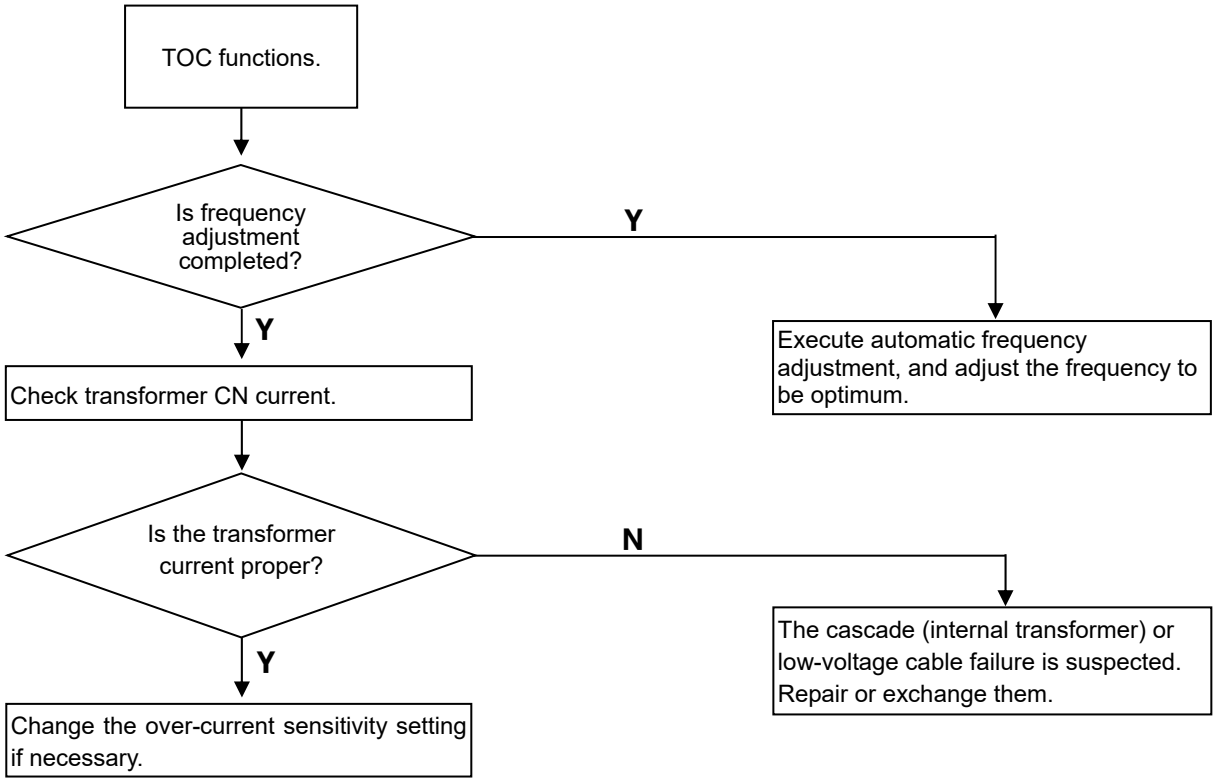
(4) Over-voltage OV functions.



(6) Under-voltage UV functions.



(6) Transformer over-current TOC functions.



12 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 this Operation and Maintenance Manual is handed over to the new owner.

●In the rare eventuality of this equipment being used outside Japan, compliance with the safety standards of the relevant countries is of course mandatory.

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