

# VSN-12Z

## Neutra-ray

### INSTRUCTION MANUAL



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- The contents of the following instruction manual are subject to change without notice.
- If you have concerns or questions regarding this instruction manual, including errors and omissions, please contact us.

## •General Safety Information

### Warning

- Do not disassemble or modify this product.
- This product generates high voltage. To avoid electric shock or malfunction, do not use the product with the main cover removed.
- As the device is not explosion-proof, do not use the device near organic solvent or flammable gas.
- This is a soft X-ray generator. Please use in a shielded enclosure.
- It uses Beryllium for the soft X-ray irradiation window.

The Beryllium used in the irradiation window does not evaporate or generate gas.

In case the Beryllium window is damaged, the particles from the damage can be hazardous. Therefore, please do not inhale the dust and wash thoroughly with a soap over running water. These are important steps to protect yourself. If the Beryllium window is damaged or dirty, please turn the device off immediately and call us directly, to keep yourself safe.

- This device is industrial-purpose product. Please ground the device prior to usage. There is a risk of malfunction, electric shock or fire.
- Please do not use if the device has come in contact with water.
- Please stop using the device if you see smoke or hear sound that is abnormal during operation. These can cause electric shock or fire. Turn the switch off immediately, disconnect the device for the AC power source and call us directly.

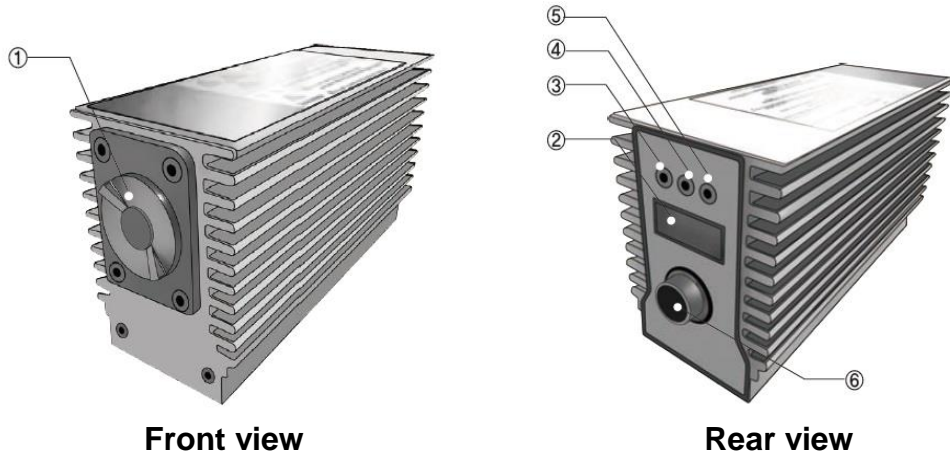
### Caution

- Do not use the device with vibration. Please fix the device as instructed in this manual.
- Do not use voltage other than the rated 100V to 240V.
- **Please check the internal impedance and acceptable voltage of the controller when connecting with other industrial equipment.**
- This product is a radiation generating device and should not be disposed of at will. In order to dispose of the product, please return the product to the seller. If you prefer to dispose of it yourself, please generate and retain any and all documents that is required, including, but not a limited to the process of disposal and associated pictures.
- Please contact Korea Institute of Nuclear Safety for more detailed procedure.

**Or follow the local regulations for the disposal procedure where the product is being used.**

## 1. Part Names and Functions

### ■ Head (VSH-12Z)



#### 1) Soft X-Ray window

A window that irradiates the soft X-ray that ionizes the air to eliminate static electricity.

#### 2) Timer LCD

The usage time (unit: hour) of the head is displayed.

- When the soft X-ray is being irradiated: Time increases, and hourglass image appears.
- When the soft X-ray is not being irradiated: Time stops, and hourglass image disappears.

#### 3) Run Indicator (Green Light)

It turns on when the soft X-ray is being irradiated

#### 4) Timer Indicator (Yellow Light)

It turns on when it operates over the **Guaranteed Operation Time**.

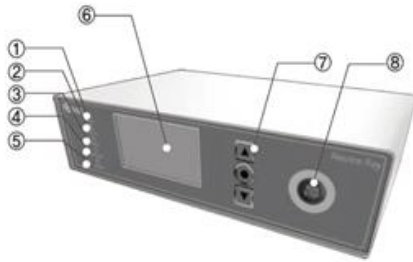
#### 5) Alarm Indicator (Red Light)

It turns on in case of abnormal the soft X-ray **Lamp** or Head operation.

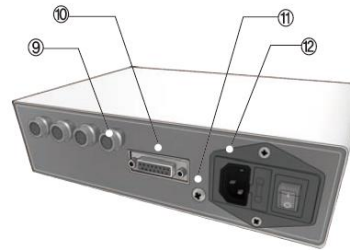
#### 6) Controller Connector

It connects the 12pin female cable that connects to the controller.

## ■ Controller (VSC-15Z)



Front

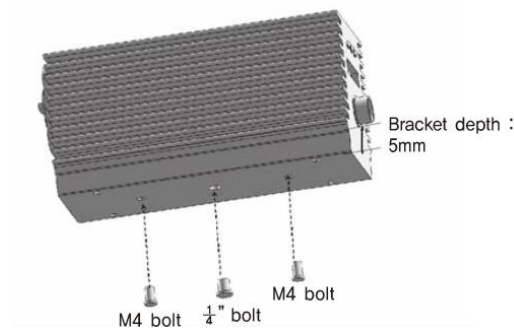


Rear

- ① **Power indicator:** Green light will come on when the controller is powered.
- ② **Interlock indicator:** The yellow light turns on when the interlock is connected (contact point is closed). It indicates the readiness for normal operation.
- ③ **Head Fail indicator:**  
Red light turns on when errors in the soft X-ray lamp, the head and the cable connection between the controller and the head are detected.
- ④ **Remote mode indicator:**  
**Green light is turned off when the remote-control mode is (mode1=Momentary).**  
**Green light is turned on when the remote-control mode is (mode2=Alternate).**
- ⑤ **Over Time indicator:** It turns on when the head usage time exceeds the **expected lifetime of the head.**
- ⑥ **Status Indicator Window:** It displays the status of the head on **channels from 1 to 4.**  
Status Indicator 1: The status of the head on channel from 1 to 4 (ion, stop, fail, time)  
Status Indicator 2: The detailed status of the head on selected channel (communication, error, time).
- ⑦ **Status Indicator Window Arrow Keys:** Arrow keys to select a head to display status on, or to select the items from the selectable menus.
  - Head Status Indicator Window: Use when selecting between heads
  - Menu Select Window: Use when moving the selection between the menus
- ⑧ **Run/Stop Button:**  
**Irradiation On Status: White LED is turned on**  
If the button is pressed while **ON**, the soft X-ray will be turned off.  
**Irradiation OFF Status: White LED is turned off**  
If the button is pressed while **OFF**, the soft X-ray will be turned on.
- ⑨ **Head connector:** It is a connector used to connect **VSH-15Z & VSH-15Z-L.**
- ⑩ **Signal Output Connector:**  
It is a connector used to remotely control the device from **external equipment.**
- ⑪ **Ground Terminal:** It is a terminal to ground the controller.
- ⑫ **Power Inlet (AC 100~240V, 50/60Hz):** It is an AC Power Inlet (integrated power switch).

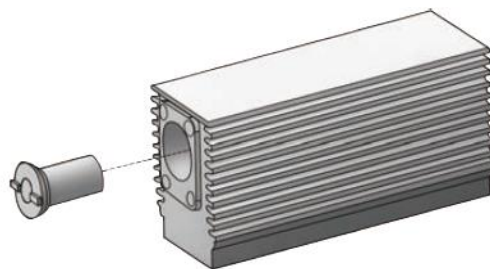
## 2. Installation and Operation

### ■ Head Installation



- ① Fix the device using the holes on the fixture bracket and the screws supplied, at a desired location.
  - ※ **The tap depth of the fixture hole is 5mm.**
  - If the supplied screw is not used, the length of your screws must be selected while considering the thickness of the fixed object to be combined with the bracket.**
  - ※ Please install the head in a shielded equipment
- ② Install the head in a shielded location, the controller at a place with easy access, and connect the power and ground cables.
- ③ Connect the Head and the controller using the connection cable provided

### ■ Tube Replacement



#### When removing the lamp

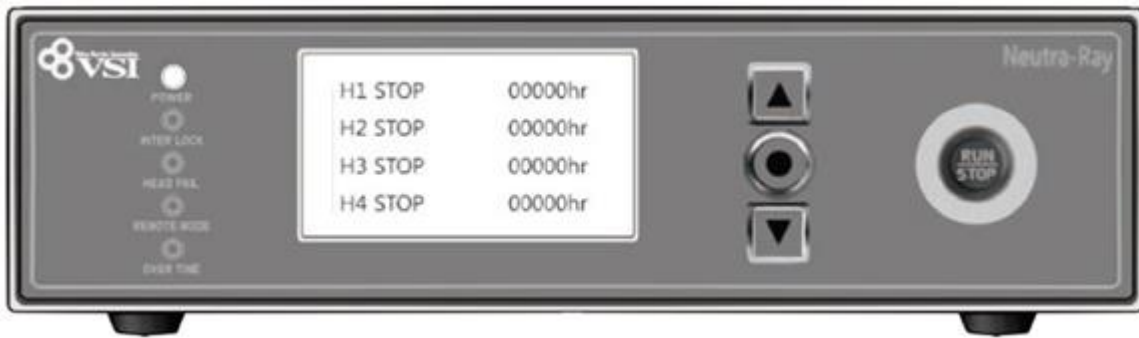
1. Turn the tube portion of the head in counterclockwise direction to loosen and remove.

#### When installing the lamp

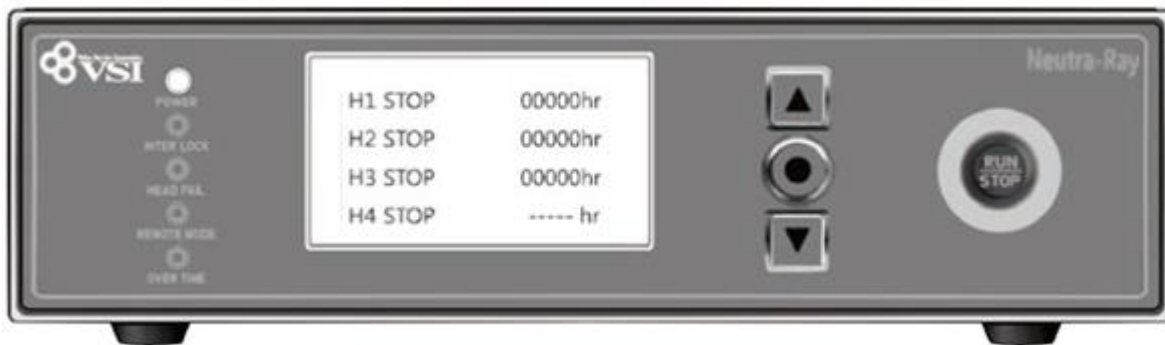
2. Turn the X-ray tube clockwise until the X-ray tube is tightly fixed to the module.

## ■ Checking Status Indicator Information with respect to the Controller Operation

1. Turn ON the controller after connecting all four heads to the controller.



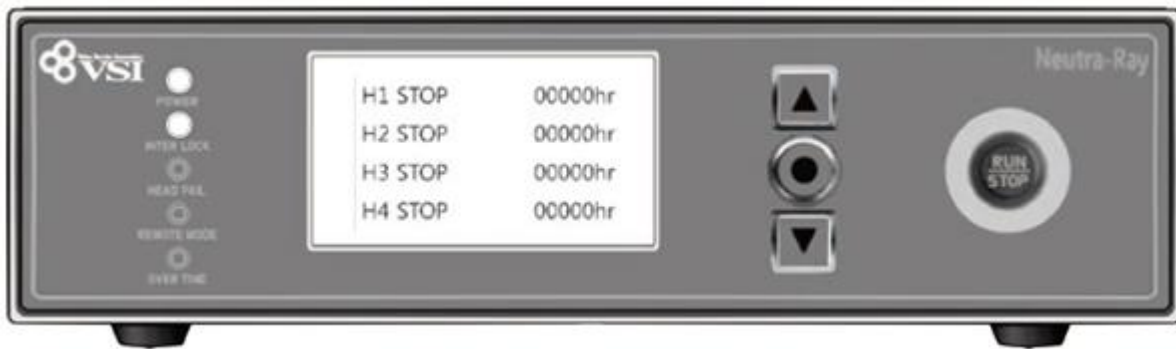
1-1 Head that is not connected will show '----' on the display.



### Normal Operation Ready Status Display (Interlock)

2. The contact point of the interlock needs to be at “Close” status (=same as Door Close status) in order to turn on the controller and irradiate the soft X-ray.

The Interlock lamp on the front display LED on the controller, lights up in yellow.  
(Check D-sub 15Pin interlock inputs)



3. Once the interlock is connected and the device is ready, pushing Run/Stop button on the front panel of the controller once will turn the white light on the Run/Stop switch and start the irradiation of the soft X-ray.

(The same indication will appear when operating remotely.)

However, if the Remote Off signal (pin 12 signal) is closed, the remote control is controlling the device to be turned off and cannot be turned on manually. To turn on manually, please disable the Remote Off signal (pin 12 signal).

4. Pressing Run/Stop button once during irradiation of soft X-ray, the Run/Stop switch lamp is turned off and the head stops the emission of soft X-ray.

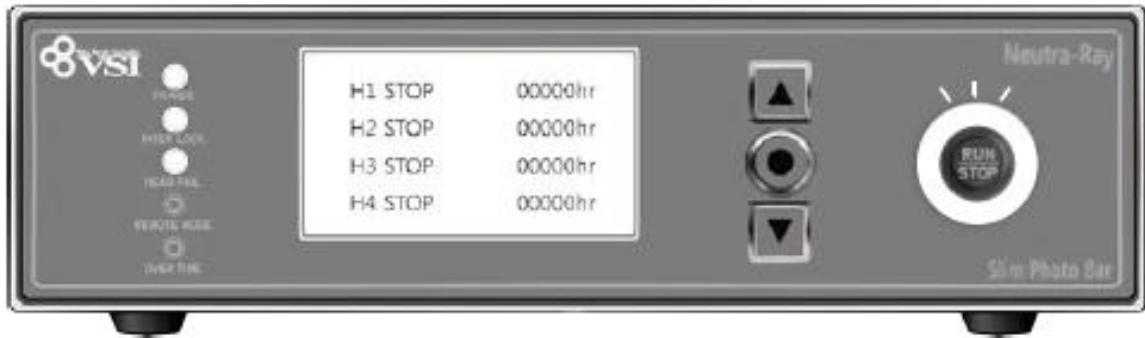
(The same indication will appear when operating remotely.)

### When head fail occurs during operation.

5. During operation of the soft X-ray in the head, if any malfunction is detected in the head (= X-ray tube lamp malfunction, head malfunction, faulty connection between the controller and head), then the operation time is displayed, and the head fail lamp is turned on.

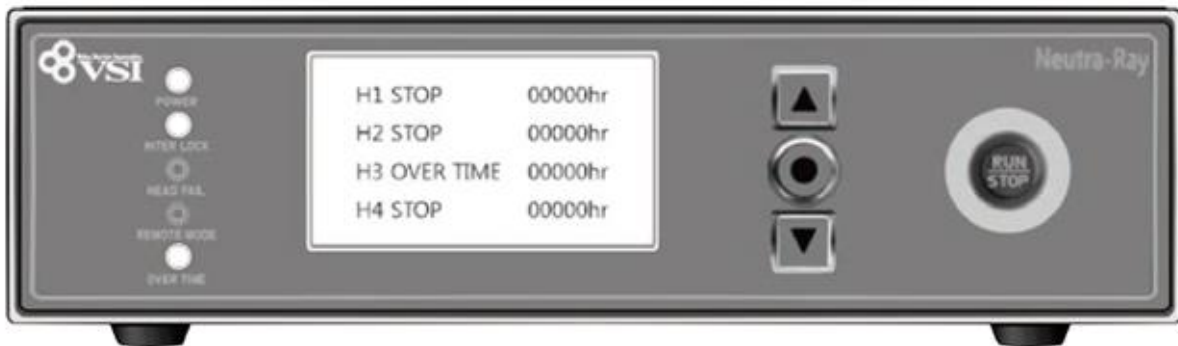


At this time, you can check the head fail information detected by using the direction switch

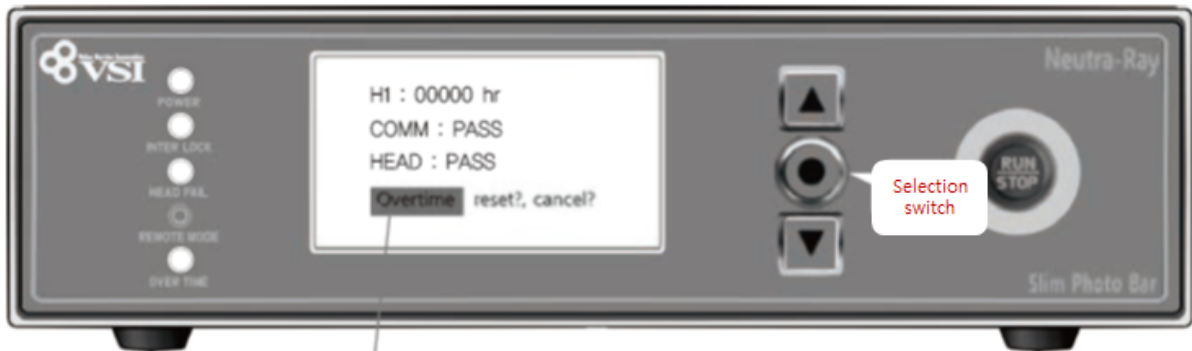
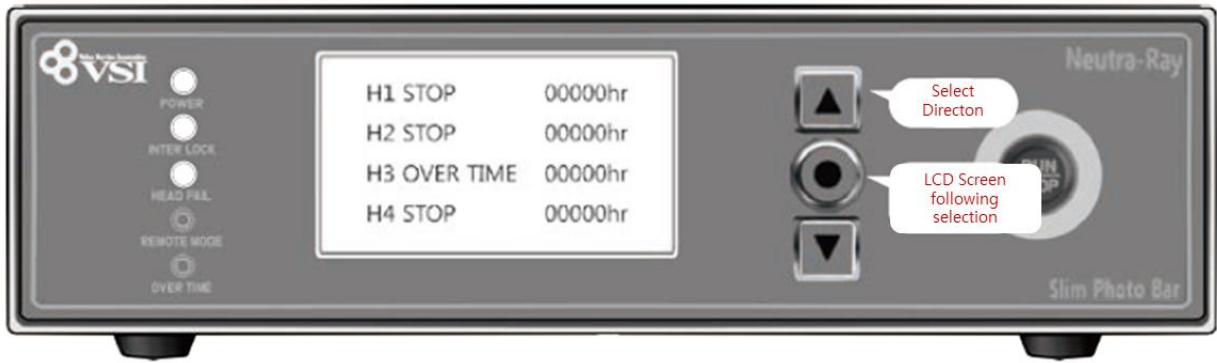


### When Operating Beyond the Expected Head Usage time

6. If the accumulated usage time exceeds the expected usage lifetime of the head, the orange LED will be turned on, the Over Time message will appear on the panel. To maintain the integrity of static elimination performance, replace the X-ray tube in the head as soon as possible.



7. Please reset the head usage of the head after replacing the X-ray tube in order to manage the usage of the replacement. Use the arrow keys to select desired Head and reset. If the accumulated usage time is reset, the Over Time LED light will be turned off.



After selecting the Overtime text using the arrow keys, "reset?" and "cancel?" texts appear and select one of the two options using the arrow keys to select desired action.

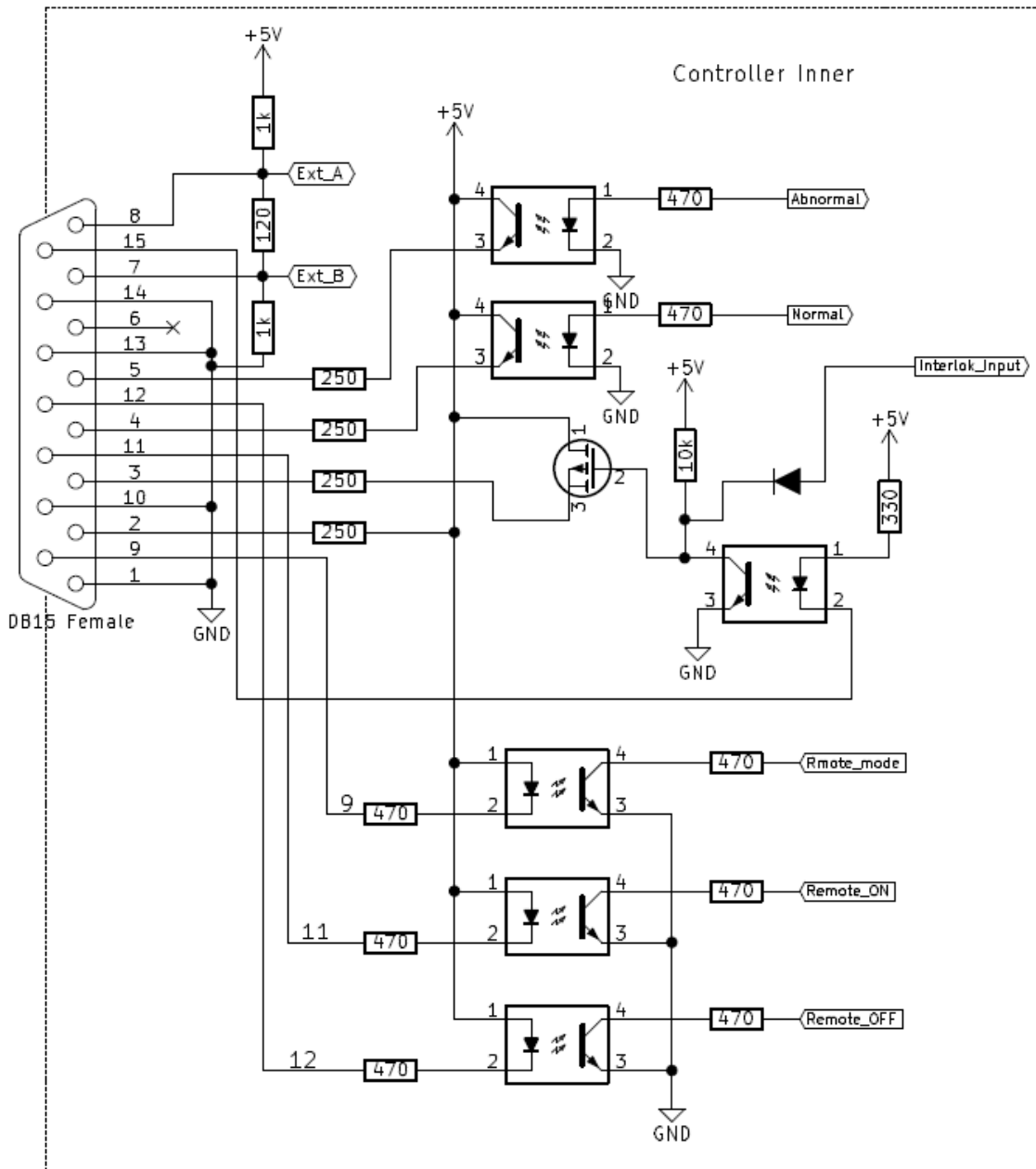
## ■ Controller Rear Panel Signal Input / Output Connections



**D-SUB 15Pin Female (5m I/O Cable Supplied)**

Pin	Connector Pin Name	Details
1	GND	Ground wire
2	POWER	Supplies +5V when the controller power switch is turned on.
3	INTERLOCK ON	Outputs +5V when pin 14 and 15 are closed.
4	NORMAL	Outputs +5V when soft X-ray is being irradiated.
5	ABNORMAL	Outputs +5V when error in the Head is detected.
6	Unused	Unused
7	RS485(-)	485(-) terminal for controlling the controller.
8	RS485(+)	485(+) terminal for controlling the controller.
9	REMOTE SEL	Input signal for selecting the remote mode.
10	REMOTE SEL G	Common ground wire for Remote mode select
11	REMOTE ON	Remote ON input signal.
12	REMOTE OFF	Remote OFF input signal.
13	REMOTE COM	Common ground wire for Remote operation.
14	INTERLOCK G	Common ground wire for Interlock operation.
15	INTERLOCK	Input signal for the Interlock.

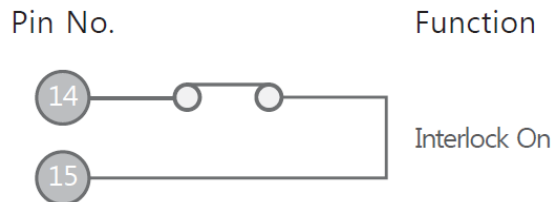
### ■ Signal Input / Output Internal Circuit



## 1) Interlock Input Signal

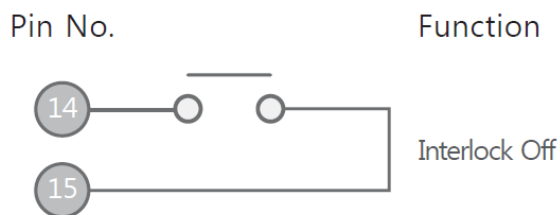
### a) Interlock ON

When the interlock contact connected to D-SUB 14 & 15 are closed, it is ready to irradiate soft X-ray. The Interlock on the front panel of the controller will be lighted in yellow.



### b) Interlock off

When the interlock contact connected to D-SUB 14 & 15 are opened, Run/Stop switch and the remote do not work. The interlock on the front panel of the controller will be turned off.



※ **Warning: If humans are exposed directly to soft X-ray, it could cause damages. Therefore, the interlock must be connected. If the enclosure door is opened during the irradiation of soft X-ray, the interlock terminal will open, and the irradiation of soft X-ray will automatically stop. Once the door is closed again and the Interlock is engaged, X-ray will not be emitted.**

## 2) Remote Input Signal

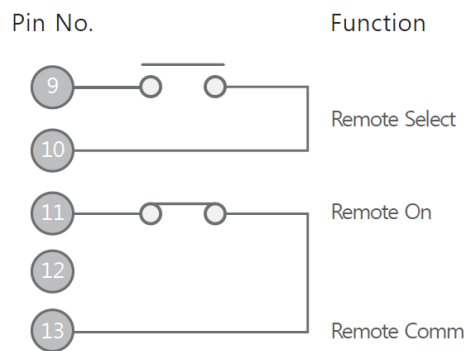
Remotely control the photo ionizer by inputting the control signal from the external (equipment side) to the D-Sub 15pin connector.

- **Control Mode 1: D-SUB 9, 10 Contact Open**
- **Control Mode 2: D-SUB 9, 10 Contact Close**

### a) Control Mode 1 (Momentary)

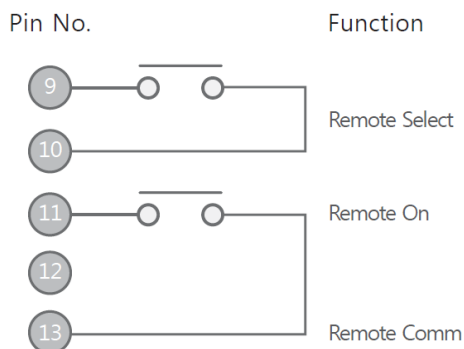
#### ① Remote On

Only irradiates soft X-ray when D-Sub15pin 11 & 13 terminals are closed.



#### ② Remote OFF

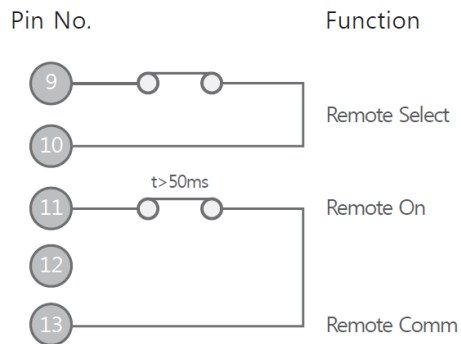
Does not irradiate when D-Sub15pin 11 & 13 switches are opened.



## b) Control Mode 2(Alternate)

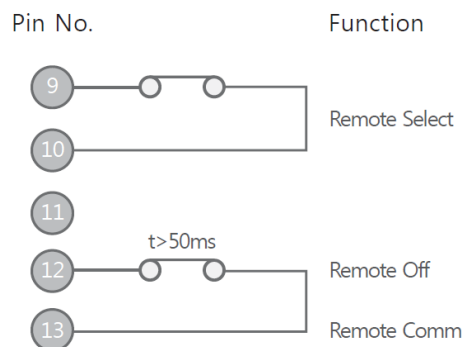
### ① Remote On

Irradiates soft X-ray when D-Sub15pin 11 & 13 terminals are closed for more than 50ms.



### ② Remote OFF

Does not irradiate when D-Sub15pin 12 & 13 terminals are closed for more than 50ms.



## - Remote Operation Procedure

- ① Confirm that the head is installed in the shielded facility and the door with Interlock capability is closed.
- ② Turn on the controller's power switch.
- ③ If the Interlock is closed, the INTERLOCK lamp will be turned on.  
※ Please confirm the proper operation of Interlock by checking the Interlock signal when the door is opened.
- ④ Start the operation by the remote procedure.  
Initiates irradiation when the Remote On signal is inputted to the device

Mode 1 (momentary) by remote control:

Remote on (Dsub 11-13) close at the initial moment of irradiation.

Remote on (Dsub 11-13) close during the desired irradiation ON period.

Remote OFF (Dsub 11-13) open to stop irradiation

Mode 2 (alternate) by remote control:

Remote on (Dsub 11-13) close at the initial moment of irradiation.

Remote OFF (Dsub 12-13) close to stop irradiation

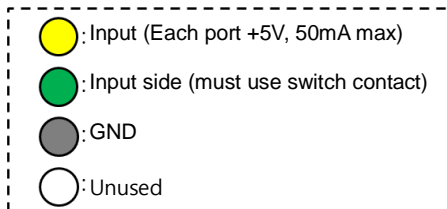
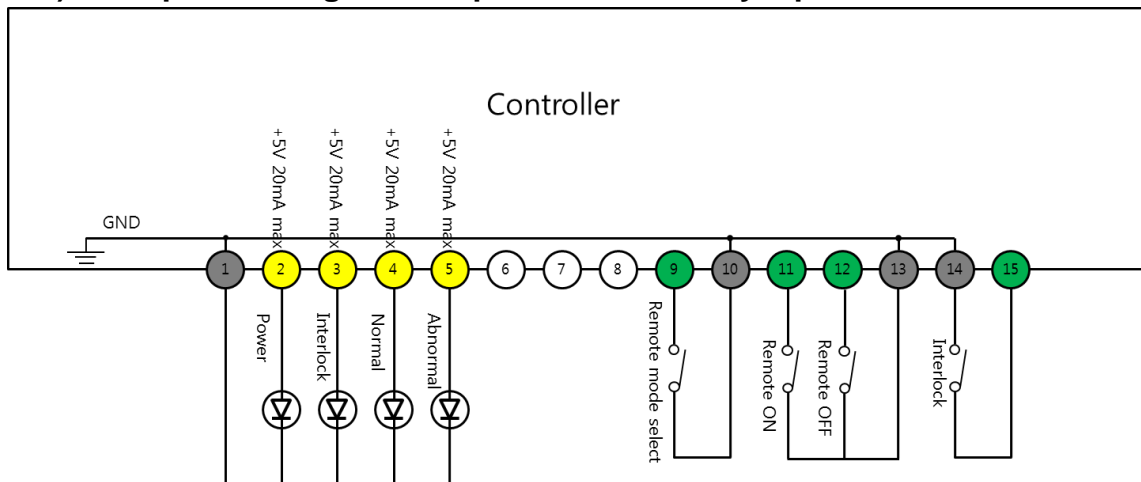
※ **It is recommended to leave the lamp turned on to extend the service life.**

※ **By frequently turning VSH-12Z on and off, it can reduce the lifespan of the product (Do not recommend On/Off within 10 minutes.)**



## ■ Signal Input / Output Operation Examples

### 1) Example of using LED output drive and relay input

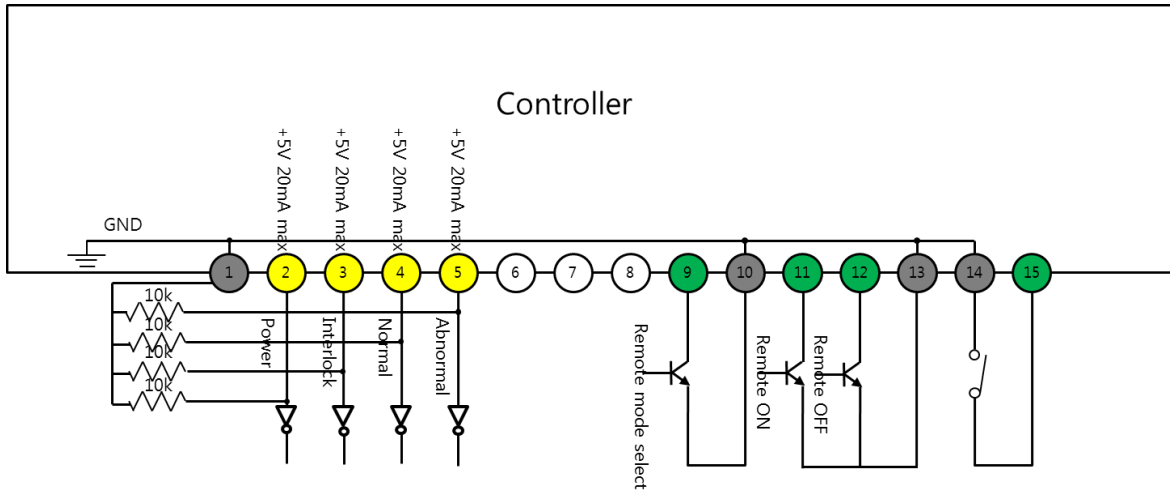


※ Parts may be damaged if external power is applied to the input side.

※ Since the output side current uses a maximum 20mA output, it is necessary to drive the external LED, photo coupler, and TTL semiconductor and use the protection resistance after checking the driving current.

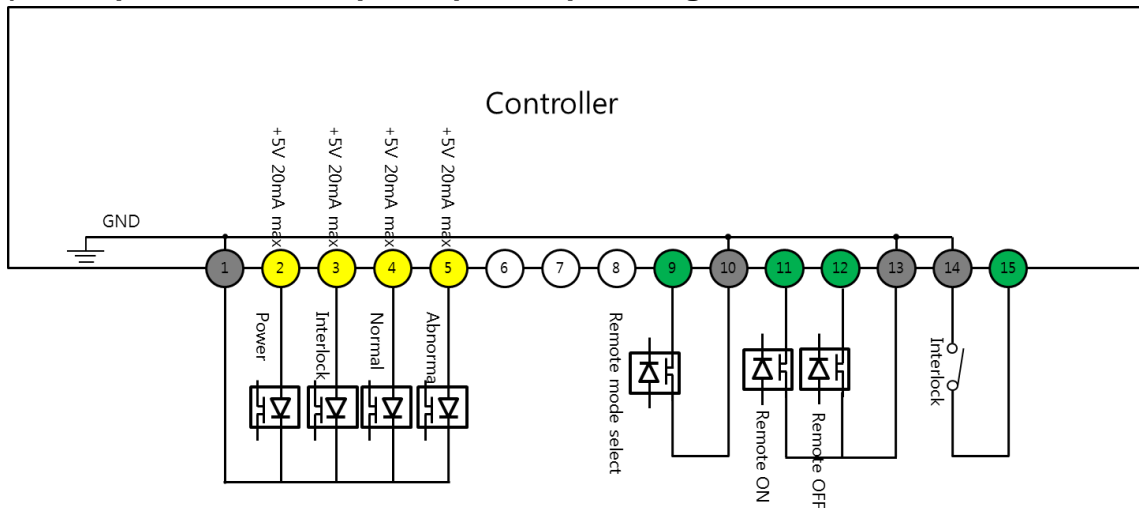
※ Terminal 9, 11, 12 and 15 on the input side can be damaged when the power is supplied.

## 2) Example of using TTL output drive and semiconductor contact input



- ※ Since the output side current uses a maximum 20mA output, it is necessary to drive the external LED, photo coupler, and TTL semiconductor and use the protection resistance after checking the driving current.

## 3) Example of Photocoupler Input/Output Usage



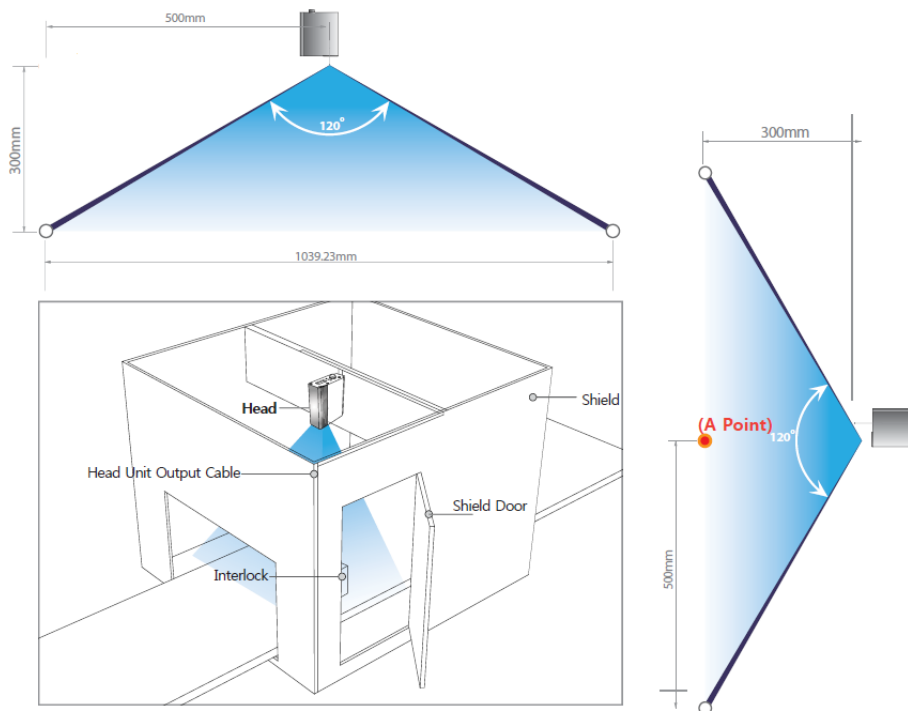
- ※ Since the output side current uses a maximum 20mA output, it is necessary to drive the external LED, photo coupler, and TTL semiconductor and use the protection resistance after checking the driving current.

### 3. Safety Instructions

Head that emits soft X-ray during operation must be shielded for users' safety. Since the shielding rate differs depending on the material, please refer to the following materials to design the shield.

- Shielding 10cm from the front of the X-ray window

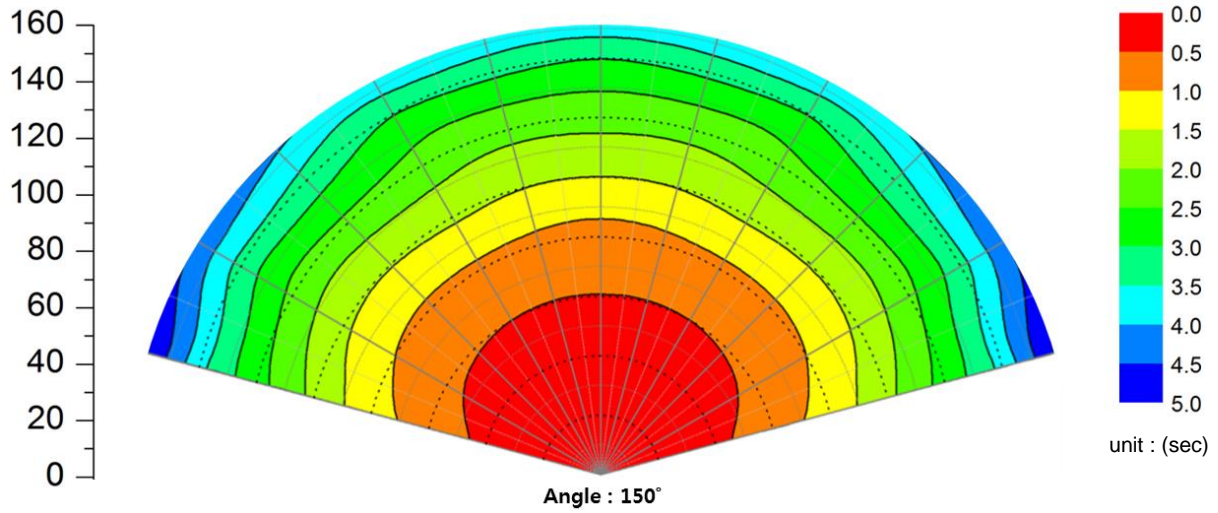
Shielding Material	Thickness [mm]
Stainless steel	0.3
Aluminum	5
glass	7
PVC	6
Acrylic	79



- The above shield thickness design is only suitable when the shield is 10cm away from the source of the X-ray. If the distance is shorter, the thickness must be increased.
- After shielding, the leaked radiation level must be lower than the legal limit ( $10\mu\text{Sv/h}$ ).

## 4. Decay Time

Static electricity removal performance is represented by the time taken to drop the metal plate charged at  $\pm 1000\text{V}$  to  $\pm 100\text{V}$  by irradiating soft X-ray.





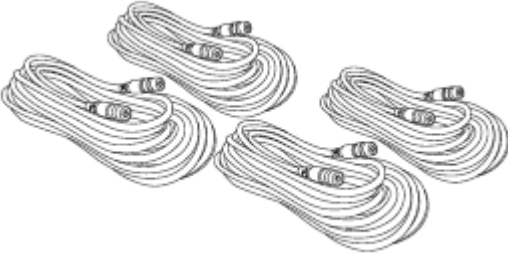
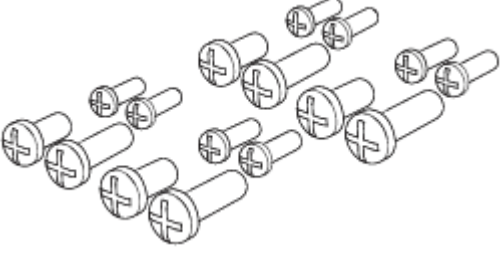
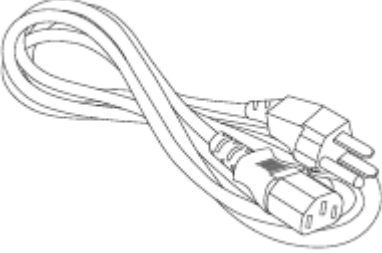
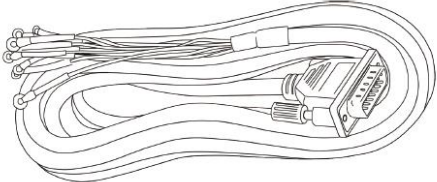
※ Decay Time (when mounted): Top -> Down Irradiation, Based on straight line distance.

## 5. Product Specifications

HEAD	
Dimensions	142.65 x 49 x 65.5 (mm)
X-Ray tube	Tube voltage 12kV Tube
Electron emission	Hot filament type
Weight	586g
LED indicator	Run / Over Time / Alarm

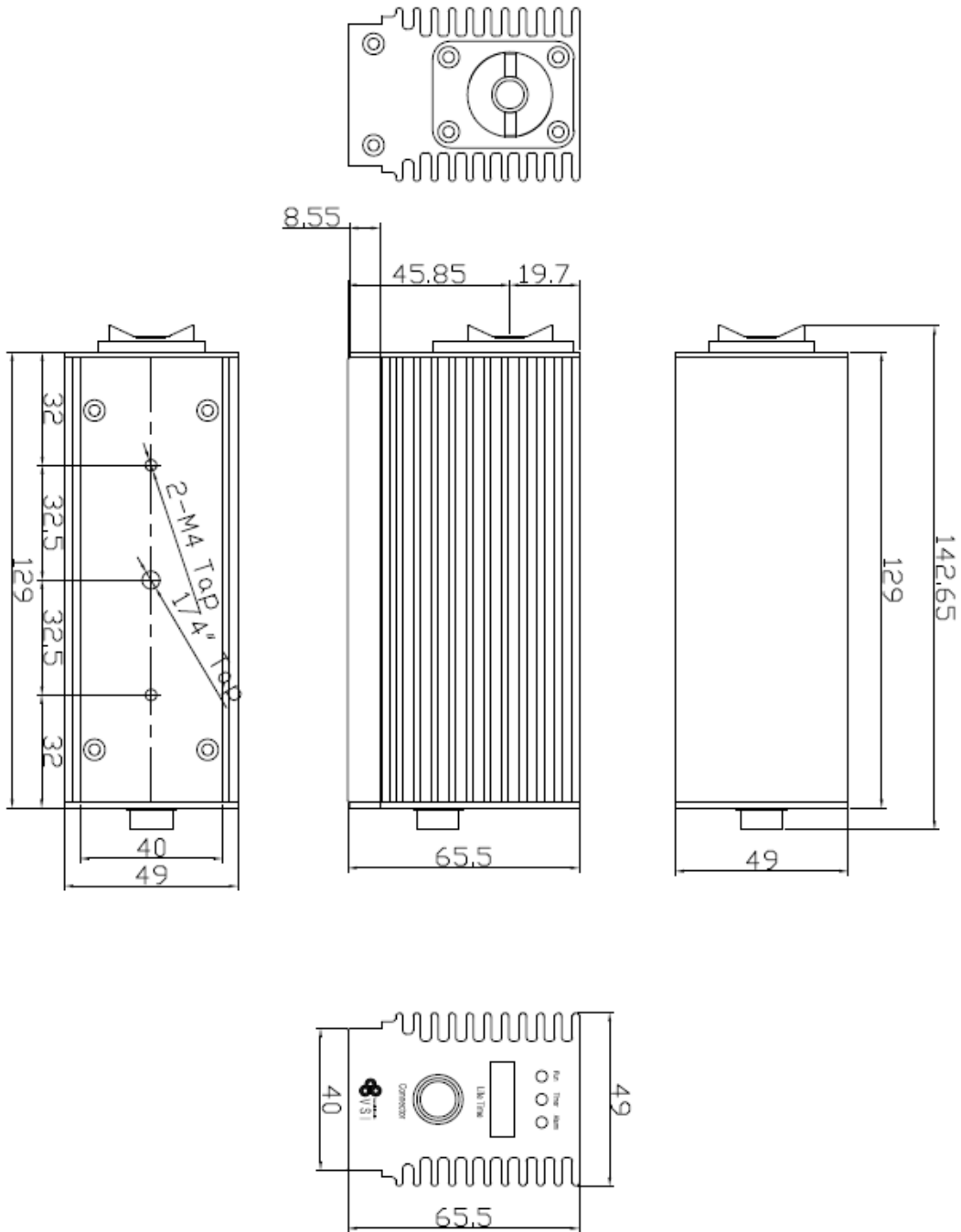
Controller	
Dimensions	214.8x62.5x140.5 mm
Fuse	250V, 3.15A, 1Ø, Glass type
Weight	917g
Power consumption	70W Max
Operating temperature	0 ~ 40°C (32 ~ 122°F), 35 ~ 85% RH
LED indicator	Power / Interlock / Head fail / Remote mode state /RunStop
Functions	Interlock On/Off, Remote On/Off Power on state, Interlock on state, Run state, X-ray tube fail state

## 6. Components Included

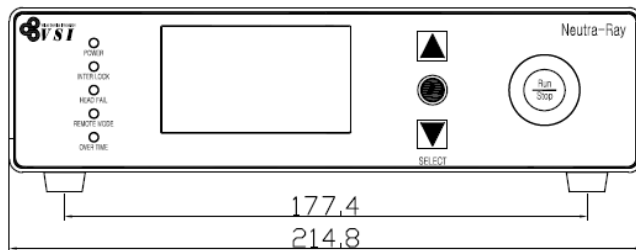
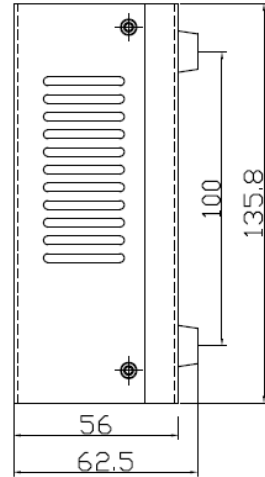
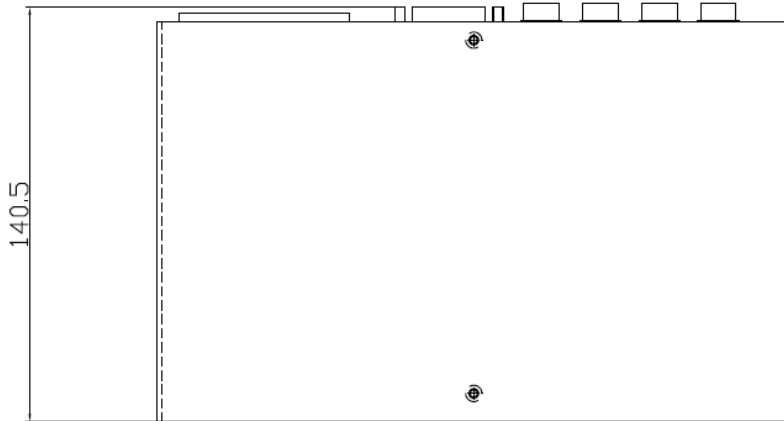
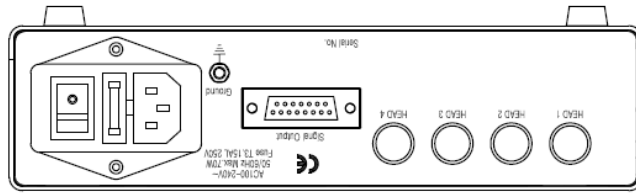
	
<p>Head VSH-12Z / 4ea</p>	<p>1:4 Type Controller VSC-15Z / 1ea</p>
	
<p>Output Cable 15m / 4ea</p>	<p>1/4"-20UNC X 8L / 4ea M4 x 10L / 8ea</p>
	
<p>AC Power Cable 50,60Hz / 1.8m / 1ea</p>	<p>Signal Cable 15Pin D-Sub / 5m / 1ea</p>

## 7. External Dimensions

### ■ Head



■ Controller





## 8. Repair and Troubleshooting

■ Please check the following items prior to requesting the A/S.

Number	Problem	Checklist	Possible Solution
1	Power Indicator does not turn on	Check power cable connection	Connect power cable
		Check correct power supply	Supply correct power
		Check the power switch on the back of the controller	Turn on the power switch on the rear panel of the controller
		Check controller AC inlet fuse breakage	Replace controller AC inlet fuse
2	Interlock Indicator does not turn on	Check D-SUB Interlock contact connection	Connect Interlock contact
		Check Interlock signal line connection	Connect Interlock contact signal
3	Run does not operate (Head X-ray does not irradiate)	Check Interlock indicator	Check interlock contact status
		Check Head connection	Connect Head
		Check Error (Head Fail)	Replace Head
4	Declined static elimination performance	Check GND connection	Connect GND
		Connection status between the Head and the Controller	Correct connection between the head and the controller

■ Please provide the following information to ensure prompt response at the time of the A/S.

1. Operating environment (temperature, humidity, and etc.)
2. Head S/N, usage time and alarm status
3. Controller S/N, indicator light status