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KEYENCE

96M10401

96M10401-3

High-performance Micro Static Eliminator

SJ-M400

Instruction Manual

Before using this Compact Static Eliminator, be sure to thoroughly read this Instruction Manual.
After you are finished with this Instruction Manual, be sure to store it in a safe place for quick reference.



Preface

This document describes handling, method of operation and precautions when using the Compact Spot-type Static Eliminator SJ-M 400 Series. Before you start to use the SJ-M 400 Series, be sure to thoroughly read this document in order to make full use and safely use its functions.
Store this document in a safe place so that you can retrieve it whenever necessary.

■ Symbols

This manual uses the following symbols to alert you to important information.
Be sure to read this information.

⚠ DANGER	**Failure to follow these instructions may lead to death or serious injury.**
⚠ WARNING	**Failure to follow these instructions may lead to injury.**
⚠ CAUTION	**Failure to follow these instructions may lead to product damage (product malfunction, etc.).**
Important	**Provides additional information on precautions and restrictions that must be followed in operation.**
Note	**Provides additional information on proper operation.**

Tip Indicates useful information or information that aids understanding of text descriptions.

Indicates a reference item or page to be referred to in this manual or a separate manual.

Safety Precautions

■ General Precautions

⚠ CAUTION

- **At startup and during operation, be sure to monitor the functions and performance of the SJ-M Series.**
- **We recommend that you take substantial safety measures to avoid any damage in the event that a problem occurs.**
- **Do not modify the SJ-M Series or use it in any way other than described in the specifications. The functions and performance of products used or modified in this way cannot be assured.**
- **When the SJ-M Series is used in combination with other instruments, functions and performance may be degraded, depending on operating conditions and the surrounding environment. Use the SJ-M after fully studying the effect of combined use with other instruments.**
- **Do not use the SJ-M Series for the purpose of protecting the human body.**

■ SJ-M Series Handling Precautions

The SJ-M Series is a high-voltage product that is not designed in an explosion-proof structure. Pay attention to the following when using the SJ-M Series.

⚠ WARNING

- **To prevent electric shock and to ensure accurate static elimination, be sure to connect a Class D ground (maximum resistance of 100 Ohms).**
- **The power cable supplied with the exclusive power supply (SJ-U3) is a 125 V rated power cable. When connecting a power supply that exceeds this power rating to the SJ-M Series, the user must prepare a power cable having adequate voltage rating. If a power cable that does not meet the voltage rating is used, this may cause electric shock, fire or malfunction.**
- **Do not use this product in locations where there is the risk of ignition or explosion from flammable solvents or dirt and dust.**
- **High voltage is applied to this product. Prevent it from being splashed with water, oil, or flammable solvents. Failure to do so may cause insulation breakdown, which will result in electric shock or malfunction.**
- **Do not bring your fingers, tools, wire or other metallic objects near this product. Doing so may cause electric shock or malfunction.**
- **If the SJ-M Series is used in an airtight location, the generated ozone may be harmful. Be sure to ventilate the area when using the SJ-M Series.**
- **Do not use this product in locations where sudden changes in temperature or condensation are likely to occur.**
- **Do not operate this product with wet hands. Doing so may cause electric shock.**
- **Before starting inspection or maintenance, be sure to turn the power OFF. Failure to do so might result in electric shock or malfunction.**
- **During maintenance, do not directly touch the electrode probe. Doing so may cause personal injury.**
- **If any malfunction is observed in this product, immediately turn it OFF, and contact your nearest agent. You should never repair this product yourself. Doing so may cause electric shock or malfunction.**
- **Take soundproofing measures such as wearing earplugs when using the SJ-M Series.**

⚠ CAUTION

- **Do not touch the electrode probe with a tool or other hard object. Damage to the electrode probe will prevent static elimination performance from being fully demonstrated, and cause accidents or malfunction.**
- **When this product is used for a long period of time, the electrode probe become dirty due to the adhesion of dust and dirt. If the ion level alarm indicator or condition alarm indicator lights, clean the electrode probe. If the product is used with the electrode probe in a dirty or dusty state, the static elimination performance can no longer be fully demonstrated, resulting in accidents or malfunction. We recommend periodically cleaning the electrode probe (as a guideline, once every two weeks in a regular operating environment though this depends on the installation conditions).**
- **Do not drop or subject this product to shock. Doing so might result in accident or malfunction.**
- **Use this product for static elimination only. Do not use it for other purposes.**
- **When installing the SJ-M Series, observe the minimum bending radius of all provided cables. Also, do not install the SJ-M with the cables deformed by staples or other objects. Doing so might cause the SJ-M to malfunction.**

■ Power Supply Precautions

⚠ CAUTION

- **Use a DC power supply with rated 24 V output.**
- **Noise applied to the power supply may cause this product to malfunction. If this happens, install an insulated transformer.**
- **When using a switching regulator, be sure to connect a Class D ground to the Frame Ground terminal.**

■ Grounding Precautions

⚠ CAUTION

- **To ensure safety and appropriate static elimination, be sure to ground this product.**
- **Be sure to connect a Class D ground (maximum resistance of 100 Ohms).**

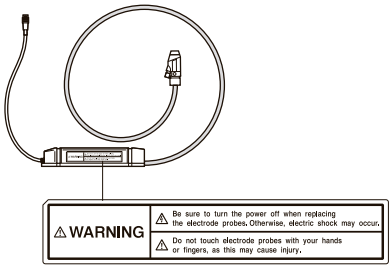
■ Air Purge Function Precautions

⚠ CAUTION

- **Be sure to use an air pressure of 0.7 MPa or less.**
- **Be sure to supply clean or dry air of temperature –20°C or more through a filter of mesh size about 0.01μm. Moisture or oil contained in the air or nitrogen may cause discharge inside the Static Elimination Head, which may result in accidents or malfunction.**

■ SJ-M Series Warning label

A WARNING label is affixed on the SJ-M Series to ensure safety. Read the description on this WARNING label to ensure correct use of the SJ-M Series.



WARNING labels in Japanese, German, French, Italian and Chinese (Simplified) are provided. Use them as necessary.

■ Installation Precautions

CAUTION

Avoid installing the SJ-M Series in the following locations as this may cause accidents.

- **Locations directly subject to vibration and shock**
- **Locations subject to ambient temperature outside of the 0°C to +40°C range**
- **Locations subject to ambient humidity outside of the 35 to 65%RH range (condensation not allowed)**
- **Locations subject to sudden changes in temperature**
- **Locations subject directly to blasts from air conditioners**
- **Locations subject to volatile or flammable substance, solvents or corrosive gases**
- **Locations subject to large amounts of dirt, and dust, salt, iron and oil smoke**
- **Locations that may be splashed with water, oil or chemical mist**
- **Locations where strong magnetic and electrical fields are generated**

■ About Warm-up

Note

After turning the SJ-M Series ON, leave it for about 20 minutes to allow the ion balance to stabilize.

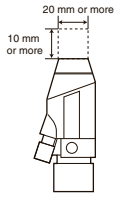
■ Other Precautions

CAUTION

- **Be sure to read the WARNINGS and CAUTIONS described in each of the items in this Instruction Manual.**
- **This Static Eliminator has a built-in EEPROM. Do not turn the Static Eliminator OFF during the setup.**

CAUTION

Install the tip of the SJ-M040 paying attention to the following point.
●Install the Static Elimination Head away from the wall or surrounding objects.



Precautions on Regulations and Standards

■ CE Marking

Keyence Corporation has confirmed that this product complies with the essential requirements of the applicable EC Directive, based on the following specifications.
Be sure to consider the following specifications when using this product in the Member State of European Union.

● EMC Directive

- Applicable standard EMI: EN61326-1 (evaluated according to EN55011 Group 1, Class A)
  EMS: EN61326-1
- Be sure to provide a ground when installing the SJ-M.
- The length of cable (power lead and I/O leads) must be less than or equal to 30m.
- Attach a one-loop ferrite core onto the High-voltage Cable Unit and pass the connector cable once through the core.
- The following ferrite core is recommended:
  SFC-10 made by KITAGAWA INDUSTRIES CO,LTD.

Remarks:
These specifications do not give any guarantee that the end-product with this product incorporated complies with the essential requirements of EMC Directive. The manufacturer of the end-product is solely responsible for the compliance on the end-product itself according to EMC Directive.

● Low-Voltage Directive

- Applicable standard: EN61010-1
- Overvoltage category I
- Use this product under pollution degree 2.
- Use the power supply for the SJ-M Series, that satisfies the requirements of the Limited Power Source specifications stipulated in EN-62368-1 and certified by European third-party certification organization, or a Keyence Corporation AC adapter (SJ-U3). The specifications of the AC adapter (SJ-U3) are as follows.
  When connecting to an SJ-U3, be sure to use a power cable compliant with European standards.
  Applicable standard: EN-62368-1
  Overvoltage category II
  Pollution degree 2
- Be sure to provide a ground when installing the SJ-M Series.

[SJ-U3]
■Output power : 64.8W
■Average active efficiency : 88% or higher
■Efficiency at low load (10%) : 79% or higher
■No-load power consumption : Less than 0.21W

1-1 Features of the SJ-M Series

This section describes an outline of the functions, the features of the SJ-M Series.

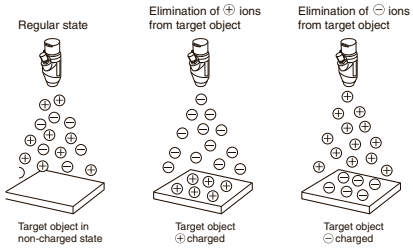
Outline of the SJ-M Series

■ Pulse AC method

The SJ-M Series uses a pulse AC method that generates + and – charged air ions from a single electrode probe. This system ensures a maximum ion level per unit time, which in turn high-speed static elimination. The SJ-M Series also automatically controls the level of + and – ions generated matched to the charged state of the target object. This enables high-speed and high-precision static elimination suited to installation conditions.

■ I.C.C. (Ion Current Control) method

This control method calculates the charged level of the target object by sensing the state of ion current that arises due to the potential difference between the electrode on the Static Elimination Head and GND. Optimum static elimination matched to the state of the target object can be performed by rapidly supplying the optimum ions suited to the polarity and charged level of the target object.



■ Ion monitor functions

● Charge monitor

The integrated ion monitor allows you to learn how much the target object is charged by + or – ions. This monitor also allows you to confirm at a glance how static elimination is being performed.

● Ion level monitor

The ion level currently being generated by the Static Elimination Head is monitored at all times so that drops in the generated ion level can be diagnosed on the unit. The generated ion level is indicated by LEDs and an alarm can be output when the generated ions fall below a certain level. This allows you to monitor the influence of a dirty electrode probe in advance.

"Ion Monitor Functions" (page 8)

■ Alarm output functions

● Alarm output functions

An indicator blinks and an alarm signal is output, for example, when internal circuits are damaged or abnormal discharging occurs. When an alarm signal is output, generation of ions is forcibly stopped.

● Ion level alarm output function

An indicator lights and an alarm signal is output when the level of generated ions drops due to a dirty electrode probe, for example.

● Condition alarm output function

An indicator lights and an alarm signal is output when static elimination performance is impaired.
"Alarm Output Functions" (page 8)

■ Abnormal discharge detection function

Abnormal discharge caused by condensation on the electrode probe tip or adhesion of debris is detected. When abnormal discharge is detected, ion generation is forcibly stopped to prevent trouble at an early stage.
"Abnormal Discharge Detection Function" (page 8)

■ Ion balance adjustment function

The ion balance zero point can be fine-adjusted.
"3. Adjusting ion balance" (page 7)

■ Static elimination stop function

Static elimination can be turned ON/OFF with the device still powered. This is achieved by disconnecting the trigger input and 0V terminals on the Controller Unit (I/O terminal section) or by holding down the two ion-balance adjustment keys simultaneously for about three seconds.
"Static Elimination Stop Function" (page 8)

■ Air purge function

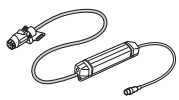
Dirt can be prevented from sticking to the electrode probe on the SJ-M040 by attaching a tube to the air duct and supplying clean or dry air. This also extends the static elimination range.
"Air Purge Function" (page 8)

1-2 Checking the Contents of the Package

The package contains the following components and accessories. Before you start using the SJ-M Series, make sure that the package contains everything that it is supposed to contain. A Replacement Electrode Unit and other accessories are available as options.
"List of Options" (page 12)

Package Contents

Static Elimination Head (SJ-M040)



Controller Unit (SJ-M400)



WARNING labels (Japanese, German, French, Italian and Chinese (Simplified)) *
* Use as necessary.

Earth lead



Instruction Manual



Options

Replacement Electrode Unit for SJ-M040 (OP-84383)



Extension cable SJ-C3

Up to 3 cables can be connected.



AC Adapter SJ-U3



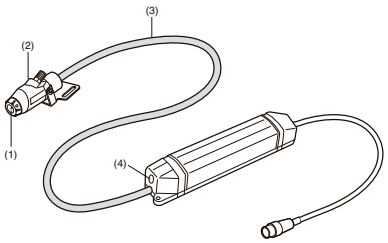
For details of the AC cable, contact the KEYENCE sales office in your district.

1-3 Names and Functions of Parts

This section describes the names and functions of parts on the SJ-M Series.

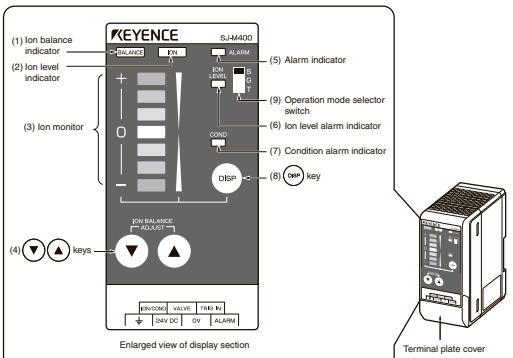
Static Elimination Head

● SJ-M040



(1) Electrode probe
Ion charge is emitted from the tip of this probe.
(2) Mounting fixture
Used to attach the static elimination head.
(3) High-voltage cable
Ambient operating temperature: 0 to +40°C
Minimum bending radius: 30 mm
(4) Drive unit
Operates the static elimination head and manages its setup information.

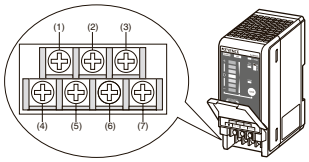
Controller Unit (operation/display section)



Enlarged view of display section

(1) Ion balance indicator ..... Lights when the charged level of the target object is displayed.
(2) Ion level indicator ..... Lights when the ion emission level is being displayed.
(3) Ion monitor ..... Indicates the charged level of the target object. Also, indicates the ion emission level.
(4) ▼ ▲ keys ..... Used for adjusting the ion balance and for selecting setting items.
(5) Alarm indicator ..... Lights when an alarm occurs.
(6) Ion level alarm indicator ..... Lights when the ion emission level has fallen below the set value due to dirt or wear of the electrode probe.
(7) Condition alarm indicator ..... Lights when the charged level of the target object is high and static cannot be completely eliminated.
(8) ↵ key ..... Used for determining setting items and for switching the display.
(9) Operation mode selector switch... Used for selecting the operation mode.

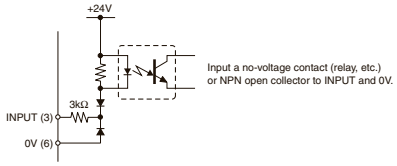
Controller Unit (I/O terminal section)



Number	Name	Function
(1)	Condition/ion level alarm output terminal	Outputs when static elimination performance is influenced by an unstable operating environment or when the ion emission level drops.
(2)	Valve output terminal	Outputs the ON/OFF signal for the valve.
(3)	Trigger input terminal	Static elimination can be turned ON/OFF by shorting this terminal with (6).
(4)	Ground terminal	Be sure to connect a Class D ground (maximum resistance of 100 Ohms).
(5)	DC power terminal	24 VDC ±10%
(6)	0V terminal	0V for power and 0V for I/O
(7)	Alarm output terminal	Outputs when an alarm occurs. (N.C.)

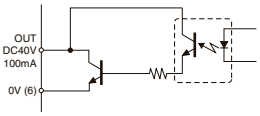
■ Input circuit diagram

[(3) (trigger input)]



■ Output circuit diagram

Open collector output
[(2) (valve output), (1) (condition/ion level alarm output), (7) (alarm output)]

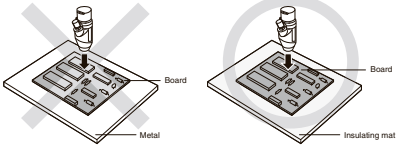


■ Appropriate static elimination method

Pay attention to the following points to ensure that static elimination is performed appropriately.

Static elimination cannot be performed accurately at locations where the target object is touching a metallic body (grounded body).

Eliminate static from the target object at locations where it is not directly touching metallic bodied (grounded body).



Static will be eliminated from only the surface of the insulated body (board, etc.) that is facing the Static Elimination Head.

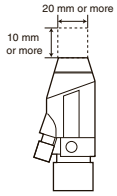
When eliminating static from both sides of a target object, install two SJ-M Series as one SJ-M Series must be installed on either side of the target object.

Note **Install the Static Elimination Head so that it can be easily accessed, for example, for replacement of parts and cleaning.**

Installation Precautions

■ Installation site

CAUTION **Install the tip of the SJ-M040 paying attention to the following point.**
●Install the Static Elimination Head away from the wall or surrounding objects.



2-1 Before Installation

This section describes the static elimination performance of the SJ-M400 Series.
Before you install the SJ-M400 Series, fully calculate the distance between the Static Elimination Head up to the target object and the time required for static elimination.

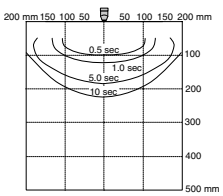
About Static Elimination Performance

The following shows a typical example where static is eliminated from an aluminum plate (20 pF) 150 x 150 mm square charged to +1000 V by the SJ-M400 Series.

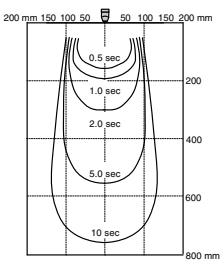
■ Static elimination area

The following graphs show the relationship between the time required for eliminating static from a target object charged between +1000 to +100 V and the distance from the charged object up to the Static Elimination Head.

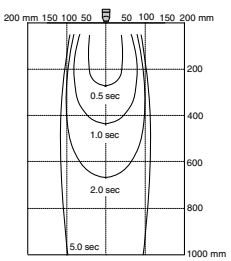
No air



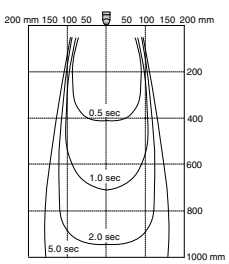
23 Hz Air flow rate 20 Nℓ/min (pressure 0.06 MPa)



23 Hz Air flow rate 60 Nℓ/min (pressure 0.18 MPa)



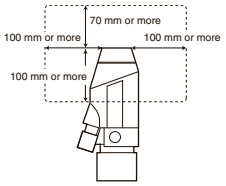
23 Hz Air flow rate 230 Nℓ/min (pressure 0.7 MPa)



■ Interference

The Static Elimination Head may not function properly if there is a conductor (grounded body) located nearby or if two or more units are used close to each other. In such an installation, refer to the figure below and maintain the indicated distance between the conductor (grounded body). If a conductor (grounded body) is located inside the distances indicated below, adjust using the ion balance manual setup.

"3. Adjusting ion balance" (page 7)



When two SJ-M Series units are used, refer to the figures below, and install the units so that the following distances are maintained between the two Static Elimination Heads.



2-2 Connection and Installation

This section describes how to connect and install the Static Elimination Head and Controller Unit.

Installing the SJ-M Series

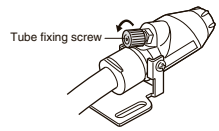
Install the SJ-M Series at locations where static electricity is generated or is likely to be generated.

■ Installing the air supply tube

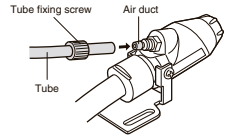
To use the air purge function, install an air supply tube to the air duct before securing the static elimination head.

"Air Purge Function" (page 8)

1 **Remove the tube fixing screw.**
Turn the tube fixing screw attached at the air duct of the static elimination head with your fingers to remove it.

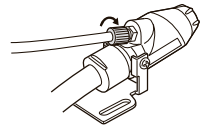


2 **Connect the air supply tube to the air duct.**
Pass the tube through the tube fixing screw and then attach it completely to the air duct.



Note **Use Nylon or Urethane tube with a 6-mm outer diameter and 4-mm inner diameter as the air supply tube.**

3 **Secure the tube to the air duct with the tube fixing screw.**
Tighten the tube fixing screw securely with your fingers.

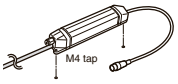


CAUTION

- **Be sure to limit the air pressure to 0.7 MPa. Exceeding this limit may cause accidents or malfunction.**
- **Be sure to use clean air, dry air as the air for supplying to the Static Elimination Head. Moisture or oil contained in the air or nitrogen may cause discharge inside the Static Elimination Head, which may result in accidents or malfunction.**

■ How to install the drive unit

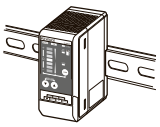
Prepare mounting holes where the drive unit is being installed. Use M4 screws for installation. (Tightening torque: 1 Nm or less)
The screws for installing the drive unit must be prepared separately.



CAUTION **Make a space of 30 mm or more around the drive unit. Otherwise, the unit may be damaged.**

■ Installing the Controller unit

Mount the Controller Unit on the DIN rail.

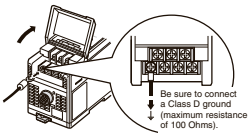


Connecting Cables

When you have finished installing the Static Elimination Head, connect the ground lead, Static Elimination Head connector cable and power supply.

■ Connecting the ground lead

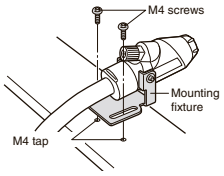
Open the terminal plate cover on the Controller Unit, and connect the ground lead to the GND connection terminal.
Be sure to connect a Class D ground (maximum resistance of 100 Ohms).



WARNING **To prevent electric shock and to ensure accurate static elimination, be sure to connect a Class D ground (maximum resistance of 100 Ohms).**

■ Installing the Static Elimination Head

Adjust the angle of the static elimination head to ensure proper installation. Tap M4 screw holes at appropriate locations and secure the mounting fixture with M4 screws.

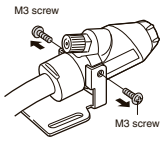


CAUTION **When installing the SJ-M Series, observe the minimum bending radius of all provided cables. Also, do not install the SJ-M Series with the cables deformed by staples or other objects. Doing so might cause the SJ-M Series to malfunction**
When bending the cable frequently with the SJ-M Series in Gun mode, make the cable's bending radius at least 5 times larger than the minimum bending radius.
This value does not guarantee limitless number of bending times.

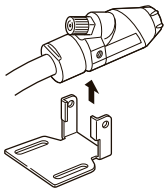
■ Detaching the mounting fixture from the head

The mounting fixture can be detached from the static elimination head.

1 **Remove the M3 screws from the static elimination head.**
Unscrew the M3 screws on both sides of the static elimination head with a Phillips screwdriver to remove them.



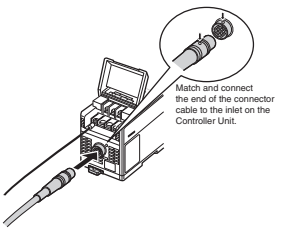
2 **Detach the mounting fixture from the static elimination head.**



Note **Keep the removed M3 screws and mounting fixture safe so that they don't get lost.**

■ Connecting the cable

Connect the Static Elimination Head connector cable to the Controller Unit. Connect this cable with the power turned OFF.
When installing the Controller Unit away from the Static Elimination Head, use the optional extension cable (SJ-C3). Up to 3 cables can be connected.

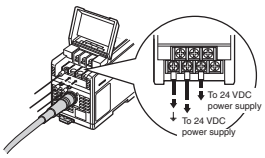


■ Connecting the power supply

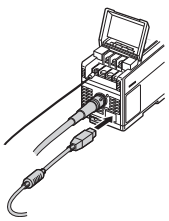
Connect the power supply according to either of the following methods.

24 VDC power supply
Connect a 24 VDC output power supply having sufficient power capacity margin to the power terminals (terminals (5) and (6))

"Controller Unit (I/O terminal section)" (page 4)



AC adapter (SJ-U3)
Connect the AC adapter to the connector on the side of the Controller Unit.
The AC adapter is available as an option.



3-1 SJ-M Series Operations

This section describes the setting and operation of the SJ-M Series.

Setup Overview

A brief overview of the setup procedure for the SJ-M Series is provided below.

Operation mode selection

1. Operation mode selection
Select an operation mode.Select the operation mode using the operation mode selector switch.

Settings adjustment

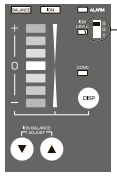
2. Settings adjustment
Change the settings for the SJ-M400.

Ion balance adjustment

3. Ion balance adjustment
The zero point, the point for reference for the I.C.C. function, can be adjusted.
(* The zero point should only be adjusted when necessary.)

1. Selecting an operation mode

Operation mode Use the operation mode selector switch to change the operation mode.



S SPOT MODE
G GUN MODE
T TEST MODE

SPOT MODE — This mode is used to continuously perform static elimination by installing the static elimination head within a device.
The valve output of the terminal (2) turns ON/OFF while the terminals (3) and (6) are shorted out.
"Timing Charts" (page 10)
Static elimination is turned ON/OFF in the cycle specified in the "Valve control frequency setting".

GUN MODE — This mode is used to frequently turn ON/OFF static elimination by installing the static elimination head within an air gun.

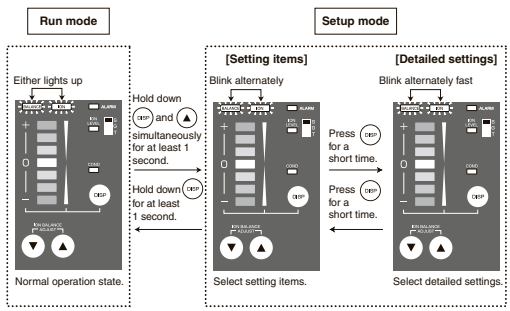
TEST MODE — This is the output terminal test mode. Alarm signals such as ion level alarm and condition alarm signals are output and static elimination stops.

* Switching the operating mode will reboot the SJ-M Series.

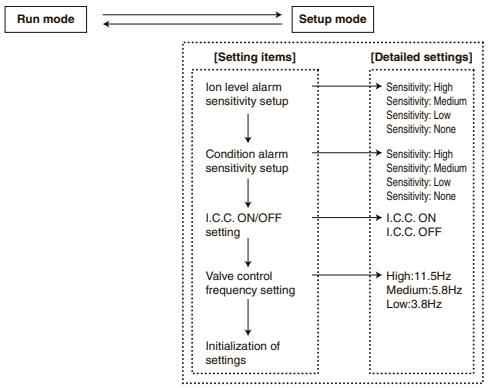
2. Changing settings

■ Setting adjustment overview

This section provides details regarding settings and a brief overview of the setup procedure used for changing operation modes on the SJ-M Series.



Setting items



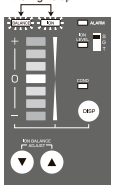
■ Procedure for changing settings

The procedure for changing settings for the SJ-M Series is as follows.

1 **Check that the unit is in Run mode.**

Tip Either "BALANCE" or "ION" lights up.

Either lights up

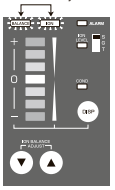


[Run mode]

2 **Hold down DISP and ▲ for at least one second to enter setting item selection in Setup mode.**

Tip "BALANCE" and "ION" blink alternately.

Blink alternately



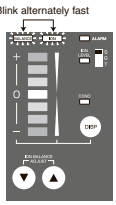
[Setup mode]

3 **Press ▲ or ▼ to select the item to be set.**
For details on items, see "Setting items" on page 7.

4 **Press DISP to select detailed Setup mode settings for adjustment.**

Tip "BALANCE" and "ION" blink alternately fast.

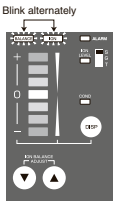
Blink alternately fast



[Setup mode]

5 **Press ▲ or ▼ to select the item to be set.**
For details on items, see "Setting items" on page 7.

Blink alternately

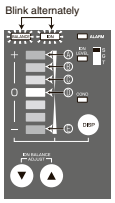


[Setup mode]

6 **Press DISP to return to setting item selection in Setup mode.**
To change other items, repeat the procedure from steps 4 to 6.

7 **Hold down DISP for at least one second to return to Run mode.**
Setting adjustment is now complete.

Setting items
Monitor positions for setting items are as follows.



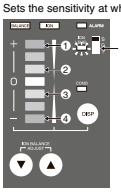
The following describes each of the items in the Select mode:

Ⓐ : Ion level alarm, sensitivity setting
Ⓑ : Condition alarm, sensitivity setting
Ⓒ : I.C.C. ON/OFF
Ⓓ : Valve control frequency setting
Ⓔ : Initialization of settings

Detailed settings
Monitor positions for detailed settings of setting items are as follows.

Ⓐ Ion level alarm sensitivity setup

Sets the sensitivity at which the ion level alarm is output.

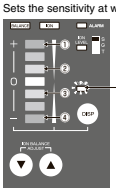


(1) High sensitivity (red): Alarms are easily output.
(2) Medium sensitivity (orange):
(3) Low sensitivity (green): Alarms are not easily output.
(4) No sensitivity (red): Alarms are not output.

Tip Default is "Low sensitivity."
"Ion level alarm output function (ION LEVEL)" (page 8)

Ⓑ Condition alarm sensitivity setup

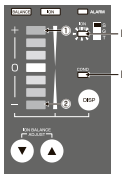
Sets the sensitivity at which the condition alarm is output.



(1) High sensitivity (red): Alarms are easily output.
(2) Medium sensitivity (orange):
(3) Low sensitivity (green): Alarms are not easily output.
(4) No sensitivity (red): Alarms are not output.

Tip Default is "Low sensitivity."
"Condition alarm output function (COND)" (page 8)

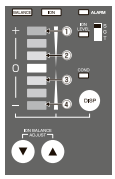
Ⓒ I.C.C. ON/OFF setting



Advance to the I.C.C. ON/OFF setting from the Select mode, and select either of the followings.
(1) I.C.C. ON (green) (Default)
(2) I.C.C. OFF (red)

Important **When I.C.C. is off, the ion level alarm is not judged correctly. The ion level monitor display is disabled.**

Ⓓ Valve control frequency setting

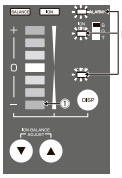


(1) High (green) : 11.5 Hz
(2) Medium (green) : 5.8 Hz
(3) Low (orange) : 3.8 Hz
(4) DC (orange) :

Tip The default setting is DC.

Ⓔ Initialization of settings

Returns settings to their defaults.



(1) Press ▼, ▲ or DISP for a short time mode without initializing the settings. :Returns to the Select
(2) Hold down DISP for at least 1 second :Initializes the settings and returns to the Select mode.

Tip When settings are initialized, the ion monitor indication moves towards both ends of the display.

CAUTION **Ion balance adjustment is not initialized. Return ion balance to its default setting from Ion Balance Adjustment mode.**

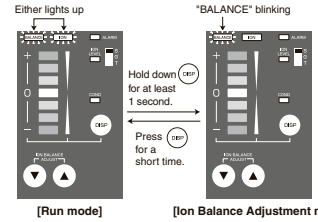
3. Adjusting ion balance

The SJ-M Series automatically senses the charged level of the target body by the I.C.C. function to automatically control the generated amount (balance) of plus and minus ions.
The zero point, the point for reference for the I.C.C. function, is adjusted before the SJ-M Series is shipped from the factory. However, in some environments, the zero point sometimes drifts. If this reference zero point drifts, adequate static elimination cannot be maintained. For this reason, you can adjust the SJ-M Series to the desired zero point.

In Ion Balance Adjustment mode, you can adjust the zero point, the point for reference for the I.C.C. function.

CAUTION **Do not turn the power OFF while the ion balance is being adjusted (while the ion balance indicator is blinking fast).**

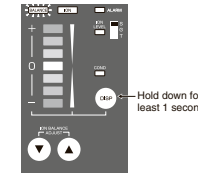
■ Ion balance adjustment overview



Tip The unit starts up in the Run mode after the power is turned ON or after static elimination is stopped.

■ Setting the ion balance

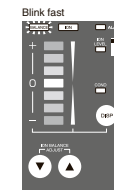
1 **Hold down DISP for at least one second to enter the Ion Balance Adjustment mode.**
The ion balance indicator blinks.



2 **Set the ion balance using ▼ ▲.**
The LED on the ion monitor corresponding to the set value lights up.

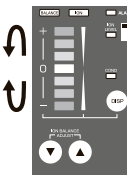
Key	Function
▲	Shifts the zero point in the + direction.
▼	Shifts the zero point in the – direction.

3 **Press DISP to end ion balance setup.**
The mode changes to the Run mode.
After the setting, the ion balance indicator will blink fast for up to 3 min, indicating that the settings are being saved in the memory.



Note **After you have finished setting up the ion balance, do not change the ambient environment while the ion balance indicator is blinking fast. If you do, the zero point sometimes cannot be set accurately.**

Note **Holding down DISP for about 1 second when setting the ion balance clears the preset ion balance zero point and returns the ion balance to its default setting.**



During this operation, the ion monitor indicatio moves towards both en of the display.

3-2 Ion Monitor Functions

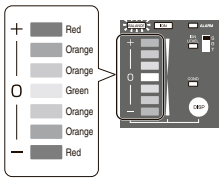
This section describes the ion monitor functions of the SJ-M Series.
Ion monitor functions are enabled in the Run mode.

Ion Monitor Functions

The charged level of the target object and the level of ions generated from the static elimination head are indicated on the ion monitor.
The ion monitor indication can be switched by (↵).

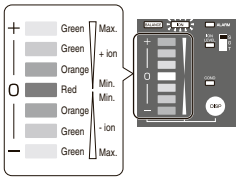
■ Charge monitor BALANCE

This monitor indicates the charged and decharged states of the target object.
The indication of this monitor fluctuates towards the + and – sides according to the charged level. The further the indication is away from the center LED, the larger the charged level. When static elimination is completed, the indication returns to the center LED so that you can easily tell how static elimination is progressing.
The ion balance indicator lights when the charge monitor is operating.



■ Ion level monitor ION

This monitor indicates the level of ions being generated by the Static Elimination Head.
The level of plus ions being generated is indicated on the upper side, while the level of minus ions is indicated on the lower side. The further the indication is away from the center LED, the larger the level of ions. In a state where ions are being sufficiently generated, both ends of this monitor light (green).
The ion balance indicator lights when the ion level monitor is operating.



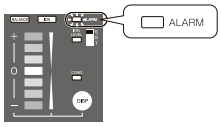
3-3 Alarm Output Functions

This section describes the alarm output functions of the SJ-M Series.

Alarm Output Functions

■ Alarm output function (ALARM)

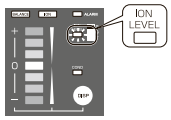
The alarm indicator blinks (red) and an alarm signal (control output (N.C.)) is output, for example, when internal circuits are damaged or abnormal discharging occurs. When an alarm signal is output, static elimination is forcibly stopped.
Alarm output turns ON even in a static elimination stopped state (including forced static elimination stop).



■ Ion level alarm output function (ION LEVEL)

The ion level alarm indicator lights and an alarm signal (control output (N.O.)) is output when the level of generated ions drops due to a dirty or worn electrode probe, for example. When an alarm signal is output, static elimination is not stopped.
Alarm output can be adjusted in three stages according to the level of ions generated.
The default setting for the ion level alarm sensitivity setting is Low.
The ion level alarm serves as a guideline for learning when to perform maintenance on the electrode probe. As static elimination is continued, be sure to turn the power OFF before starting maintenance on the electrode probe.
The ion level alarm output function is enabled in the Run mode.

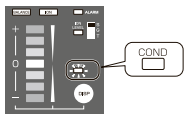
"Ion level alarm sensitivity setup" (page 7)



■ Condition alarm output function (COND)

The condition alarm output indicator lights and an alarm signal (control output (N.O.)) is output when static elimination performance is influenced by an excessive charge on the target object. When an alarm signal is output, static elimination is not stopped.
Alarm output can be adjusted in three stages according to the installation environment. The default setting for the condition alarm sensitivity setting is Low.
The ion level alarm output function is enabled in the Run mode.

"Condition alarm sensitivity setup" (page 7)



3-4 Other Functions

This section describes the abnormal discharge detection and static elimination stop functions of the SJ-M Series.

Abnormal Discharge Detection Function

To prevent trouble, the generation of ions is stopped when abnormal discharging caused by condensation on the electrode probe tips or adhesion of debris, for example, is detected. At this time, the alarm indicator and ion monitor blink to inform you that an abnormality has occurred. For details of the indicated state on the Controller Unit (operation/display section), see "During an alarm (level 2)" (page 12).

Static Elimination Stop Function

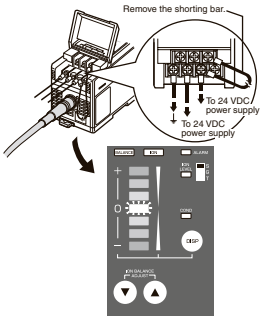
You can turn off only static elimination while leaving the unit in a powered-on state by disconnecting the trigger input and 0 V terminals on the Controller Unit (I/O terminal section), or by holding down (▼) (▲) on the Controller Unit simultaneously (operation/display section) for about three seconds.
When static elimination stop input has been performed on the Controller Unit (operation/display section), this state can be canceled by holding down (▼) (▲) simultaneously for about three seconds.
For details on indication states on the Controller Unit (operation/display section) when static elimination stop input is canceled, see "Static elimination stop input (operation/display section)" (page 12).

■ Stopping static elimination

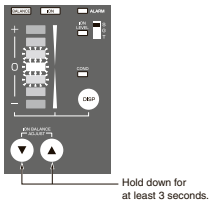
Static elimination is stopped by either of the following methods.

By operation on the Controller Unit (I/O terminal section):
Disconnect the trigger input and 0 V terminals to stop static elimination.
The center LED of the ion monitor blinks (red).

"Controller Unit (I/O terminal section)" (page 4)



By operation on the Controller Unit (operation/display section):
Hold down (▼) (▲) simultaneously for about three seconds to stop static elimination.
The three center LEDs of the ion monitor blink (red).



Air Purge Function

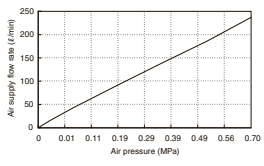
Dirt can be prevented from sticking to the electrode probe by supplying clean or dry air from the air duct of the static elimination head. This also extends the static elimination range.
* The pressure value at the neck of the air duct is indicated as the air pressure.
Use clean air or dry air of temperature –25°C, and of mesh size of about 0.01 µm.

CAUTION

- **Be sure to limit the air pressure to 0.7 MPa. Exceeding this limit may cause accidents or malfunction.**
- **Be sure to use clean air, dry air as the air for supplying to the Static Elimination Head. Moisture or oil contained in the air or nitrogen may cause discharge inside the Static Elimination Head, which may result in accidents or malfunction.**

■ Relationship between air press and flow rate

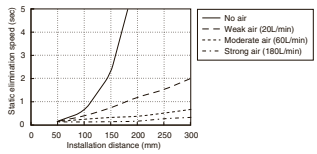
The figure on the right shows the relationship between the flow rate and pressure of the supplied air.
Select an air compressor having sufficient flow rate capacity referring to this figure.



■ Relationship between installation distance and static elimination speed according to air flow rate

The relationship between static elimination speed and installation distance between the Static Elimination Head varies according to the air flow rate.
Select an air supply flow rate referring to the typical example on the right.

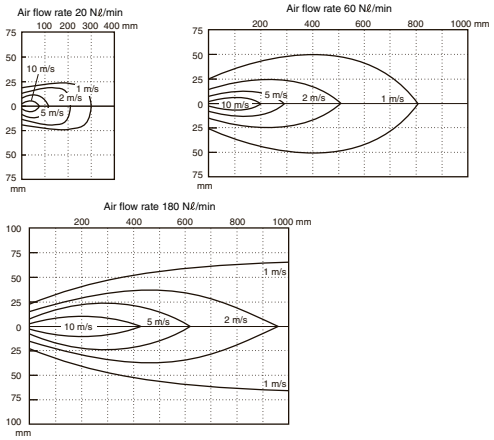
Measurement conditions:
Static elimination time in ±1000V to ±100V range
150 mm x 150 mm plate monitor (20 pF) used



WARNING **Take soundproofing measures such as wearing earplugs when using the air purge function.**

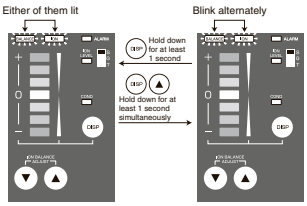
■ Relationship between installation distance and wind speed according to air flow rate

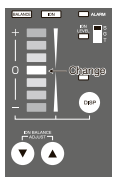
The relationship between wind speed and static elimination head installation distance varies according to the air flow rate.
Adjust the air supply flow rate referring to the following figures.



I.C.C. Setting

The I.C.C. (Ion Current Control) can be turned on and off.
Turning off the I.C.C. allows the ion balance adjustment function to generate positive and negative ions at a fixed ratio.

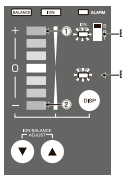




Change the 3rd LED from the top in the Select mode.

DISP Press for a short time	: advances to the Setup mode of the selected item
DISP Hold down for at least 1 second	: exits the Select mode and returns to the Run mode
▼ ▲	: moves the cursor up and down

On the ion monitor, the currently selected items are lit in green and the items whose default have been changed are lit in red.
I.C.C. is set at ON by default setting.
Items that satisfy both of these conditions blink in red and green alternately.



Advance to the I.C.C. ON/OFF setting from the Select mode in page 7, and select either of the followings.
(1) I.C.C ON (green) (Default) .....I.C.C. ON
(2) I.C.C. OFF (red) .....I.C.C. OFF

Important **Select an appropriate nozzle according to the head. Incorrect setting may cause accidents or malfunction. When the I.C.C. ON/OFF setting is selected, the ion level alarm will not be output correctly.**

4-1 About Maintenance

Maintenance must be performed periodically to ensure that the static elimination performance of the SJ-M Series is fully demonstrated. Maintenance personnel should thoroughly read the descriptions under "Safety Precautions" (page 1), and perform maintenance paying attention to the following points.

About Maintenance

WARNING

- **The SJ-M Series uses high voltage. Before starting maintenance, be sure to turn the power OFF. Failure to do so might result in electric shock or malfunction.**
- **Do not directly touch the electrode probe. Take care not to touch these probes even if the power is turned OFF. Directly touching these probes may cause personal injury.**



When the SJ-M Series is used for a long period of time, the electrode probe becomes dirty due to the adhesion of dust and dirt.
If the ion level alarm indicator lights, clean the electrode probe. If the electrode probe is used in a dirty or dusty state, static elimination performance can no longer be fully demonstrated, resulting in accidents or malfunction. We recommend periodically cleaning the electrode probe (as a guideline, once every two weeks in a regular operating environment though this depends on the installation conditions).
If cleaning the electrode probe does not improve the static elimination performance, or the ion level alarm indicator frequently lights, replace the electrode probe.

4-2 Performing Maintenance on the Electrode probe

When the SJ-M Series is used for a long period of time, the electrode probe becomes dirty due to the adhesion of dust and dirt.
If the electrode probe is used in a dirty or dusty state, static elimination performance can no longer be fully demonstrated, resulting in accidents or malfunction. Be sure to periodically perform maintenance on the electrode probe.

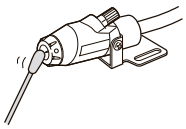
Performing Maintenance on the Electrode probe

WARNING

- **Before removing the Electrode Unit, turn the SJ-M Series OFF.**
- **Do not directly touch the electrode probe with your hands. Doing so may cause personal injury. Pay attention to this when performing maintenance on the electrode probe.**

■ How to clean the electrode probe

Clean the electrode probe gently with a cotton wool bud moistened with alcohol.



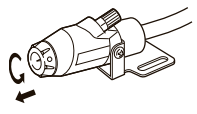
Note **If the electrode probe is difficult to reach, remove the probe from the head and clean it.**

■ Replacing the electrode probe

If cleaning the electrode probe does not improve static elimination performance, or if the ion level alarm indicator ligts frequently, replace the electrode probe.
An optional tungsten electrode probe (black) (OP-84383) is available.

● How to remove and install the electrode probe

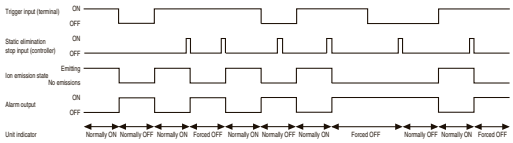
Hold the plastic section of the electrode probe and turn it counterclockwise to remove it. Then, turn it clockwise to install it.



5-1 Timing Charts

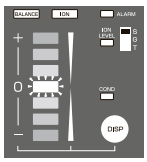
This section provides timing charts for SJ-M Series.

■ Ion generation control timing chart

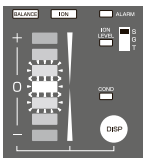


Indicator states when static elimination is OFF

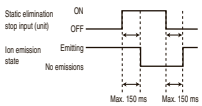
Normal static elimination OFF
<during static elimination stop input (terminal)>
- In Spot mode
  The center LED of the ion monitor blinks (red).
- In Gun mode
  The state that was active before the power was turned OFF is displayed.



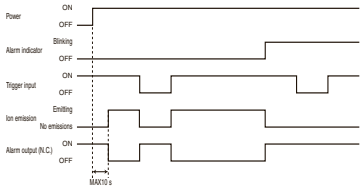
Normal static elimination OFF <during static elimination stop input (controller)>
The three center LEDs of the ion monitor blink (red).



■ Input response timing chart



■ Alarm output timing chart

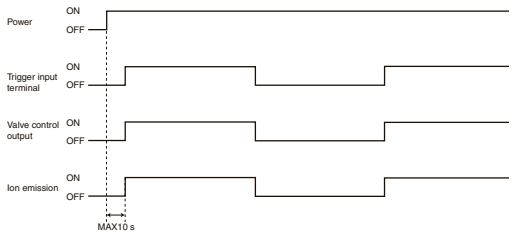


When the alarm is output, the normal state can be restored by performing one of the two available restore methods depending on the cause of alarm output.

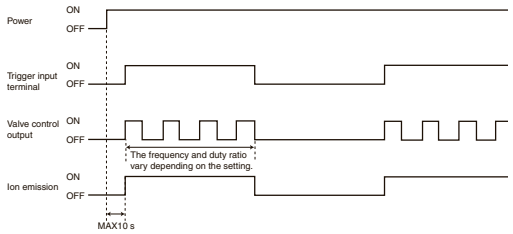
For details on how to restore the normal state, see "During an alarm (level 2)" (page 12).

■ Valve output timing chart

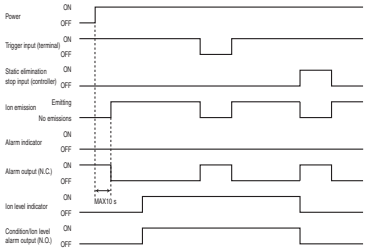
(1) When the valve control frequency is DC



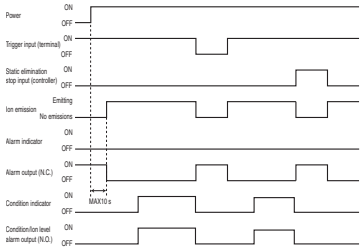
(2) When the valve control frequency is other than DC



■ Ion level alarm output timing chart (GUN MODE)



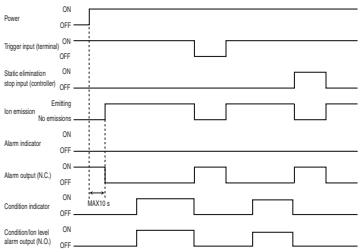
■ Ion level alarm output timing chart (SPOT MODE)



When the ion level alarm is output, remove the cause of the alarm. After that, you can restore the normal state by stopping static elimination or by turning the power OFF and then ON again. One way of restoring the normal state is to perform maintenance on the electrode probe.

For details on electrode probe maintenance, see "Performing Maintenance on the Electrode probe"(page 9).

■ Condition alarm output timing chart



When the condition lalarm is output, removing the cause of the alarm can restore the normal state. One way of restoring the normal state is to improve the installation environment.

5-2 Specifications

This section provides the specifications of the SJ-M400 Series.

■ Static Elimination Head/Controller Unit

Model	Controller Unit	SJ-M400
	Static Elimination Head	SJ-M040
Voltage application method		Pulse AC
Applied voltage		±5.5 kV
Rated output voltage		±6 kV
Ion balance control method		I.C.C. method
Ion balance		±30 V or less*1
Max. air pressure		0.7 MPa
Air supply tube		Outer diameter: 6 mm, Inner diameter: 4 mm
Control input	Trigger input	No-voltage input
Control output	Alarm output	NPN open collector 100 mA 40 V or less
	Ion level/Condition alarm output	
	Valve control	
Major functions		Condition alarm output, ion level alarm output, alarm output, ion balance adjustment, air valve control
Rating	Power voltage	24 VDC ±10%
	Current consumption	450 mA max.
Environmental resistance	Operating ambient temperature	0 to +40°C
	Operating ambient humidity	35 to +65%RH (condensation not allowed)
Weight	Static Elimination Head	Approx. 650 g
	Controller Unit	Approx. 300 g

*1 At a distance of 150 mm without using air purge.

■ AC Adapter

Model		SJ-U3
Rating	Rated input	100 to 240 VAC (50/60 Hz)
	Rated output	24 VDC 2.7 A
Environmental resistance	Operating ambient temperature	0 to +35°C
	Operating ambient humidity	20 to 80% (condensation not allowed)
Weight		Approx. 260 g

* The AC cable is for domestic use only (voltage rating 125 V).

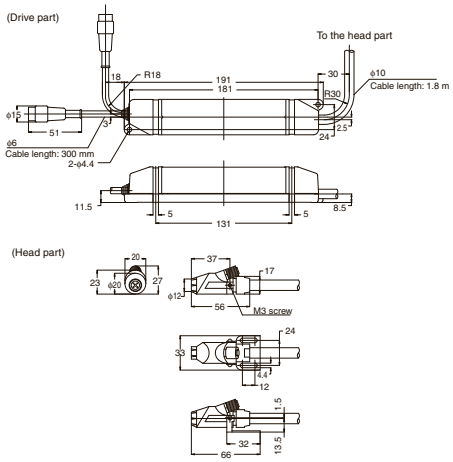
5-3 External Dimensions

This section presents the external dimensions of the SJ-M Series.

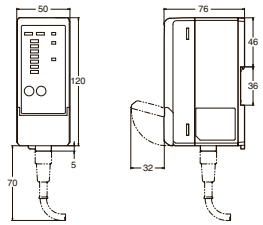
■ Body

Static Elimination Head

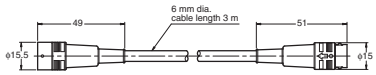
SJ-M040



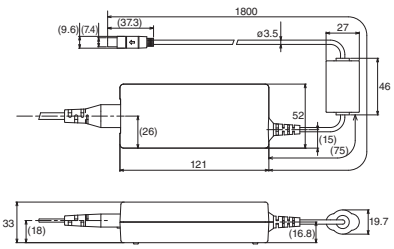
Controller Unit SJ-M400



■ Extension cable (SJ-C3)



■ AC adapter (SJ-U3)



* For details of the AC cable, contact the KEYENCE sales office in your district.

1 Troubleshooting

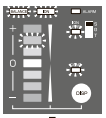
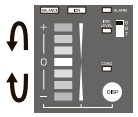
This appendix describes trouble that may occur during use of the SJ-M Series and how to remedy this trouble. Check the following table before sending in your SJ-M Series for repair.

Symptom	Check Item	Remedy
No indication on ion monitor	Is the power cable connected properly?	Connect the power cable correctly.
	Is a power supply within specification being used?	Use a power supply that is within specification.
Static elimination is not performed.	Is the electrode probe worn or dirty?	Perform maintenance on the electrode probe or replace the Electrode Unit.
	Is static elimination stop currently set?	Cancel the static elimination stop setting on the SJ-M Series.
	Is the abnormal discharge detection function operating?	Check the Electrode Unit for any conductive substances (e.g. oil droplets).
	Is the trigger input terminal disconnected?	Short the terminals (3) and (6).
Static elimination is not performed properly.	Are conductors or other Static Eliminators located nearby the Static Eliminator?	Move the Static Eliminator away from conductors or other static eliminators nearby.
The ion level alarm is indicated/output	Is the electrode probe worn or dirty?	Perform maintenance on the electrode probes or replace the Electrode Unit.
	Are conductive objects located in the surrounding area?	Check the installation state. "Installation site"(page 4)
The condition alarm is indicated/output.	Are static elimination target objects having a very high charged level located nearby the Static Eliminators?	Increase the number of connected static eliminators.
	Is the electrode probe worn or dirty?	Perform maintenance on the electrode probes or replace the Electrode Unit.
The alarm indicator lights.	–	Check "During an alarm (levels 1, 2)" (page 12).
Control output is not output correctly.	Is output wired correctly?	Check the output circuit and wiring, and connect correctly.
The trigger input is not input correctly.	Is input wired correctly?	Check the input circuit and wiring, and connect correctly.
Do not know meaning of indicators.	–	Check "Table of Indicated States".

2 Table of Indicated States

This appendix describes the various indicated states of the SJ-M Series.

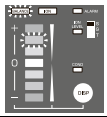
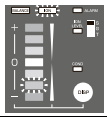
■ Indicated states when the power is turned ON

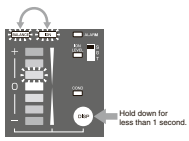
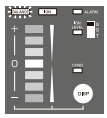
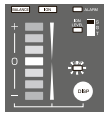
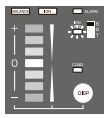
Lit State	Description
The state (charged level indication or ion level indication) that was active before the power was turned OFF is displayed. At the same time, the alarm indicator, ion level alarm indicator, and condition alarm indicator light (red).  The ion monitor LEDs fluctuate upward and downward. 	When the power is turned ON, the indicated state (charged level indication or ion level indication) that was active before the power was turned OFF is displayed. Also, the alarm indicator, ion level alarm indicator and condition alarm indicator light (red) at the same time. After this indication state continues for about two seconds, the ion monitor LEDs fluctuate upward and downward, and static elimination is then started. After static elimination starts, the charged level or ion level is indicated.

■ Mode indications (except when the power is turned ON)

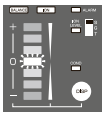
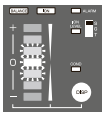
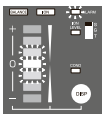
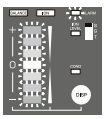
Lit State	Mode	Description
Either of the ion balance or ion level indicators is lit. 	Run mode	The SJ-M Series is operating in the Run mode. For details on other indications, see the following. "Indications in the Run mode"
The ion balance indicator is blinking. 	Ion Balance Manual Adjustment mode	For details on other indications in the Ion Balance Manual Adjustment mode, see the following. "3. Adjusting ion balance" (page 7)
The ion balance indicator is blinking fast. 	End of ion balance manual adjustment (Run mode)	The SJ-M Series is storing the setup information after ion balance manual adjustment. Though the SJ-M Series is operating in the Run mode, it cannot enter the Select mode yet. "3. Adjusting ion balance"(page 7)
The ion balance indicator and ion level indicator blink alternately. 	Select mode	For details on other indications in the Select mode, see the following. "2. Changing settings" (page 6)
The ion balance indicator and ion level indicator blink alternately fast. 	Setup mode	For details on other indications in the Setup mode, see the following. "2. Changing settings" (page 6)
Both the ion balance indicator and ion level indicators are out. 	Other	Static elimination is not being performed. For details on other indications, see the following. "Other indications" (page 12)

■ Indications in the Run mode

Lit State	Description
One of the ion monitor LEDs and the ion balance indicator light (red). 	**Charged level indication** This indicates the charged level of the target object. When there is a plus charged object, the LEDs on the upper side (+ side) light, and when there is a minus charged object, the LEDs on the lower side (– side) light according to the charged level.
One each of the plus and minus side LEDs of the ion monitor, and the ion level indicator light (red). 	**Ion level indication** This indicates the level of ions that are being generated by the SJ-M Series.

Lit State	Description
Charged level indication or ion level indication 	**Display selection** The display switches to the charged level indication when (DISP) is pressed while the ion level is indicated. When the charged level is indicated, the display switches to the ion level indication.
The ion balance indicator lights, and one of the ion monitor LEDs blinks. 	**Ion balance manual setup confirmation** If the device is not in an ion balance manual setup state, you can confirm the ion balance manual setup by pressing either of the ion balance adjustment keys. During confirmation, the ion monitor LEDs blink in one of the following three colors: Orange: The LED blinks (orange) at the position corresponding to the setup state when ion balance manual setup is being performed. (Sometimes the center LED also is lit.) Red: The LED at the edge of the side (+ or –) that was set blinks (red) when the set value was set to MAX during ion balance manual setup. Green: The center LED blinks (green) for the duration that the ion balance adjustment key is held down when ion balance manual setup is not being performed.
The condition alarm indicator lights (red). 	**Condition alarm** The condition alarm indicator lights (red) when the ion balance has deteriorated influenced by the installation environment.
The ion level alarm indicator lights (red). 	**Ion level alarm** The ion level alarm indicator lights (red) when the generated ion level falls below the preset level.

■ Other indications

Lit State	Description
The center LED of the ion monitor blinks (red). 	**Trigger input (I/O terminal section)** • In Spot mode The center LED of the ion monitor blinks (red) when the trigger input and 0V terminals are disconnected to stop static elimination. • In Gun mode The state that was active before the power was turned OFF is displayed.
The three center LEDs of the ion monitor blink (red). 	**Static elimination stop input (operation/display section)** The three center LEDs of the ion monitor blink (red) when (▼) (▲) are pressed and held down at the same time for about three seconds to stop static elimination.
The alarm indicator and the three center LEDs of the ion monitor blink (red) simultaneously. 	**During an alarm (level 1)** The alarm indicator and the three center LEDs of the ion monitor blink (red) simultaneously in the following instances. Remedy the cause of the alarm, and simultaneously hold down (▼) (▲) for about three seconds. This cancels the alarm state, and executes the power ON sequence. **Probable causes of alarms** • Cables are disconnected or broken.
The alarm indicator and the seven ion monitor LEDs of the ion monitor blink (red) simultaneously. 	**During an alarm (level 2)** The alarm indicator and seven LEDs of the ion monitor blink (red) simultaneously in the following instances. Remedy the cause of the alarm, and turn the power ON again. If this alarm frequently re-occurs, contact your agent. **Probable causes of alarms** • Abnormal discharge • Internal circuit damage

3 List of Options

This appendix lists the various options available for the SJ-M.

Item	Model	Description	External Appearance
Extension cable	SJ-C3		The 3 m extension cable is used for extending the connection between the Controller Unit and the Static Eliminator Head Unit. (Up to 3 cables can be connected.)
AC adapter	SJ-U3		AC adapter * For details of the AC cable, contact the KEYENCE sales office in your district.
Electrode replacement unit for SJ-M040	OP-84383		Electrode Unit made of tungsten

WARRANTIES AND DISCLAIMERS

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(2) KEYENCE is pleased to offer suggestions on the use of its various Products. They are only suggestions, and it is Buyer's responsibility to ascertain the fitness of the Products for Buyer's intended use. KEYENCE will not be responsible for any damages that may result from the use of the Products.

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