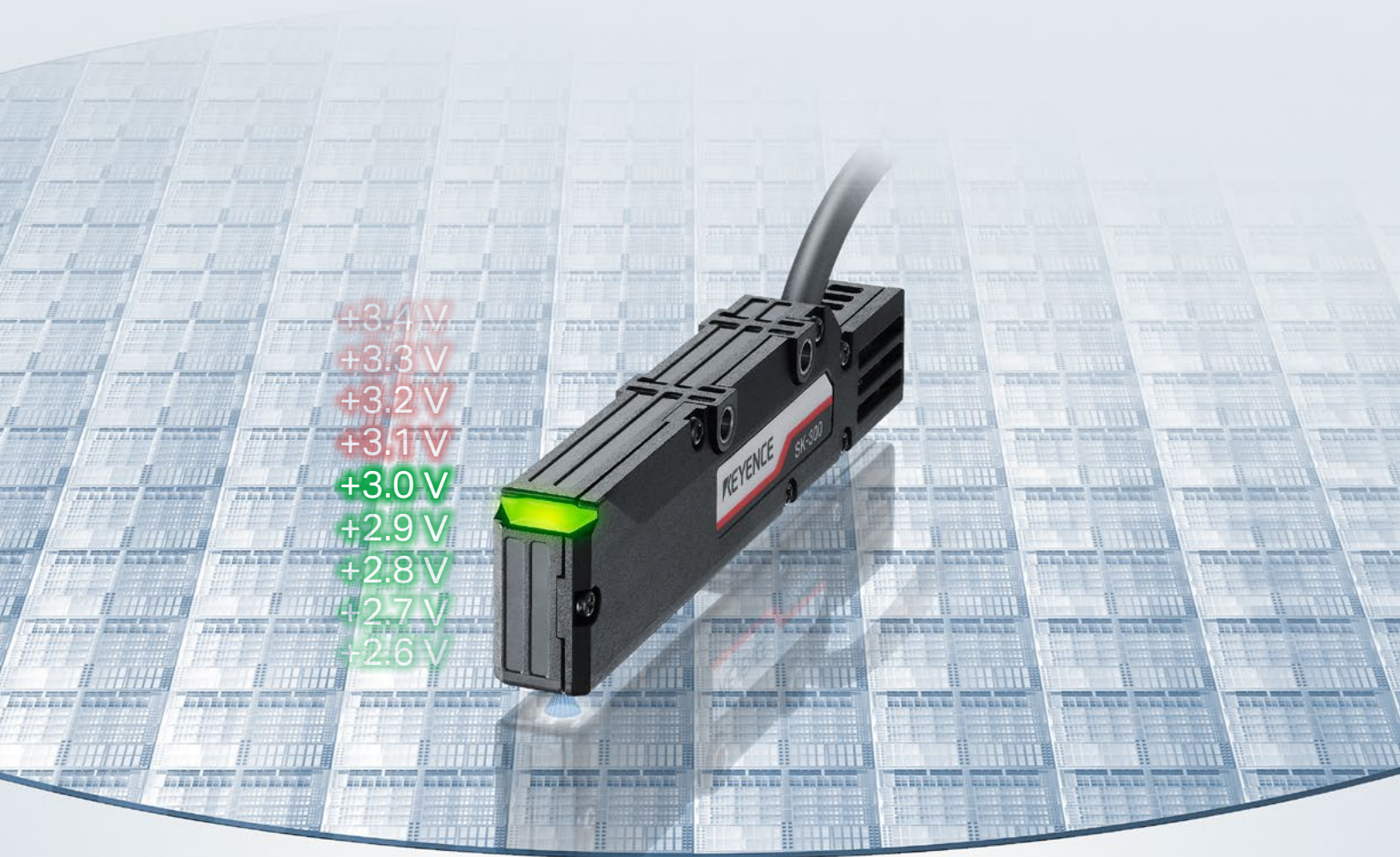




High-Accuracy Inline Electrostatic Sensor

NEW SK Series



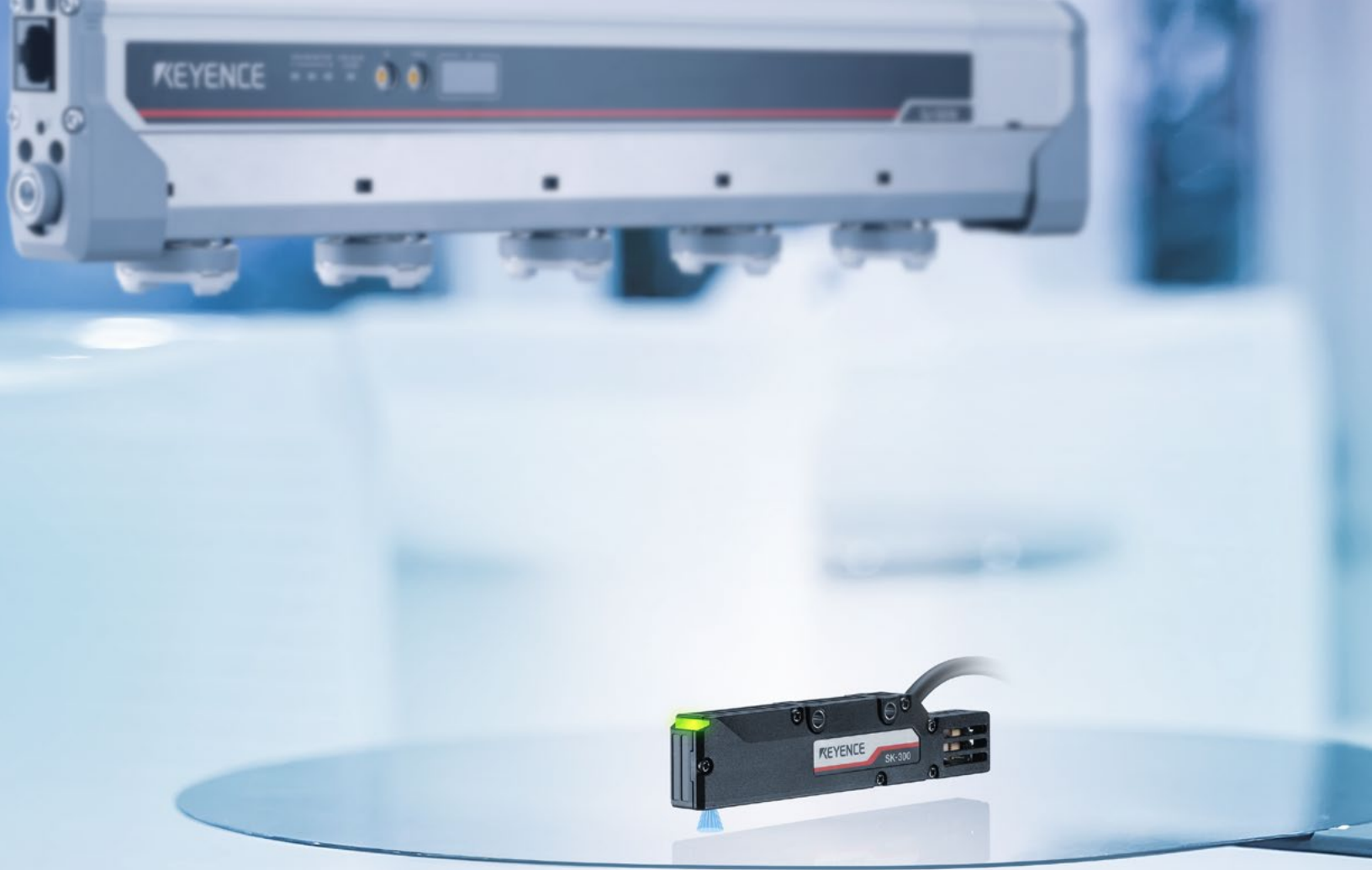
Measurement Accuracy

± 1.0 v

Real-time target charge measurement



SK Series



Advanced static electricity management

Continuous target charge measurement

Until now, value-based management of static electricity has usually only been performed periodically. Even if inspections during equipment installation or maintenance pass, there are an increasing number of cases where yield issues—likely caused by static electricity—do not improve. Real-time measurement can dramatically enhance manufacturing efficiency for advanced semiconductors.

Dramatic improvements for
electrostatic problems in
advanced semiconductors

Accuracy: 10× higher than
conventional models

Measurement accuracy

± 1.0 V

Resolution

0.1 V

Speed: 14× faster than
conventional models*¹

Responsiveness

28 ms^{*2}

Sampling speed

1.4 ms

*¹ Compared with the conventional model with a measurement
accuracy of ± 10 V and responsiveness of 397 ms
(obtained from a mean of 256 measurements).

*² Responsiveness obtained from a mean of 16 measurements for a
measurement accuracy of ± 10 V.

High-Accuracy Inline
Electrostatic Sensor
NEW SK Series



[D.C.C.] Eliminating distortion for accurate signal capturing

Unprecedented high-accuracy, high-speed static electricity measurement



The D.C.C. (Distortion Cut Circuit) is a circuit that reliably removes distortion generated in the drive power supply. This distortion is caused by factors such as instantaneous voltage drops or counter-electromotive force when driving the sensor. By preventing degradation in even the smallest sensor signals, high-accuracy detection is enabled while also reducing the time needed for complex processing.

10× higher accuracy than conventional models

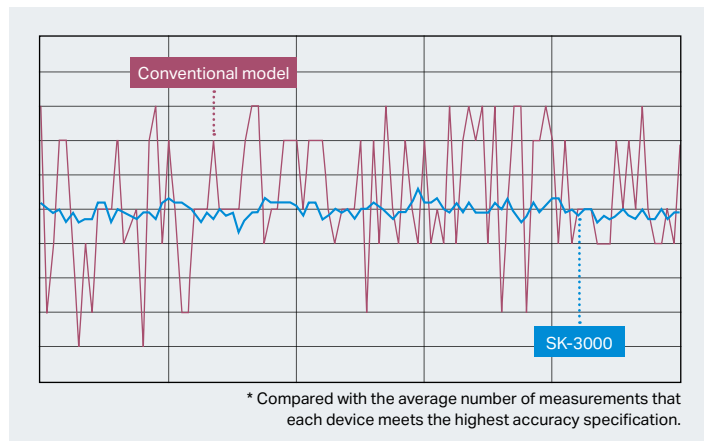
Measurement accuracy

±1.0 V

Resolution

0.1 V

Management of wafer and chip charge levels below 10 V has become the norm. There is also a growing need to distinguish between 5.0 V and 5.1 V. The SK-3000 offers the high-accuracy measurement needed to meet such demands.



14×^{*1} faster than conventional models

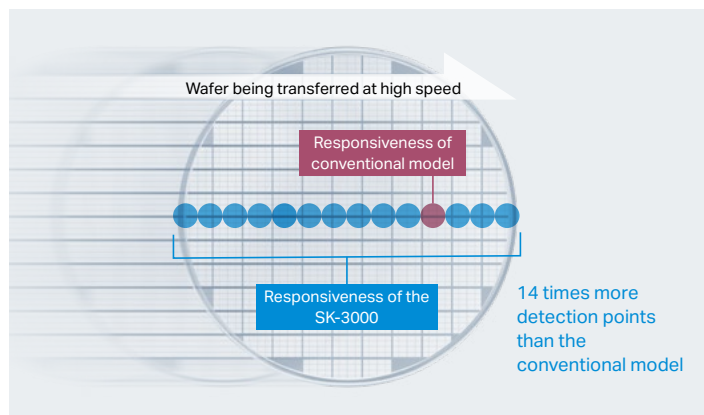
Responsiveness

28 ms^{*2}

^{*1} Compared with the conventional model with a measurement accuracy of ±10 V and responsiveness of 397 ms (obtained from a mean of 256 measurements).

^{*2} Responsiveness obtained from a mean of 16 measurements for measurement accuracy of ±10 V.

As productivity increases, so does production line speed. With 14 times^{*1} faster responsiveness than conventional models, the SK-3000 ensures problems causing electrostatic risks in high-speed transferring are always caught.



Importance of real-time target charge monitoring



Conventional method 1

Hand-held measuring instrument

Entry-level hand-held measuring instruments are often chosen as the first tool for quantifying static electricity. Although capturing general trend values is possible with these measuring instruments, monitoring conditions such as high-speed moving targets, environmental changes between morning and evening, or abnormalities during setup changes is more difficult.

Before



After



New possibilities
with the SK-3000

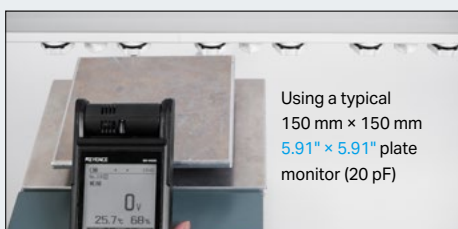


Conventional method 2

Charge monitors

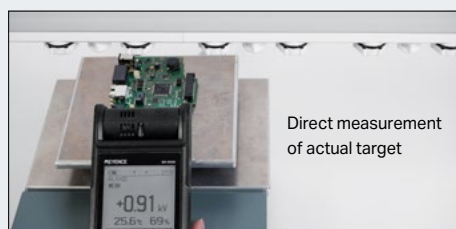
Charge monitors can be used to measure decay time (the time for a 1000 V to 100 V discharge) and ion balance (how close the ionizer can bring the voltage to 0 V), but these can only be used to judge the performance of the ionizer itself. In other words, it is impossible to determine whether the target is actually being discharged within the specified operating range.

Decay time measurement



Using a typical
150 mm × 150 mm
5.91" × 5.91" plate
monitor (20 pF)

Target voltage attenuation measurement



Direct measurement
of actual target

New possibilities
with the SK-3000



Applications

Measurement of electrostatic charge of wafers



Measurement of electrostatic charge of ICs



Offline static electricity analysis



High-priority processes

Film deposition	Cleaning
Wafer inspection	EFEM
Bonding	Molding
Dicing	Final testing

Lineup/Options



Sensor head
SK-300



Amplifier unit (main)
SK-3000



Amplifier unit (expansion)
SK-3050



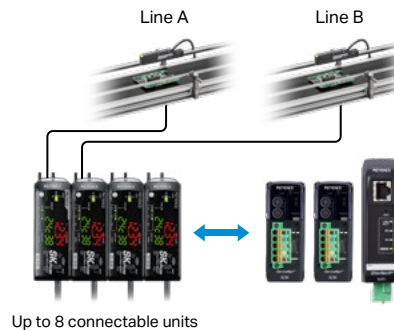
Ion balance monitoring unit
OP-87934

Cable for connecting the sensor head with the controller

OP-87056 2 m **6.6'** cable
OP-87057 5 m **16.4'** cable
OP-87058 10 m **32.8'** cable
OP-87059 20 m **65.6'** cable

Connectable networks

Monitoring the on-site static electricity volume, temperature, and humidity makes it possible to prevent accidents and defects before they occur. In addition, integrating static eliminators via network connectivity enables central management of the effects of static elimination.



EtherNet/IP®

CC-Link V2

RS-232C

DeviceNet®

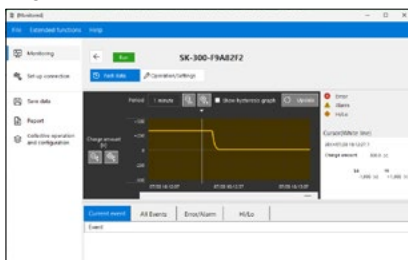
EtherCAT®

SJ-Manager SK-300 + SK-3000 + OP-87056 + DL-EN1

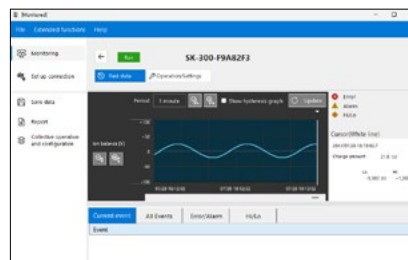
Simply connect the SK Series electrostatic sensor to also monitor the amount of electrostatic charge on the workpiece surface and the ion balance of the ionizer. Install the SK-300 sensor head in front of and behind the ionizer to save the effects of static elimination—which can vary depending on workpiece and environment—in chronological order to a PC. This is useful for verification during installation, changeover, and periodic inspections.

SJ-Manager download site www.keyence.com/SJ-Manager

Checking the electrostatic charge of the target surface



Checking the ion balance of the ionizer



Outputting data to CSV

Date and time	Data and time	Ion balance (V)	Charge amount (C)	...
2018/12/12 12:00	2018/12/12 12:00	450	45.0	...
2018/12/12 12:05	2018/12/12 12:05	450	45.0	...
2018/12/12 12:10	2018/12/12 12:10	450	45.0	...
2018/12/12 12:15	2018/12/12 12:15	450	45.0	...
2018/12/12 12:20	2018/12/12 12:20	450	45.0	...
2018/12/12 12:25	2018/12/12 12:25	450	45.0	...
2018/12/12 12:30	2018/12/12 12:30	450	45.0	...
2018/12/12 12:35	2018/12/12 12:35	450	45.0	...
2018/12/12 12:40	2018/12/12 12:40	450	45.0	...
2018/12/12 12:45	2018/12/12 12:45	450	45.0	...
2018/12/12 12:50	2018/12/12 12:50	450	45.0	...
2018/12/12 12:55	2018/12/12 12:55	450	45.0	...
2018/12/12 13:00	2018/12/12 13:00	450	45.0	...

Specifications	
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■ Sensor head

Model		SK-300	
Charging potential measurement	Measurement mode	High-accuracy mode	Wide-range mode
	Reference distance	25 mm 0.98"	100 mm 3.94"
	Measuring distance	1 to 50 mm 0.04" to 1.97"	60 to 120 mm 2.36" to 4.72"
	Measurement range*1	±2 kV	±50 kV*3
	Measurement accuracy*2	±1 V	±100 V
	Sampling cycle	Approx. 1.4 ms	
Temperature measurement	Measurement range	0 to 50°C 32 to 122°F	
	Measurement accuracy*4	±1°C ±1.8°F	
	Display resolution	0.1°C 0.18°F	
	Sampling cycle	1 s	
Humidity measurement	Measurement range	10 to 85% RH	
	Measurement accuracy*4	±5% RH	
	Display resolution	0.1% RH	
	Sampling cycle	1 s	
Ion balance measurement mode *5	Ion balance measurement range	±300 V	
	Measurement accuracy*6	±3 V	
	Display resolution	0.1 V	
	Environmental resistance	Operating ambient temperature	0 to 50°C 32 to 122°F (No freezing or condensation)
Operating ambient humidity		85% RH or less (No condensation)	
Pollution degree		3	
Material	Body case: PC, Metal parts: SUS, Cable: PVC		
Weight	Approx. 35 g 1.24 oz		

*1 If the distance to the sensing target is shorter than the reference distance, even if the conditions are within the measurable range, measurement cannot be performed up to the upper limit of the measuring range.

*2 Within ± 50 V when using high-accuracy mode; within ± 1 kV when using wide-range mode. In other ranges, accuracy is $\pm 2\%$ (display value) in high-accuracy mode, and $\pm 10\%$ (display value) in wide-range mode. The value for high-accuracy mode is obtained from a mean of 1024 measurements. The value for wide-range mode is obtained from a mean of 256 measurements.

*3 Measurement accuracy is satisfied in the range of ± 30 kV.

*4 At 25°C/77°F with 50% RH.

*5 OP-87934 is required.

*6 Within +50 V. In other ranges, accuracy is +6% (display value).

■ **Sensor amplifier**

Model		SK-3000	SK-3050
Type		DIN rail mounting	
Main unit / expansion unit		Main unit	Expansion unit
Display resolution		0.1 V	
Analog voltage output*1		±5 V, 1 to 5 V, 0 to 5 V, Output impedance: 100 Ω	None
Analog current output*1		4 to 20 mA, Max. load resistance: 350 Ω	
Control input*2	Zero shift input	Switchable between non-voltage input and voltage input [Non-voltage input] ON voltage: 2 V or less, OFF current: 0.02 mA or less [Voltage input] Maximum input rating: 30 V or less, ON voltage: 7.5 V or more, OFF current: 0.05 mA or less	
	Timing input		
	Reset input		
	Bank input		
Control output*3	Judgment output	Open collector output (NPN/PNP switching, N.O./N.C. switching)	
	Alarm output	Open collector output (NPN/PNP switching, N.C.)	
Power supply	Power supply voltage*4	10 to 30 VDC (including ripple (P-P) 10% or less)	Supplied from main unit
	Power consumption (excluding load current of each output)*5	1650 mW or less (55 mA or less at 30 V)	1170 mW or less (39 mA or less at 30 V)
Environmental resistance	Operating ambient temperature	0 to 50°C 32 to 122°F (No freezing or condensation)	
	Operating ambient humidity	85% RH or less (No condensation)	
	Pollution degree	2	
Material		Body case and front cover: PC, Key top: POM, Cable: PVC	
Weight (including accessories)		Approx. 150 g 5.30 oz	Approx. 140 g 4.94 oz

*1 Select ± 5 V, 1 to 5 V, 0 to 5 V, or 4 to 20 mA for use.

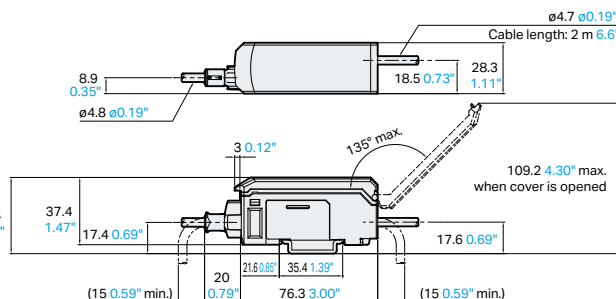
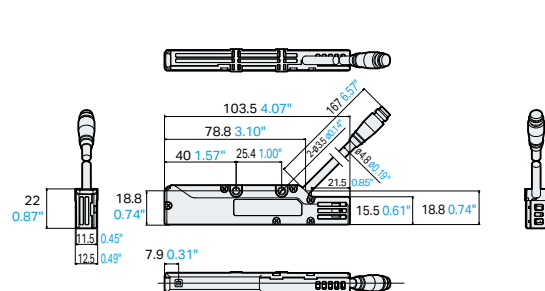
*2 Inputs are assigned to the four external input lines.

*3 NPN open collector output rating: maximum 50 mA/ch (20 mA/ch when expansion units are added), 30 V or less, residual voltage: 1 V or less (1.5 V or less when adding 6 or more expansion units, including main unit); PNP open collector output rating: maximum 50 mA/ch (20 mA/ch when expansion units are added), below power supply voltage, residual voltage: 2 V or less (2.5 V or less when adding 6 or more expansion units, including main unit)

*4| Use 20 to 30 V as the power supply voltage when using 6 or more expansion units, including the main unit.

*5 When connecting 8 units for DL connection, the maximum power consumption is 11.3 W.

Dimensions

Unit: mm **inch**

A Wide Variety of Ionizers

Bar Types

High-Accuracy, High-Speed Sensing Ionizer SJ-Q

Maintenance-free model with Inside Supersonic mechanism for 10 times higher accuracy (± 3 V) and 10 times faster speeds (0.1 sec).



Type	Bar type with built-in controller (360 to 3000 mm 14.17" to 118.11")
Method	Pulse AC with Inside Supersonic structure
Ion balance	± 3 V
ISO clean classification	Class 3

Air-Free High Speed Sensing Ionizer SJ-H

Effective for airless static elimination, static elimination using silicone probes, long-distance high-speed static elimination, and bar-type dust removal.



Type	Bar type with built-in controller (360 to 3000 mm 14.17" to 118.11")
Method	Pulse AC
Ion balance	± 30 V
ISO clean classification	Class 2 (SJ-HC model)

Blower Type

Maintenance-free Multi-Sensor Ionizer SJ-F700



Method	Variable DC
Ion balance	± 1 V
Features	Probe Cleaning/Replacement Not Required Enables ionizer traceability.

Compact Fan Static Eliminator SJ-LF



Method	High frequency AC
Ion balance	± 10 V
Features	Convenient type usable anywhere with a power supply.

Hand-held measuring instrument

Static electricity sensors SK-H



Measurement accuracy	± 10 V (High-precision mode)
Features	Simultaneously measures electric potential, temperature, and humidity.

Nozzle Type

Compact Nozzle Static Eliminator SJ-LM



Method	High frequency AC
Ion balance	± 10 V
Features	A versatile type that can be installed in any narrow space.

Gun Type

Ultra-durable, High-power Static Elimination Gun SJ-LG



Method	High frequency AC
Ion balance	± 10 V
Features	An all-in-one gun type that provides powerful dust removal.

Focused spot type

High-Performance Micro Static Eliminator SJ-M



Method	Pulse AC
Ion balance	± 15 V
Features	A versatile type with a choice of eight heads.

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