



In-line Gas Ionizer

Model 4214UN

User's Manual

About Simco-Ion

Simco-Ion develops, manufactures, and markets system solutions to manage electrostatic charge. As the world's largest provider of electrostatics management products and services, Simco-Ion improves its customers' business results by providing a total solution to their electrostatic discharge and electromagnetic interference challenges. Simco-Ion Technology Group is a division of Illinois Tool Works (ITW), located in Alameda, California. For more information about Simco-Ion visit.

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Description

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- 1.2 I/O Connectors and LED Indicators
- 1.3 Performance
- 1.4 Cleanliness
- 1.5 Input Voltage and Nitrogen Operational Requirements

1.1 Model 4214UN In-line Gas Ionizer

The Model 4214UN Gas In-Line Ionizer is a small form-factor device specifically designed to provide static neutralizing ionization for processes or tools using a Nitrogen gas flow. The Model 4214UN features include:

- High Frequency AC ionization technology
- Small footprint for installation within the limited space inside process tools.
- Replaceable Single-Crystal Silicon Emitter Assembly
- Ionization cell provides ISO 14644-12 ionization (0.01 um particles or nanoparticles) with internal particle containment system ("ultra-clean")
- Meets ISO 14644-1 Class 1 ionization (0.1 um particles)
- Self-Balanced ionization with fast discharge times; no calibration process required.
- High voltage ionizer automatically shuts off (Standby mode) with low gas flow
- Visual indicators and output relay contacts provided for alarm and maintenance required indications
- Stainless Steel Chassis and clean construction for use in ISO Class 1 environments
- Microprocessor for feedback and control functions, alarms, and remote status outputs
- 24 VDC input voltage
- Maximum ambient operating temperature 60°C
- Two year warranty

This manual covers the following model numbers:

- 91-4214UN-04
- 91-4214UN-04A

The Model 4214UN is a stand-alone unit providing a high voltage power supply, an ultra-clean ionization cell, and I/O connections for remote status and control of ionization all within a small footprint package. The end-user's nitrogen is plumbed through the unit where it is ionized and then delivered to the tool's static-sensitive product or process. Custom manifolds or nozzles can provide the ability to shape the area of coverage to the customer's requirements.

The Model 4214UN provides ultra-clean ionized nitrogen coverage over a holding area within an oven environment for several minutes.

Simco-Ion Applications Engineering can assist with the integration of the Model 4214UN into your specific application or process. Contact techsupport@simco-ion.com if assistance is needed.

1.2 I/O Connectors and LED Indicators

I/O Connectors

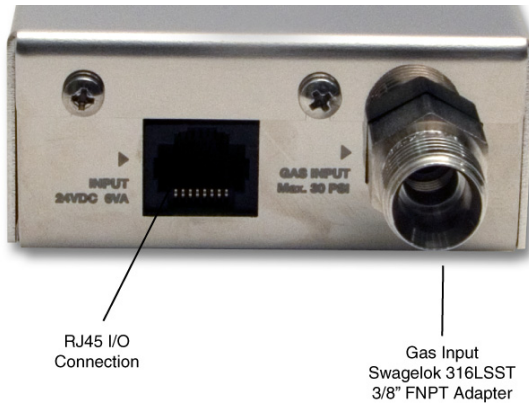


Figure 1. Inlet End of 4214UN

1. Modular RJ-45 I/O Connector: Input voltage, standby activation, and alarm relay contacts.
2. Gas Input Connector: Swagelok® 316L SST 1/8 inch FNPT Adapter to 3/8 inch OD tubing (#SS-600-7-2).

LED Indicators

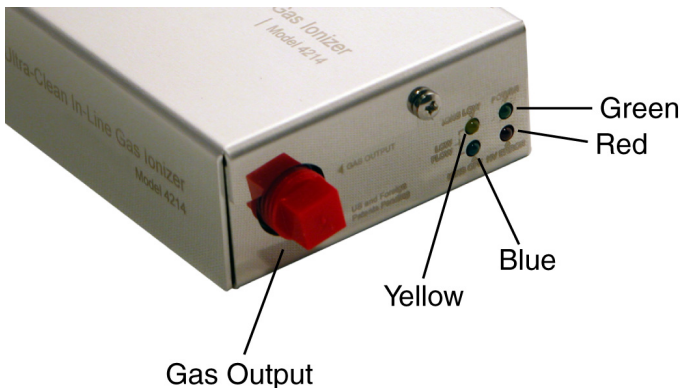


Figure 2. Outlet End of 4214UN

1. **Gas Output Connector:** Internal 1/4 NPT female threaded bushing.
2. **Status LEDs: Alarm, Power, Warning, and Learn,** see Section 3.1 Ionizer Status Indicators, Table 2. Model 91-4214UN-04A Status Indications.

1.3 Performance

The Model 4214UN utilizes high frequency AC ionization and is designed to provide decay times of 10 seconds or less for +/-1000V to 100V for targets at a distance of 150 mm (6 inches) from the end of the primary outlet port.

Balance will be maintained at +/-25V or less at a distance of 150 mm (6 inches).

Note:	Decay and balance specs stated are for a nitrogen flow rate of 40 lpm @ 36.5 kPa.
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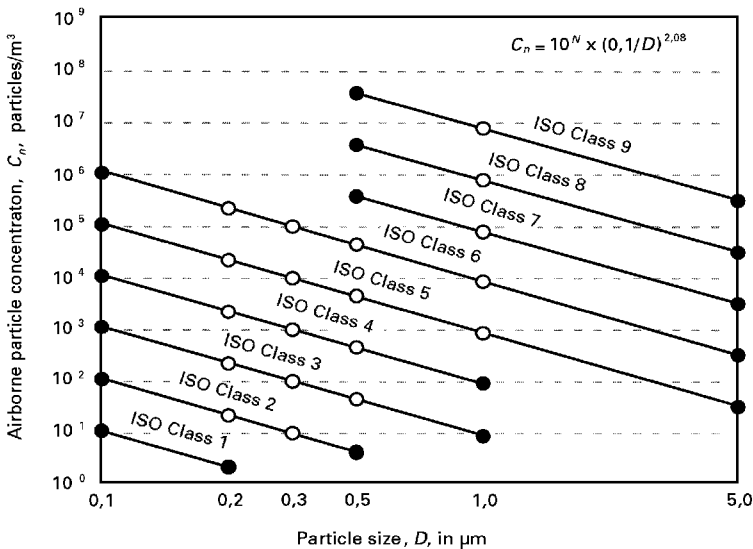
The actual area of coverage and the decay/balance performance obtained will be determined by target distance and any custom manifold/nozzle attached to the primary outlet tube.

1.4 Cleanliness

The Model 4214UN is designed to operate in and maintain ISO 14644-1 Class 1 cleanliness (10 particles or less per m³ for particles of 0.1 micron and larger). The Model 4214UN will also perform to ISO 14644-12 cleanliness (1200 particles or less per m³ / or 34 particles or less per ft³ for particles of 0.01 micron and larger) with 40 to 90 lpm (1.4 to 3.2 cfm) of nitrogen flow during normal operation.

ISO Class 1 for 0.1 and 0.01 Micron Particles

ISO 14644-1 (1999) establishes 9 particulate class limits. A class is met when airborne particles-per-cubic-meter (or particles-per-cubic-foot) do not exceed the class limit. The following graph¹ summarizes the class limit lines for particles between 0.1 micron and 5 microns.



1. Chart from ISO 14644-1: Annex A - Informative.

Note:

The solid circles indicate the minimum and maximum particle size limits that are acceptable for each of the ISO classes shown.)

For semiconductor cleanrooms, ISO Class 1 through ISO Class 6 are the most useful. Inside mini-environments or inside front-end equipment, the focus has been on ISO Class 1 and ISO Class 2.

Changing Requirements

Over the past decade, this graph has become outdated due to nanotechnology. The smallest particle size on the chart remains 0.1 micron (100 nm). However, semiconductor devices with 22 nm to 32 nm features are now being produced. The cleanliness requirements for this new generation of semiconductor devices are now covered by ISO 14644-12, Class 1 for 0.01 micron (10 nm).

Defining ISO Class 1 for Particle Size 0.01 Micron (10 nm)

ISO 14644-12 defines particle size limits down to 0.001 micron (1 nm) particles. The 0.01 micron (10 nm) particle size is typically measured using a condensation nucleus counter (CNC).

The basis of the extrapolation down to 10nm particles employs the formula which was used to define the existing ISO 14644 class limit lines. The formula is provided in ISO 14644, and it is shown in at the top of the graph above. It is:

$$C_n = 10^N (0.1/D)^{2.08}$$

where,

C_n is the maximum permitted number of particles per cubic meter,

N is the class designation, and

D is the particle diameter in microns

Therefore, to extrapolate the permitted number of particles sized 0.01 micron and larger:

$$C_n = 10^{(1)} (0.1/.01)^{2.08} = 1200 \text{ particles/m}^3 \\ \text{(or 34 particles/ft}^3\text{)}$$

Additional information regarding the ISO 14644 standards can be found at www.iso.org.

1.5 Input Voltage and Nitrogen Operational Requirements

Input Voltage

Input voltage: +24 VDC, +/-5% @ 0.25A, 6W max.

Nitrogen Requirements

Caution:

The 4214UN is designed to be used with clean (99.99% min), dry nitrogen. Appropriate upstream filtering must be used to remove moisture, oil, and particles from the compressed gas supply. Consult manufacturers of the gas supply equipment for recommendations.

The 4214UN is NOT designed to be pressurized. It should be installed downstream from any valves, with the output open to atmospheric pressure or to an approved manifold/nozzle which is then open to atmospheric pressure.

The Model 4214UN requires a minimum nitrogen flow rate of 40 lpm. The unit will automatically go into Standby mode (HV power supply turned OFF) if the gas flow rate is less than ~35 lpm.

- Operational flow range: 40-90 lpm (1.4-3.1 cfm)
- Typical input pressure range: 36-207 kPa (5.3-30 psi)

Note:

The end-user must provide external means for setting and controlling the nitrogen flow rate through the 4214UN. It is also recommended that the input pressure be monitored to insure that the input pressure does not exceed 207 kPa (30 psi).

2

Installation

- 2.1 Process Tool Integration
- 2.2 Outlet Manifold Installation
- 2.3 Mounting Considerations
- 2.4 Gas Connections
- 2.5 Electrical Connections
- 2.6 Startup
- 2.7 Setup
- 2.8 Optional Power-Signal Distribution Box

Warning: The Model 4214UN is not designed for use in hazardous or explosive environments.

Caution: The Model 4214UN has been designed for use with nitrogen only. Do not use the Model 4214UN with CDA or any other gas!

The 4214UN is shipped double-bagged. Remove the 4214UN from the inner bag only in an ISO Class 3 or cleaner environment.

2.1 Process Tool Integration

The Model 4214UN requires a short period of time to establish the ionization of nitrogen gas. Consider the following factors when using the Model 4214UN with your application or process:

- Ionization requirements of the application or process
- Proper sequencing of gas flow and standby/startup requests
- Time required to establish corona discharge in nitrogen
- Status relay interpretation for ionization and alarms
- Tolerance of end-user's process for ionization restarts

Simco-Ion Applications Engineering can assist with the integration of the Model 4214UN into your specific application or process. Contact techsupport@simco-ion.com if assistance is needed.

2.2 Outlet Manifold Installation

If your order includes a custom outlet manifold, it will be shipped double-bagged for cleanliness. Remove it from the inner bag only in an ISO Class 3 or cleaner environment.

The stainless steel Swagelok® 1/4 NPT connector of the manifold will screw clockwise into a 1/4 NPT thread in the internal ionizer body. Turn the manifold fitting only until it is finger tight and then turn it an additional 1/8 turn, maximum. It is recommended that the manifold be installed by hand only - do not use a tool to install the manifold into the ionizer body.

Caution:

Install the manifold into the 4214UN by hand only; do not use a tool. Tighten it only finger-tight. Do not over-tighten the stainless steel manifold fitting into the ionizer body!



Figure 3. Outlet Manifold

If your custom manifold utilizes a set screw to lock it in position, loosen the set screw holding the outlet manifold to the stainless steel extension tube and rotate it to correct position to aim it at the intended target. Re-tighten the set screw to prevent the manifold from rotating (approximate torque of 0.12 to 0.25 Nm).

Note:

The positioning of the manifold should be verified with the 4214UN mounted in its final position and with normal operating gas flow to confirm correct coverage of the ionized nitrogen over the intended target area.

The manifold assembly and extension tube are designed to be electrically floating -- do not ground the outlet manifold or the stainless steel extension tube and fitting.

2.3 Mounting Considerations

The Model 4214UN should be located close to the target area within the tool in order to minimize the path length of the ionized gas. Minimizing ion recombination during delivery means more ions at the charged surface of the target and faster discharge times. The best discharge times can be obtained by having a minimum distance to the target and by keeping any manifold short and by having the fewest bends and fittings in the ionized gas path. It is recommended that manifolds be made from an insulative material and be no longer than 450 mm (18 inches).

Note:	When mounted, the 4214UN should not be subjected to excessive vibration or physical shock.
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+24 VDC +/-5% @ 0.25A power will need to be provided to the unit. See Section 2.5 Electrical Connections.

Mounting Method

There are two M5 threaded inserts provided on the rear panel of the chassis. The end-user may use these inserts to secure to a custom mounting bracket (not provided) to the rear of the chassis.

Note:	The M5 screws used for mounting should not exceed 10 mm in length.
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See Section 5.3 Dimensional Drawings Model 4214UN Gas In-Line Ionizer Chassis Bottom Panel for a dimensional drawing showing the locations of the threaded inserts.

2.4 Gas Connections

Caution:	Use caution when connecting to the inlet and outlet fittings and do not rotate the fittings of the Ionizer unit. Use a second wrench to hold the Ionizer inlet fitting stationary while connecting the inlet gas fitting.
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Gas Inlet

The gas input fitting on the Ionizer is a Swagelok® 316L SST 1/8 inch FNPT to 3/8 inch OD tubing Adapter (SS-600-7-2). Connect the nitrogen gas supply to the 4214UN and tighten the connection securely.

Initial Nitrogen Purge

In order to achieve optimum operational cleanliness, the Model 4214UN should be purged with nitrogen (99.99%) for a minimum of 60 minutes after the initial unpacking and installation of the unit.

1. Turn on the nitrogen supply and purge the 4214UN at flow rate of 90 to 100 lpm. At the end of the purge period, reduce the nitrogen flow as needed to balance gas consumption rate vs. obtaining the desired decay time in the target zone. The recommended operational flow rate is 90 lpm +/-5 lpm.

Note:	The recommended minimum operational flow rate is 40 lpm.
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2. Verify that the nitrogen flow from the outlet nozzle or manifold is covering the target area correctly. Adjust the positioning of the manifold if needed.
3. Connect the electrical input cable to the RJ-45 input connector. See Section 2.5 Electrical Connections section for pin-out information on the next page.

2.5 Electrical Connections

The input voltage connector for the 4214UN is a standard 8-pin RJ-45 modular receptacle through which I/O connections and power are made. A +24 VDC @ 0.25A source must be provided to Pin 2. The DC power return must be connected to Pin 1 and to the grounded tool frame or to earth ground, see the table and figure below.

The 4214UN can also be powered using an optional +24 VDC external power supply. Simco-Ion provides the external power supply as part of a kit that includes a Power-Signal Distribution Box that conveniently separates the remote signal connections from the power connections, see Section 5.2 Parts & Accessories P/N #33-4214-05 and Section 2.8 Power-Signal Distribution Box Option or contact Simco-Ion for more information.

Pin	Function	Notes
1	GROUND	This DC power return must be connected to the grounded tool frame or to earth ground
2	+24 VDC, +/-5% input voltage	0.25A, 6W max
3	Reserved	Reserved
4	STANDBY Input	Floating (No connection) = Ionizer Standby, Ground = Ionizer RUN
5	Relay 1 contact	RELAY 1, CONTACT 1, ± 60 VDC @ 0.2A, max
6	Relay 1 contact	RELAY 1, CONTACT 2, ± 60 VDC @ 0.2A, max
7	Relay 2 contact	RELAY 2, CONTACT 1, ± 60 VDC @ 0.2A, max
8	Relay 2 contact	RELAY 2, CONTACT 2, ± 60 VDC @ 0.2A, max

Table 1. RJ-45 I/O Connections

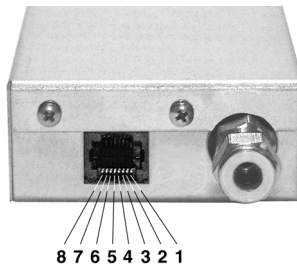


Figure 4. RJ-45 Connector Pinout

2.6 Startup

Once the 4214UN has been properly mounted in the tool and nitrogen gas and electrical connections have been made, please follow the steps listed below to startup the 4214UN.

1. **Work cycle warm-up procedure:** A “warm-up” period should be utilized prior to the normal work cycle. It is recommended that this warm-up period for the 4214UN be programmed into the initialization time for the tool prior to the start of the daily work cycle. The warm-up period of the 4214UN will provide a time for the ionizer to initiate startup of the corona ionization.
 - a. Set the nitrogen flow to your desired rate between 40 to 90 lpm and turn on the nitrogen.
 - b. Apply +24 VDC to the unit and pull the Standby line LOW (ground) to put the 4214UN into Startup Mode.
 - c. Upon initial application of +24V power, the 4214UN will go through a “startup” routine to establish ionization corona, see Section 3.2 Operating Modes. Status Relays 1 and 2 provide information regarding the operational state of the ionizer. See Section 3.1 Ionizer Status Indicators, Table 2. Model 91-4214UN-04A Status Indications.
 - d. Upon successful startup, only the green LED on the 4214UN will be lit. If desired, proper ionization can be verified by placing a charged plate monitor at a distance of 150 mm (6 inches) from the output nozzle or manifold and perform a decay and balance test for $\pm 1000V$ to 100V. The decay time should be 10 seconds or less with a maximum offset balance of about $\pm 25V$ with no manifold installed on the ionizer outlet.
 - e. If the 4214UN fails to achieve proper ionization levels during the startup routine, a HV Alarm condition will be set and indicated by a steady Red and Green LEDs.
2. **Ionization start up in nitrogen:** Due to conditions imposed by the physics and chemistry of initiating corona discharge ionization in a nitrogen gas stream, ionizers may require a short period of time between being powered up and actually “igniting” a corona discharge at the emitter point. The length of this

potential wait is dependent on the OFF time that has elapsed since the ionizer was last ionizing normally.

Typical start up time for the 4214UN is about 10 seconds. The start of the ionization can be identified by the status LEDs and/or the state of the status relays. See Sections 2.1 Process Tool Integration and 3.2 Operating Modes for more information.

3. **Normal operation:** Once the 4214UN has started up, use the STANDBY Mode to turn the Ionizer's High Voltage off or on during the tool's normal work cycle. The 4214UN should be powered off by removal of the +24V only when the work cycle for the tool is ended or the ionizer function will not be needed for a long period of time.
4. **Gas flow detection:** The Ionizer's High Voltage will turn on and off when the gas flow is cycled on and off; the Gas Flow detection feature in the 4214UN will automatically switch the Ionizer into Standby mode when the gas flow falls below ~35 lpm. However, the gas flow is not the recommended method for cycling the ionization on and off.

The Model 4214UN will maintain ISO Class 1 cleanliness if the gas flow during normal operation is held at a consistent rate with the Standby feature used to turn the ionization on or off if an interruption in the ionization is required. Turning the gas flow on and off will cause the particle containment system in the 4214UN to turn on and off and may create the possibility of dislodging particles by mechanical shock with the abrupt start/stop of the gas flow.

The maximum recommended flow through the Model 4214UN is 100 lpm.

2.7 Setup

Note: The Model 4214UN is a self-balancing device and requires no adjustment by the end-user. Ionization balance is achieved by a proprietary self-balancing design.

There are no externally accessible controls on this product.

2.8 Optional Power-Signal Distribution Box

The optional 4214 Power-Signal Distribution Box (P/N 33-4214-05) allows the user of the 4214 ionizer to:

1. Easily connect the 4214 ionizer to a standard Simco-Ion 24 VDC power supply (#14-21108) using a locking modular handset cable.
2. Connect the 4214 ionizer to +24 VDC power commonly available in most industrial equipment.
3. Control the 4214 HV standby function and access the status relay output connections via an 8-position terminal block.

Mounting

Note:	Install the 4214 Power-Signal Distribution Box in a location that is easily accessible so that the I/O cables can be connected without interference.
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1. The 4214 Power-Signal Distribution Box is provided with slotted mounting holes on two side flanges. These slots can be used with two #6 screws mounted 3.0" apart, see Section 5.2 Dimensional Drawings, 4214 Power-Signal Distribution Box.
2. For safety, all I/O cables to the Interface box should be an appropriate length for the installation.

Connections

Note:	The Power-Signal Distribution Box is shipped from the factory with terminal block Pins 1 & 4 jumpered to provide a "HV enabled" state.
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24 VDC Power Input Connections

There are three ways to supply 24 VDC power to the Interface Box:

1. Basic 24 VDC connection:
 - a. Connect the box to a standard Simco-Ion 24 VDC power supply (#14-21108) using a 26 AWG 4-conductor modular cable to the "Power In" port.

Note:

The drawing below shows the simplest connection scheme where the ionizer HV is always enabled when 24 VDC is supplied.

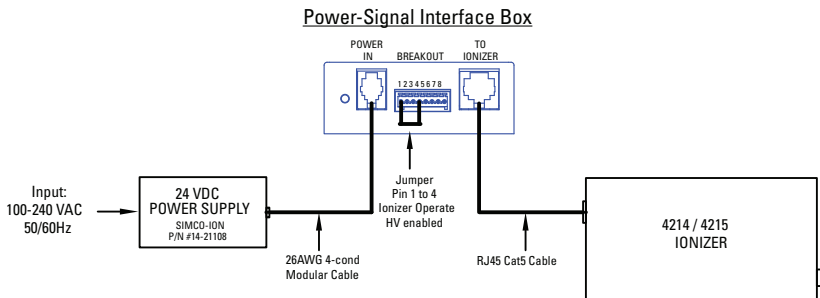


Figure 5. Basic 24 VDC Power Connection

2. 24 VDC power supply with Standby activation or Status Relay contact:
 - a. Connect the interface box to a standard Simco-Ion 24 VDC power supply (#14-21108) using a 26 AWG 4-conductor modular cable to the "Power In" port.
 - b. To enable ionization, connect Pin 4 to Ground.
 - c. To enable a Standby condition, Pin 4 should be floating (no connection). It will be pulled up internally to about 24V.

Note:

In this wiring scheme, +24VDC is NOT supplied to the terminal block Pins 1 & 2. The +24VDC is supplied from the external power supply that is connected to the modular handset jack labeled "Power In".

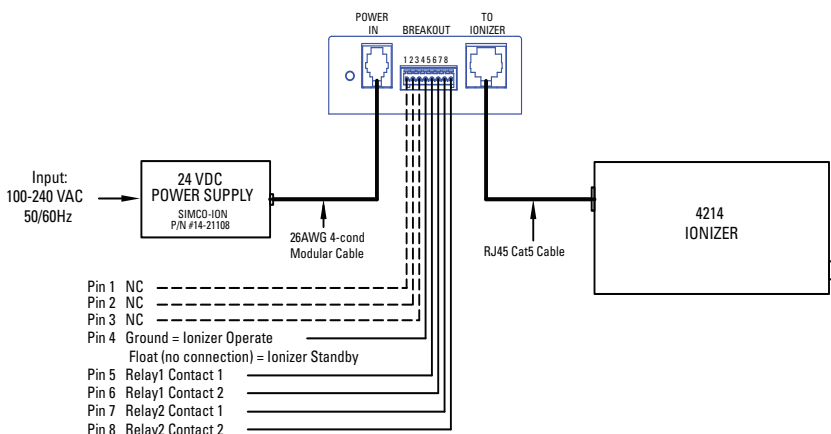


Figure 6. Basic Power Connection with Standby or Status Breakout

3. 24 VDC from tool or other external power source:

- Connect +24 VDC +/-5% power from the end-user's tool using the 8-position terminal block, Pin 2.

Note:

If 24 VDC power is supplied via the terminal block, do not connect 24 VDC to the RJ-9 "Power In" connector.

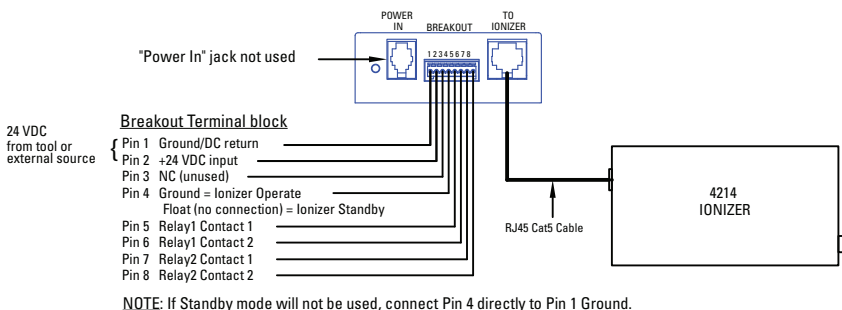


Figure 7. Power Connection via Terminal Block with Standby or Status Breakout

Caution:

If 24 VDC power is supplied via the terminal block, verify the polarity connections Pin 1 = GND, Pin 2 = +24 VDC before applying power.

Terminal Block Pin Out

The terminal block provides:

- Input for 24 VDC from an external power supply
- Standby mode control of the ionizer (HV enabled/disabled)
- Status relay contact connections

Pin	Function	Notes
1	GROUND	This DC power return must be connected to the grounded tool frame or to earth ground
2	+24 VDC, +/-5% input voltage	0.25A, 6W max
3	Reserved	Reserved
4	STANDBY Input	Floating (No connection) = Ionizer Standby, Ground = Ionizer Operate
5	Relay 1 contact	RELAY 1, CONTACT 1, ± 60 VDC @ 0.2A, max
6	Relay 1 contact	RELAY 1, CONTACT 2, ± 60 VDC @ 0.2A, max
7	Relay 2 contact	RELAY 2, CONTACT 1, ± 60 VDC @ 0.2A, max
8	Relay 2 contact	RELAY 2, CONTACT 2, ± 60 VDC @ 0.2A, max

+24 VDC Power (Pins 1 & 2): To connect tool power to the Interface box, connect +24 VDC to terminal block Pin 2 and the DC power return to Pin 1.

Standby Mode (Pin 4): The factory default external wire jumper between terminal block Pins 1 (GND) and 4 (Standby) sets the ionizer in the "operate" mode (i.e., HV enabled). Float Pin 4 with no connection and the ionizer will enter "standby mode" and the HV output of the ionizer will be disabled.

Status Relay contacts (Pins 5 & 6, 7 & 8): Pins 5 & 6 and 7 & 8 provide relay contacts that will be open or closed depending on the alarm status of the ionizer.

4214 Connection "To Ionizer"

Use a straight-through RJ-45 Cat-5 cable to connect between the Inter-face Box port marked "To Ionizer" and the power input port on the 4214 ionizer

Use a straight-through RJ-45 Cat-5 cable to connect between the Interface Box port marked "To Ionizer" and the power input port on the 4214 ionizer.

In order to maintain end-user required cleanliness, it is recommended that the Cat-5 cable (and other kit components, if needed) be re-cleaned to the appropriate cleanliness level prior to installation by the end-user.

3

Operation

3.1 Ionizer Status Indicators

3.2 Operating Modes

3.3 Alarms

3.1 Ionizer Status Indicators

The tables below describe the LED status lights and relay contact status (pins 5 & 6, 7 & 8) on the I/O connector:

Model 91-4214UN-04A

Ionizer Status	Green	Red	Yellow	Blue	Status Relay Output 1 (5-6)	Status Relay Output 2 (7-8)	Comments
Power Off	Off	Off	Off	Off	Open	Open	OFF
Startup Mode	GRN	Off	Off	Flash	Close	Close	Startup mode
Ionization On	GRN	Off	Off	Off	Close	Close	Normal operation
Ionization Off	GRN	Off	Off	BLUE	Close	Open	Standby mode
Low Gas Flow	GRN	Off	Flash	BLUE	Open	Open	Low Gas Standby*
Elevated HV Drive	GRN	Off	YEL	Off	Close	Open	Indicator only
HV Error	GRN	RED	Off	Off	Open	Open	HV Alarm

Table 2. Model 91-4214UN-04A Status Indications

* During simultaneous Standby mode and Low Gas flow conditions, the user requested Standby mode will take precedence and will be reported at the Status Relays.

Model 91-4214UN-04

Ionizer Status	Green	Red	Yellow	Blue	Status Relay Output 1 (5-6)	Status Relay Output 2 (7-8)	Comments
Power Off	Off	Off	Off	Off	Open	Open	OFF
Startup Mode	GRN	Off	Off	Flash	Open	Close	Startup mode
Ionization On	GRN	Off	Off	Off	Close	Close	Normal operation
Ionization Off	GRN	Off	Off	BLUE	Close	Open	Standby mode
Low Gas Flow	GRN	Off	Flash	BLUE	Open	Open	Low Gas Standby*
Elevated HV Drive	GRN	Off	YEL	Off	Close	Open	Indicator only
HV Error	GRN	RED	Off	Off	Open	Open	HV Alarm

Table 3. Model 91-4214UN-04 Status Indications

* During simultaneous Standby mode and Low Gas flow conditions, the user requested Standby mode will take precedence and will be reported at the Status Relays.

3.2 Operating Modes

Startup Mode

Upon initial application of +24 VDC, the LEDs will briefly light up in sequence. A steady Green LED indicates +24 VDC is applied and the Blue LED will blink indicating the unit is executing a startup routine until corona ionization begins.

During startup, the condition of the status relays 1 and 2 will depend on the model number of the 4214UN.

Model	Status Relay 1	Status Relay 2
91-4214UN-04	Open	Closed
91-4214UN-04A	Closed	Closed

Note:

In Startup mode, multiple attempts will be made to establish corona over a maximum period of about 3 minutes. The time it may take to start the ionization from a "cold start" will depend on the length of time that the ionizer has been resting in an OFF condition.

If ionization cannot be initiated within the 3 minute period, the 4214UN will indicate a HV Alarm and will enable a latched HV Error alarm.

Another Startup sequence can be initiated by:

- Cycling the 4214UN in/out of Standby mode
- Cycling the +24V off/on
- Forcing the 4214UN in/out of a Low Gas Flow alarm (Standby mode)

Note:

Cycling the 4214UN in/out of Standby mode is the preferred and recommended method of initiating a new startup sequence.

Once the control system recognizes that corona ionization has started, the HV level is automatically adjusted to provide stable gas ionization.

Normal Mode

In the normal operation mode, the high voltage is automatically set to keep the corona within the optimal operating range and only the Green LED will be lit.

Both Relay outputs (I/O pins 5 & 6 and 7 & 8) will be closed to signal normal operation of the ionizer.

Standby Mode

"Standby" mode can be activated by having pin 4 float (no connection). Pin 4 will be pulled high internally to about 24V. With standby mode activated, steady Green and Blue LEDs will be lit, the high voltage is turned off, pin 4 of the RJ-45 I/O connector will be pulled high, and relay contacts at RJ-45 I/O connector pins 5 & 6 will be closed and 7 & 8 will be open.

- To exit standby mode and resume operation, connect I/O pin 4 to ground. The 4214UN will re-enter Startup mode and then resume normal operation.

3.3 Alarms

Elevated HV Drive Indicator

During normal operation, the control system will maintain the minimum HV drive level required to provide a stable corona voltage. An Elevated Drive Level indicator will be set when the digital control system needs to raise the HV drive to a relatively high level within its internal range limit. This alert state will be indicated by steady Green and Yellow LEDs and the relay contacts at the RJ-45 I/O connector Pins 5 & 6 will be closed and 7 & 8 will be open.

Please note that the Elevated Drive Level Indicator is only an "alert". The activation of this indicator does not mean that the 4214UN has ceased to operate properly; it only means that the internal HV drive level is moving towards the higher end of its operating range.

If the Elevated Drive Level Indicator persists over several startups of the ionizer, or for long periods of operation, this may then be an indication that servicing of the ionizer could be required

HV Alarm

If the 4214UN's control system is not able to achieve and maintain the desired corona voltage, a High Voltage Alarm is set and the high voltage is turned off. This latched alarm state will be indicated by steady Red and Green LEDs and relay contacts at the RJ-45 I/O connector Pins 5 & 6 and 7 & 8 will both be open, indicating that service is required. After a HV Alarm has been set, you must cycle the 4214UN in/out of Standby mode, or in/out of a Low Gas Flow shutdown, or cycle the +24V off/on in order to have the 4214UN attempt to resume normal operation.

Gas Flow Alarm

If the gas flow rate through the 4214UN falls below ~35 lpm, the unit enables a low Gas Flow Alarm and goes into Standby mode. Low Gas Flow status will be indicated by steady Green and Blue LEDs and a flashing Yellow LED. The relay contacts at the RJ-45 I/O connector Pins 5 & 6 and 7 & 8 will both be open. When the gas flow

rate is raised above ~39 lpm, the 4214UN will automatically re-enter startup mode and then resume normal operation.

The maximum recommended gas flow through the Model 4214UN is 100 lpm.

A gas flow alarm can also be caused if the outlet of the ionizer is restricted and more than about 2 psi of back pressure is created within the ionizer. The Model 4214UN is NOT designed to be pressurized. If an outlet manifold is needed for proper dispersion of the ionized gas, please be careful while designing the manifold to make it free flowing and to not create a back pressure situation.

Note:

If a Standby condition is requested during a period of low gas flow, the user requested Standby condition will take precedence and will be reported at the Status relays until the standby request is removed.

4

Maintenance

- 4.1 Emitter Replacement
- 4.2 Filter Cartridge Replacement
- 4.3 Troubleshooting

4.1 Emitter Replacement

The Model 4214UN features a replaceable single-crystal silicon emitter assembly (P/N 71-24219-04). Emitter point replacement requires opening the chassis; it is recommended that this operation be scheduled during a tool maintenance period.

It is recommended that the emitter assembly be replaced every 12 months for an installation where the duty cycle of the 4214UN is typically 10-20%. However, an optimum maintenance cycle for the emitter assembly will need to be established by the end-user for his application.

Do not remove the new emitter assembly from its packaging until you are ready to install it in the Ionizer. The new emitter assembly has been pre-conditioned for optimum startup performance. Do not be alarmed if the tip of the new emitter appears discolored.

Note:

Emitter assembly #71-24219-04 is not backwards compatible with "-03" or earlier ionizers. If you have a Model 4214 ionizer whose part number ends with a "-01" to "-03", please order emitter replacement part number #71-24219-01. If you have any questions regarding the emitter replacement part number, please contact Simco-Ion for assistance.

Note:

Clean performance of the 4214UN should be verified after replacement of the emitter assembly. Contact Simco-Ion support if you have any questions.

The replacement emitter assembly will contain the following:

- Emitter point holder with single-crystal silicon emitter point installed (1 piece)
- GORE-TEX® gasket (1 piece)
- Nylon screws, M3 x 6 mm Phillips, pan-head (3 pieces)

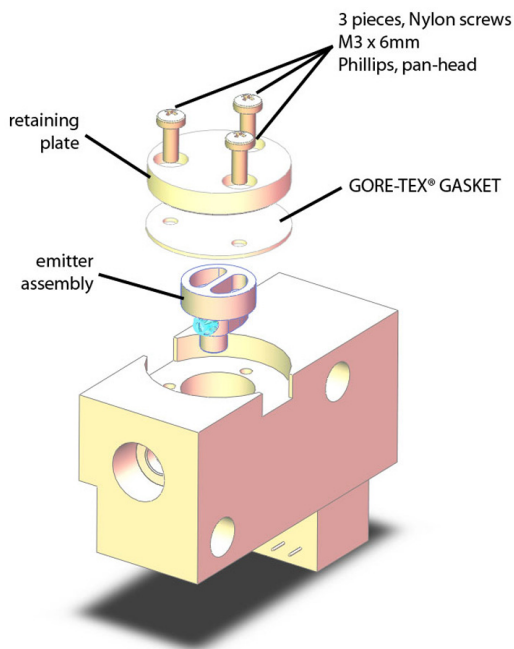


Figure 8. Emitter Replacement

Replacement Procedure

1. Loosen the three M3 chassis screws and lift off the stainless steel chassis cover.
2. Remove the three nylon screws holding the emitter retaining plate. Discard the used nylon screws.
3. Remove the retaining plate.
4. Remove and discard the used white GORE-TEX® gasket.
5. Pull the old emitter assembly from the 4214UN noting how it is oriented, then discard it.
6. Remove the new emitter holder from its sealed bag. Insert the emitter holder into the lonizer, fitting the male pin from the emitter holder to the socket in the polycarbonate ionization block. Verify that the emitter holder is fully inserted into the block cavity.

7. Place the new white GORE-TEX® gasket over the emitter assembly handle.
8. Replace the retaining plate; it should press the GORE-TEX® gasket into the chassis recess. Secure the retaining plate to the lonizer with the three new nylon screws provided with the new emitter assembly.
9. Replace the stainless steel chassis cover and secure it with the original three M3 screws.

4.2 Filter Cartridge Replacement

The Model 4214UN features a disposable/replaceable filter cartridge (P/N 33-24214-41) with an efficiency rating of 99.99% for 0.01 micron particles.

Filter cartridge replacement requires opening the chassis of the 4214UN - it is recommended that this operation should be scheduled during a tool maintenance period. It is recommended that the filter be replaced at the same time as the emitter point assembly.

The replacement filter cartridge kit contains the following:

- Filter cartridge (1 piece)
- O-ring (2 pieces)

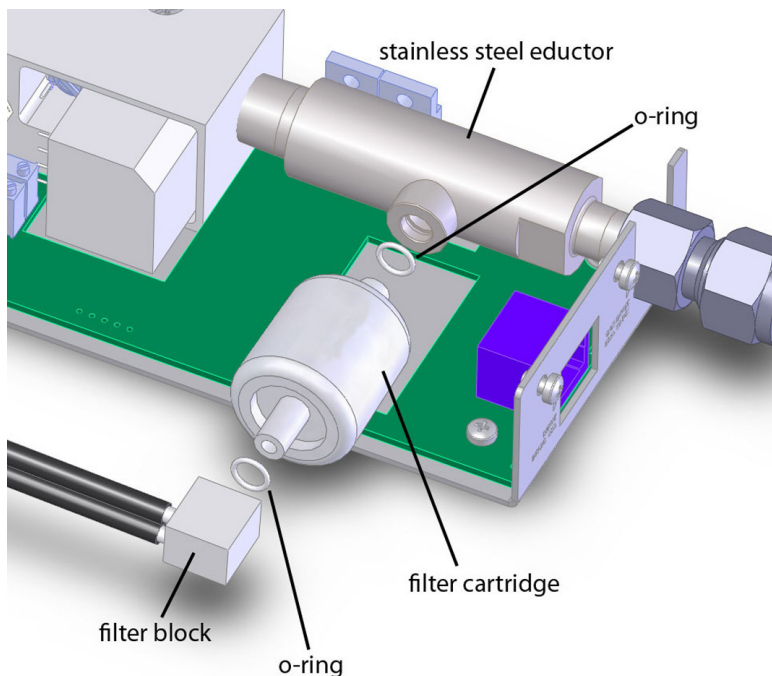


Figure 9. Filter Cartridge Replacement

Replacement Procedure

1. Loosen the three M3 chassis screws and lift off the stainless steel chassis cover.
2. Use a flat blade screwdriver as a wedge between the filter and the white filter connector block to work the filter block off the filter.
3. Once the filter block is disconnected from the filter, grasp the filter itself and use a twisting motion while pulling it free from the stainless steel eductor.
4. Remove and discard the old O-ring from inside the groove of the eductor vacuum port. Install a new O-ring into the groove.
5. Remove the new filter from its packaging.

Note:

If your unit has a filter with a blue housing, the end of the filter with a glued on endcap should face the white nylon filter connector block.

If your unit has a filter with a green housing with a directional arrow molded into the housing, install the filter with the arrow pointing at the white nylon filter connector block.

6. Insert the stem of the filter housing into the SST eductor and twist/push the filter into place against the eductor.
7. Remove and discard the O-ring from the groove inside the filter connector block. Carefully install a new O-ring into the groove in the connector block. Fit the connector block onto the stem of the filter housing and push it into place against the body of the filter.
8. Check that the two Teflon lines are still firmly seated to their connectors.
9. Re-install the stainless steel chassis cover and secure it with the original M3 screws.

4.3 Troubleshooting


Symptom	LED Status	Suggested Fix
Unit does not start up	Green, Red	Cycle the +24 VDC power and attempt re-start of unit.
Gas Flow rate alarm	Green, Blue, & flashing Yellow	<ul style="list-style-type: none">Adjust nitrogen flow rate to be at least 40 lpm @ 36.5 kPa (1.4 cfm @ 5.3 psi) and <100 lpm @ 207 kPa (3.5 cfm @ 30 psi)Verify that there are no restrictions creating back pressure on the outlet flow of the ionizer.
Decay times too long	Green	<ul style="list-style-type: none">Increase nitrogen flow rateLocate the ionizer closer to the targetAdjust manifold for improved target coverage

5

Specifications

- 5.1 Model 4214UN Specifications
- 5.2 Parts & Accessories
- 5.3 Dimensional Drawings
- 5.4 Timing Diagram

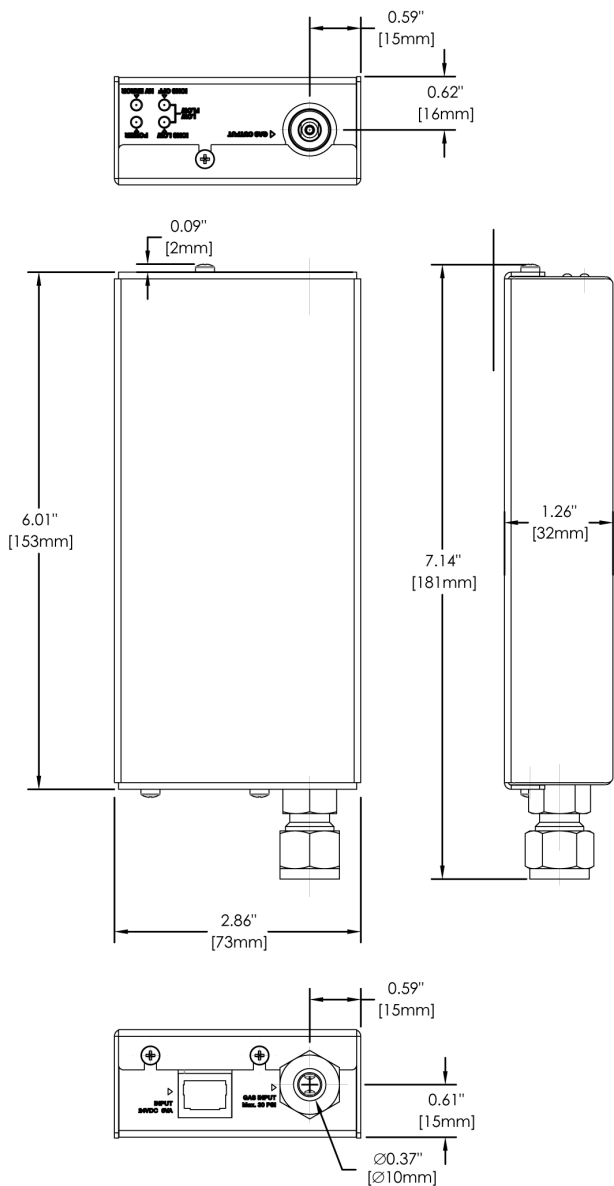
5.1 Model 4214UN Specifications

Input Voltage	+24 VDC, +/-5% @ 0.25 A, 6W (max)
Balance	±25V or less (typ) with no output manifold, measured @ 150 mm (6") from CPM, standard nitrogen flow rate 40 lpm @ 36.5 kPa (1.4 cfm @ 5.3 psi)
Discharge	No manifold: ±1000-100V, 10 sec. ±0.2 VDC or less (typ), measured @ 150 mm (6 in.) to CPM, nitrogen flow rate 40 lpm @ 36.5 kPa (1.4 cfm @ 5.3 psi) With manifold: 1000-100V, 100 sec. or less (typ), measured @ 500 mm (19.6 in.) from custom manifold
Ion Emission	High frequency AC corona discharge
Cleanliness	ISO 14644-1 Class 1 (0.1 µm particles) and ISO 14644-12 Class 1 (0.01 µm particles)
Ion Emitter	Single crystal silicon
Gas	Nitrogen; minimum purity 99.99%
Gas Flow Rate	Minimum: 40 lpm @ 36.5 kPa (1.4 cfm @ 5.3 psi) Recommended: 90 lpm @ 171 kPa (3.2 cfm @ 24.8 psi) Maximum: 100 lpm @ 207 kPa (3.5 cfm @ 30 psi)
Gas Supply Temp	60°C (max)
Inlet Gas Connector	Swagelok® 316L SST 1/8" FNPT Adapter to 3/8" OD tubing (#SS-600-7-2)
Outlet Gas Connector	¼ NPT female threaded port on ionizer block; optional custom manifold to have ¼ NPT male
Operating Temp	Ionizing unit 15-60°C (max); custom manifold per individual specification
Control System	Microprocessor controlled ionization, self balancing
Alarms	HV alarm, ELEVATED HV DRIVE alarm, GAS FLOW alarm
Status Relays 1&2	±60 VDC @ 0.2A, max
Filter Cartridge	Disposable 99.99% filtration efficiency for 0.01 micron particles
Dimensions	6.0L x 2.85W x 1.26H in. (152.4 x 72.4 x 32 mm) without manifold
Weight	0.64 kg (1.4 lbs) without manifold
Enclosure	Stainless steel
Mounting	Two M5 threaded inserts provided on bottom of unit; M5 screws should not exceed 10 mm in length
Certifications	 RoHS 2 Compliant

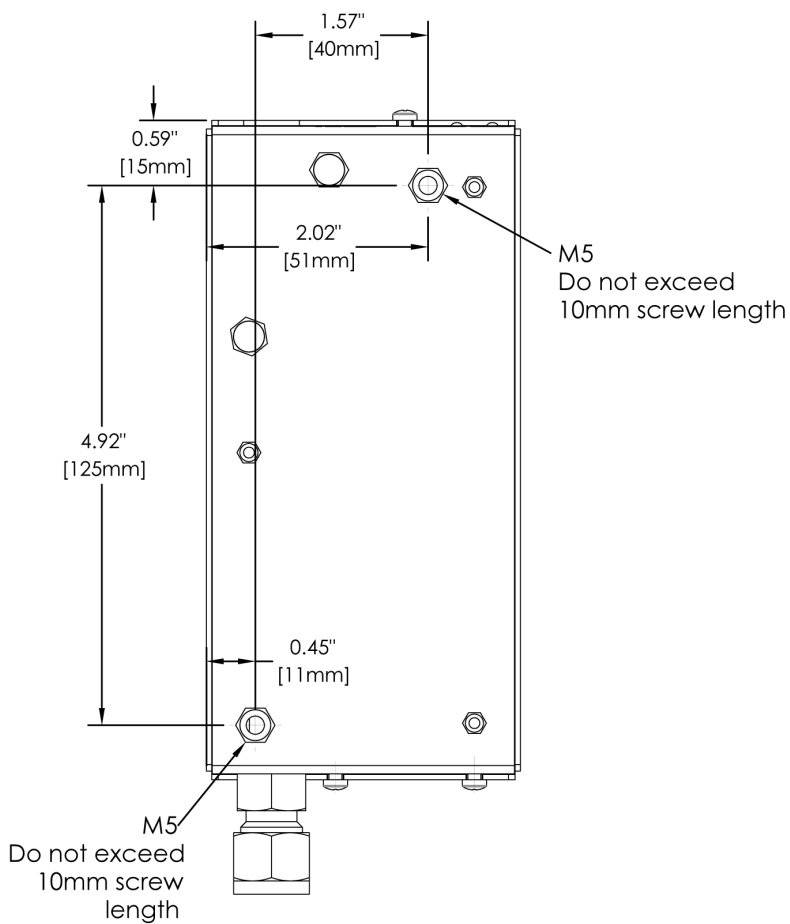
5.2 Parts & Accessories

Parts	Simco-Ion P/N
Single crystal silicon emitter point assembly (emitter holder with emitter point, 3 nylon screws, GORE-TEX® gasket)	
Note: Emitter assembly #71-24219-04 is not backwards compatible with "-03" or earlier ionizers. If you have a Model 4214 ionizer whose part number ends with a "-01" to "-03", please order emitter replacement part number #71-24219-01.	71-24219-04
Filter cartridge kit, 99.99% efficient (filter cartridge, 2 o-rings)	33-24214-41
Accessories	
Model 4214 Power-Signal Distribution Box	33-4214-05
Model 4214 Power-Signal Distribution Kit (Distribution Box, 10' cable, 24 VDC universal input power supply) Note: Power cord must be specified separately - see below.	33-4214-15
Model 4214 Power-Signal Distribution Kit (Distribution Box, 25' cable, 24 VDC universal input power supply) Note: Power cord must be specified separately - see below.	33-4214-16
China Power Cord	25-20750
Europe Power Cord	25-20735
Northern America Power Cord	25-20660
UK Power Cord	25-20710

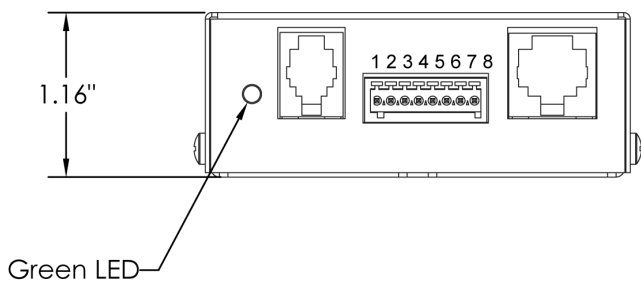
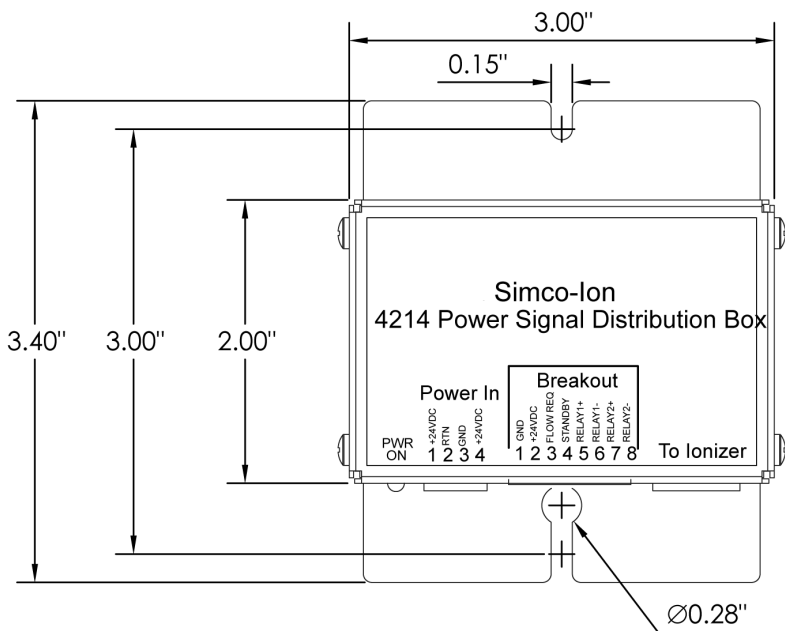
5.3 Dimensional Drawings



Model 4214UN Gas In-Line Ionizer

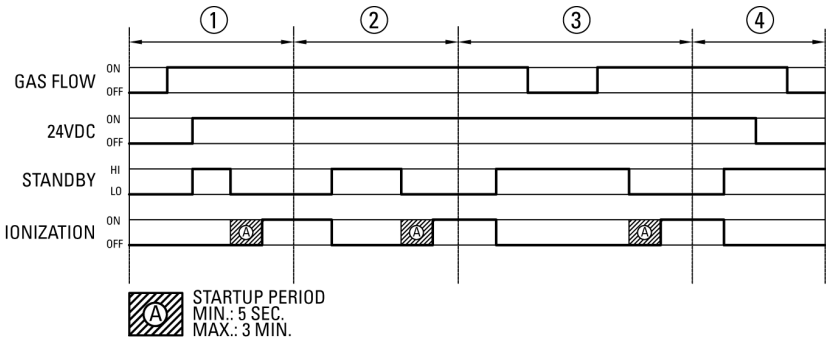


Model 4214UN Gas In-Line Ionizer Chassis Bottom Panel



Optional Model 4214UN Power-Signal Distribution Box

5.4 Timing Diagram



Section 1: Typical startup sequence. Note that the gas flow should be ON before the start of ionization.

Section 2: Standby mode without turning off gas flow.

Section 3: Typical sequence for placing unit into Standby with the gas flow turned OFF during the Standby period.

Note: Ionization is OFF before the gas flow is stopped and that the gas flow should be started before turning the ionization back on.

Section 4: Typical shut down sequence. Note that the ionization is off BEFORE the gas flow is stopped.

Note: During simultaneous Standby mode and Low Gas flow conditions, the user requested Standby mode will take precedence and will be reported at the Status Relays.

Start Up Period

Ionization start up requires a minimum of 5 seconds and a typical start up is approximately 10 seconds. The 4214 will indicate a HV Fault alarm if it fails to startup within 3 minutes.

6

Warranty & Service

Simco-Ion provides a limited warranty for the Ionizer Model 4214UN. New products manufactured or sold by Simco-Ion are guaranteed to be free from defects in material or workmanship for a period of two (2) years from date of initial shipment. Simco-Ion liability under its new product warranty is limited to servicing (evaluating, repairing, or replacing) any unit returned to Simco-Ion that has not been subjected to misuse, neglect, lack of routine maintenance, repair, alteration, or accident. In no event is Simco-Ion be liable for collateral or consequential damages. Consumable items such as, but not exclusive to, emitter points, emitter wires, batteries, filters, fuses or light bulbs are only covered under this warranty if found defective as received with the new product.

To obtain service under this warranty, please contact Simco-Ion Technical Support at techsupport@simco-ion.com or (510) 217-0470.

Notes

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