

AutoJet[®] ES2500 Electrostatic Manifold System

OWNER'S MANUAL

AutoJet[®]
TECHNOLOGIES



Spraying Systems Co.[®]
Experts in Spray Technology

ML00ES2500F
spray.com

TABLE OF CONTENTS

- 1. Preface3**
 - 1.1 Important3
 - 1.2 How To Use This Manual3
- 2. Safety3**
 - 2.1 General Safety Information3
 - 2.2 Unpacking The System4
- 3. System Overview5**
 - 3.1 Introduction5
 - 3.2 Product Features And Specifications5
 - 3.3 Encoder Kit (Optional)5
- 4. Control Panel7**
 - 4.1 Control Panel Overview7
 - 4.2 HMI Overview8
 - 4.3 Purge/Clean Settings9
 - 4.4 Operating (Home Screen)9
 - 4.5 Recipe Setup10
 - 4.6 System Configuration10
 - 4.7 CH1 Configuration11
 - 4.8 Motor/Driver Information12
 - 4.9 Alarm Settings12
 - 4.10 Monitor IO Settings14
 - 4.11 Help Settings15
- 5. Fluid Delivery Cart16**
 - 5.1 Overview16
 - 5.2 Tank16
 - 5.3 Pump16
 - 5.4 Level Sensor16
- 6. Manifold18**
 - 6.1 Overview18
 - 6.2 Mounting18
 - 6.3 Hook-Up19
 - 6.4 Control Functions20
 - 6.5 Nozzle Configuration21
 - 6.6 Start-Up Procedure21
 - 6.7 Manifold Disassembly22
 - 6.8 Electrostatic Manifold Diagram24
- 7. Troubleshooting25**
- 8. System Maintenance27**

SECTION 1

PREFACE

1.1 IMPORTANT

The AutoJet[®] ES2500 Electrostatic Manifold System are produced, tested, and checked at the factory. The system can be dangerous if used incorrectly. Read this manual carefully and pay special attention to any safety instructions.

Operators must always follow the general safety instructions in the working area and aim to prevent accidents.

The manufacturer reserves the right to make changes in standard construction without prior notification.

Images and diagrams in this manual may not be exact representations of your system configuration.

1.2 HOW TO USE THIS MANUAL

This manual is intended to be a source of information for the operators and technicians who may be installing, interacting with or servicing/maintaining Spraying Systems Co.[®] systems and components.

This manual contains important safety warnings, installation instructions, operating instructions, troubleshooting and maintenance information.

ICONS



WARNING: The user can be seriously injured, damage their health, and/or damage the system.



CAUTION: Product, process, or environment can be damaged or be in danger if the instructions are not followed correctly.



ATTENTION: Supplementary information for the user that draws attention to possible problems.

SECTION 2

SAFETY

2.1 GENERAL SAFETY INFORMATION

READ AND FOLLOW INSTRUCTIONS

All safety-related and operating instructions should be read before the system is operated. Follow all operating instructions.

SERVICING

Do not attempt to service this system unless you have been trained or authorized to conduct repairs. Only authorized and qualified service personnel should attempt to service this system. Service by unauthorized personnel may void any and all warranties.



WARNING: Before performing any maintenance, make sure electrical power is off and any air/liquid pressure is bled from the system.

UNINTENDED USE

Use of Spraying Systems Co.[®] equipment in ways other than those described in the documentation supplied with the equipment may result in injury to persons or damage to property. Examples of unintended use of equipment would be:

- Using incompatible materials/damaged parts
- Making unauthorized modifications/using unapproved auxiliary equipment

- Removing or bypassing safety guards or interlocks
- Operating equipment in excess of maximum ratings

REGULATIONS AND APPROVALS

Make sure all equipment is rated and approved for the environment in which it is used. Any approvals obtained for Spraying Systems Co.® equipment will be voided if instructions for installation, operation, and service are not followed. All phases of equipment installation must comply with federal, state, and local codes.

PERSONAL PROTECTIVE EQUIPMENT

Spraying Systems Co.® strongly recommends the use of appropriate safety equipment when working in potentially hazardous environments and chemicals. This safety equipment includes, but is not limited to, the following:

- Protective hat
- Safety glasses or face shield
- Chemical-resistant safety gloves and apron
- Long sleeve shirt and long pants

Users of this product should never place themselves in the path of the spray. Users should consult and follow the recommendations of the Safety Data Sheet (SDS) of any chemical or fluid sprayed using this system.

PRESSURIZED SYSTEMS

It is important to recognize proper safety precautions when using a pressurized spray system. When dealing with pressure applications, the system pressure should never exceed the lowest rated component. Always know your system, all component capabilities, maximum pressures and flow rates.



WARNING: Fluids under pressure can penetrate skin and cause severe injury.



ATTENTION: Always remember to carefully read the chemical manufacturer's labels, follow SDS and all directions.

WARNING OF SHOCK HAZARD

To reduce the risk of electric shock, do not open the cover on electrical control panel. For service contact Spraying Systems Co.® at 1-866-321-2250.



WARNING: Plug panels into a GFCI outlet.

WARNING: To prevent injury, avoid contact with potentially hot parts. Components can cause severe burns. Do not aim the spray at any person or part of the body. Do not place any part of your body into the spray pattern.

USE OF CHEMICAL COMPONENTS

Spraying Systems Co. does not manufacture or supply any of the chemical components used in this equipment and is not responsible for their effects. Because of the large number of chemicals that could be used and their different chemical reactions, the buyer and user of this equipment should determine compatibility of the materials used and any of the potential hazards involved.

2.2 UNPACKING THE SYSTEM

The system components come packaged to protect them from damage. Use caution when opening the crate. The crate will contain all parts needed to install the unit. Parts of the unit may be wrapped in bubble wrap. Remove all of the packaging material wrapping the system. Once unpacked and removed from the crate, the system is ready for installation and connection.



CAUTION: The packaging may contain exposed cables, hoses, and other components. Always exercise caution when opening boxes to avoid accidental damage or slicing of various components.



SYSTEM OVERVIEW

3.1 INTRODUCTION

The Spraying Systems Co. ES2500 is an Electrostatic System that utilizes a low flow rate and negatively charged fluid to produce electrostatic spraying. The system's purpose is to deliver a controlled spray with a very high transfer efficiency. System applications include spraying various oils and other coating or lubricating fluids onto neutrally charged and grounded metallic targets.

In electrostatic spraying, a negative charge is introduced into a fluid in the nozzle body using direct contact charging. When this charge is applied, it causes the fluid to also acquire a negative charge. This causes the fluid molecules to repel each other, following the principle that like charged molecules will repel and opposite charged molecules will attract. This applied negative charge also causes the fluid to be over the Rayleigh limit, which means it will form into droplets as it exits the nozzle orifice.

After leaving the nozzle orifice, the newly formed droplets continue to repel each other—causing the already small droplets to split evenly into even smaller droplets. This process will continue until the repulsive force between fluid molecules is no longer strong enough to break the surface tension and split the droplet again.

The tiny and uniformly sized droplets retain their negative charges, and will be attracted to any neutral, grounded target nearby with an attractive force stronger than gravity. Electrostatic forces pull the fluid droplets towards this target, thinly and evenly coating the target surface. The average final drop diameter produced by the Electrostatic Manifold is less than 10 microns.

3.2 PRODUCT FEATURES AND SPECIFICATIONS

The ES2500 Electrostatic Spray System consists of three main component groups:

- System Control Panel
- Fluid Delivery Cart
- Electrostatic Manifold

This manual contains general specifications and information for the ES2500 Electrostatic Manifold System. This includes product overviews, installation, operation, maintenance, and troubleshooting information.

SYSTEM USAGE

- The ES2500 is designed to run continuously and provide electrostatic fluid application with high transfer efficiency
- Intended uses include spraying a lubrication oil or a release agent onto a specific metallic target .
- The ES2500 system control panel features a 10" touchscreen HMI
 - Operators can control fluid flow rate and applied voltage
 - System software has been customized for electrostatic spraying, including specific faults and alarms
- The system features two strainer valve assemblies, which allows one strainer to be accessible for cleaning **during** system operation. This limits system downtime for maintenance and allows for continuous system use.

3.3 ENCODER KIT (OPTIONAL)

This system can be programmed to use an encoder and control the system with units of distance instead of timing. Speed/Encoder settings require a connected line speed encoder. There are two encoders that Spraying Systems Co. offers, but the customer can also supply their own.

ENCODER SELECTION

The hollow shaft encoder will mount in the conveyor, while the wheel and pivot style encoder requires the wheel to rest on the conveyor surfaces to measure the line speed.

M12 (f) x 4 pole M12 (f) cable 5m
(Included in both kits)



HOLLOW SHAFT ENCODER

Calculating the calibration constant—K Factor (pulses/ft)

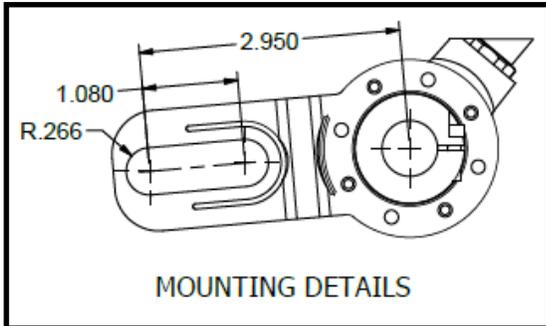
$$K = \text{PPR} / \text{CIR (ft.)} = \text{PPR} / (\text{PI} * \text{DIA})$$

*Use diameter of drive/tail pulley that encoder is attached to.

$$K = \text{PPR} (*\text{D1}/\text{D2}) / (\text{PI} * \text{D2})$$

*Used with dual pulley configuration. D1—Drive/Tail pulley, D2—Secondary pulley encoder is attached to.

$$\text{Gear ratio} = \text{D1}/\text{D2}$$

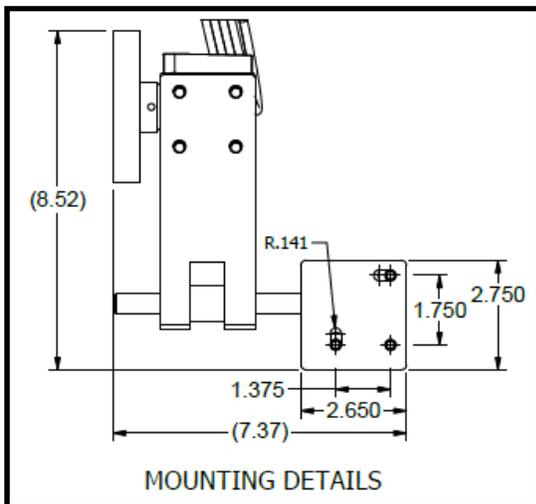


SPECIFICATIONS	
Resolution (PPR)	1024
Output	5-26V push-pull
Input	5-26V
Bore	5/8" hollow bore w/ tether
Bore Inserts Metric	11 mm, 12 mm, 14mm
Bore Inserts Standard	1/4", 3/8", 1/2"
Enclosure Rating	NEMA4/IP65 (Dust Proof,

WHEEL AND PIVOT MOUNTED ENCODER

Calculating the calibration constant—K Factor (pulses/ft)

$$K = \text{PPR} / \text{Wheel CIR (ft.)}$$



SPECIFICATIONS	
Resolution (PPR)	1024
Output	5-26V push-pull
Input	5-26V
Bore	3/8" sealed shaft
Wheel Circumference (CIR)	12"
Enclosure Rating	IP67 w/ shaft seals

CONTROL PANEL

4.1 Control Panel Overview

The ES2500 Control Panel is used to adjust the parameters of the manifold and adjust the settings on the fluid delivery cart. Using the HMI screen settings you can adjust the operation and configuration settings.

PANEL POWER REQUIREMENTS :

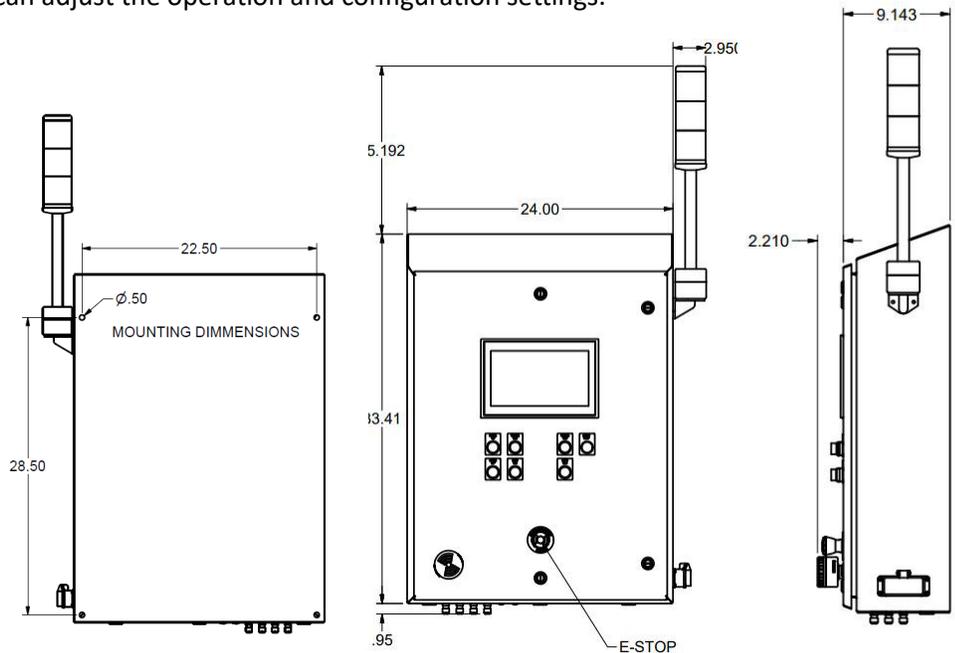
Voltage- 120VAC, 3Ph

Frequency- 60Hz

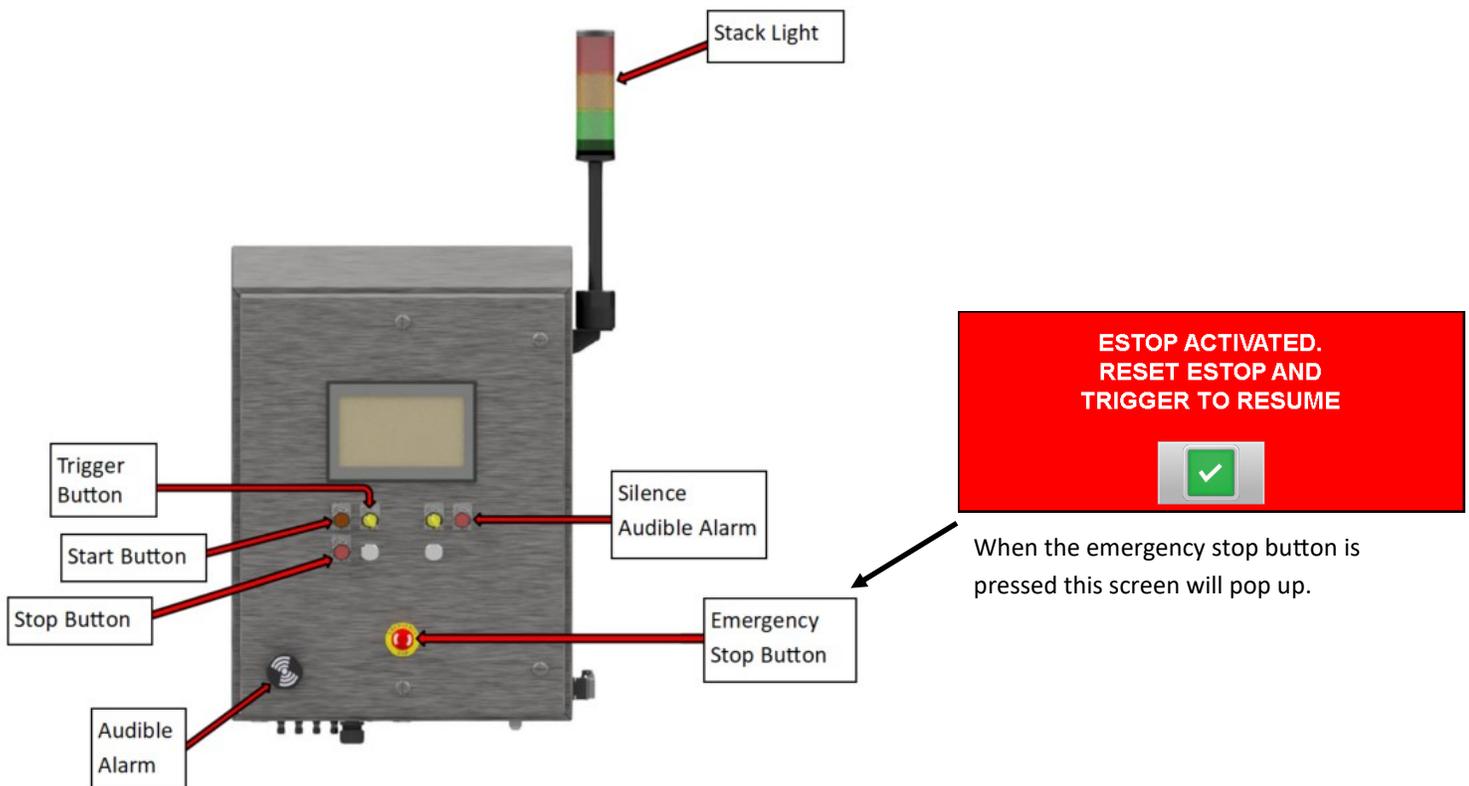
Current- 20A max

ELECTROSTATIC PANEL FEATURES:

- 10" HMI Touch Screen display
- Customizable spray parameters
- Washdown rated
- Three (3) Color Stack Light
- Audible alarm
- Emergency stop button
- Start/Stop Button
- System Trigger Button



SYSTEM CONTROL PANEL LABELED DIAGRAM



4.2 HMI OVERVIEW

The HMI screens are shown with additional features or options that may not be included with your system configuration.

First starting up and after any system reboot, the Operating screen will load as the system default screen. From the 'Operating' screen, you can:

- Trigger Channel standby and run
- View and change the currently selected recipe
- View the voltage setpoint
- View the line speed (If Encoder is connected)
- View the flow rate setpoint
- View the Electrostatic system status
- View if the motor is currently running
- Access the Purge/Clean settings

Operating Screen Buttons

Button	Description
	<p>Channel Current Status:</p> <p>This button allows the operator to toggle the system in to run or standby mode. The button will appear green while the system is operating.</p>
	<p>Recipe Selection:</p> <p>The name of the currently selected recipe will appear in the text window. Use the up or down arrow buttons if you need to select a new recipe.</p>
	<p>Electrostatic Status:</p> <p>Displays the current operating status of the Electrostatic system. This image shows how the button is during standby state.</p> <p>The button will be green during system operation.</p>
	<p>Motor Idle:</p> <p>This button will be red when the motor is off and will be green while the motor is running.</p>
	<p>Purge/Clean:</p> <p>This button brings up the system 'Purge/Clean' settings. See the Purge/Clean section for more information.</p>
	<p>ES2500 Menu:</p> <p>Whenever this button is visible in the top right-hand corner of the HMI, operators can open and make selections from the navigation menu.</p>

Note: If included in your configuration, CH2 buttons operate in the exact same way as CH1 buttons.

4.3 PURGE/CLEAN SETTINGS

The 'Purge/Clean' features allows for pump operation and liquid flow without the activation of the High Voltage Power Supply (HVPS) and Electrostatic components.

PURGE

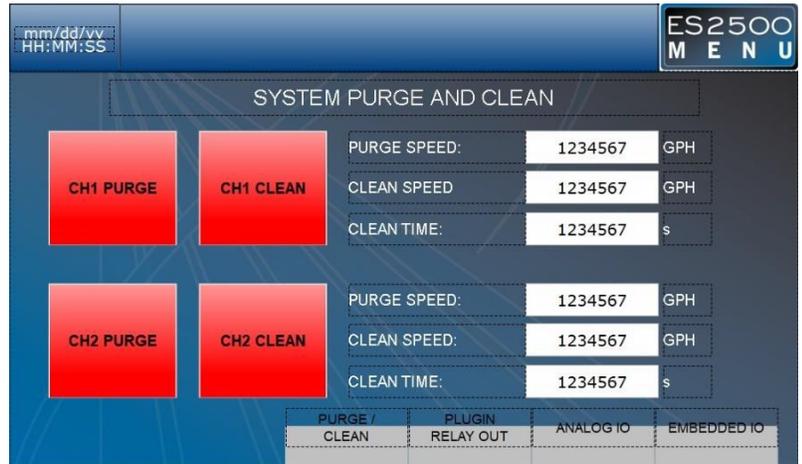
The purge function purges the fluid lines of air by running the pump to fill the lines with fluid. Purge mode should be run until fluid begins to drip from the manifold nozzles. The purge function is to be used during initial installation to fill the fluid lines, and before each system run when the fluid lines have been previously drained. Operators can set the purge speed in gallons per hour (GPH), and should set the pump speed within the upper range of its maximum flow setting.

CLEAN

The system should be flushed and cleaned with a frequency determined by system operators. It is suggested to flush and clean the system at the end of each product run.

The clean function should be utilized when cleaning and flushing the system. This is because the clean function does not activate the HV connection. This allows water to flush the system.

Operators can set the flow rate for the clean cycle in GPH and set a time for the duration of the function.



Begin by draining the tank of fluid by opening the discharge port of the 3-way valve at the bottom of the tank. Rinse the tank after fluid has been drained.

Add water and a detergent (if desired) to the tank to run through the system and clean the system lines.

Purge/Clean screen with the *optional* two (2) Channel set up.

4.4 OPERATING (HOME SCREEN)

All system settings options can be accessed through the ES2500 Menu button at the top of the HMI screen, allowing system operators to quickly access the settings and information that they need.

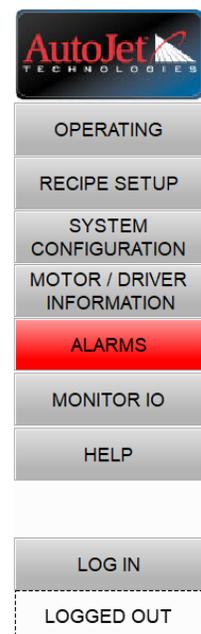
The following sections will explain the function of each navigation menu option.

RETURNING TO THE OPERATING (HOME) SCREEN

Return to the 'Operating' screen at any time to see the current system configuration.



Operating screen shown here with *optional* CH 2 (second channel) configuration.



4.5 RECIPE SETUP

The Recipes feature allows you to create and save your commonly used spray parameters. The system supports the creation and storage of up to 16 customized recipes. Switching between premade Recipes allows for much quicker transitions when changing batches or products that may require different spray parameters. Each individual recipe allows you to:

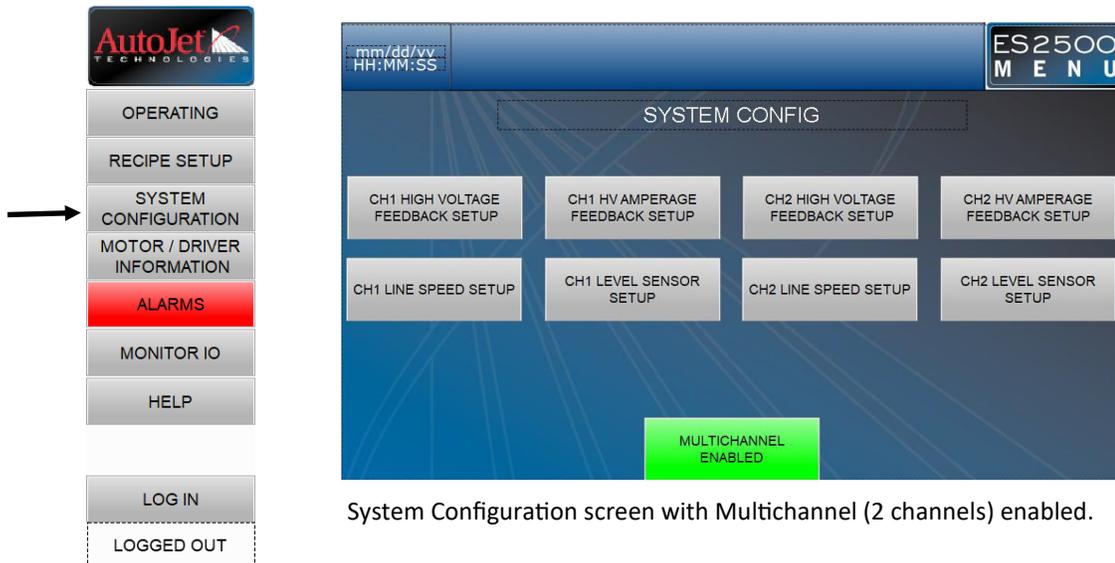
- Create a name
- Enter the flowrate setpoint in gallons per hour (GPH) or based on mL per Sq. Ft. (line speed)
- Enter the Electrostatic voltage setpoint in kV
- Set the pump priming time
- Set the desired spray width in inches



Recipe Setup screen

4.6 SYSTEM CONFIGURATION

The 'System Configuration' setting allows operators to set system parameters for operation. For each channel, the operator has control over options that will affect the system output.



System Configuration screen with Multichannel (2 channels) enabled.

4.7 CH1 CONFIGURATION

CH1 HIGH VOLTAGE FEEDBACK SETUP

Note: Ch2 configurations setup are the same as Ch1 configuration setup.

The operator can set the max voltage output in kV for both the HVPS and PLC.

CH1 HIGH VOLTAGE SETUP		
VOLTAGE MONITOR	123.4	kV
MAX VOLTAGE MONITOR	123.4	kV
VOLTAGE OUTPUT (PLC)	123.4	kV
MAX VOLTAGE OUTPUT	123.4	kV

CH1 LINE SPEED SETUP

If you are using a line speed encoder with the ES2500, this configuration will allow you to use the device with the system.

See Encoder Selection for more information about encoders.

CH 1 LINE SPEED SETUP		
LINE SPEED 1:	123.45	FT/MIN
LINE SPEED:	NOT INSTALLED	▼
K-FACTOR	12345.67	PULSE/IN

CH1 HV AMPERAGE FEEDBACK SETUP

This screen allows the operator to set an amperage alarm, if the amperage exceeds this amount the system will fault.

CH1 HV AMP FEEDBACK SETUP		
AMPERAGE MONITOR	123.4	μA
MAX AMP MONITOR	1234.5	μA

CH1 LEVEL SENSOR SETUP

Relying on the input data from the fluid level sensor, this screen will allow operators to configure system faults and alarms will occur based on the fluid level in the tank.

Operators can set two separate alarms, the first alarm will trigger when the fluid reaches the set low level percentage, and the second will trigger when the fluid reaches a level that is no longer safe for system operation. A tolerance time option is also editable.

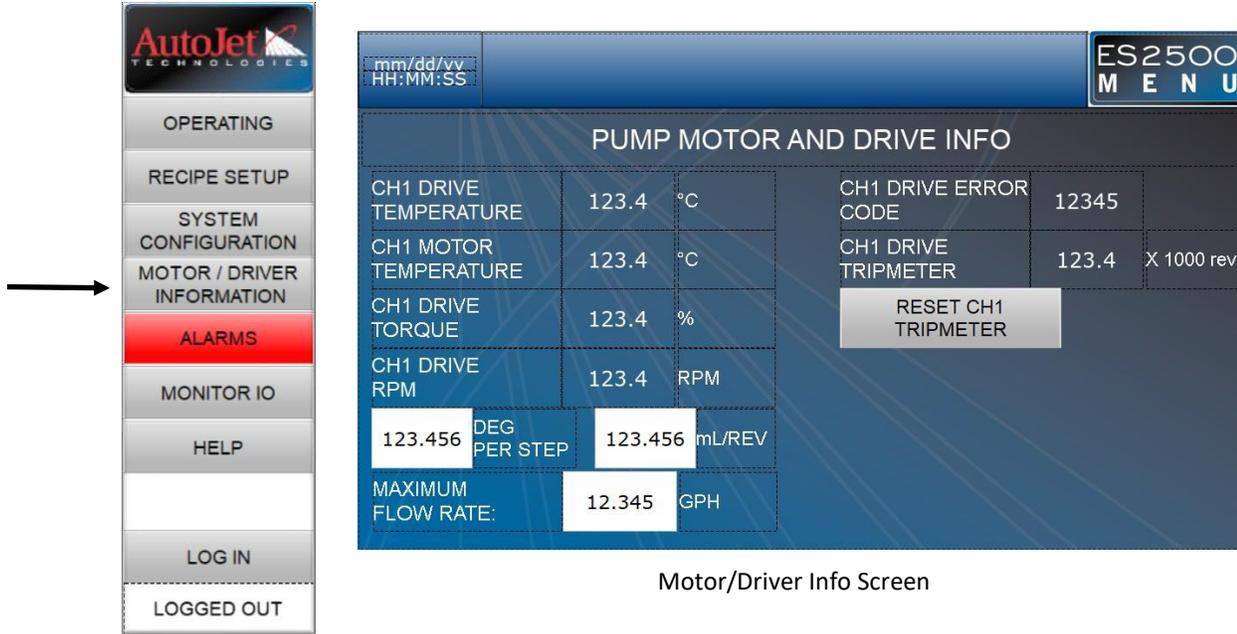
CH1 LEVEL SENSOR SETUP		
LEVEL SENSOR 1:	123.45	%
LEVEL SENSOR:	NOT INSTALLED	▼
SPAN:	123.4	%

CH1 LEVEL SENSOR ALARM		
CH1 LEVEL SENSOR ALM	DISABLED	
MAX LEVEL:	123.4	%
CRITICAL LOW LEVEL:	123.4	%
LOW LEVEL:	123.4	%
TOLERANCE TIME:	123.4	s

4.8 MOTOR/DRIVER INFORMATION

The Pump Motor and Drive Information section provides operators with current operational information for the system motor and sets certain system parameters and view/reset the trip meter.

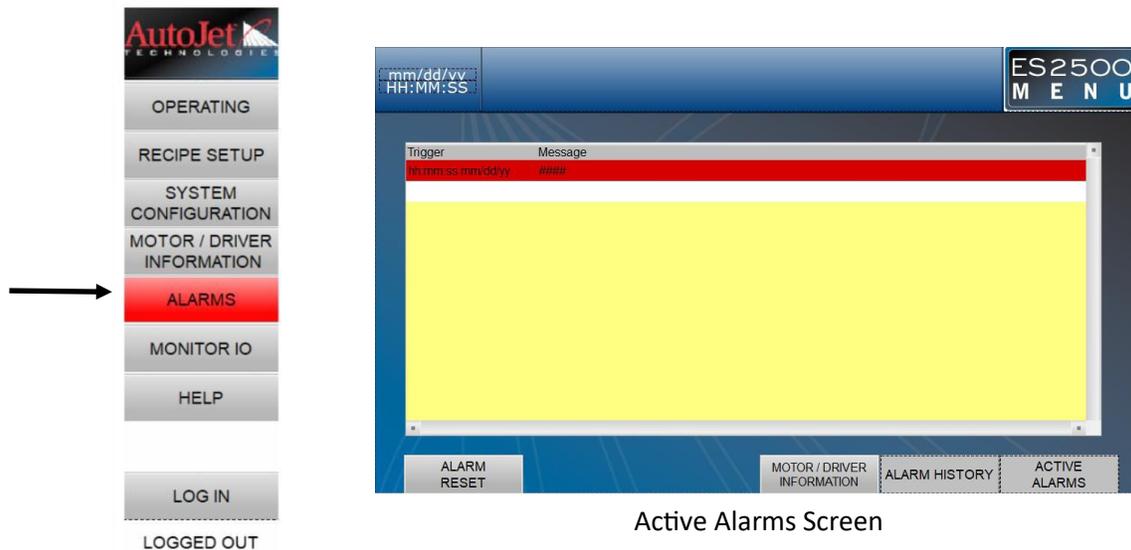
It allows the operator to set the degrees per step (Deg Per Step) and the milliliters per revolution (mL/Rev) for the pump. The information on this screen can be useful when troubleshooting the motor.



4.9 ALARM SETTINGS

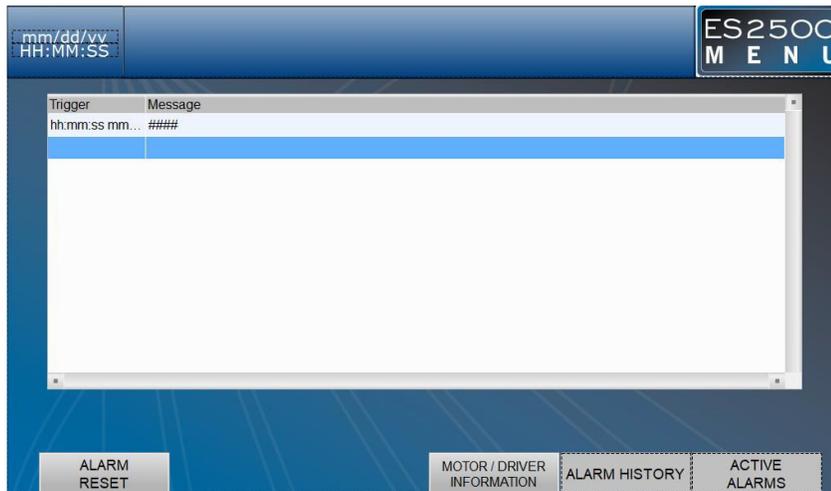
The ES2500 system notifies operators of active and ongoing alarms at the top of the HMI screen and via stack light illumination. The Active Alarms screen, as seen below, lists the time of the fault and the alarm fault code. This screen can be accessed through clicking the alarm popup at the top of the screen, or through clicking Alarms in the Navigation menu. Once resolved, alarms can be cleared by pressing the Alarm Reset button.

See Troubleshooting section for more information.



ALARM HISTORY SCREEN

The Alarm History screen allows operators to view any ongoing or past alarms. This screen will log the time that an alarm occurs, as well as the specific alarm fault code.



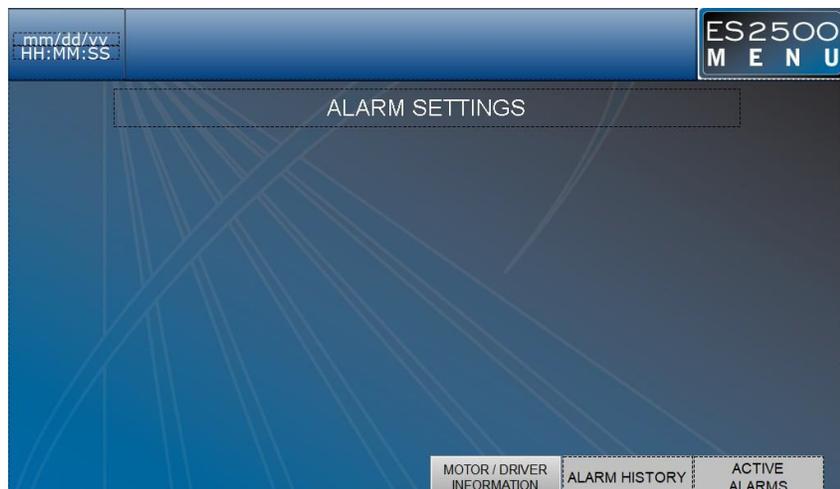
ALARM SETTINGS

Alarm settings allows operators to adjust the parameters for system alarms. Most alarms have tolerance times that are user-controlled settings. The tolerance time determines how long a certain fault can occur before triggering an alarm. Operators can also disable certain alarms if desired.

Stack Light

The Stack Light serves as an easy visual indication for the current system status of the ES2500. The Stack Light features three possible notification lights: green, amber, and red. The green and red lights can appear as either a solid or flashing illumination.

- **Green:** When the stack light is green, it represents normal system conditions.
 - Solid green- the system is ready for operation
 - Flashing green- occurs during system operation.
- **Amber:** When the stack light is displaying an amber light, it represents that the system is not ready for operation.
- **Red (Warning):** The stack light appears red when there is a system fault and the Emergency stop button is deployed.
 - Solid red- a standard system fault
 - Flashing red- a critical system fault.



4.10 MONITOR IO SETTINGS

When Monitor IO is selected from the Navigation menu, the first screen you will see is “Embedded IO Monitor” as seen below. This screen provides live readings of both the analog and digital aspects of the PLC. This screen can provide useful information when troubleshooting system components.

The image shows the AutoJet navigation menu on the left and the Embedded IO Monitor screen on the right. An arrow points from the 'MONITOR IO' menu item to the main screen.

Navigation Menu:

- OPERATING
- RECIPE SETUP
- SYSTEM CONFIGURATION
- MOTOR / DRIVER INFORMATION
- ALARMS**
- MONITOR IO
- HELP
- LOG IN
- LOGGED OUT

Embedded IO Monitor Screen:

mm/dd/vv HH:MM:SS ES2500 MENU

EMBEDDED IO MONITOR

CH1 ENCODER	DI 00 OFF	CH2 ESTAT FLT	DI 07 OFF	CH1 E-STAT FAULT RESET	DO 00 OFF	ALARM HORN	DO 05 OFF
CH1 ESTAT RUNNING	DI 01 OFF	E-STOP STS	DI 08 OFF	CH2 E-STAT FAULT RESET	DO 01 OFF	SOL - AUTO REFILL FLT TO CUSTOMER	DO 06 OFF
CH2 ENCODER	DI 02 OFF	SILENCE ALM	DI 09 OFF	STCKLT - RED	DO 02 OFF	STCKLT - AMBER	DO 03 OFF
CH1 ESTAT ON	DI 03 OFF	REMOTE FAULT	DI 10 OFF	STCKLT - GRN	DO 04 OFF	DOUT_SP02	DO 08 OFF
CH1 ESTAT FLT	DI 04 OFF	CH1 ON/OFF SWITCH	DI 11 OFF	DOUT_SP01	DO 09 OFF		
CH2 ESTAT RUNNING	DI 05 OFF	CH2 ON/OFF SWITCH	DI 12 OFF				
CH2 ESTAT ON	DI 06 OFF	DIN_SP01	DI 13 OFF				

AUTO-REFILL OFF
PLUGIN RELAY OUT
ANALOG IO
EMBEDDED IO

IO Information

PLUGIN RELAY OUTPUT

This screen displays output relays that can also be toggled on or off. These options can be helpful for troubleshooting purposes.

The image shows the Plugin Relay Output screen. It features a navigation menu on the left and a main screen with two columns of relays.

Navigation Menu:

- OPERATING
- RECIPE SETUP
- SYSTEM CONFIGURATION
- MOTOR / DRIVER INFORMATION
- ALARMS
- MONITOR IO
- HELP
- LOG IN
- LOGGED OUT

Plugin Relay Output Screen:

mm/dd/vv HH:MM:SS ES2500 MENU

PLUGIN RELAY OUTPUT

PLUGIN 1		PLUGIN 2	
CH1 PUMP RUN SIGNAL	RLY 00 OFF	CH1 ZN 1 RLY	RLY 00 OFF
CH2 PUMP RUN SIGNAL	RLY 01 OFF	CH1 ZN 2 RLY	RLY 01 OFF
CH1 ESTAT TRIGGER	RLY 02 OFF	CH2 ZN 1 RLY	RLY 02 OFF
CH2 ESTAT TRIGGER	RLY 03 OFF	CH2 ZN 2 RLY	RLY 03 OFF

PLUGIN RELAY OUT
ANALOG IO
EMBEDDED IO

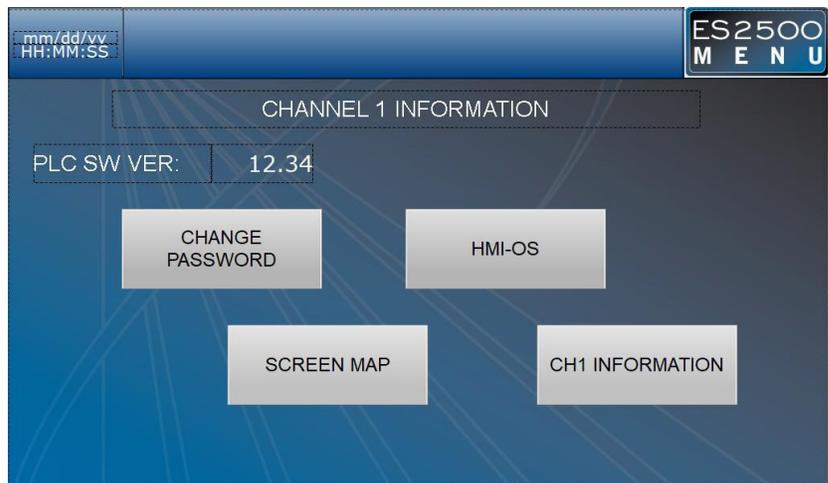
ANALOG IO

The Analog IO screen displays current analog values for the controller, which can be useful for troubleshooting purposes.



4.11 HELP SETTING

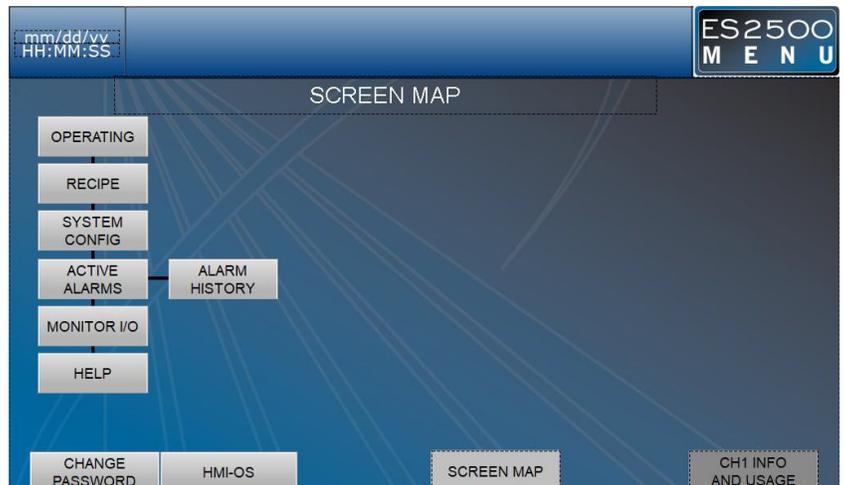
Selecting 'Help' from the navigation menu will bring up a screen that displays system information, access the HMI OS, Screen Map, and change password profiles.



The 'Help' screen also displays the current PLC software version.

SCREEN MAP

The Screen Map displays all possible screens within the ES2500 menu. It allows operators to select any settings.



FLUID DELIVERY CART

5.1 OVERVIEW

The fluid tank features a level sensor to monitor and produce a fault when the fluid falls to a low level. The tank also features a 3-way ball valve at its outlet for fluid draining and cleaning purposes.

Fluid Delivery Cart Dimensions: 40.500" x 31.263" x 54.502"

5.2 TANK

Tank is mounted using 4 3/8" -16 screws

TANK SPECIFICATIONS:

Capacity: 15 Gal, Cone Bottom

Material: Polyethylene

Dimensions: 16" x 16" x 24"

5.3 PUMP

The ES2500 pump comes standard with one pump to power fluid delivery to the Electrostatic Manifold(s). It has a motor driven, progressive cavity pump, with speed adjusted by the ES2500 control panel for desired flow.

PUMP SPECIFICATIONS:

Max flow: 10 GPH

SET-UP

Pump gets fed from the tank with a 3/4" Tygon hose.

ATTENTION: Viscosity of the fluid being sprayed may have a significant impact on the pump specifications.

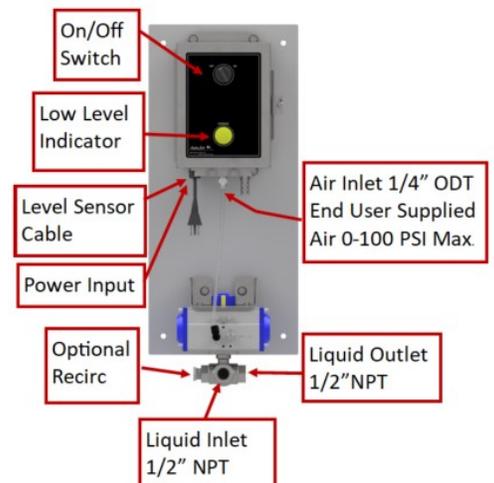
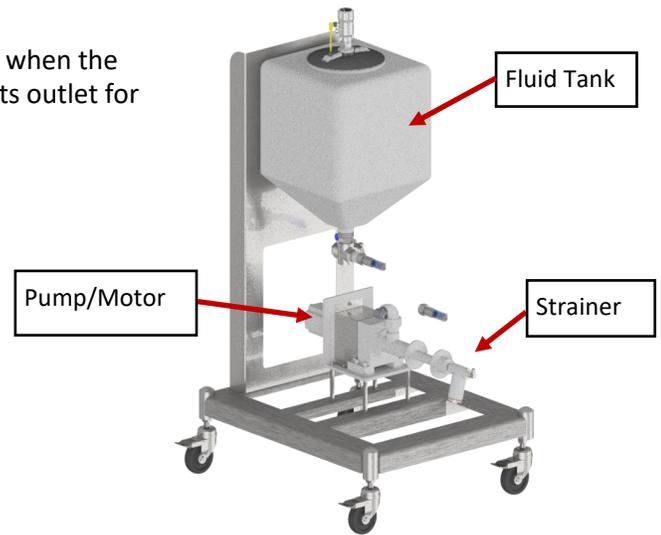
5.4 LEVEL SENSOR

The level sensor sends a signal when the tank gets low to let the control panel know when to shut off the system to prevent the pump from running dry and becoming damaged. The level sensor gets wired into the ES2500 control panel by cable.

See CH1 Configuration section for setting parameters in the control panel.

CONNECTING THE LEVEL SENSOR TO THE CONTROL PANEL

1. Connect power to the controller.
2. Plug the level sensor cable into the sensor mounted to the main tank unit.
3. An NPT thread push tube fitting needs to be added to the air inlet port on the bottom of the controller provided by the customer. Air must be supplied to the air inlet port.
4. The auto-refill controller unit will supply air to the pneumatic valve when the main tank level is low. In that case, the yellow light on the controller will illuminate indicating the automatic refill has been triggered and is currently filling.
5. Supply air to the inlet on the control box (0-100 PSI max.)



PROGRAMMING THE LEVEL SENSOR

The tank level sensor comes pre-programmed. However, the set points (Q1 – SP1 and Q1 – RP1) can be adjusted to configure the system specifically for the application.

The level sensor displays the tank level as a percent (%) full. However, all parameters are measured in millimeters (mm) from the bottom of the probe. The usable range of the level sensor is between 10 mm and 410 mm from the bottom of the probe, a 400 mm range.

There are two switching outputs that can be adjusted: Q1 and Q2. Output Q1 is used for the Auto-Refill feature and output Q2 is used for the Low Tank Level indicator.

Menu	Parameter	Name	Description	Preset
Expert	Probe	Probe Length	Length of probe for this application	457 mm
Qa	QAHIGH	High Level 20ma	Maximum tank level (QAHIGH>QALOW)	380 mm
AutCal				
Qa	QALOW	Low Level 4ma	Minimum tank level	10 mm
Qa	QAPOL	Configure	Analog output signal as configured	QA-Nrm
Qa	QATYP	Configure	Setting the output signal	Auto V
DspVal	Length	Configure	Display shows fill level in %	%
Q1	SP1	Switching Point 1	High Level - Auto-Refill stops filling	380
Q1	RP1	Reset Point 1	Low Level - Auto-Refill begins filling	76
Q1	OU1	Switching Function	Output Type - Normally Open/Closed	Qx-Hnc
Q2	SP2	Switching Point 2	Not Low Level - Indicator will turn off at or below this value	50
Q2	RP2	Reset Point 2	Low Level - Indicator will turn on at or below this value	10
Q2	OU2	Switching Function	Output Type - Normally Open/Closed	Qx-Hno

To access the above parameters from the main display (% full), press and hold the “Set” button. Use the up and down arrows to navigate to “Q1MENU” or “Q2MENU” and press the “Set” button. Use the up and down arrows to navigate to “SP1” or “RP1” (or “SP2” and “RP2”) and press the “Set” button. Use the up and down arrows and the “Set” button to change the numeric values assigned to the given parameter. Instructions for setting other parameters can be found on pages 32-35 of the provided component manual.

Assuming the tank has been initially filled and given the values in the above table, as the system is being used the level in the tank will decrease. Once the fluid reaches 250 mm from the bottom of the probe, 63% full ($100\% * (250 - 10) / 380 = 63\%$), Auto-Refill will turn on. As the fluid level rises and reaches 390 mm from the bottom of the probe, 100% full, Auto-Refill will be turned off.

If Auto-Refill is switched off or the supply is interrupted, and the fluid level reaches 10 mm from the bottom of the probe, 0% full, the Low Tank Level indicator will turn on. This is intended as a warning that the system is not automatically refilling. The Low Tank Level indicator will turn off once the fluid level rises above 50 mm from the bottom of the probe, 10% full.

MANIFOLD

6.1 OVERVIEW

In electrostatic spraying, a negative charge is introduced into the fluid in the manifold body via a central charging electrode. This causes the liquid to become negatively charged, which will then cause the fluid molecules to repel each other.

At the manifold orifice, the fluid forms into a tiny cone. A single stream of droplets will be propelled away from the orifice due to their negative, repelling charge. The droplets will continue to repel each other as they descend, causing the small droplets to break up into even smaller droplets. This will continue until the repulsive force between the molecules is no longer strong enough to break the surface tension and split the droplet.

Yet, these tiny and uniformly sized droplets still retain their negative charge. These fluid molecules will be attracted to any neutral and grounded target nearby through an attractive force stronger than gravity. This electrostatic force pulls the liquid molecules evenly towards the target, coating the surface and providing a very high transfer efficiency.

SPECIFICATIONS:

- Width– 6", 12" or 24" modular sections
- Orifice Size– 0.020" (0.51 mm) or 0.030" (0.79 mm)
- Flow Rate (per manifold)- 0.1-20 cc/min per manifold
- System Sizes– 6", 12" 18", 24", 30", 36", custom sizes available (combined width, all manifolds)

6.2 MOUNTING

ADJUSTABILITY

The mounting location should allow the operator to be able to view the Electrostatic Manifold while at the control panel. This will allow for easier adjustments and fine tuning of the electrostatic spray, as the operator will be able to easily see the result of changing system parameters.

When positioning the fluid delivery cart, be aware of its distance from the system control panel mounting location—there is a 7-meter maximum cable run. The fluid delivery cart is equipped with caster wheels for easy positional adjustments if needed.

The ES2500 Manifold has been designed to have a high degree of adjustability and can be configured as needed. The user can control the following:

- The applied voltage
- Fluid flow rate
- The intensity of the electrostatic field
- The height of the Manifold from the target
- Rotation of the Manifold around its axis for 360-degree coverage

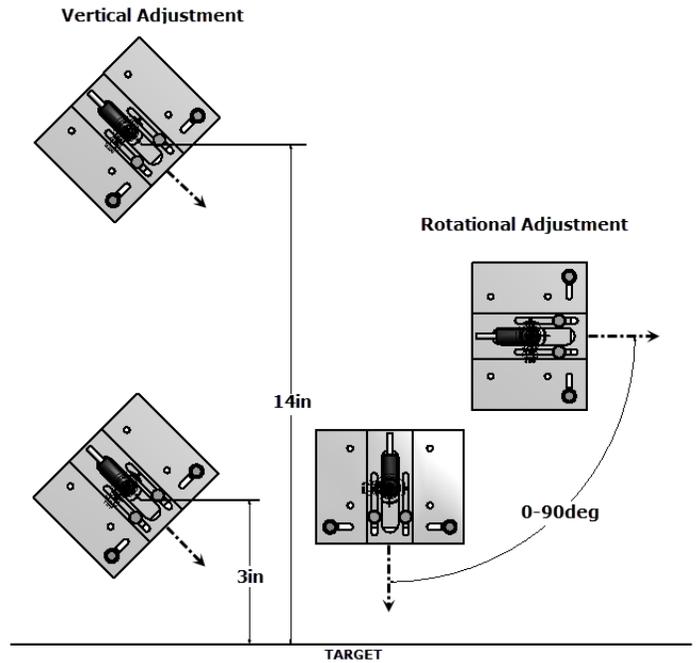
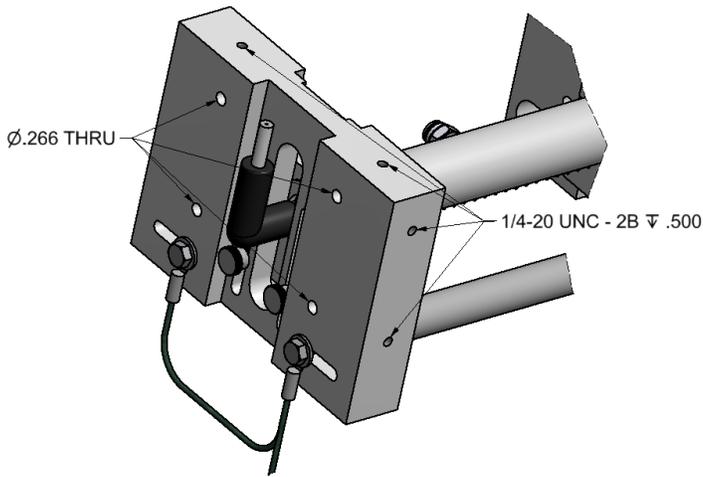
The end mount blocks are pre-drilled with a set of 1/4-20 UNC threaded and 0.266" dia. through holes. These can be used all together, or in part, to mount the assembly from the top, sides, front, and back.

The more degrees of movement that are built into the mounting scheme, the easier it will be to adjust the spray width and achieve even fluid flow. The nozzle assembly should be able to slide vertically from between 3" to 14" from target and should be able to rotate from 0 to 90 degrees to the target.



ATTENTION: Nothing metallic or conductive, with exception to the target, should be within an 18" envelope of the nozzle. This includes mounting fixtures, which should be made of plastic whenever possible.





6.3 HOOK-UP

FLUID LINE

Tubing must be made from a material that is compatible with fluid to be sprayed, as well as rigid enough to work with the 1/4" OD tube push-to-connect fittings that are supplied with nozzle assembly.



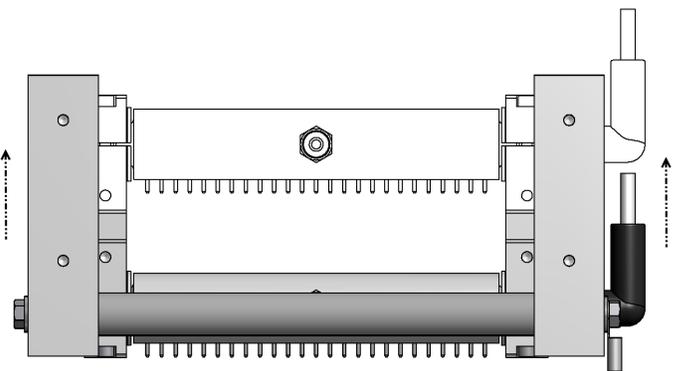
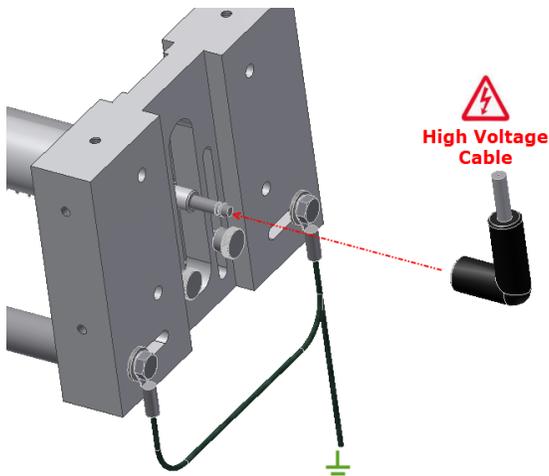
ATTENTION: Metallic tubing is not to be used as it will interfere with the electrostatic fields and skew the spray or potentially trip the AccuJet Electrostatic Controller. All fluid must be run through a filter capable of removing 90-micron particulates.

HIGH VOLTAGE CABLE

One side of the nozzle body has an electrode connector like the top of a spark plug. This plugs into the boot on the high voltage cable. Inside the rubber boot is a steel fastener. Be sure this fastener is firmly attached to the electrode.

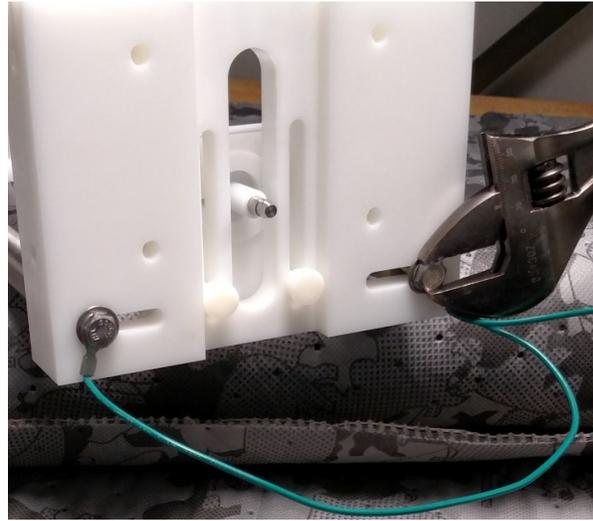
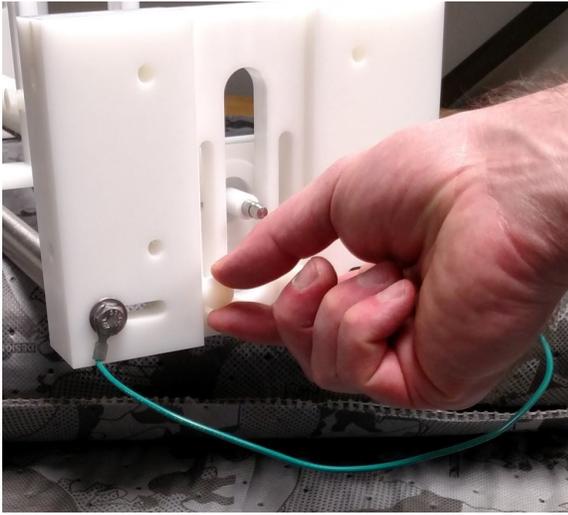


Manifold Fluid Line Connection



GROUND WIRE

The ground wire assembly should come connected to the ground rods with 7/16 hex head bolts on each end of the conveyor nozzle assembly. The ground wire assembly should be connected directly to an earth ground as defined by local electrical codes.



6.4 CONTROL FUNCTIONS

VARIABLE ELECTROSTATIC FIELD

The nozzle bodies can be slid up and down inside the end blocks by loosening the 4 plastic thumb screws on both ends of the assembly. This allows for minor adjustments toward and away from the target, and to increase or decrease the effects from the ground rods on the electrostatic field. The ground rods themselves can also be moved inward to increase the effect.

ELECTROSTATIC VOLTAGE

The ES2500 Manifold is rated to work with a voltage from 0-30,000V. This wide range ensures that a variety of fluids will achieve atomization and allow for adjustment for spray pattern and drop size.

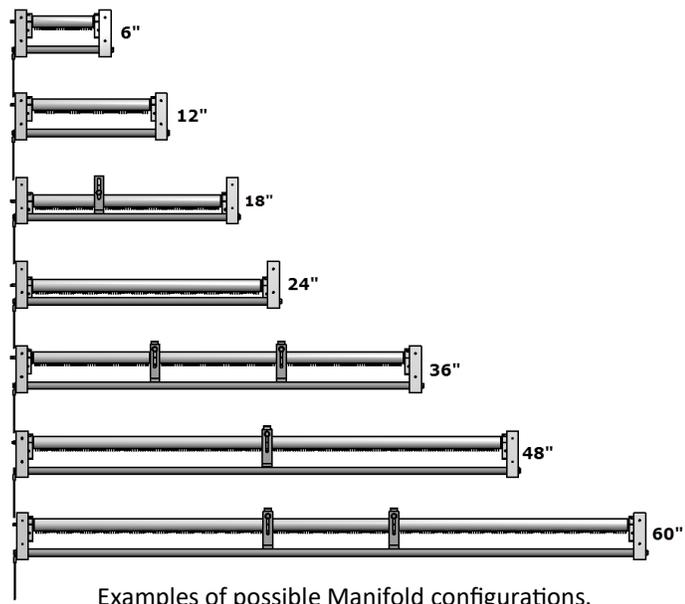


WARNING: DO NOT exceed voltage rating for manifold nozzle assembly; serious injury or death may occur.

MANIFOLD SECTIONS

Fluid is fed in through the push-to-connect fitting directly in the center of each manifold section.

The ES2500 Manifold is available in 6", 12", and 24" long sections. These sections can be used individually, or combined, to create a size that matches the desired spray coverage area.



Examples of possible Manifold configurations.

6.5 NOZZLE CONFIGURATION

1. Start with the nozzle body slide all the way down to the end blocks and with the ground rods moved as far out from the nozzle body as possible.
2. Position the manifold so that nozzle spray tube tips are 8" above the target with tubes pointing straight down.
3. Allow enough time for fluid to start dripping from every orifice before applying voltage.
4. Start the voltage at zero and slowly increase, watch for when the drops start to form into small cones. These small cones will have a series of single file droplets propelling off from the tip. At the lower end of the voltage range, droplets will be heavier with spaces in between. As voltage is increased, droplets will shrink and appear to be one very thin, continuous stream.

ADJUSTMENT OF SPRAY DISTRIBUTION

If the spray pattern appears "streaky" or has heavy drops, try one or all of these:

- Increase voltage
- Move the ground rods in closer to the nozzle tips
- Increase the distance between the manifold and the target. This will give the droplets more time in the air, which allows for more atomization, so the drops can break up and spread out evenly.

If the spray is extremely fine and droplets appear to be floating away, try one or both of these:

- Lower voltage
- Position the Manifold closer to the target

Note: The spray produced by the manifold can be very faint and hard to see. Using a flashlight to illuminate the spray distribution from different angles may be necessary for pattern identification.

6.6 START-UP PROCEDURE

1. Verify that all system electrical and liquid connections are properly connected and secure.
2. Ensure that the manifold is plumbed and positioned properly above the target.
3. Verify that the manifold grounding wires are properly connected. (Ensure that it is plugged into a GFCI outlet)
4. Fill the tank with fluid. Always check the tank level sensor reading or visually confirm that there is enough fluid in the tank before spraying.
5. Look to the strainer valve assemblies on the fluid delivery cart. Ensure that the one strainer assembly has the inlet and outlet valves in the open position, and that the other strainer has the inlet valve open. Keep the second strainer outlet valve closed while the first strainer is in use. (See Strainer Valve section for more information.)
6. Wait approximately 5 minutes after adding fluid to the tank—so that fluid can fill the lines and strainer assemblies—before attempting to run the pump. DO NOT run the pump before this waiting period is over as the fluid may not have reached the pump inlet. Running the pump without fluid present at the inlet may cause system damage. After the waiting is complete, proceed to the next step.
7. Press the 'On' button and wait for the HMI to turn on and load.
8. Select the button for the 'Purge' function which runs the pump and fills the line and manifold with fluid. Set the pump speed within the upper range of its maximum flow setting.

 **ATTENTION: Keep the system in 'Purge' mode until you see fluid dripping from the manifold.**

9. Once fluid has begun to drip from the manifold, the 'purge' function can be turned off.
10. Select 'Recipes' from the navigation menu and configure the recipe to meet your spraying needs. Be sure to set and be aware of the pump priming time, as this priming time will occur after the system has been triggered.



9. At this point, the run function can be turned on by returning to the 'Operating' screen and selecting 'run'.

10. Flip the CH1 trigger switch on the panel door to the right.

Note: An external trigger can be connected to the system for remote activation.

13. The system will begin standard operation.

6.7 MANIFOLD DISASSEMBLY

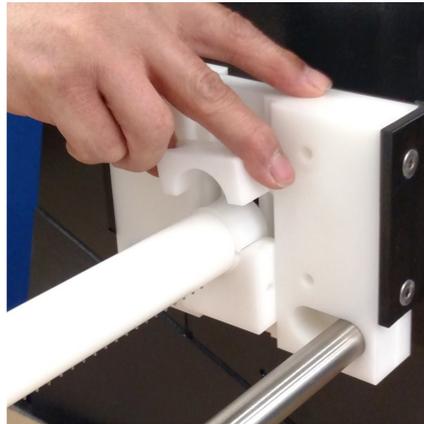
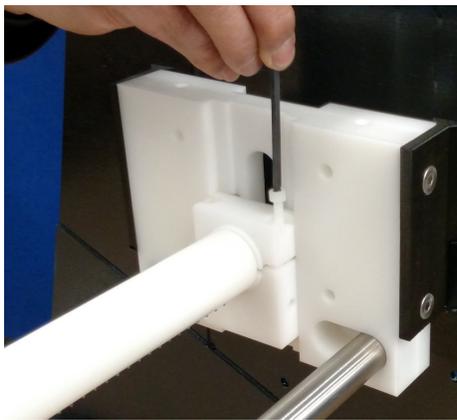


WARNING: High Voltage. Make sure that power has been disconnected to high voltage line before any attempt at disassembly.

STEP 1

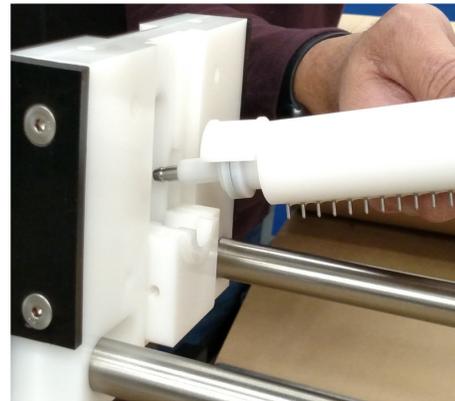
The Manifold nozzles can be removed from the end mounts so they can be left in place and the fine-tuned adjustments remain untouched.

Use a 5/32 Allen wrench to remove the nylon screw from the top of the end mount insulator clamps.



STEP 2

The entire nozzle body can be removed at once. Elevate the side opposite of the electrode first, and then remove the electrode side.



STEP 3

Remove the end cap and sanitary gasket from the end opposite of the electrode. With the end cap and sanitary gasket removed, the electrode end bushing is now visible.

Turning the nozzle upright, the electrode end bushing and electrode should fall out. Take note of how the electrode fits inside the bushing.



STEP 4

Remove the electrode and its gasket. Then, the through-hole bushing should fall out.



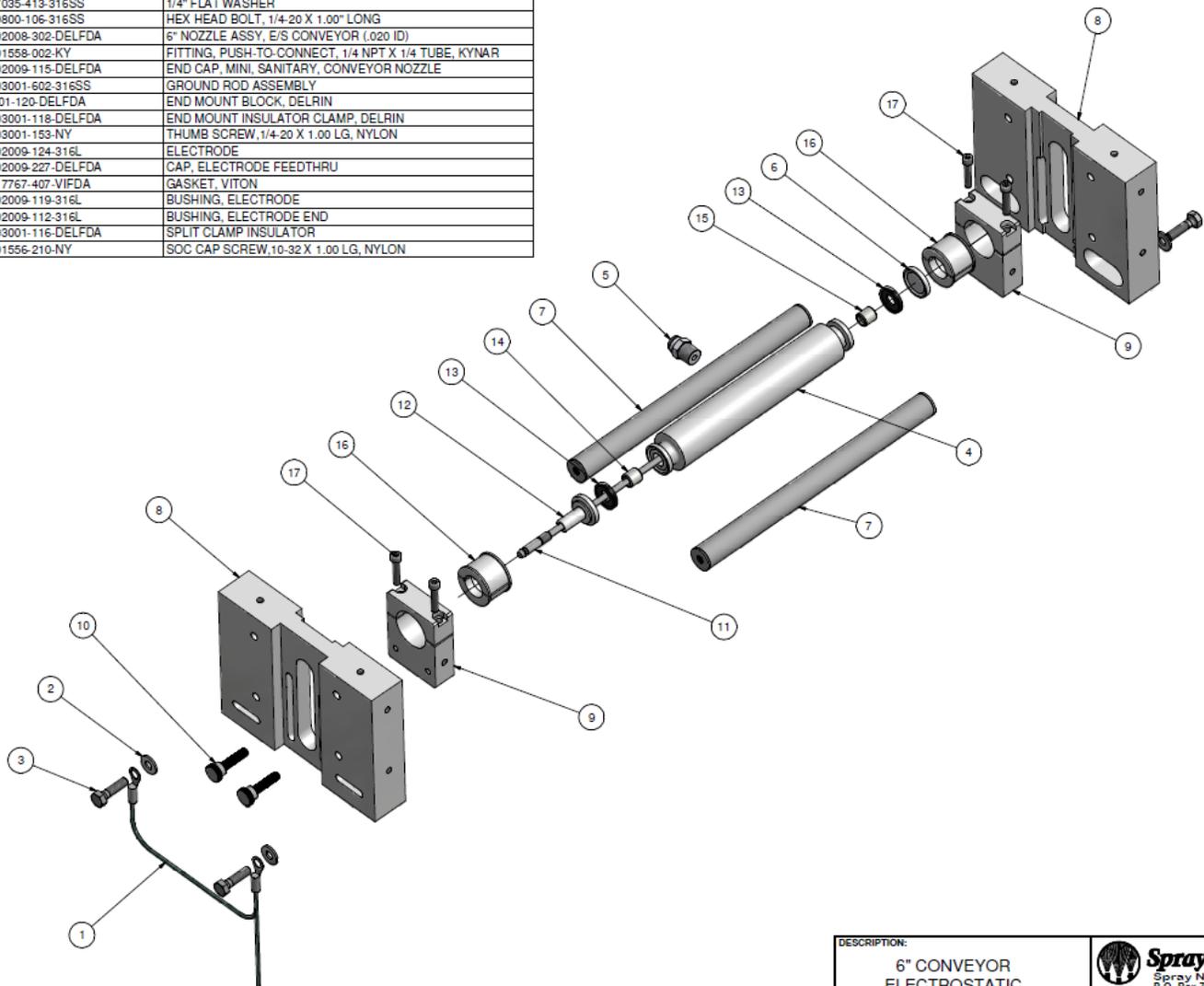
STEP 5

Remove screws from underside of center support brackets. In assemblies with multiple nozzle sections, a double-sided bushing with a pocket at each end to accept the electrode is used, between the nozzles, to make continuous electrical connections the length of the assembly.



6.8 Electrostatic Manifold Diagram

Parts List		
ITEM	PART NUMBER	DESCRIPTION
1	CP102009-920	ASSEMBLY, GROUNDING ROD CABLE CONNECTION
2	CP27035-413-316SS	1/4" FLAT WASHER
3	CP29800-106-316SS	HEX HEAD BOLT, 1/4-20 X 1.00" LONG
4	CP102008-302-DELFDA	6" NOZZLE ASSY, E/S CONVEYOR (.020 ID)
5	CP101558-002-KY	FITTING, PUSH-TO-CONNECT, 1/4 NPT X 1/4 TUBE, KYNAR
6	CP102009-115-DELFDA	END CAP, MINI, SANITARY, CONVEYOR NOZZLE
7	CP103001-602-316SS	GROUND ROD ASSEMBLY
8	103001-120-DELFDA	END MOUNT BLOCK, DELRIN
9	CP103001-118-DELFDA	END MOUNT INSULATOR CLAMP, DELRIN
10	CP103001-153-NY	THUMB SCREW, 1/4-20 X 1.00 LG, NYLON
11	CP102009-124-316L	ELECTRODE
12	CP102009-227-DELFDA	CAP, ELECTRODE FEEDTHRU
13	CP317767-407-VIFDA	GASKET, VITON
14	CP102009-119-316L	BUSHING, ELECTRODE
15	CP102009-112-316L	BUSHING, ELECTRODE END
16	CP103001-116-DELFDA	SPLIT CLAMP INSULATOR
17	CP101556-210-NY	SOC CAP SCREW, 10-32 X 1.00 LG, NYLON



DESCRIPTION: 6" CONVEYOR ELECTROSTATIC ASSEMBLY (DELRIN)		 Spraying Systems Co. Spray Nozzles and Accessories P.O. Box 7900 • Wheaton, IL 60188-7900
REVISION NO. 2	PL102240-111	
REFERENCE:	SHEET: 1 OF 1	DWG SIZE: C

SECTION 8

TROUBLESHOOTING

If troubleshooting steps are followed and the system still does not function, please contact your local Spray Specialist or call 1-800-95-SPRAY (1-800-957-7729).

If any system/component malfunctions occur, **shut off** the system immediately and perform the following steps:

- Disconnect and lock out electrical power
- Close any pneumatic shutoff valves and relieve the pressure
- Identify and correct the malfunction before restarting the system
- Check all pneumatic, hydraulic, and electrical connections

GENERAL TROUBLESHOOTING

1) System won't power on

- Be sure disconnect is on
- Measure power input at the disconnect
- Check fuses

2) System does not spray or has a bad pattern

- Check power to the system control panel
- Check HV cable connection between the system control panel and the manifold
- Verify trigger signal
- Check manifold for clogging

3) Air in liquid line/poor pump performance

- Check for leaks
- Clean filter, check if clogged

4) No fluid at spray nozzles

- Check for leaks
- Clean filter, check if clogged

Stack Light Quick Reference Table	
Light	Description
Flashing Red	Critical Fault
Solid Red	Standard Fault
Amber	System Not Ready
Solid Green	System Ready
Flashing Green	System Operating

Arc Fault Detection Tips	
Cause:	Solution:
Arc occurring at the Electrostatic Manifold nozzle	<ul style="list-style-type: none"> • Ensure no air pockets are entrapped in the nozzles • Check that the Manifold isn't too close to the target • Check for any grounded objects, other than the target, that may be too close to the Manifold • Verify the silicone boots are tightly connected to the Manifold electrode connection

No fluid at spray nozzles	
Cause:	Solution:
Improper pump adjustment	Adjustment pump flow by changing the setting in the recipe
Damaged or leaking lubricant lines	Inspect, identify, and replace lines
Clogged or leaking pump	Clean or replace pump
Clogged spray nozzle(s)	Flush spray nozzle with hot water/detergent solution. Dry before reuse. Replace nozzle if necessary.
Lubricant coming out in drips	
Cause:	Solution:
HV setting too low	See/change HV setting in Recipes
Improper connection between HV cables	Tighten each HV cable connection and make sure it is clean of any dirt and/or foreign particles
HV power supply malfunction	Replace HV power supply
Arcing near the machine	
Cause:	Solution:
Surrounding machinery not grounded	Connect grounding cables to machine base and connect earth ground to machine base

FAULT CODES

If your system configuration is equipped with two (2) channels, all fault code numbers for CH2 specific faults have been included in parenthesis.

All faults include a tolerance time, which is the time the error needs to be active for the fault to occur. For many of the ES2500 faults, this is an operator customizable setting.



CAUTION: Any time the Emergency Stop button is used, resolve the system issue before resetting the button by pulling it up. Pulling the button up will resume system operation.

No.	Fault	Cause	Remedy
1 or (2)	CH1 (CH2) COLTAGE MONITOR NOT WIRED	Detects if there is a broken wire in the panel, or a possible faulty power supply	<ul style="list-style-type: none"> • Check the panel wired connections • Replace power supply if needed
3 or (4)	CH1 (CH2) AMPERAGE MONITOR NOT WIRED	Detects if there is a broken wire in the panel, or a possible faulty power supply	<ul style="list-style-type: none"> • Check the panel wired connections • Replace power supply if needed
16	EMERGENCY STOP ACTIVATED	Occurs when the Emergency Stop button has been pressed	Pull up button
19 or (21)	CH1 (CH2) TANK LEVEL CRITICAL (RED FLASHING)	Fluid level is too low for safe pump operation	Refill the fluid tank
20 or (22)	CH1 (CH2) TANK LEVEL (RED SOLID)	Fluid level is approaching the critical setpoint	Refill the fluid tank soon
22 or (23)	CH1 (CH2) DRIVE ALARM	<ul style="list-style-type: none"> • Problems with motor wiring • Motor torque/speed out of range 	<ul style="list-style-type: none"> • Review and replace cables if damaged • Check operating conditions and settings, specifically max flow • Pump servicing may be required

SECTION 9

SYSTEM MAINTENANCE

System maintenance is primarily dependent on system usage. The following maintenance items are suggested by the manufacturer, but system buyers and operators are ultimately responsible for creating and following their own maintenance schedule.

Please contact your Spray Specialist and Sales office to purchase replacement parts.

MONTHLY MAINTENANCE

It is suggested to check the following:

- The grounding wires and electrostatic (HV) cable are free of wear and/or damage
- All fluid delivery connections
- Fluid level sensor connections
- Tightness of the motor and pump coupling screws
- Pump inlet and outlet connections
- All manifold sections for leaks or malfunctions

REGULAR MAINTENANCE

- Flush the Electrostatic Manifold at the end of each product run.
- Ensure system is off and wipe down ground bars to remove oil buildup at the end of each product run.

© 2023 All rights reserved. Printed in the U.S.A.

Under copyright laws, this manual may not be reproduced in any form, in whole, or in part, without prior written permission from Spraying Systems Co.[®]. This revision supersedes all previous revisions. Every effort has been made to ensure that the information in this manual is accurate at the time of printing.

However, Spraying Systems Co. assumes no liability for errors or omissions and reserves the right to make changes without notice to any products described herein to improve reliability, function, or design. Other company and product names may be trademarks of their respective companies.

Warranty is one (1) year on non-wear parts from ship date. Wear items are covered for manufacturing defect only for a period of one (1) year. Wear items include, but may not be limited to, Liquid pump and Liquid regulator. Seller warrants that its products will conform to and perform in accordance with the products' specifications.

Seller warrants that the products do not infringe upon any copyright, patent, or trademark.

THE FOREGOING WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THOSE CONCERNING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.



Spraying Systems Co.[®]
Experts in Spray Technology

North Avenue and Schmale Road, P.O. Box 7900, Wheaton, IL 60187 - 7901

Tel: 1.800.95.SPRAY Intl. Tel: 1.630.665.5000

Fax: 1.888.95.SPRAY Intl. Fax: 1.630.260.0842

www.spray.com

