

Versa-Spray[®] II IPS Three-Gauge Control Unit

Customer Product Manual
Part 106990C
Issued 7/05

**For parts and technical support, call the Industrial Coating
Systems Customer Support Center at (800) 433-9319 or
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Table of Contents

Safety	1-1	Operation	4-1
Introduction	1-1	Startup	4-1
Qualified Personnel	1-1	Adjustments	4-2
Intended Use	1-1	Electrostatic Voltage/AFC Control	4-2
Regulations and Approvals	1-1	Fluidizing Air Pressure	4-3
Personal Safety	1-2	Flow Rate Air Pressure	4-3
Fire Safety	1-2	Atomizing Air Pressure	4-4
Grounding	1-3	Optimum Flow Rate and Atomizing Pressure	4-4
Action in the Event of a Malfunction	1-3	Shutdown	4-4
Disposal	1-3	Daily Maintenance	4-4
Safety Labels	1-5	Troubleshooting	5-1
Safety Label Locations	1-6	Troubleshooting Charts	5-2
Description	2-1	Circuit Board Test Points, Jumpers, Switches, Fuses and Connectors ..	5-5
Introduction	2-1	Wiring Diagram	5-6
Pneumatic Inputs, Outputs, and Controls	2-2	Electrical Schematic	5-7
Front Panel Controls	2-2	Air Tubing Diagram	5-8
Rear Panel Connections	2-4	Repair	6-1
Specifications	2-5	Control Module Removal	6-1
Enclosure	2-5	Gauge and Regulator Replacement	6-2
Electrical	2-5	Gauge Replacement	6-2
Pneumatic	2-5	Regulator Replacement	6-2
Typical Operating Pressures	2-5	Valve Manifold Rebuild	6-4
Air Supply Quality	2-5	Solenoid Valve Replacement	6-4
Symbols	2-5	Three-Way Cartridge Valve Replacement ...	6-4
Installation	3-1	Circuit Board Replacement	6-6
Mounting	3-1	Control Module Installation	6-8
Circuit Board Configuration	3-1	Parts	7-1
Electrical Connections	3-3	Introduction	7-1
Pneumatic Connections	3-5	Using the Illustrated Parts List	7-1
Input and Output Air	3-5	Control Unit Assembly	7-2
Gun Air	3-5	Control Module	7-4
		Pneumatic Output Manifold	7-8

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Section 1

Safety

Introduction

Read and follow these safety instructions. Task- and equipment-specific warnings, cautions, and instructions are included in equipment documentation where appropriate.

Make sure all equipment documentation, including these instructions, is accessible to all persons operating or servicing equipment.

Qualified Personnel

Equipment owners are responsible for making sure that Nordson equipment is installed, operated, and serviced by qualified personnel. Qualified personnel are those employees or contractors who are trained to safely perform their assigned tasks. They are familiar with all relevant safety rules and regulations and are physically capable of performing their assigned tasks.

Intended Use

Use of Nordson equipment in ways other than those described in the documentation supplied with the equipment may result in injury to persons or damage to property.

Some examples of unintended use of equipment include

- using incompatible materials
- making unauthorized modifications
- removing or bypassing safety guards or interlocks
- using incompatible or damaged parts
- using unapproved auxiliary equipment
- 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 Nordson equipment will be voided if instructions for installation, operation, and service are not followed.

All phases of equipment installation must comply with all federal, state, and local codes.

Personal Safety

To prevent injury follow these instructions.

- Do not operate or service equipment unless you are qualified.
- Do not operate equipment unless safety guards, doors, or covers are intact and automatic interlocks are operating properly. Do not bypass or disarm any safety devices.
- Keep clear of moving equipment. Before adjusting or servicing any moving equipment, shut off the power supply and wait until the equipment comes to a complete stop. Lock out power and secure the equipment to prevent unexpected movement.
- Relieve (bleed off) hydraulic and pneumatic pressure before adjusting or servicing pressurized systems or components. Disconnect, lock out, and tag switches before servicing electrical equipment.
- Obtain and read Material Safety Data Sheets (MSDS) for all materials used. Follow the manufacturer's instructions for safe handling and use of materials, and use recommended personal protection devices.
- To prevent injury, be aware of less-obvious dangers in the workplace that often cannot be completely eliminated, such as hot surfaces, sharp edges, energized electrical circuits, and moving parts that cannot be enclosed or otherwise guarded for practical reasons.

Fire Safety

To avoid a fire or explosion, follow these instructions.

- Do not smoke, weld, grind, or use open flames where flammable materials are being used or stored.
- Provide adequate ventilation to prevent dangerous concentrations of volatile materials or vapors. Refer to local codes or your material MSDS for guidance.
- Do not disconnect live electrical circuits while working with flammable materials. Shut off power at a disconnect switch first to prevent sparking.
- Know where emergency stop buttons, shutoff valves, and fire extinguishers are located. If a fire starts in a spray booth, immediately shut off the spray system and exhaust fans.
- Clean, maintain, test, and repair equipment according to the instructions in your equipment documentation.
- Use only replacement parts that are designed for use with original equipment. Contact your Nordson representative for parts information and advice.

Grounding



WARNING: Operating faulty electrostatic equipment is hazardous and can cause electrocution, fire, or explosion. Make resistance checks part of your periodic maintenance program. If you receive even a slight electrical shock or notice static sparking or arcing, shut down all electrical or electrostatic equipment immediately. Do not restart the equipment until the problem has been identified and corrected.

All work conducted inside the spray booth or within 1 m (3 ft) of booth openings is considered within a Class 2, Division 1 or 2 Hazardous location and must comply with NFPA 33, NFPA 70 (NEC articles 500, 502, and 516), and NFPA 77, latest conditions.

- All electrically conductive objects in the spray areas shall be electrically connected to ground with a resistance of not more than 1 megohm as measured with an instrument that applies at least 500 volts to the circuit being evaluated.
- Equipment to be grounded includes, but is not limited to, the floor of the spray area, operator platforms, hoppers, photoeye supports, and blow-off nozzles. Personnel working in the spray area must be grounded.
- There is a possible ignition potential from the charged human body. Personnel standing on a painted surface, such as an operator platform, or wearing non-conductive shoes, are not grounded. Personnel must wear shoes with conductive soles or use a ground strap to maintain a connection to ground when working with or around electrostatic equipment.
- Operators must maintain skin-to-handle contact between their hand and the gun handle to prevent shocks while operating manual electrostatic spray guns. If gloves must be worn, cut away the palm or fingers, wear electrically conductive gloves, or wear a grounding strap connected to the gun handle or other true earth ground.
- Shut off electrostatic power supplies and ground gun electrodes before making adjustments or cleaning powder spray guns.
- Connect all disconnected equipment, ground cables, and wires after servicing equipment.

Action in the Event of a Malfunction

If a system or any equipment in a system malfunctions, shut off the system immediately and perform the following steps:

- Disconnect and lock out electrical power. Close pneumatic shutoff valves and relieve pressures.
- Identify the reason for the malfunction and correct it before restarting the equipment.






Disposal

Dispose of equipment and materials used in operation and servicing according to local codes.



Safety Labels

Table 1-1 contains the text of the safety label on this equipment. The safety label is provided to help you operate and maintain your equipment safely. See Figure 1-1 for the location of the safety label.

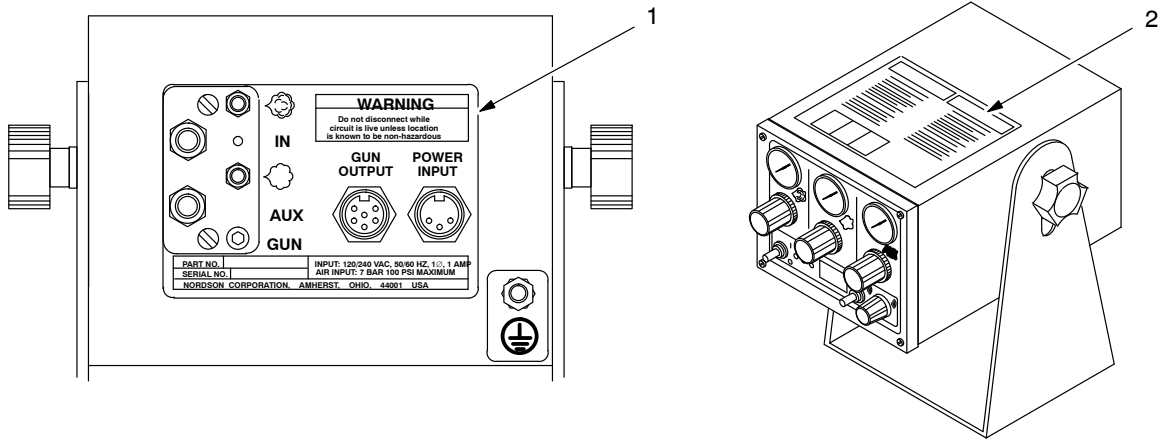
Table 1-1 Safety Labels

Item	Part	Description
1	—	 WARNING: Do not disconnect while circuit is live unless location is known to be non-hazardous.
2	129597	<p style="text-align: center;">SAFETY INSTRUCTIONS</p> <ol style="list-style-type: none"> 1. To be installed in accordance with all local codes and ordinances, all pertinent statutes and regulations, and the safety provisions of the Nordson manual. 2. Ground all equipment and other metal objects within 10 ft (3 m) of spray area. Keep spray area clean. 3. Work pieces must be grounded. Keep conveyor and hangers clean. 4. Hold gun in bare hand. Wear shoes with conductive soles such as leather. (Rubber soles are not conductive.) 5. Turn off power and ground nozzle before doing any cleaning or other work on gun. 6. Do not store flammable materials in spraying area. 7. Caution: Shut off electrical power before breaking connections or opening enclosure. <p style="text-align: center;">  WARNING: Disconnect main power before servicing.  </p>
	244644	 WARNING: The following procedures <u>MUST</u> be followed when working with this electrostatic spray equipment. Failure to follow these instructions may result in a fire and/or serious personal injury. Display this warning on the spray booth.
		 <ol style="list-style-type: none"> 1. NO SMOKING. Keep open flames, hot surfaces, and sparks from torches or grinding away from booth. 2. Turn the electrostatic power unit <u>off</u> when the spray gun is not in use. 3. Shut down immediately in event of fire. 4. Maintain ground circuit on all conductive objects below 1 megohm to prevent sparking. (ANSI/NFPA 33, Chapter 9, or local codes) 5. Shut down operation and correct grounds if sparking occurs. 6. Install fixed fire suppression system in accordance with ANSI/NFPA 33, Chapter 7 (or local codes), before operating with combustible powder.

Safety Labels *(contd)*

Item	Part	Description
		<p>7. Install automatic flame detectors in accordance with ANSI/NFPA 33, Chapter 7 (or local codes), before operating automatic guns.</p> <p>8. Examine all equipment at the beginning of each work period and repair or replace any damaged, loose, or missing parts.</p> <p>9. Before cleaning or performing any maintenance on the electrostatic spray gun, turn off the power unit and ground the nozzle. Maintain electrostatic spray equipment in accordance with instruction manual. Do not deviate. Do not substitute parts from other manufacturers.</p> <p> 10. Operator must be grounded to prevent shocks from static electricity. Floor surface must be conductive. Footwear and gloves must be static dissipative in accordance with ANSI Z41-1991 (or local codes).</p> <p>11. Air velocity through all booth openings must meet local requirements and contain powder within the booth. If powder escapes from the booth, shut down operation and correct the malfunction.</p> <p> 12. Powder may be toxic or be a nuisance dust hazard. Refer to supplier's MSDS. If exposed to dust during operation, maintenance, or clean up, operators must use appropriate personal protective equipment.</p> <p>13. Do not use compressed air or organic solvents for removal of powder from skin or clothing. Do use soap and water. Wash hands before eating or smoking.</p> <p>14. Guns, feeders, booths, etc., may be cleaned with clean dry air at 1.7 bar (25 psig).</p> <p>If you have any questions concerning this electrostatic spray equipment, call (440) 988-9411, and ask to speak with the Powder Systems Group Technical Service Department.</p>

Safety Label Locations



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Figure 1-1 Safety Label Locations

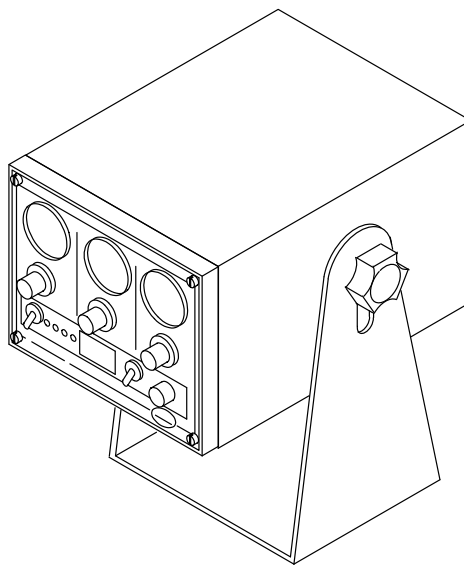
1. Electrical warning
2. Safety instructions

Section 2

Description

Introduction

See Figure 2-1. The Versa-Spray II Three-Gauge Integral Power Supply (IPS) control unit provides pneumatic and electrostatic controls, dc power, and monitoring functions for Versa-Spray IPS manual powder spray guns. The unit can also be used with automatic guns.



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Figure 2-1 Versa-Spray II IPS Control Unit

The control unit provides low-voltage dc power to the spray gun voltage multiplier. The multiplier produces the electrostatic voltage used to charge the powder as it is sprayed.

A push-pull rotary switch and potentiometer (kV/AFC switch) allows the operator to choose between two different control modes and to set output levels. In the kV mode, voltage output is controlled by the potentiometer setting.

In the Automatic Feedback Current (AFC) mode, maximum current output is controlled by the potentiometer setting. The AFC mode provides an optimum combination of kV output and electric field strength for coating parts with interior corners and deep recesses at close range or recoating coated and cured parts.

Pneumatic Inputs, Outputs, and Controls

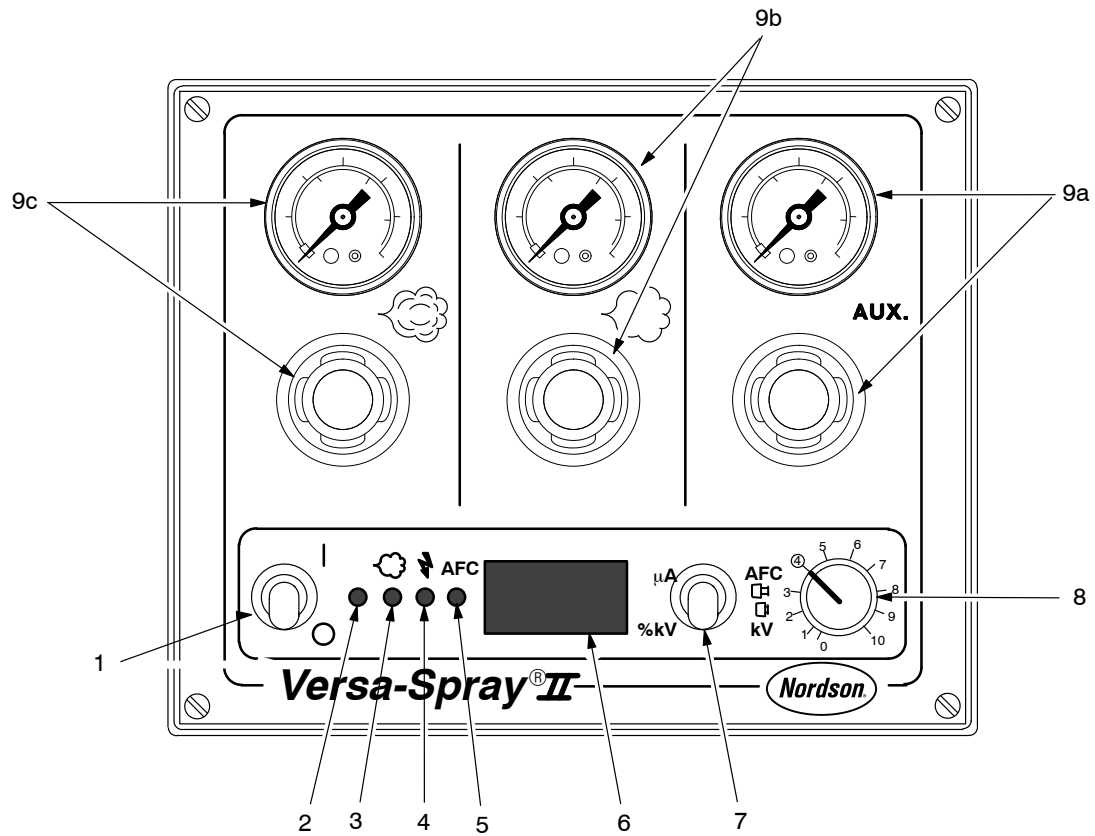
Refer to Table 2-1. Switched outputs supply air when the gun is triggered.
Unswitched outputs supply air when the regulator is set above zero.

Table 2-1 Pneumatic Inputs, Outputs, and Controls

Description	Controls	Function
Input	External	Supply, 7 bar (100 psi) max.
Flow-rate	Regulated, switched	Pumps powder from hopper.
Atomizing	Regulated, switched	Atomizes and accelerates powder pumped from hopper.
Auxiliary	Regulated, unswitched	Feed hopper fluidizing air, or vibrator motor air.
Gun	Add-on fixed-orifice restrictor, switched (port is normally plugged at factory)	Electrode washing air (manual and automatic guns) and diffuser air (automatic guns only). A fixed-orifice restrictor furnished with a gun or kit reduces air pressure to 0.7 bar (10 psi).

Front Panel Controls

See Figure 2-2 and refer to Table 2-2.



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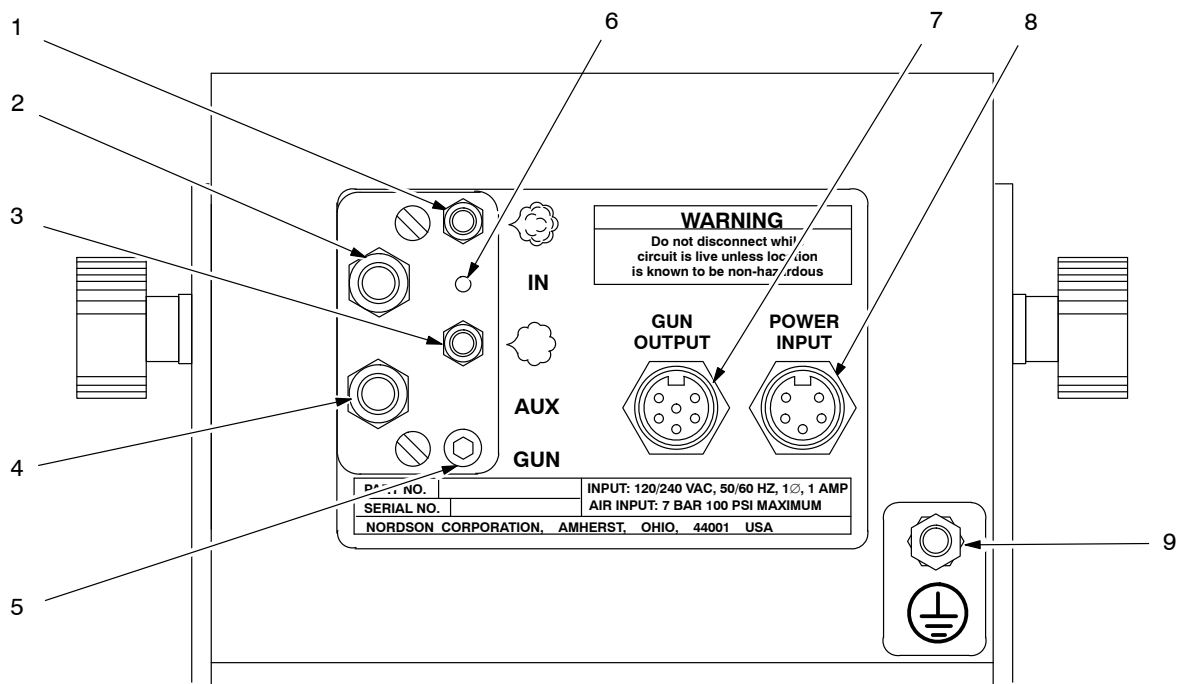
Figure 2-2 Front Panel Controls

Table 2-2 Front Panel Controls

Item	Component	Function
1	Power switch	Turns on the control unit. If switch S5 on the circuit board is set to continuous, the power switch will start flow rate, atomizing air, and gun air flowing, and activate the gun multiplier (if air pressures are set above zero, and the kV/AFC switch is turned on).
2	Power LED (green)	Lights when the control unit power switch is turned on.
3	Powder LED (green)	Lights when gun is triggered and the solenoid valve is energized. Flow rate air and atomizing air flow to the powder pump. Gun air will flow to Versa-Spray II gun if optional port is used.
4	kV LED (amber)	Lights when the kV/AFC switch is set in the kV mode and turned on.
5	AFC LED (amber)	Lights when the kV/AFC switch is set in the AFC mode and turned on.
6	Digital display	Displays the percentage of kV output, microampere (μ A) output, and multiplier polarity (positive or negative) in both kV and AFC modes. The kV/ μ A switch changes the display from %kV to μ A. As parts go by the gun, both kV and μ A output will fluctuate. μ A output increases when the gun is moved closer to a grounded part. kV output decreases as μ A output increases. If the unit is in AFC mode, μ A output will not increase past the maximum current setpoint. Part shape and powder flow rates also affect μ A output.
7	μ A/kV switch	Changes the output displayed from percent of kV output to microamperes.
8	AFC/kV knob/potentiometer	Changes voltage control modes and sets output levels. Pushing the knob in puts unit in kV mode. Pulling knob out puts unit in AFC mode. Turning the knob to position 1 turns on electrostatic voltage. Rotating the knob clockwise increases voltage output when in kV mode or increases maximum current setpoint when in AFC mode.
9a	Auxiliary air regulator and gauge (fluidizing or vibrator motor)	Control and indicate air pressure. Pull regulator knobs out to unlock, push in to lock. Flow rate and atomizing air flow are controlled by trigger signal or power switch, depending on circuit board switch S5 setting. Auxiliary air flow starts when air pressure is set above zero.
9b	Atomizing air regulator and gauge	
9c	Flow rate air regulator and gauge	

Rear Panel Connections

See Figure 2-3 and refer to Table 2-3.



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Figure 2-3 Rear Panel Connections

Table 2-3 Rear Panel Connections

Item	Component	Function
1	Flow rate air connector	6-mm or 1/4-in. tubing connector for the powder pump flow rate air supply
2	Supply air connector	10-mm or 3/8-in. tubing connector for supply air. 100 psi (7 bar) max.
3	Atomizing air connector	6-mm or 1/4-in. tubing connector for the powder pump atomizing air supply
4	Auxiliary air connector	10-mm or 3/8-in. tubing connector for fluidizing or vibrator motor air, or other uses.
5	Gun air connector	Plugged port for Versa-Spray II gun air. Air pressure is unregulated. A restrictor, supplied with a gun or service kit, is installed in this port to reduce air pressure.
6	Solenoid valve vent	Solenoid valve exhaust air vent. Vent must not be plugged.
7	Gun cable receptacle	6-pin receptacle for the gun cable
8	Power cable receptacle	5-pin receptacle for the power cord
9	Cabinet ground stud	Ground wire connection. The control unit must be connected to a true earth ground.

Specifications

Enclosure

The control unit enclosures meet IP54 and Class II, Division II requirements.

Electrical

Input	120 or 240 Vac \pm 10% at 50/60 Hz
Output	7–21 Vdc
Short circuit output current	300 mA
Maximum output current	500 mA

Pneumatic

Minumum input pressure	4 bar (60 psi)
Maximum input pressure	7 bar (100 psi)

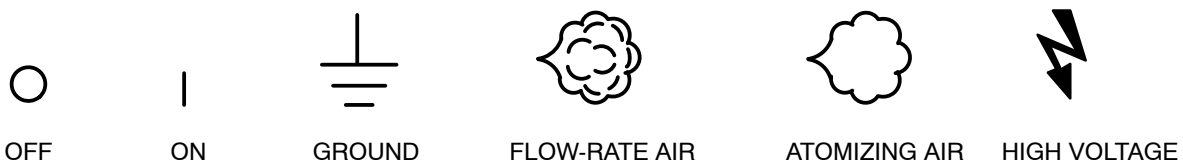
Typical Operating Pressures

Flow rate	1.5 bar (20 psi)
Atomizing	2 bar (30 psi)
Auxiliary	Fluidizing: 1.00–2.75 bar (15–40 psi) Vibrator motor: 2.75–5.5 bar (40–80 psi)
Gun air (optional)	0.7 bar (10 psi) fixed, 1 CFM(w/factory restrictor)

Air Supply Quality

Air must be clean and dry. Use a regenerative desiccant or refrigerated air dryer capable of producing a 3.4 °C (38 °F) or lower dew point at 7 bar (100 psi) and a filter system with prefilters and coalescent-type filters capable of removing oil, water, and dirt in the submicron range.

Symbols



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Figure 2-4 Symbol Definition

Section 3

Installation



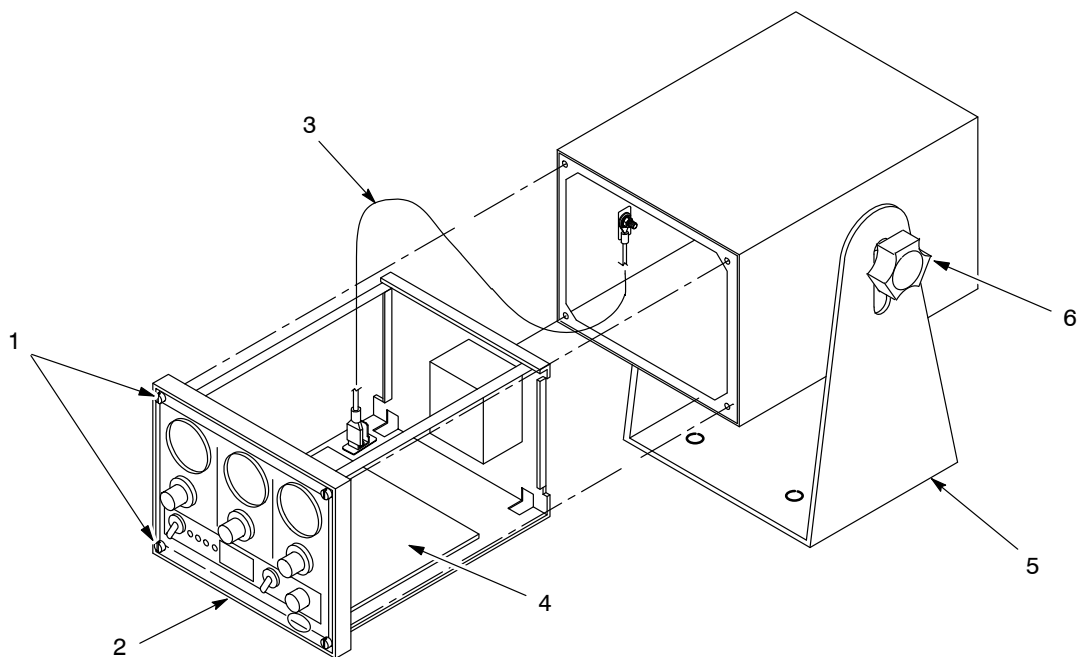
WARNING: Allow only qualified personnel to perform the following tasks. Follow the safety instructions in this document and all other related documentation.

Mounting

See Figure 3-1. Unscrew the clamping knobs (6) from the cabinet and remove the bracket (5). Use the bracket as a template to drill holes in the mounting surface for fasteners. Make sure there will be clearance at the back of the cabinet for the gun and power cables and air tubing. Use 1/4-in. fasteners to mount the bracket.

Circuit Board Configuration

1. See Figure 3-1. Loosen the captive screws (1) at the four corners of the front panel, and slide the control module (2) out of the cabinet. Unplug the ground wire (3) from the control module if necessary.



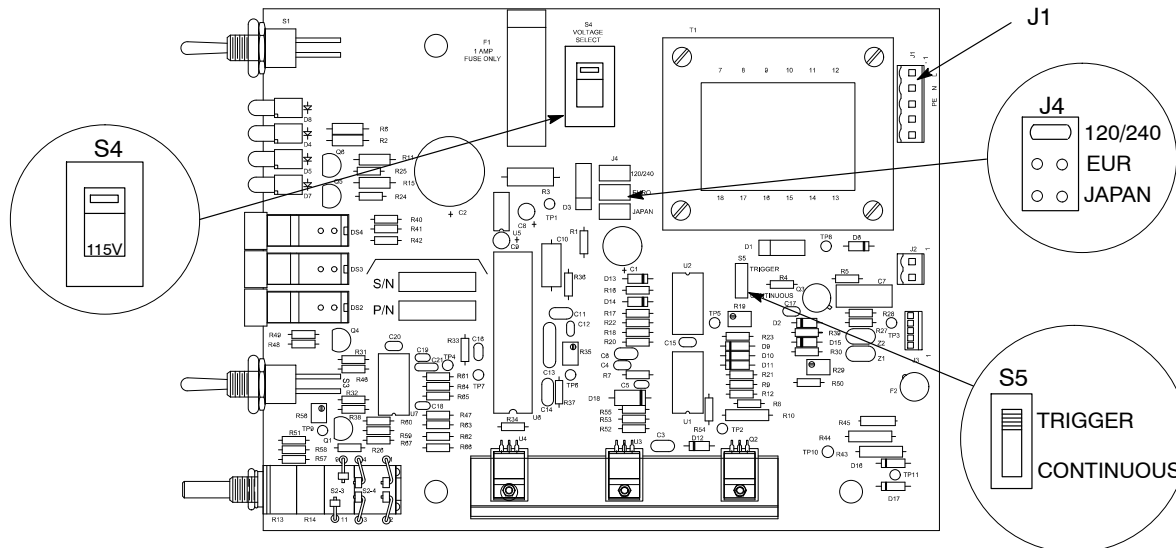
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Figure 3-1 Removing the Control Module

- | | | |
|-------------------|------------------|------------------|
| 1. Captive screws | 3. Ground wire | 5. Bracket |
| 2. Control module | 4. Circuit board | 6. Clamping knob |

Circuit Board Configuration *(contd)*

2. Set up the control unit for your application using the jumper blocks and switches shown in Figure 3-2 and explained in Table 3-1.



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Figure 3-2 Jumper Block and Switch Settings

Table 3-1 Jumper Block and Switch Settings

Jumper Block J4 — Install the jumper to match voltage as follows:	
Top	120/240-volt nominal input power (USA)
Middle	110/220-volt nominal input power (Europe)
Bottom	100/200-volt nominal input power (Japan)
Switch S4 — Set the switch to input voltage range (range showing is range selected) as follows:	
Top	100/115/120 Vac
Bottom	200/230/240 Vac
Switch S5 — Set the switch to the correct position for your application:	
Ext. Trigger	External trigger (manual gun or external switch)
Continuous	Internal trigger. (The power switch turns on air and high voltage, if the kV/AFC switch is turned on. Use this setting with an automatic gun.)

Electrical Connections



WARNING: Install a locking disconnect switch or breaker in the service line ahead of the equipment so power can be shut off during installation or repair.



CAUTION: Equipment damage may occur if the control unit is connected to any line voltage other than that stated on the I.D. plate.

Input voltage must be 100–240 Vac nominal, 1 \emptyset , 50/60 Hz. Switches and jumpers must be set as shown in Figure 3-2. The control unit is shipped set for 230 Vac.

1. See Figure 3-3. Connect the power cord to the POWER INPUT receptacle (8) on the rear panel. Install a three-prong plug on the unterminated end of the cord according to Table 3-2.

Table 3-2 Power Cord Plug Connections

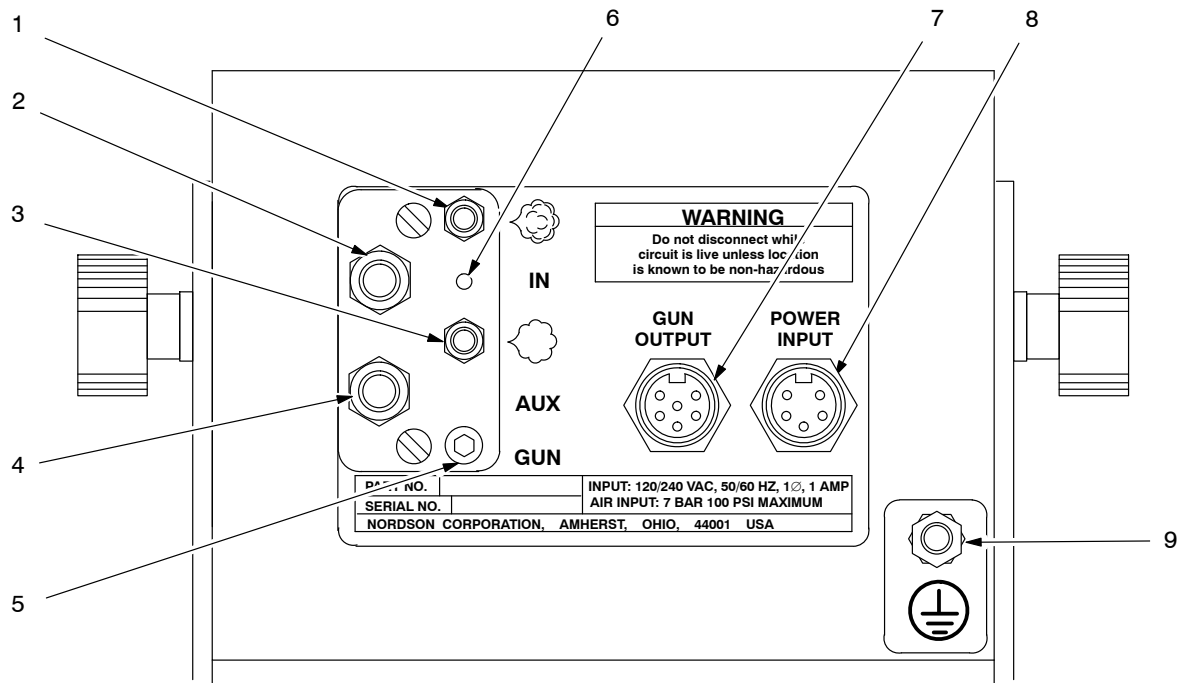
Function	Wire Color
L (L1-hot)	Brown
N (L2-neutral)	Blue
PE (Ground)	Green/Yellow



WARNING: All electrically conductive equipment in the spray area must be grounded. Ungrounded or poorly grounded equipment can store an electrostatic charge which can give personnel a severe shock or arc and cause a fire or explosion.

2. Connect the ground strap furnished with the control unit to the ground stud (9). Secure the clamp to an earth ground.
3. Connect the IPS gun cable to the GUN OUTPUT receptacle (7).

Electrical Connections *(contd)*



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Figure 3-3 Rear Panel Connections

- | | | |
|------------------|---------------------------|--------------------------|
| 1. Flow rate air | 4. Auxiliary air | 7. Gun cable receptacle |
| 2. Input air | 5. Gun air port | 8. Power cord receptacle |
| 3. Atomizing air | 6. Solenoid valve exhaust | 9. Ground stud |

Pneumatic Connections

See Figure 3-3.



Maximum input air pressure is 7 bar (100 psi). The supply air must be clean and dry. Moist or contaminated air can cause powder to cake in the feed hopper, stick to feed hose walls, clog pump venturi throats and gun passages, and cause grounding or arcing inside the gun.

Use prefilters and coalescent filters with automatic drains and a refrigerated or regenerative desiccant air dryer capable of producing a 3.4 °C (38 °F) or lower dewpoint at 7 bar (100 psi).

NOTE: The unit is shipped with 10- and 6-mm tubing connectors installed in the input and output ports. To use $\frac{3}{8}$ - or $\frac{1}{4}$ -in. tubing, remove the connectors and install in their place the $\frac{3}{8}$ - and $\frac{1}{4}$ -in. connectors shipped with the unit. Wrap the connector threads with PTFE tape before installing them.

Input and Output Air

Table 3-3 Input and Output Air Connections

Air Type	Tubing size	From		To
Input	10-mm	air supply		IN connector (2) on the rear panel
Output Flow rate	6-mm		Flow rate connection (1) on rear panel	"F" connection on powder pump
Atomizing	6-mm		Atomizing connection (3) on rear panel	"A" connection on powder pump
NOTE: Install a manually operated, self-relieving shutoff valve in the supply line to the control unit.				

Gun Air

To use the gun air with a Versa-Spray II gun, you will need to install the restrictor and connector shipped with the gun or service kit in the GUN port.

1. Remove the plug from the GUN air port (5).
2. Wrap PTFE tape around the threads of the restrictor and install it in the GUN port.
3. Install the 6-mm tube x $\frac{1}{8}$ -in. BSPT connector in the threaded end of the restrictor.
4. Connect tubing to the restrictor, route the tubing with the cable to the gun, and connect the tubing to the appropriate connectors on the gun. Refer to your gun manual or kit instruction sheet for more information.

Section 4

Operation



WARNING: Allow only qualified personnel to perform the following tasks. Follow the safety instructions in this document and all other related documentation.



WARNING: This equipment can be dangerous unless it is used in accordance with the rules laid down in this manual.

Before operating a Nordson powder spray system, read all the system component manuals and familiarize yourself with the operating characteristics of each component. A thorough understanding of system operation will help you obtain desired results and diagnose problems.

Startup

Before activating the control unit, make sure the booth exhaust fans are on, and the powder recovery system is operating. Refer to the appropriate component manuals for startup procedures.



WARNING: All electrically conductive equipment in the spray area must be grounded. Ungrounded or poorly grounded equipment can store an electrostatic charge which can give personnel a severe shock or arc and cause a fire or explosion.

1. Turn the control unit power switch on. The power LED will light.

If you set switch S5 to continuous, the powder LED will light. Atomizing and flow rate air will begin to flow to the powder pump, and gun air to the gun. If the kV/AFC switch has been turned on, the voltage multiplier will be energized.

2. Set the fluidizing (auxiliary) air pressure as recommended in the manual for your feed hopper. Typical pressures are 1.0–2.8 bar (15–40 psi). Wait 5–10 minutes for the powder in the feed hopper to be adequately fluidized before spraying.

Startup *(contd)*

3. Set flow rate and atomizing air pressures.
Flow rate air 1.4 bar (20 psi)
Atomizing air 2.1 bar (30 psi)
4. Trigger the gun. Adjust the flow rate and atomizing air pressures and the pattern adjust sleeve (if used) to obtain the desired spray pattern.
5. Turn the kV/AFC switch on. Push the kV/AFC knob in to put the unit in kV mode or pull it out to put the unit in AFC mode. Refer to the *Description* section for more information.
 - a. If the switch is set for the kV mode, rotate it fully clockwise for maximum voltage.
 - b. If the switch is set for the AFC mode, rotate it to position 4. This position represents approximately 40 microamps.
6. Coat a part and adjust the kV output or AFC settings and air pressures to achieve the desired results.

NOTE: When a gun is first put into service, set the kV/AFC switch to the kV mode, turn the switch to the maximum setting, and record the μA output with no parts in front of the gun. Monitor the μA output daily, under the same conditions. A significant increase in μA output indicates a probable short in the gun resistor. A significant decrease indicates a failing resistor or voltage multiplier.

Adjustments



WARNING: Turn off the electrostatic voltage and ground the gun electrode before making adjustments to the gun or nozzle.

Obtaining a high-quality finish and maximum transfer efficiency (percentage of powder sprayed that adheres to the part) requires experimentation and experience. Settings for electrostatic voltage and air pressure affect overall coating performance. In most applications, the settings should produce a soft spray pattern that directs as much of the powder as possible onto the part with a minimum of overspray. These settings will allow the maximum amount of charged powder to be attracted to the grounded part.

Electrostatic Voltage/AFC Control

Lowering the voltage is a common method for trying to improve coverage of deep recesses and interior corners of parts. However, lowering the voltage may also reduce your overall transfer efficiency. Powder velocity, direction, and pattern shape can be just as important as electrostatic voltage in coating these areas.

Use the AFC mode when recoating parts that have already been cured but require additional coating and curing, and when coating parts with deep recesses. In this mode, the AFC switch/potentiometer lets you set a feedback current threshold. Voltage is automatically set to the maximum. If the current threshold is reached the voltage is automatically adjusted to maintain the required coverage. A suggested starting point is position 4 on the kV/AFC switch dial, which corresponds to approximately 40 microamps. Adjustments can then be made to optimize performance for different part configurations and application parameters.

The AFC mode can also be very effective when used with automatic guns. When gun movers or changes in part configuration cause changes in the gun-to-part distances, the AFC circuitry maintains the optimum combination of voltage and current. The AFC mode provides maximum coating performance and transfer efficiency, whether coating large, flat exterior surfaces from a distance or moving the gun close to coat edges or recessed areas.

Fluidizing Air Pressure

Refer to the manual for your feed hopper for the recommended fluidizing air pressure. When properly fluidized, small air bubbles should rise gently and uniformly to the surface of the powder, making it look like it is boiling. In this state, the powder will feel and act similar to a liquid, enabling it to be easily transported by the powder pump from the hopper to the spray gun.

If you set the fluidizing pressure too low, you may get a heavy, inconsistent powder flow. If you set the fluidizing pressure too high, the powder will boil violently and the flow will be uneven, with possible air pockets in the powder stream.

Flow Rate Air Pressure

Flow rate air transports a powder and air mixture from the feed hopper to the spray gun. Increasing the flow rate air pressure increases the amount of powder sprayed from the gun and may increase the thickness of the powder deposited on the part.

If the flow rate air pressure is set too low you may get inadequate film build or uneven powder output. If the flow rate air pressure is too high, too much powder could be output at too high a velocity. This could cause excessive film build or overspray, which reduces transfer efficiency and wastes powder. Excessive flow rate air pressure may also accelerate the build-up of impact-fused powder (impact-fusion) in the gun or pump or cause premature wear of gun and pump parts in contact with the powder.

Keeping the amount of overspray to a minimum reduces the amount of powder to be recovered and recycled. This minimizes wear and tear on system components such as pumps, spray guns, and filters, and helps keep maintenance costs down.

Atomizing Air Pressure

Atomizing air is added to the powder and air stream to increase the powder velocity in the feed hose and break up clumps of powder. Higher atomizing air pressures are needed at lower powder flow rates to keep the powder particles suspended in the air stream. Higher powder velocities may cause the spray pattern to change.

If the atomizing air pressure is set too low, the result may be uneven powder output from the gun along with puffing and surging. If set too high, atomizing air pressure can increase the powder velocity and cause excessive overspray, impact-fusion, and premature wear of pump and gun parts. Increasing the atomizing air pressure will decrease the powder flow rate of some pumps, requiring minor adjustments in the flow-rate air pressure setting to maintain the same powder flow rate.

Optimum Flow Rate and Atomizing Pressure

Flow rate and atomizing air should be set to the lowest possible pressures that provide an acceptable spray pattern and the desired powder coverage, film build, and finish quality. These settings may be different from one powder to another.

Shutdown

1. Turn the control unit power switch off. This will turn off dc power to the gun and close the solenoid valve, shutting off air to the pump and gun. If you are using auxiliary air, turn the regulator counter-clockwise until the gauge reads zero.
2. Perform the daily maintenance procedures.

Daily Maintenance

- Compare the gun's μA output in kV mode, with no parts in front of the gun, with the output and kV setting recorded at initial startup. Significant differences may mean that the gun resistor or multiplier is shorted or failing.
- Check all ground connections, including part grounds. Ungrounded or poorly grounded parts will affect transfer efficiency, electrostatic wrap, and the quality of the finish. Ungrounded equipment and parts may accumulate a charge that could arc and cause a fire or explosion.
- Check power and gun cable connections.
- Make sure air being supplied to the control unit is clean and dry.
- Wipe powder and dust off the control unit cabinet with a clean, dry cloth.

Section 5

Troubleshooting



WARNING: Allow only qualified personnel to perform the following tasks. Follow the safety instructions in this document and all other related documentation.

This section contains troubleshooting procedures. These procedures cover only the most common problems that you may encounter. If you cannot solve the problem with the information given here, contact your local Nordson representative for help.

Component designations, such as SW1 and U3, may be given in troubleshooting procedures. These identify components on the circuit board. Refer to the illustrations at the end of this section to locate these components.

Troubleshooting Charts



WARNING: Electrical power must be on to check voltages. Perform these procedures carefully with insulated tools. Touching energized electrical components could be fatal.

Problem	Possible Cause	Corrective Action
1. All LEDs off, no display	No input power Power switch (S1) off or open Blown F1 fuse. C2 shorted S4 not set properly J4 jumper loose or missing Solenoid valve coil shorted	Make sure power is supplied to the control unit. Make sure switch S1 is operating properly. Correct the overload or short and replace fuse F1. If fuse F1 continues to blow, replace the circuit board. Make sure switch S4 is set correctly. Make sure the jumper is located correctly on jumper block J4. Check for a short, starting with the J2 connector on the circuit board.
2. No power or powder LEDs	Solenoid coil or wiring shorted, no powder LED Regulator U3 failed, no power or powder LED	Check the solenoid wiring. Replace the circuit board.
3. kV LED off, AFC LED off, display on	Faulty LED D5 or D7 S2 defective	Replace the circuit board. Replace the circuit board.
4. Display off, kV LED on or AFC LED on	Q4 faulty U6 defective	Replace the circuit board. Replace the circuit board.
5. No air output, powder LED on	No air to control unit Obstruction in valve manifold or cartridge valve sticking Bad solenoid connection Solenoid coil open	Check the supply air pressure. Remove the pilot manifold and solenoid valve from the manifold. Make sure the cartridge valves move freely in their bores. Check the manifold passages for blockages. Check for a loose connection at the J2 connector on the circuit board or broken wires. Replace the solenoid valve.
6. No air output, powder LED off, power LED on, kV or AFC LED on	Diode D6 shorted Q1 failed. TP-8 to ground is greater than 1 volt	Replace the circuit board. Replace the circuit board.
<i>Continued...</i>		

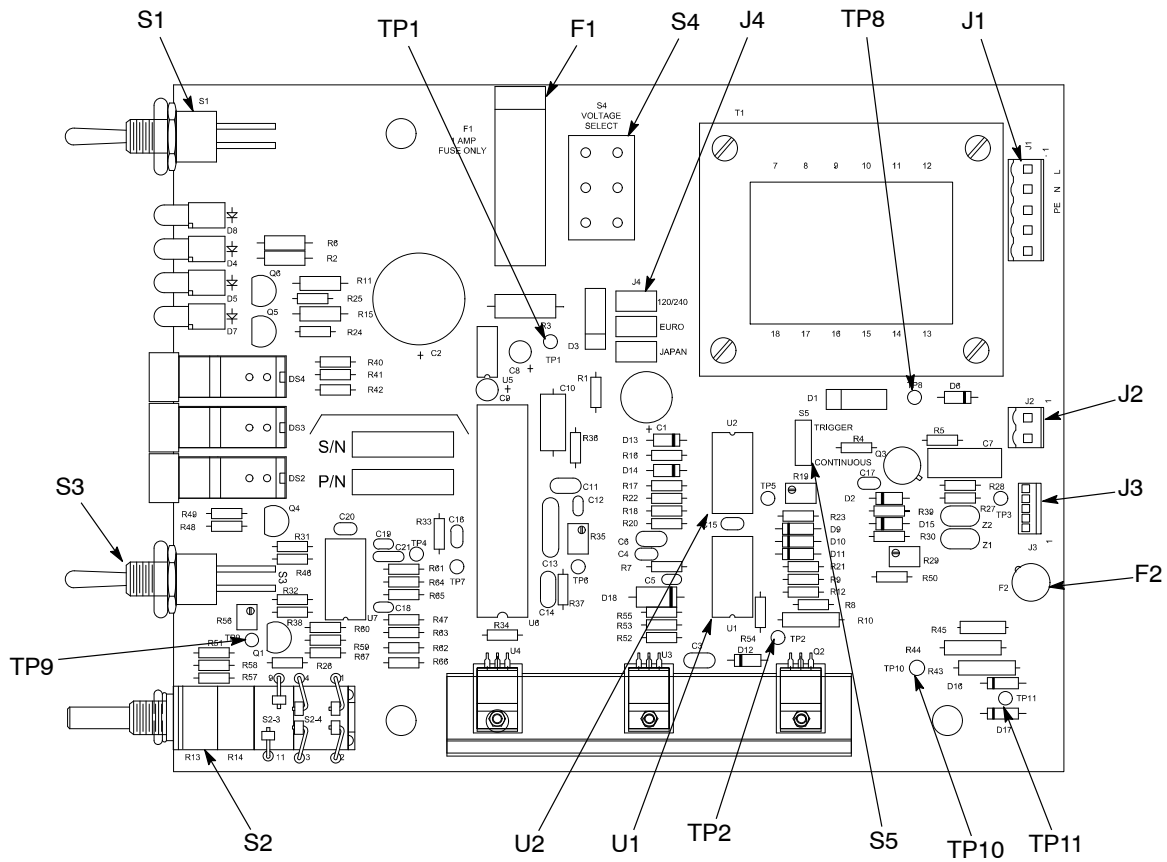
Problem	Possible Cause	Corrective Action
7. No kV out, kV or AFC LED on, powder LED off, display reads 00	<p>No trigger signal, possible cable damage</p> <p>Connections at circuit board connector J3 or GUN OUTPUT receptacle bad</p> <p>Fuse F2 blown</p> <p>U1 or U2 chip defective</p> <p>S5 defective</p>	<p>Disconnect the gun cable from the control unit. Trigger the gun and check for continuity across plug pins 1 and 2. Replace the cable if no continuity is detected.</p> <p>Check the connections at the J3 connector and the receptacle.</p> <p>Check fuse F2 and replace it, if it is blown.</p> <p>Replace the U1 chip. If this does not fix the problem, replace the U2 chip. If this still does not fix the problem, replace the circuit board.</p> <p>Move S5 to the CONTINUOUS position. Turn on the control unit. If the air and kV are now available, replace the circuit board.</p>
8. No kV out, kV or AFC LED off, display off, powder LED on	<p>kV/AFC switch (S2) off</p> <p>U1, Q2, or U3 defective</p>	<p>Turn on the switch and set it to the desired level.</p> <p>Replace the U1 chip. If this does not fix the problem, replace the circuit board.</p>
9. Low kV output	<p>kV/AFC switch (S2) not adjusted properly</p> <p>Low input voltage. TP-1 less than 24 Vdc</p> <p>U1 chip failed</p> <p>Gun resistor, cable, or multiplier failed</p>	<p>Increase the AFC current setpoint or the kV output.</p> <p>Make sure S4 and J4 are set correctly for the input voltage.</p> <p>Check from TP-2 to ground for 21 Vdc with a voltmeter. If this voltage is not present, replace the U1 chip.</p> <p>Check the gun resistor and multiplier with a megohmmeter. Check the cable continuity.</p>
10. Display reads 0 μA output, gun spraying normally	<p>Gun cable feedback circuit open, or loose or dirty cable connection</p> <p>Feedback resistor open</p> <p>kV/μA switch (S3) failed</p>	<p>Check the connections at the J3 connector on the circuit board, the GUN OUTPUT receptacle, and at the gun multiplier. Check the cable continuity. Replace the cable if no continuity is detected.</p> <p>Replace the gun multiplier. Refer to gun manual for procedures.</p> <p>Replace the circuit board.</p>
11. Display reads 100% kV, but reads 0 μA output, loss of wrap/transfer efficiency	<p>Loose or dirty gun cable connections, or cable damaged</p> <p>Multiplier failure</p>	<p>Check connections at J3, receptacle, and gun. Check gun cable continuity and replace if necessary.</p> <p>Replace the multiplier.</p>

Continued...

Troubleshooting Charts *(contd)*

Problem	Possible Cause	Corrective Action
12. Loss of wrap, poor transfer efficiency	Poorly grounded part	Measure the resistance between the part and ground with a standard ohmmeter. Clean the conveyor and part hangers if the resistance is greater than one megohm. For best results, the resistance should be 500Ω or less.
	Gun resistor or multiplier failed	Check the gun resistor and multiplier with a megohmmeter.
	Moisture in air causing kV to leak to ground	Check the air dryer and filters.
	Dirt or powder contamination of the high-voltage connections in the gun are causing arcing	Check the connection between the multiplier and resistor. Clean or replace components as needed. Make sure dielectric grease is properly applied.
13. Poor surface finish, cratering, starring, or orange peel	Excess surface charge on part	Set kV/AFC switch in the AFC mode, position 4. Adjust for the best combination of surface finish and transfer efficiency. Increase the setting to improve powder transfer efficiency. Decrease the setting to improve surface finish.
	Poorly grounded part	Measure the resistance between the part and ground with a standard ohmmeter. Clean the conveyor and part hangers if the resistance is greater than one megohm. For best results, the resistance should be 500Ω or less.
	Powder conductivity is too low	Contact the powder manufacturer.

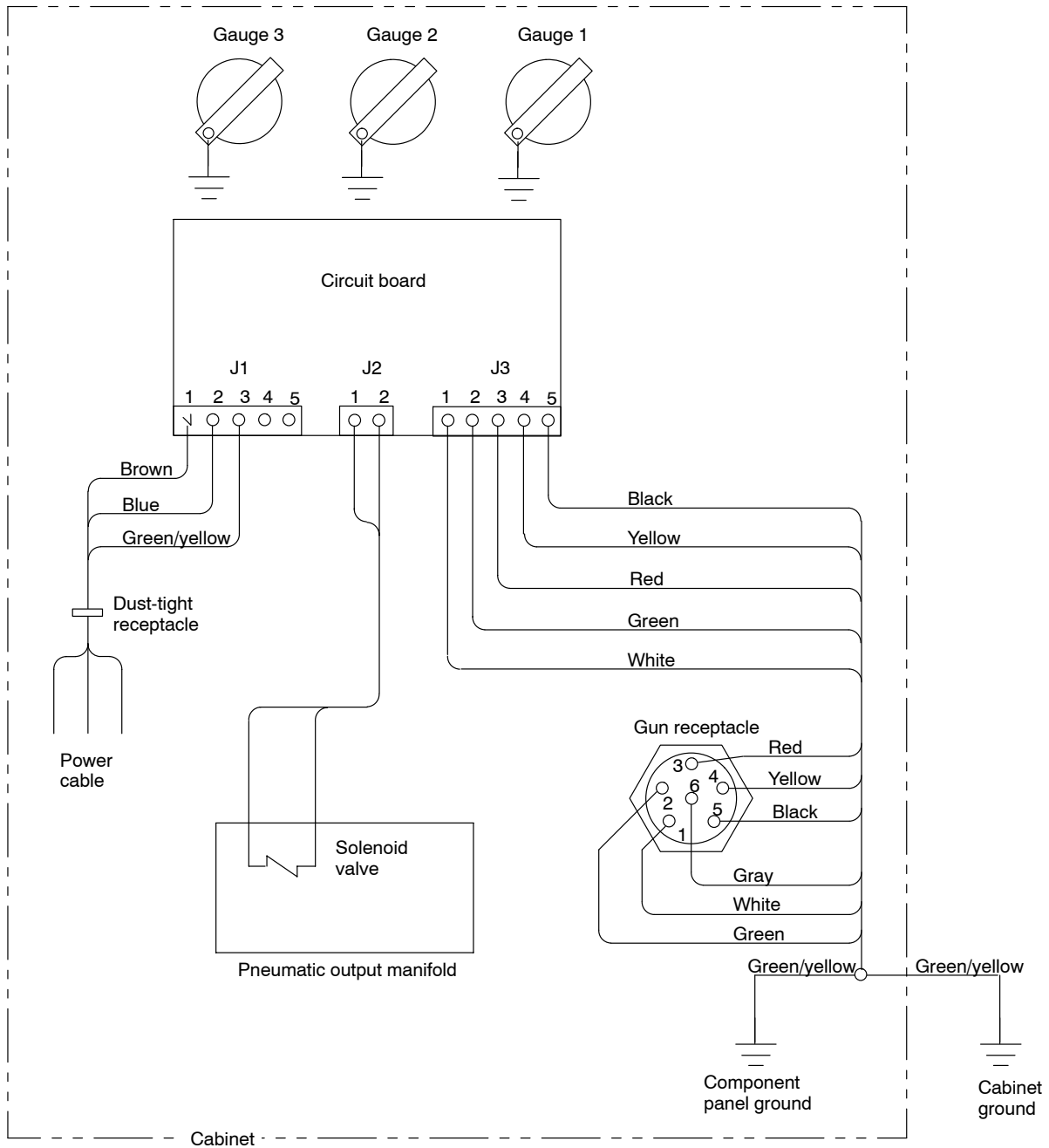
Circuit Board Test Points, Jumpers, Switches, Fuses and Connectors



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Figure 5-1 Circuit Board Test Points, Jumpers, Switches, Fuses, and Connectors

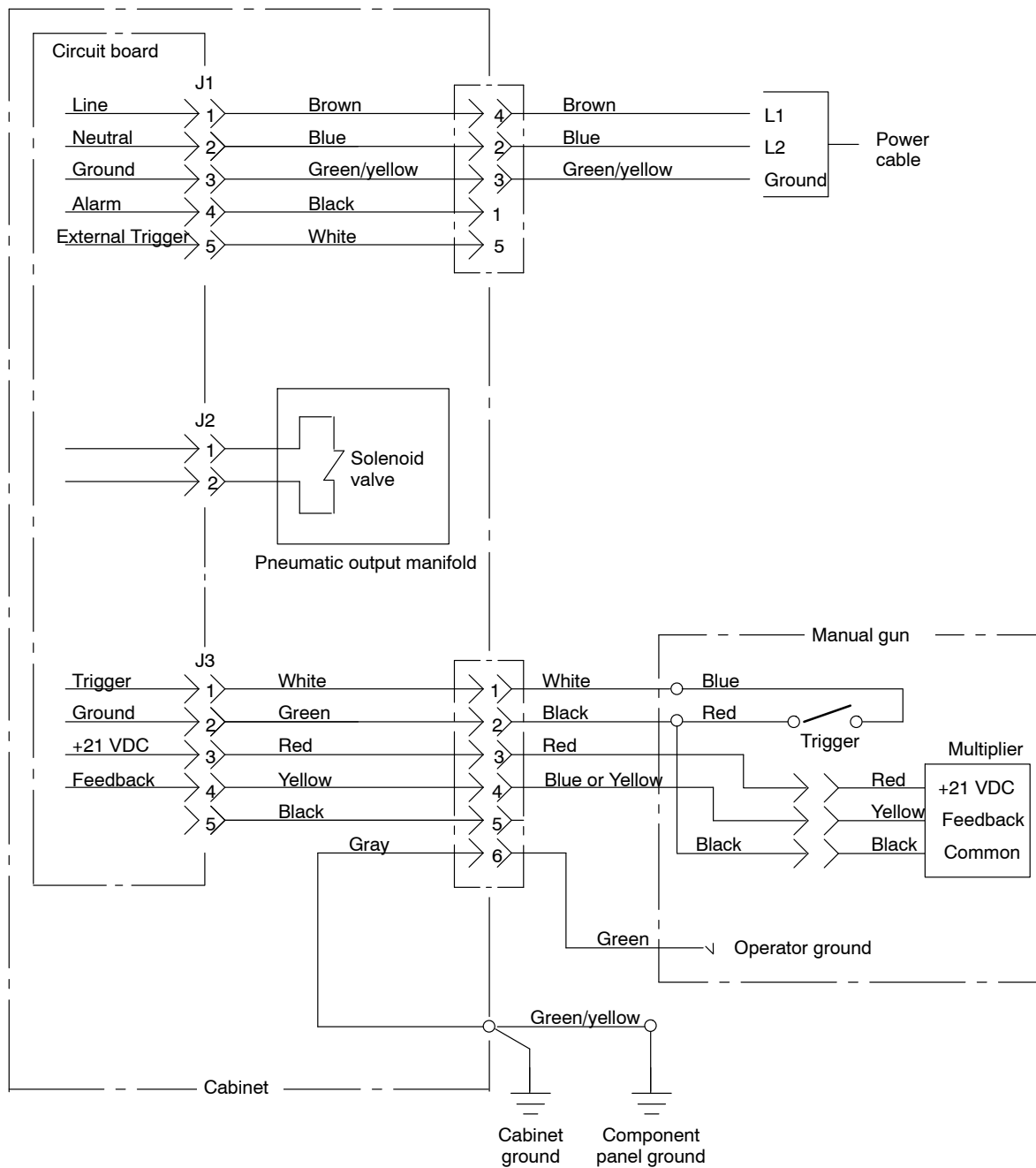
Wiring Diagram



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Figure 5-2 Wiring Diagram

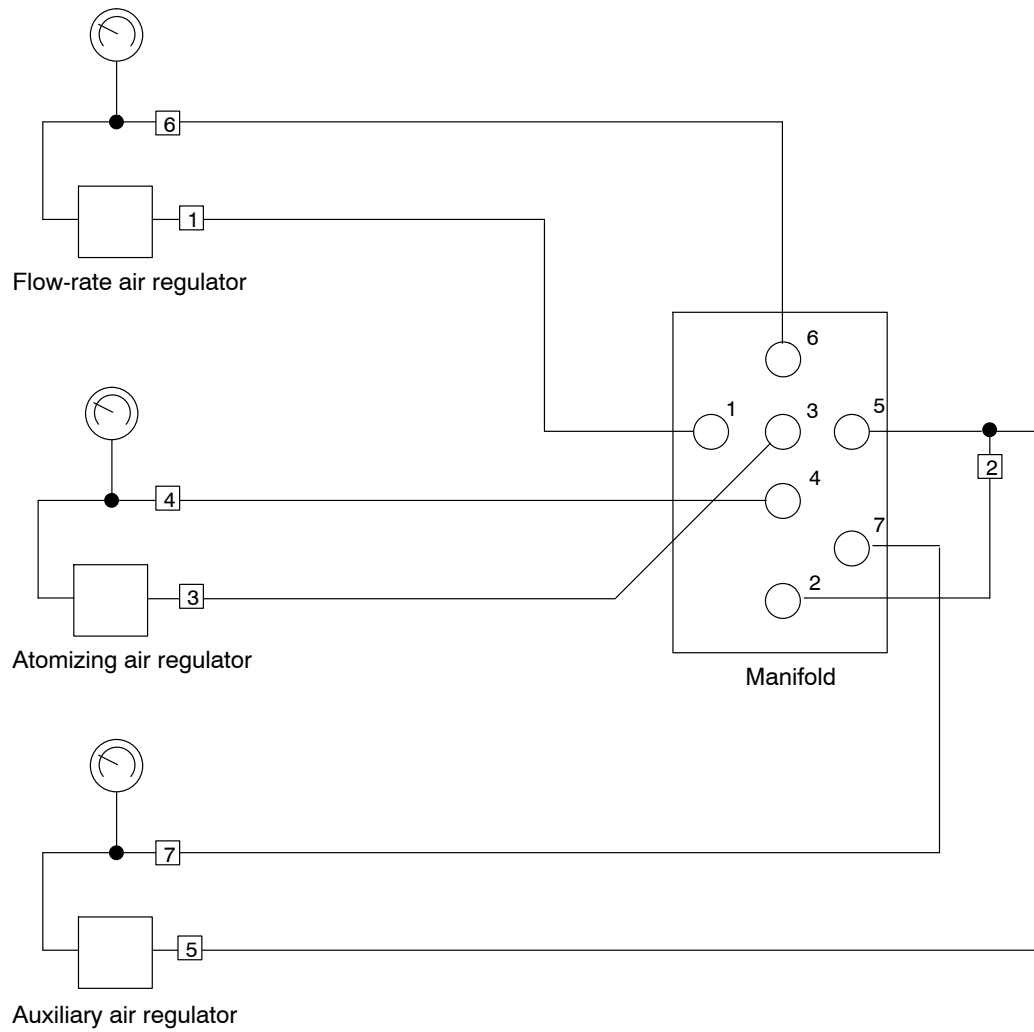
Electrical Schematic



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Figure 5-3 Electrical Schematic

Air Tubing Diagram



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Figure 5-4 Air Tubing Diagram

Section 6

Repair



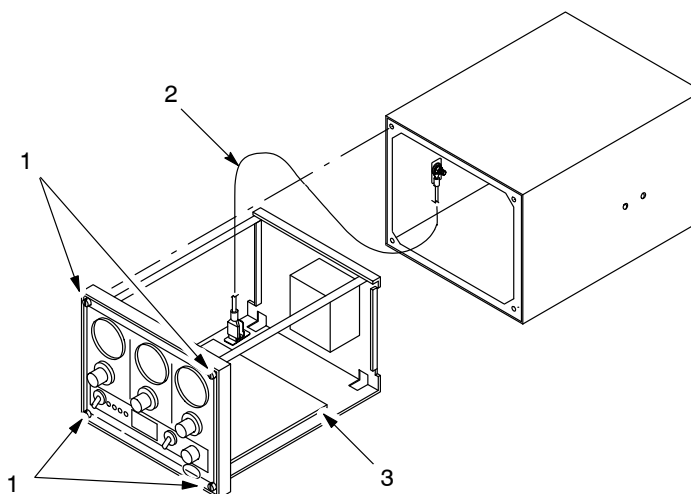
WARNING: Allow only qualified personnel to perform the following tasks. Follow the safety instructions in this document and all other related documentation.



WARNING: Disconnect and lock out electrical power before performing the following tasks. Failure to observe this warning could result in personal injury or death.

Control Module Removal

1. Shut off the air supply and relieve the pressure. Unplug the power cable, and disconnect the gun cable and air tubing.
2. See Figure 6-1. Loosen the captive screws (1) securing the control module to the cabinet.
3. Slide the control module from the cabinet. Disconnect the ground wire (2) from the module.



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Figure 6-1 Removing the Control Module from the Cabinet

- | | |
|-------------------|------------------|
| 1. Captive screws | 3. Circuit board |
| 2. Ground wire | |

Gauge and Regulator Replacement

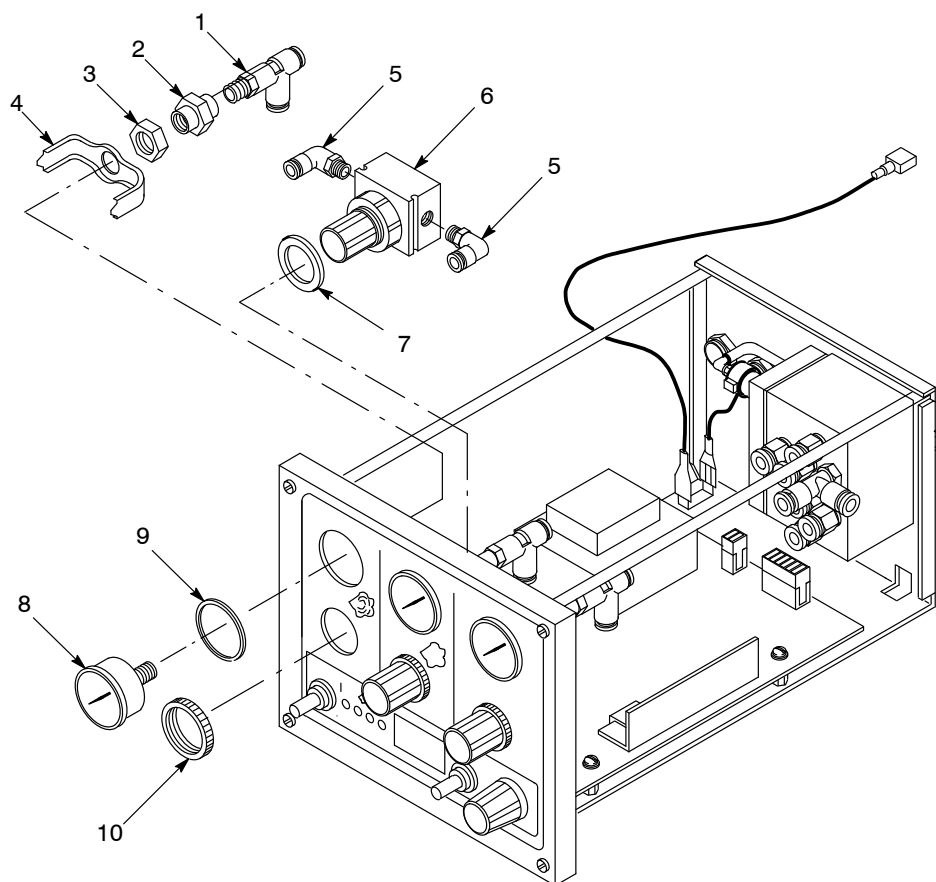
NOTE: A dust-free environment must be maintained inside the control unit cabinet. Make sure that the panel and gauge gaskets are in good condition and correctly installed before putting the unit back into service.

Gauge Replacement

1. See Figure 6-2. Disconnect the air tubing from the tee (1). Remove the coupling (2) and tee from the gauge.
2. Remove the nut (3) and bracket (4). Remove the air gauge (8) and gasket (9) from the front panel.
3. Remove the nut and bracket from the new air gauge. Install the gasket around the gauge bezel.
4. Install the gauge in the panel and secure it with the bracket and nut. Align the gauge face correctly before tightening the nut.
5. Wrap the gauge threads with PTFE tape. Install the coupling on the gauge.
6. Wrap the threads of the tee with PTFE tape and install it into the coupling. Connect the tubing to the tee. See the tubing diagram in Figure 5-4.

Regulator Replacement

1. See Figure 6-2. Disconnect the air tubing from the elbow connectors (5).
2. Remove the knurled locking ring (10) securing the regulator to the panel.
3. Remove the regulator (6) and seal (7) from the panel. Remove the elbow connectors from the regulator.
4. Wrap the elbow connector threads with PTFE tape and install them in the new regulator. Install the seal on the regulator.
5. Install the regulator in the front panel. Secure the regulator to the front panel with the locking ring.
6. Connect the air tubing to the elbow connectors. See the tubing diagram in Figure 5-4.



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Figure 6-2 Gauge and Regulator Replacement

- | | | |
|-------------|---------------------|------------------|
| 1. Tee | 5. Elbow connectors | 8. Gauge |
| 2. Coupling | 6. Regulator | 9. Gasket |
| 3. Nut | 7. Seal | 10. Locking ring |
| 4. Bracket | | |

Valve Manifold Rebuild

The solenoid valve and cartridge valves can be replaced without removing the manifold from the rear panel.

Solenoid Valve Replacement

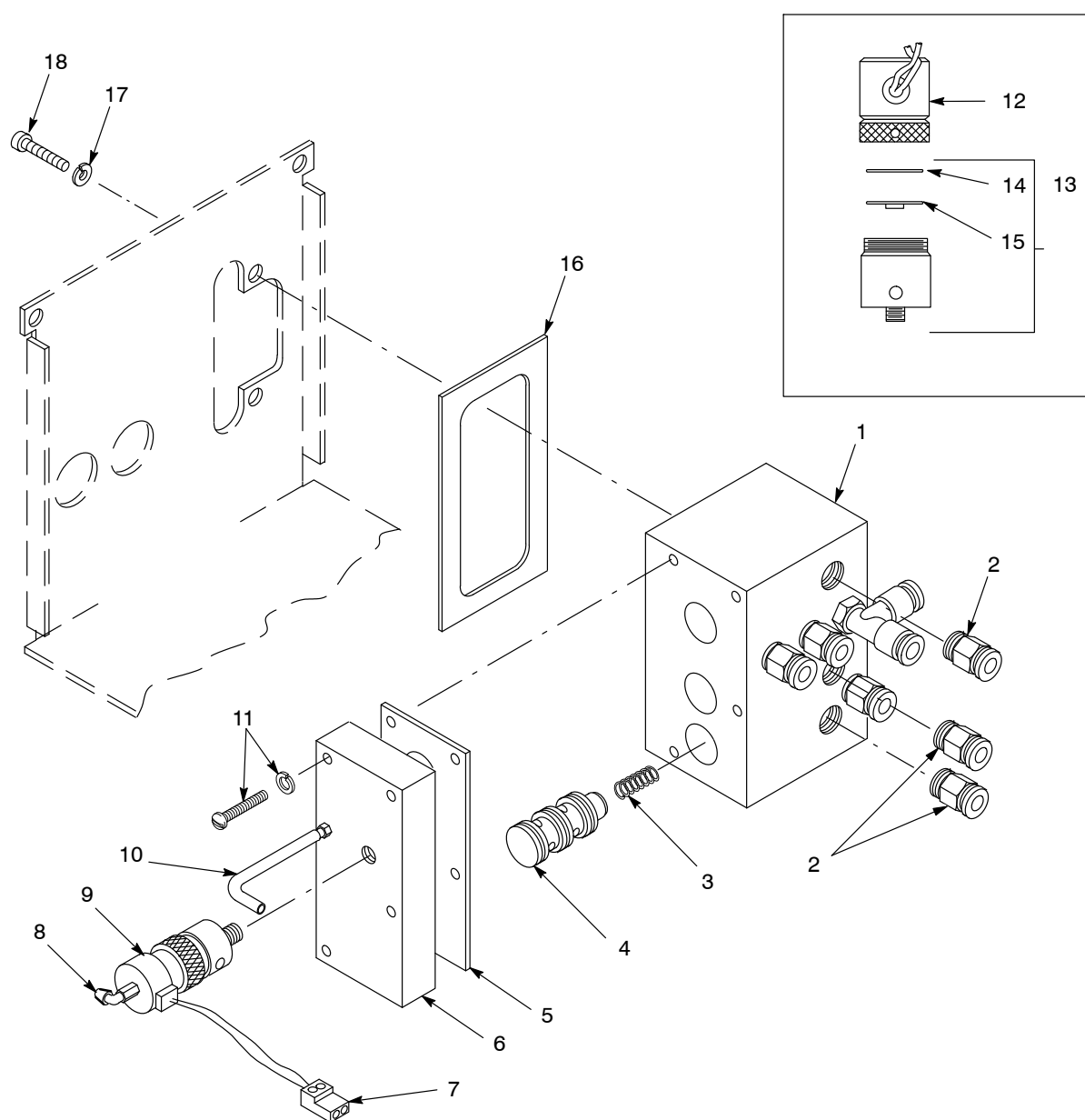
1. See Figure 6-3. Disconnect the exhaust tubing (10) from the barbed elbow connector (8).
2. Disconnect the plug connector (7) from the J2 receptacle on the circuit board.
3. Place a small diameter metal rod or awl in one of the holes in the base of the solenoid valve (9). Use the rod to unscrew the valve from the pilot manifold (6).

NOTE: Do not unscrew the solenoid coil section from the valve section. If the solenoid valve is disassembled, reassemble it as shown in the inset in Figure 6-3. Make sure the diaphragm is installed with the seal side facing the valve.

4. Remove the plug connector (7) and the barbed elbow connector (8) from the old solenoid valve and install them on the new solenoid valve. Apply threadlocking adhesive to the connector threads before installing it.
5. Wrap the solenoid valve threads with PTFE tape. Screw the valve into the pilot manifold. Tighten the valve securely.
6. Connect the exhaust air tubing to the connector. Connect the plug connector to the J2 receptacle.

Three-Way Cartridge Valve Replacement

1. See Figure 6-3. Remove the screws and lock washers (11) from the pilot manifold (6).
2. Remove the pilot manifold and gasket (5) from the manifold (1).
3. Remove the straight 6-mm tube connectors (2) from manifold ports 2, 4, and 6.
4. Insert a brass rod or wood dowel into the open ports and push the cartridge valves (4) out of the manifold. Remove the cartridge springs (3). New springs are included with the new cartridges.
5. Install the springs in the new cartridge valves and insert the cartridges into the manifold.
6. Wrap the threads of the connectors you removed in step 3 with PTFE tape and install them into the ports.
7. Install the gasket, pilot manifold, and solenoid valve on the manifold.
8. Connect the air tubing to the fittings. See the tubing diagram in Figure 5-4.



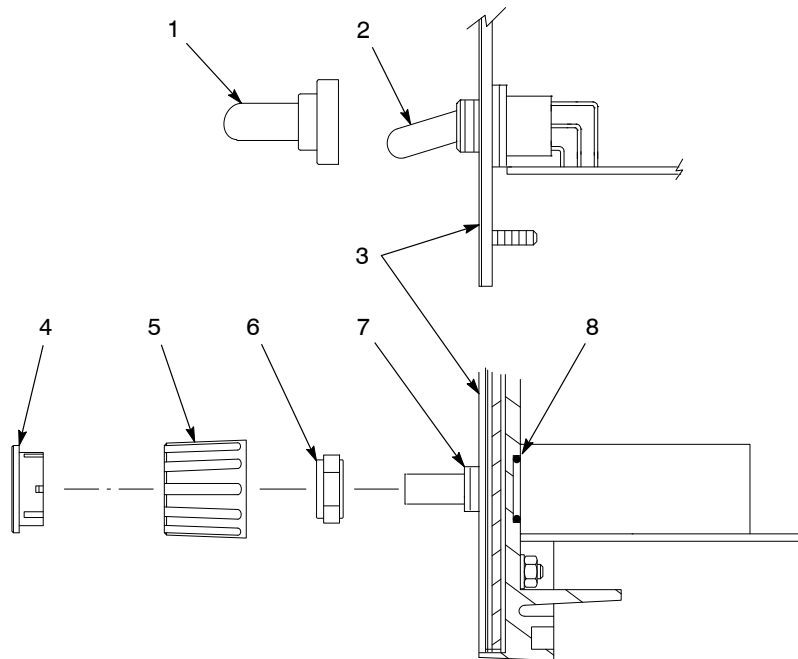
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Figure 6-3 Replacing the Solenoid Valve and Cartridge Valves

- | | | |
|---------------------|-----------------------------|-------------------|
| 1. Manifold | 7. Plug connector | 13. Valve section |
| 2. Tube connectors | 8. Barbed elbow connector | 14. Shim |
| 3. Springs | 9. Solenoid valve | 15. Diaphragm |
| 4. Cartridge valves | 10. Exhaust tubing | 16. Panel gasket |
| 5. Gasket | 11. Screws and lock washers | 17. Lock washers |
| 6. Pilot manifold | 12. Coil section | 18. Screws |

Circuit Board Replacement

1. Remove the control module from the cabinet as described in *Removing Control Module*.
2. Disconnect the plug connectors from the J1, J2, and J3 receptacles on the circuit board.
3. See Figure 6-4. Remove the dust-cover nuts (1) securing the power and kV/ μ A toggle switches (2) to the front panel.
4. Remove the cap (4) and knob (5) from the kV/AFC switch (7).
5. Remove the nut (6) securing the switch to the panel.



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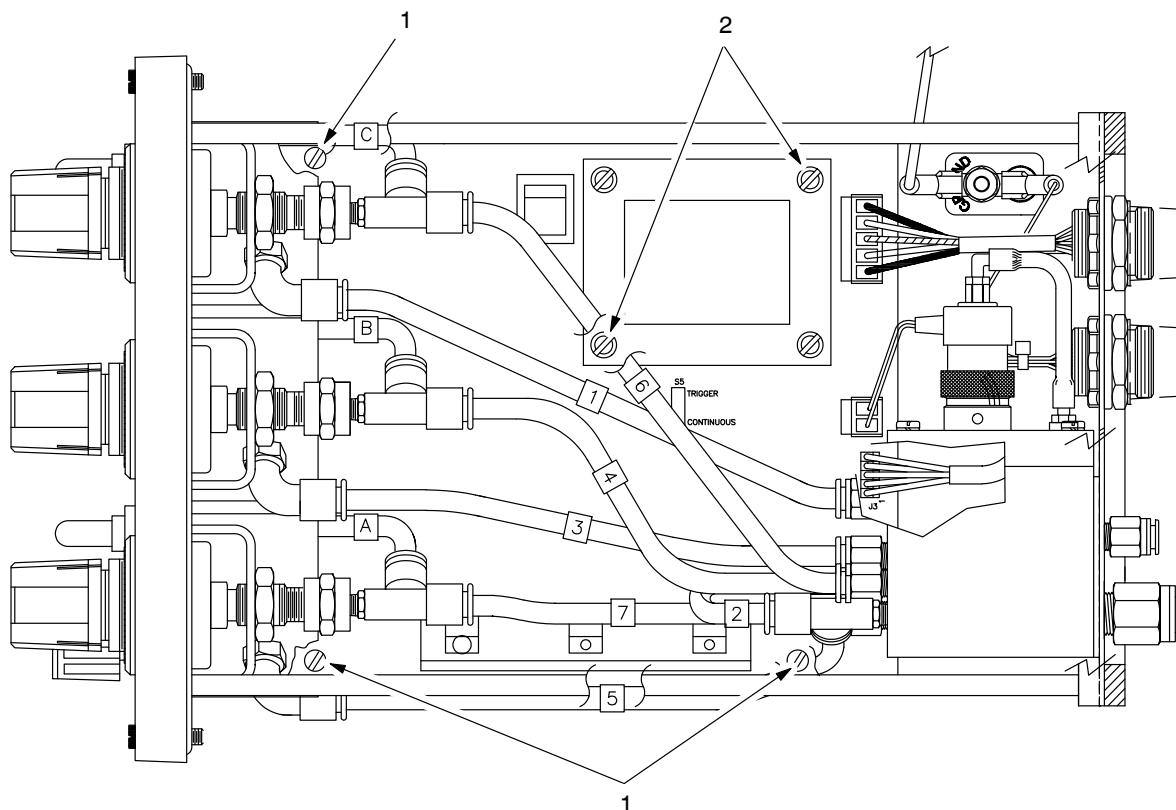
Figure 6-4 Removing Switch Dust Covers and Knobs Before Removing Circuit Board

- | | | |
|--------------------|---------|------------------|
| 1. Dust-cover nuts | 4. Cap | 7. kV/AFC switch |
| 2. Toggle switches | 5. Knob | 8. O-ring |
| 3. Front panel | 6. Nut | |

6. See Figure 6-5. Remove the screws (1, 2) securing the circuit board to the control module, and remove the board from the module.
7. To install a new circuit board in the module, follow the removal procedures in reverse. Make sure the O-ring (8, Figure 6-4) is in place before installing the board in the module.



CAUTION: Do not overtighten the screws or you will damage the circuit board.



1400899A

Figure 6-5 Removing Screws Securing Circuit Board to Module

1. Short screws
2. Long screws

Control Module Installation

Check all electrical connections before installing the module in the cabinet.

1. See Figure 6-1. Connect the ground wire (2) to the module.
2. Make sure the front and rear panel gaskets are undamaged and correctly positioned. Slide the control module into the cabinet.
3. Tighten the captive screws (1) to secure the control module to the cabinet.
4. Connect the gun cable to the GUN OUTPUT receptacle and the power cable to the POWER INPUT receptacle.
5. Connect the cabinet ground wire to a true earth ground.
6. Connect air tubing to the input and output fittings on the rear panel as shown in the *Installation* section.

Section 7

Parts

Introduction

To order parts, call the Nordson Customer Service Center or your local Nordson representative. Use this five-column parts list, and the accompanying illustration, to describe and locate parts correctly.

Using the Illustrated Parts List

Numbers in the Item column correspond to numbers that identify parts in illustrations following each parts list. The code NS (not shown) indicates that a listed part is not illustrated. A dash (—) is used when the part number applies to all parts in the illustration.

The number in the Part column is the Nordson Corporation part number. A series of dashes in this column (- - - -) means the part cannot be ordered separately.

The Description column gives the part name, as well as its dimensions and other characteristics when appropriate. Indentions show the relationships between assemblies, subassemblies, and parts.

- If you order the assembly, items 1 and 2 will be included.
- If you order item 1, item 2 will be included.
- If you order item 2, you will receive item 2 only.

The number in the Quantity column is the quantity required per unit, assembly, or subassembly. The code AR (As Required) is used if the part number is a bulk item ordered in quantities or if the quantity per assembly depends on the product version or model.

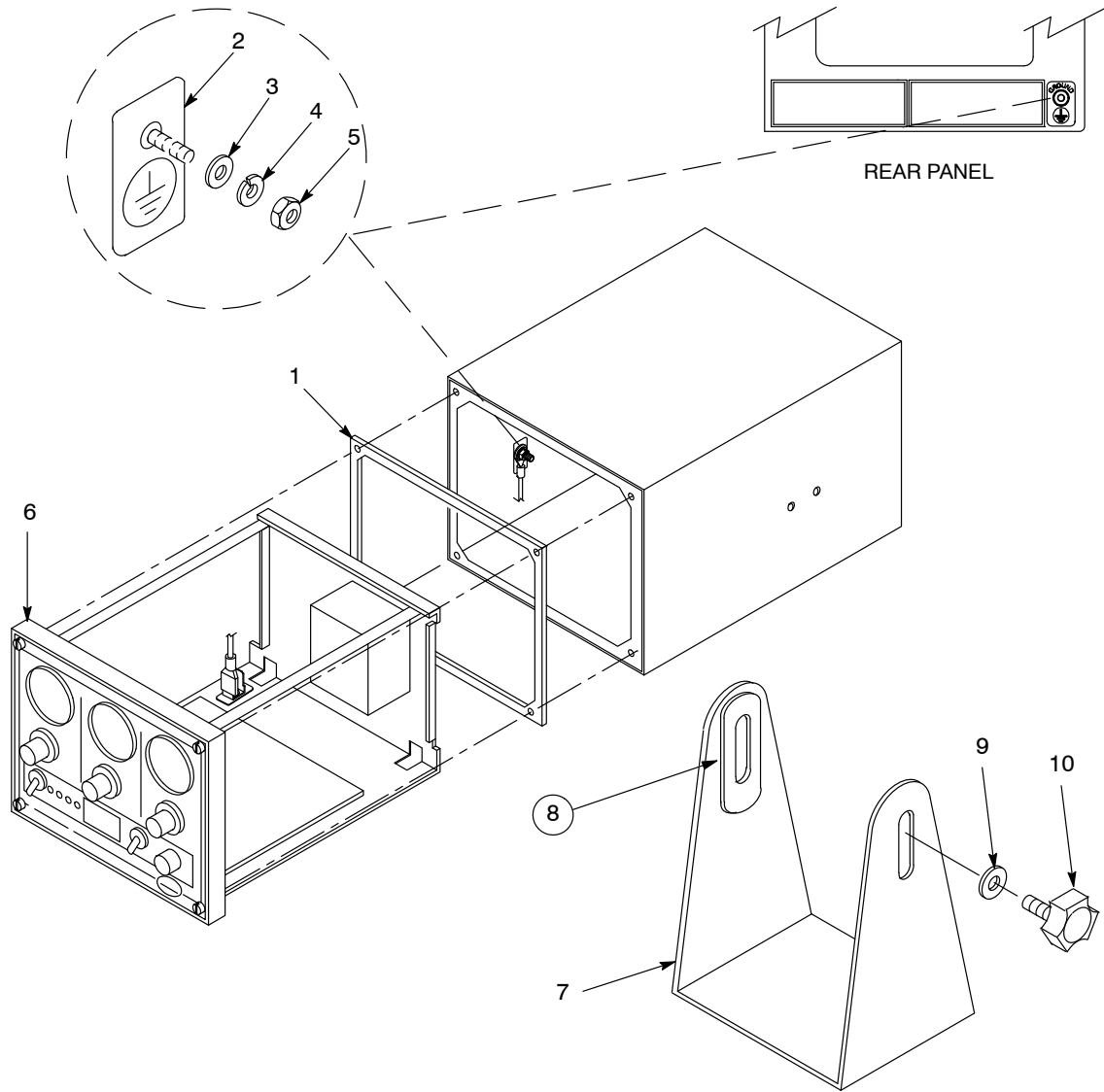
Letters in the Note column refer to notes at the end of each parts list. Notes contain important information about usage and ordering. Special attention should be given to notes.

Item	Part	Description	Quantity	Note
—	0000000	Assembly	1	
1	000000	• Subassembly	2	A
2	000000	• • Part	1	

Control Unit Assembly

See Figure 7-1.

Item	Part	Description	Quantity	Note
—	173098	POWER UNIT, Versa Spray II, 3-gauge, manual, packaged	1	
1	140165	• GASKET, filler, panel, front	1	
2	240674	• TAG, ground	2	
3	983021	• WASHER, flat, E, 0.203 x 0.406 x 0.040 in., brass	2	
4	983401	• WASHER, lock, split, M5	2	
5	984702	• NUT, hex, M5, brass	2	
6	173096	• MODULE, electronic., Versa-Spray II, 3-gauge, manual	1	A
7	168427	• BRACKET, cabinet	1	
8	129590	• SPACER, cabinet, friction	2	
9	983410	• WASHER, flat, M6	2	
10	129592	• KNOB, clamping, M6 x 12-mm	2	
NS	971177	• CONNECTOR, male, $\frac{3}{8}$ -in. tube x $\frac{1}{4}$ -in. BSPT	2	B
NS	972716	• CONNECTOR, male, $\frac{1}{4}$ -in. tube x $\frac{1}{8}$ -in. BSPT	2	B
NS	240976	• CLAMP, ground with wire	1	B
NOTE A: Refer to following pages for parts illustration and list.				
B: Noted parts are shipped loose.				
NS: Not Shown				



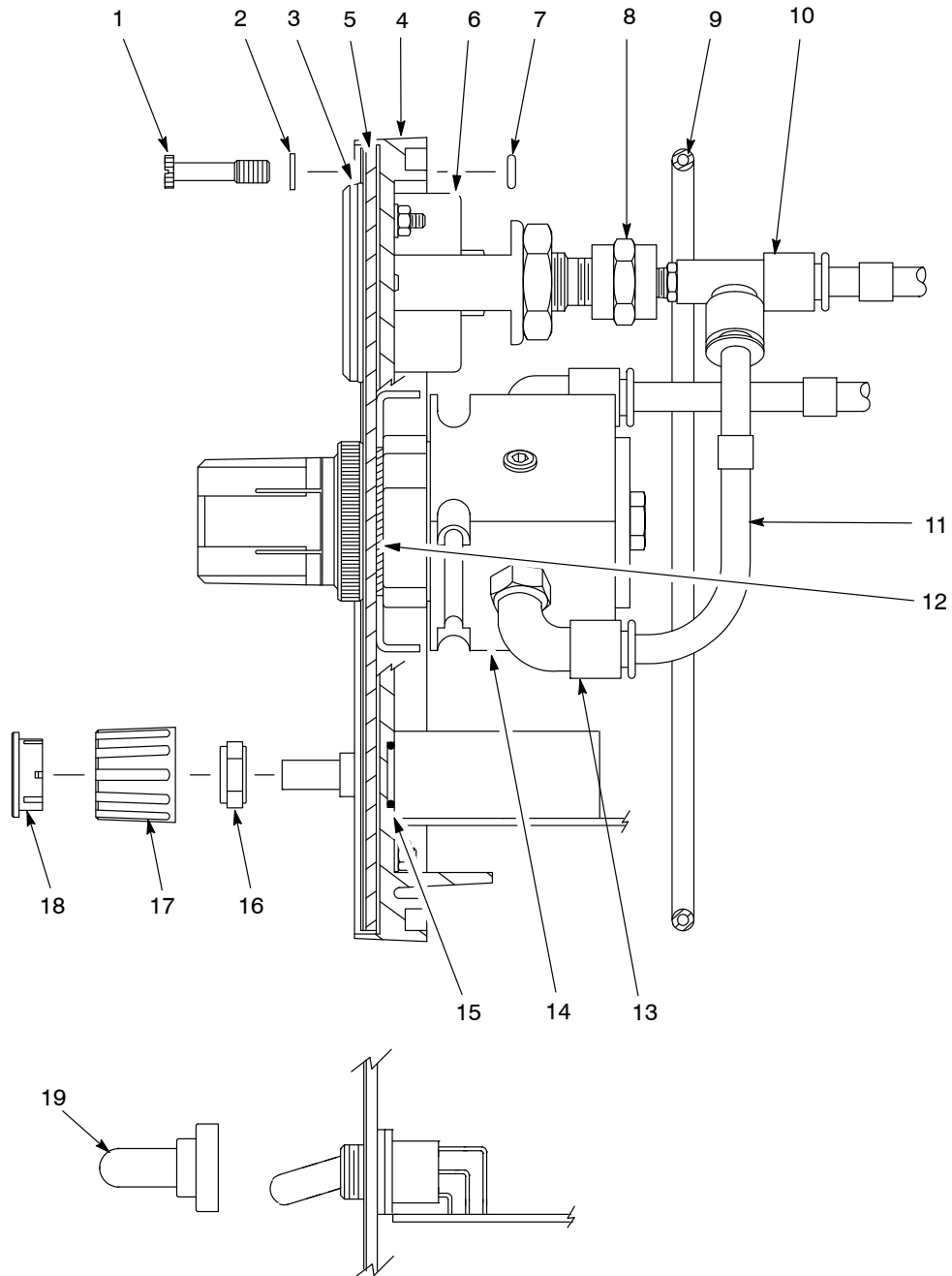
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Figure 7-1 Control Unit

Control Module

See Figure 7-2.

Item	Part	Description	Quantity	Note
—	173096	MODULE, electronic., Versa-Spray II, 3-gauge, manual	1	
1	981387	• SCREW, captive, M5 x 21-mm	4	
2	983038	• WASHER, nylon, 0.203 x 0.309 x 0.040 in.	4	
3	631138	• GASKET, gauge, 40-mm dia., EPDM	3	
4	159647	• PANEL, bezel, 3-gauge	1	
5	129596	• • GASKET, panel, bezel	1	
6	901267	• GAUGE, air, 0–7 bar, 0–100 psi	3	
7	940073	• O-RING, Viton, 0.156 x 0.281 x 0.063 in.	4	
8	973572	• COUPLING, pipe, hydraulic, SAE, 1/8-in. NPT	3	
9	129583	• GASKET, bezel	1	
10	972840	• TEE, male run, 6-mm tube x 1/8-in. BSPT	3	
11	900742	• TUBING, polyurethane, 6-mm, blue	AR	A
12	141603	• SEAL, panel, regulator	3	
13	972142	• ELBOW, male, 6-mm tube x 1/4-in. BSPT	6	
14	901444	• REGULATOR, air, 1/4-in. NPT, 5–125 psi	3	
15	940121	• O-RING, Viton, 0.375 x 0.500 x 0.063 in.	1	
16	173121	• SEAL, 1/8-in. shaft, rotary	1	
17	173099	• KNOB, collet, 21 mm, 1/8-in. shaft	1	
18	173100	• CAP, flat, 21 mm, with line	1	
19	170695	• BOOT, switch, waterproof	2	
NOTE A: Bulk part number. Order in one foot increments. AR: As Required				
				<i>Continued</i>



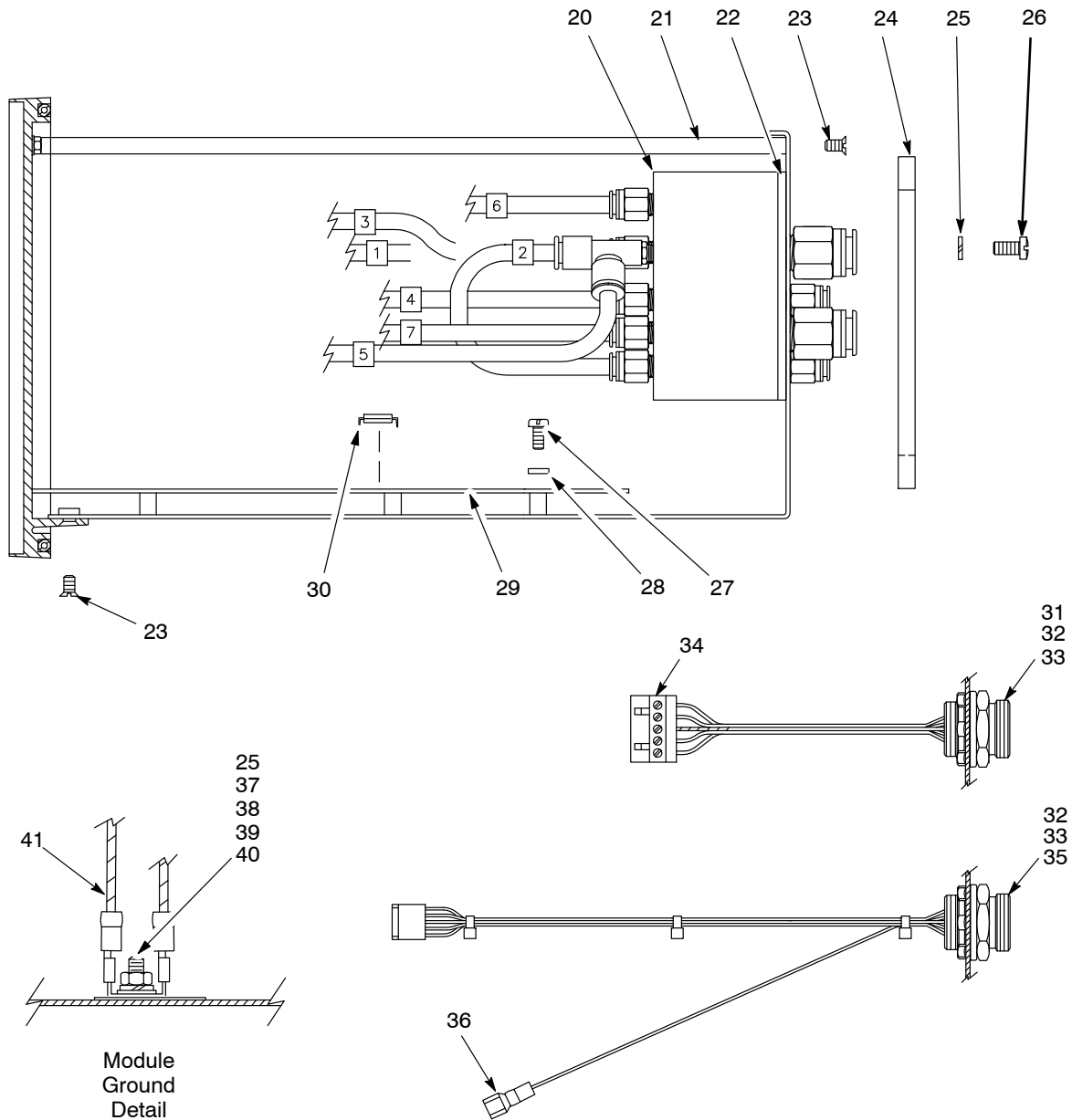
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Figure 7-2 Control Module

Control Module *(contd)*

See Figure 7-3.

Item	Part	Description	Quantity	Note
20	1062887	• KIT, manifold, pneumatic output, 3-gauge, with auxiliary	1	B
21	129591	• ROD, support	2	
22	173113	• GASKET, manifold, 3-valve	1	
23	982139	• SCREW, flat head, M4 x 8	5	
24	129600	• GASKET, rear panel	1	
25	983401	• WASHER, lock, split, M5	3	
26	982239	• SCREW, fillet head, M5 x 10	2	
27	982096	• SCREW, pan head, M4 x 8	3	
28	983416	• WASHER, lock, M4	3	
29	171031	• BOARD, circuit, Versa Spray II	1	
NS	939098	• • FUSE, 1-amp, 250V, fast-acting	1	
NS	939991	• • FUSE, 50-mA, 250V, fast-acting	1	
30	171017	• • SERVICE KIT, IC, Versa-Spray (U1, U2 chips)	1	
31	130625	• RECEPTACLE, input, 5-wire, male	1	
32	939122	• SEAL, conduit fitting, 1/2-in.	2	
33	984526	• NUT, lock, conduit	2	
34	933343	• CONNECTOR, plug, 5-pin	1	
35	130627	• RECEPTACLE, input, 6-wire, female	1	
36	933162	• TERMINAL, push-on, 0.250-in.	1	
37	240674	• TAG, ground	1	
38	933469	• LUG, 90°, double, 0.250, 0.438	1	
39	983021	• WEASHER, flat, external, brass, 0.203 x 0.406 x 0.040-in.	1	
40	984702	• NUT, hex, M5, brass	1	
41	163443	• JUMPER, ground, cabinet, 15-in.	1	
NS	173086	• CABLE, power, 3-wire, female, 18-ft	1	
NOTE B: For parts breakdown see following pages.				
NS: Not Shown				



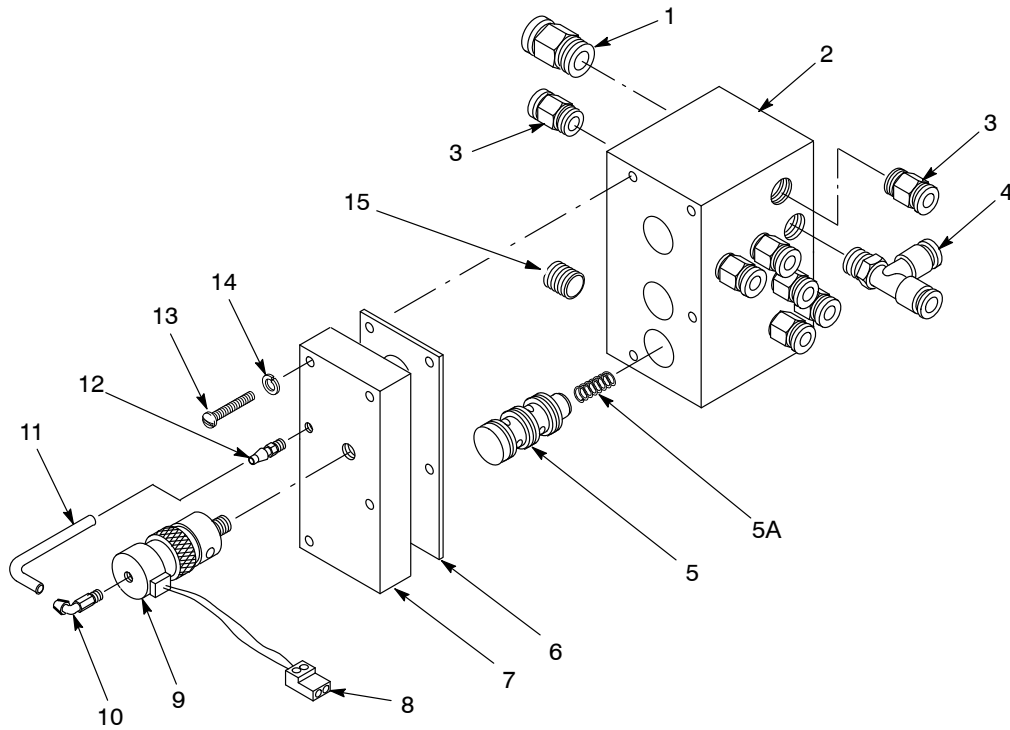
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Figure 7-3 Control Module

Pneumatic Output Manifold

See Figure 7-4.

Item	Part	Description	Quantity	Note
—	1062887	KIT, manifold, pneumatic output, 3-gauge, with auxiliary	1	
1	972841	• CONNECTOR, male, 10-mm tube x 1/4-in. BSPT	2	
2	173114	• MANIFOLD BODY, 3-valve	1	
3	972141	• CONNECTOR, male, 6-mm tube x 1/8-in. BSPT	8	
4	972840	• TEE, male run, 6-mm tube x 1/8-in. BSPT	1	
5	248716	• VALVE, 3-way cartridge	2	
5A	173123	• • SERVICE KIT, spring, cartridge valve, bag of 3	1	
6	173116	• GASKET, manifold/pilot plate	1	
7	173115	• MANIFOLD, pilot plate	1	
8	335241	• CONNECTOR, plug, 2-position	1	
9	129503	• VALVE, solenoid, 12 Vdc, N.O.	1	
10	129933	• ELBOW, male, 10-32 x 1/8-in. ID, barbed	1	
11	900572	• TUBING, silicone, 0.093-in. ID x 0.062-in. thick	4	
12	173090	• FITTING, male, 10-32 x 1/8-in. ID, barbed	1	
13	982245	• SCREW, pan head, M5 x 25	4	
14	983401	• WASHER, lock, split, M5	4	
15	973402	• PLUG, pipe, socket, flush, 1/8-in. BSPT	1	



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Figure 7-4 Pneumatic Output Manifold