Versa-Spray® IPS
Three-Gauge Control Unit

Part 106716B

NORDSON CORPORATION • AMHERST, OHIO • USA

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Notice

Trademarks

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Section 1
Safety

1. Introduction

This section contains general safety instructions for using your Nordson equipment. Task- and equipment-specific warnings are included in other sections of this manual where appropriate. Note all warnings and follow all instructions carefully. Failure to do so may result in personal injury, death, or property damage.

To use this equipment safely,

- read and become familiar with the general safety instructions provided in this section of the manual before installing, operating, maintaining, or repairing this equipment.
- read and carefully follow the instructions given throughout this manual for performing specific tasks and working with specific equipment.
- store this manual within easy reach of personnel installing, operating, maintaining, or repairing this equipment.
- follow all applicable safety procedures required by your company, industry standards, and government or other regulatory agencies. Refer to the National Fire Protection Association (NFPA) standard 33 and to federal, state, regulatory agency, and local codes for rules and regulations covering installation and operation of powder spray systems.
- obtain and read Material Safety Data Sheets (MSDS) for all materials used.

2. Safety Symbols

Become familiar with the safety symbols presented in this section. These symbols will alert you to safety hazards and conditions that may result in personal injury, death, or property and equipment damage.

WARNING: Failure to observe this warning may result in personal injury, death, or equipment damage.

2. Safety Symbols (contd.)

WARNING: Risk of electrical shock. Failure to observe this warning may result in personal injury, death, or equipment damage.

WARNING: Disconnect equipment from line voltage. Failure to observe this warning may result in personal injury, death, or equipment damage.

WARNING: Risk of explosion or fire. Fire, open flames, and smoking prohibited.

WARNING: Wear protective clothing, safety goggles, and approved respiratory protection. Failure to observe may result in serious injury.

WARNING: System or material pressurized. Relieve pressure. Failure to observe this warning may result in serious injury or death.

CAUTION: Failure to observe may result in equipment damage.

3. Qualified Personnel

"Qualified personnel" is defined here as individuals who thoroughly understand the equipment and its safe operation, maintenance, and repair. Qualified personnel are physically capable of performing the required tasks, familiar with all relevant safety rules and regulations, and have been trained to safely install, operate, maintain, and repair the equipment. It is the responsibility of the company operating the equipment to see that its personnel meet these requirements.

4. Intended Use

WARNING: Use of this equipment in ways other than described in this manual may result in personal injury, death, or property and equipment damage. Use this equipment only as described in this manual.

Nordson Corporation cannot be responsible for injuries or damages resulting from nonstandard, unintended applications of its equipment. This equipment is designed and intended only for the purpose described in this manual. Uses not described in this manual are considered unintended uses and may result in serious personal injury, death, or property damage. Unintended uses may result from taking the following actions:

- making changes to equipment that have not been recommended or described in this manual or using parts that are not genuine Nordson replacement parts
- failing to make sure that auxiliary equipment complies with approval agency requirements, local codes, and all applicable safety standards
- using materials or auxiliary equipment that are inappropriate or incompatible with your Nordson equipment
- allowing unqualified personnel to perform any task

5. Installation

Read the installation section of all system component manuals before installing your equipment. A thorough understanding of system components and their requirements will help you install the system safely and efficiently.

- Allow only qualified personnel to install Nordson and auxiliary equipment.
- Use only approved equipment. Using unapproved equipment in an approved system may void agency approvals.
- Make sure all equipment is rated and approved for the environment in which you are using it.
- Follow all instructions for installing components and accessories.
- Install all electrical, pneumatic, gas, and hydraulic connections to local code.

5. Installation (contd.)

- Install locking, manual, shutoff valves in the air supply lines to the system. This allows you to relieve air pressure and lock out the pneumatic system before undertaking maintenance and repairs.
- Install a locking disconnect switch or breaker in the service line ahead of any electrical equipment.
- Use only electrical wire of sufficient gauge and insulation to handle the rated current demand. All wiring must meet local codes.
- Ground all electrically conductive equipment within 10 feet (3 meters) of the spray area. Ungrounded conductive equipment can store a static charge which could ignite a fire or cause an explosion if a hot spark is discharged.
- Route electrical wiring, electrostatic cables, and air hoses and tubing along a protected path. Make sure they will not be damaged by moving equipment. Do not bend electrostatic cables around a radius of less than 6 in. (152 mm).
- Install safety interlocks and approved, fast-acting fire detection systems. These shut down the spray system if the booth exhaust fan fails, a fire is detected, or other emergency situation develops.
- Make sure the spray area floor is conductive to ground and that the operator's platform is grounded.
- Use only designated lifting points or lugs to lift and move heavy equipment. Always balance and block loads when lifting to prevent shifting. Lifting devices must be inspected, certified, and rated for a greater weight than the equipment being lifted.
- Protect components from damage, wear, and harsh environmental conditions.
- Allow ample room for maintenance, material supply container drop-off and loading, panel accessibility, and cover removal.
- If safety devices must be removed for installation, install them immediately after the work is completed and check them for proper functioning.

6. Operation

Only qualified personnel, physically capable of operating the equipment and with no impairments to their judgement or reaction times, should operate this equipment.

Read all component manuals before operating a powder spray system. A thorough understanding of all components and their operation will help you operate the system safely and efficiently.

- Use this equipment only in the environments for which it is rated. Do not operate this equipment in humid, flammable, or explosive environments unless it has been rated for safe operation in these environments.

- Before starting this equipment, check all safety interlocks, fire-detection systems, and protective devices such as panels and covers. Make sure all devices are fully functional. Do not operate the system if these devices are not working properly. Do not deactivate or bypass automatic safety interlocks or locked-out electrical disconnects or pneumatic valves.

- Know where EMERGENCY STOP buttons, shutoff valves, and fire extinguishers are located. Make sure they work. If a component malfunctions, shut down and lock out the equipment immediately.

- Before operating, make sure all conductive equipment in the spray area is connected to a true earth ground.

- Never operate equipment with a known malfunction or leak.

- Do not attempt to operate electrical equipment if standing water is present.

- Never touch exposed electrical connections on equipment while the power is ON.

- Do not operate the equipment at pressures higher than the rated maximum working pressure of any component in the system.

- Know the pinch points, temperatures, and pressures for all equipment that you are working with. Recognize potential hazards associated with these and exercise appropriate caution.

- Wear shoes with conductive soles, such as leather, or use grounding straps to maintain a connection to ground when working with or around electrostatic equipment.

6. Operation *(contd.)*

- Do not wear or carry metallic objects (jewelry or tools) while working with or around electrostatic equipment. Ungrounded metal can store a static charge and cause harmful shocks.

- Maintain skin-to-metal contact between your hand and the gun handle to prevent shocks while operating manual electrostatic spray guns. If wearing gloves, cut away the palm or fingers.

- Keep parts of the body or loose clothing away from moving equipment or parts. Remove personal jewelry and cover or tie back long hair.

- Wear National Institute of Occupational Safety and Health (NIOSH) approved respirators, safety glasses or goggles, and gloves, and while handling powder containers, filling hoppers, operating spray equipment, and performing maintenance or cleaning tasks. Avoid getting powder coatings on your skin.

- Never point manual guns at yourself or other persons.

- Do not smoke in the spray area. A lit cigarette could ignite a fire or cause an explosion.

- If you notice electrical arcing in a spray area, shut down the system immediately. An arc can cause a fire or explosion.

- Shut off electrostatic power supplies and ground gun electrodes before making adjustments to powder spray guns.

- Shut off moving equipment before taking measurements or inspecting workpieces.

- Wash exposed skin frequently with soap and water, especially before eating or drinking. Do not use solvents to remove coating materials from your skin.

- Do not use high-pressure compressed air to blow powder off your skin or clothes. High-pressure compressed air can be injected under the skin and cause serious injury or death. Treat all high-pressure fittings and hoses as if they could leak and cause injury.

7. Less-obvious Dangers

Operators should also be aware of less-obvious dangers in the workplace that often cannot be completely eliminated:

- exposed surfaces on the equipment which may be hot or have sharp edges and cannot be practically safeguarded
- electrical equipment which may remain energized for a period of time after the equipment has been shut off
- vapors and materials which may cause allergic reactions or other health problems
- automatic hydraulic, pneumatic, or mechanical equipment or parts that may move without warning
- unguarded, moving mechanical assemblies

8. Action in the Event of a System or Component Malfunction

Do not operate a system that contains malfunctioning components. If a component malfunctions, turn the system OFF immediately.

- Disconnect and lock out electrical power. Close and lock out hydraulic and pneumatic shutoff valves and relieve pressures.
- Allow only qualified personnel to make repairs. Repair or replace the malfunctioning component.

9. Maintenance and Repair

Allow only qualified personnel to perform maintenance, troubleshooting, and repair tasks.

- Always wear appropriate protective devices and use safety devices when working on this equipment.
- Follow the recommended maintenance procedures in your equipment manuals.
- Do not service or adjust any equipment unless another person trained in first aid and CPR is present.
- Use only genuine Nordson replacement parts. Using unapproved parts or making unapproved modifications to equipment may void agency approvals and create safety hazards.

9. Maintenance and Repair (contd.)

- Disconnect, lock out, and tag electrical power at a disconnect or breaker in the service line ahead of electrical equipment before servicing.
- Do not attempt to service electrical equipment if there is standing water present. Do not service electrical equipment in a high-humidity environment.
- Use tools with insulated handles when working with electrical equipment.
- Do not attempt to service a moving piece of equipment. Shut off the equipment and lock out power. Secure equipment to prevent uncontrolled movement.
- Relieve air pressures before servicing equipment. Follow the specific instructions in this manual.
- Make sure that the room where you are working is sufficiently ventilated.
- If a “power on” test is required, perform the test carefully and then shut off and lock out power as soon as the test is over.
- Connect all disconnected equipment ground cables and wires after servicing the equipment. Ground all conductive equipment.
- Service lines connected to panel disconnect switches may still be energized unless they are disconnected. Make sure the power is off before servicing. Wait 5 minutes for capacitors to discharge after shutting off the electrical power.
- Turn off the electrostatic power supply and ground the gun electrode before adjusting or cleaning.
- Keep high-voltage connection points clean and insulated with dielectric grease or oil.
- Check all ground connections periodically with a standard ohmmeter. Resistance to ground must not exceed one megohm. If arcing occurs, shut down the system immediately.

9. Maintenance and Repair (contd.)

- Check interlock systems periodically to ensure their effectiveness.

WARNING: Operating faulty electrostatic equipment is hazardous and can cause electrocution, fire, or explosion. Make resistance checks part of your periodic maintenance program.

- Do not store flammable materials in the spray area or room. Keep containers of flammable materials far enough away from spray booths to prevent their inclusion in a booth fire. If a fire or explosion occurs, flammable materials in the area will increase the chances and the extent of personal injuries and property damage.

- Practice good housekeeping procedures. Do not allow dust or powder coatings to accumulate in the spray area or booth or on electrical equipment. Read this information carefully and follow instructions.

10. Disposal

Dispose of equipment and materials used in operation and cleaning according to your local regulations.

11. Safety Labels

Table 1-1 contains the text of the safety labels on or shipped with the Versa-Spray IPS 3-gauge control unit. Figure 1-1 shows where the labels with item numbers in the table are located. Familiarize yourself with these labels. They are provided to help you operate and maintain your equipment safely.

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.	129 597	**SAFETY INSTRUCTIONS** 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.
		WARNING: Disconnect main power before servicing.

Item	Part	Description
	244 664	**WARNING:** The following procedures MUST 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. 1. NO SMOKING. Keep open flames, hot surfaces, and sparks from torches or grinding away from booth. 2. Turn the electrostatic power unit off 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 meg ohm 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. 7. Install automatic flame detectors in accordance with ANSI/NFPA 33, Chapter 7 (or local codes), before operating automatic guns. 8. Examine all equipment at the beginning of each work period and repair or replace any damaged, loose, or missing parts. 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. 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). 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. 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. 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. 14. Guns, feeders, booths, etc., may be cleaned with clean dry air at 25 psig (1.7 bar). If you have any questions concerning this electrostatic spray equipment, call (216) 988–9411, and ask to speak with the Powder Systems Group Technical Service Department.

Safety Label Locations

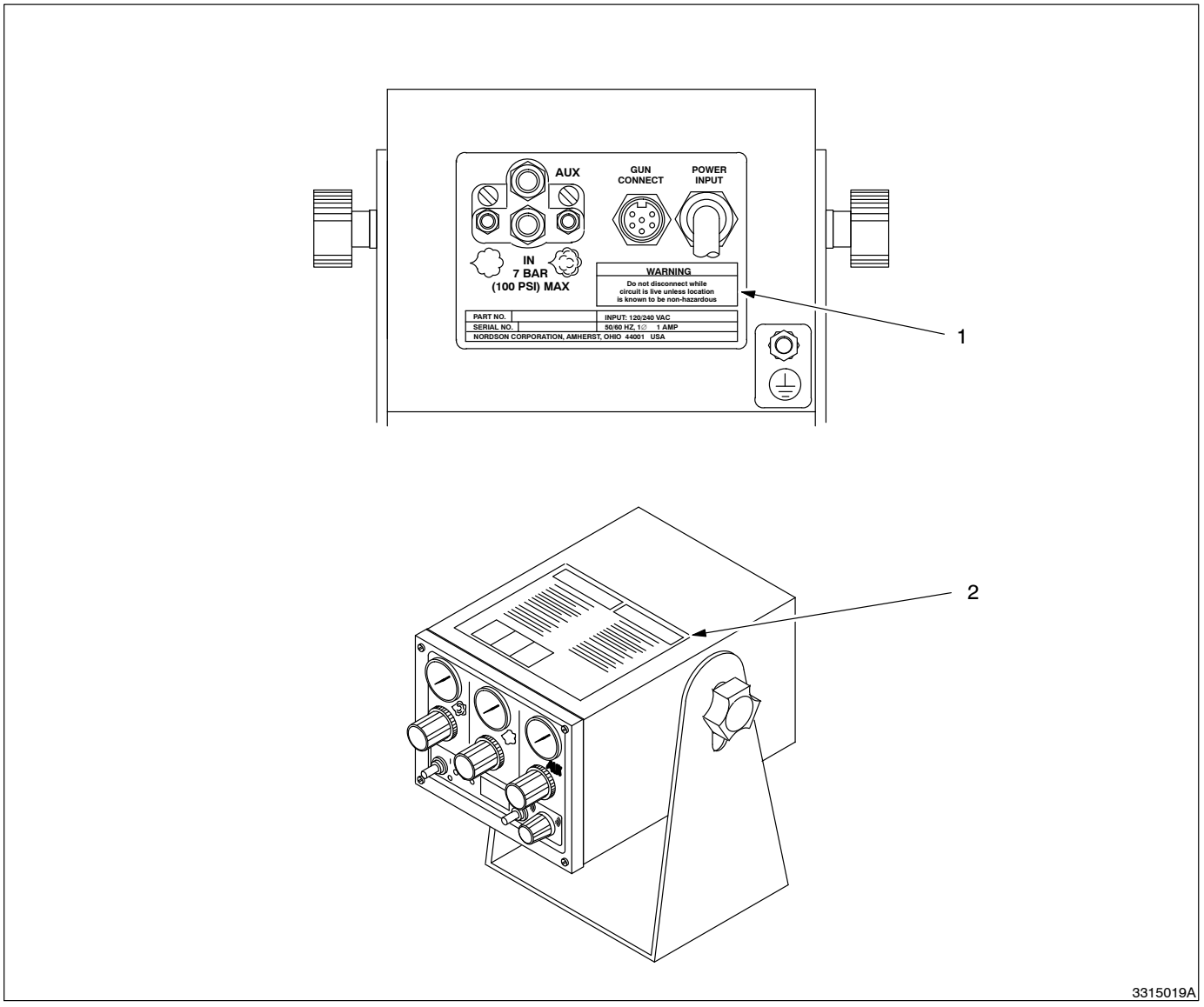


Fig. 1-1 Safety label locations

1. Electrical warning *2. Safety instructions*

Section 2

Description

Section 2
Description

1. Introduction

The Versa-Spray Three-Gauge Integral Power Supply (IPS) control unit (Figure 2-1) provides pneumatic and electrostatic controls, DC power, and monitoring functions for Versa-Spray IPS manual or automatic powder spray guns.

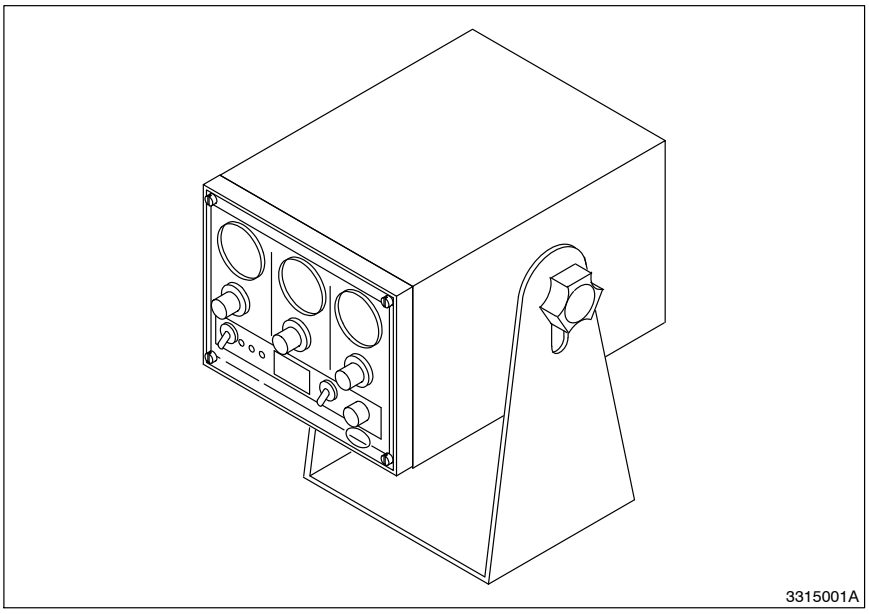


Fig. 2-1 Versa-Spray IPS control unit

The control unit can be mounted on a two-wheeled dolly, operator's platform, or wall. The mounting bracket can be positioned to extend from the bottom as shown, or from the top. The control unit swivels in the bracket. The knobs lock the unit in position when tightened.

Two sets of regulators and gauges control powder pump flow-rate and atomizing air pressure. A third regulator and gauge controls auxiliary air. This air can be used to fluidize powder in a feed hopper or to power a vibrator motor on a Nordson vibratory box feeder.

The control unit provides 6.3 to 21 VDC to the spray gun voltage multiplier. The multiplier produces the high voltage used to electrostatically charge the powder as it is sprayed. The digital display on the front panel of the control unit provides the operator with voltage and current information.

2. Front Panel Controls

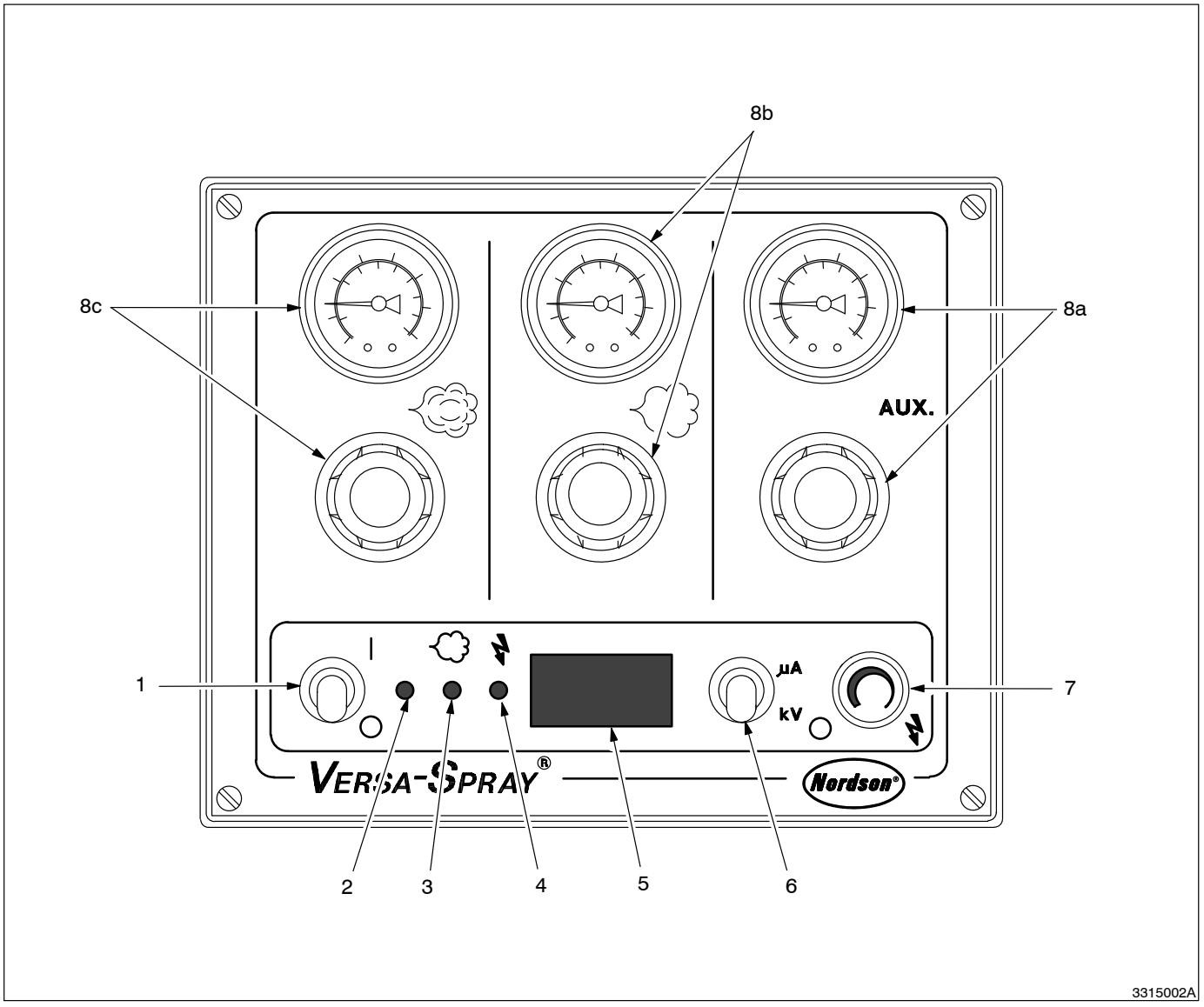


Fig. 2-2 Front panel controls

Table 2-1 Front Panel Controls (See Figure 2-2)

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 and atomizing air flowing, and activate the gun multiplier (if air pressure is set above zero, and the kV potentiometer is turned on).
2	Power LED (Green)	Lights when the control unit power switch is turned on.
3	Powder LED (Green)	Lights when the solenoid valve is energized by a trigger signal and flow-rate air and atomizing air flow to the powder pump.
4	kV LED (Amber)	Lights when the kV potentiometer is turned on.
5	Digital display	Displays kV output and multiplier polarity (positive or negative), or microampere (μA) output. The kV/μA switch changes the display function. When the control unit is used with a PRX automatic gun, the display reflects the percentage of voltage output. The digital display shows true kV output only when there is no load on the gun multiplier. The actual kV output will be less than the displayed value because parts passing in front of the gun create a load. The microampere (μA) output will fluctuate as parts go by the gun tip. The closer a part is to the electrode, the greater the μA output. Part shape and powder flow rates also affect microampere output.
6	kV/μA switch	Changes the output displayed from kV to microamperes. The switch is non-latching.
7	kV potentiometer	Controls high-voltage output. Clockwise rotation turns on high-voltage and increases output.
8a Auxiliary air regulator and gauge (fluidizing) **8b** Atomizing air regulator and gauge **8c** Flow-rate air regulator and gauge		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.

3. Rear Panel Connections

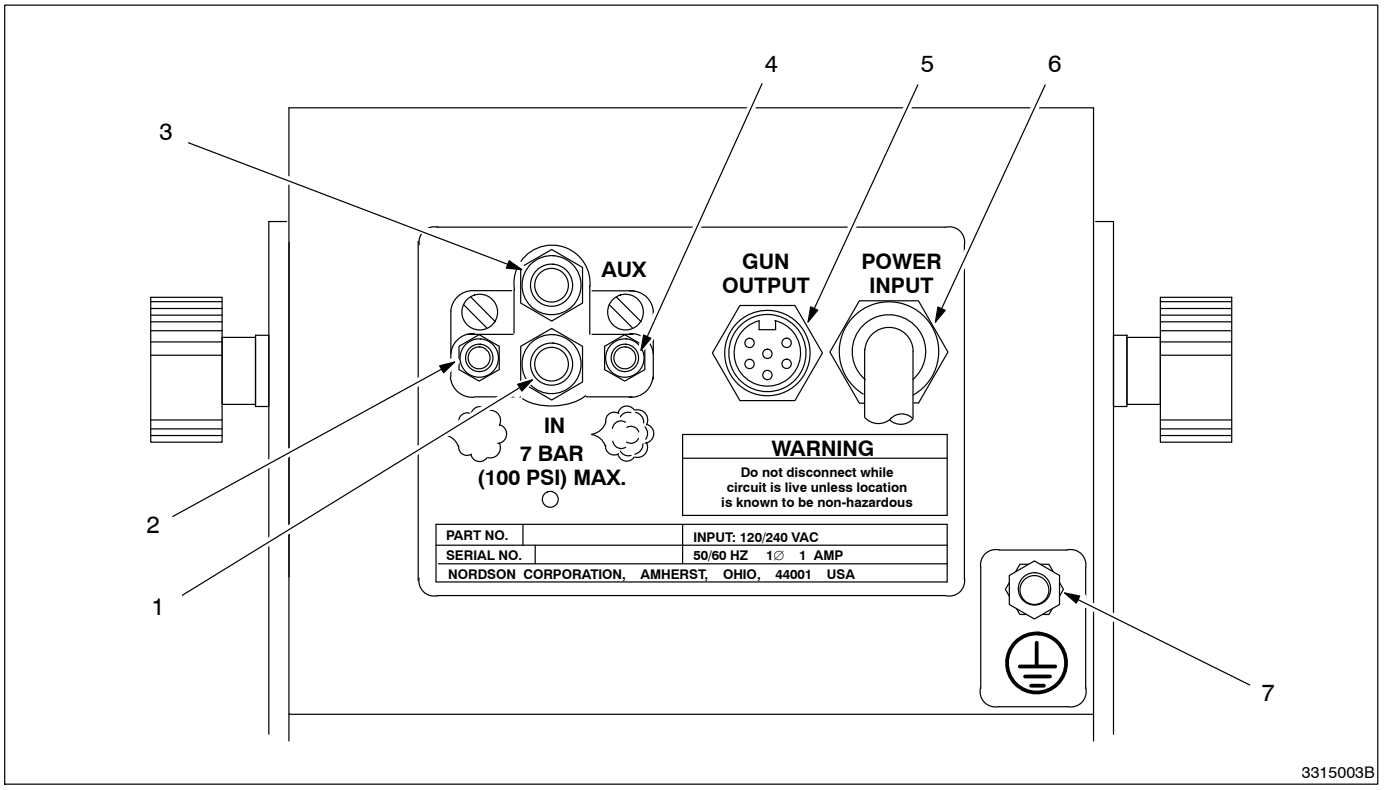


Fig. 2-3 Rear panel connections

Table 2-2 Rear Panel Connections

Item	Component	Function
1	Supply air connector	10-mm tubing connector. 100 psi (7 bar) maximum.
2	Atomizing air connector	6-mm tubing connector for powder pump atomizing air supply.
3	Auxiliary air connector	10-mm tubing connector for fluidizing air or other uses.
4	Flow-rate air connector	6-mm tubing connector for powder pump flow-rate air supply.
5	Gun output receptacle	6-pin connector for Nordson Versa-Spray IPS manual gun cable.
6	Power supply	Strain-relief connector and 3-wire power cord, unterminated. Customer must furnish and install a 3-prong plug.
7	Cabinet ground stud	Ground wire connection. Must be connected to a true earth ground.

4. Specifications

Enclosure

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

Electrical

Input	120 or 240 VAC ± 10% at 50/60 Hz
Output	6.3–21 VDC
Short circuit output current	500 milliamperes (500 mA)

Pneumatic

Minimum input pressure	60 psi (4.1 bar)
Maximum input pressure	100 psi (6.89 bar)

Average Operating Pressures:

Flow-rate	30 psi (2.1 bar)
Atomizing	20 psi (1.4 bar)
Auxiliary	Fluidizing: 15–40 psi (1.03–2.75 bar) Box feeder: 40–80 psi (2.75–5.5 bar)

Air Supply Quality

Air must be clean and dry. Use a regenerative desiccant or refrigerated air dryer capable of producing a 38 °F (3.4 °C) or lower dew point at 100 psi (6.89 bar) and a filter system with prefilters and coalescent-type filters capable of removing oil, water, and dirt in the submicron range.

5. Symbols

Symbols used on this equipment are described in Figure 2-4.

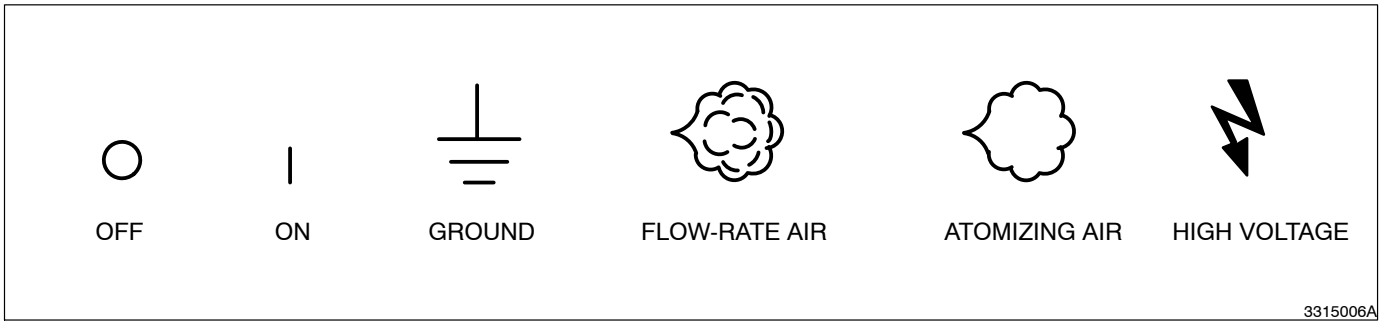


Fig. 2-4 Symbols used on control units

Section 3

Installation

Section 3
Installation

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

1. 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.

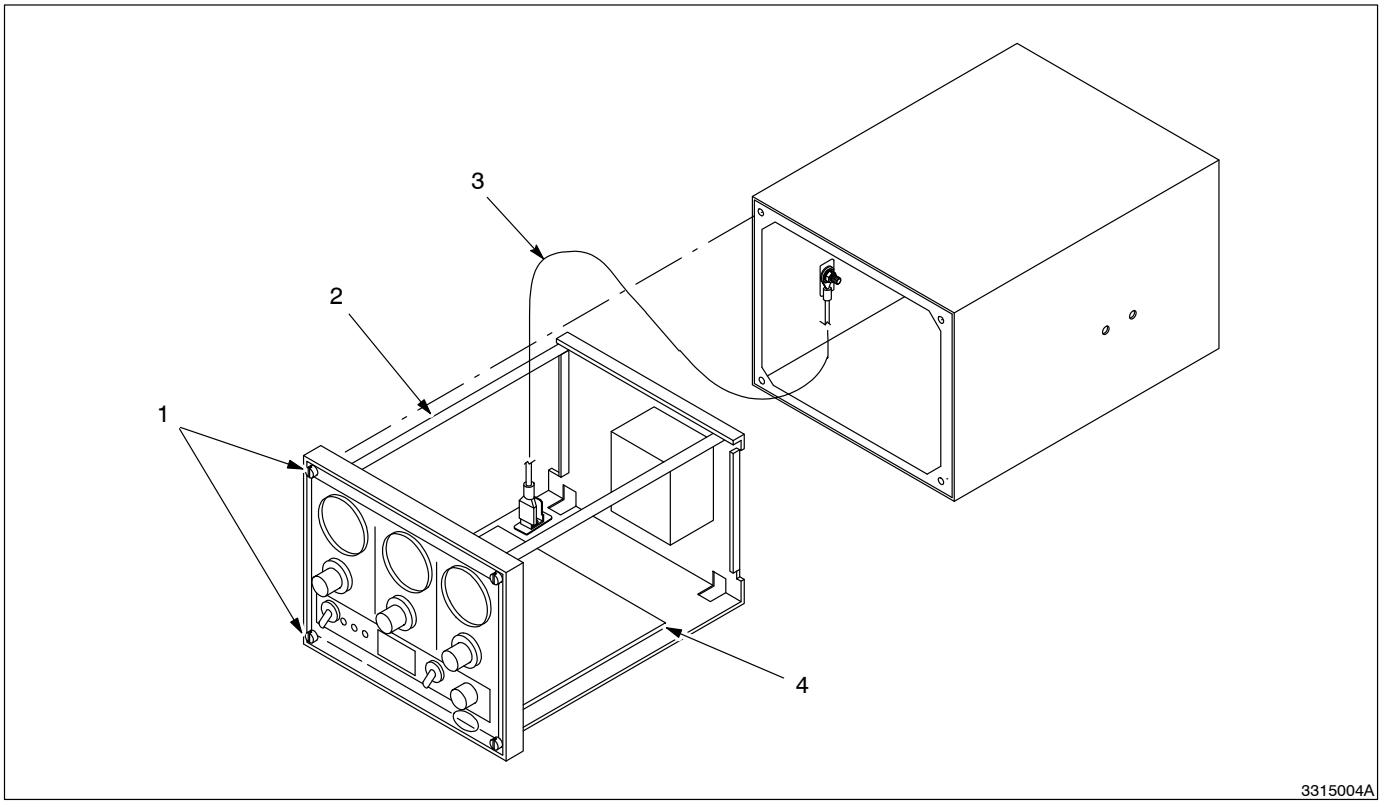


Fig. 3-1 Removing the control module

1. Captive screws
2. Control module
3. Ground wire
4. Circuit board

1. Circuit Board Configuration (contd.)

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

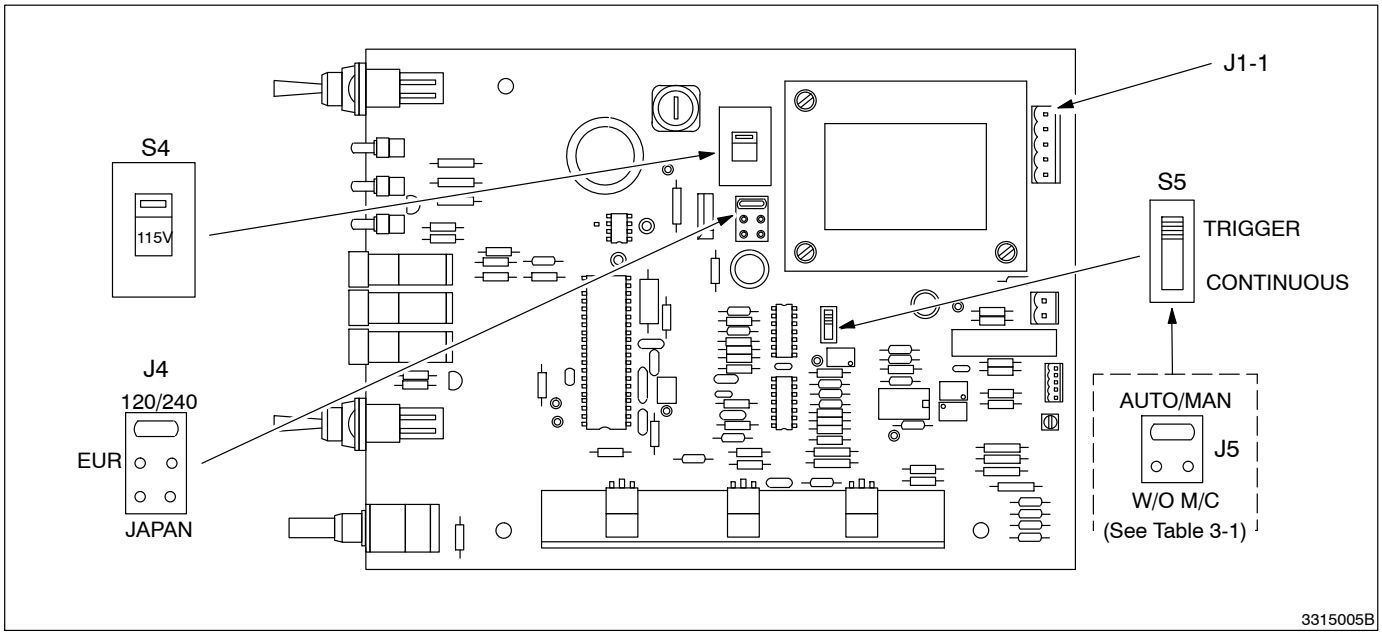


Fig. 3-2 Jumper block and switch settings

Table 3-1 Jumper block and switch settings

Jumper Block J4 – Install the jumper on the block to match the nominal input voltage.	
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 this switch to match the input voltage range (range showing is range selected).	
Top	Set to 115 for 100/115/120 VAC
Bottom	Set to 230 for 200/230/240 VAC
Switch S5 – Set this switch to the correct position for your system controls.	
TRIGGER	Use this setting with an external trigger (manual gun or automatic gun with master control unit)
CONTINUOUS	Use this setting to trigger the unit internally. (Power switch turns on air and high voltage, if kV potentiometer turned on.)
Jumper Block J5 – This jumper was used on revision A, B, and C circuit boards. Revision D removed this block and added switch S5. Install the jumper in the correct position for your system controls.	
AUTO/MAN	Use this setting with an external trigger (manual gun or automatic gun with master control)
W/O M/C	Use this setting to trigger the unit internally. (Power switch turns on air and high voltage, if kV potentiometer turned on. Use with automatic gun only.)

2. 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 ∅, 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. Control units are shipped with a three-wire power cable connected to circuit board connector J1 (Figure 3-2) and installed through a strain-relief connector. Connect power to the three stripped wires using the following chart:

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

Internally, the power cord is connected to a five-position plug that mates with receptacle J1 on the circuit board. The wires are connected to the plug so they connect to J1 as follows:

J1 Pin No.	Wire Color
1	Brown
2	Blue
3	Green/Yellow
4	Open
5	Open

2. Connect the ground strap furnished with the control unit to the ground stud located on the rear of the cabinet (Figure 3-3). Secure the clamp to an earth ground.

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.

3. Connect the IPS gun cable to the GUN OUTPUT receptacle on the control unit rear panel (Figure 3-3).

2. Electrical Connections
(contd.)

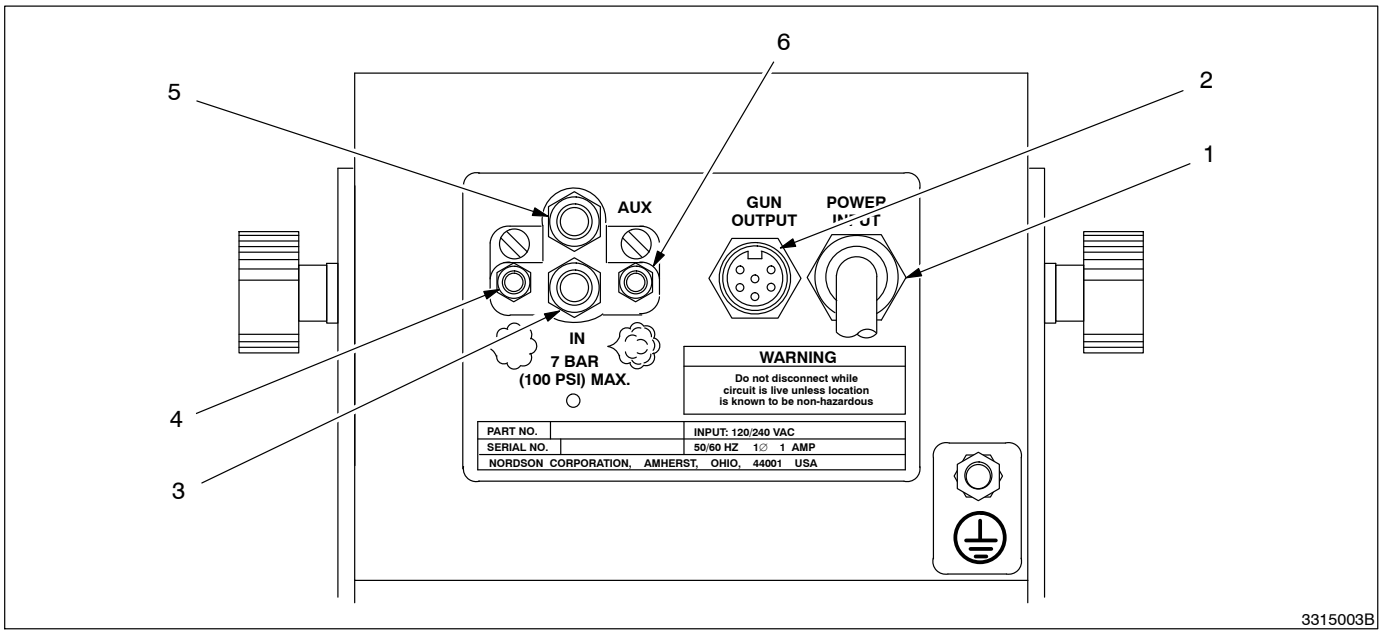


Fig. 3-3 Rear panel connections

1. *Input power cable*
2. *Gun output receptacle*
3. *Input air (10-mm tubing)*
4. *Atomizing air output (6-mm tubing)*
5. *Auxiliary air output (10-mm tubing)*
6. *Flow rate air output (6-mm tubing)*

3. Pneumatic Connections

Maximum input air pressure is 100 psi (7 bar). 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 38 °F (3.4 °C) or lower dewpoint at 100 psi (7 bar).

Input Air

Connect 10-mm tubing from the air supply to the fitting marked IN on the rear panel (Figure 3-3). Install a manually-operated, pressure-relieving shutoff valve in the supply line to the control unit.

Output Air

1. Connect 6-mm tubing to the atomizing and flow-rate air fittings on the rear panel (Figure 3-3). Route this tubing to the fittings marked *A* (atomizing air) and *F* (flow-rate air) on the powder pump.

2. If using auxiliary air for powder fluidizing, connect 10-mm tubing to the auxiliary air fitting on the rear panel (Figure 3-3). Route this tubing to the fitting on the hopper plenum.

Section 4

Operation

Section 4
Operation

WARNING: Allow only qualified personnel to perform the following tasks. Observe and 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.

1. Introduction

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.

2. Operation

Before activating the control unit, make sure the booth exhaust fans are on, the powder recovery system is operating, and the powder in the feed hopper is thoroughly fluidized. 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.

Startup

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

   If you set switch S5 to continuous and are using an automatic gun, the powder LED will light. Atomizing and flow-rate air will begin to flow to the powder pump. If the kV potentiometer has been turned on the voltage multiplier will be energized.

2. Turn on fluidizing (auxiliary) air, and set the pressure as recommended in the manual for your feed hopper. Typical pressures are 15–40 psi (1.0–2.8 bar). 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.

Atomizing air	30 psi (2.1 bar)
Flow-rate air	20 psi (1.4 bar)

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 potentiometer switch on and adjust it to the output required. The display shows kV output or percent of output (PRX systems). It will show μA output when the kV/μA switch is pressed upward.

NOTE: When a gun is first put into service, record the μA output. Monitor the output daily. A significant increase in μA output indicates a probable short in the gun resistor. A significant decrease indicates a failing resistor or voltage multiplier.

6. Coat a part and adjust the kV output to achieve desired results. The output can be adjusted as follows:

30 to 100 kV	Versa-Spray IPS automatic guns
30 to 100 %	Versa-Spray PRX guns
25 to 80 kV	Versa-Spray IPS manual guns

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

Adjustments

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

Lowering the voltage is a common method for trying to improve coverage of deep recess 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. If the gun is close to the part and the voltage is set at maximum the quality of the finish could be affected. Also, high voltage may cause the the powder first deposited on the part to repel additional powder.

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 relatively 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 the fluidizing pressure is set too low, you may get a heavy, inconsistent powder flow. If the fluidizing pressure is 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. 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. With some pumps, increasing the atomizing air pressure will decrease the powder flow rate, requiring minor adjustments in the flow-rate air pressure setting to maintain the same flow rate.

Adjustments *(contd.)*

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

Turn the control unit power switch off. This will shut off the power supply to the gun and stop air flow to the pump.

3. Preventive Maintenance

Perform the following procedures daily.

- Watch the control unit gauges and digital display while spraying powder. Compare the gun's μA output with the output recorded at initial startup. Significant differences may mean that the gun resistor or multiplier is failing.
- Check all ground connections. Ungrounded parts will not attract charged powder. Ungrounded equipment and parts may accumulate a charge which could arc and cause a fire or explosion. A poor ground will decrease the amount of powder attracted to the part and increase waste.
- 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

Section 5
Troubleshooting

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

1. Introduction

This section contains troubleshooting procedures for the Versa-Spray IPS control unit. These troubleshooting 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 when troubleshooting problems involving circuit boards.

2. Troubleshooting Charts

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

Problem	Possible Reason	Corrective Action	Refer to
1. All LED's off, no display	No input power	Check for appropriate input power on J1-1 and J1-2.	Figure 5-2 or page 3-3
	Power switch (S1) off or open	Check S1 for proper operation.	Figure 5-1
	Blown F1 fuse	Correct overload or short and replace fuse F1. If F1 continues to blow, replace circuit board.	Figure 5-1
	S4 not set properly	Check S4 for completed switch travel.	Page 3-2
	J4 loose or missing	Check J4 for proper location.	
2. No power or powder LED's	Solenoid output shorted, no powder LED	Check solenoid coil and wiring.	Figure 5-2
	Regulator U3 failed, no power or powder LED	Replace board.	Figure 5-1 or page 6-6
3. kV LED off, display on	Faulty LED D16	Replace board.	Page 6-6
	Q3 defective	Replace board.	
4. Display off, kV LED on	Q4 faulty	Replace board.	Page 6-6
	U6 defective	Replace board.	
5. No air output, powder LED on	No air to control unit	Check supply air pressure.	
	Obstruction in valve manifold, or cartridge valve sticking	Remove pilot manifold and solenoid valve from manifold. Check cartridge valve travel by depressing and releasing. Check manifold passages for blockages.	Page 6-3
	Bad solenoid connection	Check for loose connections or broken wire.	Figure 5-2
	Solenoid coil open	Replace solenoid valve.	Page 6-3

Problem	Possible Reason	Corrective Action	Refer to
6. No air output, powder LED off, all other LED's on	Diode D6 shorted	Replace board.	Page 6-6
	Q1 failed. TP-8 to ground is greater than 1 volt	Replace board.	
7. No kV out, kV LED off, powder LED off, display off when control unit triggered	No trigger signal	Disconnect gun cable from control unit, depress trigger, and check for continuity across plug pins 1 and 2. Replace cable if no continuity.	Figure 5-2 or gun manual
	U1, Q2, or U2 defective	Replace U1. If problem not solved, replace U2. If problem is still not solved, replace board.	Figure. 5-1 or pages 6-6, 7-6
8. No kV out, kV LED off, display off, power and powder LED's on when control unit triggered	kV potentiometer (S2) off or defective	Turn on kV and set to desired level. Replace board if kV potentiometer is defective.	Page 2-2
	S2, U1, or R10 defective	Replace U1. If problem not solved, replace board.	FIgure 5-1 or pages 6-6, 7-6
9. Low kV output	kV potentiometer (S2) not adjusted properly	Adjust potentiometer to increase output.	Page 2-2
	Low input voltage. TP-1 less than 24 VDC	Check S4 and J4 for proper configuration.	Page 3-2
	Regulator U1 failed	Check TP-2 for 21 VDC. If not present, replace U1 regulator.	Figure 5-1, or page 7-6
	Gun resistor or multiplier failed	Check gun resistor and multiplier with megohm meter.	Gun manual
10. Gun will not operate when triggered, kV LED off, powder LED off, display off	Connections at J3 connector or gun cable receptacle bad	Check connections at receptacle and connector J3.	Figures 5-1, 5-2
	Fuse F2 blown	Check fuse F2; replace if blown.	Figure 5-1
	Gun cable damaged, circuit open	Check cable continuity.	Gun manual
	Trigger switch failed	Disconnect gun cable from control unit. Check for continuity across pins 1 and 2 with trigger depressed. Make sure actuator is properly installed on trigger switch. Replace cable if actuator is correctly installed, but unable to obtain continuity.	Gun manual

2. Troubleshooting Charts
(contd.)

Problem	Possible Reason	Corrective Action	Refer to
11. Display reads 0 μA output, gun spraying normally	Gun cable feedback circuit open, or loose or dirty cable connection	Check connections at J3, receptacle, and gun. Check gun cable continuity and replace if necessary.	Figures 5-1, 5-2, or gun manual
	Feedback resistor open	Replace multiplier. Refer to gun manual for procedures.	Gun manual
	kV/μA switch (S3) failed	Replace board.	Page 6-6
12. Display reads 0 μA output, loss of wrap/transfer efficiency	Loose or dirty gun cable connections, or cable damaged	Check connections at J3, receptacle, and gun. Check gun cable continuity and replace if necessary.	Figures 5-1, 5-2, or gun manual
	Multiplier failure	Replace multiplier.	Gun manual
13. Loss of wrap, poor transfer efficiency	Poorly grounded part	Measure resistance between part and ground with a standard ohm meter. Resistance should not be greater than one megohm. For best results, the resistance should be 500 ohms or less. Clean conveyor and hangers if necessary.	—
	Gun resistor or multiplier failed	Check gun resistor and multiplier with megohm meter.	Gun manual
	Moisture in air causing kV to leak to ground	Check air dryer and filters.	OEM manuals
	Dirt or powder contamination of high-voltage connections in gun causing arcing	Check connection between multiplier and resistor. Clean or replace components as needed. Make sure dielectric grease is properly applied as specified.	Gun manual

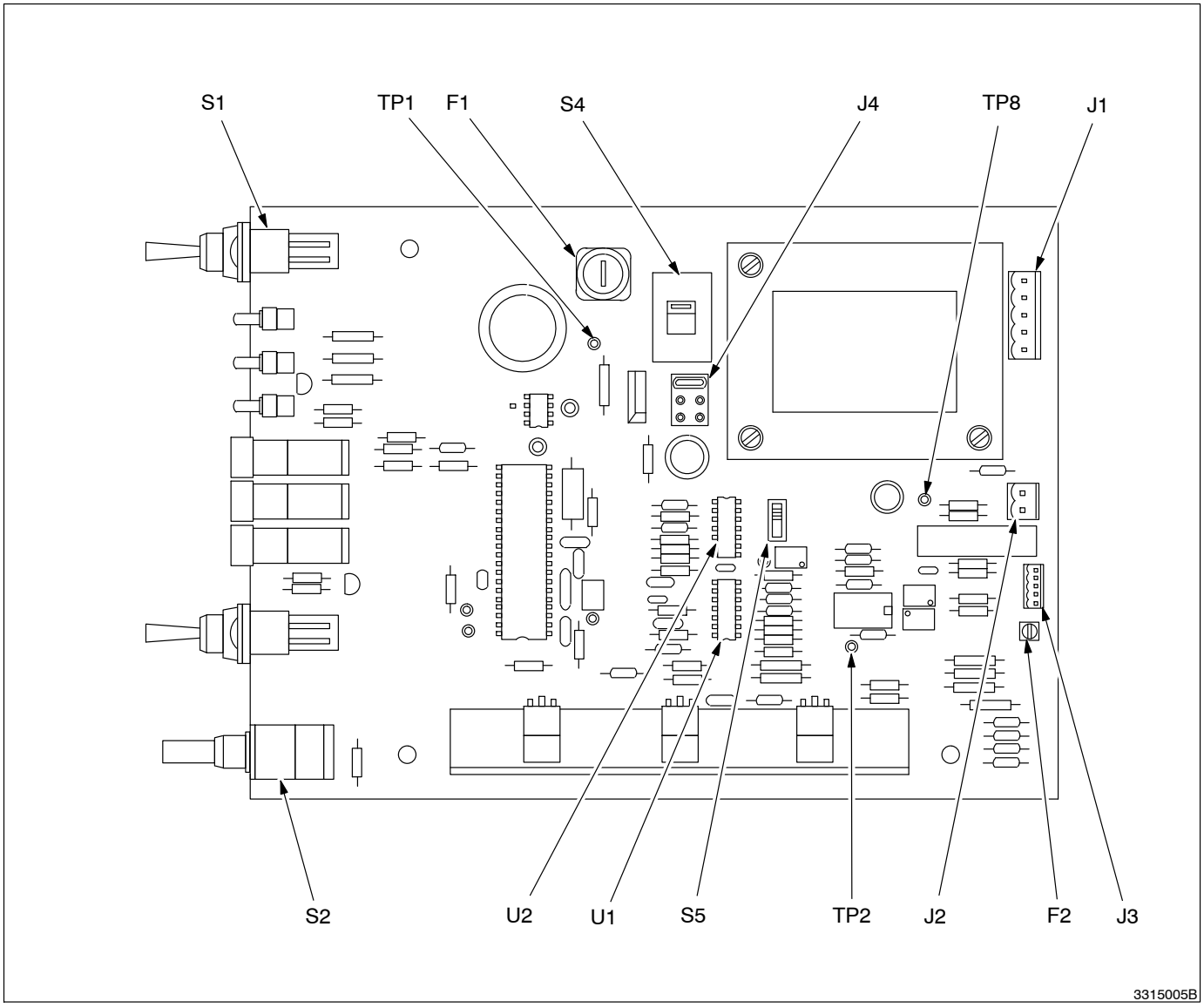
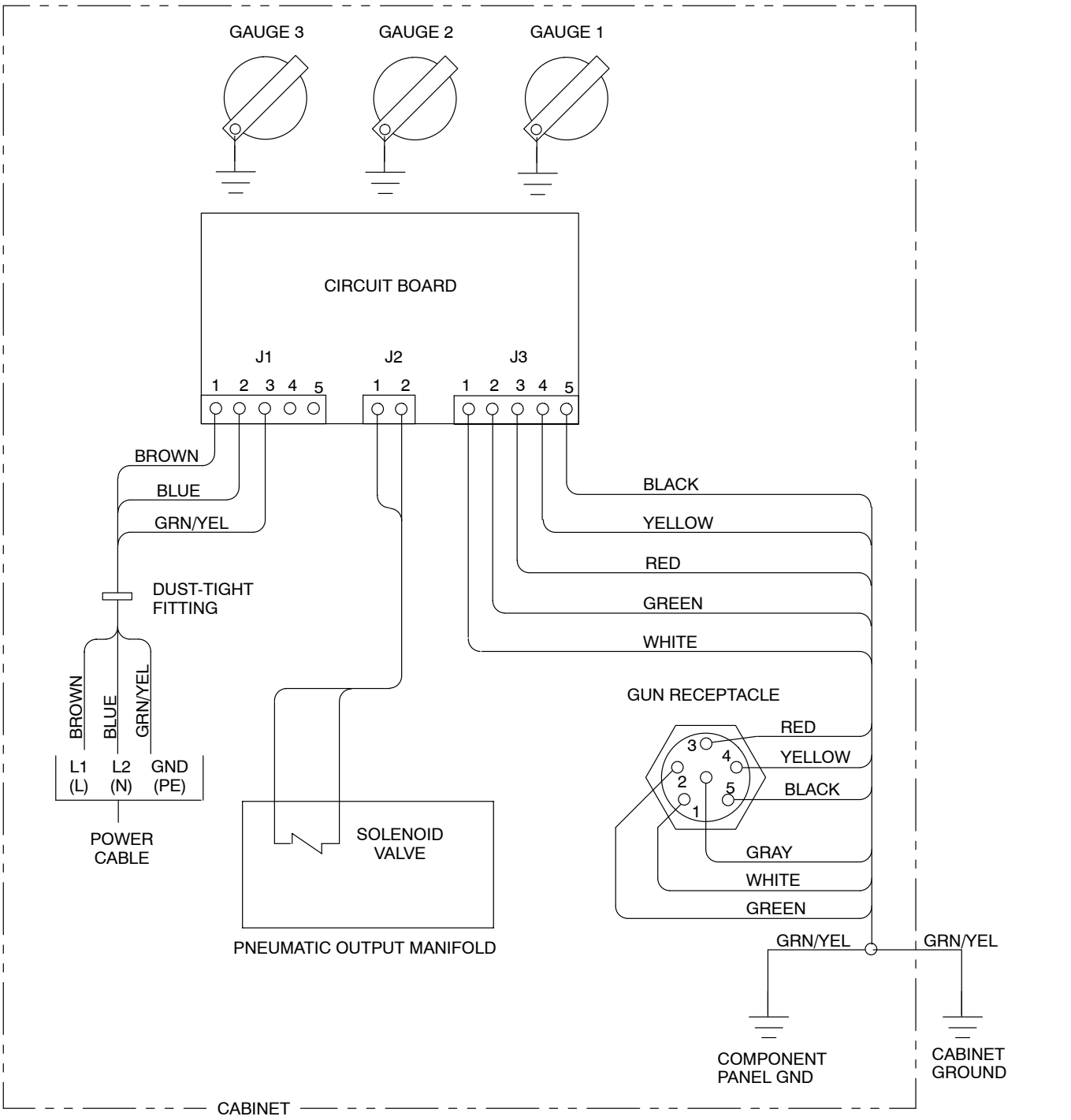


Fig. 5-1 Circuit board test points, jumpers, switches, fuses, and connectors

Wiring Diagram



3315007A

Fig. 5-2 Wiring diagram

Section 6

Repair

Section 6
Repair

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

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

1. Control Module Removal

The control module must be removed from the cabinet to replace or repair internal components.

1. Unplug the power cable from the receptacle. Disconnect the gun cable and all air tubing from the rear of the cabinet.
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 and disconnect the ground wire (2) from the module.

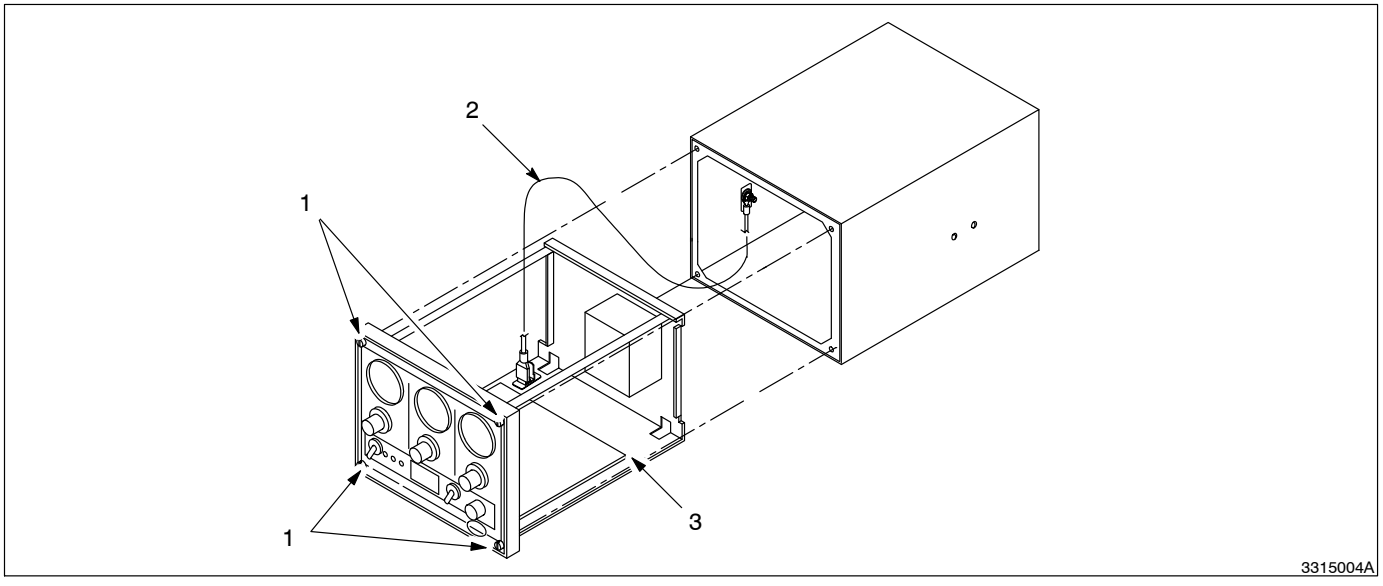


Fig. 6-1 Removing the control module from the cabinet

1. Captive screws *2. Ground wire* *3. Circuit board*

2. 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 (4). Remove the coupling (3) and tee from the gauge.
2. Remove the nut (2) securing the bracket (1) to the air gauge (9). Remove the air gauge and gasket (10) from the front panel.
3. Remove the nut and bracket from the new air gauge. Make sure the gasket (10) is in place around the gauge bezel. Install the gauge in the panel and secure it with the bracket (1) and nut (2).
4. Wrap the gauge threads with PTFE tape and install the coupling (3) on the gauge.
5. Wrap the tee (4) threads with PTFE tape and install the tee into the coupling. Reconnect the tubing to the tee.

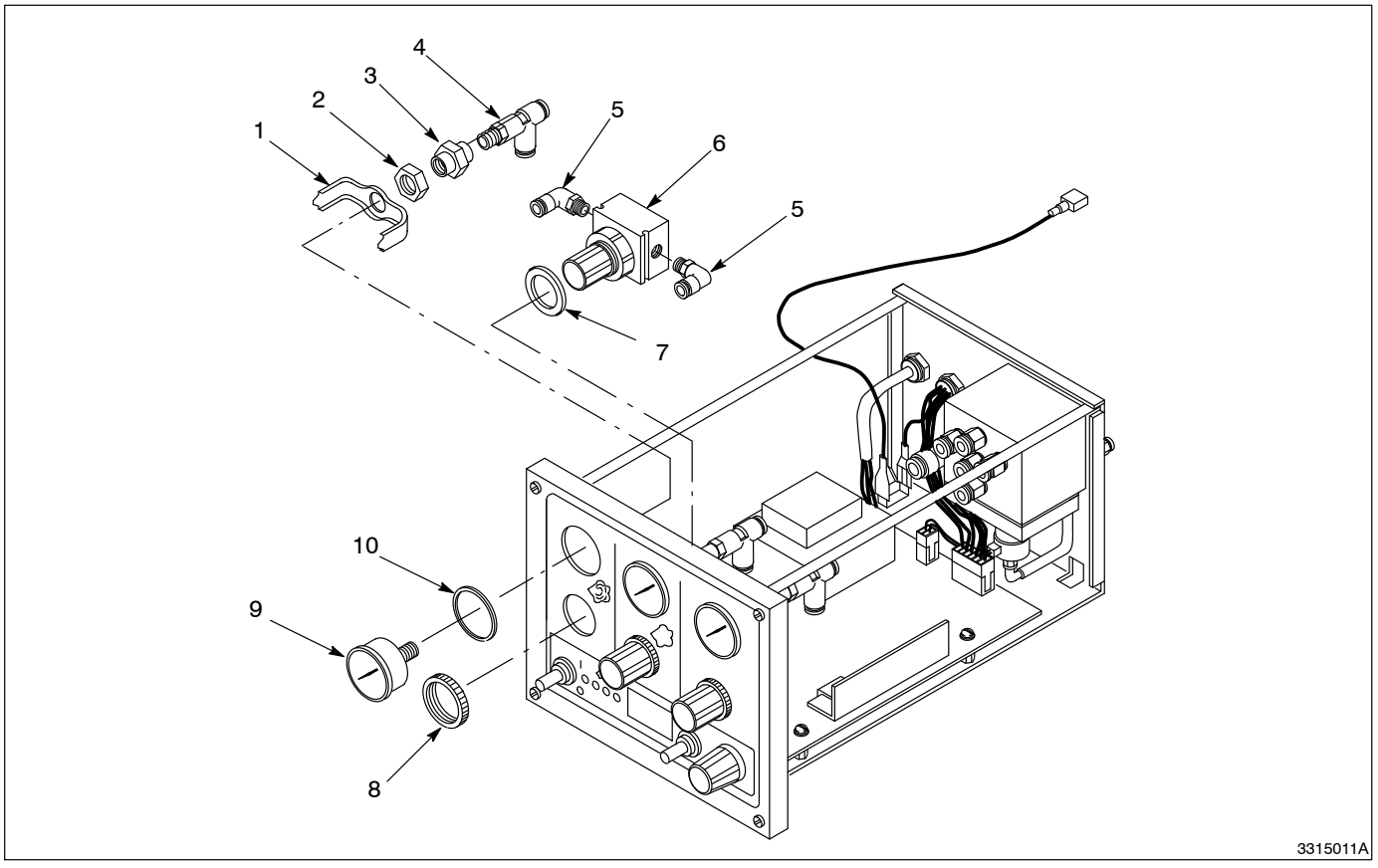


Fig. 6-2 Replacing gauges and regulators

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

Regulator Replacement

1. See Figure 6-2. Disconnect the air tubing from the elbow fittings (5).
2. Remove the knurled locking ring (8) securing the regulator to the panel.
3. Remove the regulator (6) and seal (7) from the panel. Remove the elbow fittings from the regulator.
4. To install a new regulator, follow the removal procedure in reverse. Wrap the elbow fitting threads with PTFE tape before installing them in the new regulator. Make sure the seal (7) is in place before installing the new regulator in the front panel.

3. Valve Manifold Rebuild

To replace the solenoid valve or valve cartridges, remove the manifold from the rear panel first.

Removing the Manifold from the Rear Panel

1. See Figure 6-3. Disconnect the air tubing from the fittings (3).
2. Disconnect the solenoid plug connector (4) from the J2 connector on the circuit board.
3. Disconnect the exhaust tubing (5) from the panel elbow or from the top of the solenoid.
4. Remove the screws and lockwashers (6) securing the manifold to the rear panel. Remove the manifold (2) and panel gasket (1).

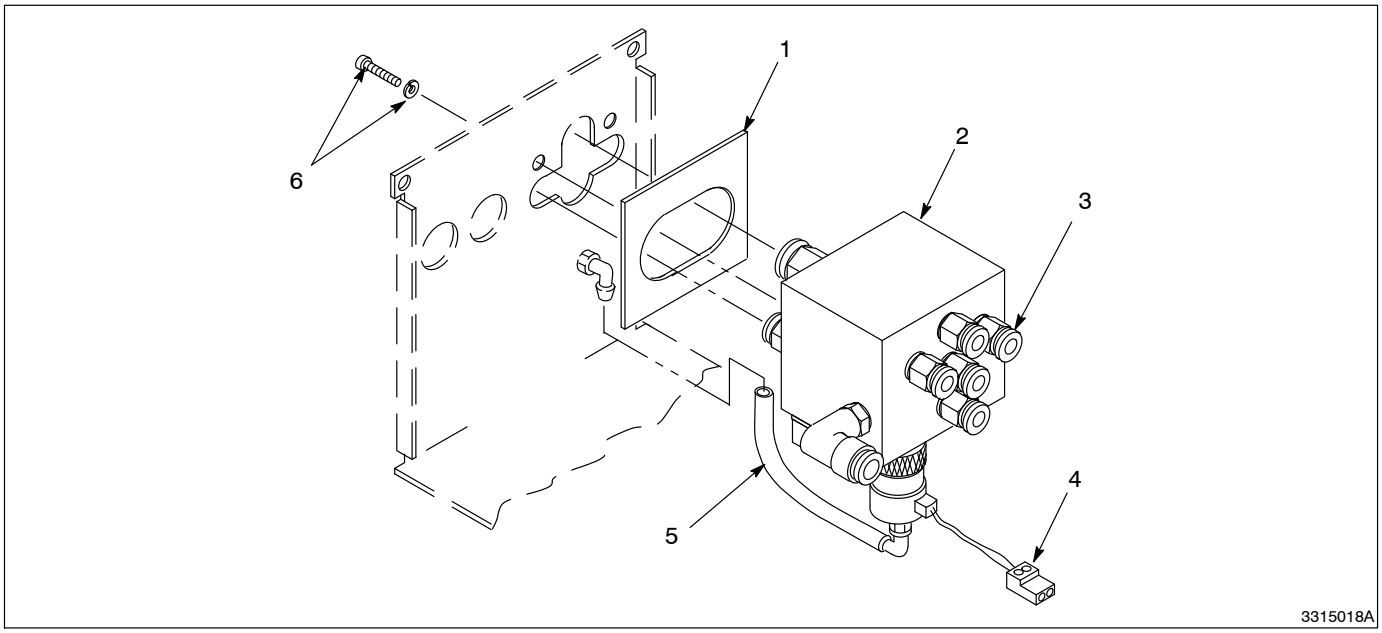


Fig. 6-3 Removing the manifold from the rear panel

1. Panel gasket
2. Manifold
3. Manifold fittings
4. Solenoid plug connector
5. Exhaust tubing
6. Screws and lockwashers

Solenoid Valve Replacement

1. See Figure 6-4. Place a small diameter metal rod or awl in one of the holes in the base of the solenoid valve (7). Use the rod to unscrew the valve from the pilot manifold (5).

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 6-4. Make sure the diaphragm is installed with the seal side facing the valve.

2. Remove the plug connector (8) from the old solenoid valve leads and install it on the new solenoid valve leads.

3. Wrap the solenoid threads with PTFE tape and screw the solenoid into the threaded port in the pilot manifold. Tighten the solenoid securely with the rod used in step 1.

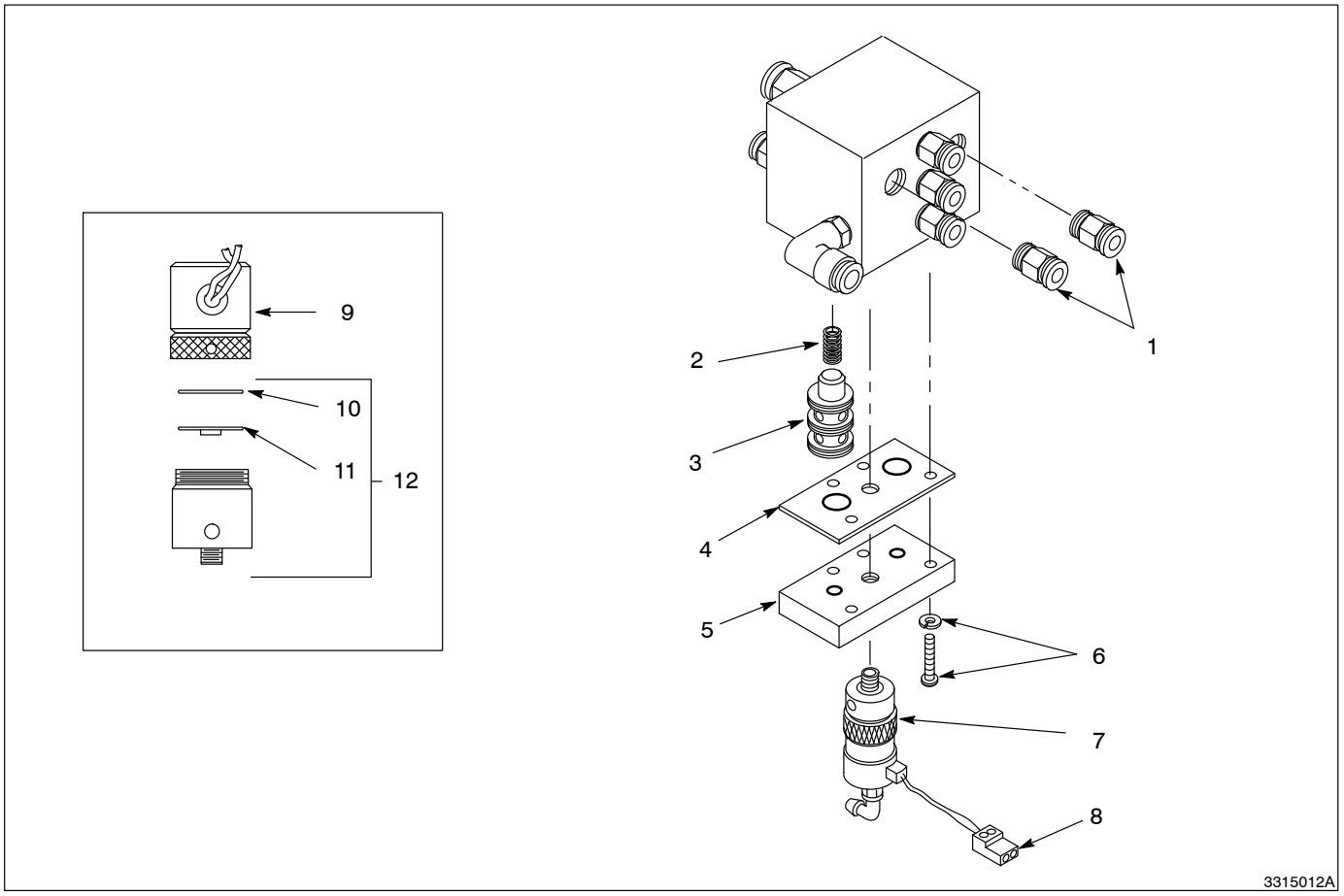


Fig. 6-4 Replacing solenoid valve and valve cartridges

1. Fittings
2. Spring
3. Valve cartridge
4. Gasket
5. Pilot manifold
6. Screws and lockwashers
7. Solenoid valve
8. Plug connector

Three-Way Valve Cartridge Replacement

1. See Figure 6-4. Remove the screws and lockwashers (6) from the pilot manifold (5).

2. Remove the pilot manifold (5) and gasket (4) from the manifold body. Remove the two straight 6-mm tube fittings (1) from the manifold block ports 1 and 4.

3. Insert a brass rod or wood dowel into the open ports and push the valve cartridges (3) out of the manifold. Remove the cartridge springs (2). New springs are included with new cartridges.

4. Install springs in the new valve cartridges and insert the cartridges into the manifold body. Make sure the valve springs are properly seated between the cartridges and the bottom of the manifold bores.

5. Wrap the threads of the tube fittings you removed in step 2 with PTFE tape and install the fittings into the ports.

6. Install the gasket, pilot manifold, and solenoid valve on the manifold.

7. Reinstall the manifold on the rear panel.

4. Circuit Board Replacement

1. Remove the control module from the cabinet as described in *Removing Control Module*.
2. Remove the manifold from the rear panel, as described in *Removing the Manifold from the Rear Panel*.
3. Disconnect connectors J1, J2, and J3 from the circuit board. See Figure 5-1 for connector locations, if necessary.
4. See Figure 6-5. Remove the dust-cover nuts (1) securing the power and kV/μA toggle switches (2) to the front panel.
5. Remove the cap (4) and knob (5) from the kV potentiometer (7).
6. Remove the nut (6) securing the kV potentiometer to the panel.

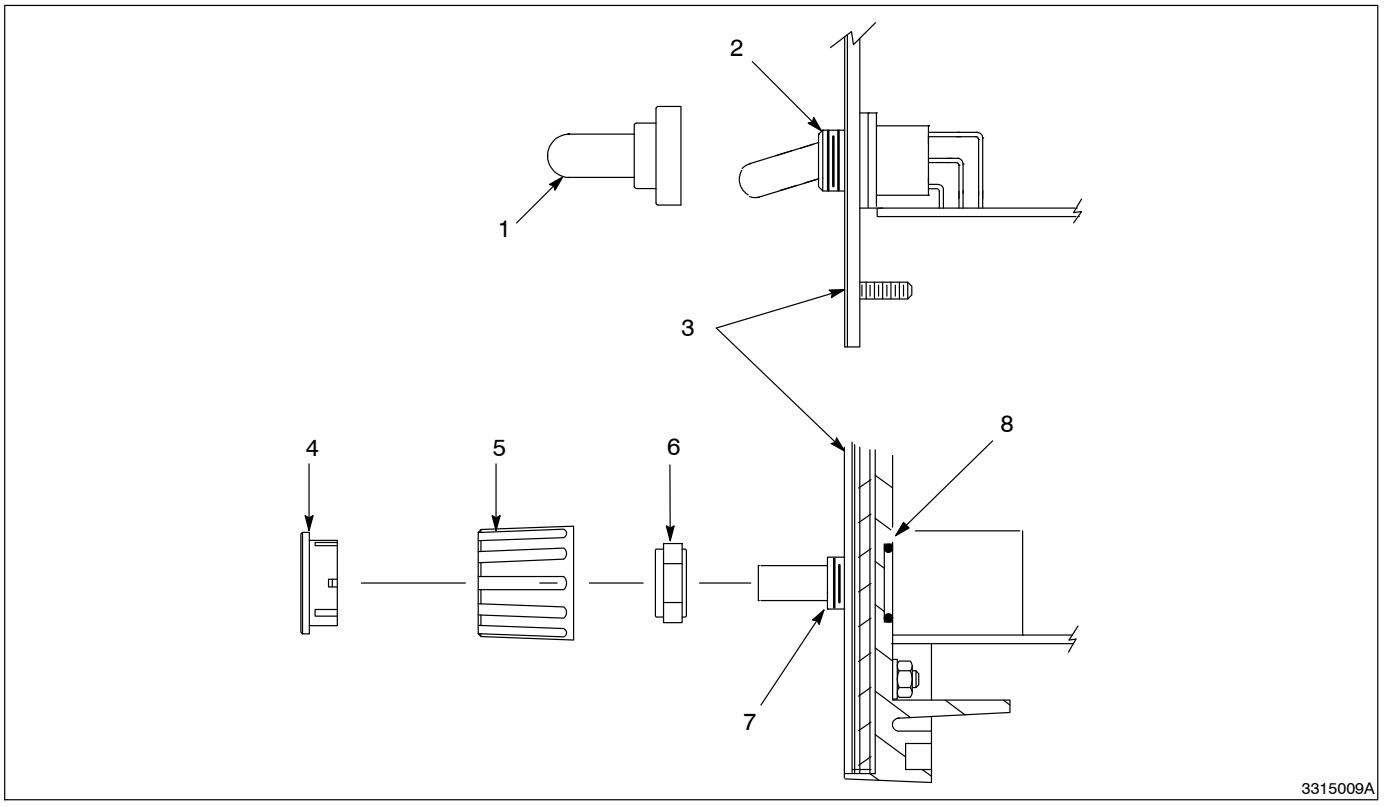


Fig. 6-5 Removing switch dust covers and knobs prior to removing circuit board

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

4. Circuit Board Replacement (contd.)

7. See Figure 6-6. Remove the screws (1, 2) securing the circuit board to the control module, and remove the board from the module.

8. To install a new circuit board in the module, follow the removal procedures in reverse. Make sure the O-ring (8) shown in Figure 6-5 and the switch gaskets (included with the new board) are in place before reinstalling the board in the module.

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

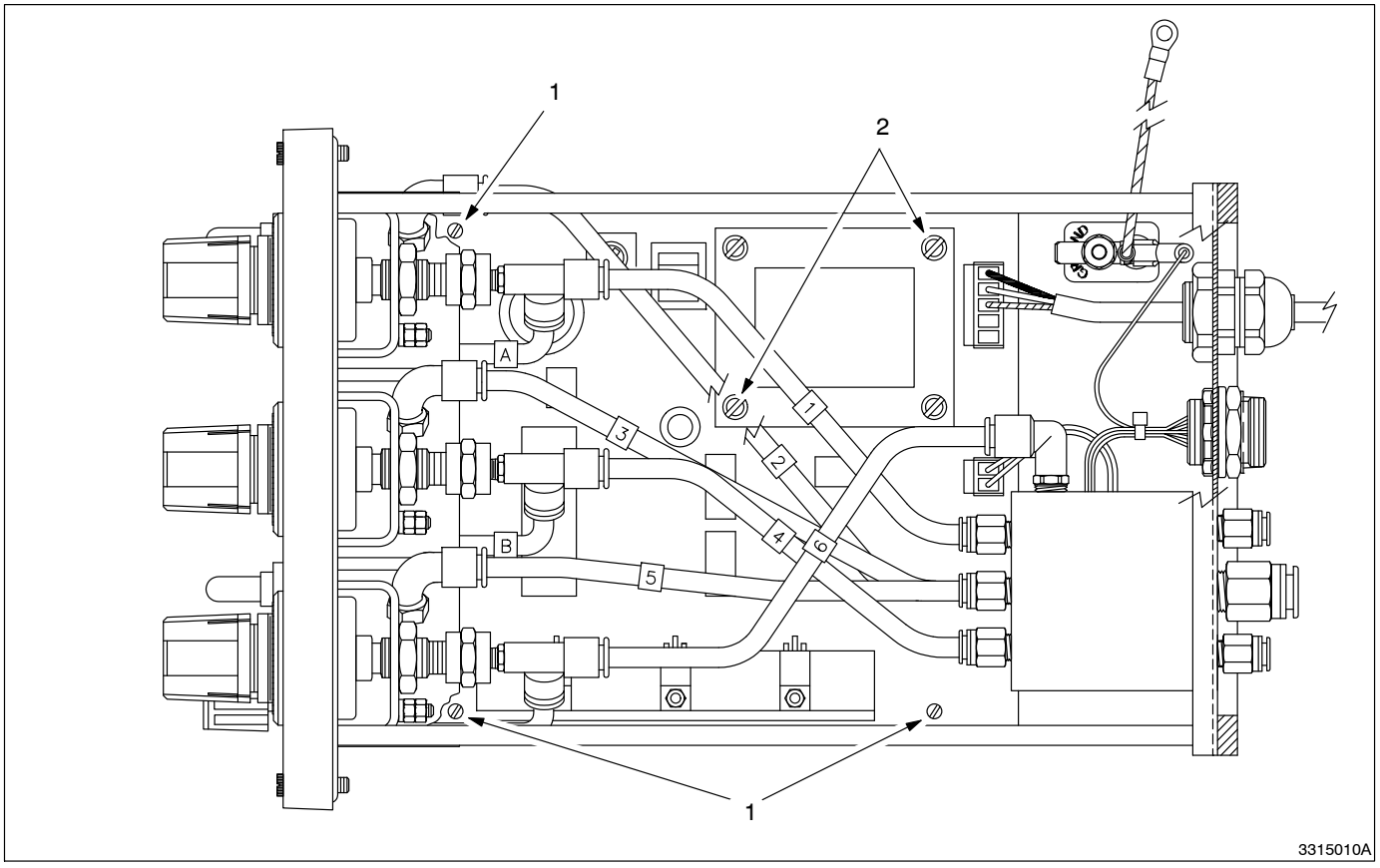


Fig. 6-6 Removing screws securing circuit board to module

1. Short screws
2. Long screws

5. 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 in place. Slide the control module into the cabinet.
3. Tighten the captive screws (1) securing the control module to the cabinet.
4. Connect the gun cable to the GUN OUTPUT 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 *section 3, Installation*.

Section 7

Parts

Section 7
Parts

1. Introduction

To order parts, call the Nordson Customer Service Center at 800-241-8777 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 six-digit 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.

Item	Part	Description	Quantity	Note
—	000 000	Assembly	1	
1	000 000	• Subassembly	2	A
2	000 000	• • Part	1	

- 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.

2. Control Unit Assembly Parts List

See Figure 7-1.

Item	Part	Description	Quantity	Note
—	159 688	Power unit, Versa Spray, IPS, 3-gauge	1	
1	140 165	• Gasket, filler, panel, front	1	
2	240 674	• Tag, ground	2	
3	984 702	• Nut, hex, M5, brass	2	
4	983 401	• Washer, lock, split, M5	2	
5	983 021	• Washer, flat, E, .203 x .406 x .040 in., brass	2	
6	156 637	• Module, electronic control, Versa-Spray	1	A
7	129 595	• Bracket, cabinet	1	
8	129 590	• Spacer, cabinet, friction	2	
9	983 410	• Washer, flat, M6	2	
10	129 592	• Knob, clamping, M6 x 12 mm	2	
NS	971 177	• Connector, male, $^3/_8$-in. O.D. x $^1/_4$-in. NPT	1	
NS	240 976	• Clamp, ground w/wire	1	

NOTE A: For parts breakdown, see page 7-4.
NS: Not Shown

Control Unit Assembly Parts Illustration

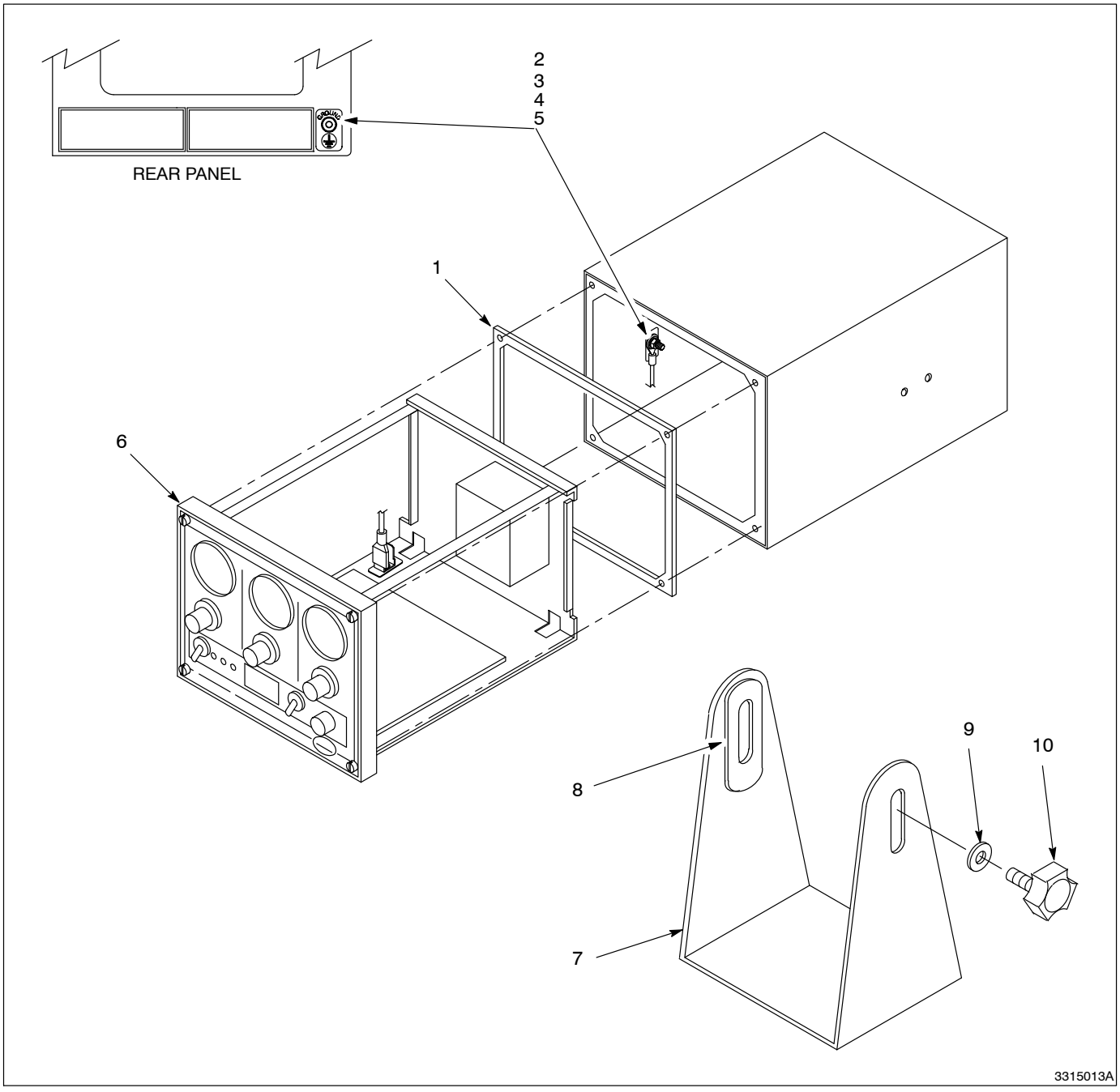


Fig. 7-1 Control unit assembly

3. Control Module Parts List

See Figure 7-2.

Item	Part	Description	Quantity	Note
—	159 637	Module, electronic control	1	
1	981 387	• Screw, captive, M5 x 21 mm	4	
2	983 038	• Washer, nylon, .203 x .309 x .040 in.	4	
3	631 138	• Gasket, gauge, 40-mm dia., EPDM	3	
4	159 647	• Panel, bezel, 3-gauge	1	
5	129 596	• • Gasket, panel, bezel	1	
6	901 260	• Gauge, air, $^1/_4$-in. NPT, 0–100 psi	3	
7	940 073	• O-ring, Viton, .156 x .281 x .063 in.	4	
8	973 572	• Coupling, pipe, hydraulic, SAE, $^1/_8$-in. NPT	3	
9	973 583	• Gasket, bezel	1	
10	972 840	• Tee, male run, M6 x $^1/_8$-in. RPT	3	
11	900 742	• Tubing, polyurethane, 6/4 mm, blue	AR	A
12	141 603	• Seal, panel, regulator	3	
13	972 142	• Elbow, male, M6 tube x $^1/_4$-in. RPT	6	
14	901 444	• Regulator, air, $^1/_4$-in. NPT, 5–125 psi	3	
15	940 121	• O-ring, Viton, .375 x .500 x .063 in.	1	
16	248 741	• Seal, shaft, rotary	1	
17	129 593	• Knob, collet, 21 mm, $^1/_4$-in. shaft	1	
18	129 585	• Cap, flat, 21 mm, w/curved arrow	1	
19	170 695	• Boot, switch, waterproof	2	

NOTE A: Bulk part number. Order in one foot increments.
B: For parts breakdown see following pages.
AR: As Required

Continued

Control Module Parts Illustration

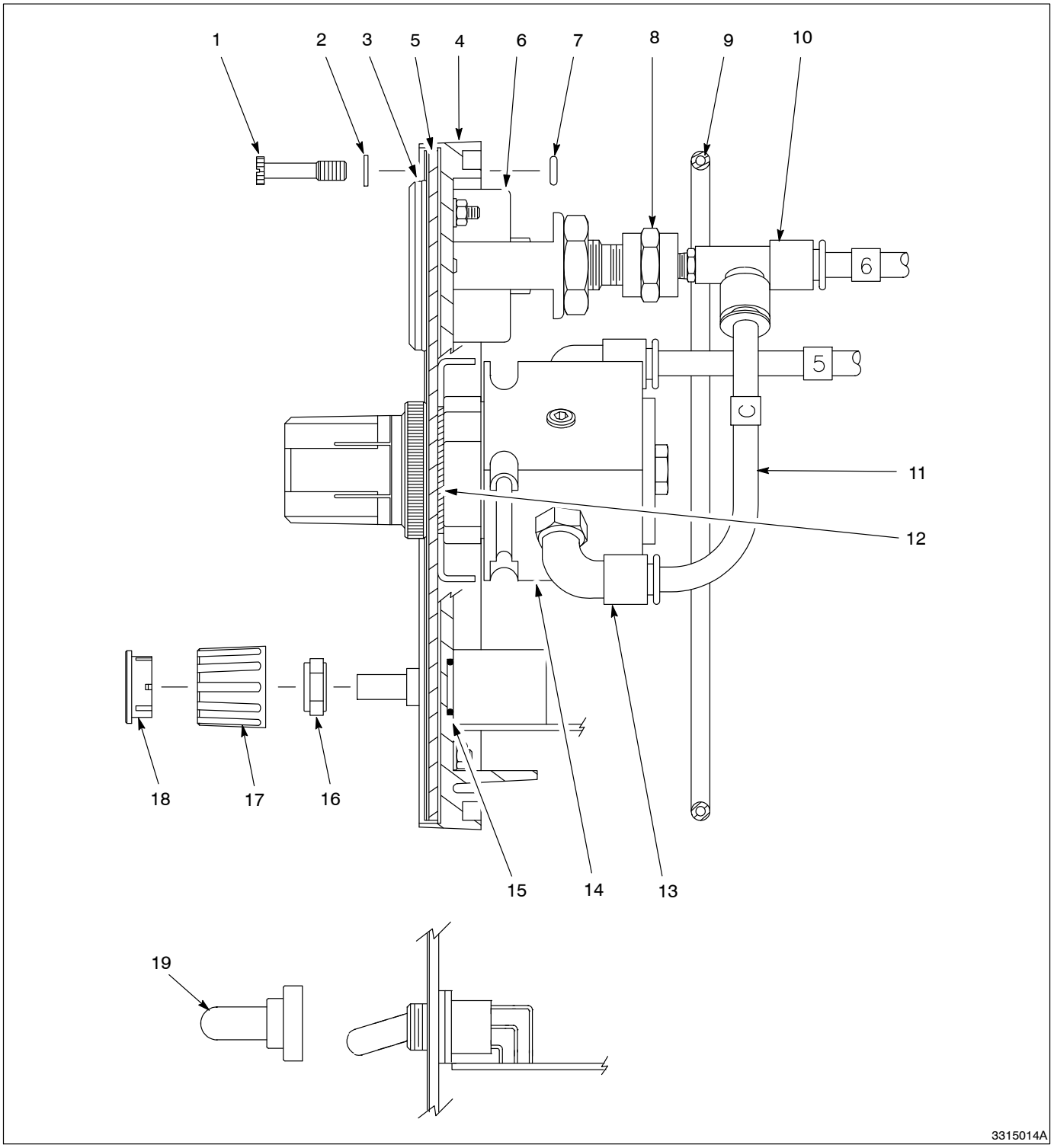


Fig. 7-2 Control module parts illustration

3. Control Module Parts List *(contd.)*

See Figure 7-3.

Item	Part	Description	Quantity	Note
20	159 639	• Manifold, pneumatic output, 3	1	B
21	129 591	• Rod, support	2	
22	982 139	• Screw, flat head, M4 x 8	5	
23	129 600	• Gasket, rear panel	1	
24	983 401	• Washer, lock, split, M5	3	
25	982 239	• Screw, fillet head, M5 x 10	2	
26	129 933	• Elbow, male, #10-32 x $^1/_8$-I.D.	1	
27	900 572	• Tubing, silicone, .093 in.-I.D. x .062-in. thick	AR	A
28	130 739	• Circuit board, Versa Spray	1	
NS	939 098	• • Fuse, 1 amp, 250V, fast acting	1	
NS	939 991	• • Fuse, 50 mA, 250V, fast-acting	1	
29	171 017	• • Service Kit, IC, Versa-Spray (U1, U2)	1	
30	982 096	• Screw, pan head, M4 x 8	3	
31	983 416	• Washer, lock, M4	3	

NOTE A: Bulk part number. Order in one foot increments.
B: For parts breakdown see following pages.
AR: As Required
NS: Not Shown

Continued

Control Module Parts Illustration

(contd.)

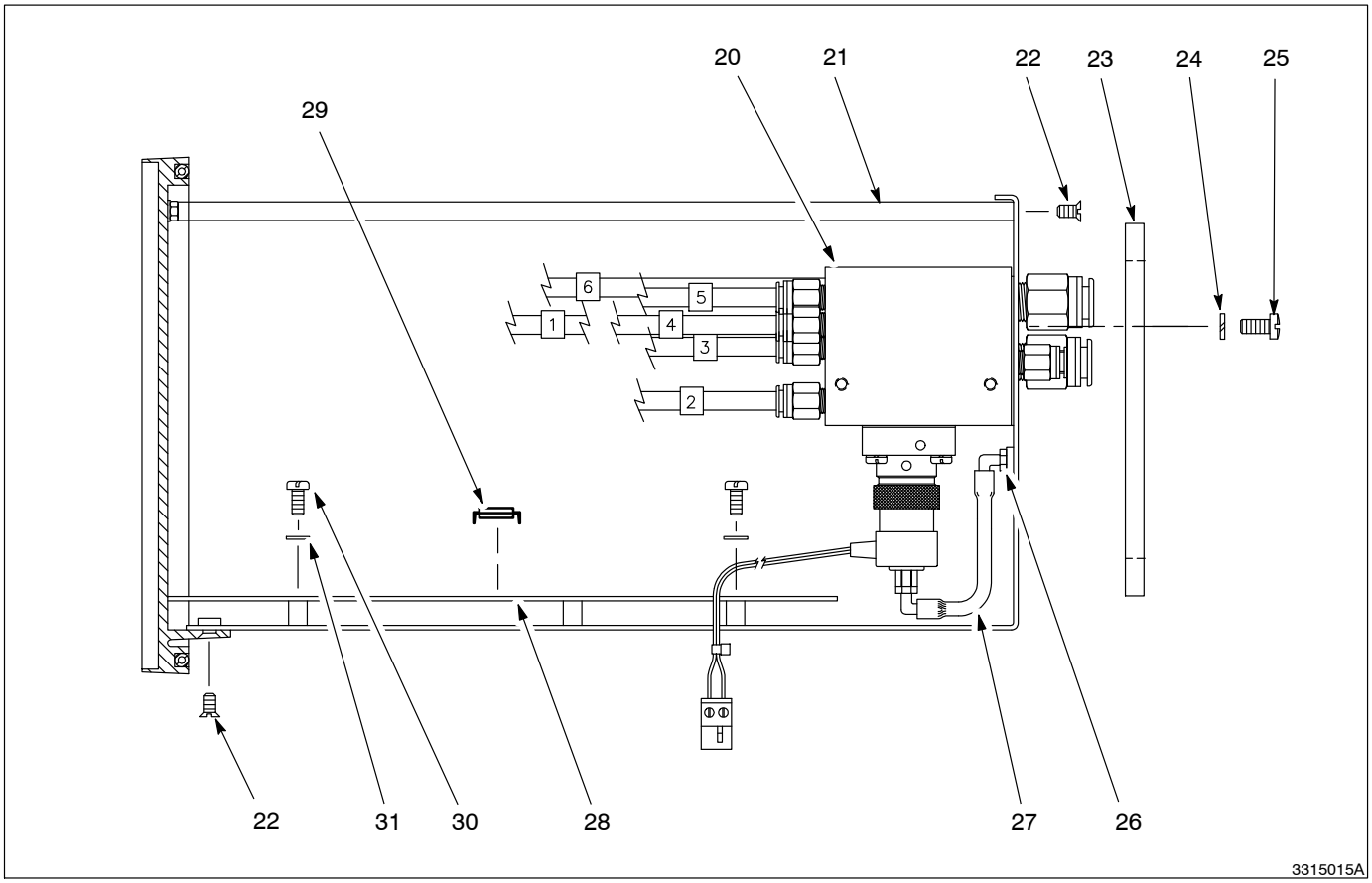


Fig. 7-3 Control module parts illustration

3. Control Module Parts List (contd.)

See Figure 7-4.

Item	Part	Description	Quantity	Note
32	144 356	• Fitting, straight, $^1/_2$-in. NPT	1	
33	984 192	• Nut, lock, $^1/_2$-in. NPT, nylon	1	
34	144 662	• Cable, power, Versa-Spray, manual	1	
35	933 343	• Connector, plug, 5-pin	1	
36	933 162	• Terminal, push-on, .250 in.	1	
37	130 630	• Jumper, ground, cabinet	1	
38	240 674	• Tag, ground	1	
39	271 221	• Lug, terminal, ground	1	
40	933 469	• Lug, terminal, 90°, tab	1	
41	983 021	• Washer, flat, external, .203 x .406 in.	1	
42	984 702	• Nut, hex, M5, brass	1	
43	130 627	• Receptacle, input, 6-wire, female	1	
44	939 122	• Seal, conduit fitting, $^1/_2$ in.	1	
45	984 526	• Nut, lock, conduit	2	

Control Module Parts Illustration

(contd.)

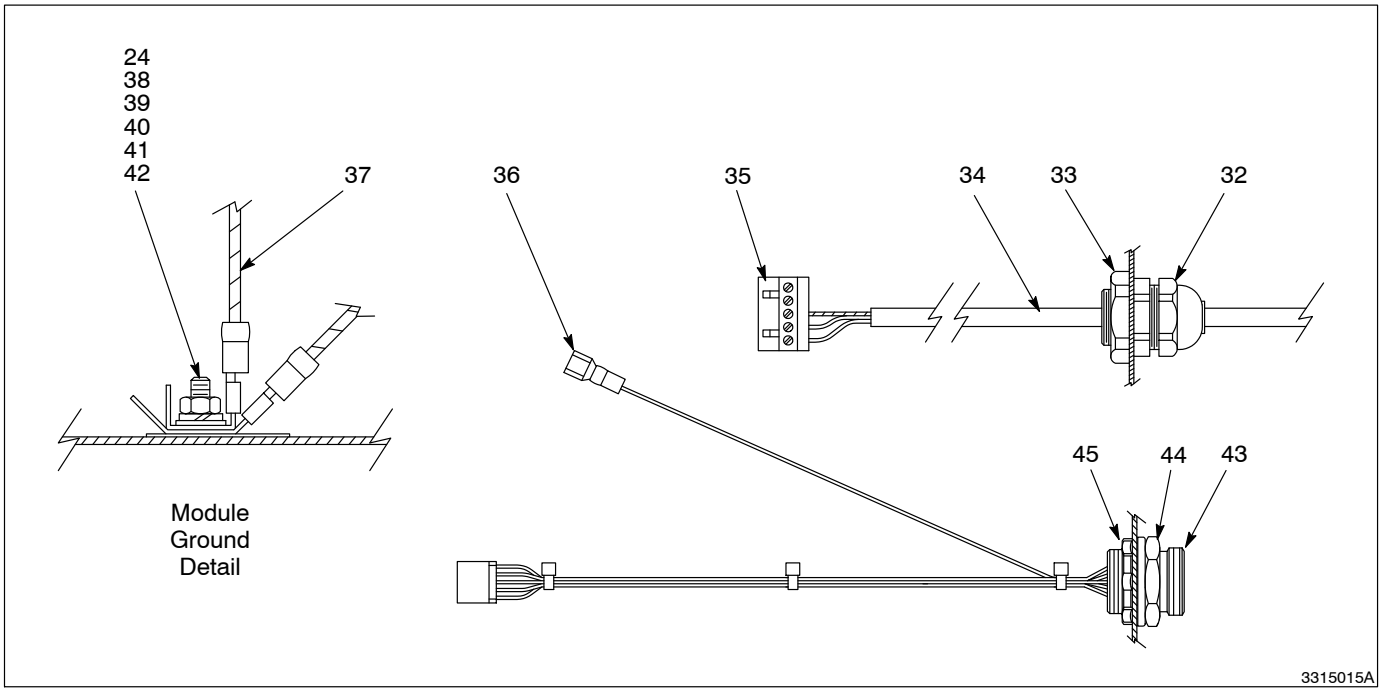


Fig. 7-4 Control module parts illustration

Pneumatic Output Manifold Parts List See Figure 7-5.

Item	Part	Description	Quantity	Note
—	159 639	Manifold, pneumatic output, 3, IPS	1	
1	972 141	• Connector, male, 6-mm tube x $^1/_8$-in. RPT	7	
2	972 841	• Connector, male, 10-mm tube x $^1/_4$-in. RPT	2	
3	163 442	• Gasket, manifold	1	
4	159 641	• Manifold, body	1	
5	129 423	• Gasket, pilot manifold	1	
6	129 329	• Manifold, pilot	1	
7	983 403	• Washer, lock, split, M4	4	
8	982 069	• Screw, pan head, M4 x 16	4	
9	335 241	• Connector, plug, 2-position	1	
10	129 503	• Valve, solenoid, 12 VDC	1	
11	248 716	• Valve, three-way cartridge	2	
12	972 126	• Elbow, 6-mm tube x $^1/_8$-in. RPT	1	

Pneumatic Output Manifold Parts Illustration

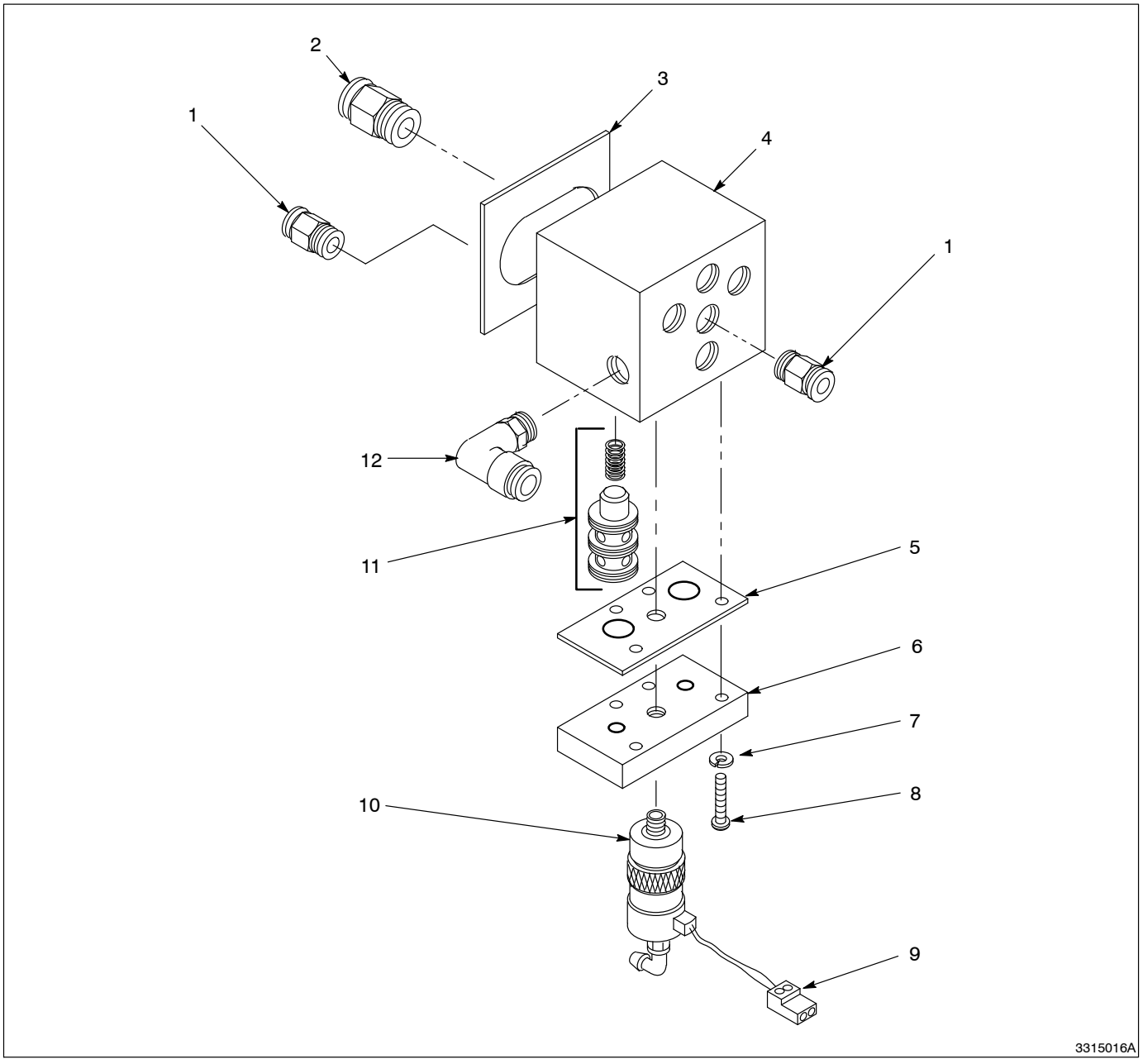


Fig. 7-5 Pneumatic output manifold