FC-2200 Flame Detector

Customer Product Manual
Part 237 388E

Nordson Corporation welcomes requests for information, comments and inquiries about its products.

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1. Safety

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.

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.

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.

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.

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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

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.

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.

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.

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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.

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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

Action in the Event of a 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.

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.

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.

- 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.

Disposal

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

2. Description

The Nordson FC-2200 flame detector is a microcomputer-based flame detection device used with automatic powder coating systems. The flame detector consists of a controller, two flame sensors, and two test lights. The sensors and test lights are connected to the controller by two- and six-conductor shielded cables.

One FC-2200 flame detector is required for each spray booth. The spray booth and conveyor are interlocked with the flame detector through a relay board in the controller. The automatic powder application equipment is interlocked with the spray booth.

The FC-2200 flame detector monitors itself for malfunctions and the inside of the booth for arcs and fires. The control unit initiates audible and visible WARNING, FAULT, or FIRE alarms, depending on what it detects. A WARNING alarm is audible only, to notify the operator that a problem has been detected. A FAULT alarm will shut down the spray booth and powder application equipment. A FIRE alarm will shut down the spray booth, powder application equipment, and conveyor. Refer to the *Operation* section for more information on alarms.
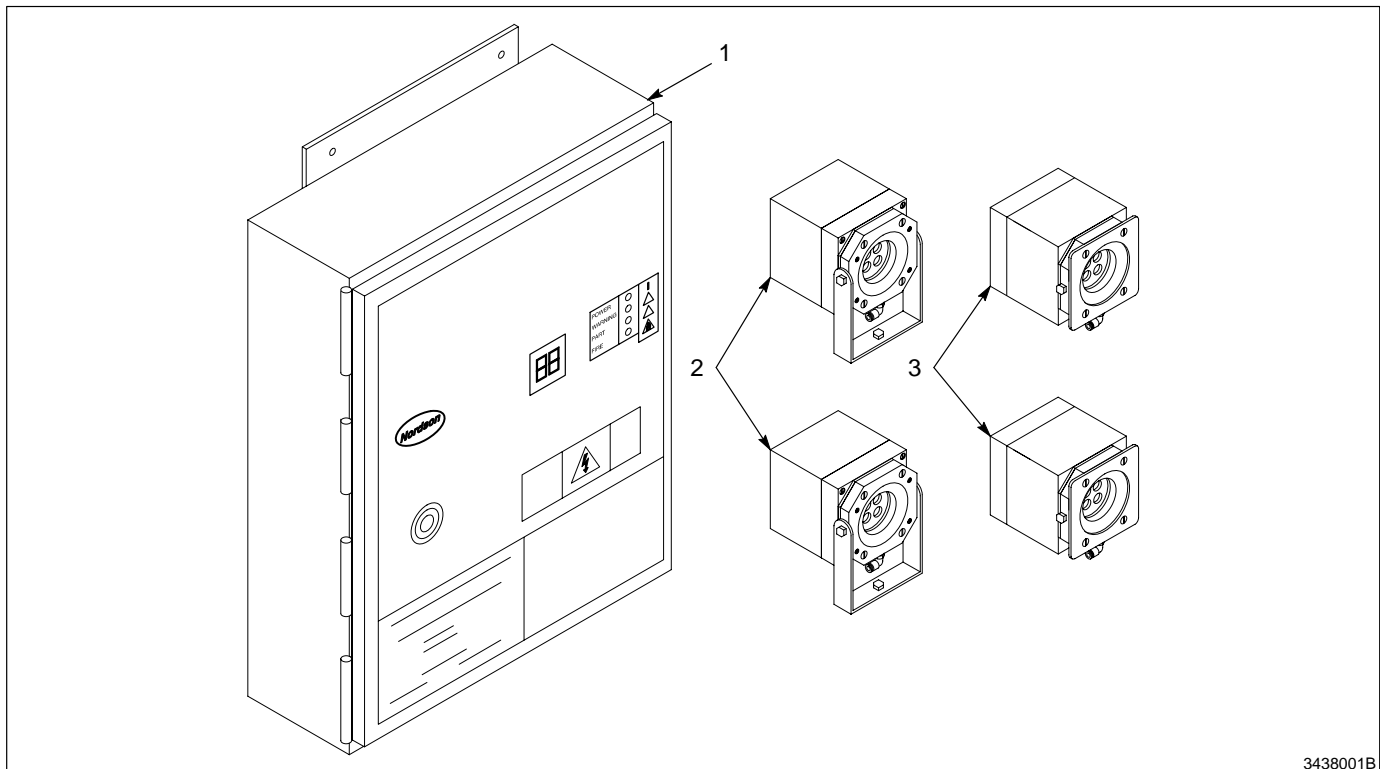
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Fig. 1   FC-2200 Flame Detector

1. Controller   2. Flame sensors   3. Test lights

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Controller

The controller is contained in a NEMA 4 weather-proof steel enclosure. Two seven-segment numerical displays and four LEDs show system status and fault codes. A buzzer on the front panel sounds when the controller initiates an alarm. The enclosure houses a DC power supply board, a circuit board set, and terminal blocks. A free, normally open relay (fault relay) closed by a fault alarm is included. This relay can be used to operate additional alarm devices.

Flame Sensors

The flame sensors are enclosed in IP-65/DIN 40-050 (watertight) NEMA/EEMAC enclosures. Each enclosure contains sensors that detect ultraviolet (UV) and infrared (IR) radiation given off by burning hydrocarbons or electrostatic arcs.

When the sensors detect UV or IR radiation, they send signals to the controller that correspond to the type and intensity of the radiation. The controller processes the signals and compares the results to known values stored in its memory. The controller may then initiate an alarm.

If the sensors detect only UV radiation, the controller will initiate a Warning alarm. Both UV radiation and IR radiation must be present before the controller will initiate a FIRE alarm.

An air shroud is installed around the sensor lenses. A constant flow of low-pressure air through the air shroud helps keep the lenses clean.

Test Lights

The test lights are enclosed in IP-65/DIN 40-050 (watertight) NEMA/EEMAC enclosures. Each enclosure contains a circuit board and a UV light bulb.

The FC-2200 flame detector performs an external test by turning on the test lights at set time intervals. To pass the test, the sensors must see the UV radiation emitted by the test lights and send the correct signal back to the controller. This test ensures that the sensors are working properly and that their view of the interior of the booth is not blocked.

An air shroud is installed around the test light lens. A constant flow of low-pressure air through the air shroud helps keep the lens clean.

Specifications

For more information, contact your Nordson representative.

Controller

Weight:	7701 g (17 lb)
Dimensions:	152 mm x 279 mm x 343 mm
(Height x Width x Depth)	(6 in. x 11 in. x 13.5 in.)

Sensor

Weight:	1359 g (3 lb)
Dimensions:	152 mm x 152 mm x 152 mm
(Height x Width x Depth)	(6 in. x 6 in. x 6 in.)

Test Light

Weight:	1132.5 g (2.5 lb)
Dimensions:	152 mm x 152 mm x 152 mm
(Height x Width x Depth)	(6 in. x 6 in. x 6 in.)

Controller Input Voltage

100–240 Vac, 2A, 50/60 Hz

Controller Output Voltage

To Sensors:	9–30 Vdc, 120 mA
To test lights:	100–240 Vac, 2A, 50/60 Hz

Alarm Buzzer Sound Level

109 dB at 0.6 m (2 ft)

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.

Mounting

1. See Figure 2 and refer to Table 1 to determine the approximate locations for the test lights and flame sensors. Note that while the flame sensors have a 90° field of view, the test lights only emit UV radiation over a 60° field of view. Mount the flame sensors and test lights as follows:

   • The test lights must be mounted no more than 3.7 m (12 ft) from the sensors, at no more than a 30° angle from the sensor centerlines.

   • The sensors must be aimed so that their centerlines are pointed at the spray guns and workpiece hangers.

Table 1 Sensor and Test Light Locations

If dimension W is: (mm (in.))	Then dimension X is: (mm (in.))
305 (12)	127 (5)
457 (18)	203 (8)
610 (24)	279 (11)
762 (30)	381 (15)
914 (36)	457 (18)
1067 (42)	559 (22)
1219 (48)	635 (25)
1372 (54)	711 (28)
1524 (60)	787 (31)
1676 (66)	889 (35)
1829 (72)	965 (38)
1981 (78)	1041 (41)
2134 (84)	1143 (45)
2286 (90)	1219 (48)
2438 (96)	1295 (51)

Mounting (contd.)

76.2 mm (3 in.)

W

X

Top View

Side View

152.4 mm (6 in.)

3.6 m (12 ft) maximum

Booth Top View
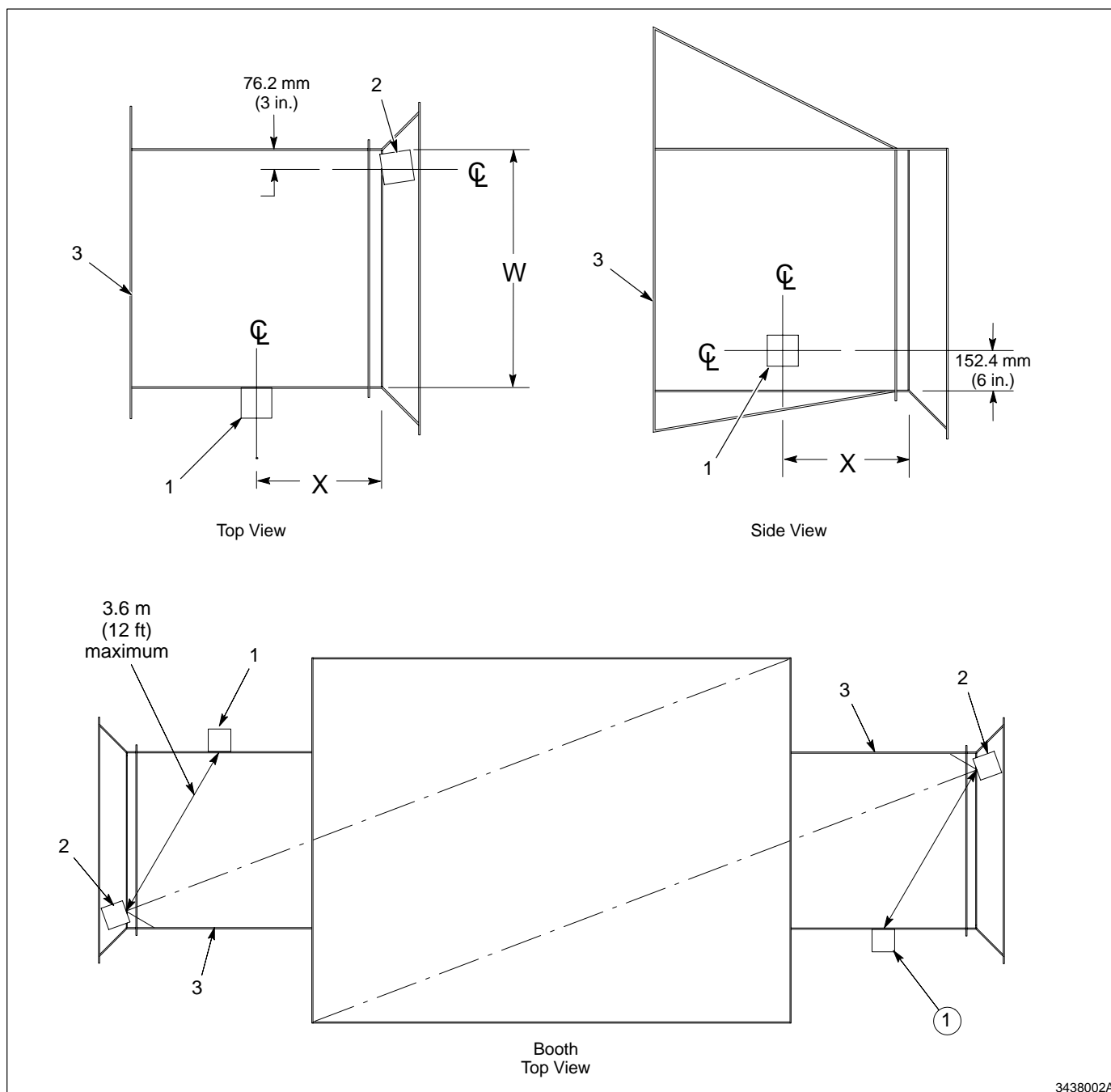
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Fig. 2   Determining Sensor and Test Light Locations

1. Test lights   2. Flame sensors   3. Booth vestibules

2. See Figure 3. Use the test-light mounting plates as templates to mark drill points on the booth vestibule walls. Drill a 77-mm (3-in.) hole for the lens and 6-mm ($1/4$-in.) holes for the mounting screws.

3. Mount the test lights as shown with the screws and mounting plate.

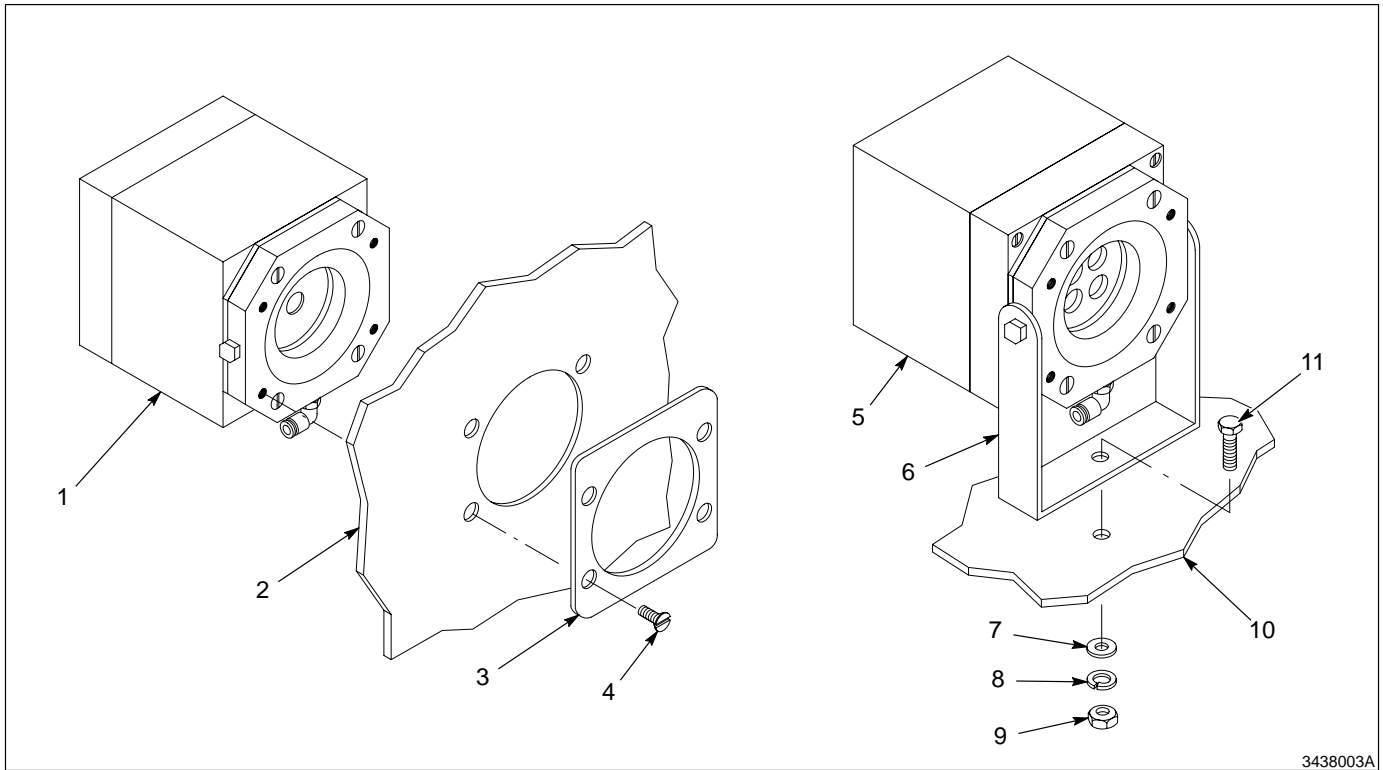4. Mount the sensors in the booth vestibules as shown with the included fasteners and brackets.

Fig. 3   Mounting Sensors and Test Lights

1. Test light
2. Vestibule wall
3. Mounting plate
4. Screws

5. Flame sensor
6. Bracket
7. Flat washer
8. Lock washer

9. Nut
10. Vestibule floor
11. Hex screw

5. Mount the controller in an appropriate location, using $5/16$-inch fasteners. The controller is usually mounted to a bracket on the operator platform railing, next to the spray booth electrical panel.
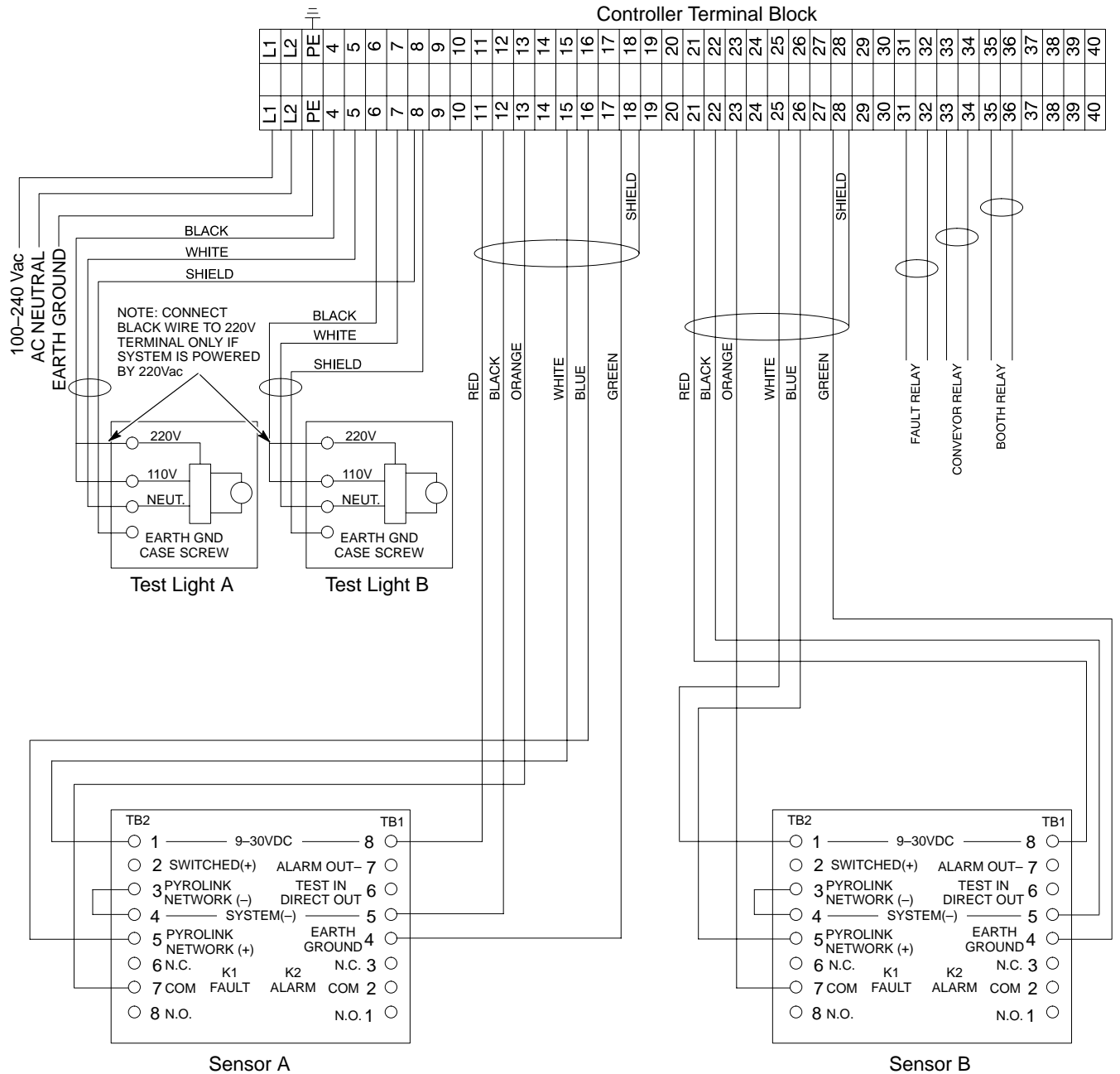
Electrical Connections

Electrical connections are shown in Figure 4. A system wiring diagram is also glued to the inside of the controller door.

WARNING: Shut off system electrical power before making electrical connections. Failure to observe this warning may result in equipment damage, personal injury, or death.

Use these guidelines when connecting the flame sensors and test lights to the controller:

- Use 6-conductor shielded cable to connect the flame sensors to the controller. Use 2-conductor shielded cable to connect the test lights to the controller. Install the cables in flexible metal conduit and use waterproof conduit connectors. Refer to the *Parts* section for the cable part numbers.

- Power supply wiring and interlock relay (fault, conveyor, booth) must conform to local electrical codes. Use flexible metal conduit and waterproof conduit connectors.

- Remove the flame sensor and test light enclosure covers to connect the cables. Refer to the *Repair* section for instructions.

- A free, normally open relay (fault relay) is connected to terminals 31 and 32 on the controller terminal block. Use this relay to operate additional alarm devices if necessary. The relay closes on a fault alarm.

Controller Terminal Block

Fig. 4 Wiring Diagram

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Test Light A

Test Light B

Sensor A

Sensor B

NOTE: CONNECT
BLACK WIRE TO 220V
TERMINAL ONLY IF
SYSTEM IS POWERED
BY 220Vac

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Pneumatic Connections

A constant flow of air at 1 bar (15 psi) is required to help keep the flame sensor and test light lenses clean. Refer to the *Parts* section for regulator, tubing, and fitting part numbers.

1. Install the 10-mm x $^1/_4$-NPT connectors in the regulator input ports and the 6-mm x $^1/_4$-NPT tees in the output ports.

2. Route 6-mm air tubing from the tees to the elbow fittings on the detector and test light air shrouds.

3. Route 10-mm air tubing from the regulator connectors to a 10-mm tubing connector in the booth pneumatic panel. Make sure air is supplied to the regulators at system pressure.
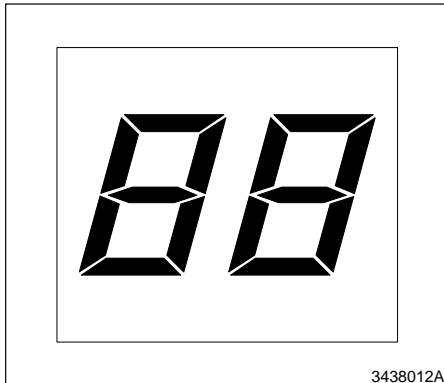
4.   Operation

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Fig. 5   System Fault Digital Display

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

See Figure 5. The FC-2200 flame detector displays any system faults on its digital display located on the front of the control panel. The left digit shows the status of sensor A and the right digit shows the status of sensor B. Read the fault codes following these examples:

Fault Code	Problem
01	Arc detected on sensor B; sensor A is operating normally
30	Sensor A failed external test; sensor B is operating normally
55	Power loss on both sensors

The FC-2200 flame detector has no power switch. It turns on when the spray booth power is turned on. When the flame detector is operating normally

- the green POWER LED is on
- all other LEDs are off
- the numerical display shows 00

WARNING: Do not operate the coating system with the FC-2200 flame detector shut down, bypassed, or with a known malfunction. Failure to observe this warning may result in equipment damage, personal injury, or death.

WARNING Alarm

WARNING: IImmediately find and fix any malfunction that initiates a WARNING alarm. Failure to observe this warning may result in equipment damage, personal injury, or death.

A WARNING alarm is initiated if an arc is detected or a system component malfunctions. Refer to the *Troubleshooting* section for information on diagnosing and correcting malfunctions.

When a WARNING alarm is initiated the

- yellow WARNING LED turns on
- buzzer sounds for 1 second at 5 second intervals
- spray booth, application equipment, and conveyor continue to operate
- numerical display shows one of the following fault codes:

Fault Code	Problem
1	Arc detected in booth or conveyor
2	Dirty sensor lens
3	Failed external test
4	Communications link (current loop) with one sensor broken
5	Power loss to one sensor

FAULT Alarm

WARNING: Immediately find and fix any malfunction that initiates a FAULT alarm. Do not restart the coating system until repairs are made. Failure to observe this warning may result in equipment damage, personal injury, or death.

A FAULT alarm is initiated if a component malfunction disables the FC-2200 flame detector. Immediately find and fix the problem. Refer to the *Troubleshooting* section for information on diagnosing and correcting malfunctions.

When a FAULT alarm is initiated the

- blue FAULT LED turns on
- buzzer sounds for one (1) second at one (1) second intervals
- spray booth and application equipment shuts down; the conveyor continues to operate
- numerical display shows one of the following fault codes:

Fault Code	Problem
44	Communications links (current loops) with both sensors broken
55	Power loss to both sensors

FIRE Alarm

⚠️ **WARNING:** Do not disregard a FIRE alarm. Immediately take action to extinguish the fire. Failure to observe this warning may result in equipment damage, personal injury, or death.

A FIRE alarm is initiated if the system detects a fire in the booth. Respond to the alarm immediately.

When a FIRE alarm is initiated the

- red FIRE LED turns on
- buzzer sounds continuously
- spray booth, application equipment, and conveyor shuts down
- numerical display shows a 99 fault code

Alarm Silence

To silence the buzzer, open the controller door. Press and release the red reset button on the power supply board cover. The button is clearly labeled. If you have fixed the malfunction, the green POWER LED will turn on, and the WARNING, FAULT, or FIRE LED will turn off. If you did not fix the malfunction, the buzzer will go off again.

5. Maintenance

Maintenance is limited to the following procedures.

- Inspect the flame sensor and test light lenses daily. Clean the lenses with compressed air or a clean, dry cloth. Use a soft cloth soaked with isopropyl alcohol to remove any stubborn deposits.

- Make sure the sensor and test light air shrouds are supplied with compressed air and the shroud orifices are clear. Air must be clean and dry.

- Visually check all electrical conduit and wiring. Make sure that all electrical connections are secure and the enclosures are sealed.

- Make sure the sensors can see the test lights at all times.

6. 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.

Introduction

WARNING: Immediately correct any problem that causes the system to initiate a WARNING or FAULT alarm. Do not operate the coating system if the FC-2200 flame detector is malfunctioning, shut down, or bypassed.

WARNING: Hazardous voltages are present during testing procedures. Serious injury or death may result if personnel fail to observe standard safety precautions.

CAUTION: Printed circuit boards are susceptible to damage from static discharge. Make sure you are electrically grounded before handling printed circuit boards.

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.

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Troubleshooting Tables

See Figures 4 and 6 for terminal locations and wiring diagrams. Refer to the *Repair* section for controller, flame sensor, and test light disassembly instructions. After making repairs, turn on spray booth power. When the green LED lights, press the reset button on the power supply board to reset the FC-2200 flame detector.

Table 2   Problem Diagnosis and Correction

Problem	Possible Cause	Corrective Action
No power (green LED not lit)	No input power	Check for the correct input voltage at controller terminals L1 and L2. If no voltage is present, check the wiring to the controller. If voltage is present, check for a blown fuse.
	Fuse blown	Check for +12 Vdc at controller terminals 11 and 12. If no voltage is present, replace the fuse on the power supply board. If voltage is present, check for a failed power supply board.
	Faulty power supply board	Turn off power and disconnect the connector at CN2 on the power supply board. Turn on power and check for 5 Vdc between CN2 pins 4 and 2, +12 Vdc between pins 4 and 1, and -12 Vdc between pins 5 and 6. If any of these voltages are incorrect, replace the power supply board. If all voltages are correct, turn off power and reconnect the CN2 connector. Check for a faulty sensor or cable.
	Faulty controller circuit board	Contact your Nordson representative.

Table 3 Fault Code Diagnosis and Correction

Fault Code	Possible Cause	Corrective Action
1	Significant UV event (spark or arcing) detected without a fire being detected	Check for ungrounded part(s) on conveyor, sticking conveyor chain link, damaged gun, or any ungrounded objects in the booth.
2	One or more sensor lens are dirty	Clean the lenses on both sensors. Make sure the air shrouds are supplied with compressed air.
3	One sensor has failed the external test	One of the sensors did not see the test lights. Clean the sensor lenses and make sure the sensors are aligned properly. If this does not solve the problem, make sure the test lights are working. Open the controller door and press the reset button while a co-worker watches the test lights for a brief flash of UV light. Repair the test lights if they are not working. Repair or replace the sensors if the problem persists.
4	Communications link (current loop) between one sensor and controller is broken	Check the sensor cable connections. If all connections are good, check the continuity of the cable leads. Repair or replace the cable if one of the leads is open or shorted. Repair or replace the sensor if the cable is good.
5	No power to one sensor	See if the red LED by the sensor's UV tube is flashing. Check for +12 Vdc between terminal block pins 11 and 12 and between pins 21 and 22. If voltage is present, check the continuity of the cable leads. Repair or replace the cable if one of the leads is open or shorted. Repair or replace the sensor if the cable is good.

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Troubleshooting Tables *(contd.)*

| Fault Code	Possible Cause	Corrective Action
33	Both sensors have failed the external test	Neither of the sensors saw the test lights. Clean the sensor lenses and make sure the sensors are aligned properly. If this does not solve the problem, make sure the test lights are working. Open the controller door and press the reset button while a co-worker watches the test lights for a brief flash of UV light. Repair the test lights if they are not working. Repair or replace the sensors if the problem persists.
44	Communications links (current loop) between both sensors and controller are broken	Check the sensor cable connections. If all connections are good, check the continuity of the cable leads. Repair or replace the cables if any of the leads is open or shorted. Repair or replace the sensors if the cables are good.
55	Power loss to both sensors	See if the red LED by the sensor's UV tube is flashing. Check for +12 Vdc between terminal block pins 11 and 12 and between pins 21 and 22. If voltage is present, check the continuity of the cable leads. Repair or replace the cables if any of the leads are open or shorted. Repair or replace the sensors if the cables are good.
99	FIRE alarm	UV and IR light detected.

Controller Wiring Diagram
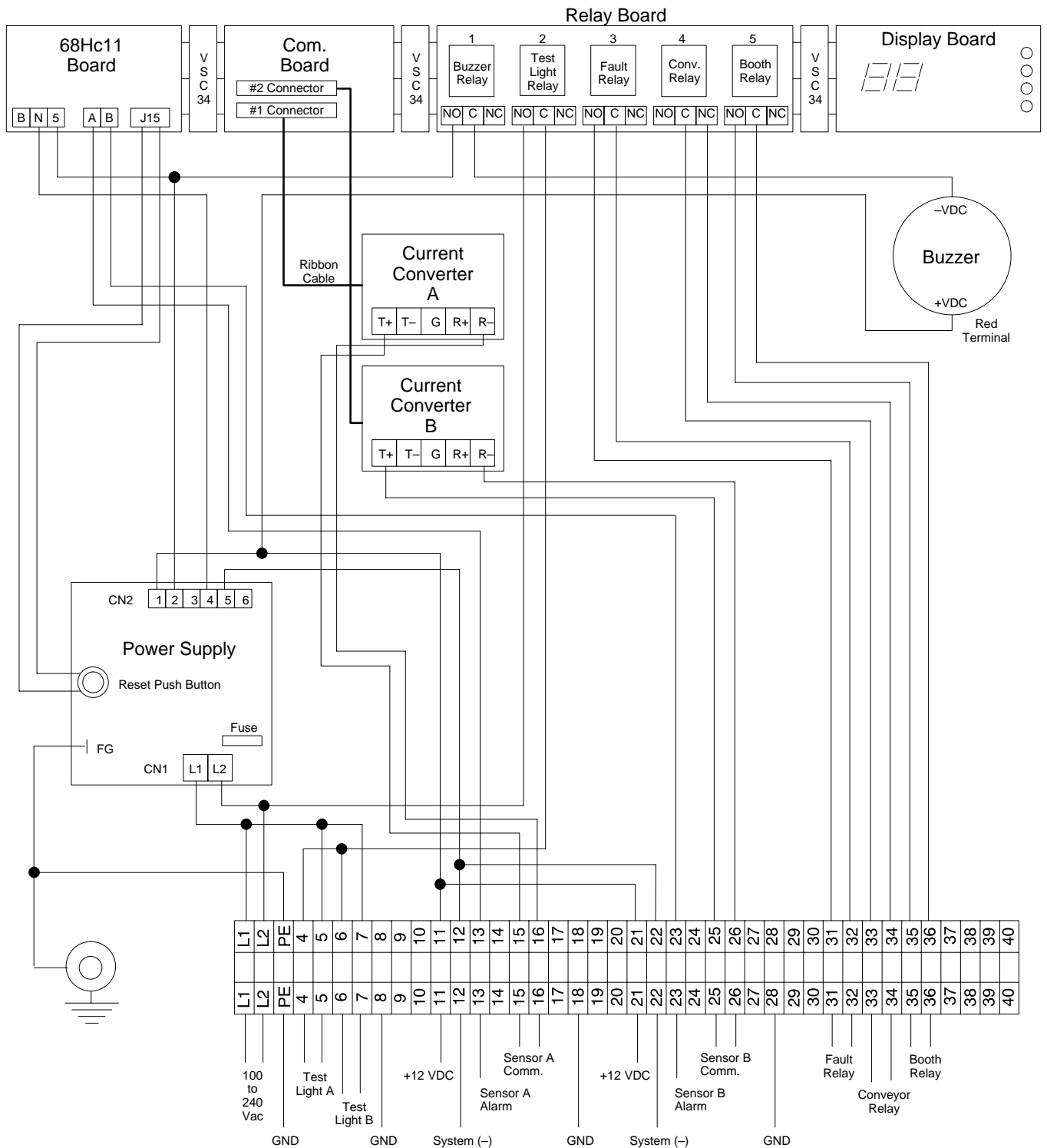
Fig. 6 Controller Wiring Diagram

7. 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, lock out, and tag electrical power before servicing any component of the FC-2200 flame detector. Failure to observe this warning could result in personal injury or death.

CAUTION: Printed circuit boards and electronic components are susceptible to damage from static discharge. Make sure you are electrically grounded before handling printed circuit boards.

NOTE: After making repairs, turn on power. When the green LED lights, open the controller door and press the reset button to reset the system.

Flame Sensor

Follow this procedure to disassemble the flame sensor so you can replace serviceable parts.

1. See Figure 7. Remove the two screws (6), lock washers (7), and flat washers (8). Remove the sensor from the bracket (9).

2. Remove the four screws (10), the air shroud (11), and the gasket (5) from the cover (3).

3. Unscrew the four screws (12) in the corners of the cover. The screws are captive. Do not remove them from the cover.

4. Carefully separate the body (1) from the cover. Be careful not to damage the sensor module (2).

5. Remove the two screws (4) securing the sensor module to the cover. Gently remove the sensor module from the cover. The module is not a serviceable part.

6. Be careful not to touch the sensors on the sensor module. If you accidentally touch them, gently wipe off any fingerprints with a silicone- and oil-free cloth.

Reverse the disassembly steps to reassemble the flame sensor. Make sure the cover O-ring is properly installed.
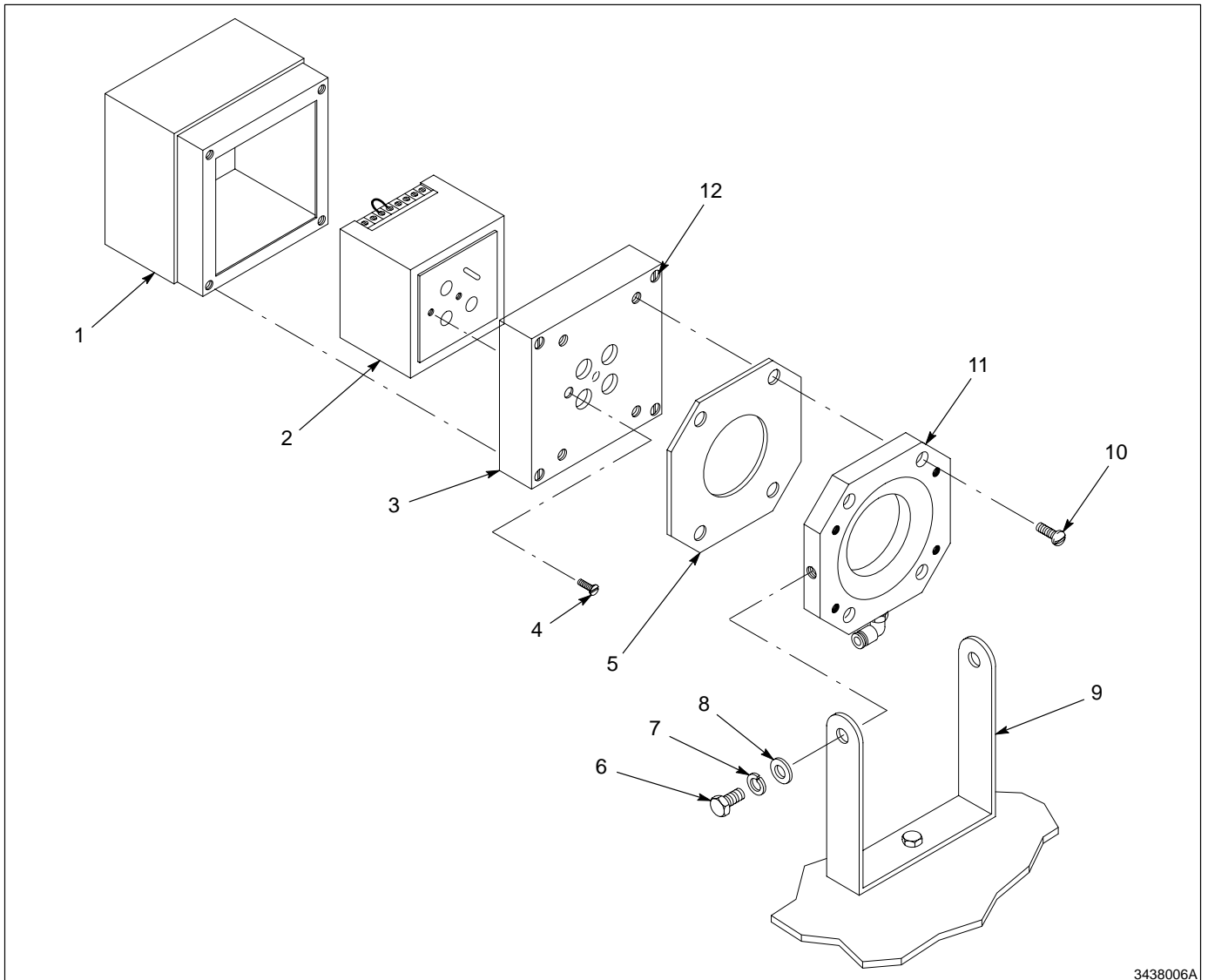
Fig. 7   Flame Sensor Disassembly

|		
1. Body	5. Gasket	9. Bracket
2. Sensor module	6. Screws	10. Screws
3. Cover	7. Lock washers	11. Air shroud
4. Screws	8. Flat washers	12. Captive screws

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Test Light

Follow this procedure to disassemble the test lights so you can replace serviceable parts.

1. See Figure 8. Remove the four screws (11) and mounting plate (10).

2. Unscrew the four screws (2) in the corners of the cover (1). The screws are captive. Do not remove them from the cover.

3. Carefully separate the cover from the body (6).

4. Disconnect the connector (4) from the terminal block on the circuit board (5).

5. Remove the two screws (3).

6. Gently remove the circuit board. Be careful not to touch the UV lamp on the board. If you accidentally touch it, gently wipe off any fingerprints with a silicone- and oil-free cloth.

7. Remove the four screws (9), air shroud (8), and gasket (7).

Reverse the disassembly steps to reassemble the test light. Make sure the cover O-ring is properly installed.
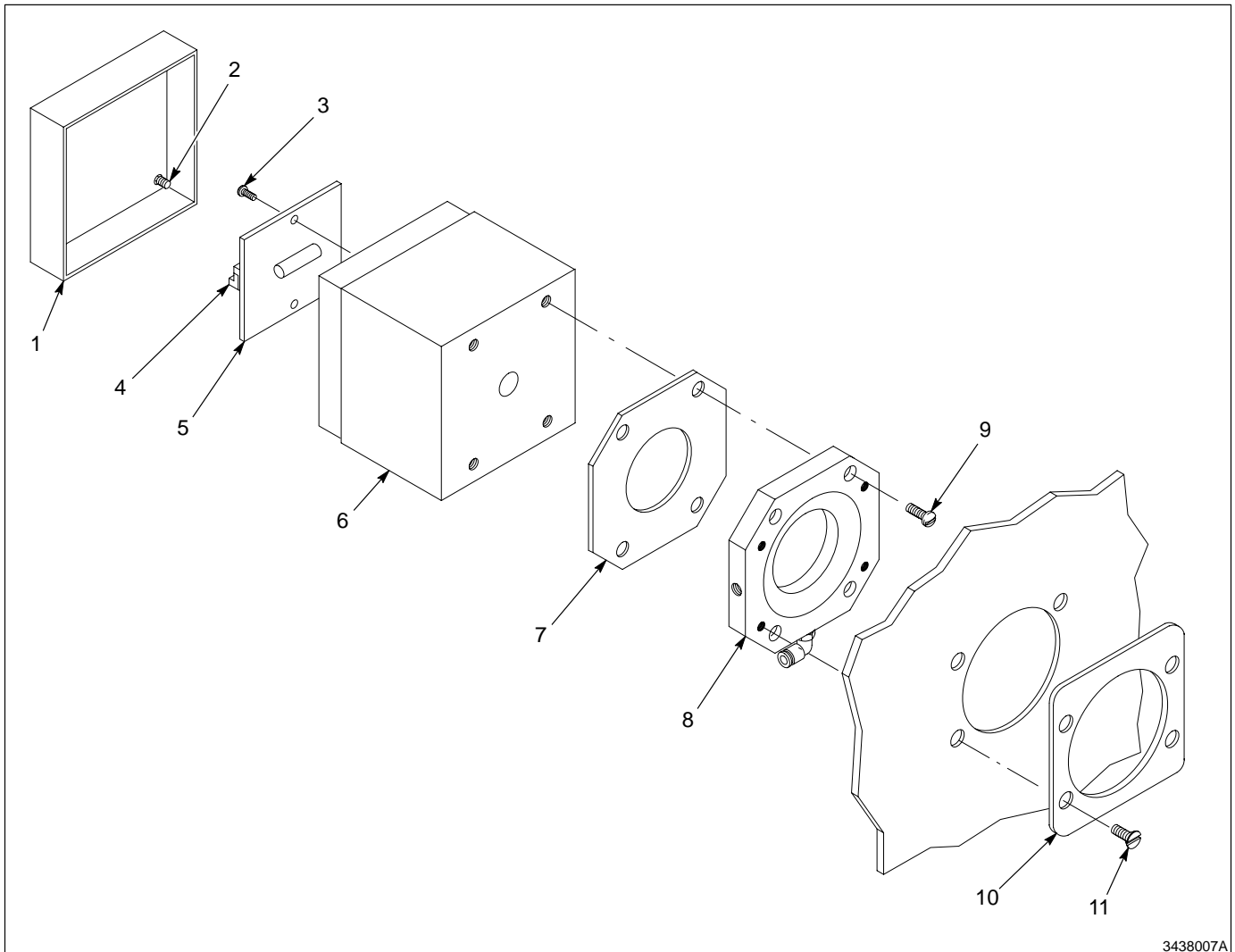
Fig. 8 Test Light Disassembly

1. Cover
2. Captive screws
3. Screws
4. Connector

5. Circuit board
6. Body
7. Gasket
8. Air shroud

 9. Screws
10. Mounting plate
11. Screws

System Controller

See Figure 9. Follow this procedure to remove the serviceable parts of the controller.

1. Open the enclosure door. Disconnect all wiring and ribbon cables necessary to remove the component(s) you are replacing.

2. Remove the four screws (3) to remove the back panel (2) from the enclosure.

3. If you are replacing the entire board set, unscrew the screws (not shown) on the rear of the back panel that secure the standoffs (9) to the panel.

4. If you are replacing the relay board (6), display board (7), or mother board (8), unscrew the nuts from the corners of the boards. Lift the boards off the standoffs.

5. If you are replacing the power supply board, remove the cover (4). Unscrew the nuts from the corners of the board and lift the board off the standoffs.

6. To remove the buzzer (1), disconnect the wires from the buzzer terminals and unscrew the bezel from the front of the door. Remove the buzzer from the inside of the door.

Reverse the disassembly steps to reassemble the controller. See Figure 6 for wiring connections.

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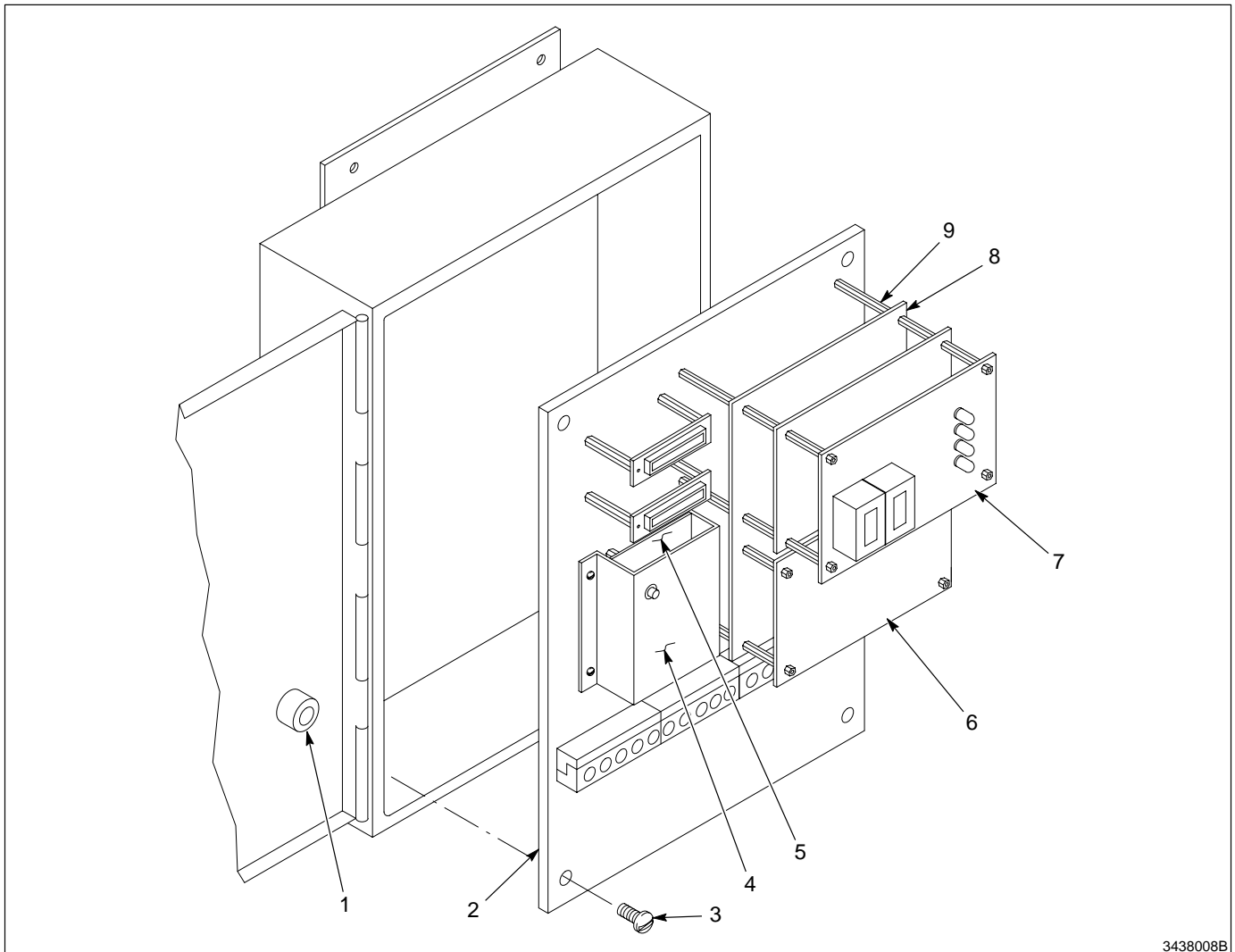
Fig. 9   System Controller Disassembly

1. Buzzer	4. Cover	7. Display board
2. Back panel	5. Power supply board	8. Mother board
3. Screws	6. Relay board	9. Standoffs

8. Parts

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 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.

FC-2200 Components

Item	Part	Description	Quantity	Note
—	183 481	Detector, flame, FC-2200, 1 booth	1	
1	183 435	• Controller, system, FC-2200	1	
2	183 436	• Sensor, flame, FC-2200	2	
3	183 437	• Light, test, FC-2200	2	
NS	183 420	Regulator, air, in-line, 15 psi	2	A
NS	972 841	Connector, male, 10 mm tube x $^1/_4$ in. NPT	2	A
NS	971 107	Tee, male branch, 6 mm tube x $^1/_4$ in. NPT	2	A
NS	183 474	Cable, 2 conductor, shielded, 20 gauge	AR	A, B
NS	183 475	Cable, 6 conductor, shielded, 20 gauge	AR	A, B
NS	900 593	Tubing, air, polyethylene, 10 mm OD	AR	A, B
NS	900 586	Tubing, air, polyethylene, 6 mm OD	AR	A, C
NOTE A: Provided with new automatic booth systems. Order separately for retrofit systems.				
B: Order in 1-ft increments. Typically 100 ft per system.				
C: Order in 1-ft increments. Typically 50 ft per system.				
AR: As Required				
NS: Not Shown				

FC-2200 Components *(contd.)*
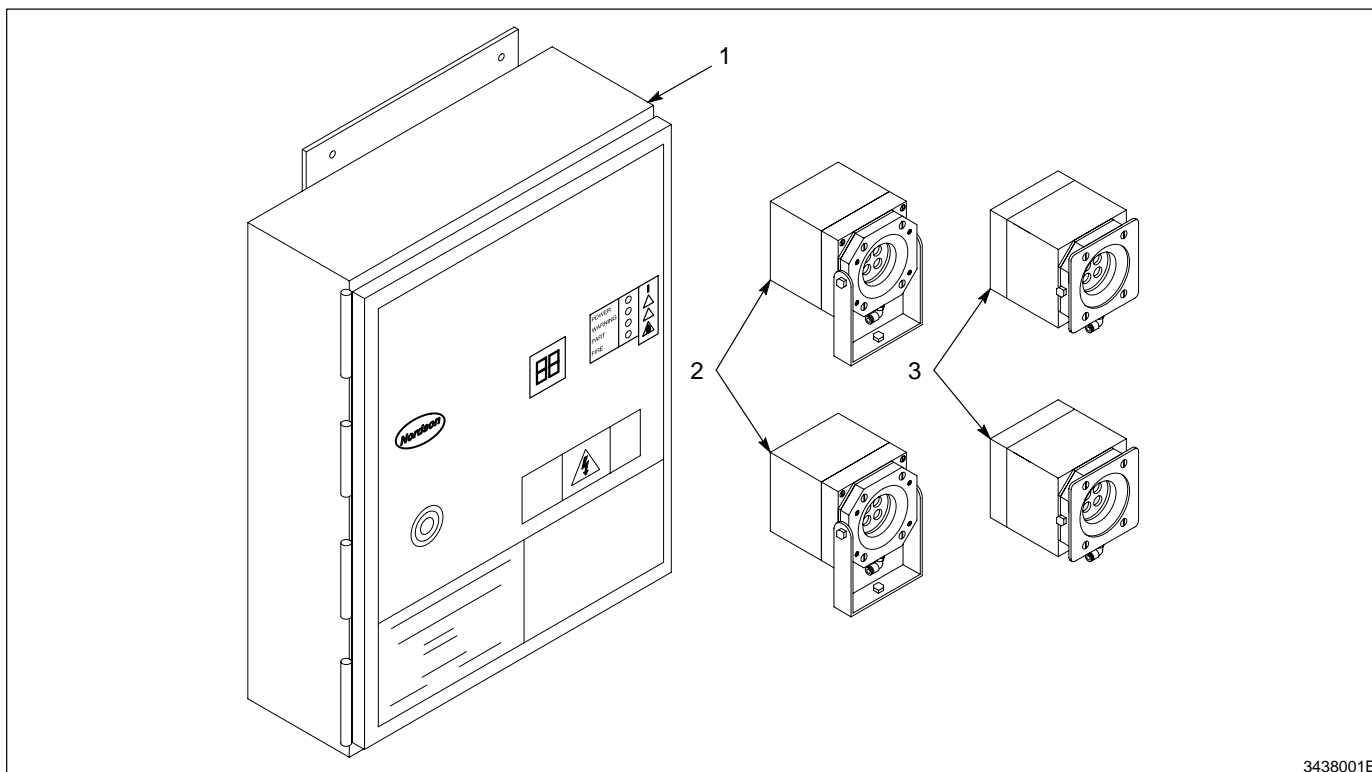
Fig. 10 FC-2200 Flame Detector Components

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Controller Parts

Item	Part	Description	Quantity	Note
—	183 435	Controller, FC-2200	1	
1	183 441	• Buzzer, alarm, FC-2200	1	
2	183 440	• Power supply, controller, FC-2200	1	
NS	131 477	• • Fuse, fast-acting, 5 x 20 mm, 250V, 2A	1	
3	183 445	• Board, set, controller, with standoffs	1	
4	323 983	• • Board, mother, FC-2200	1	
5	183 439	• • Board, display, FC-2200	1	
6	183 438	• • Board, relay, FC-2200	1	
7	335 242	• • Connector, plug, 10-position	4	
NS: Not Shown				

Controller Parts *(contd.)*
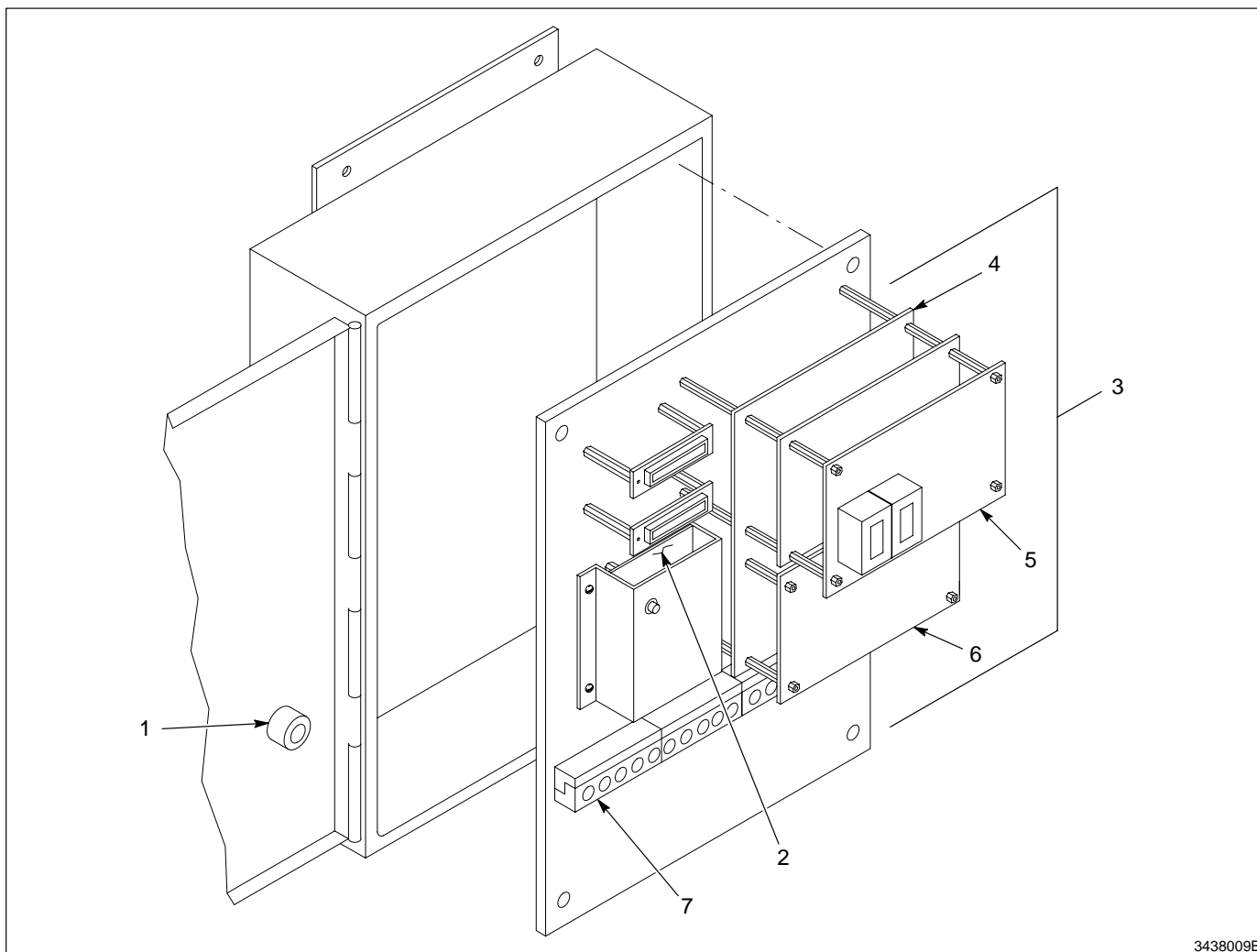
Fig. 11 Controller Parts

Flame Sensor Parts

See Figure 12.

Item	Part	Description	Quantity	Note
—	183 436	Sensor, flame, assembly, FC-2200	1	
1	183 444	• Sensor, FC-2200	1	
2	183 472	• • Cover, sensor, with quartz lens	1	
3	183 421	• Gasket, air shroud, FC-2200	1	
4	183 422	• Shroud, air, FC-2200	1	
5	982 193	• Screw, pan head, slotted, M5 x 16 mm	4	
6	972 126	• Elbow, male, 6 mm tube x $^1/_8$ in. NPT	1	
7	183 423	• Bracket, mounting, sensor, w/shroud	1	
8	982 049	• Screw, hex, cap, M8 x 25 mm	1	
9	983 013	• Washer, flat, M8	3	
10	983 404	• Washer, lock, M8	3	
11	984 707	• Nut, hex, M8	1	
12	982 500	• Screw, hex, machine, M8 x 16 mm	2	

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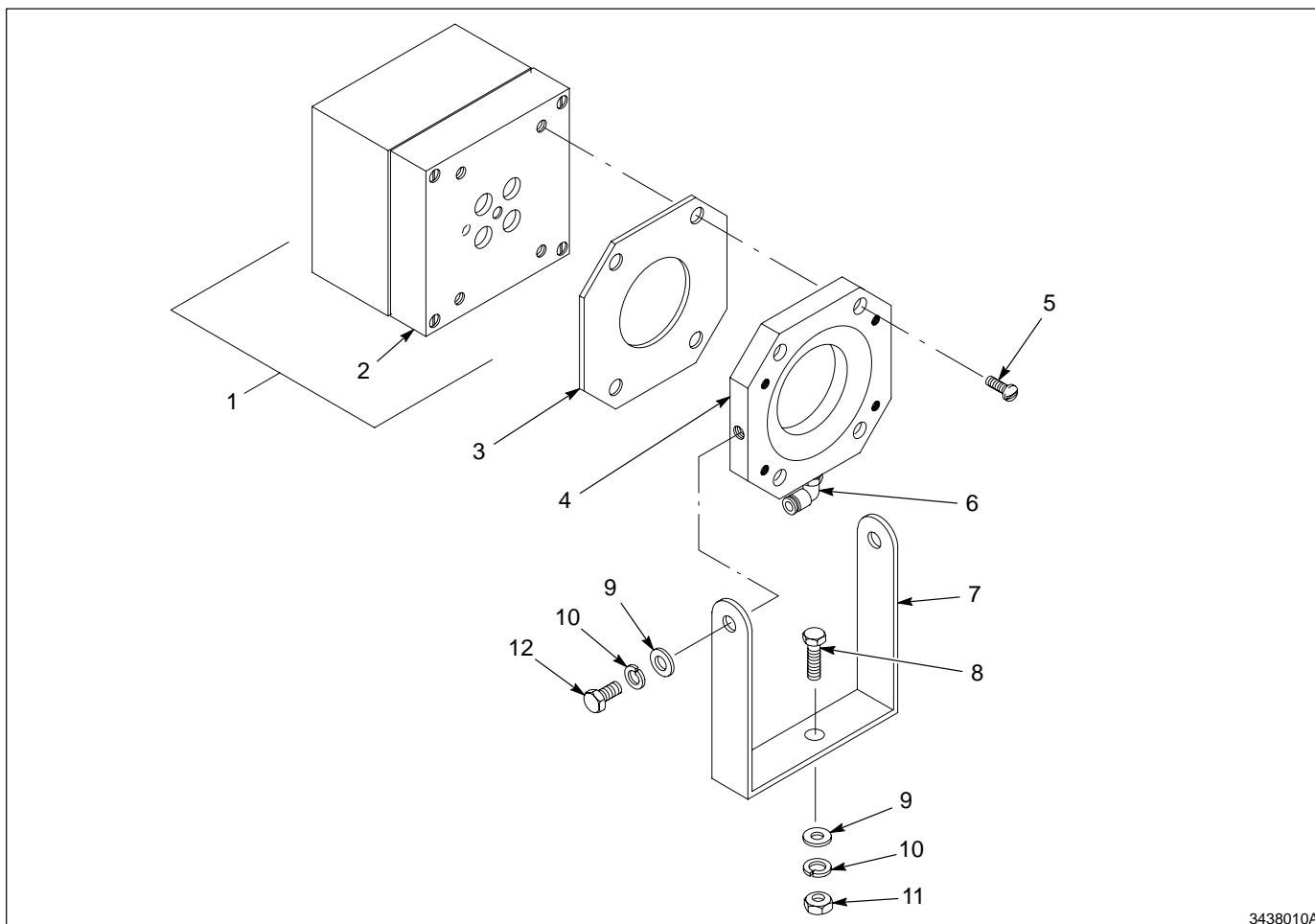
Flame Sensor Parts (contd.)

Fig. 12 Flame Sensor Parts

Test Light Parts

Item	Part	Description	Quantity	Note
—	183 437	Light, test, assembly, FC-2200	1	
1	183 446	• Light, test, FC-2200	1	
2	933 549	• • Connector, plug, 3-position	1	
3	183 443	• • Module, UV light source	1	
4	183 442	• • Body, test light, with quartz lens	1	
5	183 421	• Gasket, air shroud, FC-2200	1	
6	183 422	• Shroud, air, FC-2200	1	
7	972 126	• Elbow, male, 6 mm tube x $1/8$ in. NPT	1	
8	982 193	• Screw, pan head, slotted, M5 x 16 mm	4	
9	183 419	• Plate, mounting, test light, FC-2200	1	
10	982 793	• Screw, flat head, M6 x 16 mm	4	
NS	982 792	• Screw, flat head, M6 x 12 mm	4	
NS: Not Shown				

Test Light Parts *(contd.)*

Fig. 13 Test Light Parts