Coolwave® 2 610 UV Curing System

Customer Product Manual
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For technical support call 800-524-1322.

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Notice

Change Record

Revision	Date	Change
02	09/14	Replaced light detector board part number 1077320 with 1605735 for internal blower.
03	04/15	Updated part number 1083258 to 1607248 in Parts List.

Table of Contents

Section 1
Safety

Introduction

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

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

All equipment is designed and manufactured to International Safety Standards to ensure that the health and safety of the operator is protected at all times.

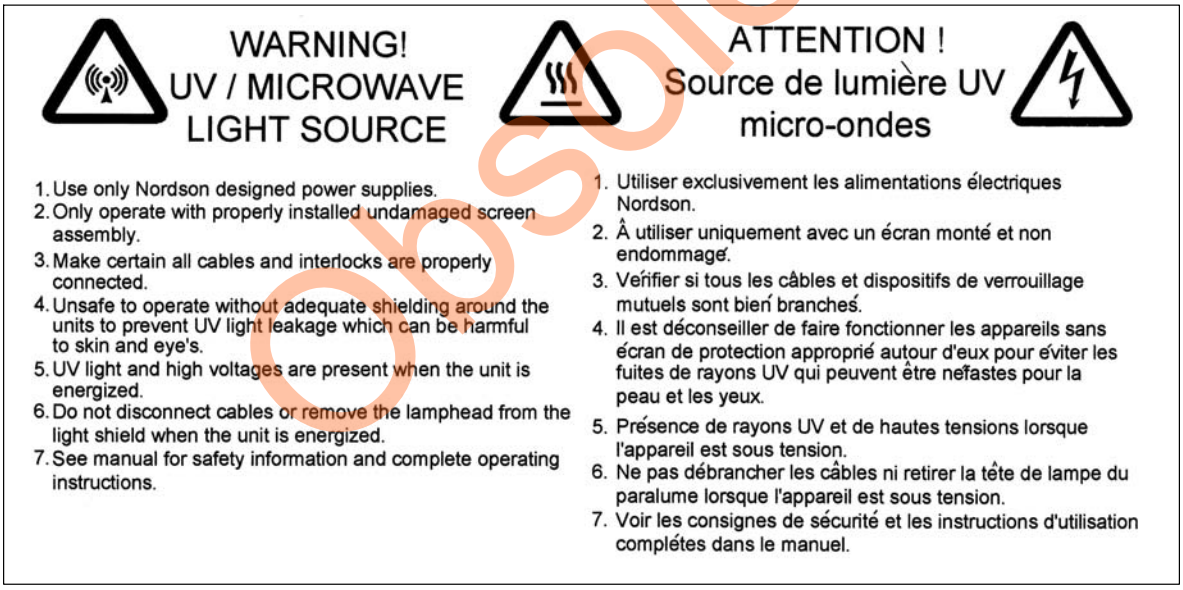


Figure 1-1 Microwave UV Warning

Qualified Personnel

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

Intended Use

Nordson ultraviolet (UV) equipment is intended specifically for integration into other machines and should **NOT** be operated as a standalone system or without appropriate safety guarding, shielding, and interlocks. It is the responsibility of the integrator and end user to ensure that the final assembly fulfills all necessary legislation and is completely safe before operation.

This equipment is designed for the accelerated curing of UV inks, adhesives, and coatings. Do not use this equipment to cure alternative materials unless approved by the material supplier.

The equipment is not flame or explosion proof and is not designed for use in hazardous areas.

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

Some examples of unintended use of equipment include

- using incompatible materials
- making unauthorized modifications
- removing or bypassing safety guards, shielding or interlocks
- using incompatible or damaged parts
- using unapproved auxiliary equipment
- operating equipment in excess of maximum ratings
- using equipment in hazardous areas

Regulations and Approvals

Make sure all equipment is rated and approved for the environment in which it is used. Any approvals obtained for Nordson equipment will be voided if instructions for installation, operation, and service are not followed.

Personal Safety

To prevent injury follow these instructions.

- Do not operate or service equipment unless you are qualified.
- Do not operate equipment unless safety guards, light shields, doors, and/or covers are intact and automatic interlocks are operating properly. Do not bypass or disarm any safety devices.
- Keep clear of moving equipment. Before adjusting or servicing any moving equipment, shut off the system controller and wait until the equipment comes to a complete stop. Lock out power and secure the equipment to prevent unexpected movement.
- Obtain and read Material Safety Data Sheets (MSDS) for all materials used. Follow the manufacturer's instructions for safe handling and use of materials. Always use recommended personal protection devices.
- Make sure the UV area is adequately ventilated.
- The UV equipment runs at extremely high temperatures. Do not touch the UV lamphead face during operation or immediately after shutting off the equipment.
- To prevent injury, be aware of less-obvious dangers in the workplace that often cannot be completely eliminated, such as hot surfaces, sharp edges, energized electrical circuits, and moving parts that cannot be enclosed or otherwise guarded for practical reasons.
- Always wear safety glasses that offer UV protection.
- Never expose any part of the body to direct or indirect UV light.

Ultraviolet Radiation

WARNING: Ultraviolet light is a form of electromagnetic radiation and can be harmful if exposure exceeds recommended levels. Protect eyes and skin from direct exposure to UV light. All equipment or areas where UV light is used must be adequately guarded, shielded, and interlocked to prevent accidental exposure.

Ultraviolet light is not capable of penetrating into the body and interacting with internal tissues and organs.

The National Institute for Occupational Safety and Health (NIOSH) document *Criteria for Recommended Standard... Occupational Exposure to Ultraviolet Radiation* (PB214 268) establishes guidelines for safe use.

See Figure 1-2. Ultraviolet light is divided into wavelength bands A, B, C, and V along with vacuum UV. Although values for wavelength bands will vary depending on the source, the following ranges may be used as a guide.

- UV-V (450–400 nanometers) – visible UV.
- UV-A (400–315 nanometers) – represents the largest portion of UV energy and is most responsible for human skin aging and increased pigmentation. UV–A is at the lower limit of sensitivity to the human eye.
- UV-B (315–280 nanometers) – most responsible for reddening and burning of the skin and damage to the eyes.
- UV-C (280–100 nanometers)

Exposure to UV radiation can result in

- reddening of skin
- headaches
- sore eyes

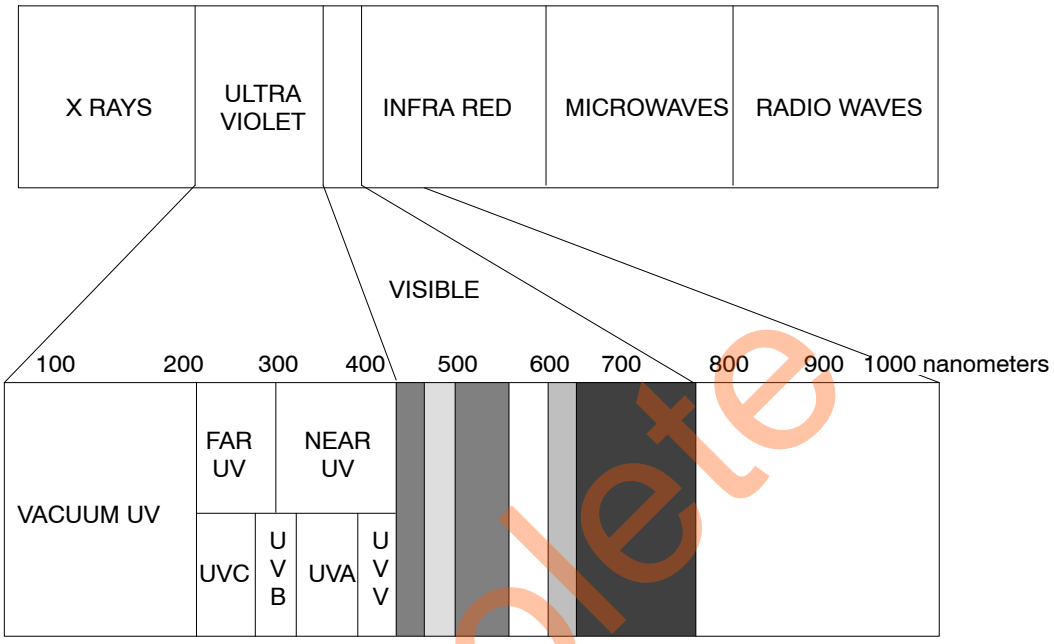


Figure 1-2 Ultraviolet Light Wavelength Bands

It is very important that all precautions are taken to prevent all UV light, whether direct or indirect, from escaping the curing area. Exposure to UV light can be harmful to both eyes and skin. Use the following table to determine the permissible exposure time to UV light on unprotected eyes or skin.

Permissible Ultra Violet Exposures as Recommended by the American Conference of Government and Industrial Hygienists	
Duration of Exposure (Per Day)	**Effective Irradiance (E Micro Watts/cm sq)**
8 hours	0.1
4 hours	0.2
2 hours	0.4
1 hour	0.8
30 minutes	1.7
15 minutes	3.3
10 minutes	5.0
5 minutes	10
1 minute	50
30 seconds	100
10 seconds	300
1 second	3000

First Aid

Seek immediate medical attention for skin burns and direct UV exposure to the eyes.

Microwave Radiation

WARNING: The lamp system utilizes high powered RF microwave energy generated by a magnetron to provide power to the UV lamp. This technology is identical to that of residential microwave ovens and like these ovens can be dangerous if misused. The lamp system is safe provided that the RF screen and gasketing are intact. Any damage such as rips or holes in the screen may cause leakage of dangerous amounts of microwave radiation. The power to the lamp is interlocked to the RF detector and will shut down if microwave leakage exceeds safe levels. Any excessive leakage will cause the system to shutdown.

Currently there are two organizations that set recommended guidelines for exposure to occupational microwave radiation exposure, OSHA (U.S. Department of labor, Occupational Safety and Health Administration – Directive 29cfr 1910.97) and ANSI (American National Standards Institute – Directive C95.1–1982). The ANSI directive, which is more stringent and most commonly referred to, states that individuals should not be exposed to microwave radiation levels above 8 mW/cm^2 at 2.45 GHz on a continuous basis, or an average of 8 mW/cm^2 over a six minute period.

RF levels near the CoolWave 2 system installation should be checked periodically. To measure RF levels, a hand-held survey meter is available from ETS-Lindgren company. Their HI-1501 Survey Meter is calibrated for 2450 Mhz microwave sources and can measure RF levels from 0–2, 0–10, and 0–100 mW/cm^2. More information can be obtained on the internet from http://www.ets–lindgren.com/.

Radio Interference

UV lamps are classified as non-consumer industrial, scientific, and medical (ISM) equipment, as defined in Federal Communications Commission (FCC) Rules and Regulations Volume 47, Part 18. As required by these rules, Nordson Corporation verifies that their systems are capable of compliance with applicable technical standards governing radiated emissions when the equipment is properly maintained and is installed in an appropriate light shield. This system complies with EN55011 (CISPR-1, Group 2, Class A).

NOTE: Nordson UV lamps operate at a fundamental frequency of 2.45 GHz. They may cause interference with wireless local area networks (WLANs) that also operate at this frequency.

Ozone

Ozone (O_3) is a colorless gas that is generated by the reaction of short-wave UV light (around 200–220 nanometers) with air, and it occurs whenever high-energy electrical discharge is present.

Ozone readily reverts to breathable oxygen when mixed with atmospheric air. Ozone should be removed from the UV source via a sealed duct and discharged to atmosphere according to local regulations. The discharge location should be away from pedestrian walkways and window openings and should be well above the average human breathing height for the area.

Regular ozone checks should be carried out every three months using an ozone meter. Recommended levels of ozone in the atmosphere of a factory should not exceed 0.1 parts per million (PPM). This level is easily obtainable if factory recommended exhaust rates are followed.

Ozone has a very distinct, strong odor even at low levels. Immediate ozone checks should be made if an operator can smell ozone. Most people can smell ozone at about one third the maximum allowable 0.1 PPM level.

Ozone exposure will cause headaches and fatigue. It will also irritate the mouth and throat. Overexposure can lead to respiratory infections.

If ozone is detected,

1. Shut down the UV system.
2. Check exhaust ducting for leaks.
3. Check the operator working area with an ozone meter.

If a person is overcome by ozone,

- Seek immediate medical assistance.
- Move the individual to a warm uncontaminated atmosphere and loosen tight clothing at the neck and waist.
- Keep the individual at rest.
- If the person has difficulty breathing, oxygen may be administered provided that suitable apparatus and a trained operator are available.
- If breathing is weak or has ceased, artificial respiration should be started.

High Temperatures

UV curing systems generally run at extremely high temperatures. A sudden shock from touching a high temperature surface might cause an operator to jump or take his attention away from other potential hazards.

When shutting down UV equipment for maintenance, allow the equipment to cool before beginning work, or wear protective gloves and clothing to prevent burns.

High Voltage

The UV curing equipment operates at high voltages up to 5000 Vdc. If any electrical faults develop, the operator should:

1. Switch the equipment off immediately.
2. Make no attempt to service the equipment.
3. Call a qualified electrician trained to service this type of equipment.

Mercury Bulbs (Lamps)

The bulbs used in UV lamp systems contain mercury. Mercury is a toxic substance and must not be ingested or come into direct contact with the skin. Under normal UV operating conditions, mercury presents no hazard as it is completely contained in the sealed quartz tube of the bulb; however, it is strongly recommended that protective gloves and eye protection be worn when handling UV bulbs, and that a mercury spill kit be readily available. Mercury spill kits are commercially available from a number of sources.

These precautions should be followed when disposing of UV bulbs:

- Place the bulb in a rigid protective carton.
- Dispose of used bulbs through a local mercury recycling center.
- Wash your hands if a bulb breaks: mercury could come into contact with your skin.
- Do not store or handle bulbs near food or beverages.

Nordson Corporation will dispose of UV bulbs free of charge provided the customer covers all shipping costs associated with returning the bulbs. For bulb disposal, please clearly mark on the all bulb containers and shipping packages: BULBS FOR DISPOSAL ONLY.

Bulbs should be shipped to:

Primarc UV Technologies
Bulb Disposal Department
2 Dan Forth Drive
Easton, Pennsylvania 18045

UV-Curable Inks and Products

Some materials used in UV curable inks, adhesives, and varnishes are toxic. Before handling them, read the Material Safety Data Sheets provided by the manufacturer, use the recommended personal safety equipment, and follow the recommended procedures for safe use and disposal.

Fire Safety

Under proper operating conditions, the surface temperature of the bulb is anywhere between 700–900 °C (1300–1700 °F), and the vapor gas inside the bulb is several thousand degrees Fahrenheit. Any form of flammable material (such as paper, lint, powder, or dirt) trapped under the lamp, within the lamp housing or in the lamp's vicinity, will result in an increased risk of fire.

To avoid a fire or explosion, follow these instructions.

- Know where emergency stop buttons, shut-off valves, and fire extinguishers are located.
- Clean, maintain, test, and repair equipment according to the instructions in this manual.

Should a fire occur, the operator must de-energize the UV equipment immediately.

Action in the Event of a Malfunction

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

- Disconnect and lock out electrical power.
- Identify the reason for the malfunction and correct it before restarting the equipment.

Safety Precautions While Servicing

A qualified competent electrician must carry out all electrical maintenance and servicing of this equipment.

WARNING: This equipment operates at high voltages up to 5000 volts dc and is therefore potentially dangerous. The electrician servicing this equipment must take all precautions.

WARNING: Isolate the equipment at the main, disconnect or lockout before removing any of the cover panels.

Control System Cleaning

Keep all contactors and relays clean and free from dirt and dust. Check them regularly.

WARNING: This equipment is not rated for explosive environments. Do not install in extremely dusty or powder-charged work rooms. Contact your Nordson representative if in doubt.

High Voltage Connections

Check the high-voltage connections within the equipment carefully to make sure that these do not become dirty or coated with powder or other possible conducting material. Clean them regularly, at least whenever the lamp is changed, possibly more often where a particularly heavily polluted atmosphere occurs.

Always make sure the unicable connectors are secure and tight before applying power.

Disposal

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

Moving and Storage

Moving or storing of the Nordson UV curing system must comply with all applicable local and state regulations. The lamphead and system controller should be shipped or stored in the original container or an equivalent and kept dry and clean at all times.

All electrical power and other services must be disconnected and the lamphead must be cool before moving or storing this equipment. Remove the bulb from the lamphead before moving the lamphead. Store or ship the bulb in the original shipping tube.

Due to the system controller's weight, it is recommended a mechanical device be used for handling and they should be kept as low to the floor as possible. Controllers should be properly fastened to an appropriate fixture such as a pallet for handling and storing.

Shipping of Nordson UV curing systems and their component parts must be done in accordance with all applicable shipping regulations including requirements for shipping of magnetic materials and mercury lamps.

Safety Symbols

The following safety symbols are used in this manual. The symbols are used along with warnings to help you operate and maintain your equipment safely. Pay attention to all warnings and follow directions to avoid personal injury.

WARNING: Mechanical or combined mechanical/electrical hazards.

WARNING: Electrical hazard.

WARNING: UV, microwave, and RF radiation hazards.

WARNING: Hot surface hazard.

CAUTION: Equipment hazard.

Section 2
Description

Introduction

This manual covers the Nordson CoolWave 2 610 Ultraviolet Microwave Curing System. It provides safety, installation, operation, and troubleshooting and repair information for the system and its components.

What is UV Curing?

Ultraviolet curing is achieved by a chemical reaction in special inks and coatings when intense UV energy is focused on them. Curing efficiency depends on UV power, coating weight, operation speed, type of substrates, material chemistry, and other factors.

The UV Curing System

The system is designed to cure UV inks, adhesives, and coatings for numerous industrial applications. The system consists of an individual 10-in. lamphead, a corresponding variable output system controller, a RF detector, and appropriate cables. Additional lampheads can be lined up end-to-end to form longer curing widths.

How Does it Work?

Inside the lamphead, a microwave generator (magnetron) operating at 2400 to 2500 MHz excites a 10-inch medium pressure UV bulb. Microwave energy from a magnetron is directed by a wave guide to the UV bulb. A screen located at the opening of the cavity allows the UV light emitted by the bulb to pass through while containing the microwave radiation.

The wavelength of the emitted UV light is between 220 and 470 nanometers. Power output is 600 watts per inch.

Light shielding is required to protect the operator and meet safety criteria. If shielding cannot fully contain the UV light, then the operator should be provided with protective equipment (refer to *Safety* in this manual).

In addition to ultraviolet light, the UV bulbs radiate heat. A constant flow of cooling air through the lamphead is required to remove the excess heat and make sure that the bulbs, reflectors, and housings remain at an acceptable operating temperature. Two versions of the lamphead are available: with an internal blower, or with a duct connection to a customer-supplied external blower.

The system controller supplies and controls the high voltage to the lamphead and provides a control circuit to interlock the lamphead with the curing machine. The unit is fitted with additional interlocks and safety features that prevent the operation of the system in an unsafe condition. The front panel of the controller displays operating and fault messages.

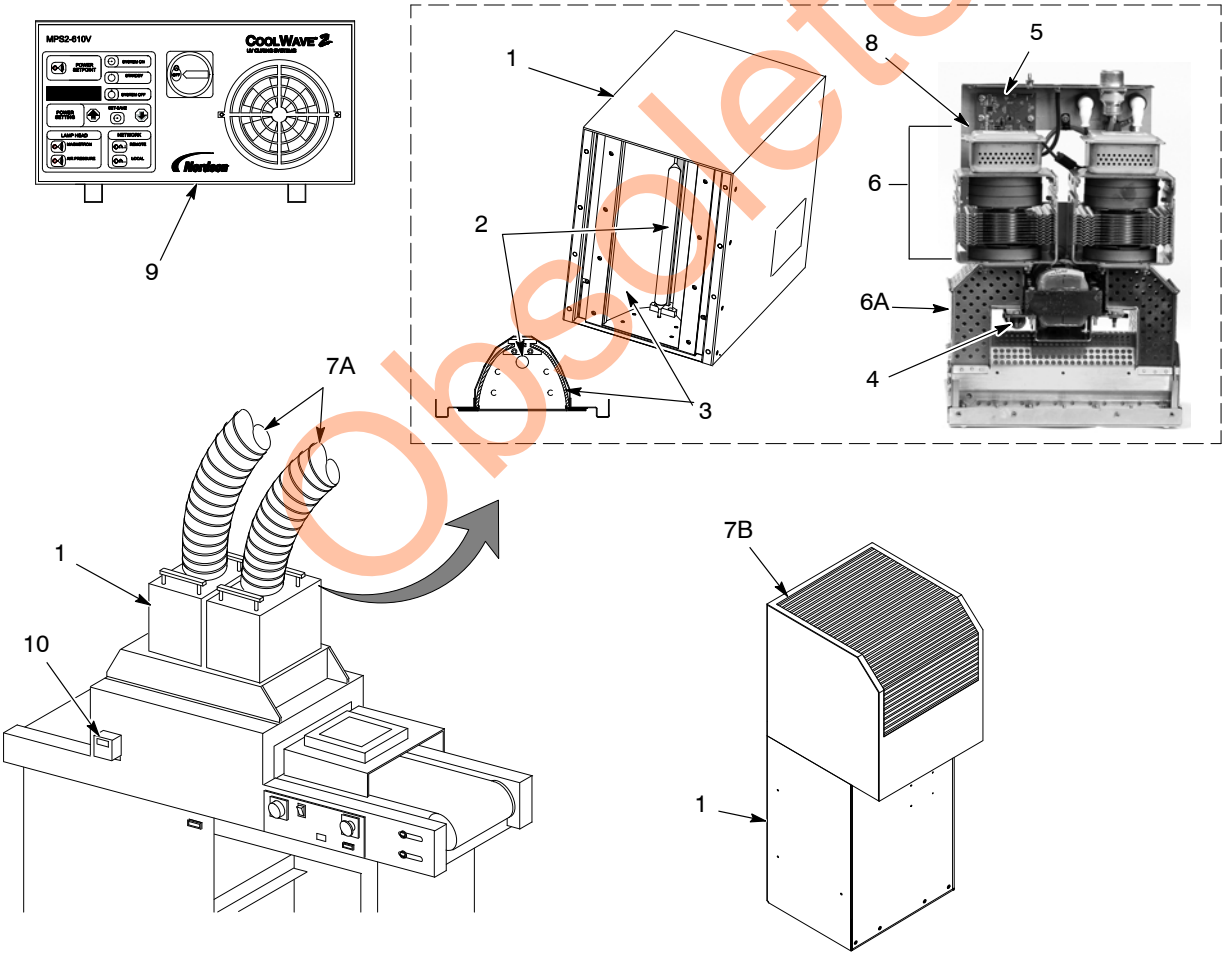
System Components

Table 2-1 and Figure 2-1 describe and illustrate the major components of a typical CoolWave ultraviolet microwave curing system. Your system may appear different depending on your application requirements.

Table 2-1 System Components

Item	Component	Description
1	Lamphead	The lamphead consists of a bulb housing, UV bulb, starter bulb, reflectors, wave guide, magnetron and filament transformer assembly, and a circuit board incorporating a light detector, temperature sensor, and pressure sensor. The patented wave guide couples the magnetron output to the bulb. Lampheads are available in internal and external blower versions.
2	Ultraviolet Bulbs	Use genuine Nordson replacement bulbs with this system. Alternative bulbs may damage the controls or overheat the reflector system. **NOTE:** The system warranty is void if genuine Nordson UV bulbs are not used. Contact a Nordson UV representative for ordering information. The system uses medium-pressure bulbs. The bulbs consist of high-purity quartz and have various fills to produce light at different wavelengths. Bulbs and controls are carefully matched to give optimum UV output and wavelength requirements.
3	Reflectors	Refer to *Reflectors* on page 2-5 for more information. Reflectors can be ordered to suit the application. Focus reflectors are elliptical in shape to guide the UV light into a tight band across the surface of the material being cured. Flood reflectors produce a wider band of light. The reflectors are manufactured from glass with a proprietary coating to give maximum UV reflectivity while minimizing infrared radiation.
4	Starter Bulb	Acts as the ignitor for the ultraviolet bulb. The starter bulb lights at the same time the magnetron is energized. After the UV bulb reaches full power the starter bulb turns off automatically.
5	Light Detector/Pressure /Temperature Board	Monitors UV light and shuts the system down if the bulb fails to emit enough light. Includes a pressure transducer that monitors the lamphead cooling air pressure and shuts off system power if the cooling system fails to prevent a catastrophic lamphead failure. Monitors temperature inside the lamphead and shuts down the system if the internal temperature goes over the limit.

Item	Component	Description
6	Magnetrons	The magnetrons are 3 KW, 2450 MHz generators that convert high voltage electrical inputs to RF energy.
6A	Waveguide	The wave guide directs the RF energy into the UV bulb, exciting a UV-emitting plasma within the bulb.
7A	External Blowers	Forced air is used to cool the UV bulb and magnetrons. If external blowers are used, they must be sized appropriately to provide the required air flow. Contact Nordson UV engineering for external cooling air guidance.
7B	Internal Blower	
8	Temperature Sensor	Monitors the lamphead internal temperature. The sensor consists of a thermistor potted to a ring-tongue terminal and cable, which is connected to the light detector board.
9	System Controller	Provides and controls high voltage to the lamphead magnetrons and controls other system functions.
10	RF Detector	Detects leakage of microwave radiation. Will shut down system if radiation is detected.



External Blower Lampheads (Mounted on Curing Machine)

Internal Blower Lamphead

Figure 2-1 System Components (Typical UV Curing System Setup)

Magnetron Operation and Life

Magnetrons consist of a cathode built into the center of a circular vacuum chamber, surrounded by permanent magnets. The chamber itself is the anode. Like a vacuum tube, a filament in the chamber is heated and bleeds off electrons which are attracted to the anode, the positive outer part of the chamber. This starts the magnetron. A high voltage power supply then apples a high negative potential to the anode, which accelerates the free electrons generated by the filament.

A magnetic field parallel to the filament is imposed by the permanent magnets. The magnetic field causes the free electrons to spiral outward from the cathode in a circular path. Spaced around the rim of the chamber are cylindrical cavities open along their length and connected to the common cavity space. As electrons sweep past these openings, they induce a resonant, high-frequency electrical field in the cavity. A short antenna directs the high frequency (2.4 GHz) microwave energy into the waveguide which contains the energy and directs it to the UV bulb.

Although magnetrons have no moving parts, they do eventually wear out and fail. The filament will slowly lose its ability to emit electrons to the point where the magnetron cannot start. The filament can fail open, or short to the anode. Magnetrons generate a lot of heat, and the heat can eventually cause the permanent magnets to lose energy and cause the magnetron to fail. Heat can also cause the ceramic antenna cap to crack and lose vacuum causing magnetron failure. An imbalance in the frequency output from the magnetrons can shorten their life as they then try to couple energy into one another. This typically causes the ceramic antenna cap to break, permanently damaging the magnetron.

Reflectors

The reflectors are manufactured from borosilicate glass with a proprietary coating to provide maximum UV reflectivity while minimizing infrared radiation. Two types of reflectors are available for the lamphead: focus and flood.

- The focus reflectors are available in 2.1 (53 mm) and 3.1 inch (79 mm) focal lengths. The focal point is measured from the bottom of the lamphead. See Figures 2-2 and 2-3.
- The flood reflectors produce a wider band of UV light. See Figure 2-4.

2.1 Inch Focus Reflector

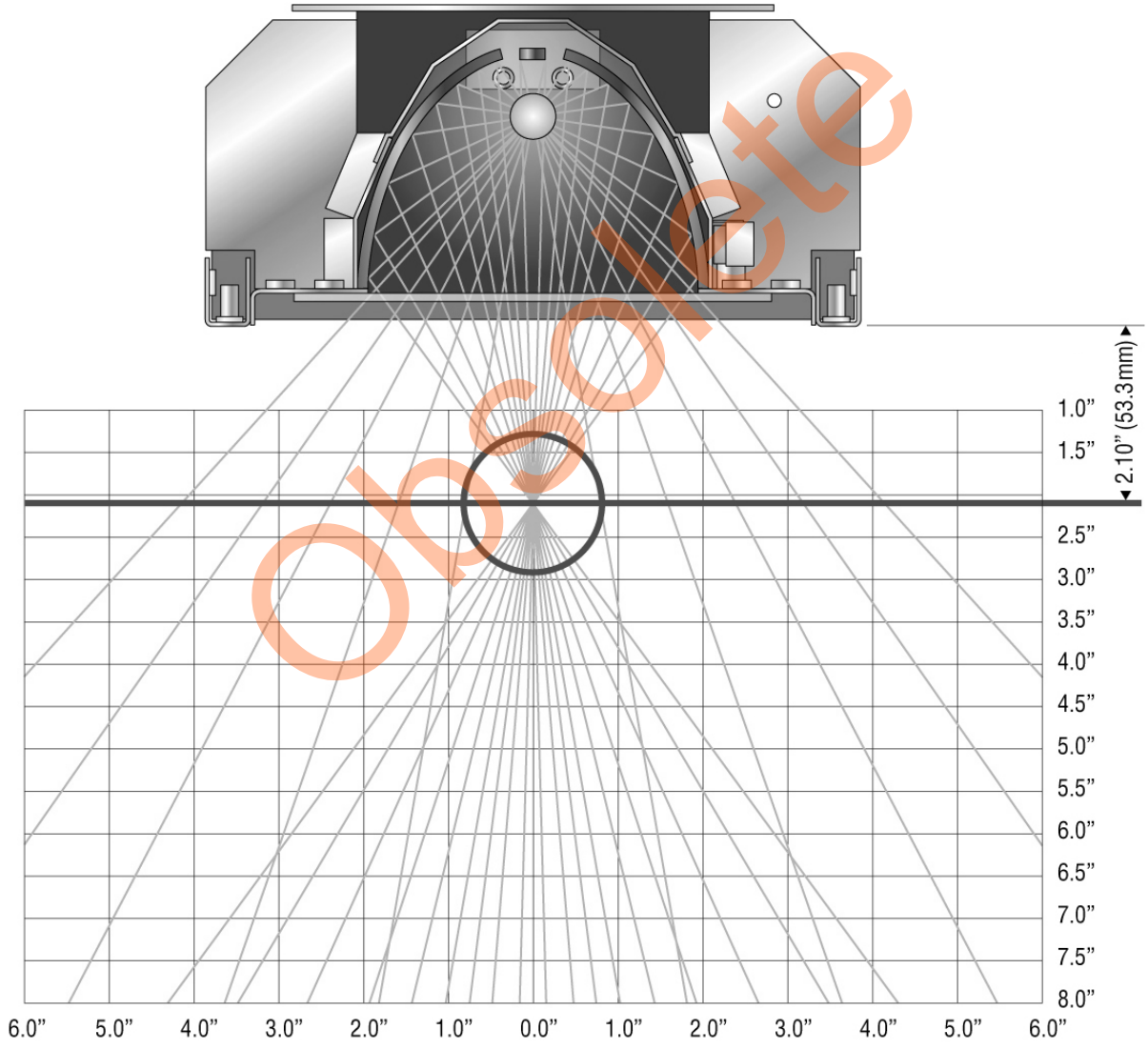


Figure 2-2 2.1 Inch Focus Reflectors

3.1 Inch Focus Reflector

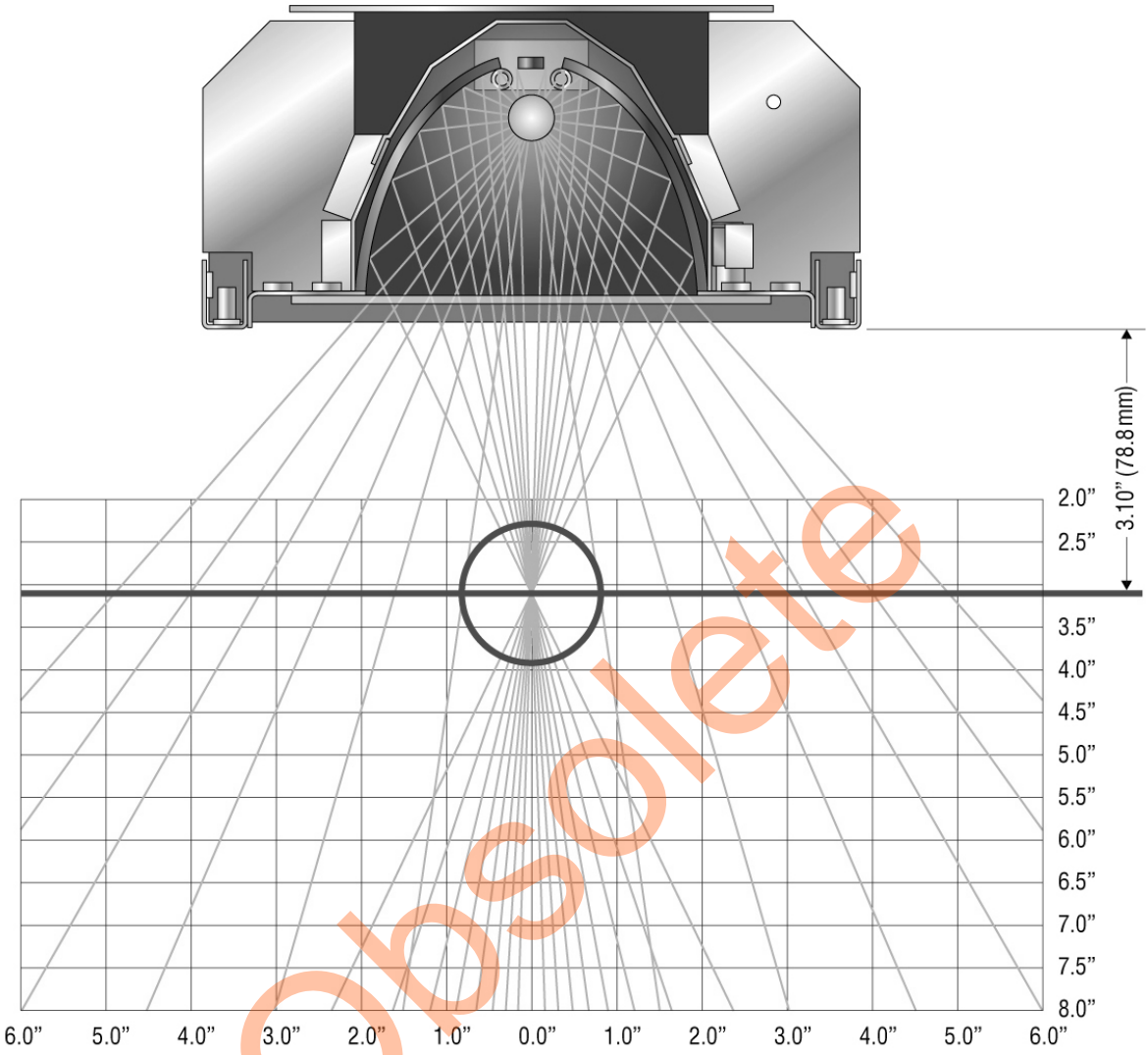


Figure 2-3 3.1 Inch Focus Reflectors

Flood Reflector

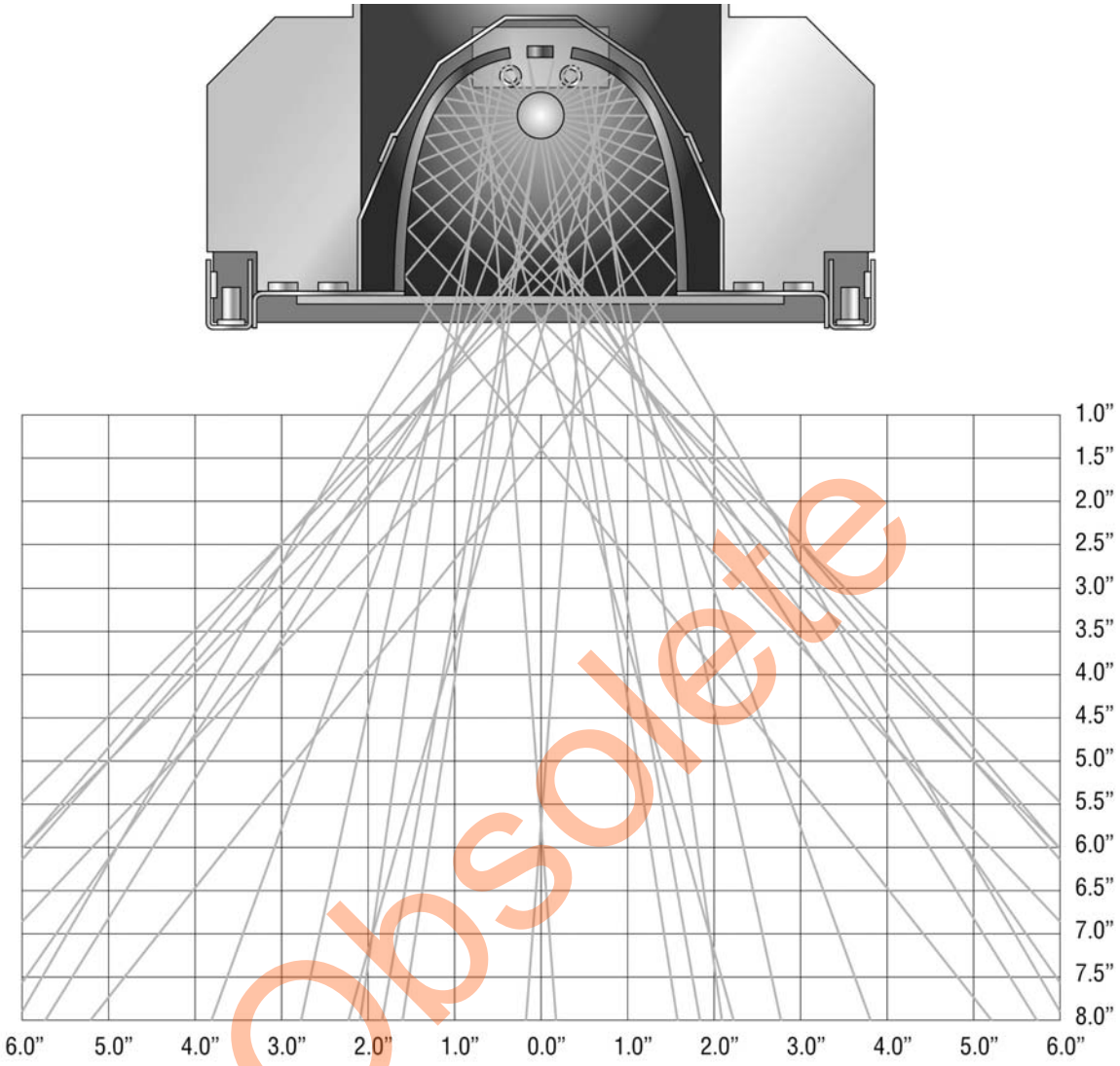


Figure 2-4 Flood Reflector Diagram

Options

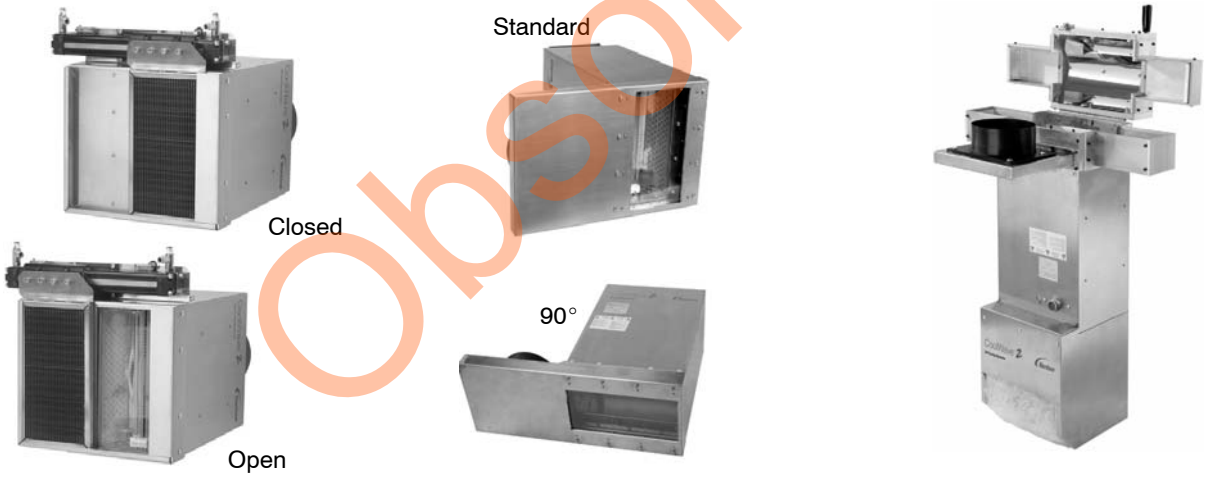
Each CoolWave system lamp head can be fitted with optional patented components for maximum operating performance.

AirShield Ventilation System: The modular patented AirShield ventilation system installs a high-quality quartz plate between the lamphead and the product to protect the product while maintaining cooling air flow through the lamphead.

LightTite Shutter: Installed on the lamphead, the pneumatically powered proprietary Nordson LightTite shutter opens and closes instantly to block UV light without turning off the lamp head and system controller. The LightTite shutter is ideally suited for systems running manually loaded and unloaded parts, or heat-sensitive parts where accurate control of UV exposure is required.

ThruCure Continuous Coating System: A hinged aluminum curing chamber equipped with customer-machinable entrance and exit vestibules and additional reflectors for a 360 degree cure that mounts on the lamphead. The ThruCure system can also be fitted with an optional nitrogen inerting system.

Contact your Nordson representative for more information on these options.



LightTite Shutter System | AirShield Ventilation System | ThruCure Chamber

Figure 2-5 Lamphead Options

Section 3
Installation

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

Introduction

This section contains information for installing the CoolWave 2 10-inch lamphead and system controller. Mounting and shielding are explained in general terms due to differences for each independent installation.

Inspection and Packaging

The Nordson CoolWave system has been carefully tested, inspected, and packaged prior to shipping. Upon receipt, inspect the shipping materials and components for visible damage. Report any damage immediately to the shipper and to your Nordson representative.

NOTE: When opening the packaging, please take care so that the packaging can be re-used to ship the unit if necessary. Keep all packaging materials together and in a location where they will not get damaged.

System Controller Installation

Mounting Guidelines

WARNING: Heavy equipment. Be careful when moving the system controller. Use approved lifting equipment or get help. Failure to observe this warning could result in personal injury or equipment damage.

See Figure 3-1.

- The system controller can be mounted on any stable horizontal surface.
- Install the system controller so the operator panel and disconnect switch are easily accessible.
- The blowers mounted on the front and the rear of the system controller and the exhaust vents on the sides must not be obstructed.

- Leave at least six inches of ventilation clearance on all four sides of the system controller.
- If the system controller is mounted in an enclosure, there must be free and unobstructed ventilation from top to bottom and side to side within the enclosure. Contact your Nordson representative for enclosure cooling requirements.

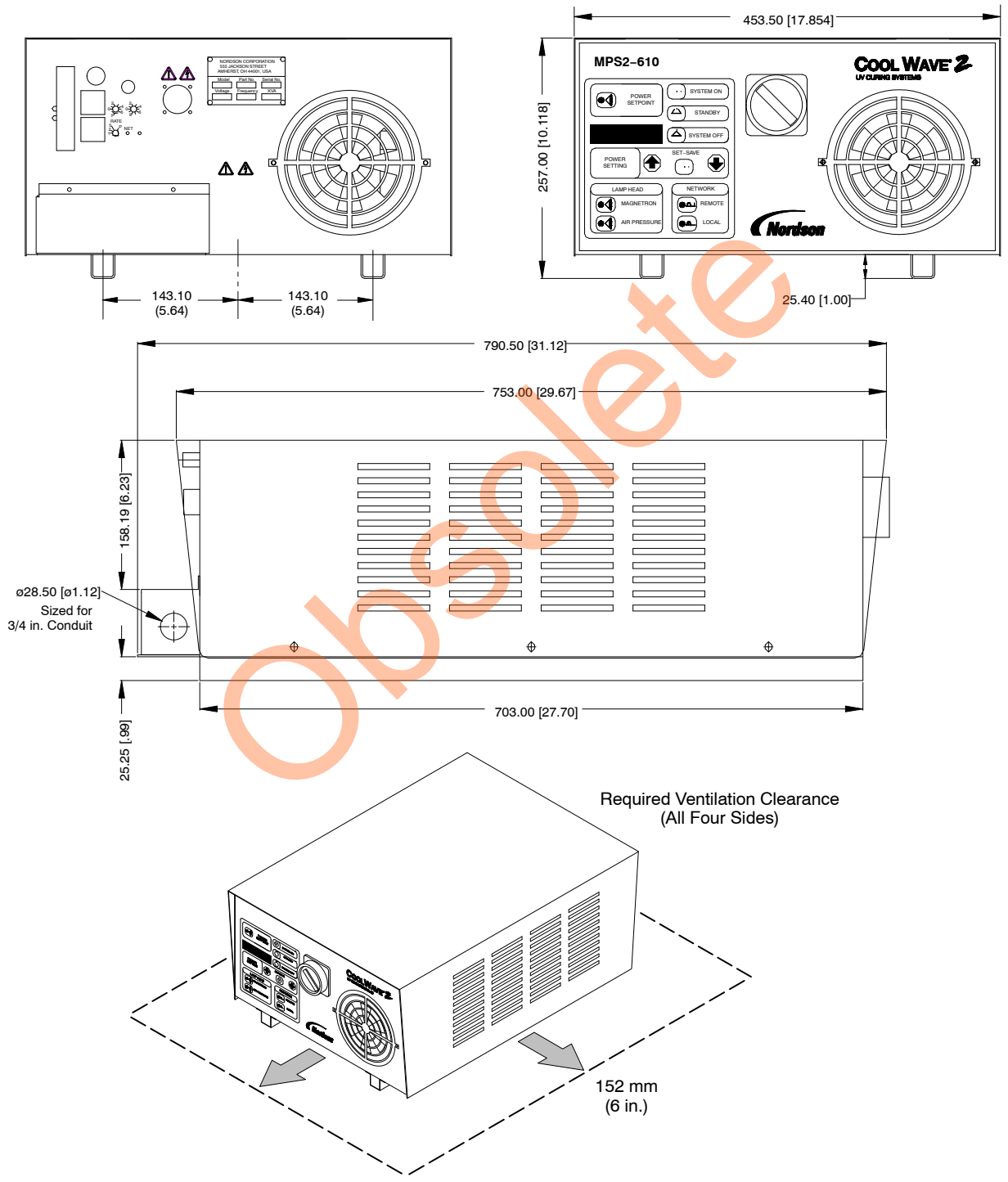


Figure 3-1 System Controller Dimensions and Required Ventilation Clearance

Power Connections

NOTE: Power must be supplied from a dedicated source with a disconnect switch.

See Figure 3-2.

The customer power source must be wired in accordance with either the National Electric Code, Part I or the Canadian Electrical Code, Part I, or local codes. At a minimum, 10 AWG 600 volt wire is required unless superseded by local codes. Four #10–32 studs provide for line connection.

Refer to the system controller ID plate for the input voltage and verify the transformer tap wiring using Tables 3-1 and 3-2. Measure the incoming power source voltage from the main power supply. Incoming voltage transients shall not exceed 150 volt amplitude and have a frequency content of less than 500 Hz.

- The power line input is three phase (three wire with ground).
- Refer to Table 3-1 for the T1 and T2 high-voltage transformers. Each has a terminal block with H1, H2, and H3 terminals.
- Refer to Table 3-2 for the T3 control transformer.
- All transformers must be wired for the same input voltage.

Table 3-1 High Voltage Transformer Taps (T1 and T2)

Input Voltage Range	Transformer Tap
440–480	H1–H3
380–440	H1–H2

Table 3-2 Control Transformer Taps (T3)

Input Voltage	Transformer Tap
480	H1 and H4
400	H1 and H3
380	H1 and H2

Refer to Tables 8-2 and 8-3 in the *Specifications* section for current demand during normal full-power operation. Size supply wiring and circuit breakers or fuses to allow for heavy current draw during startup.

To connect power to the system controller, remove the voltage cover on the back of the enclosure. Connect power wiring to the terminals labeled A (L1), B (L2), C (L3), and Ground.

Power Connections *(contd)*

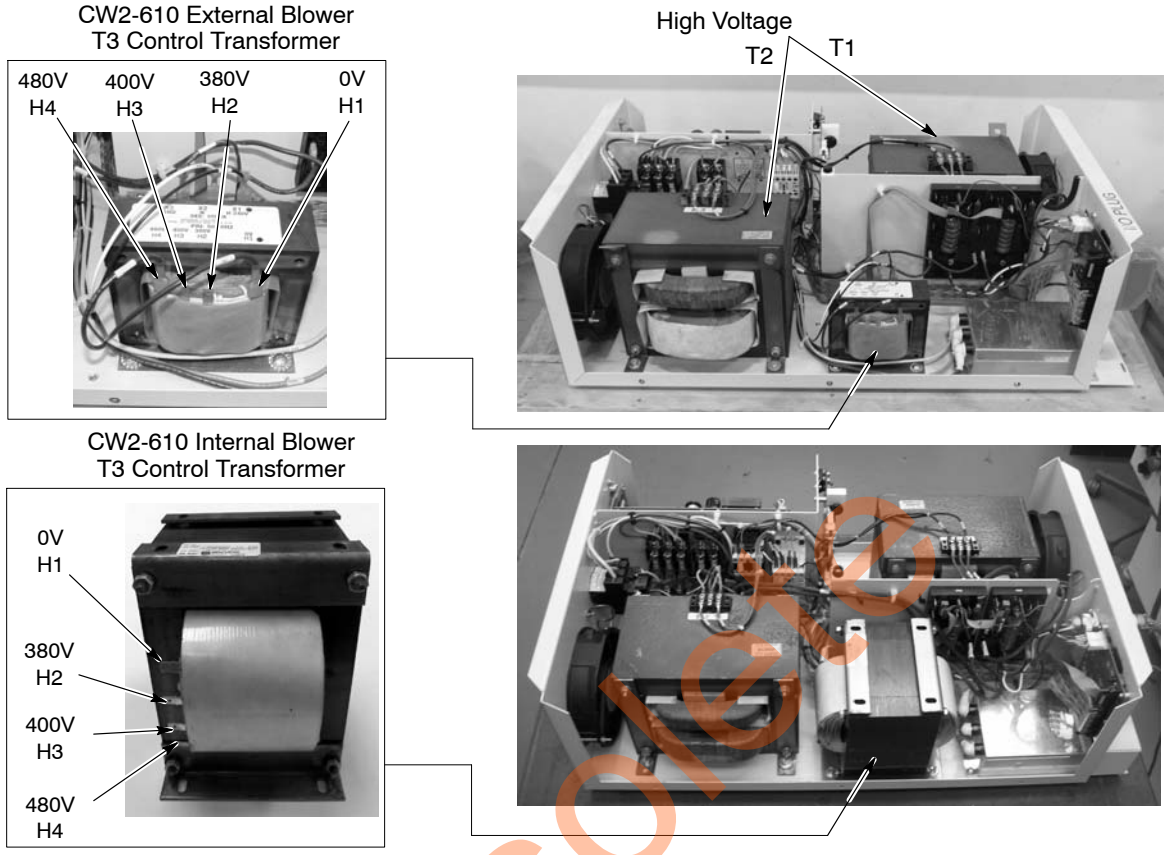


Figure 3-2 System Controller Transformers

Power Load Balancing

Refer to the System Connection Diagrams. If you are supplying power to more than one system controller from a single source, shift the phases to balance the load as shown in Figures 3-4 and 3-5. If you have more than three system controllers, repeat the phase shift sequence again starting with the fourth system controller.

System Connection Diagrams

Only the network configuration settings are shown in the following diagrams. All other settings are optional and depend on the application. Refer to Table 3-6 for all configuration settings.

Unicable Connection: Refer to page 3-21.
RF Detector Installation: Refer to page 3-22.

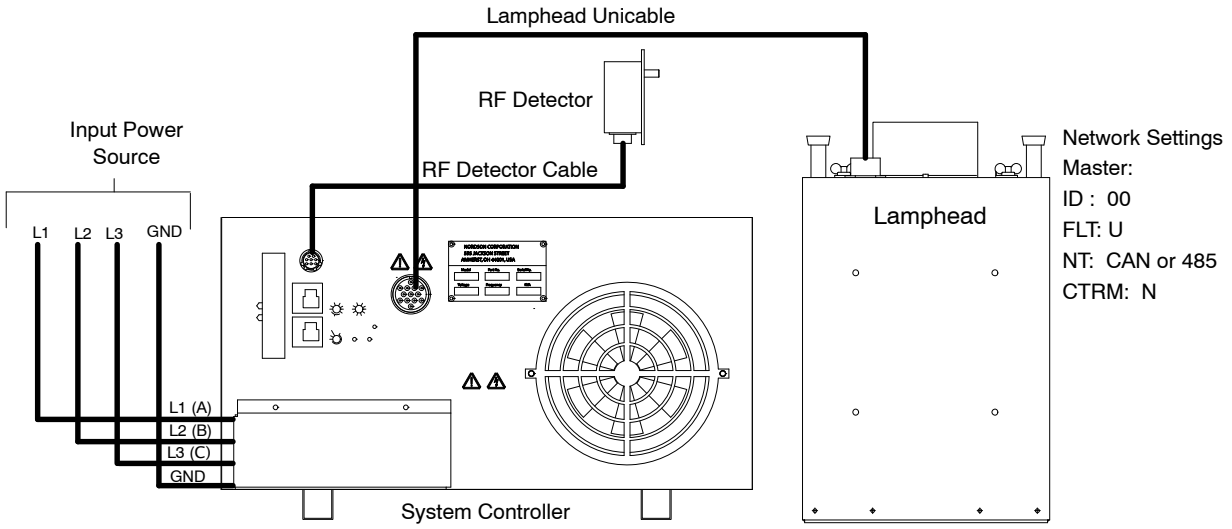


Figure 3-3 System Connection Diagram – Stand Alone System

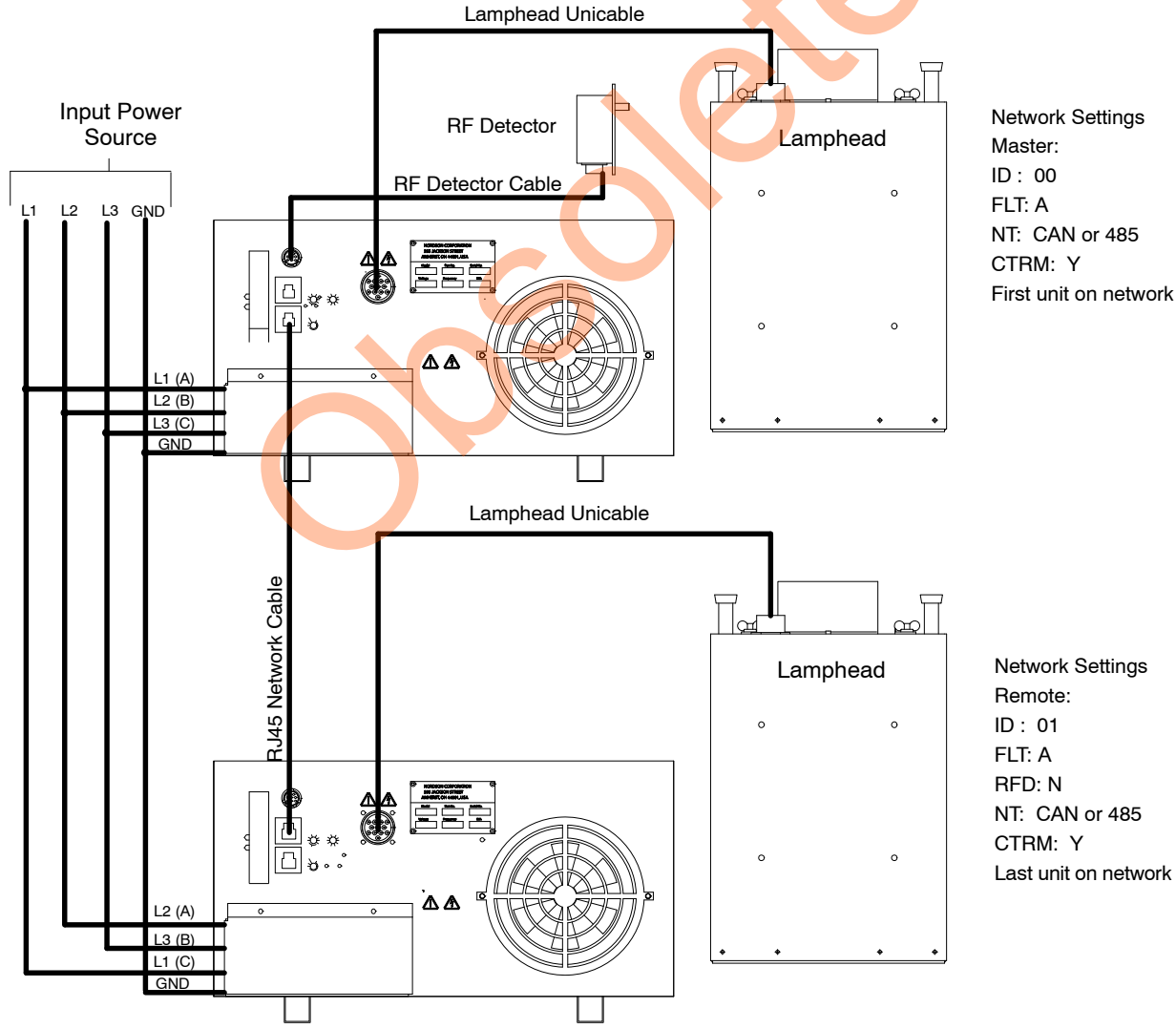


Figure 3-4 System Diagram – Two Systems, One RF Detector, One Network

Power Connections *(contd)*

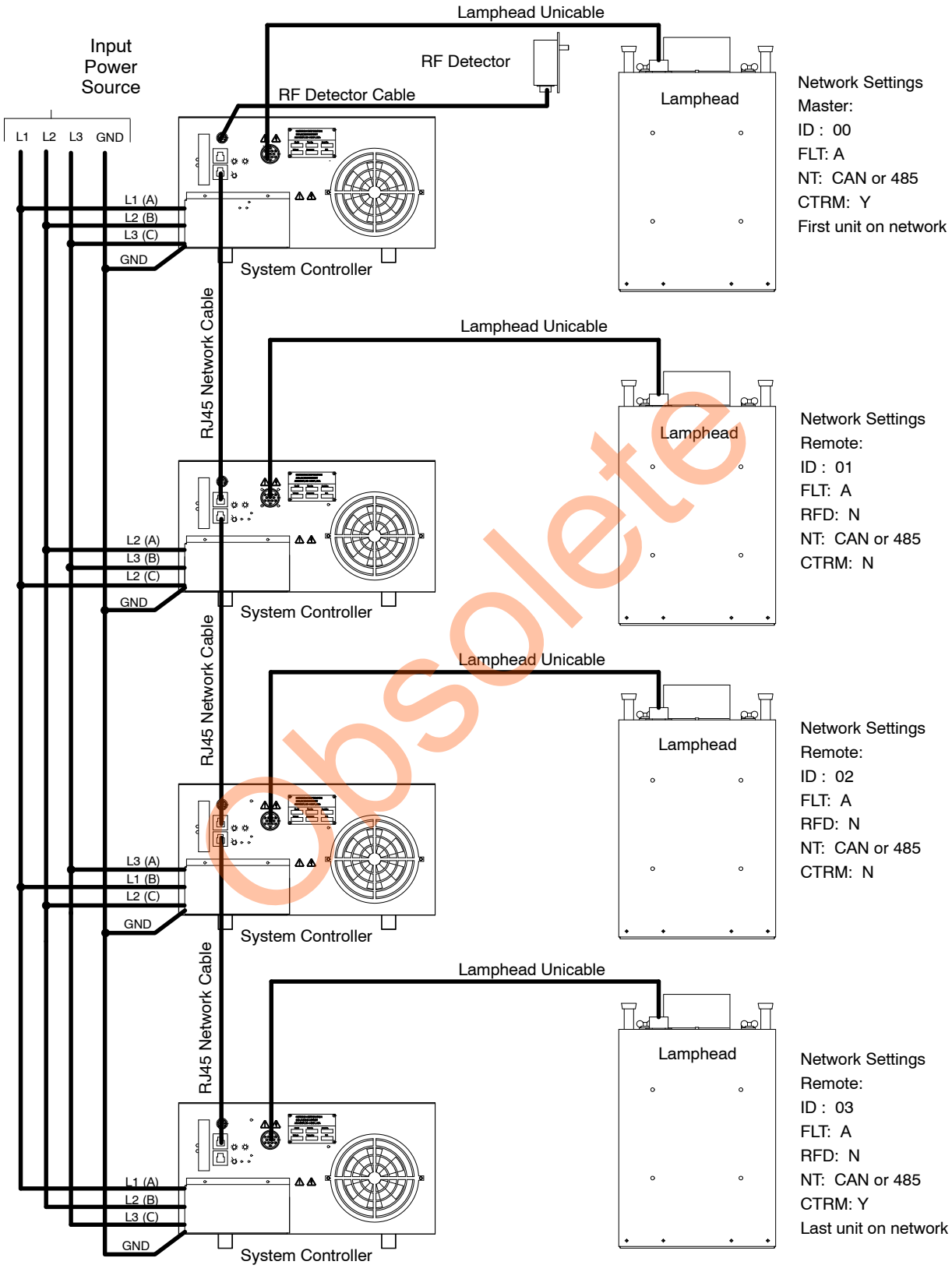


Figure 3-5 System Diagram – Four Systems, Two RF Detectors, One Network

Network Connections

See Figures 3-3, 3-4, and 3-5. Up to 16 system controllers can be connected together with RJ-45 cables to form a network, which can then be operated from the master controller front panel or from a remote source.

Master/Remote: When you configure the system controllers, you can set one unit (usually the first unit in the chain) as the Master, with the rest as Remotes. This is done through the ID configuration selection for each controller. The master is always configured as ID: 00; the Remotes as ID: 01.....15.

Termination: The first and last units on the network must be terminated to prevent transmission line data errors. This is done through the CTRM configuration selection for each controller. CTRM: Y is terminated; CTRM: N is not terminated.

Refer to System Controller Configuration on page 3-23 to make these settings.

Remote Inputs and Outputs

Refer to Figure 3-6 and Table 3-3. All inputs and outputs from the Remote I/O connector are normally open relay contacts and are rated for 24 Vdc. If you are using the PLC interface, refer to the DeviceNet specifications in Section 10 of this manual.

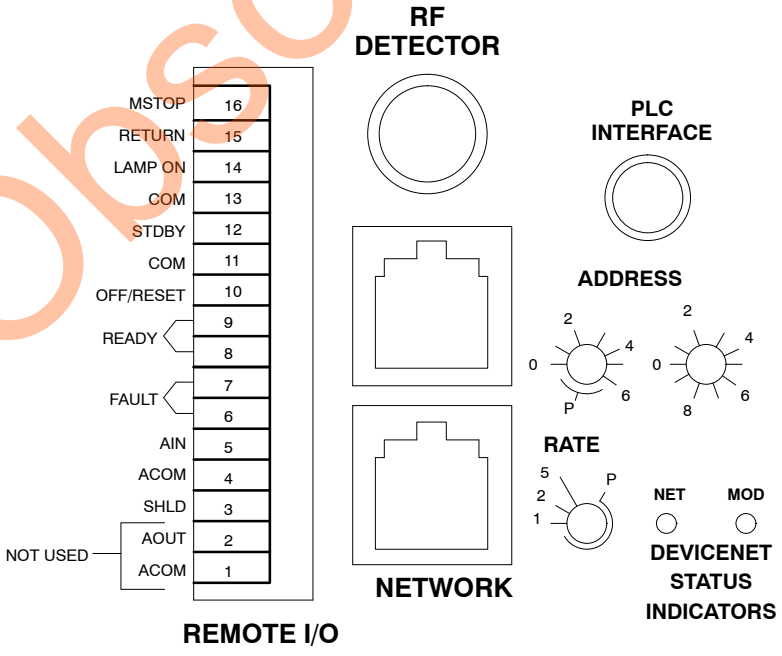


Figure 3-6 Remote I/O Connections

Table 3-3 Remote Inputs and Outputs

Connector Type	Pin	Function	Description
Input	16	Machine stop interlock (MSTOP) +	If this input is not interfaced to external equipment, a jumper must be installed across the pins. Opening this input turns off the lamp, sets the FAULT output, and causes the FAULT EXTERNAL INTERLOCK OPEN fault message to appear on the display. On I/O boards with the DeviceNet option this interlock can be configured for normal contact closure (Default setting) or isolated 24VDC. Refer to Machine Stop Interlock Jumper Setting on page 3-9.
	15	Machine stop interlock (RETURN) –	
Input	14	Lamp ON (LAMPON)	Remotely controls the system controller when operating in Remote mode. A pulse or momentary contact closure to this input turns the CoolWave lamphead on. (The Off/Reset contact must be closed.) The Off/Reset contact must be opened to turn the lamphead off.
	13	Lamp ON (COM)	
Input	12	Standby (STDBY)	**With Idle Mode Disabled** (see IDLE in the System Controller Configuration section on page 3-25) – Controls the system controller when operating in Remote mode. A pulse or momentary contact closure to this input places the system in Standby mode. (The Off/Reset contact must be closed.) **With Idle Mode Enabled from Lamp ON State**– The first pulse or momentary contact closure to this input places the system in Idle Mode. A second pulse or momentary contact closure places the system in Standby mode. **With Idle Mode Enabled from Lamp OFF State** – A pulse or momentary contact closure to this input places the system in Standby mode. **Note:** Idle Mode can only be achieved from Lamp ON state.
	11	Standby (COM)	
Input	10	Off/Reset	Controls the system when operating in Remote mode. This contact must be closed for the lamphead to be turned on. Opening the contact turns the lamphead off and clears a fault condition. Use Pins 11 or 13 as Off/Reset (COM).
Output	9	Ready	Contact closes after the system controller is turned on and the light detector senses light output. In a networked system all system controllers must be turned on and all light detectors sense output.
	8	Ready	
Output	7	Fault	Contact closes whenever there is a fault present on the system.
	6	Fault	
Input	5	Analog Input (AIN) + Remote Power Level Control	Remotely varies the UV light output from 20% to 100% in 1% increments when the system is in Remote mode. This input can be configured for 4–20 mA or 0–10 Vdc. Refer to *System Controller Configuration* on page 3-24 for instructions.
	4	Analog (ACOM) –	Common
Ground	3	Shield (SHLD)	Earth ground
Output	2	Analog Output (AOUT)	Not used. Do not connect.
	1	Analog Common (ACOM)	Not used. Do not connect.

Machine Stop Interlock

CAUTION: Allow only qualified personnel to service the equipment. All power must be disconnected. Follow the safety instructions in this document and all other related documentation.

The Machine Stop interlock (Remote I/O pins 15 and 16) can be configured for Normal or Isolated operation on I/O boards with the DeviceNet option by changing the J1 and J2 jumper positions on the Remote I/O circuit board.

Jumper Position	Pins	Description
Normal	MSTOP (15, 16)	Input compatible looking for contact closure only. This is the only interlock operation mode available on controllers without DeviceNet.
Isolated (ISO)	MSTOP (15, 16)	External 24 Vdc @ 5 mA is required to maintain interlock contact closure. This is available only on controllers with DeviceNet.

See Figure 3-7. To access the Machine Stop Interlock jumpers remove the system controller cover. The jumpers are on the back of the I/O connector circuit board.

- The signal voltage range for the Isolated Machine Stop Interlock is 20–30 volts DC.
- Both jumpers must be set to one of the two positions as shown in Figure 3-7.

CAUTION: Any other jumper combination is invalid and will cause damage.

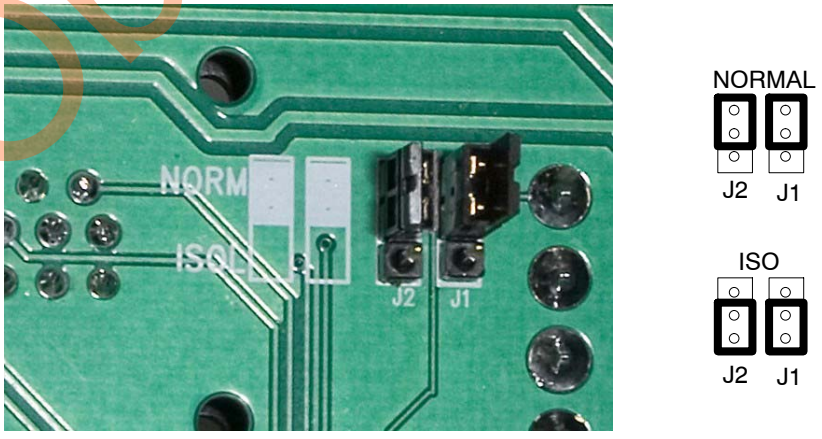


Figure 3-7 Machine Stop Interlock Jumper Settings – Shown Set To NORMAL

Remote Power Level Control

The Remote Power Level Control (AIN inputs 4 and 5) function adjusts the UV light output based on an external analog signal. This function must be enabled and configured for 4–20 mA or 0–10 Vdc.

- Refer to Table 3-3 and Table 3-5 for connection and configuration instructions.
- Refer to Table 4-4, step 5, in the *Section 4, Operation* for Power Level setting instructions.

Idle Mode

Idle Mode is a low power state used to quickly switch the lamp from curing power to an inactive, low light and heat state. Refer to Table 3-3 and Table 3-5 for connection and configuration instructions.

The system must be in Lamp ON state to activate Idle Mode from the power control, the Remote I/O, or through the DeviceNet network.

NOTE: The lamp should not remain in Idle Mode for longer than necessary. After 10 minutes in Idle Mode the lamp reverts to Standby mode.

Table 3-4 Cycle Timing for Idle Mode

Cycle Timing	
Idle to Lamp ON	3 seconds
Lamp ON to Idle	2 seconds

Remote Standby and Lamp On

The Off/Reset contact (I/O 10, 13) must be closed for the unit to go to **Standby** or **On** mode. Once the lamphead is in Standby or On mode the lamphead remains in that mode until the Off/Reset contact is opened.

Standard Startup: Use to go from off, through the warm-up sequence, to the SYSTEM ON mode.

1. On the host machine (or the master system controller), press the SYSTEM ON button.
2. The unit goes through the warm up cycle for 15 seconds before turning On.
3. After approximately 10 more seconds the unit has stabilized and is ready to run. The system ready output contact closes.

Quick Startup: Use to go quickly from STANDBY mode to SYSTEM ON mode.

1. On the host machine (or master system controller), press the STANDBY button. Power is applied to the magnetron filament to prepare it for operation.
2. After approximately 15 seconds the magnetron filament is warmed up. The system goes into standby mode and remains there indefintely.

NOTE: Do not leave the system controller in the standby mode for longer than 30 minutes. Prolonged standby periods shorten the magnetron life.

3. Press the SYSTEM ON button to turn on the UV lamp. The lamp turns on instantly but takes approximately 10 seconds to stabilize. After 10 seconds, the system ready output contact closes.

Quick Cycle Using Idle Mode

NOTE: IDLE configuration must be set to IDLE Y to enable Idle Mode. See IDLE in the System Controller Configuration table on page 3-25.

1. Begin by using the Standard or Quick Startup procedures on page 3-10 to achieve Lamp ON state.
2. Initiate Standby command (locally or remotely).
3. The unit immediately switches to Idle State (within 1 second).
4. To return to curing, initiate the Lamp ON command (locally or remotely).
5. The UV lamp turns on but full output is not available until the bulb has reached operating temperature, which takes approximately 5 seconds.

This process can be repeated as required.

DeviceNet Installation

Chassis Isolation

DeviceNet Drain to Chassis	The drain wire is referenced to the chassis ground through one megohm resistance.
V+ and V– to Chassis	The DeviceNet power is not referenced to chassis ground with any impedance other than the stray capacitance due to the pc board layout. The board is designed to withstand +/– 500 volt test applied between the V+ and V– and the chassis.
CAN_H and CAN_L to Chassis	The circuit is designed to withstand the application of a +/– 500 volt test applied between these data lines and the chassis.
CAN_H to CAN_L Isolation	The CAN transceiver is fully compatible with the ISO 11898–24V specification. An un-powered node will not disturb the CAN bus lines.

BUS Power

BUS Sense Circuitry	The system controller has an isolated physical layer. An optical isolator is used to monitor the BUS power, the loss of which results in an un-powered transceiver.
Hot Plugging	The system controller can be hot plugged into a DeviceNet network. Inrush current is limited to less than 500 milliamps for less than 50 microseconds.
Mis-Wiring Protection	The system controller supports mis-wiring protection as defined in the DeviceNet Specification (Section 10 of this manual).

Hardware Specifications

The hardware design of the DeviceNet Interface follows ODVA recommendations. The interface can be found on the rear of the CoolWave2 system controller.

Interface Connector	Sealed micro connector is specified in ODVA specifications Volume 1, Release 2.0, Errata 2. Appendix C, table C.3. CoolWave2 uses a Phoenix connector.
Indicators	Red and green LEDs indicate the status of the module and the network.
Node Address Switches	Two 10-position rotary switches for setting the MAC ID.
Data Rate Switch	A 10-position rotary switch to set the data rate to 125, 250, or 500k Baud.

Software Specifications

Refer to Section 10 for the DeviceNet Interface Module specifications.

Lamphead Installation

The lamphead mounting must include provisions for UV light shielding and cooling air ductwork and venting. Each application has different constraints and therefore requires custom-designed enclosures and light shielding. Contact Nordson UV systems engineering department for help with designs.

Mounting Guidelines

Figures 3-9 and 3-10 provide the physical dimensions of the CoolWave 2 lampheads. See page 2-5 for focal lengths. Install lampheads with focus reflectors with the base positioned as follows:

2.1 focus reflectors: 53.3-mm (2.1-in.) above the substrate
3.1 focus reflectors: 78.8-mm (3.1-in.) above the substrate

NOTE: Flood reflectors have no set distance. The base to substrate distance is not as critical and can be adjusted to vary the dosage and intensity.

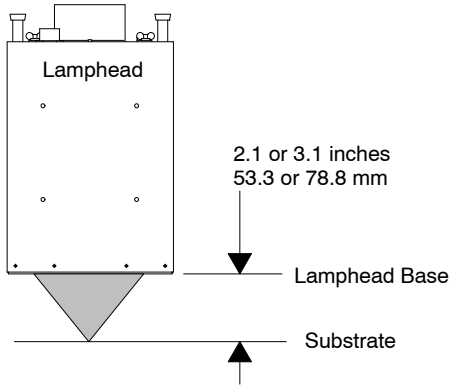


Figure 3-8 Focus Reflector Lamphead Mounting

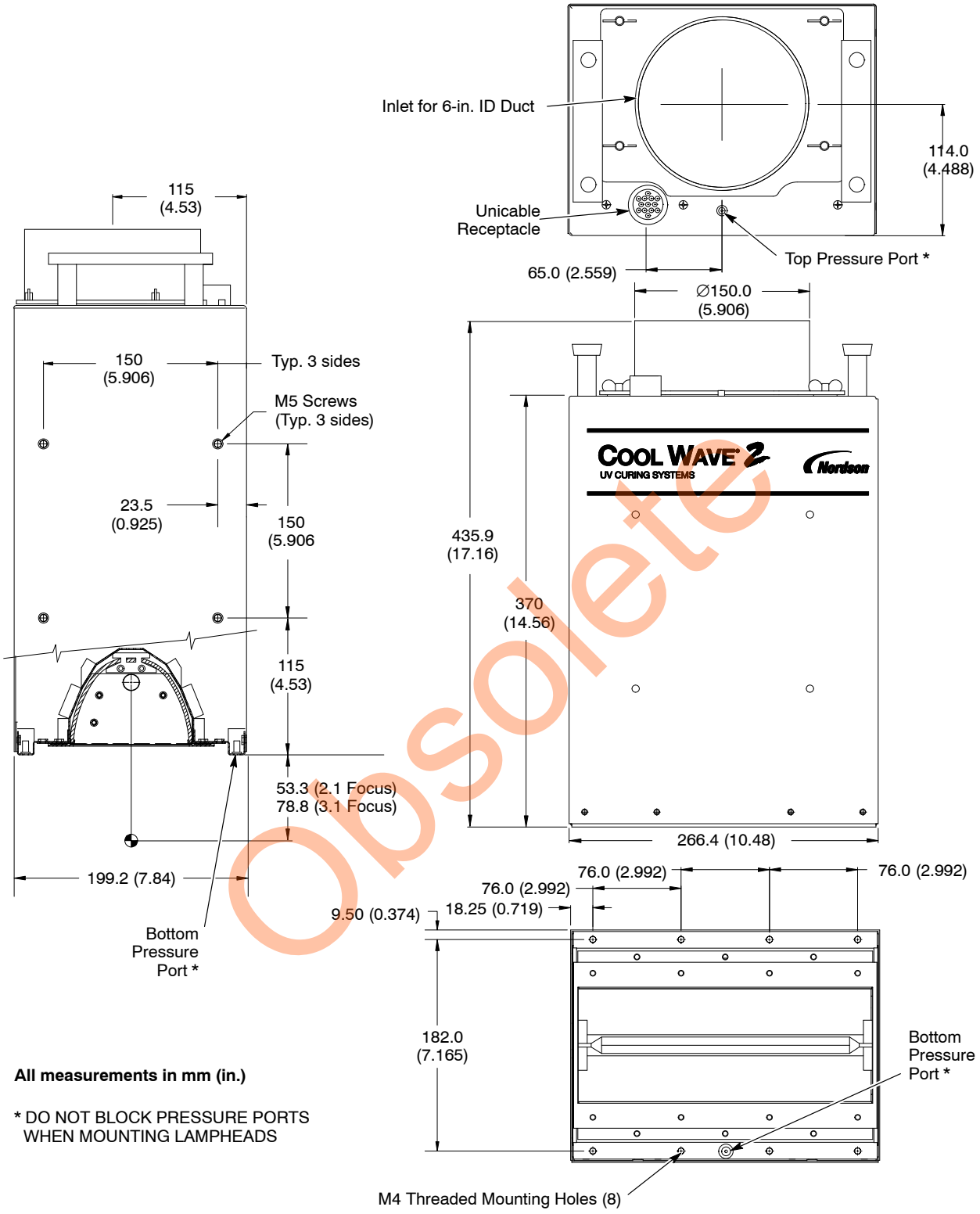


Figure 3-9 Lamphead Dimensions – External Blower Version

NOTE: Refer to page 3-18 for top and bottom pressure port usage. It is important that the pressure port being used to measure differential pressure not be blocked, and that the appropriate port be used depending on the cooling air and exhaust air arrangements.

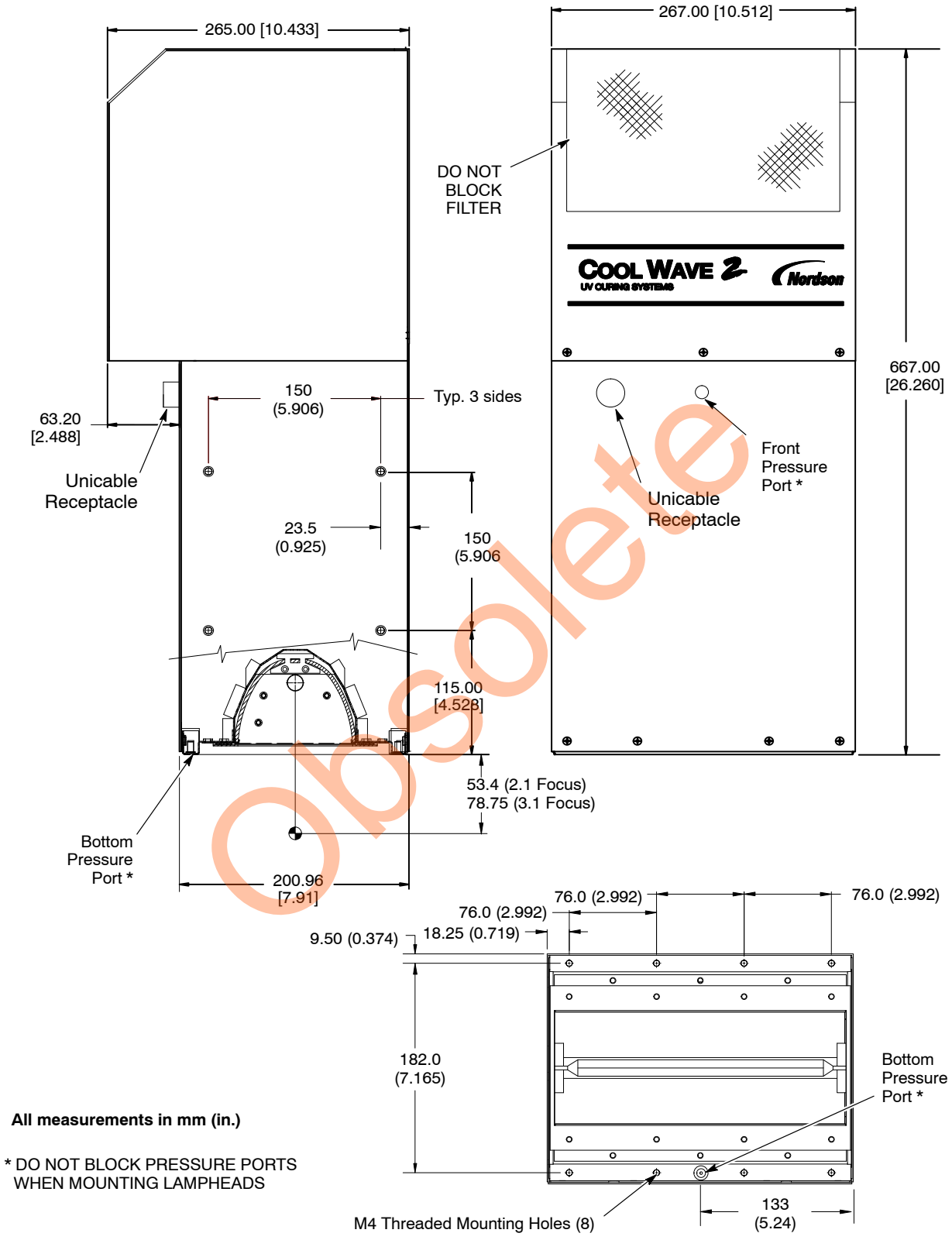


Figure 3-10 Lamphead Dimensions – Internal Blower

Optional Mounting Kit for Lampheads

An optional adjustable bracket, mounting plate, and screws are available as a kit for flexible mounting of lampheads. Refer to page 7-13 in *Parts* for the kit part number and mounting instructions.

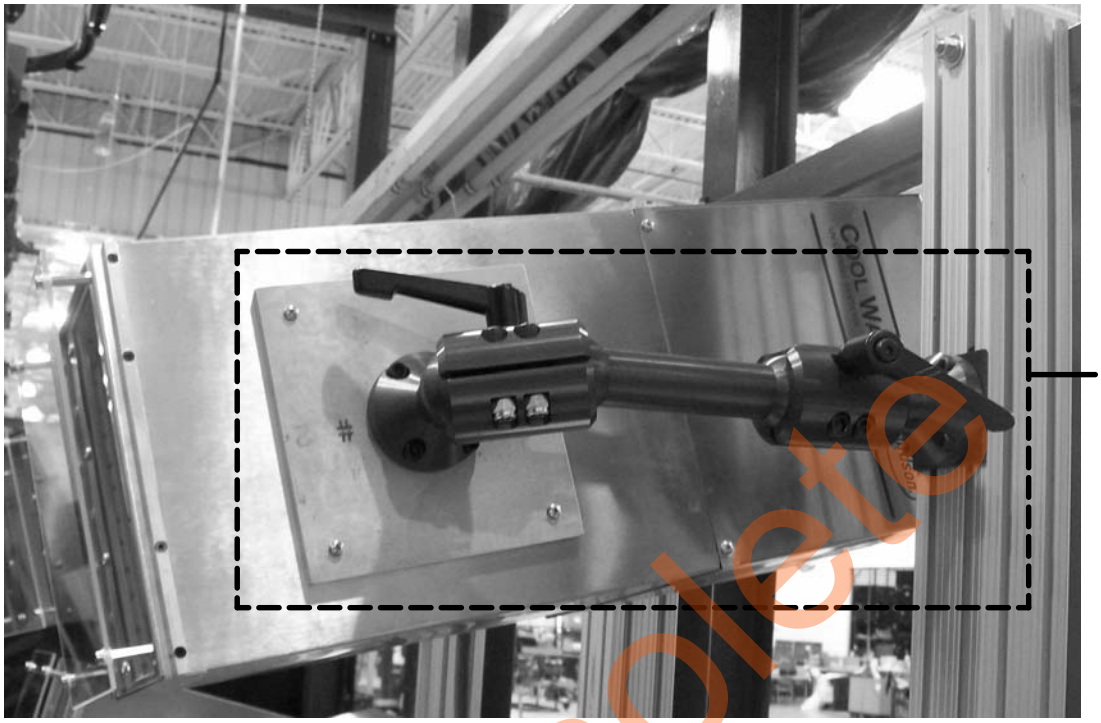


Figure 3-11 Optional Adjustable Mounting Bracket

Light Shielding

Personnel in the area should be shielded from the UV light.

- Provide adequate shielding of UV light. The lamphead must be enclosed so that no UV light is allowed to escape.
- Any louvered material used for exhaust must be a light-shielding design.
- If UV light does escape the operator must wear approved UV-protective clothing and eyewear.

Cooling Air Installation

Internal Blower Lampheads

Internal blower lampheads do not require a cooling air source. However, the flow of cooling air must not be restricted or impeded, either at the inlet or the outlet. If an AirShield ventilation system or any type of exhaust-restricting devices are used, the exhaust air must be evacuated to ensure adequate cooling air flow. Refer to the AirShield Ventilation System instructions on page 3-17.

External Blower Lampheads

For lampheads without internal blowers, the customer must supply cooling air through ductwork to each lamphead. The duct connection is for 6-in. ID ducts. If you plan on using variable speed external blowers, contact Nordson UV engineering for advice on the design of the air handling system.

The following specifications must be maintained for all applications at all times or the life of the lamphead will be greatly reduced with the possibility of failure:

- Unimpeded and unrestricted flow of cooling air through the lamphead.
- Constant static pressure of 7-in. water column measured from the inside of the lamphead to atmosphere.
- 350+25% CFM of filtered airflow through the lamphead.

It is important to size the cooling air blower to provide at least an additional 25% of cooling air measured at the duct inlet just prior to the lamphead. Size the blower to accommodate all losses in the ducts and ensure that the specified air flow and pressure are delivered to the lamphead.

NOTE: Recommended Flexible Duct Hose for External Lamphead cooling air: McMaster-Carr part number 55125K26, neoprene coated 6-in ID hose. Use worm clamps to connect the hose to the lamphead.

In many applications cooling air is provided to multiple lampheads from a common source. In these installations it is recommended that air flow adjustment dampers such as the Fantech IR-6 iris damper be added to the ducting as close to the lamphead as possible, within 0.5 meters (1.6 ft), for proper air flow balancing.

Once the system is up and running, check the pressure inside the lamphead by pressing the LAMPHEAD – AIR PRESSURE button on the face of the system controller. Refer to *Operation* for startup procedures.

Exhaust Requirements

Lamphead cooling air must be exhausted when lampheads are enclosed in a cure chamber or when the air flow is restricted and/or captured at the lamphead face.

When lampheads are installed in a cure chamber and the lamphead cooling air is exhausted to the open air within the chamber you must size the chamber exhaust system to evacuate at least 125% of the air flow into the lampheads. You must also factor in the capacity to remove all air in the chamber including air flow into the chamber through all openings, doors, conveyors, and cracks. The air flow required is the sum of all the lampheads and openings and must be at a static pressure great enough to keep a negative pressure in the chamber.

When an AirShield Ventilation system, quartz plate, or any other device restricts the lamphead exhaust air flow, the exhaust system must evacuate at least 125% of the air flow into the lamphead at a static pressure that ensures that there is an even flow or a slight negative pressure at the lamp face.

The exhaust blower and duct size for each application will depend on many variables. Size all blowers to accommodate all losses in the ductwork and ensure that the specified air flow and pressure for each lamphead is maintained.

AirShield Ventilation System

Figure 3-12 shows a standard AirShield Ventilation System kit installed on an external blower lamphead. A high flow AirShield kit is also available.

Before mounting the lamphead on the AirShield enclosure, switch the pressure hose from the top or front port to the bottom port as described in Switching Pressure Ports on page 3-18.

Use eight M4 screws to mount the AirShield enclosure to the lamphead. The internal blower lampheads are mounted to the kits in the same way. Refer to the *Parts* section for the AirShield kit part numbers.

NOTE: Recommended Flexible Duct Hose for exhaust extraction: McMaster-Carr part number 55125K26, neoprene coated 6-in ID hose. Use worm clamps to connect the hose to the vent stubs.

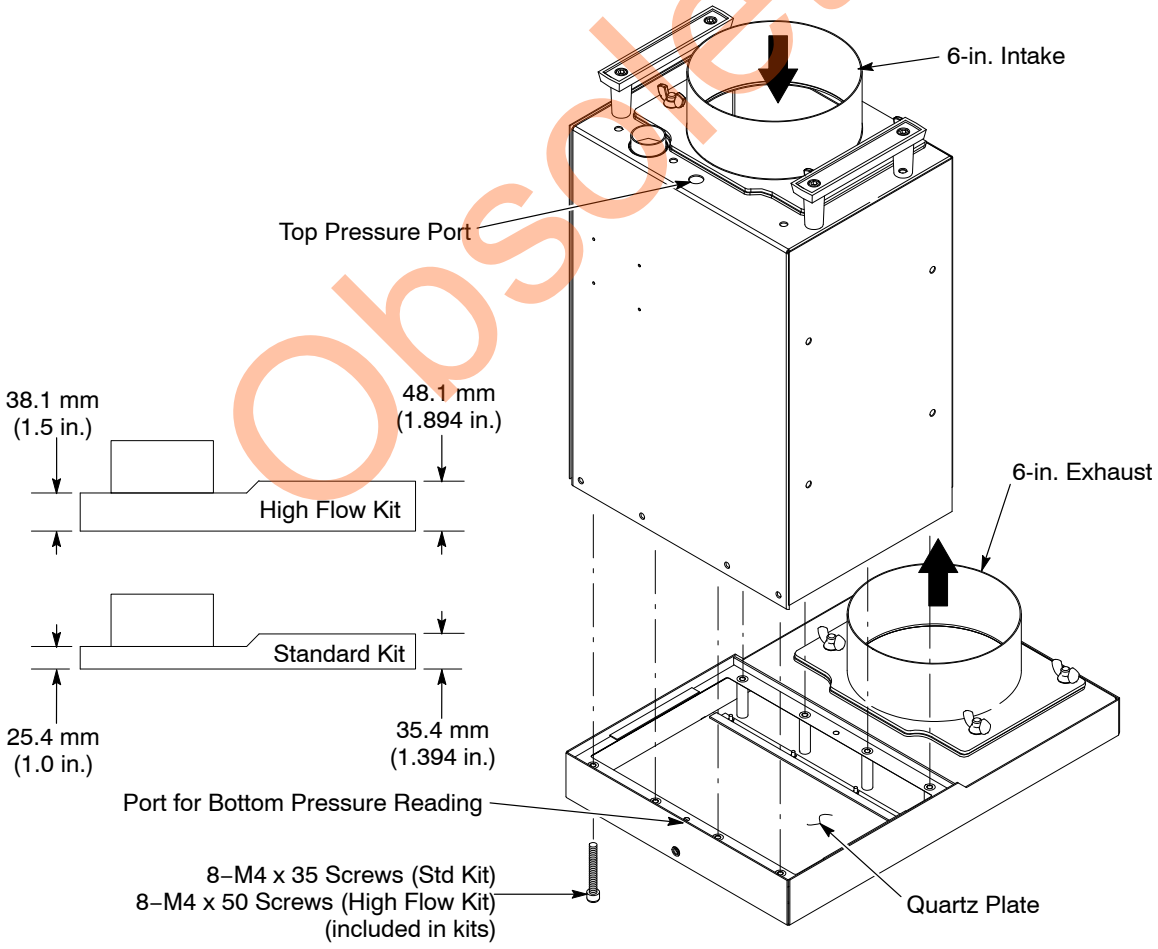


Figure 3-12 AirShield Kit Installation (External Blower Lamphead Shown)

Monitoring Lamphead Air Pressure

See Figures 3-13 and 3-14. The lamphead pressure sensor on the light detector board is connected by a hose to atmosphere at the top/front or bottom pressure port. (See Figures 3-9 and Figure 3-10 for the location of the pressure ports on internal and external blower versions.) **The hose must be connected to Port B on the board, as shown.**

It is important that the pressure port not be blocked, and that the appropriate port be used depending on the cooling air and exhaust air arrangements.

Top Pressure Port

(Factory default.) If the exhaust air from the lamphead is not restricted in any way the top pressure port should be used. Examples of this type of installation are when lamps are mounted in a large enclosure. Caution should be used when using the top pressure port as any restriction of the exhaust air will influence the pressure sensor readings and possibly damage the lamphead.

Bottom Pressure Port

In applications where there is a restriction preventing the free flow of exhaust air from the lamphead, the bottom pressure port must be used. Examples of this type of application are quartz light shields, AirShield ventilation systems, dedicated exhaust ducts, or any other type of exhaust box or lamp face attachment that can restrict the exhaust air flow.

When using the bottom pressure port the lamphead mounting structure must be designed so that this port is open to the air exiting through the screen. Do not simply set the lamp in a bracket or on a ledge that could cover over the bottom pressure port.

Switching Pressure Ports

External blower lampheads are shipped with the pressure transducer connected to the top port. Internal blower lampheads are shipped with the transducer connected to the front port.

Use this procedure to switch the hose connection from the top or front port to the bottom:

1. See Figures 3-13 and 3-14. Remove the lamphead cover.
2. Disconnect the pressure hose and unscrew the barbed fitting from the top or front pressure port.
3. Install the barbed fitting in the bottom pressure port, then feed the hose through the lamphead and connect it to the barbed fitting.

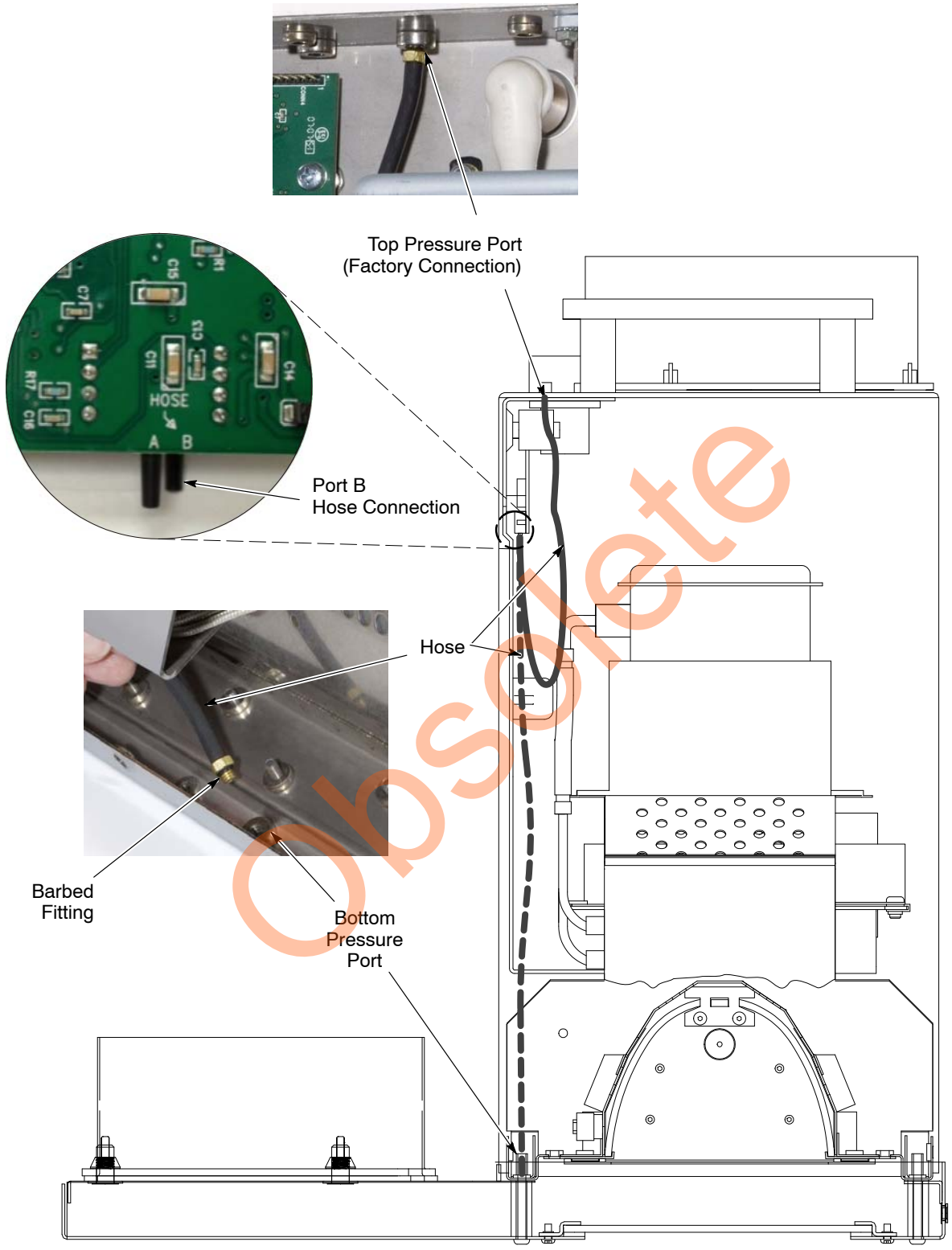


Figure 3-13 Pressure Port Connections – External Blower Version

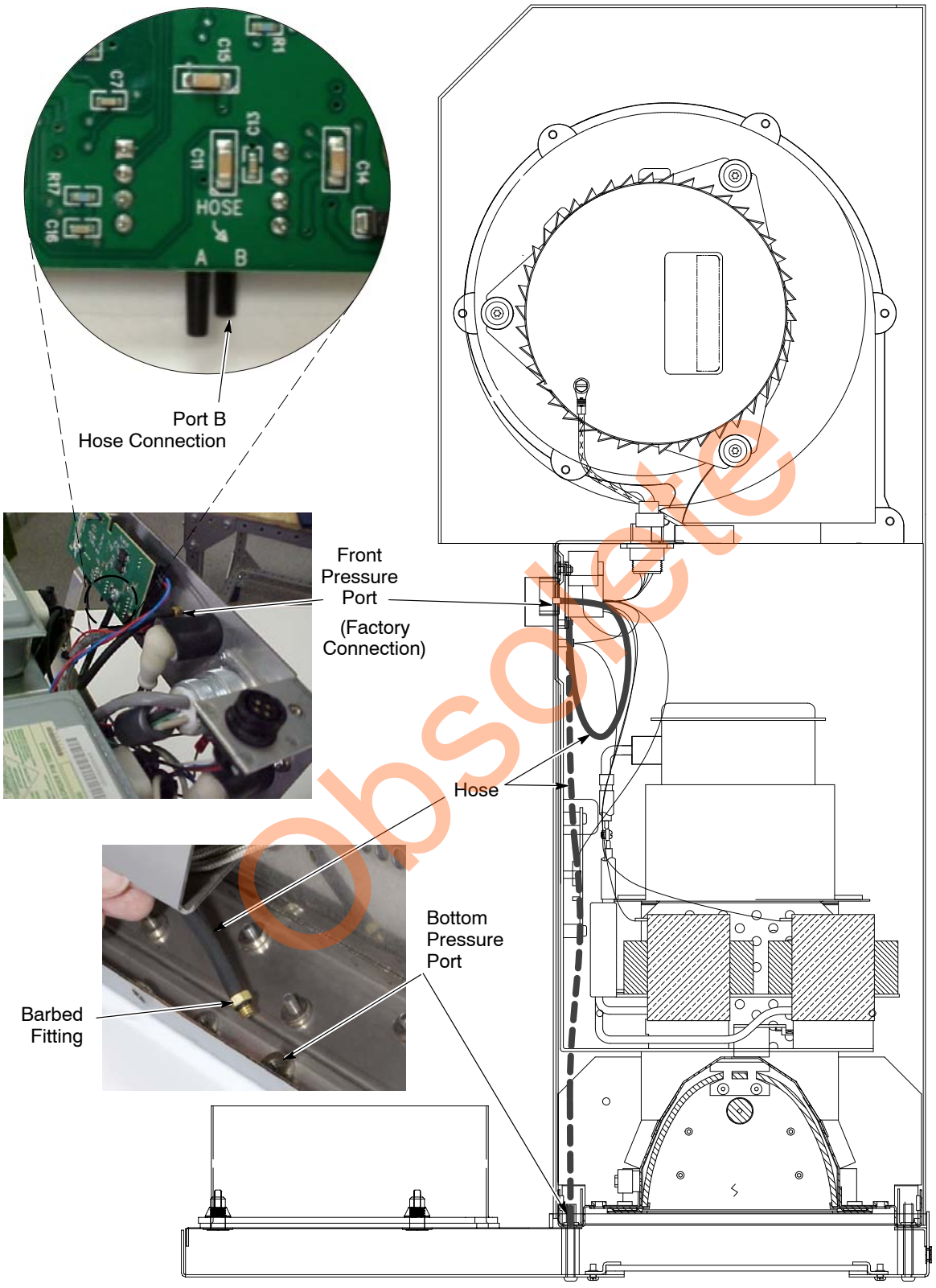


Figure 3-14 Pressure Port Connections – Internal Blower Version

Lamphead Cable Connections

CAUTION: The unicable conducts high and low voltage between the system controller and the lamphead. It is important that the unicable connectors be completely engaged and tightened before turning on the UV system. Failure to properly engage these connectors can result in severe damage to the system components.

Before inserting the plug into the receptacle check both and ensure that the pins are not bent, and that the rubber inserts are in good condition and not damaged. Make sure also that there is no evidence of arcing or other damage on the pins and sockets.

See Figures 3-3 and 3-15. Connect the unicable to the system controller and the lamphead.

NOTE: The unicable plugs are keyed and can only be inserted into the receptacles when correctly oriented. Do not force the plugs into the receptacles. Do not use the screw rings to pull the plugs into the receptacles. In most cases, it might help to wiggle the plug slightly while pushing it into the receptacle to ensure that all the pins mate securely with the sockets.

Push the plug into the receptacle as far as it will go, then start threading the screw ring onto the threaded portion of the receptacle. Continue to push on and wiggle the plug while tightening the screw ring until the plug is firmly seated into the receptacle.

When fully mated, the red indicator on the plug should not be visible and there should be no movement between the plug and the receptacle.

NOTE: When tightening the screw ring, it is recommended to use a 30–32 DIN1810B hook wrench (spanner wrench) to insure that the connection is secure. There are four holes in the screw ring for the wrench pin.

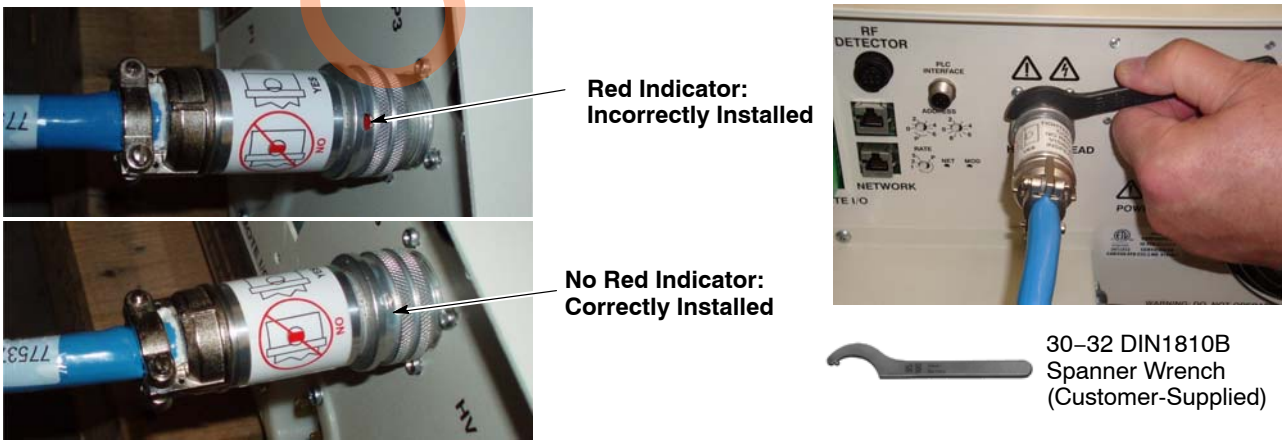
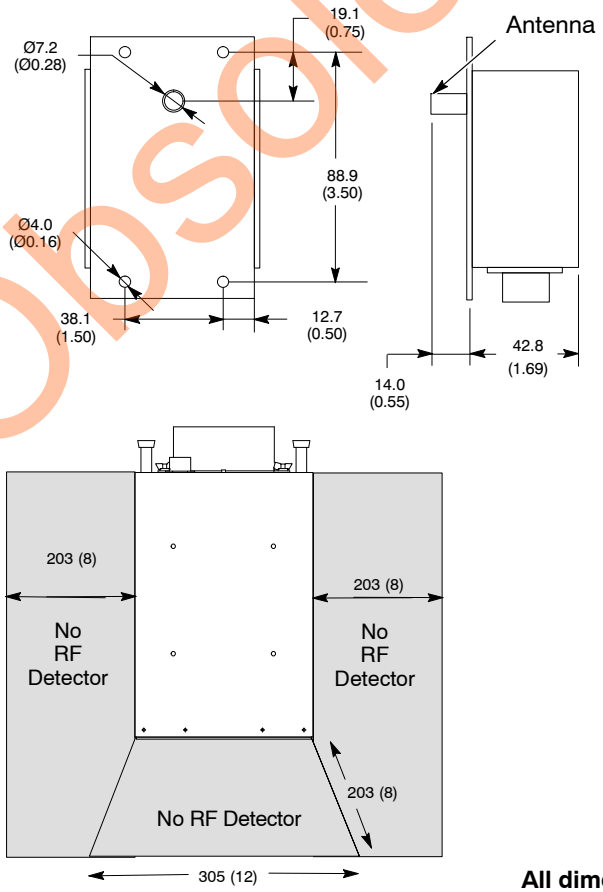


Figure 3-15 Unicable Connection

RF Detector Installation

See Figures 3-3 and 3-6 for RF Detector connections and Figure 3-16 for dimensions.

- The RF detector shuts down the system controller when the RF level detected is above the calibrated trip level. This can happen if the lamphead RF screen is torn or incorrectly installed.
- One RF detector is normally required for every 16 networked units within one curing enclosure. However, some applications and systems may require a RF detector on each unit. Contact your Nordson representative for more information.
- Do not mount the RF detector directly below the lamphead.
- The RF detector can be damaged by excessive heat and extreme RF fields. Do not install it less than 8 inches from the lamphead.
- Mount the RF detector so that the antenna faces the lampheads and is between the operator and the lampheads or the lampheads and any opening (the major source for RF leakage).
- The detector has a patented self test feature to make sure it is working properly. The detector is not serviceable. If it fails, fault code 26 appears on the system controller. Replace the RF detector if it fails.



All dimensions are in mm (in.)

Figure 3-16 RF Detector Installation

System Controller Configuration

Once the system controller and lamphead are mounted and all connections made, the last step is to configure the controller for your application, using the front panel display, keys, and configuration menus.

NOTE: The system controller power must be on and the lamphead must be OFF to enter the configuration menus. Press the SYSTEM OFF button to turn the lamphead off if LAMPON is displayed.

Use these keys to configure the system controller:

Key	Function
Nordson Logo (behind the letter “d”)	Press for 5–15 seconds to enter the configuration menu.
SET–SAVE	Set choice and advance to next configuration setting.
UP/DOWN	Scroll through setting choices.

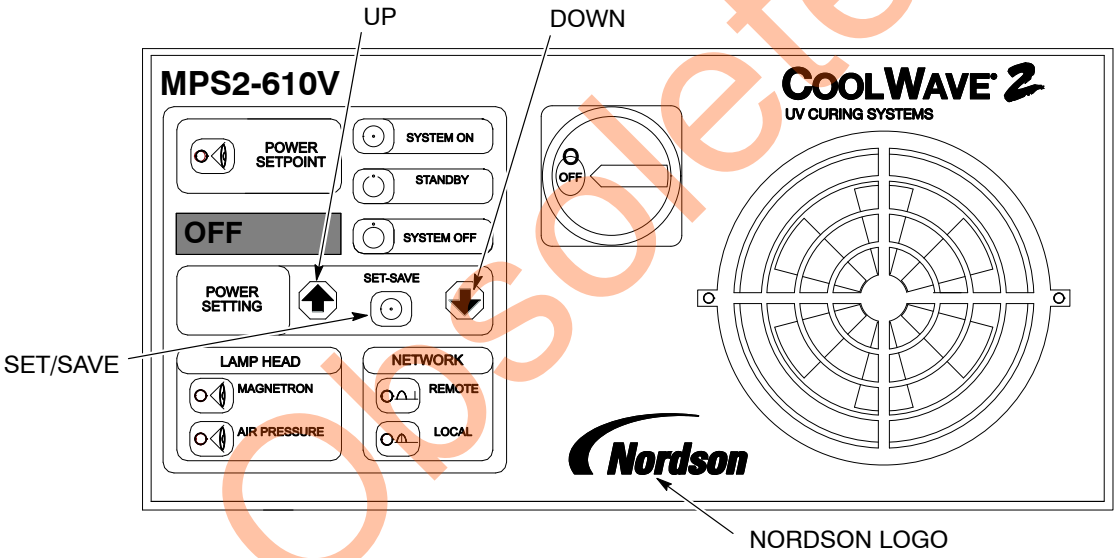


Figure 3-17 System Controller Front Panel

1. Move the front power switch to the ON position. The system goes through a power-up test sequence, then displays the installed software version numbers, then displays OFF.
2. Press the Nordson Logo for 5–15 seconds to enter the configuration menu. The configuration settings are displayed in the order listed in Table 3-5.
3. Press the UP or DOWN keys to scroll through the choices available for each setting. Press the SET–SAVE key to save the displayed choice and advance to the next setting.
4. The last display is PWROFF. Turn the power supply power switch to the OFF position to set the configuration in flash memory.

NOTE: The only configuration setting not done through the system software is the Remote I/O Machine Stop Interlock function. Refer to page 3-9 for this setting.

Table 3-5 Power Supply Configuration Settings

Display	Function	Configuration 1	Configuration 2
ID 00..15 (Unit ID)	Unit ID: Sets unit ID for network, identifies master or remote.	Master = ID 00	Remotes = ID 01..15
	For a standalone system controller, set the unit ID to 00. For networked power supplies, set the master to 00 and set the remotes to 01, 02.....15. • Each system controller on a network must have a unique ID number.		
FLT (Fault)	Fault State: Sets Unit Fault to fault units separately or all together.	FLT U = FAULT UNIT (Fault this unit only)	FLT A = FAULT ALL (Shuts down all units on the network).
	This setting is for multiple system master/remote networks. A networked system controller in a fault condition can fault just itself or the entire network. • All networked system controllers must have the same fault setting.		
RFD (RF Detector)	Sets RF detector status for each system controller.	RFD Y = RF Detector connected	RFD N = No RF detector connected
	A Master controller is automatically set to RFD Yes. Remote power supplies can be set to Yes or No. Only one RF detector is required for a network.		
NT (Network)	Specifies network communication protocol.	NT CAN = CAN BUS protocol	NT 485 = 485 protocol
	The CAN BUS protocol is the preferred protocol for system controller networks. It must be selected for any network using DeviceNet. • All system controllers on the network must be set to the same protocol.		
CTRM	Can termination	CTRM Y = CAN termination Yes.	CTRM N = CAN termination No.
	Internal network termination setting. • Set to Yes for networked controllers that have only one network port connected (and so are on one end of the network). The Master system controller is typically on one end of the network. • Set to No for all networked controllers that have both network ports connected.		
ANA	Remote Power Level Control enable/setting	ANA Y = Y (yes)	ANA N = N (no)
	Refer to Table 3-3 on page 3-8 for connections. • If set to ANA Y, then the next setting allows you to choose the input. In Remote mode, light output is controlled by the input to the AIN and ACOM terminals (5 and 4). • If set to ANA N, then the light output is controlled from the system controller front panel in both Remote and Local modes.		
IN	Analog input selector	mA = 4–20 mA control	V = 0–10 Vdc control
	Specifies the input type for Remote Power Level Control. This selection appears if ANA Y is selected. Refer to Table 3-3 on page 3-8 for connections.		
CTL	Remote control source	IO = Use discrete remote I/O terminal	DN = Use DeviceNet for remote control
	Refer to Table 3-3 on page 3-8 for discrete remote I/O connections. IO is the default setting.		

Display	Function	Configuration 1	Configuration 2
PCTL	Power control algorithm	Y = Enable Power Control mode	N = Use current control mode (default)
	If set to PCTL Y, the power control algorithm controls the total power output to reduce the variation of power over the life of the magnetron. PCTL N is the default and preferred method of control (current control).		
LAN	Language in which faults are displayed	ENG=English	FR=French IT=Italian GE=German SP=Spanish
	Use this setting to choose the language for fault messages. English is the default language.		
IDLE	Enabling IDLE mode allows a return to Lamp ON mode within 3 seconds (use the Standby command for activation). This is done by operating the lamp system at a low power, which is not capable of curing, with minimal heat on substrate.	IDLE N=No Not enabled	IDLE Y=Yes Operation of IDLE mode (local or remote) through Standby control. Refer to the Operation Section for the proper sequence.
VSPD	Lampheads with an internal blower may incorporate variable speed control to provide consistent bulb temperature.	VSPD N=No Set to N if lamphead is not equipped with internal blower	VSPD Y=Yes Enables speed control Set to Y only if an internal blower lamphead is used.
PWROFF	POWER OFF	No selection	No selection
	This is a message instructing you to turn the power supply switch OFF to save your settings in flash memory.		

Section 4
Operation

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

Introduction

Startup procedures will vary depending on how the UV system is integrated into other systems and equipment. The startup procedures documented in this manual are strictly for the UV equipment.

Display and Controls

See Figure 4-1 and Table 4-1.

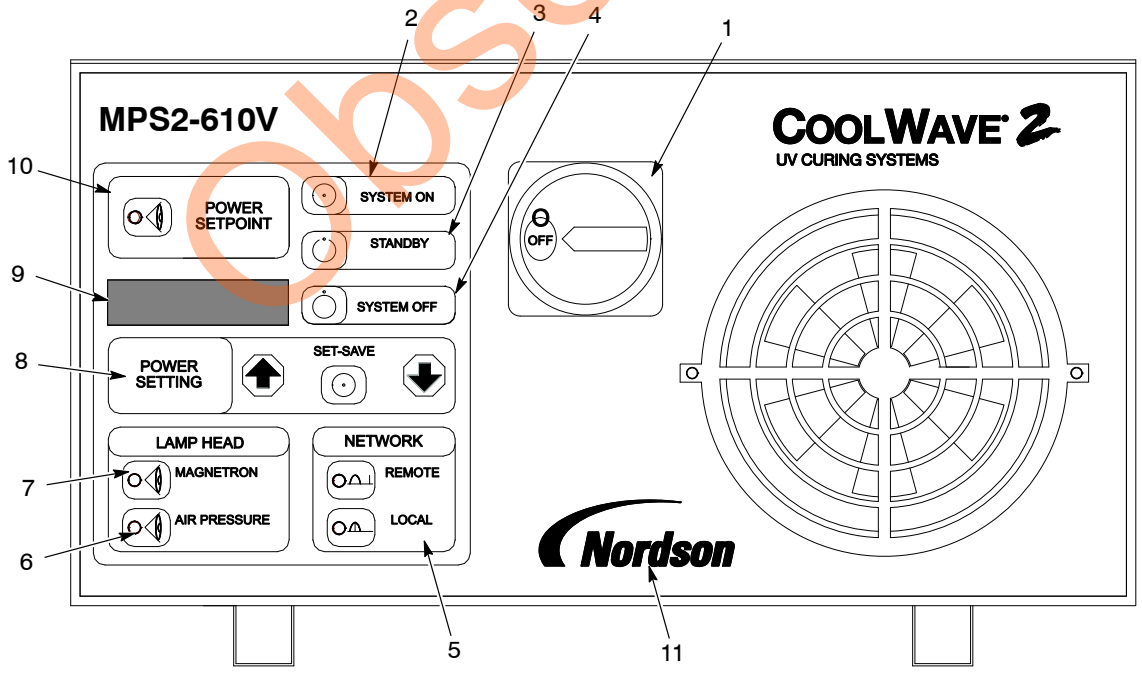


Figure 4-1 CoolWave 2 System Controller Displays and Controls

Table 4-1 CoolWave 2 Displays and Controls

Item	Control	Description
1	Main Power Switch	Turns system power on and off.
2	SYSTEM ON	Turns the lamphead on when STDBY, IDLE, or OFF is displayed. From OFF, the system goes into WARMUP mode until the filament is warmed up, then power is applied to the magnetrons and LMPDLY is displayed while the magnetrons stabilize. LAMPON is displayed when the lamp lights.
3	STANDBY	When the Standby button is pressed power is removed from the lamp. The magnetron filaments remain powered. STDBY is displayed. This mode allows the system to cycle to curing power faster than from OFF. Excessive use of Standby mode will shorten magnetron life.
	IDLE (if enabled)	If the Idle mode is enabled during system configuration, then pressing the Standby button puts the system in Idle mode. In this mode, the lamp is powered at a low light and heat state. When SYSTEM ON is pressed, the lamp will cycle to LMPDLY then to LAMPON. The lamp should not remain in Idle Mode for longer than necessary. After 10 minutes in Idle Mode the lamp automatically reverts to Standby mode.
4	SYSTEM OFF	Turns the lamphead off.
5	NETWORK LOCAL REMOTE	Sets system operation to LOCAL mode (system controlled from front panel) or to REMOTE mode (system controlled by a remote device or controller through discrete I/O or DeviceNet).
6	LAMPHEAD AIR PRESSURE	Displays lamphead pressure in X.X inches w.c. (water column).
7	LAMPHEAD MAGNETRON	Displays the current through each magnetron in milliamps (mA). Pressing the MAGNETRON button toggles between MAG A and MAG B current. If the power control mode is configured, then OPC is displayed.
8	POWER SETTING	Adjusts the UV output of the lamp, as a percentage of full power. Power can be adjusted from 20% to 100% while the lamp is in the OFF or ON state. At 100% the lamp produces the maximum UV intensity it is capable of (600 watts/inch). The system is factory set to operate at 100% output. To check the power level set point, press the SET-SAVE button. In network LOCAL mode, you can change the output in 5% increments by pressing the UP or DOWN buttons. Press the SET-SAVE button in order to save your changes and return to normal operation. In network REMOTE mode, power can be adjusted in 1% increments by a remote PLC. Regardless of the control method, changes to the power setting take effect immediately. **Remote Units Controlled by a Master:** The remote units determine their power setting by multiplying the master power setting by the remote set point (set at the front panel of the remote unit). If the Master power setting is 80%, then the output of a remote unit set at 50% is actually 40% of its potential output (80% x 0.5 = 40%). • The remote unit set point is always the value set from its front panel. • The Master set point is set from its front panel when it is in Local mode. In Remote mode it can be set by analog input or DeviceNet. • All systems can only be set to values between 20% and 100%. If any of the above cases calculate a value below 20% the control will stay at 40% until the calculated value is again above 20%. This will not set an error but the unit power will not go below 20%.

Item	Control	Description
9	Digital Display	Displays power levels, operation and fault messages.
10	POWER SETPOINT	When pressed, displays the current power setpoint.
11	Nordson Logo (System Configuration)	Accesses system controller configuration. Refer to Table 3-4 in the *Installation* section for more information.

Additional Functions

Temperature

To display the internal temperatures of the lamphead and system controller press the OFF and SET-SAVE buttons simultaneously:

LH xxC = Lamphead Internal Temperature
LB xxC = Lamphead Circuit Board Temperature
MB xxC = System Controller Control Board Temperature

Light Detector

To test the light detector and check UV output, press the DOWN button and STANDBY buttons simultaneously. You can do this on controller power up to watch the UV output come up to full power.

Sensor Saturation = 900–960 counts
Normal Operation = 920–950 counts
Acceptable Operation = greater than 700 counts
Alarm Trip Point for 50% to 100% Power Level = 600 counts
Alarm Trip Point for less than 50% Power Level = 300 counts

Starter Bulb Test

To test the starter bulb, turn OFF the lamp, press the LOCAL button for approximately 20 seconds, and check for light output. The starter bulb turns on for a few seconds during lamp ignition, to help the UV bulb ignite.

Panel Lock

NOTE: For use with systems operated in remote modes.

To lock out all front panel control functions, press REMOTE for approximately 20 seconds. LOCK is displayed momentarily. The period at the left of the display remains on as long as the system is locked.

To unlock the system press REMOTE for approximately 20 seconds. UNLOCK displays and the unit returns to normal operation.

Operating Messages

Table 4-2 lists the messages that indicate operating status.

Table 4-2 Display Messages

Message	Description
OFF	The system controller power is On. The lamphead is in the Off state.
WARMUP	The magnetron filament is energized. This message is only displayed during filament warm-up (about 15 seconds).
STDBY	The filament is warm and the unit is waiting for an On command.
LMPDLY Lamp Delay	Lamp ON has been enabled. The power contactor is closed, and high voltage has been applied to the magnetrons. This message is displayed during lamp warm-up (about 10 seconds).
LAMPON	Lamp is On at the set power level.
L COOL Lamp Cool Down	Lamp was On and a Standby command has been received. The magnetron power is shut off. This message is displayed during lamp cool down (about 20 seconds). The lamphead then goes to a standby state. The unit will not restart until the lamp cool down is complete.
C DLY Cool Down Delay	An Off command was received. The lamphead power is turned off. The message is displayed during lamp cool down (about 60 seconds). The unit will not restart until the lamp cool down is complete.
IDLE	Lamp is idling at 10% of full power.

Fault Messages

When a fault is detected, the system controller shuts down the high voltage, turns on the FAULT relay output, and displays a fault message. Table 4-3 lists the fault messages. Refer to *Section 5, Troubleshooting*, for fault correction procedures.

Table 4-3 Fault Messages

No.	Fault Message	Description
0	NETWORK CONFIG	Duplicate system IDs on the network.
2	FILAMENT FUSE BLOWN	There is no current detected on the filament transformer circuit when the system controller is turned on.
3	HIGH CURRENT ON MAG	High current exceeding 950 mA has been detected on the magnetron high-voltage circuit.
4	CURRENT IMBALANCE	The magnetrons are turned on (LAMPON) and the magnetron currents differ by more than 100 ma for a period exceeding about 600 ms.
5	ON NETWORK UNIT	There is a fault on a remote unit.
6	MAG POWER WHEN OFF	Magnetron current sensed in standby mode.
7	NO LIGHT DETECTED	There was insufficient output from the lamp when the system controller energized the magnetrons in the Lamp On mode.
9	HARDWARE FAILURE	The system controller is not communicating with the light board.

No.	Fault Message	Description
10	DEVICENET ERROR	There is a DeviceNet communication fault.
11	DEVICENET HARDWARE FAIL	There is no communication with the DeviceNet processor.
12	MAG VOLTAGE ERROR	The magnetron voltage is not within limits.
13	NETWORK COMM ERROR	The control board can no longer communicate with a previously detected system.
15	POWER CONTROL AT LIMIT	The power control cannot control the output within 5% of the setpoint.
16	LOW LAMPHEAD PRESSURE	There is insufficient or no air pressure in the lamphead.
17	EXT INTERLOCK OPEN	The external machine stop interlock is open or is not at 24 Vdc, depending on the jumper setting.
18	POWER UNIT OVER TEMP	The system controller is over temperature.
19	RF DETECTOR MISSING	The RF detector is not connected.
20	RF DETECTOR TRIPPED	The RF detector has detected a high RF field.
22	LAMPHEAD OVER TEMP	Lamphead temperature sensor is over temperature. Transformer thermal switch(es) open. May be caused by insufficient air flow through system controller cabinet.
23	HV CABLE UNPLUGGED	The system controller is not communicating with the lamphead. The high-voltage cable from the system controller to the lamphead is disconnected or damaged.
24	LOW CURRENT ON MAG	The magnetron is below 5 mA minimum current value.
25	PHASE CONTROL AT LIMIT	The system controller cannot regulate to the power setpoint.
26	RF DETECTOR FAILED	The RF detector is defective and must be replaced.
27	PHASE CONTROLLER ERROR	The system control is not communicating with the phase board.
28	MAG FILAMENT IS OPEN	One of the two magnetron filaments has failed.

Resetting Faults

Operating in Local Mode: Press the Off button to reset a fault once it has been corrected.

Operating in Remote Mode: Open and close the Reset contact to reset a fault once it has been corrected.

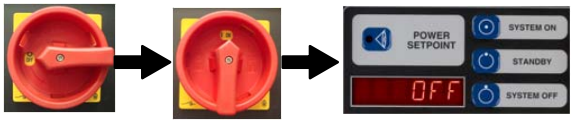
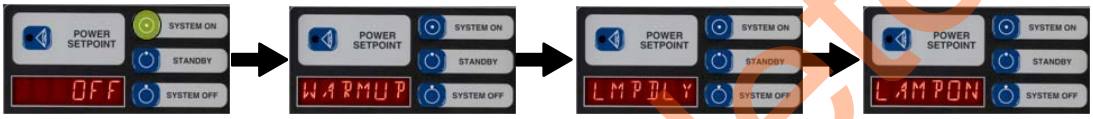
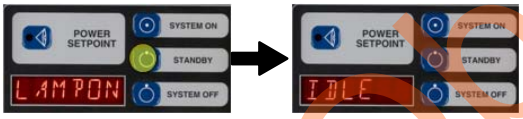
NOTE: Once the fault has been corrected you can reset a fault on a unit operating in Remote Mode from the host controlling the master unit through either a discrete I/O or DeviceNet.

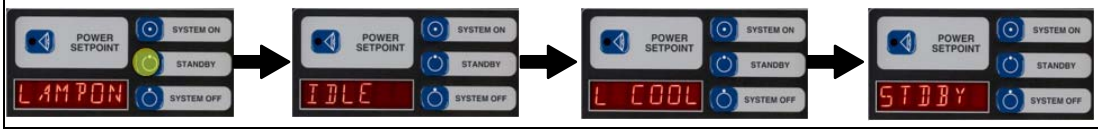
System Timing Sequences

NOTE: Refer to *Section 5, Troubleshooting* if the system fails during startup.

Timing Sequence with Idle = Y

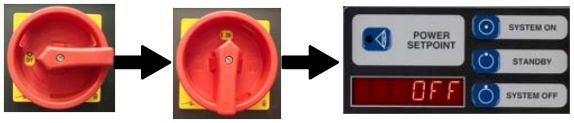
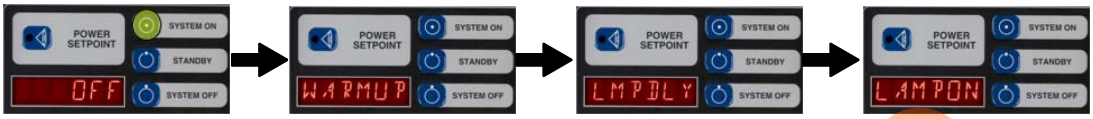
(Also see Table 3-5)

Powering ON the System Controller	
	
Total Seconds 12 seconds	Turn on main disconnect switch on front panel. Controller goes through initial boot sequence with a full display test. When complete, controller displays OFF.
Changing system status from OFF to LAMP ON	
	
Total Seconds 25 seconds	Press SYSTEM ON button. Display reads WARMUP. Display reads LMPDLY. Display reads LAMPON.
Changing system status from LAMP ON to IDLE	
	
Total Seconds ~ 1 second	Press STANDBY button *Once*. Display reads IDLE. **NOTE:** The controller automatically switches to Standby after 10 minutes in Idle mode. Idle is a configurable mode. If not enabled, only the Standby mode is active.
Changing system status from IDLE to LAMP ON	
	
Total Seconds ~ 2 seconds	Display reads IDLE. Press SYSTEM ON button. Display reads LMPDLY. Display reads LAMPON.

Changing system status from LAMP ON to STANDBY	
	
Total Seconds 20 seconds	Display reads LAMPON. Press STANDBY button *Twice*. Display reads IDLE followed by L COOL. Display reads STDBY. **NOTE:** If Idle is not enabled, pressing the Standby button *Once* switches the controller to Standby mode.
Changing system status from STANDBY to LAMP ON	
	
Total Seconds 10 seconds	Display reads STDBY. Press SYSTEM ON button. Display reads LMPDLY. Display reads LAMPON.
Changing system status from LAMP ON to OFF	
	
Total Seconds 60 seconds	Display reads LAMPON. Press SYSTEM OFF button. Display reads C DELY. Display reads OFF. Shutdown timing at completion of process allows for proper cooling.

Timing Sequence with Idle = N

(Also see Table 3-5)

Powering ON the System Controller	
	
Total Seconds 12 seconds	Turn on main disconnect switch on front panel. Controller goes through initial boot sequence with a full display test. When complete, controller displays OFF.
Changing system status from OFF to LAMP ON	
	
Total Seconds 25 seconds	Press SYSTEM ON button. Display reads WARMUP. Display reads LMPDLY. Display reads LAMPON.
Changing system status from LAMP ON to STANDBY	
	
Total Seconds 20 seconds	Display reads LAMPON. Press STANDBY button *Once*. Display reads L COOL. Display reads STDBY.
Changing system status from STANDBY to LAMP ON	
	
Total Seconds 10 seconds	Display reads STDBY. Press SYSTEM ON button. Display reads LMPDLY. Display reads LAMPON.
Changing system status from LAMP ON to OFF	
	
Total Seconds 60 seconds	Display reads LAMPON. Press SYSTEM OFF button. Display reads C DELY. Display reads OFF. Shutdown timing at completion of process allows for proper cooling.

Correcting a Fault Condition

Correcting a fault condition	
	
Total Seconds	Display reads fault condition (message scrolls). Correct the reason for the fault, then push SYSTEM OFF button.
Max 60 seconds	Display reads C DELY. Press SYSTEM ON button.
	Display reads WARMUP.
	Display reads LMPDLY.
25 seconds	Display reads LAMPON.

Startup

Locally Operated Units

Table 4-4 Startup Procedures for Locally Operated Units

Step	Single Unit Operated Locally	Multiple Units Networked to a Master Unit Operated Locally
1	Switch system electrical power ON.	
2	Turn the main power switch on the front of the system controller unit to the ON position. After a brief power-up test sequence, OFF appears on the display.	
3	Make sure that all interlocked access doors are closed and that external cooling and exhaust fans are running if not directly connected to the system controller blower contacts. If external interlocks are wired and open, FAULT EXT INTERLOCK will be displayed.	
4	On the NETWORK selector, press LOCAL.	Set the NETWORK configuration. • On the master unit NETWORK selector, press LOCAL. • On the remote unit NETWORK Selectors, press REMOTE.

Continued...

Step	Single Unit Operated Locally	Multiple Units Networked to a Master Unit Operated Locally
5	Set the POWER SETTING. 1. Press the SET-SAVE button on the POWER SETTING selector until the power level is displayed. 2. Press the UP or DOWN arrows to set the desired power level. The power level changes immediately. 3. Press the SET-SAVE button to save the setting and exit the power setting function. **NOTE:** The power level can be changed at any time during operation with the lamp ON or OFF.	Set the POWER SETTING. 1. On the master unit, press the SET-SAVE button on the POWER SETTING selector until the power level is displayed. 2. Press the UP or DOWN arrows to set the desired power level. 3. Press the SET-SAVE button to save the setting. 4. Set the POWER SETTING at each remote unit between 20 and 100 using the same procedure as the master unit. Each remote POWER SETTING can be different. The actual power output of each remote is dependent on the Master POWER SETTING. For example, if your master unit POWER SETTING is 80 and your first remote unit POWER SETTING is 50, the actual output of the first remote unit will be 0.5 x 0.8 or 40%. **NOTE:** In most cases, remote units should be set to 100%.
6	**External Blower Units:** Turn on the external blower. If there is insufficient pressure the system faults and FAULT LOW LAMPHEAD PRESSURE is displayed. (Check for proper pressure with the appropriate instrumentation.) The internal blower automatically turns on and off as required.	

Continued...

Step	Single Unit Operated Locally	Multiple Units Networked to a Master Unit Operated Locally
7	Press SYSTEM ON to start the lampheads. LAMPON is displayed when the lamphead is ready to cure. **Standard Startup – Preferred Method** Use this procedure to go directly through the warm-up to the LAMPON mode. 1. On the single unit or master unit, press SYSTEM ON. WARMUP will appear on the display. The magnetron filaments are warmed up for 15 seconds. 2. LMPDLY now displays while lamphead takes approximately 10 seconds to stabilize. 3. LAMPON appears in the display and the system is ready to run. Or **Quick Startup from Standby Mode** **NOTE:** Excessive use of the standby mode will shorten magnetron life. This method should only be used when a quick startup is required. Use this procedure to put the system in Standby mode before moving to the SYSTEM ON mode. 1. On the single unit or master control unit, press the STANDBY button. WARMUP appears on the display for approximately 15 seconds, then STDBY appears. **NOTE:** Do not leave the system controller in the standby mode for longer than 30 minutes. Prolonged standby periods shorten magnetron life. 2. Press the SYSTEM ON button to turn on the lamps. LMPDLY appears for approximately 10 seconds while the lamphead stabilizes, then LAMPON appears. **Quick Cycle Using Idle Mode** **NOTE:** IDLE mode must be enabled. See IDLE in the System Controller Configuration table on page 3-25. 1. Use the Standard or Rapid startup procedures to achieve LAMPON state. 2. Initiate Standby command (locally or remotely). 3. The unit will immediately switch to Idle State (achieved in 1 seconds). 4. To return to curing, initiate LAMPON command (locally or remotely). 5. The lamp is ready to cure within approximately 5–7 seconds. **NOTE:** After 10 minutes in Idle mode, the unit automatically switches to Standby mode.	

Remotely Operated Units

NOTE: The system can be wired to initiate lamphead start from either the process machine or from the UV system controller.

The system controller I/O and a simple panel can be used to control the UV system. Or, if the DeviceNet protocol is used, the UV system can be fully automated to work in concert with a complete production system.

Table 4-5 Startup Procedures for Remotely Operated Units

Step	Single Unit and Units Networked to a Master Unit Operated Remotely
1	Switch the electrical disconnect to ON.
2	Turn the main power switch on the front of the system controller to the ON position. After a brief power-up test sequence, OFF appears on the display.
3	Make sure that all interlocked access doors are closed and that the exhaust fan is running. If external interlocks are wired and open, the fault message FAULT EXT INTERLOCK appears in the display.
4	On the front panel under NETWORK, press REMOTE. **NOTE:** For networked units, press REMOTE on each unit.
5	Set the POWER SETTING. See Table 4-1 item number 8 on page 4-2.
6	Turn on the external blowers. If there is insufficient pressure a system fault occurs and the message FAULT LOW LAMPHEAD PRESSURE appears in the display. (Check for proper pressure.) The internal blower automatically turns on and off as required.

Shutdown

CAUTION: Do not shut off the system with the main power switch while the lamps are operating. Bulbs and magnetrons can and will be damaged.

The lamp turns off if any of the following conditions occur:

Normal Shutdown

- SYSTEM OFF button on the system controller is pressed.
- REMOTE OFF command through discrete I/O or DeviceNet.

Fault Shutdown

- Cooling air for the lamphead ceases or is insufficient.
- Any of the safety interlocks wired into the UV equipment are interrupted. These include exhaust fan, access panels, doors and process equipment.
- Any fault condition occurs.

Table 4-6 Shutdown Procedures

Step	Shutting Down Systems Locally	Shutting Down Systems Remotely
1	Press the SYSTEM OFF button.	Press the SYSTEM OFF button on the remote or host machine.
2	External Blower units: Allow the lampheads at least 60 seconds of cool down time before shutting off the cooling air. On units with internal blowers, the system shuts off the blower when the internal temperature falls to a safe level. **CAUTION:** Failure to provide cool down time can cause problems restarting the lamps as well as greatly reduce the life of the lamphead bulbs.	External Blower units: Allow the lampheads at least 60 seconds of cool down time before shutting off the cooling air. Typically the external blowers are controlled by the remote or host machine. On units with internal blowers, the system shuts off the blower when the internal temperature falls to a safe level. **CAUTION:** Failure to provide cool down time can cause problems restarting the lamps as well as greatly reduce the life of the lamphead bulbs.
3	Turn off main power to all units.	

Section 5
Troubleshooting

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

These troubleshooting procedures cover only the most common problems. If you cannot solve a problem with the information given here, contact your local Nordson representative for help or call 800−524−1322 for technical support.

System Software Versions

If you call for technical support, you may be asked to provide the version numbers for the software installed in your system. During power up, the system controller displays the software versions for the following components, in this order:

V DXXX = Display Board
V MXXX = Main Control Board Microprocessor
V PXXX = Phase Board Microprocessor
V IXXX = Main Control Board CAN Interface
V LXXX = Light Detector Board (Lamphead)
V OXXX = I/O Board to DeviceNet

NOTE: V OXXX only present for systems using DeviceNet.

General Troubleshooting

Use the charts on the following pages to troubleshoot your system.

NOTE: If a system controller does not start up, disconnect power to the controller, then remove the cover and check the fuses. Refer to page 6-2 in *Section 6, Maintenance and Repair* for fuse locations.

Fault Message Troubleshooting

Problem	Possible Cause	Corrective Action
Fault 0: **FAULT NETWORK CONFIGURATION** Network detecting multiple units with same ID.	Incorrect controller ID setting, two or more controllers with same ID.	Reconfigure ID settings so that each controller has a unique ID number. Refer to *System Controller Configuration* beginning on page 3-23.
Fault 2: **FAULT FILAMENT FUSE BLOWN** Open filament transformer circuit. No filament current.	Filament transformer fuse F4 on main control board blown.	Excessive power line noise. Refer to *Power Line Connections* on page 3-3.
	Open in filament control circuit to transformer.	Verify proper continuity within system controller and lamphead. See Figure 8-1, System Schematic.
Fault 3: **FAULT HIGH CURRENT ON MAG** High current on high-voltage circuit. Current exceeds limit.	Magnetron has failed.	Replace the magnetrons.
	Short in unicable cable.	Inspect the unicable for shorts.
	Short in the lamphead.	Inspect the high voltage white and black cables from the unicable receptacle to the magnetrons for shorts.
Fault 4: **FAULT CURRENT IMBALANCE** Magnetron current imbalance. The current level of magnetron A and B differs by more than 100 mA.	End of magnetron life.	Replace the magnetrons.
	Improper magnetron wiring.	Verify the magnetron wiring connections. See Figure 8-1, System Schematic.
Fault 5: **FAULT ON NETWORK UNIT** Fault on remote unit.	Fault has occurred on remote system controller.	Correct fault on remote system controller.
Fault 6: **FAULT MAG POWER WHEN OFF** Phase control board failure Magnetron current detected when in Standby or Off mode.	Phase control board has failed.	Replace phase control board.

Continued...

Problem	Possible Cause	Corrective Action
Fault 7: **FAULT NO LIGHT DETECTED** Lamp Fault The light detector does not sense sufficient light output.	Bulb has failed.	Replace the bulb.
	Light sensor D1 on light detector board blocked.	Refer to page 4-3 to check the light output seen by the sensor. Clean the sensor on with isopropyl alcohol, or replace the board.
	Light sensor D1 has degraded, or light detector board failed.	Replace the light detector board. The recommended replacement interval is 10,000 hours of operation. Refer to page 6-18 in *Section 5, Maintenance and Repair*.
	Magnetrons are approaching end of life.	Replace magnetrons.
Fault 9: **FAULT HARDWARE FAILURE** Control board failure Main controller not communicating with lamphead interface chip.	Main control board has failed.	Replace main control board.
Fault 10: **FAULT DeviceNet ERROR** DeviceNet Error. DeviceNet communications failure.	DeviceNet is not properly configured.	Review DeviceNet software specification and reconfigure.
Fault 11: **FAULT DEVNET HARDWARE** DeviceNet Hardware Error. Communication between main control board and I/O board is lost.	Controller hardware failure.	Replace the I/O board or main control board, or replace the ribbon cables.
Fault 12: **FAULT MAG VOLTAGE ERROR** Magnetron voltage error. Magnetron voltage maximum exceeded or the difference between the magnetrons is too great.	Arcing or opens in the high voltage circuit.	Check the high voltage wiring, from the inside of the controller to the magnetrons.
	Failed diode block in system controller.	Test diode block as described on page 5-8. Replace diode block if failed.
	Magnetrons have failed.	Check the high voltage wiring, from the inside of the controller to the magnetrons. Replace the magnetrons.
Fault 13: **FAULT NETWORK COMM** Network Fault Master/remote network connection lost.	Remote controllers not powered or connected to network.	Turn on remote controllers, check connections.
	Damaged network cables.	Replace the network cables.
	Improper network setup.	Refer to *Network Connections* and *System Controller Configuration* in *Section 3, Installation*.

Continued...

Problem	Possible Cause	Corrective Action
Fault 15: **FAULT POWER CTRL AT LIMIT** Power control at limit. System controller is unable to regulate output.	Magnetrons have failed.	Replace the magnetrons.
	Low voltage to magnetrons.	Transformer taps set incorrectly. Check transformer in system controller.
Fault 16: **FAULT LOW LAMPHEAD PRESSURE** Pressure Fault Lamphead air pressure is below setpoint at selected power setting.	External blower is off.	Turn external blower on.
	Internal blower failure.	Check blower wiring, transformer, fuse. Replace blower if necessary.
	Air flow through lamphead is restricted.	Remove any restrictions in lamphead air flow.
	Large pressure drop in external blower ducting.	Correct restrictions in external blower ductwork. Ducts must be sized properly with minimum bends to supply proper air pressure. If low pressure faults persist, consider mounting the blower closer to the lamphead, increasing the duct size, or increasing the blower size.
	Pressure hose connected to wrong port.	Check port connection. Refer to page 3-18 for instructions.
	Pressure port is blocked.	Unblock the pressure port.
	Damaged pressure hose.	Check hose and replace if necessary.
Fault 17: **FAULT EXT INTERLOCK** Interlock Fault MSTOP I/O open or under voltage.	Open external interlock.	Check all system interlocks and the MSTOP connection. There must be continuity between Pins 15 and 16 on the rear panel Remote I/O connector.
	I/O jumpers are set incorrectly (DeviceNet capable system).	Verify that the jumper position matches the interlock method. Make sure 24Vdc is available to interlock circuit.
	24Vdc not being supplied to interlock.	Check voltage and correct if necessary.
Fault 18: **FAULT POWER UNIT OVER TEMP** System controller temperature is over 65 °C.	System controller cooling fans are restricted or not operating.	Remove fan restrictions or replace the fans. Make sure fans are rotating in the correct direction.
	Ambient temperature is above specification.	Reduce the ambient temperature to 5–40 °C (41–104 °F).
Fault 19: **FAULT RF DETECTOR MISSING** RF Fault. System does not sense the RF detector.	RF detector is not properly connected.	Check the RF detector connections.
	RF cable is damaged.	Check the continuity of the RF cable. Replace the cable if necessary. See Figure 8-1, System Schematic.
	RF detector is damaged.	Replace the RF detector.

Continued...

Problem	Possible Cause	Corrective Action
Fault 20: **FAULT RF DETECTOR TRIP** RF Fault. High RF field detected.	RF Detector is detecting a high level of RF	Make sure the RF screen is not missing, loose, or damaged.
	Incorrect RF detector mounting location.	Refer to page 3-22 for mounting requirements.
Fault 22: **FAULT LAMPHEAD OVER TEMP** Lamphead temp is over 95 ° C.	Cooling air is being restricted.	Make sure air flow through lamphead is not restricted. Refer to Corrective Actions for Fault 16.
Fault 23: **FAULT HV CABLE UNPLUGGED** System controller not communicating with lamphead.	Unicable not connected or damaged.	Check unicable connections and continuity. See Figures 8-1 and 8-2, System Schematics.
	Light detector board in lamphead unplugged or failed.	Check the internal connections to the light detector board. Replace board if all connections are good.
Fault 24: **FAULT LOW CURRENT ON MAGS** Magnetron Current Fault Magnetron current cannot be maintained.	Open HV circuit to magnetrons.	Check black and white high-voltage cables to magnetrons.
	Wiring to magnetrons not connected properly.	Verify wiring connections.
	HV transformer taps set incorrectly in system controller.	Refer to the *Transformer Tap Table* on page 3-3 to verify settings.
	Failed diode block in system controller.	Test diode block as described on page 5-8. Replace diode block if failed.
	Magnetrons at end of life.	Replace magnetrons.
	Failed contactor.	Replace contactors.
	Failed diode block (open diode) in system controller.	Test diode block as described on page 5-8. Replace diode block if failed.
	Damaged main control board (defective relay #1).	Replace main control board.
Fault 25: **FAULT PHASE CTRL AT LIMIT** Phase control at limit. System controller is unable to regulate the system to the specified output level.	HV transformer taps set incorrectly.	Refer to the *Transformer Tap Table* on page 3-3 to verify settings.
	Phase control board failed.	Replace phase control board.
Fault 26: **FAULT RF DETECTOR FAILED** RF Fault. RF Detector failed self-test.	RF detector self test fails or detector has been permanently damaged by a very high RF field. **NOTE:** This failure is only possible under extreme conditions.	Replace RF detector. Refer to *RF Detector Installation* on page 3-22.

Continued...

Problem	Possible Cause	Corrective Action
Fault 27: FAULT PHASE CONTROLLER ERROR Control does not detect the phase board.	Phase control board failure.	Replace phase control board.
Fault 28: FAULT MAG FILAMENT IS OPEN Low filament current.	Magnetron has failed.	Replace magnetrons.

Bulb Troubleshooting

NOTE: Any bulb that has been touched with bare hands or otherwise contaminated should be cleaned with isopropyl alcohol prior to use. Clean latex or nitrile gloves must be worn when handling bulbs. Failure to keep bulbs clean may result in premature failure.

Problem	Possible Cause	Corrective Action
1. Bulbs have white fingerprints	Dirt and oils on the bulb were burned in while the bulb was operating.	Replace the bulb. Wear clean latex or nitrile gloves whenever handling bulbs.
2. Bulb does not start	Bulb is damaged or system controller has faulted.	Check the system controller for fault messages. Replace the bulb.
3. Bulb is rippled	Bulb is overheating.	Clean all air filters. Check the lamphead pressure by pressing the LAMPHEAD AIR PRESSURE button. Make sure the proper bulb for the lamp is installed.
4. Bulb has a white or gray cloudy appearance	End of bulb life.	Replace the bulb.
	Bulb is overheating.	If UV output is below acceptable levels, check the system cooling then replace the bulb if necessary. Make sure the proper bulb for the lamp is installed.
5. Bulb does not fit securely in lamphead	Bulb mounting tips are chipped or broken.	Replace the bulb.
6. Bulb is overheating	Reflectors not properly installed.	Check reflectors and install correctly if necessary. Refer to page 6-7 in the *Section 6, Maintenance and Repair* for installation instructions. Replace the reflectors if necessary.
	Wrong bulb used.	Make sure the proper bulb for the lamp is installed.

Curing Process Troubleshooting

Problem	Possible Cause	Corrective Action
System running correctly but material not curing	Reflectors are installed incorrectly.	Check reflectors; make sure they are installed correctly in the brackets and supports.
	Reflectors are dirty or damaged.	Clean or replace the reflectors.
	RF screen dirty.	Replace the RF screen.
	Lamp not in focus.	Focus the lamphead.
	Incorrect bulb type.	Replace with the correct bulb type.
	Low power level setting.	Increase the power level on the system controller.
	Material issue.	Contact the material supplier to verify the UV spectrum/intensity output.

General Lamphead Troubleshooting

Problem	Possible Cause	Corrective Action
Low lamphead pressure	Refer to *Fault Message Troubleshooting* in this section.	
Magnetron failure		
RF fault on system controller	Tear in the RF screen in front of the bulb.	Replace the screen.
	RF screen not securely fastened.	Tighten the screen.
	Lamphead bulb has failed.	Replace the lamphead bulb.
	RF detector was improperly installed.	Check RF placement and connections to system controller. Refer to the *Section 3, Installation* for installation requirements.
The lamphead is showing signs of electrical arcing	Loose component or debris in the lamphead.	Tighten all fasteners. Clean the lamphead interior. Refer to *Section 6, Maintenance and Repair* to replace any damaged lamphead parts.

Diode Block Testing

WARNING: Shut off power to the system controller, allow the capacitors time to bleed off voltage, then remove the diode blocks from the controller before performing the following tests. Failure to observe this warning can result in equipment damage or personal injury.

There are two diode blocks in the system controller. Each diode block contains 4 high voltage rated diodes connected in a bridge network.

Diode 1 Connection: HV– and AC-1 (Anode to HV–, Cathode to AC-1)
Diode 2 Connection: HV– and AC-2 (Anode to HV–, Cathode to AC-2)
Diode 3 Connection: AC-2 and C (Anode to AC2, Cathode to C)
Diode 4 Connection: C and AC-1 (Anode to AC1, Cathode to C)

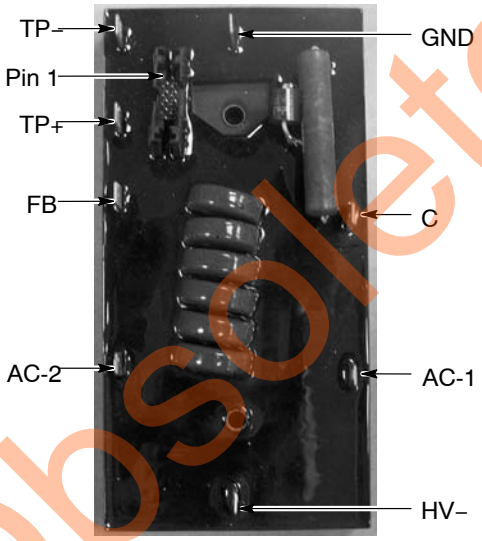


Figure 5-1 Diode Block Terminals and Connector Pins

Tests:

GND to pin 1	1005 ohm ±1%
GND to pin 2	short, less than 0.2 ohm
GND to pin 3	20,000 ohm ±1%
GND to pin 4	short, less than 0.2 ohm
GND to pin 5	open, over 20 M ohm
GND to pin 6	open, over 20 M ohm
GND to pin 7	open, over 20 M ohm
GND to pin 8	open, over 20 M ohm
GND to pin 9	open, over 20 M ohm
GND to pin 10	open, over 20 M ohm
TP– to pin 2	short, less than 0.2 ohm
TP– to TP+	200 ohm ±1%
C to FB	1000 ohm ±1%
C to GND	4.9 ohm ±1%

Section 6
Maintenance and Repair

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

Introduction

Establish acceptable curing levels for your process and then develop a maintenance schedule that fits your needs. Radiometers can be used to measure relative readings for spectral output as a means of monitoring spectral intensity.

The maintenance and replacement schedule for the system will depend upon your:

- application process.
- plant environment.
- quality of cooling air passing through the system.
- coating formulation.

Torque Specifications for System Fasteners

Torque specifications for controller and lamphead fasteners are contained in tables following the controller and lamphead parts lists in the Parts section. They are identified in the tables and illustrations by item number. Use these tables to prevent over- or under-tightening the fasteners.

System Controller Maintenance and Repair

Maintenance Schedule

Recommended maintenance for the system controller consists of removing dust from the enclosure and components. This should be done as necessary.

System Controller Repair Procedures

Preparation

1. Turn off the UV system from the process equipment controller or at the system controller panel.
2. Allow the lamphead fan to complete its cooling cycle before shutting off power to the controller.

NOTE: Always shut down the system before shutting off controller power. Shutting off the system while the UV lamp is on could result in equipment damage.

3. Turn off the main electrical disconnect. Follow all relevant OSHA established lockout procedures or local codes as appropriate.
4. Allow time for all capacitors to bleed off their stored energy before removing the system controller cover.

CAUTION: The integrated circuits on the system controller printed circuit boards can be damaged by small electrostatic charges. Always wear an approved grounding strap when handling circuit boards.

Fuses

See Figures 6-1 and 6-2 to identify the replaceable fuses in the system controller. Use an appropriate tool to remove the fuses. Replace them with identical fuses. Refer to the *Section 7, Parts* for ordering information.

- F1: Blower, 3A, slow blow, 250V
- F2: Blower, 3A, slow blow, 250V
- F3: Board Power, 160mA, slow blow, 250V
- F4: Filament Transformers, 2A, slow blow, 250V

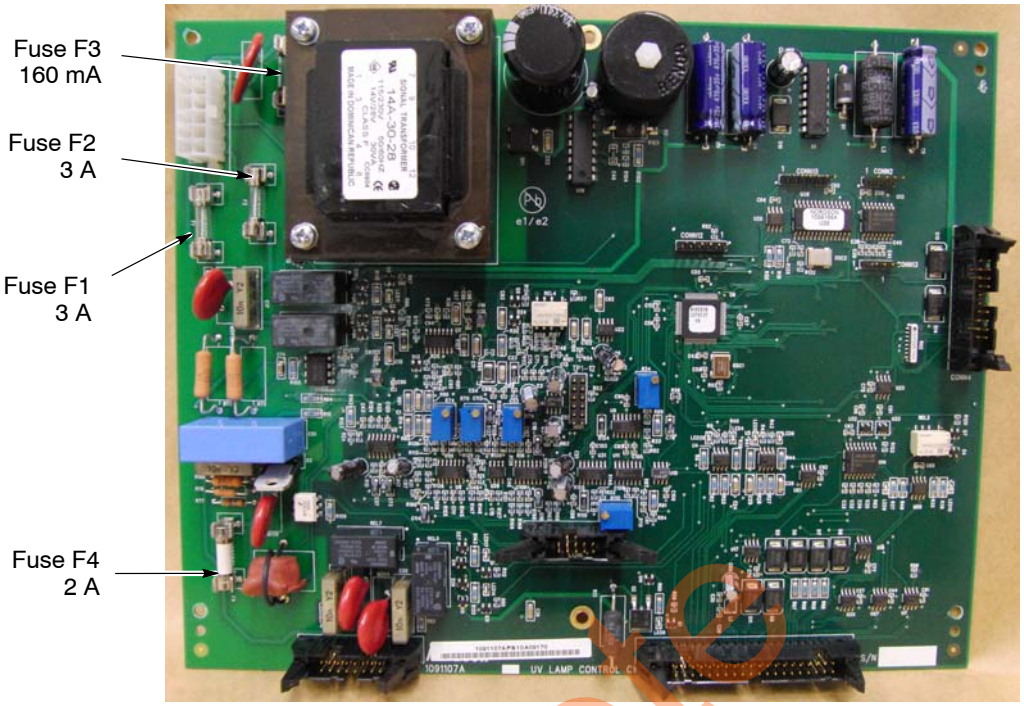
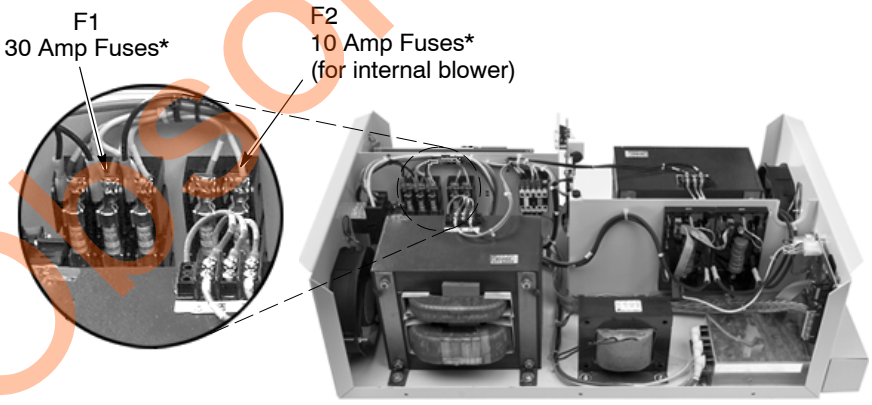


Figure 6-1 Main Control Board Fuses



* These fuses must be FNQ rated or equivalent

Figure 6-2 System Controller Fuses

Cleaning System Controller Cooling Fans

1. Turn off the main electrical disconnect. Follow all relevant OSHA-established lockout procedures or local codes as appropriate.
2. The system controller cooling fans are located on the front and rear panels. Make sure the safety covers are clean and free of debris.
3. Examine the fan blades for contamination or damage. Clean the blades or replace the fan if necessary.

Lamphead Maintenance and Repair

Table 6-1 lists typical maintenance guidelines and replacement schedules for the components of the CW2 10-inch lamphead.

Recommended maintenance to the lamphead consists of changing bulbs and reflectors and cleaning or replacing filter material. It is also recommended that reflectors be cleaned periodically.

Table 6-1 Typical Lamphead Maintenance Schedule

Component	Maintenance Guidelines	Replace component
UV Bulb	Bulbs are warranted for a specific number of hours when operating under the manufacturer specifications (hours vary with differing bulbs). Depending on your application, some installations may provide acceptable curing well beyond the warranty. **NOTE:** Do not touch or handle the bulb with bare hands. Wear clean latex or nitrile gloves. Clean the bulbs with isopropyl alcohol and a clean lint-free cloth or tissue to remove any fingerprints or other contamination.	as needed
Magnetrons	The magnetrons are warranted for a specific number of hours when operating under the manufacturer specifications. Each application will be different and, in many cases, the magnetron life will last well beyond the warranty.	as needed
Screen	The screen should be free of all debris such as cured material, lint, dust or anything that might impede cooling or UV transmittance. Do not use damaged screens. This can result in RF radiation leakage.	as needed
Reflectors	**DO NOT USE A CLEANING SOLUTION THAT CONTAINS AMMONIA.** Never use any abrasive media to clean the reflectors. This will damage the reflector surface. Reflector surfaces should be cleaned as needed (more frequently in dirty environments) and at every bulb change. Wipe the reflector surface and the cavity with a clean, lint-free cloth dipped in a suitable solvent such as isopropyl alcohol. No residue should be left on the reflector surface. Do not touch reflectors with bare hands; use clean latex or nitrile gloves. Be careful when replacing reflectors. They are made of glass and may break if dropped or forced into position.	as needed
Filters • Remote blower (see Note) • Internal blower lamphead	Filters are designed to prevent dust and contaminants from entering the UV equipment. Eventually, the filters become clogged and start to impede the cooling air flow, causing excessive heat which will result in premature failure of the UV equipment. A dirty filter can also release contaminates into the air flow that may deposit on the part being cured as well as the bulb and reflector. Internal blower filters cannot be cleaned. They are coated with a tacky material that traps contaminants.	Weekly or as needed
NOTE: Nordson does not supply filters on the system controller or external blowers. Filters must be supplied by the customer. For Internal blower lampheads, a filter is provided (refer to page 6-5 for replacement instructions). Refer to *Section 7, Parts* for replacement filters.		

Internal Blower Lamphead Filter Replacement

WARNING: Turn off the lamp and allow the system to proceed through the cool down cycle and shut down the blower before replacing the filter.

The lamphead filters are held in place by a lip around the air inlet opening and supports across the opening. Pull the used filter out from under the lip and discard it.

Lamphead filters have a white, coarse side and a colored, fine side. Replace the filter with the **colored side down**, white side showing, making sure that the filter is tucked under the lip all around the opening.

WARNING: Filters cannot be cleaned. They contain a tacky material that traps dirt. Do not attempt to clean or reuse dirty filters. Do not flip dirty filters over and re-install them, as this will allow dirt and other contaminants to enter the lamphead and damage the bulb and reflector, and possibly contaminate the product being cured.

Lamphead Repair Procedures

Preparation

1. Turn off the UV system from the process equipment controller or at the system controller control panel.
2. Allow the lamphead fan to complete its cooling cycle. If this has been prevented by shutting off power to the system controller or to the external blowers prematurely, always allow sufficient time for the bulb to cool before proceeding.
3. Turn off the main electrical disconnect. Follow all relevant OSHA lockout procedures or local codes.
4. Disconnect the unicable from the lamphead.
5. If necessary, loosen the lamphead mounting fasteners and remove the lamphead from its mounting.

Bulb Replacement

CAUTION: Use only the Nordson bulbs listed in this manual. Equipment damage may occur if bulbs from any other source are used.

1. Perform the *Preparation* procedure in this section.
2. See Figure 6-3. Turn or place the lamphead assembly so that the entire bulb area is exposed and accessible.
3. Remove the eight screws from the screen flanges to remove the RF screen.

Bulb Replacement *(contd)*

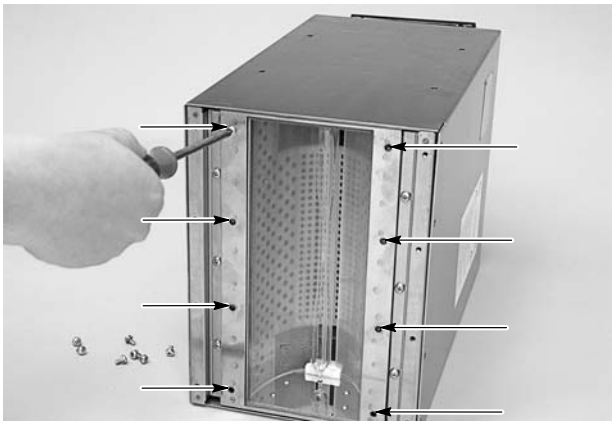


Figure 6-3 RF Screen Removal

CAUTION: Do not touch the bulb or reflectors with bare hands. Wear clean, residue-free nitrile or latex gloves.

4. See Figure 6-4. The bulb is held in place by springs inside the retaining holes at each end of the lamp. Grasp both ends of the bulb and push one end into its retaining hole until the other end comes free. Carefully tilt the bulb to the side just enough to remove the retained end from the hole. Tilting the bulb too much could break off the tip of the bulb.
5. Place one end of the new bulb into a retaining hole and carefully push down on that end to force the spring down. Guide the other end of the bulb into the opposite retaining hole and allow the springs to secure the bulb in place.
6. Place the old bulb in the new bulb packaging and dispose of according to your company disposal policies. Refer to the *Section 1, Safety* section for the bulb return policy.
7. Install the RF screen on the lamphead base with the eight M4 screws. Torque the screws to 1.18–1.57 N•m (0.87–1.16 lb-ft).

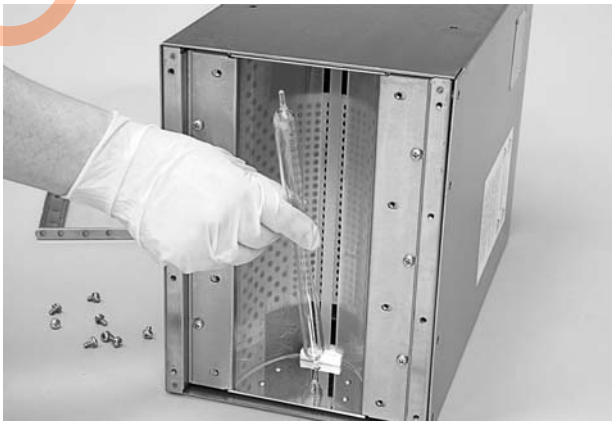


Figure 6-4 Bulb Removal and Replacement.

Reflector Replacement

Two types of reflectors may be used in the lamphead: **Flood** or **Focus**. Each type uses different retaining brackets and supports.

Use these outlines to find out what kind of reflectors and supports are installed in your lamphead.

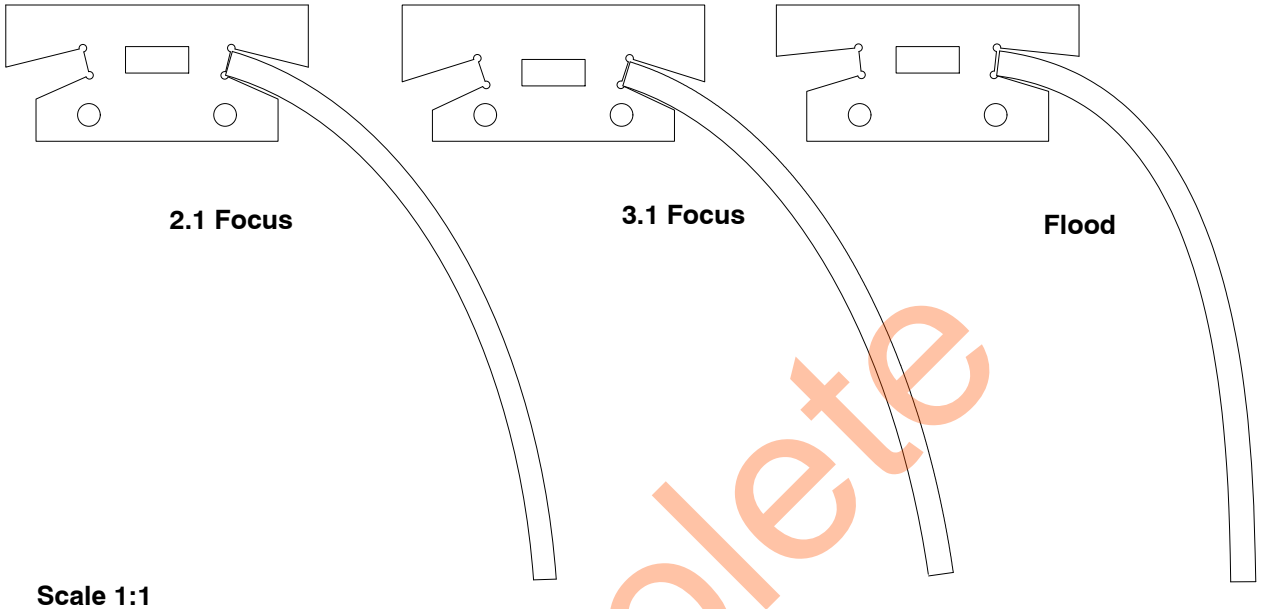


Figure 6-5 Reflector and Reflector Support Outlines

Different retaining brackets are used to secure the reflectors in place in the lamphead. Figure 6-6 illustrates the differences in their retaining brackets. Note that two retainers are stamped into the flood bracket.

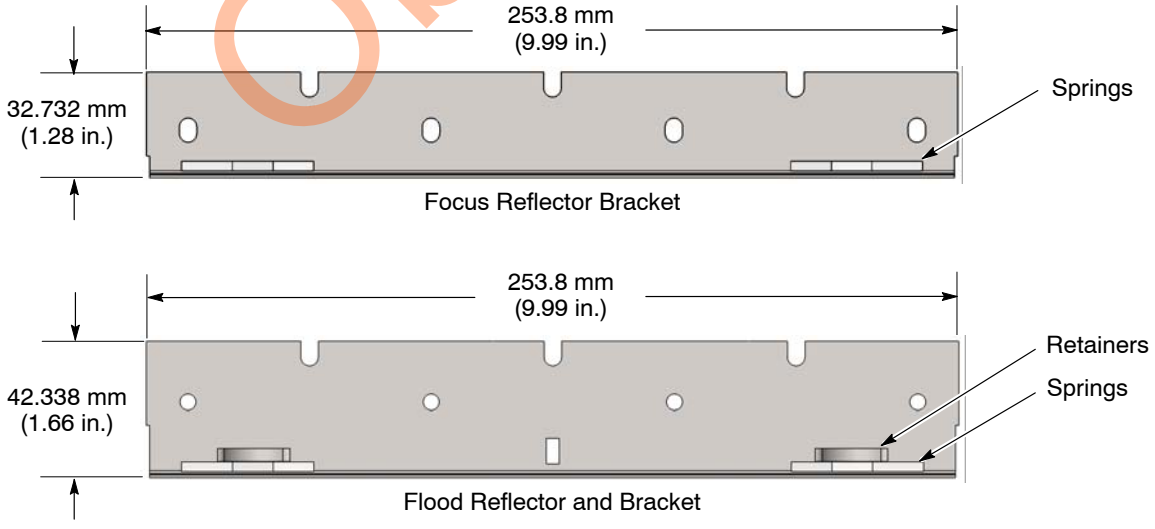


Figure 6-6 Reflector Brackets

Reflector Replacement *(contd)*

NOTE: Great care should be taken when replacing reflectors as they are made of glass and may break if dropped or forced.

1. Perform the *Preparation* procedure on page 6-5.
2. Turn or place the lamphead so that the entire bulb area is exposed and accessible.

CAUTION: Do not touch the bulb or reflectors with bare hands. Wear clean latex or nitrile gloves.

3. Remove the screen and bulb as described on page 6-5.
4. See Figure 6-7. Loosen the six mounting screws, then remove the two retaining brackets from the lamphead base.

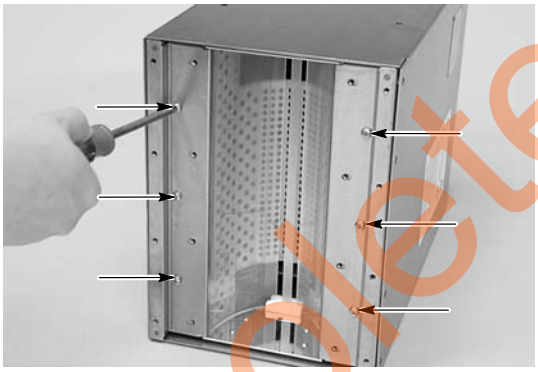


Figure 6-7 Retaining Bracket Removal

5. Carefully slide the two reflectors from the lamphead base.

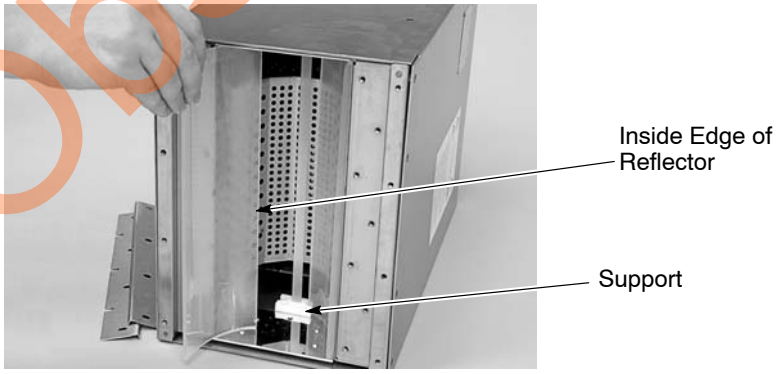


Figure 6-8 Reflector Removal and Replacement

NOTE: The outside edges of the reflectors are printed with the part number.

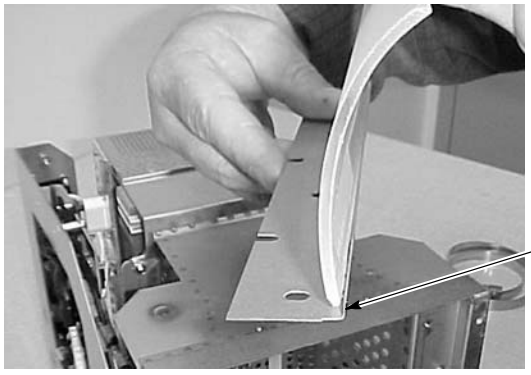
6. Slide the new reflectors into the lamphead base and slide the inside edges into the notches in the white supports.

7. Set the retaining brackets in place. The placement of the retaining brackets differs between focus and flood reflectors.

   Focus Reflectors: See Figure 6-9. The edge of the reflector sits on the springs next to the lip of the bracket. The lip wraps around the edge of the reflector.

   Line up the retaining bracket mounting holes with the three mounting holes in the lamphead base.

Focus Reflector and Retaining Bracket



Installing the Focus Retaining Bracket

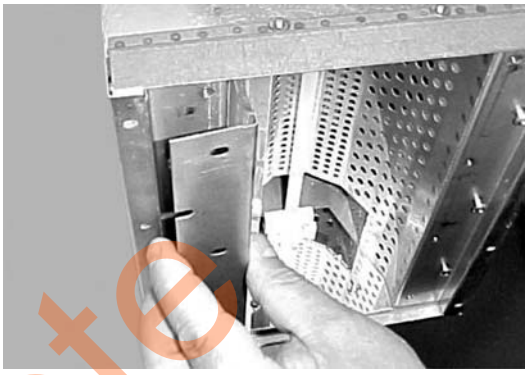
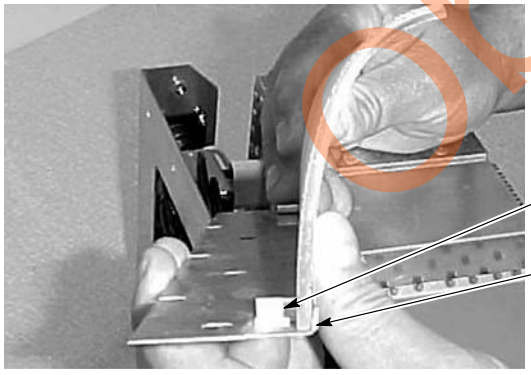


Figure 6-9 Focus Reflector Installation

Flood Reflectors: See Figure 6-10. The edge of the reflector sits on the springs next to the inside lip of the bracket and between the curved retainers and the lip.

The lip on the flood bracket goes inside of the lamphead and wraps around the edge of the reflector. Line up the retaining bracket mounting holes with the three mounting holes in the lamphead base.

Flood Reflector and Retaining Bracket



Installing the Flood Retaining Bracket

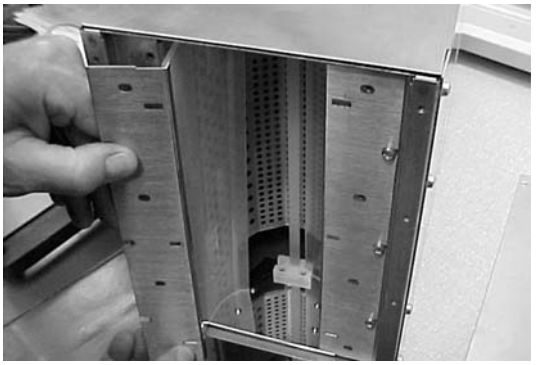


Figure 6-10 Flood Reflector Installation

8. Torque the six retaining bracket screws to 1.8–1.57 N•m (0.87–1.16 lb-ft) to secure the retaining brackets.
9. Install the bulb and RF screen as described on page 6-6.

Internal Blower Replacement

1. See Figure 6-11. Remove the blower cover by removing the 6 M4 x 10 Philips head screws (3 front and 3 rear). Set the blower cover aside.
2. Disconnect the blower cable from the receptacle in the cover.
3. Remove the four M6 x 20 machine screws, lock washers, flat washers, and ground wire from the blower base, then lift the blower off the bottom cover.
4. Plug the new blower harness into the blower connector.
5. Install the blower on the cover and secure it in place with the four M6 x 20 machine screws, lock washers, and flat washers, making sure to connect the ground wire to the blower base with one of the screws. Torque the screws to 2.25 N•m (20 in-lbs).
6. Plug the blower harness into the receptacle on the cover.
7. Install the blower cover and secure it with the six M4 x 10 screws. Torque the screws to 1.35 N•m (12 in-lbs).

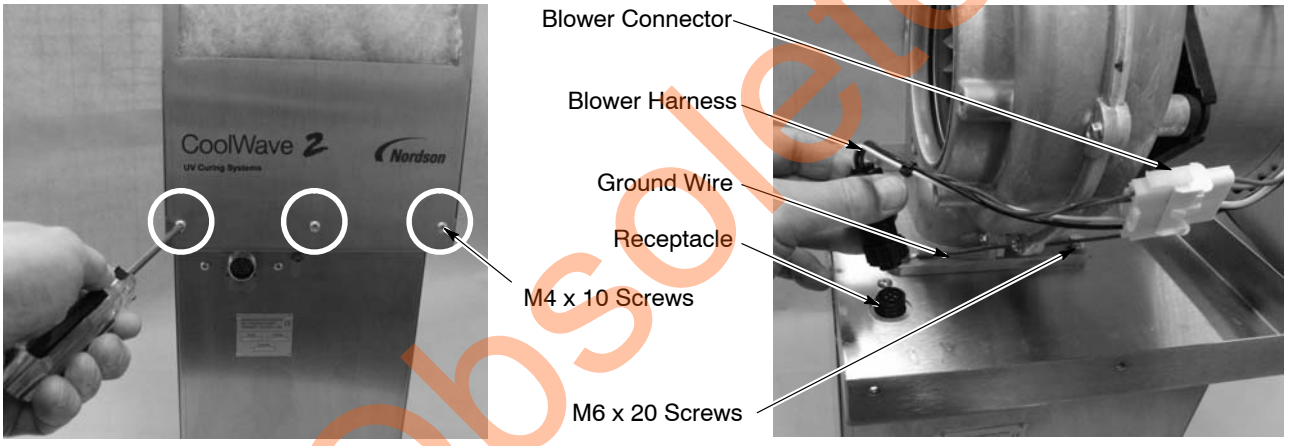


Figure 6-11 Removing Blower Cover

Internal Blower Lamphead Complete Cover Removal

1. Disconnect the unicable from the lamphead.
2. See Figure 6-12. Remove the top blower cover by removing the 6 M4 x 10 Philips screws (3 front and 3 rear) and set aside.
3. Remove the 2 M4 x 20 screws on either side of the unicable receptacle.

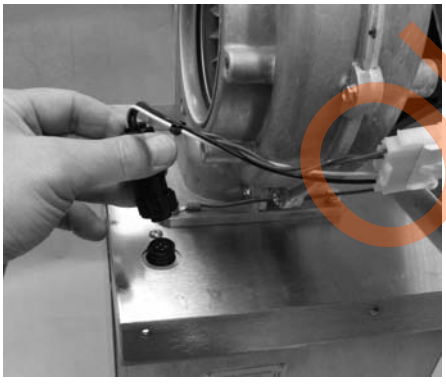
Removing Screws from Top Cover

Removing Screws at Unicable Receptacle

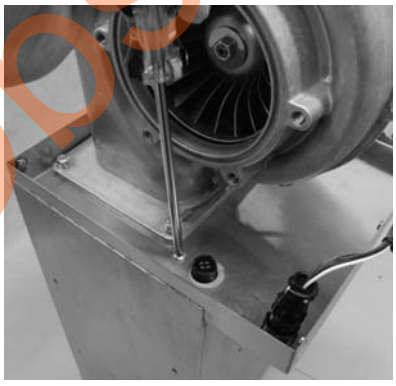
Figure 6-12 Removing Top Blower Cover

4. See Figure 6-13. Remove the M4 x 10 Philips screw next to the blower cable receptacle. Unplug the blower cable from the receptacle.
5. Remove the 8 screws at the base of the lamphead (4 front and 4 rear).

Remove Blower Plug



Remove Top Screw



Remove 8 Screws – 4 Front and 4 Rear

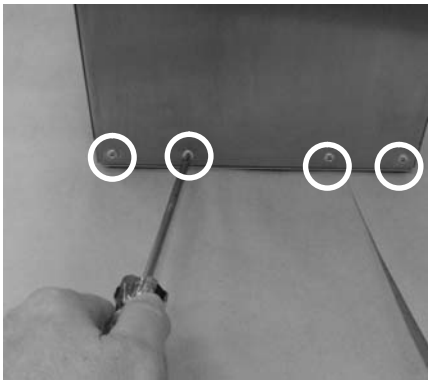


Figure 6-13 Removing Blower Plug and Screws

6. See Figure 6-14. Lift the bottom cover straight up and then push the unicable receptacle into the cover until it clears the cover housing.

Internal Blower Lamphead Complete Cover Removal *(contd)*

Unicable Receptacle Clearing Cover

Lifting Bottom Cover

Figure 6-14 Removing the Cover

7. Pull the cover the rest of the way up and off the lamphead and set it aside.

Internal Blower Lamphead Cover Replacement

1. Slide the bottom cover down over the lamphead until the unicable receptacle drops into the slot and the 8 holes at the bottom of the cover line up.
2. See Figure 6-13. Replace the 8 screws at the base of the lamphead (4 front and 4 rear). Install the two screws into the cover on both sides of the unicable receptacle. Tighten the screws to 1.35 N•m (12 in-lbs).
3. Reconnect the blower cable and install the screw next to the plug.
4. See Figure 6-12. Replace the top blower cover and secure with 6 screws (3 front and 3 rear). Tighten the screws to 1.35 N•m (12 in-lbs).
5. Refer to page NO TAG. Reconnect the unicable to the lamphead.

External Blower Lamphead Cover Removal

See Figure 6-15. Remove the 11 screws (3 top, 8 bottom) from the lamphead cover. Lift the cover off the lamphead.

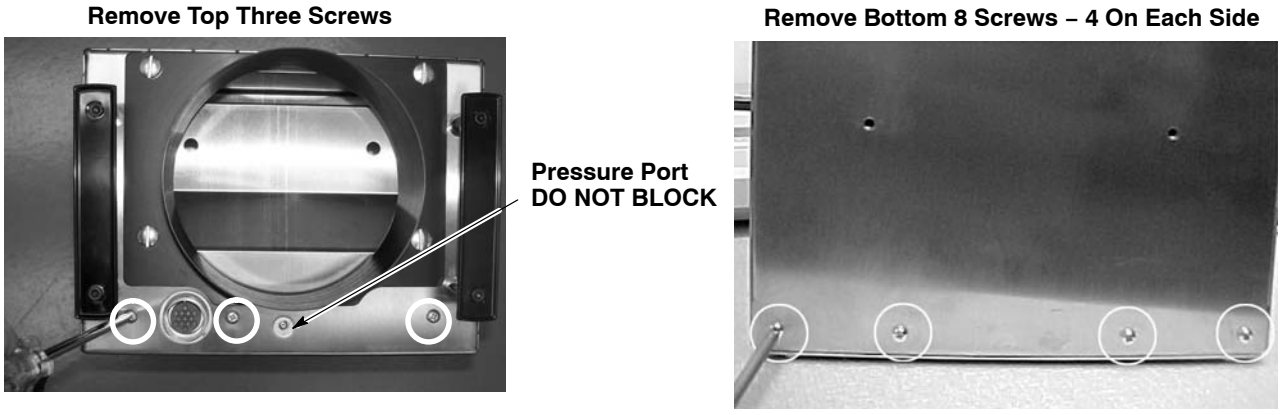


Figure 6-15 External Blower Lamphead Cover Removal

Lamphead Internal Component Replacement

Remove the lamphead cover to replace the following internal components:

- Magnetrons
- Filament transformers
- Light detector/temperature/pressure board
- Starter bulb

Preparation

NOTE: Step 2 is taken to prevent damage to the RF screen or bulb.

1. Perform the *Preparation* procedure on page 6-5.
2. Remove the RF screen and bulb as described on page 6-5.
3. Remove the lamphead cover as described in the *Internal Blower* or *External Blower Lamphead Cover Removal* procedures.
4. Remove the two M4 screws shown in Figure 6-16.

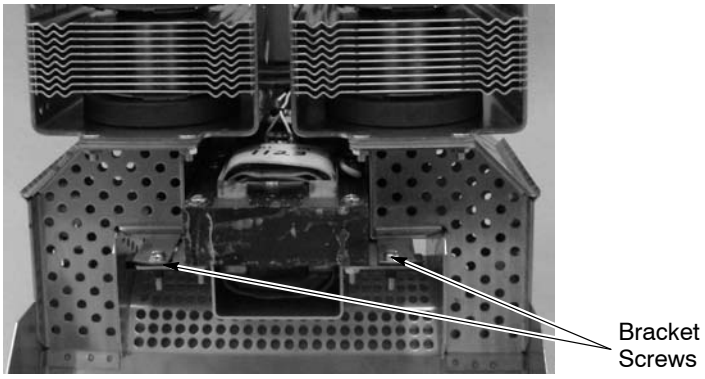


Figure 6-16 Transformer Bracket Screws

Preparation *(contd)*

5. See Figure 6-17. Pull the the transformer bracket from the wave guide assembly far enough out to access the wiring connections.

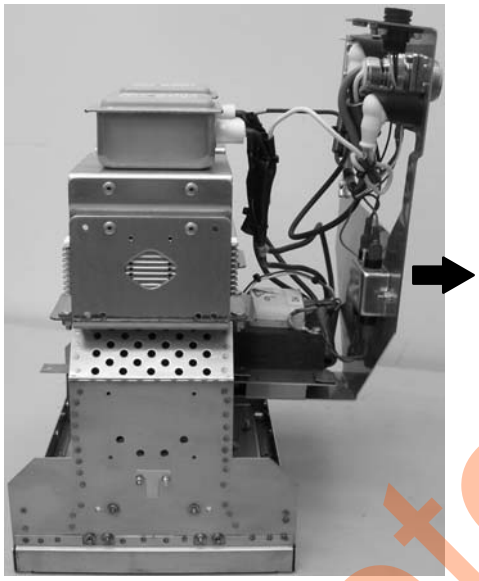


Figure 6-17 Removing the Transformer Bracket (External Blower Version Shown)

Magnetron Replacement

NOTE: Each lamphead contains two magnetrons. The replacement procedure is the same for each magnetron.

1. Follow steps 1–5 under *Preparation* on page 6-13.
2. See Figure 6-18. Cut the four ties securing the black HV insulation sleeves to the HV cables. Slide the sleeves down to expose the two ring-tongue terminal connections.
3. Remove the two terminal screws and disconnect the cables from the magnetron pigtails. Remove the sleeves and discard them. Save the screws for re-use.

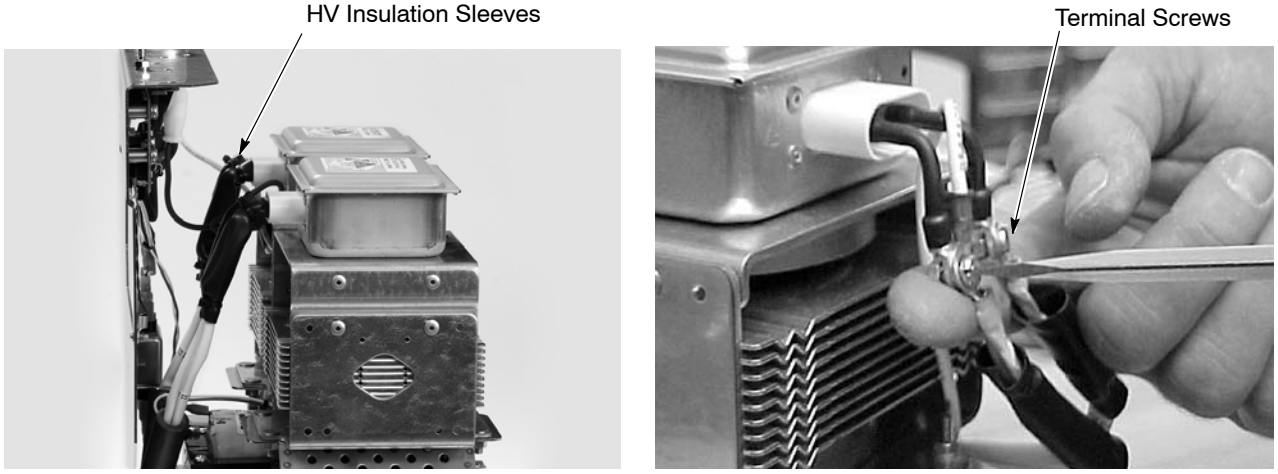


Figure 6-18 Magnetron Removal

4. See Figure 6-19. Remove the four nuts that secure each magnetron to the wave guide. Remove the magnetrons. Save the nuts for re-use.

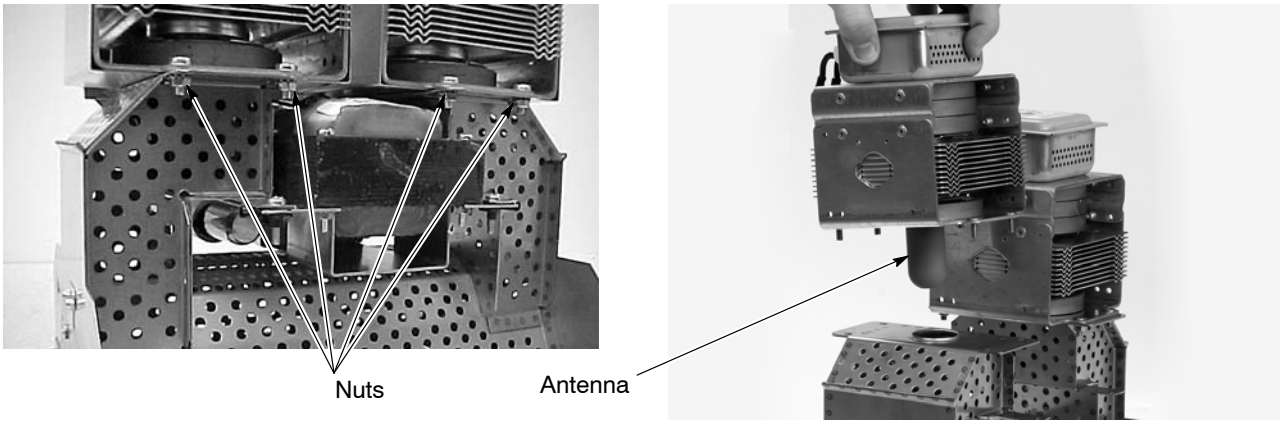


Figure 6-19 Magnetron Removal

5. See Figure 6-19. Inspect the gasket around the antenna of the new magnetron, making sure it is smooth and free of debris.
6. Carefully insert the antenna through the hole in the wave guide.
7. Make sure the magnetron gasket is sealed evenly on the flange, then secure the magnetron to the wave guide with the four nuts, washers, and screws. Tighten the nuts to 1.9 N•m (17-in. lb).
8. Install one new black insulating sleeve (shipped with the magnetrons) over the X1and HV cables. Install the other new sleeve over the X2 cable.
9. Use the screws removed in step 3 to connect the X2 secondary cable to the magnetron **F** terminal pigtail. Connect the X1 secondary cable and the 20 AWG HV cable with ferrite to the **FA** terminal pigtail.
10. Pull the black insulation sleeves over the terminals so that they are completely covered. Secure the top and bottom of the sleeves with cable ties.

Filament Transformer Replacement

NOTE: To replace both filament transformers, order two filament transformer kits. The filament transformer kit contains one transformer, one ferrite, two insulation sleeves, and four cable ties for the sleeves.

1. Follow steps 1–5 under *Preparation* on page 6-13.
2. See Figure 6-18. Cut the four ties securing the black HV insulation sleeves to the HV cables at the magnetron. Slide the sleeves down to expose the ring-tongue terminal connections.
3. Remove the two terminal screws and disconnect the cables from the magnetron pigtails. Remove the sleeves and discard them. Save the screws for re-use.
4. Remove the transformer bracket from the wave guide assembly.

Filament Transformer Replacement (contd)

5. See Figure 6-20. Note the colors of the primary wires connected to the transformer H1 and H2 terminal tabs, then disconnect the wire receptacles from the tabs.
6. Remove the four M4 screws and nuts securing the transformer and transformer ground wire to the bracket. Cut the cable ties around the secondary cables as necessary, then remove the transformer from the bracket.

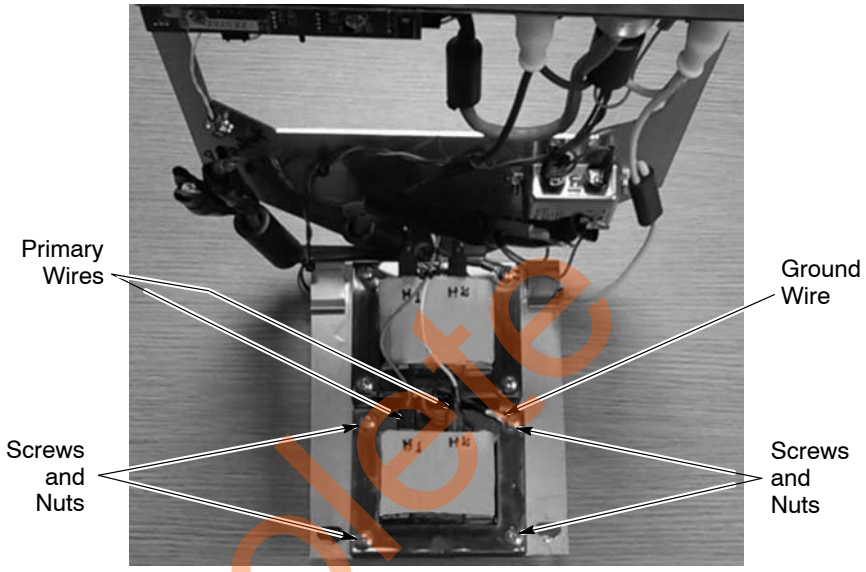


Figure 6-20 Transformer Removal

7. See Figure 6-21. Install the new transformer on the bracket. If replacing the outer transformer, route the secondary cables under the inner transformer.
8. Secure the transformer to the bracket with the M4 screws and nuts, securing the green transformer ground wire to the bracket with the screws.

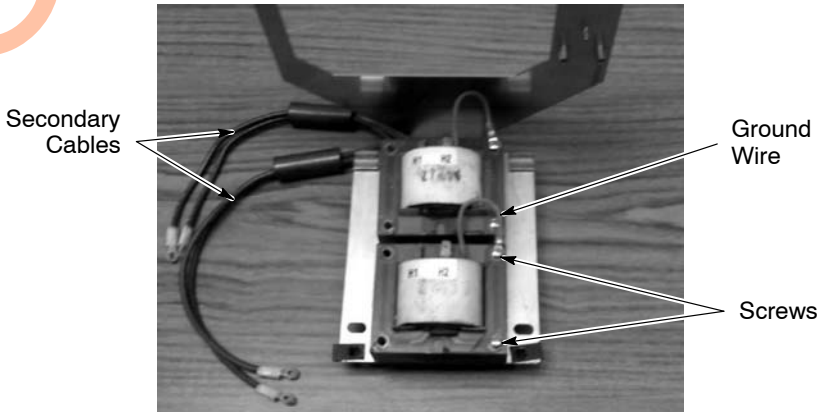


Figure 6-21 Transformer Installation

9. See Figure 6-22. Arrange the secondary cable ferrites of both transformers as shown. Install cable ties below the ferrites to prevent them from sliding down the secondary cables, then install another cable tie joining both pairs of secondary cables approximately 2 inches (51 mm) above the ferrites.

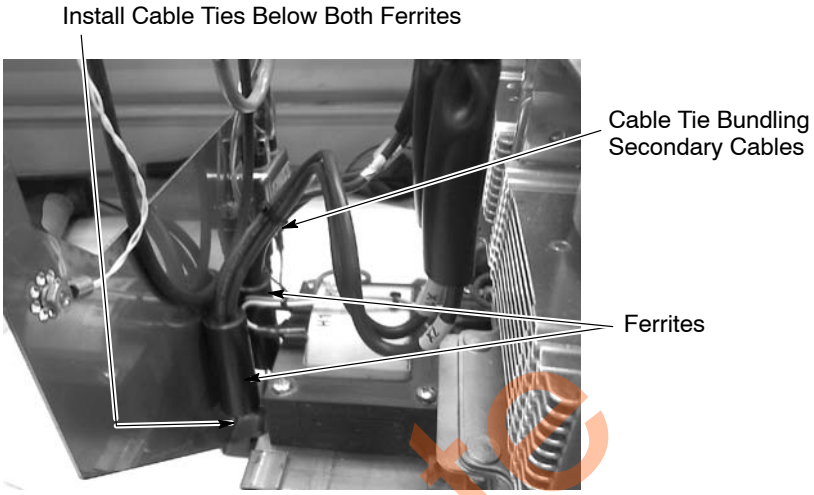


Figure 6-22 Installing Cable Ties on Secondary Cables

10. Slide new insulation sleeves over X2 secondary cables, and another over both the X1 secondary cables and the 20AWG HV harness cables.
11. Slide the transformer bracket part way back into the wave guide assembly.
12. Connect the bracket harness wires to the transformer H1 and H2 tabs exactly as removed in step 5.
13. See Figure 6-18. Use the screws removed in step 3 to connect the X2 secondary cable to the magnetron **F** terminal pigtail. Connect the X1 secondary cable and the 20 AWG HV cable with ferrite to the **FA** terminal pigtail.
14. Pull the black insulation sleeves over the terminals so that they are completely covered. Secure the top and bottom of the sleeves with cable ties.
15. Slide the transformer bracket all the way into the wave guide assembly. Secure the bracket with the two M4 screws shown in Figure 6-16.

Light Detector Board Replacement

1. Follow steps 1–5 under *Preparation.*
2. See Figure 6-23. Disconnect the temperature sensor harness, the controller harness, and the pressure sensor hose from the light detector board.
3. Remove the three screws and the light detector board.
4. Install and connect the new board. Note that the pressure sensor hose must be connected to the barbed fitting labeled “B”.

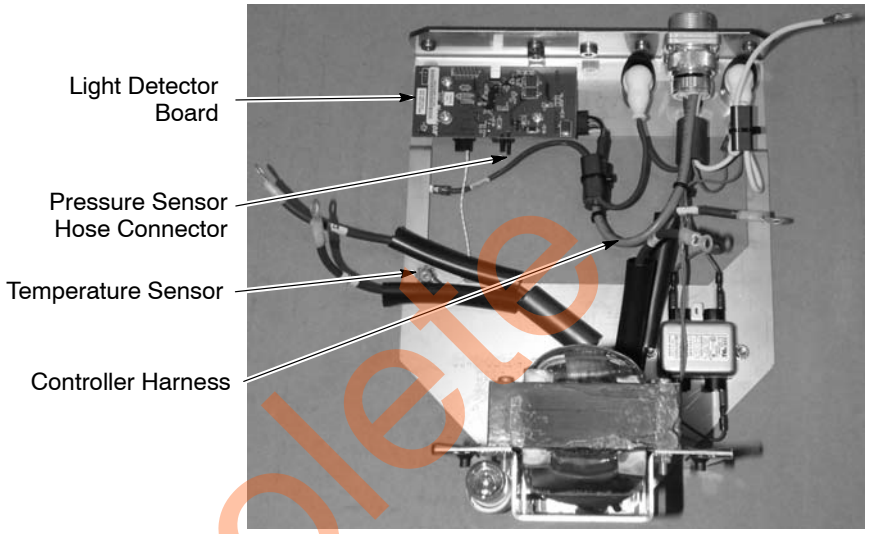


Figure 6-23 Light Detector Board Replacement (External Blower Version Shown)

Temperature Sensor Replacement

See Figure 6-23. The internal temperature sensor (thermistor) is also replaceable separately. It consists of a two-wire harness with plug and ring-tongue terminal. The thermistor is potted to the ring-tongue terminal.

To replace the sensor, unplug the harness from the light detector board and remove the screw securing the ring-tongue terminal to the bracket.

Starter Bulb Replacement

1. Follow steps 1–5 under *Preparation.*
2. See Figure 6-24. Cut the RTV sealant at the bulb base and unscrew the bulb.
3. Screw the new bulb into the socket. Apply a small dot of RTV sealant between the bulb and socket. The RTV sealant keeps the bulb from vibrating out of the socket.

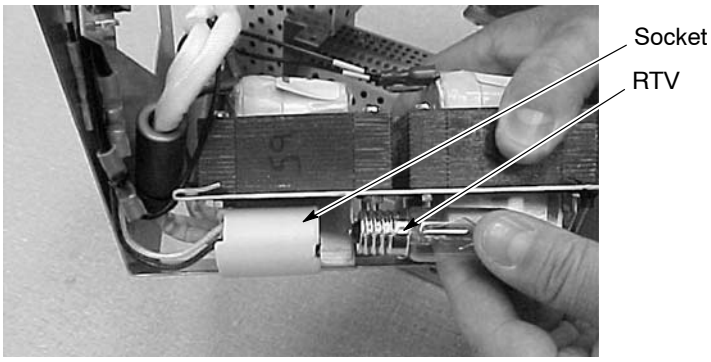


Figure 6-24 Starter Bulb Replacement

Re-Assembly

1. Check all wiring connections and make sure they are secure and that insulation is intact.
2. Install the cover on the lamphead.
3. Install the bulb and RF screen as described in *Bulb Replacement* on page 6-6.

Section 7
Parts

Introduction

To order parts, call the Nordson Industrial Coating Systems Customer Support Center at (800) 433-9319 or contact your local Nordson representative.

CW2 610 System Controllers

Part	Description	Note
60 Hz Applications:		
1084113	System controller, 480V	
1084110	System controller, 480V, with DeviceNet	
1086251	System controller, 480V, internal blower	
1086252	System controller, 480V, internal blower, with DeviceNet	
50 Hz Applications:		
1084112	System controller, 400V	
1079706	System controller, 400V, with DeviceNet	
1084625	System controller, 400V, internal blower	
1083276	System controller, 400V, internal blower, with DeviceNet	

System Controller Repair Parts

See Figure 7-1.

Item	Part	Description	Quantity	Note
–	- - - - - -	50/60 HZ System Controller, CW2	1	
1	1077135	• CONNECTOR, I/O board, CW2, kit	1	
2	1077121	• TRANSFORMER, HV, CW2, kit	2	
3	1089207	• TRANSFORMER, control, CW2, kit	1	
4	772214	• FAN, 6 in x 1.5 in, 240 VAC	2	A
5	1098890	• MAIN CONTROL BOARD with contactor, CW2, standard, kit	1	C
6	775142	• PCB, display, CW10, kit (display board)	1	
7	1102449	• PHASE CONTROL BOARD AND CABLE, CW2, kit	1	
8	1077131	• I/O CONNECTOR BOARD, CW2, with DeviceNet, kit	1	D
8	1083974	• I/O CONNECTOR BOARD, CW2, without DeviceNet, kit	1	D
9	1091465	• FUSE, CW2, kit	1	A, B
9a	------	• • FUSE, 30 amp, slow-blow, 500V	3	B
9b	------	• • FUSE, 10 amp, time-delay, 250V	2	B
9c	------	• • FUSE, 160 ma, 250V, slow-blow, 5 x 20 mm	1	B
9d	------	• • FUSE, 2 amp, slow-blow, 250V, 5 x 20 mm	1	B
10	103200	• FUSE, 3 amp, slow-blow, 250 volt	2	A
11	1077128	• DIODE, HV, CW2. Kit (diode block)	2	
12	------	• SCREW, truss head, M5 x 8	6	
13	772236	• SWITCH, control, MPS-410/610	1	
14	1077129	• FUSE BLOCK, 3 pole, CW2, kit	1	
15	1077130	• FUSE BLOCK, 2 pole, CW2, kit	1	
16	1077127	• CONTACTOR, CW2, kit	1	C
17	------	• CONTACTOR, 4 pole, 600V, 20A	1	
18	1078306	• CAPACITOR, CW2, kit	1	
19	1077134	• POWER COVER, CW2, kit	1	
20	1077132	• BUMPER, CW2, kit	1	
21	------	• FILTER, 3 phase, line	1	
22	1077125	• MEMBRANE, CW2, kit	1	
23	1089206	• HARNESS, unicable, internal, kit	1	
NS	1077126	• COVER, system controller, kit, CW2	1	
24	1086731	DETECTOR, RF, kit, CW	1	

NOTE A: Recommended spare part. Keep this part in inventory to avoid unplanned downtime.

B: Fuse kit 1091465 contains three 30 amp, 500 volt main fuses; two 10 amp, 250 volt fuses for the step down transformer; one 160 microamp, 250 volt control board fuse; one 2 amp, 250 volt fuse for the filament transformer.

C: This part is a 4 pole, 600V, 20A, 24V coil contactor.

D: Choose correct I/O board kit for your application.

NS: Not Shown

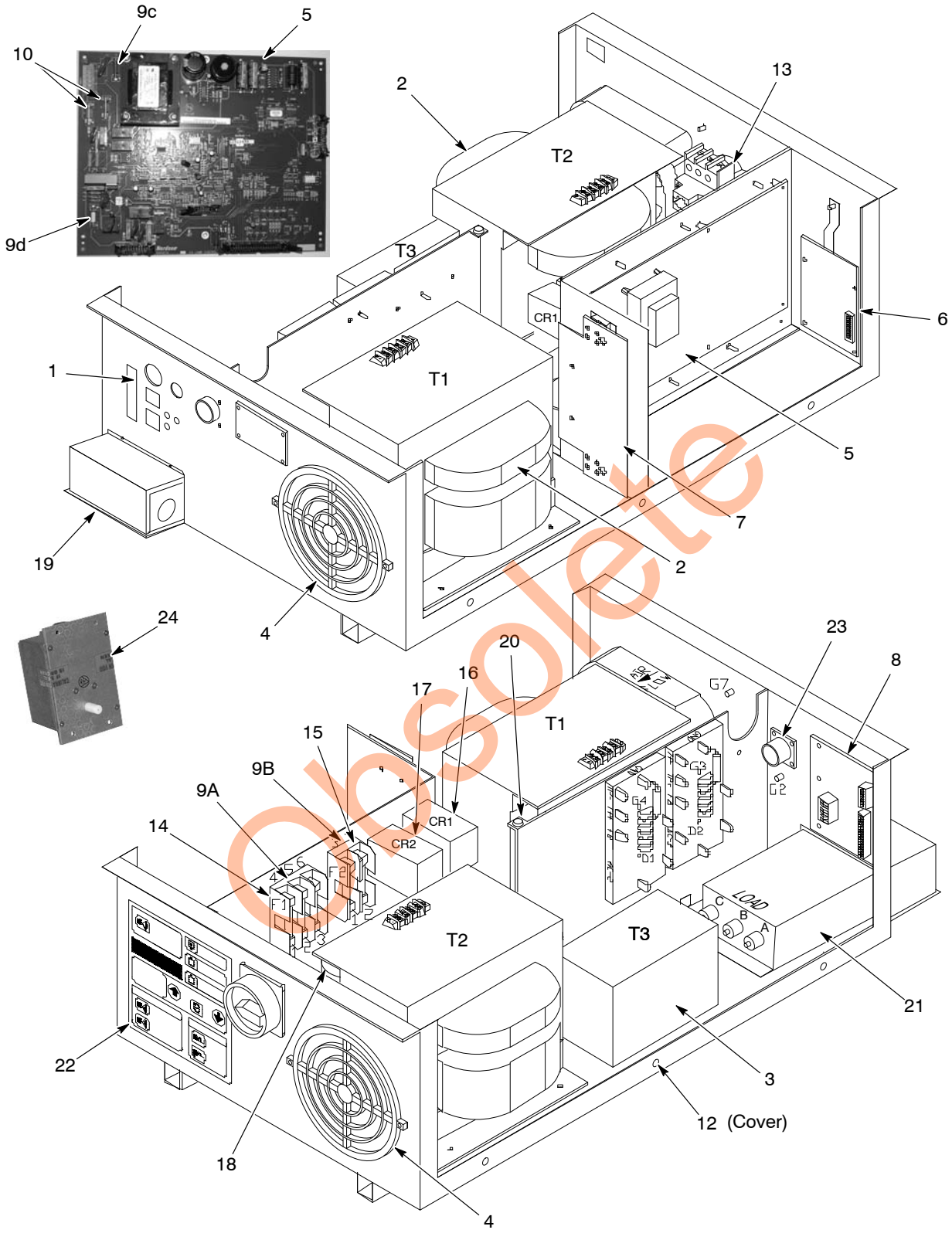


Figure 7-1 CoolWave 2 610 System Controller and RF Detector

CW-2 Internal Blower Lampheads

See Figure 7-2.

Item	Part	Description	Quantity	Note
–	1103923	LAMPHEAD, focus, 2.1, internal blower	1	
–	1103924	LAMPHEAD, focus, 3.1 internal blower	1	
–	1103925	LAMPHEAD, flood, internal blower		
1	------	• BULB, UV, microwave, CW2-610	1	A
2	775060	• RETAINER KIT, reflector, focus, CW10, pair	1	E
2	775061	• RETAINER KIT, reflector, flood, CW10, pair	1	E
3	1605735	• LIGHT DETECTOR board kit, CW2, int blower	1	B
3A	1080150	• • TUBING, Norprene, 0.625 ID x .125 OD	AR	
3B	1074544	• • FITTING, barbed, 1/16 x to 10–32	1	
4	1086973	• HARNESS, thermistor, CoolWave	1	
5	1079419	• TRANSFORMER, filament, kit, CW2	1	B
6	775040	• STARTER BULB, kit, CW10/6	1	B
7	1101443	• REFLECTOR, CW10, focus, 2.1, kit	2	B, C, D
7	775092	• REFLECTOR, CW10, focus, 3.1, kit	2	B, C, D
7	1103118	• REFLECTOR, CW10, flood, kit	2	B, C, D
8	775115	• DEFLECTOR, strip, quartz, CW10, kit	1	B
9	775120	• SCREEN KIT, lamphead, CW10	1	B
10	1075164	• MAGNETRON PAIR KIT, 3.0 Kw	1	B
11	------	• SCREW, truss, M4 x 10, Phillips, steel, zinc	AR	
12	------	• SCREW, button head, socket, M3 x 4, zinc	8	
13	1053767	• MOUNTING kit, reflector and bulb, 2.1 focus, CW10	1	D
13	1053768	• MOUNTING kit, reflector and bulb, 3.1 focus, CW10	1	D
13	1053769	• MOUNTING kit, reflector and bulb, flood, CW10	1	D
14	775116	• REFLECTOR, end, CW10, pair, kit	1	
15	1089205	• KIT, HARNESS, lamphead, CW2, internal blower	1	
16	1092143	• KIT, internal blower	1	
17	1102567	• KIT, 4 pack, filter, air, CW2, internal blower MERV4, blue	1	F
17	1601884	• KIT, 4 pack, filter, air, CW2, internal blower, MERV11, orange	1	F
18	982617	• MACHINE SCREW, hex, M6 x 20, zinc	AR	
19	983409	• WASHER, lock, split, M6, steel, zinc	AR	
20	983410	• WASHER, flat, narrow, M6, steel, zinc	AR	
21	982881	• SCREW, pan head, recessed, M4 x 6, zinc	AR	
22	983416	• WASHER, lock, internal, M4, steel, zinc	AR	
23	------	• SCREW, slotted pan head, 6–32 x .250 in.	AR	
24	984101	• NUT, hex, machine, 6–32, steel, zinc	AR	
25	983044	• WASHER, lock, internal, 6, steel, zinc	AR	
26	------	• NUT, lock, nylon, M3, steel, zinc	AR	
27	984727	• NUT, hex, M4, brass	AR	

Continued...

Item	Part	Description	Quantity	Note
28	------	• WASHER, flat, regular, M4, brass	AR	
29	------	• WASHER, lock, split, M4, brass	AR	
30	------	• SCREW, pan head, recessed, M4 x 16	AR	
31	983416	• WASHER, lock, internal, M4, steel, zinc	AR	
32	------	• NUT, hex, w/external toothed washer, M5	AR	
33	------	• SCREW, pan head, Phillips, M4 x 40, steel	AR	
34	------	• NUT, hex, w/external toothed washer, M4	AR	
35	------	• SCREW, truss, M4 x 10, Phillips, steel, zinc	AR	
36	------	• SCREW, pan head, slotted, M4 x 8, brass	AR	

NOTE A: Order the correct bulb for your application from the list on page 7-10.

B: Recommended spare part. Keep this part in inventory to avoid unplanned downtime.

C: Order the correct reflector for your application. A kit includes one reflector. To replace both, order 2 kits.

D: Order the correct reflector and bulb mounting kit for your reflectors. Kit includes 2 TPFE reflector supports, 2 bulb spring retainers, 4 M3 x 10 screws, and 4 M3 lock nuts.

E: Retainer kit includes 2 reflector retaining brackets. If you are not sure what type of reflectors, supports, and retaining brackets you have, refer to page 6-7.

F: MERV4 blue filters are standard. For dirty environments, use MERV11 orange filters. Both are 270 x 370 mm.

NS: Not Shown

AR: As Required

Torque Specifications for Lamphead Fasteners

Item	Description	Torque
11	SCREW, truss, M4 x 10, Phillips, steel, zinc	1.18–1.57 N•m (0.87–1.16 lb-ft)
12	SCREW, button head, socket, M3 x 4, zinc	0.50–0.65 N•m (4.5–6.0 lb-in)
13	SCREW, button head, socket, M3 x 10, zinc	0.34–0.57 N•m (0.25–0.42 lb-ft)
18	MACHINE SCREW, hex, M6 x 20, zinc	2.26 N•m (20 lb-in)
21	SCREW, pan head, recessed, M4 x 6, zinc	1.18–1.57 N•m (0.87–1.16 lb-ft)
23	SCREW, slotted pan head, 6–32 x .250 in.	0.51–0.68 N•m (0.37–0.49 lb-ft)
26	NUT, lock, nylon, M3, steel, zinc	0.51–0.68 N•m (0.37–0.49 lb-ft)
33	SCREW, pan head, phillips, M4 x 40, steel	1.18–1.57 N•m (0.87–1.16 lb-ft)
34	NUT, hex, w/external toothed washer, M4	1.18–1.57 N•m (0.87–1.16 lb-ft)
35	SCREW, truss, M4 x 10, Phillips, steel, zinc	1.35 N•m (12 lb-in)

Parts Illustration – Internal Blower Lamphead Parts

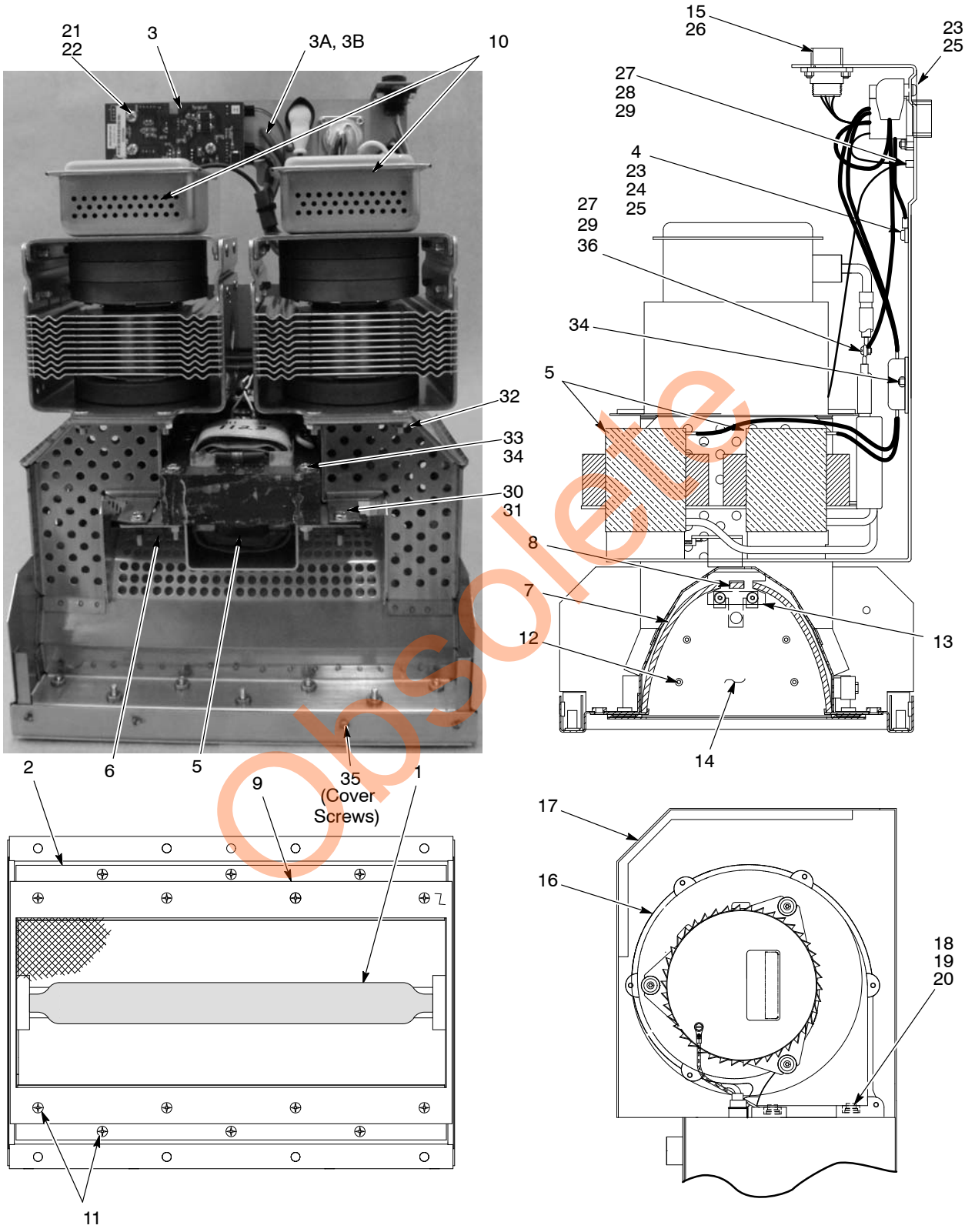


Figure 7-2 CoolWave 2 Internal Blower Lamphead (shown with cover removed)

CW-2 External Blower Lampheads

See Figure 7-3.

Item	Part	Description	Quantity	Note
–	1074677	LAMPHEAD, focus, 2.1, external blower	1	
–	1075554	LAMPHEAD, focus, 3.1, external blower	1	
–	1075555	LAMPHEAD, flood, external blower	1	
1	------	• BULB, UV, microwave, CW2-610	1	A
2	775060	• RETAINER KIT, reflector, focus, CW10, pair	1	E
2	775061	• RETAINER KIT, reflector, flood, CW10, pair	1	E
3	1077320	• LIGHT DETECTOR KIT, CW2	1	B
3A	1080150	• • TUBING, Norprene, 0.625 ID x .125 OD	2 ft	
3B	1074544	• • FITTING, barbed, 1/16 x to 10–32	1	
4	1086973	• HARNESS, thermistor, CoolWave	1	
5	1079419	• TRANSFORMER KIT, filament, CW2	1	B
6	775040	• STARTER BULB KIT, CW10/6	1	B
7	1101443	• REFLECTOR KIT, CW10, focus, 2.1	2	B, C
7	775092	• REFLECTOR KIT, CW10, focus, 3.1	2	B, C
7	1103118	• REFLECTOR KIT, CW10, flood	2	B, C
8	775115	• DEFLECTOR KIT, strip, quartz, CW10	1	B
9	775120	• SCREEN KIT, lamphead, CW10	1	B
10	1075164	• MAGNETRON PAIR KIT, 3.0 Kw	1	B
11	------	• SCREW, truss, M4 x 10, Phillips, steel, zinc	AR	
12	------	• SCREW, button head, socket, M3 x 4, zinc	8	C
13	1053767	• MOUNTING kit, reflector and bulb, 2.1 focus, CW10	1	C
13	1053768	• MOUNTING kit, reflector and bulb, 3.1 focus, CW10	1	C
13	1053769	• MOUNTING kit, reflector and bulb, flood, CW10	1	C
14	775116	• REFLECTOR, end, RR, kit, CW10	1	
15	982881	• SCREW, pan head, recessed, M4 x 6, zinc	3	
16	983416	• WASHER, lock, internal, M4, steel, zinc	3	
NS	1607248	KIT, HARNESS, lamphead, CW2, external blower	1	D
17	------	• SCREW, slotted pan head, 6–32 x .250 in.	AR	
18	984101	• NUT, hex, machine, 6–32, steel, zinc	AR	
19	983044	• WASHER, lock, internal, 6, steel, zinc	AR	
20	------	• NUT, lock, nylon, M3, steel, zinc	AR	
21	984727	• NUT, hex, M4, brass	AR	
22	------	• WASHER, flat, regular, M4, brass	AR	
23	------	• WASHER, lock, split, M4, brass	AR	
24	------	• SCREW, pan head, recessed, M4 x 16	AR	
25	983416	• WASHER, lock, internal, M4, steel, zinc	AR	
26	------	• NUT, hex, w/external toothed washer, M5	AR	
27	------	• SCREW, pan head, Phillips, M4 x 40, steel	AR	
28	------	• NUT, hex, w/external toothed washer, M4	AR	
29	------	• SCREW, truss, M4 x 6, Phillips, steel, grade 8	AR	
30	------	• SCREW, pan head, slotted, M4 x 8, brass	AR	

Continued...

Item	Part	Description	Quantity	Note
31	------	• SCREW, flat head, phillips, M3 x 10, steel, zinc	AR	
32	760529	• HANDLE, lamphead	2	
33	982178	• SCREW, socket, M5 x 50, black	4	
34	983401	• WASHER, lock, split, M5, steel, zinc	4	

NOTE A: Order the correct bulb for your application. Bulbs are listed on page 7-10. Bulbs are recommended spare parts.

B: Recommended spare part. Keep this part in inventory to avoid unplanned downtime.

C: Order the correct reflector and bulb mounting kit for your reflectors. Kit includes 2 TPFE reflector supports, 2 bulb spring retainers, 4 M3 x 10 screws, and 4 M3 lock nuts.

D: Optional equipment.

E: Retainer kit includes 2 reflector retaining brackets. If you are not sure what type of reflectors, supports, and retaining brackets you have, refer to page 6-7.

NS: Not Shown

Torque Specifications for Lamphead Fasteners

Item	Description	Torque
11	SCREW, truss, M4 x 10, Phillips, steel, zinc	1.18–1.57 N•m (0.87–1.16 lb-ft)
12	SCREW, button head, socket, M3 x 4, zinc	0.50–0.65 N•m (4.5–6.0 lb-in)
13	SCREW, button head, socket, M3 x 10, zinc	0.34–0.57 N•m (0.25–0.42 lb-ft)
15	SCREW, pan head, recessed, M4 x 6, zinc	1.18–1.57 N•m (0.87–1.16 lb-ft)
17	SCREW, slotted pan head, 6–32 x .250 in.	0.51–0.68 N•m (0.37–0.49 lb-ft)
20	NUT, lock, nylon, M3, steel, zinc	0.51–0.68 N•m (0.37–0.49 lb-ft)
27	SCREW, pan head, phillips, M4 x 40, steel	1.18–1.57 N•m (0.87–1.16 lb-ft)
28	NUT, hex, w/external toothed washer, M4	1.18–1.57 N•m (0.87–1.16 lb-ft)
29	SCREW, truss, M4 x 10, Phillips, steel, zinc	1.6–1.8 N•m (14–16 lb-in)
33	SCREW, socket, M5 x 50, black	4.6–5.1 N•m (40–45 lb-in)

Parts Illustration – External Blower Lamphead Parts

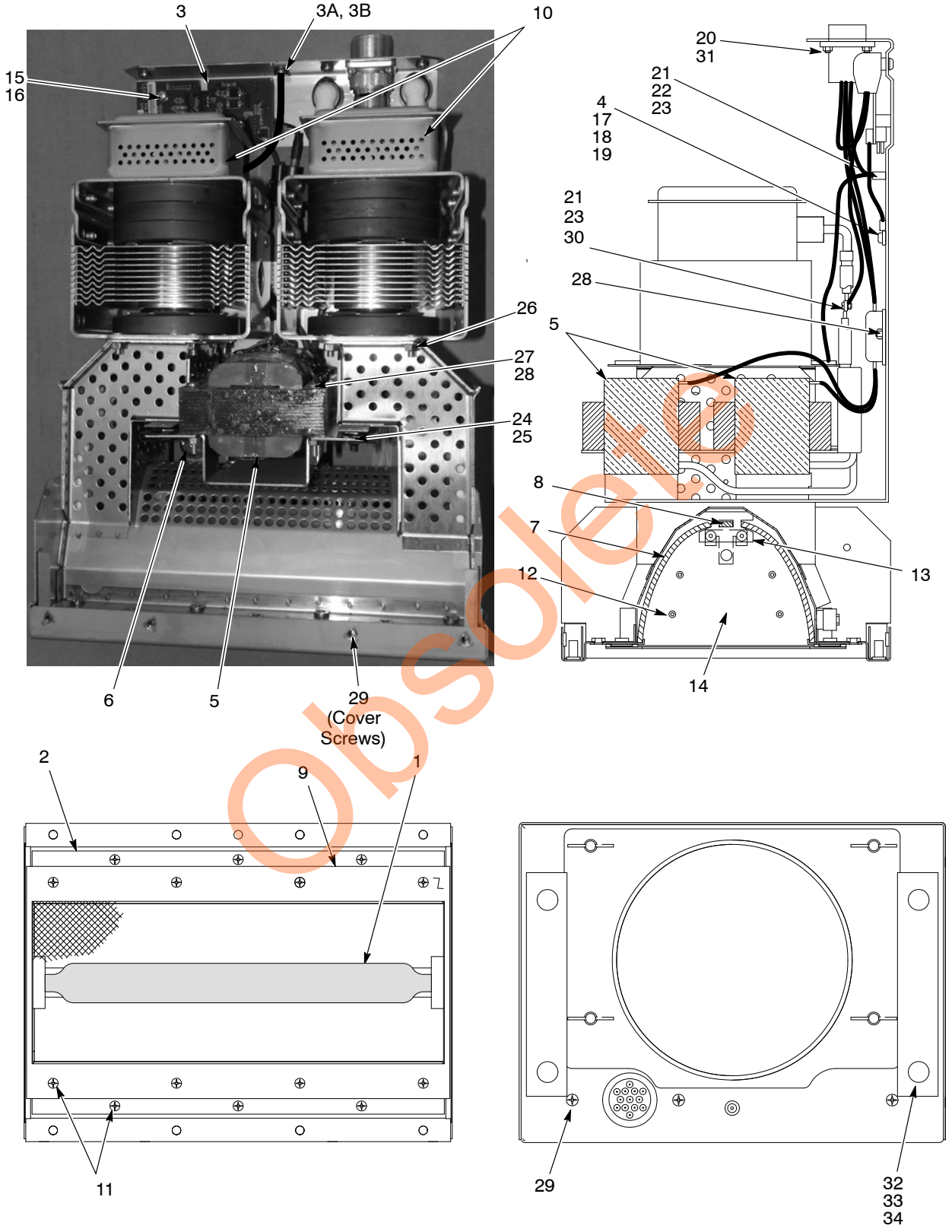


Figure 7-3 CoolWave 2 External Blower Lamphead (shown with cover removed)

Bulbs

Order the correct bulb for your application. Keep spare bulbs on hand to avoid unplanned downtime.

Part	Description	Note
1087356	BULB, UV, microwave, CW610, H (Mercury)	
775043	BULB, UV, microwave, CW610, D, (Iron)	
775044	BULB, UV, microwave, CW610, V (Galium)	
775045	BULB, UV, microwave, CW610, Q (Indium)	
775246	BULB, UV, microwave, CW610, H+ (Mercury Plus)	
1051461	BULB, UV, microwave, CW610, M (Lead)	

Reflector Conversion Kits

Use these kits to convert your lamphead between focus lengths, or between focus and flood reflectors.

Part	Description	Note
1053794	KIT, reflector conversion, 3.1 focus, CW10	A
1103600	KIT, reflector conversion, 2.1 focus, CW10	A
1103601	KIT, reflector conversion, flood, CW10	B

NOTE A: Kit includes 2 reflectors, 2 reflector supports, 2 bulb retainer springs, 4 screws, 4 locknuts. If switching from flood reflectors to focus reflectors, you must also order a 775060 focus reflector retainer bracket kit (contains 2 brackets).

B: If switching from focus reflectors to flood reflectors, order this kit. It includes 2 flood reflectors, 2 reflector supports, 2 bulb retainer springs, 4 screws, 4 locknuts. You must also order a 775061 flood reflector retainer bracket kit (contains 2 brackets).

RF Detector

Part	Description	Note
1086731	Detector, RF	A

NOTE A: Refer to System Cables on page 7-11 for proper length RF Detector cables.

System Cables

See Figure 7-4. Order the correct cable length for your system.

Item	Part	Description	Quantity	Note
1	775374	12-ft UNICABLE	1	
1	775023	25-ft UNICABLE	1	
1	775375	50-ft UNICABLE	1	
1	775377	75-ft UNICABLE	1	
1	775380	100 ft UNICABLE	1	
2	1061134	12 ft CABLE, RF detector	1	
2	775029	25 ft CABLE, RF detector	1	
2	775050	50 ft CABLE, RF detector	1	
2	775051	75 ft CABLE, RF detector	1	
2	775052	100 ft CABLE, RF detector	1	
3	775031	NETWORK CABLE, 6 ft	1	

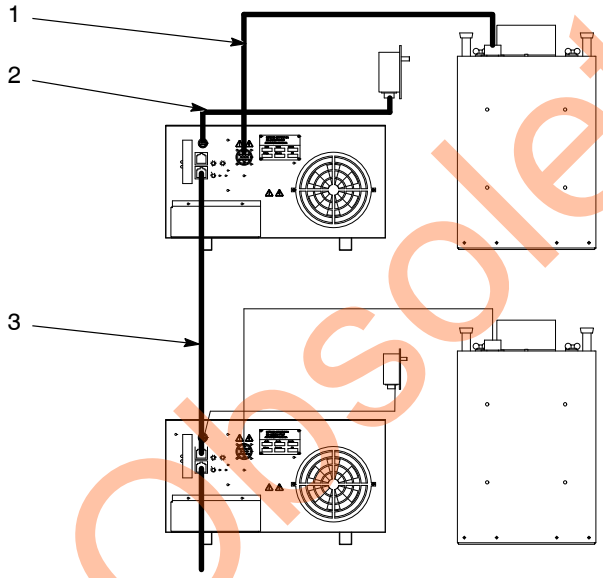


Figure 7-4 System Cables

Accessories

Part	Description
AirShield Ventilation System – Captures the heated exhaust air from the lamphead and exhausts it into a separate exhaust duct. Refer to page3-17 for installation.	
775055	KIT, duct, exhaust, CW10, encl, quartz (for CW-410/CW-610T lampheads)
1068608	KIT, duct, exhaust, deep, CW10, encl, quartz (for CW-410/CW-610T lampheads using a bottom pressure port)
1600656	KIT, duct, exhaust, CW10, encl, quartz, 90 degree (for CW410/CW610T lampheads)
775056	KIT, plate, quartz, duct, exhaust, CW10 enclosure (replacement quartz plate for AirShield Ventilation Kits)
LiteTite Shutter System – A pneumatically powered shutter opens and closes instantly to block UV light without turning off the lamphead or power supply.	
775198	KIT, shutter, LH, CW10
ThruCure Continuous Coating System – A hinged aluminum chamber equipped with customer-machinable entrance and exit vestibules and additional reflectors for a 360 degree cure that mounts on the lamphead.	
1100919	Chamber, ThruCure, 10 in.
External Blowers – Contact your Nordson representative for information on external blowers.	

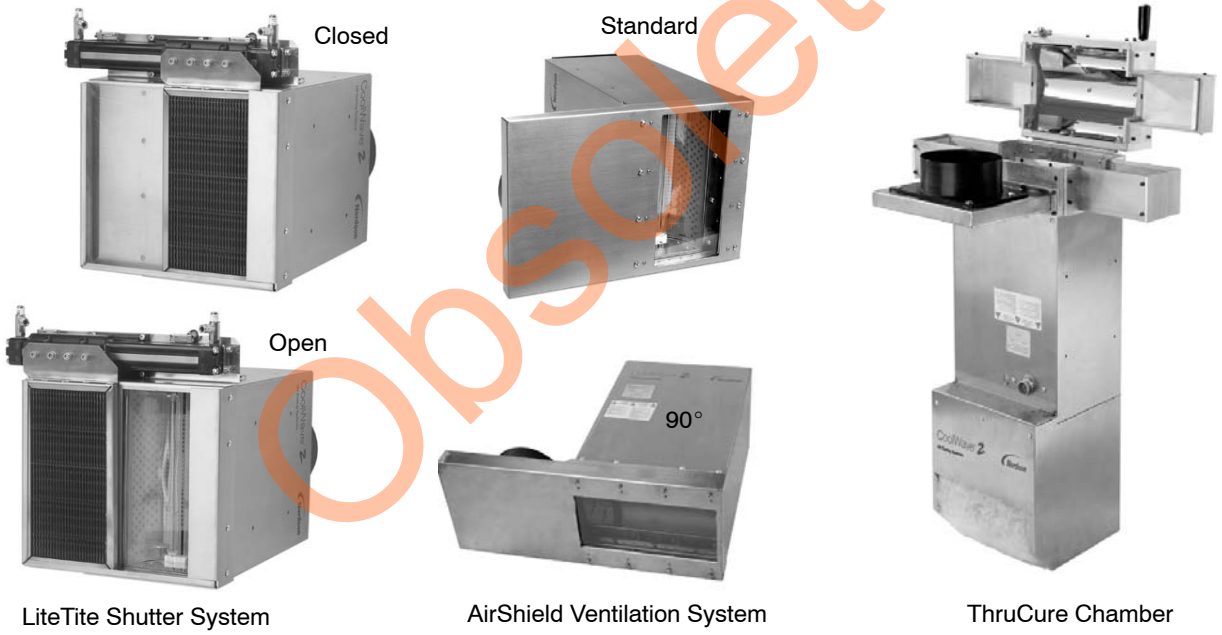


Figure 7-5 Accessories

Optional Lamphead Mounting Kit

See Figure 7-6.

Item	Part	Description	Quantity	Note
–	1106333	KIT, bracket, adjustable, 10 in. lamphead		
1	------	• BRACKET, adjustable, lamphead, UV	1	
2	------	• PLATE, interface, 10 in. lamphead	1	
3	981340	• SCREW, socket, 5/16–18 x 0.750 in., black	8	
4	982432	• SCREW, pan, recessed, M5 x 16, zinc	4	

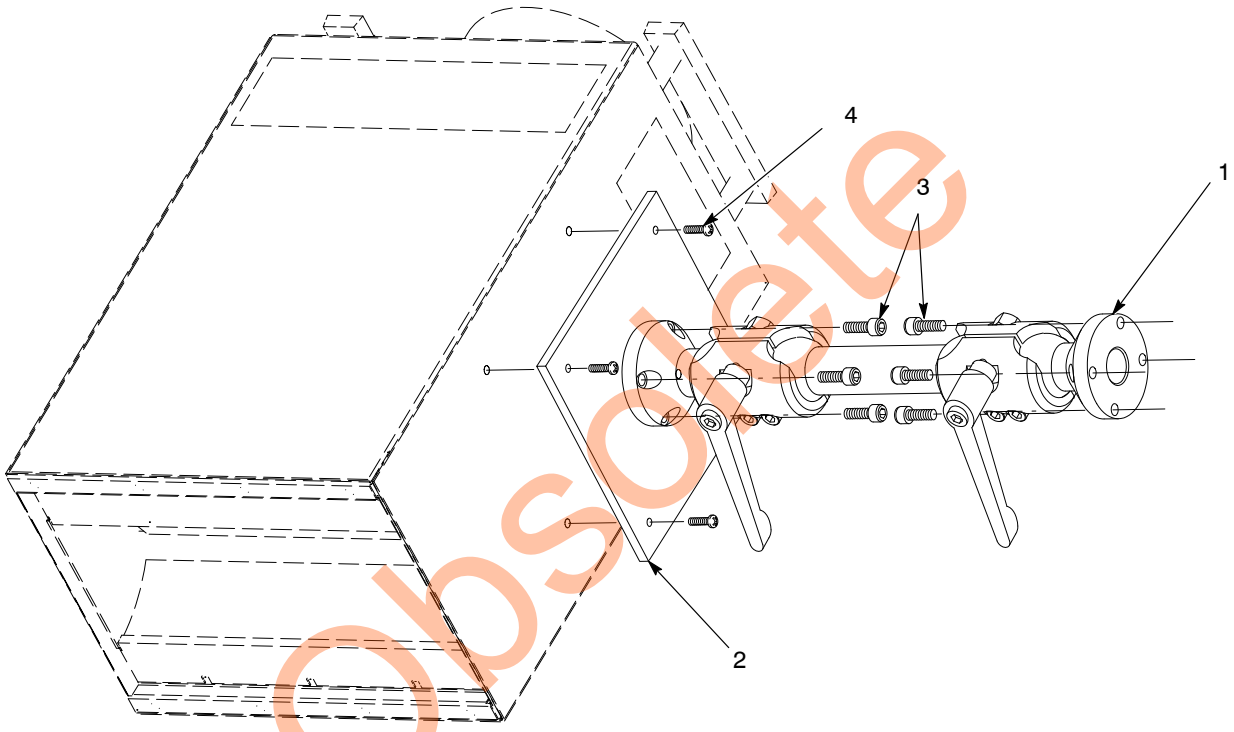


Figure 7-6 Optional Lamphead Mounting Bracket Kit

Mounting Kit Installation

1. Install the mounting plate (2) on the bracket (1) with four 5/16–18 socket-head screws (3).
2. Install the mounting plate on the lamphead with four M5 x 16 pan-head screws(4). Three sides of the lamphead have M5 threaded mounting holes that match up to the mounting plate holes.
3. Mount the bracket on a suitable surface or rack, using the extra four 5/16–18 socket-head screws (3).

Use the bracket handles to tighten and loosen the pivot joints and position the lamphead as desired.

Section 8
Specifications

System Controller

Specifications

Table 8-1 Standard and Enclosure Mounted System Controller Specifications

Item	Specification
Dimensions	
length	753 mm (29.65 in.)
width	465.5 mm (18.33 in.)
height	256.3 mm (10.09 in.)
Weight	118 kg (260 lb)
Voltage	480 Vac ±10%, 3⌀, @ 60 Hz or 400 Vac ±10%, 3⌀, @ 50 Hz
Current	Refer to Table 8-2
Environmental Operating Conditions	
Ambient Temperature	5–40 °C (41–104 °F)
Altitude	Contact Nordson UV Engineering
Relative humidity	80% up to 31 °C (88 °F), decreasing linearly to 50% at 40 °C (104 °F)
Ingress Protection Rating	IP–21
RF Detector	
Max. Temperature	60 °C (140 °F) Ambient

Current Draw

Table 8-2 Power Line Current for 610 External Blower

Line	60 Hz		50 Hz	
	Amps @ 440 Vac	**Amps @ 480 Vac**	**Amps @ 380 Vac**	**Amps @ 440 Vac**
L1	14	13	17	16
L2	22	19	26	24
L3	14	15	17	16

Table 8-3 Power Line Current for 610 Internal Blower

Line	60 Hz		50 Hz	
	Amps @ 440 Vac	**Amps @ 480 Vac**	**Amps @ 380 Vac**	**Amps @ 440 Vac**
L1	14	13	17	17
L2	22	20	28	27
L3	14	15	17	17

Light Output Settings

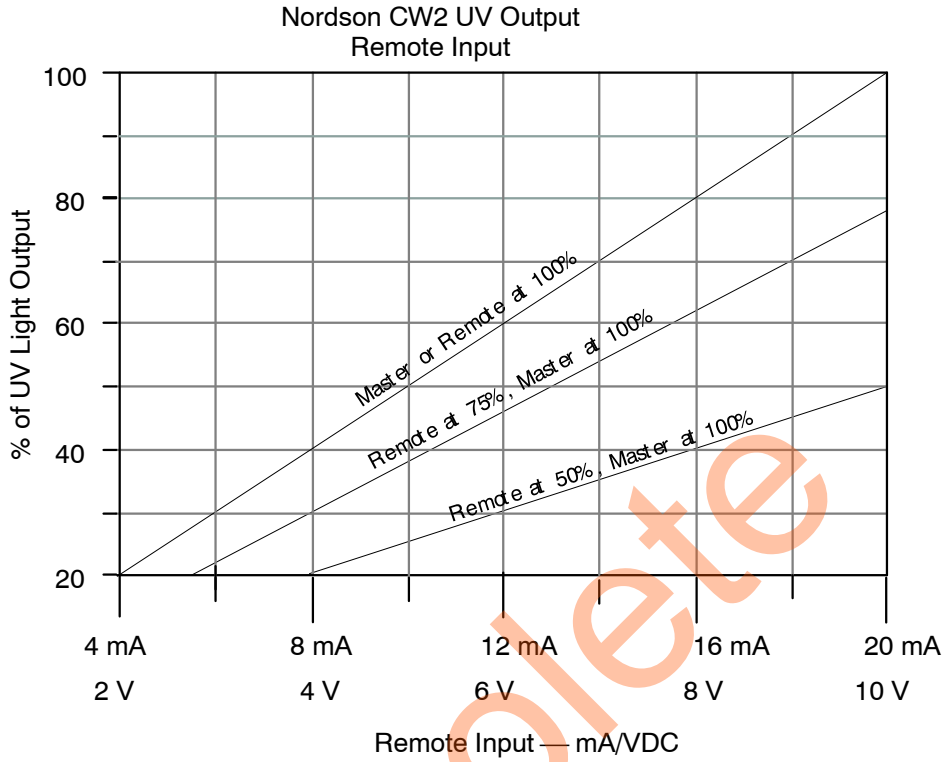


Figure 8-1 Light Output Settings

Master/Remote Power Setting Examples

If the Master Unit is set at	and the Remote Unit is set at	The Remote Unit will run at
100%	100%	100% of 100%
100%	75%	75% of 100%
50%	75%	75% of 50%
75%	50%	50% of 75%
NOTE: The standard setting is Master Unit 100%, Remote unit 100%.		

Lamphead

Table 8-4 Lamphead Specifications

Item	Specification
Dimensions	Refer to *Section 3, Installation* for lamphead dimensions.
Weight	With External Blower – 19 kg (42 lb), With Internal Blower – 27.67 kg (61lb)
Cooling Air	350 cfm @ 7 in. W.C.; measured at lamphead (9.9 mm^3 @ 1780 Pascal)
Reflector	Glass with a proprietary coating 220–470 nm; focus/flood profiles
Focal Length	2.1 in., 3.1 in., flood
Interlocks	• Light on detector • Cooling air sensor • Unicable detection • RF leakage detection

Bulb

Table 8-5 Bulb Specifications

Item	Specification
Length	254 mm (10 in.)
Power	600 watts/in. maximum
Types	Mercury, Mercury +, Iron, Gallium, Indium, Lead

System Schematic

See Figures 8-1 and 8-2.

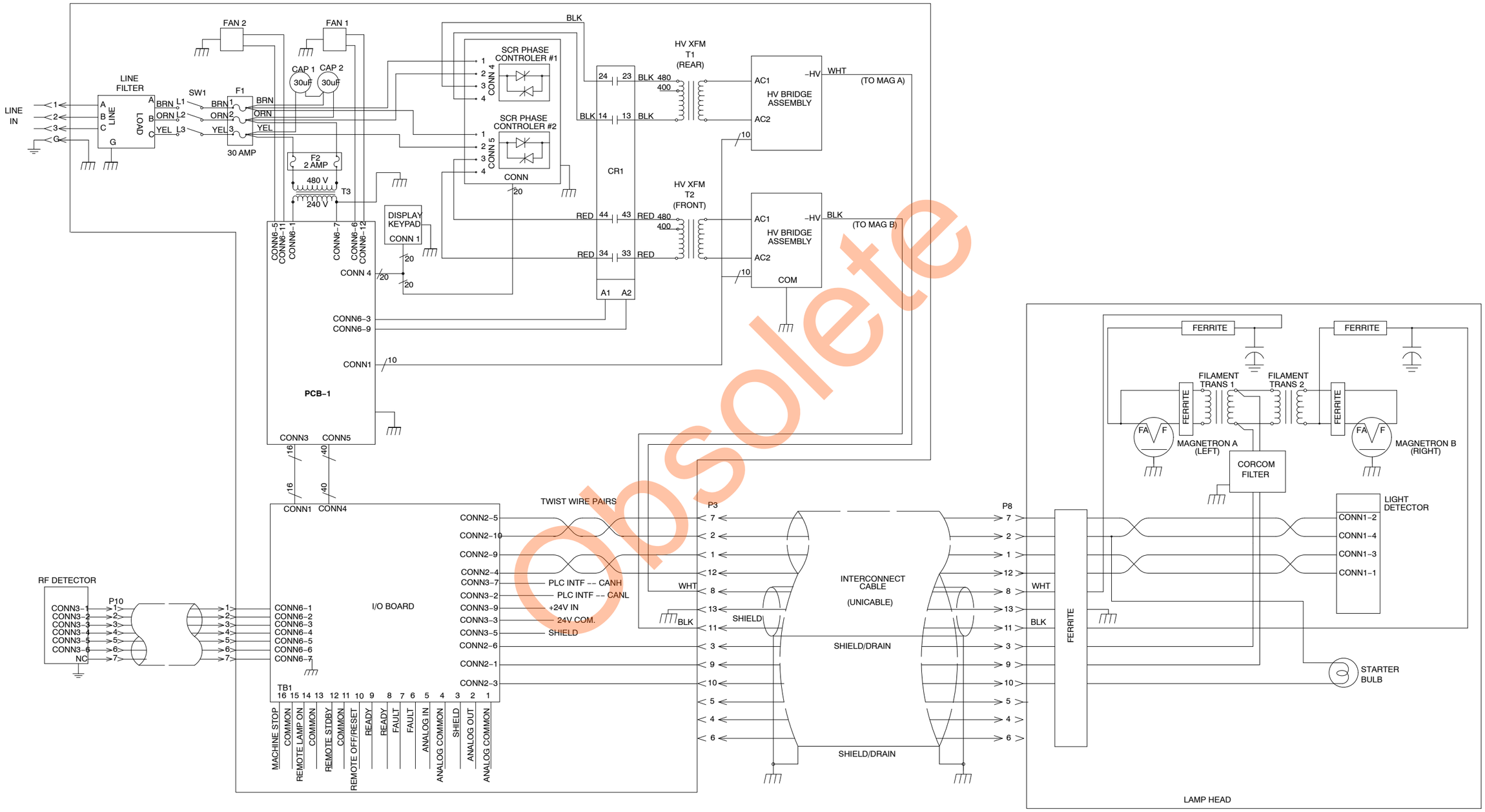


Figure 8-1 External Blower System Schematic

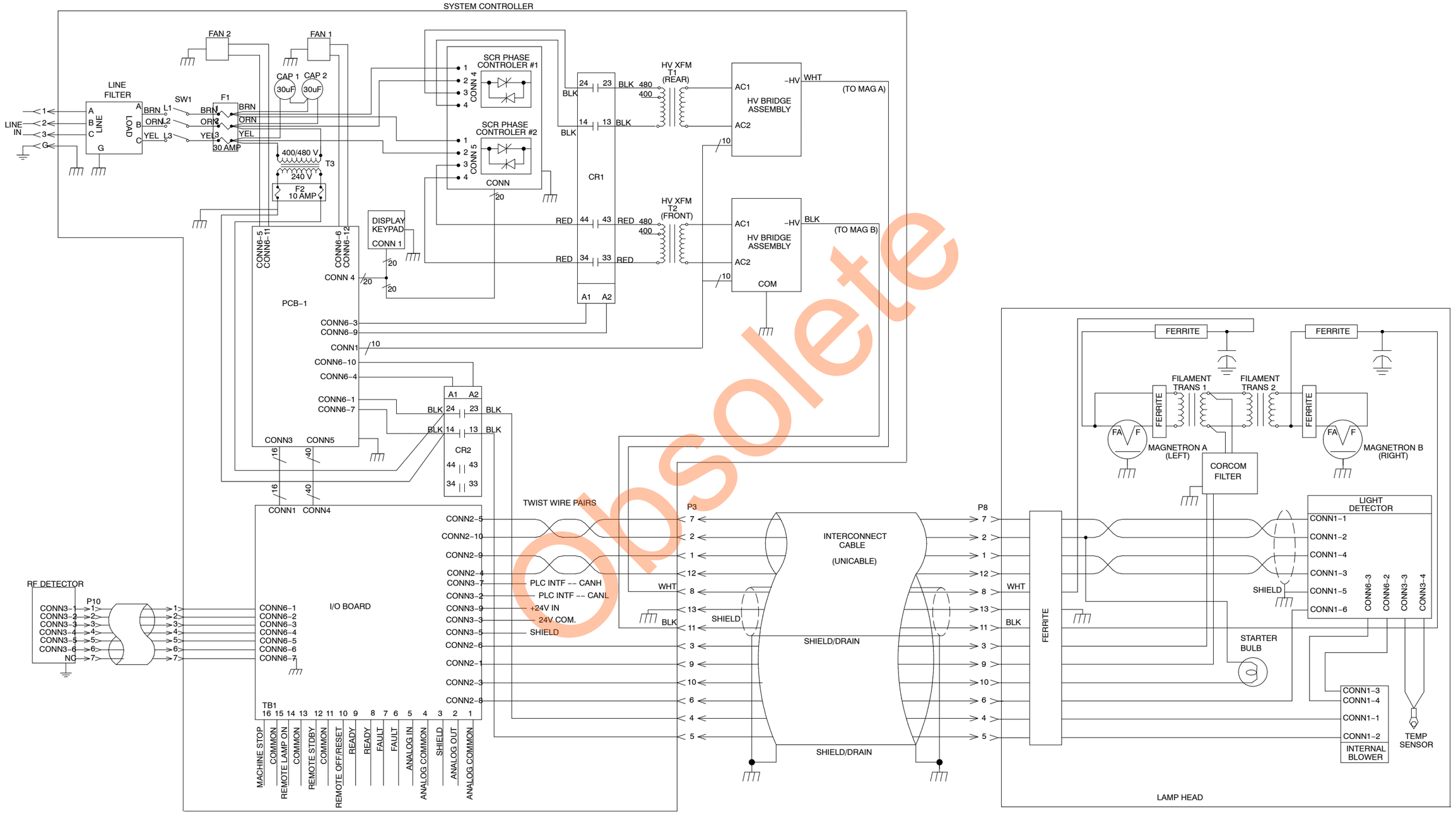


Figure 8-2 Internal Blower System Schematic

Section 9
UV Glossary

absorption — Not reflecting. The partial loss in energy that results when light passes through or reflects off a medium.

additive bulb — A mercury bulb that contains metal additives such as iron, gallium, indium, or others. These bulbs produce variations in spectral output as compared to mercury only bulbs.

ASTM spec D3359–95a — Refer to tape test.

black light UV — Low powered UV composed of wavelengths in the UVA band. Usually powered with several 100-watt power supplies or less instead of several 1000-watt power supplies. Nordson's UV Star and CoolWave product lines are much higher in irradiance and energy density than black light UV products.

bulb — A sealed quartz tube that contains a mixture of inert gas and mercury under medium pressure. Electrode bulbs are fitted with electrical connections at the ends of the bulb. Microwave bulbs contain no electrical connections. The mercury and inert gas are energized (vaporized) by either a voltage arc or microwave energy. The vaporized plasma gas emits UV light.

capacitor — Corrects the power factor in the main power supply to reduce current levels in the UV system.

cold mirror — A reflector that is coated with a dichroic material that absorbs or passes wavelengths in the infrared range while reflecting those in the UV range. Refer to dichroic.

cross hatch test — Refer to tape test.

cure — A UV drying process that occurs through a chemical reaction between a UV ink or coating and UV light.

dichroic — A coating designed to pass certain wavelengths and reflect other wavelengths. In UV lampheads, dichroics are used on reflectors to pass or absorb infrared energy and reflect UV energy.

devitrification — The act of making quartz glass opaque and porous through prolonged heating and UV exposure.

doped bulb — Refer to additive bulb.

dose (dosage)	Refer to energy density.
dose rate (dosage rate)	Refer to irradiance.
dynamic exposure	Exposure to a varying irradiance. It occurs when a lamphead passes over a substrate without pausing or when a substrate passes under a lamphead without pausing.
dynamic range	The span between the minimum irradiance and the maximum irradiance to which a radiometer will accurately respond. Measured in joules/cm^2.
effective cure length	The length of a bulb that delivers optimal UV output. For electrode bulbs, the effective cure length is always less than the arc length. For microwave bulbs, the effective cure length is the length of the bulb.
electrodeless	A microwave-powered UV system.
electromagnetic spectrum	The full wavelength range of electromagnetic radiation, including microwave, ultraviolet, visible, and infrared energy.
energy density	The total amount of UV energy delivered to a particular area, measured in joules/cm^2. Also referred to as total energy. Improperly referred to as dose.
flood	An unfocused band of UV light that is more evenly and diffusely distributed across the width of the reflector.
flux	The flow of photons, measured in einsteins/second.
focal distance (length)	The perpendicular distance from the edge of the lamphead to the point where the UV light emitting from the bulb converges. This is the location of maximum UV concentration.
focus	The band where the UV energy reflected from the lamphead is at the highest concentration.
frequency	The number of times a periodic wavelength cycle occurs in one second, measured in Hertz (Hz).
gallium	A bluish-white metallic element used in additive mercury bulbs. The gallium additive provides a yellowish tint to an un-energized UV bulb and a violet coloration to the UV output. Gallium bulbs have a spectral peak around 417 nm and a spectral concentration between 400 and 450 nm. They are often used when deeper cure is required or with white coatings containing titanium oxides. In some industries, microwave gallium bulbs are referred to as V bulbs.

germicidal UV	Low-powered UV in the UVC band. Usually powered with several 100-watt power supplies or less instead of several 1000-watt power supplies. Nordson's UV Star and CoolWave product lines are much higher in irradiance and energy density than germicidal UV products.
indium	A silver-white metallic element used in additive mercury bulbs. The indium additive provides a yellowish tint to an un-energized UV bulb and a violet coloration to the UV output. Indium is used to shift the spectral output past 400 nm. In some industries, indium bulbs are referred to as Q bulbs.
infrared energy	Energy having wavelengths between 1 and 100 µm.
integral cooling fan (blower)	The bulb-cooling fan when it is mounted to the lamphead.
integral shutter	A shutter assembly that is built into the lamphead. Common designs include a pneumatically actuated clam shell that blocks the light when closed and acts as a reflector when open and a pneumatic slide mechanism that moves the lamphead behind an internal louver when shuttered. Shutters are typically associated with electrode systems.
intensity	The amount of UV energy delivered to a particular area per unit time, measured in joules/cm^2/sec or watts/cm^2/sec. Also referred to as watt density. Improperly referred to as dose rate.
iron	A white metallic element used in additive mercury bulbs. The iron provides a reddish tint to an un-energized UV bulb and a bluish coloration to the UV output. Iron is used to concentrate the spectral output between 350 and 400 nanometers. In some industries, iron bulbs are referred to as D bulbs.
irradiance	Radiant power arriving at a surface from all forward angles per unit area, measured in watts/cm^2.
irradiator	Refer to lamphead.
joule	Metric unit for measuring work or energy. One joule is equivalent to the work done by a force of one Newton acting through a distance of one meter. (1 KW-hour equals 3.6×10^6 joules).
lamp	Refer to bulb.
lamphead	Assembly containing a sheet metal housing and cover and integral or remote cooling fan. An electrode system also contains cradles and a microwave system contains magnetrons, a cavity, and a screen.
light detector	A photocell inside a microwave lamphead that confirms UV output.
long UV	Refer to UVA.

louver	A part of a UV shutter system or shielding section that blocks the UV light while allowing cooling air to pass through.
magnetron	Assembly contained inside a microwave lamphead that converts high-voltage electrical input into RF energy.
mercury	A silver-white metallic element that is liquid at room temperature and is used to create a vaporized, UV-emitting gas plasma inside a quartz tube when it is energized through the use of either a voltage arc or microwave energy. When energized the bulb produces a bright white UV output. Mercury bulbs have a peak spectral output around 365 nm and a concentration around 254 nm. In some industries, mercury bulbs are referred to as H bulbs.
mercury plus (H+)	Mercury plus bulbs are only available in microwave systems as it is difficult to vaporize the additional mercury in an electrode bulb.
metal halide bulb	Refer to additive bulb.
micrometer (μm)	Unit of length equivalent to one millionth of a meter.
microwave	That part of the electromagnetic spectrum associated with the larger infrared waves and the shorter radio waves.
monomers	A molecule of relatively low molecular weight and simple structure capable of combining with itself or other similar molecules to form polymers.
nanometer (nm)	Unit of length equivalent to one billionth of a meter.
negative cooling	When the cooling air for the lamphead is drawn from the area surrounding the substrate being cured and through the lamphead. Negative cooling provides exhaust for the UV system if it is ducted to atmosphere. Negative cooling is most often supplied through a remote cooling fan.
nitrogen blanketing	Refer to nitrogen inerting.
nitrogen inerting	When the coating or ink is flooded with a nitrogen blanket to prevent the coating or ink from oxidizing before cure. Nitrogen inertion reduces oxygen inhibition.
oligomers	A low molecular weight resin or polymer used in a radiation curable coating.
out-of-focus	When a lamphead is located further away from the substrate or closer to the substrate than the focal distance.
oxidizing	When the coating or ink reacts with oxygen and slows the polymerization process of the cure.

oxygen inhibition	Oxygen slows the cure response of UV curable coatings. The higher the ratio of exposed surface area to coating mass, the greater the impact oxygen has on the coating.
ozone (O_3)	An unstable, colorless gas with a penetrating odor that is generated by the reaction of short-wave UV light (≈184 nanometers) with air.
ozone-inhibiting (ozone-free) bulbs	Bulbs where the quartz is manufactured with an additive that prevents the transmission of UV beneath 200 nm in wavelength. It is the reaction of short-wave UV light (≈184 nanometers) with air that produces ozone.
Parts Per Million (PPM)	The units of the Threshold Limit Value (TLV) when referring to the maximum level of a substance that a person should inhale over an 8-hour shift during a 40-hour week without producing an ill effect. Also refer to Threshold Limit Value.
peak irradiance (peak power density)	The maximum irradiance measured over a sample period, measured in joules/cm^2/sec or watts/cm^2.
photoinitiator	A molecule which when exposed to a specific wavelength of energy forms a reaction that begins the cure process.
photopolymerization	Turning a liquid (wet) into a solid (dry) through exposure to UV light.
planar shutter	A shutter assembly that is attached to the outside of a lamphead. The louvered shutter moves perpendicular to the emitted UV light.
polymer	A macromolecule consisting of a large number of monomer units.
positive cooling	When the cooling air for the lamphead is blown through the lamphead and onto the substrate being cured. Positive cooling can be supplied through either an integral or remote cooling fan. With positive cooling, an additional exhaust system is required to remove heat and ozone.
post cure	The continuation of chemical reactions in the ink or coating after exposure to UV has ceased.
power density	Refer to irradiance.
quartz plate	Plates that allow UV energy to penetrate with minimal loss in intensity and are mounted in front of the lamphead. The plates are used to prevent positive cooling air and airborne contaminants from contacting the substrate, negative cooling air from contaminating the bulb and reflectors, or to remove some of the infrared that is radiated from the UV bulb. If the goal is to reduce the amount of heat contacting the substrate, additional cooling air must be blown across the quartz. If additional air is not used, the quartz will eventually heat up and begin radiating heat onto the substrate. To further reduce heat, the quartz can be coated with a material that passes UV light and absorbs infrared energy.

quartz tube	(1) A sealed tube made from a silicate material that is filled with a precise mixture of mercury and various inert gases and sometimes fitted with electrical connections. The vapor emits light when it is energized through the use of either a voltage arc or microwave energy. Often used to refer to the bulb. (2) An open tube made from a silicate material through which a substrate can pass. The tube is often placed in front of a UV lamphead and flooded internally with Nitrogen. Parts traveling through the tube are then safeguarded from exposure to the oxygen and ozone in the lamphead cooling air.
reflector	Reflect and concentrate the UV light onto the substrate. Rolled from highly polished aluminum sheet metal or formed from borosilicate into elliptical or parabolic profiles. Elliptical profiles optimize the concentration of UV energy that is reflected by guiding the radiation into a tightly focused UV band while parabolic reflectors result in a flood of UV light. Holes or slots in the reflector allow cooling air to pass through. The holes or slots are engineered for size and location to provide both optimal and balanced airflow across the length of the bulb.
remote cooling fan (blower)	The cooling fan when it is mounted separate from the lamphead and ducted in to the lamphead.
RF	Radio Frequency. Any frequency between normally audible sound waves and the infrared light portion of the spectrum lying between 10 KHz and 1,000,000 MHz.
RF detector	Monitors RF levels in the vicinity of the UV system and signals the power supply to shut off the UV if RF levels exceed allowable limits.
screen	A wire mesh assembly attached to a microwave lamphead that allows UV to pass through but prevents RF from leaking from the unit.
short UV	Refer to UVC.
single	An electrode lamphead assembly with a cradle that supports only one bulb and one reflector.
shutter	An assembly designed to block UV light while passing cooling air.
solarization	The effect of the UV light on the quartz bulb. Over time, UV light and heat will cause the quartz to devitrify or revert back to a crystalline and porous state.
spectral output	The various wavelengths of light emitted from a UV bulb.
spectral output efficiency graph	A graph or chart showing the relative concentration of UV at various wavelengths for a particular bulb type. Typically, the concentration is provided as a normalized percentage where the energy is integrated over 10-nanometer bands to reduce the difficulty of quantifying the effects of line emission spectra.

starter bulb	Used in the start up of microwave systems to ignite the mercury vapor in the bulb.
static exposure	Exposure to a constant irradiance for a controlled period of time.
surface cure	When the UV material is cured only on the surface exposed to the UV.
tape test for measuring adhesion	When an X-cut or lattice pattern of 6 or 11 cuts are scratched through the UV cured material to the substrate. Pressure-sensitive tape is then applied over the cuts and removed. Pulling the tape away from the substrate will reveal the degree of adhesion. If any material between the lines is pulled off with the tape, the adhesion is poor. If the material remains, the adhesion is good. The recommended guidelines for testing and evaluation are documented in the ASTM spec D3359-95a under Methods A and B. Method A employs the X-cut and is used for coatings that are 5 mils or greater. Method B calls for lattice cuts and is recommended for coatings with 0–5 mils of thickness.
through cure	When the UV material is cured down to and including the material / substrate interface.
Threshold Limit Value (TLV)	The maximum exposure a person should receive over an 8-hour shift during a 40-hour week without producing an ill effect. Often reported in (mg / m^3) or ppm.
Time-Weighed Average (TWA)	Refer to Threshold Limit Value (TLV).
total energy	Refer to energy density.
transmittance	The ratio of the radiant energy passed through a body to the total radiant energy received by the body.
ultraviolet light	Radiant energy in the wavelength band of 100 to 400 nanometers.
UVA (315–400 nanometers)	The portion of the electromagnetic spectrum ranging between 315 and 400 nm. UVA represents the largest portion of UV energy and is commonly referred to as long UV. UVA is most responsible for skin aging and increased skin pigmentation. UVA is at the lower limit of sensitivity to the human eye.
UVB (280–315 nanometers)	The portion of the electromagnetic spectrum ranging between 280 and 315 nm. UVB is most responsible for reddening and burning of the skin and damage to the eyes.
UVC (200–280 nanometers)	The portion of the electromagnetic spectrum ranging between 200 and 280 nm. UVC is typically referred to as short UV.
UVV (400–445 nanometers)	The portion of the electromagnetic spectrum ranging between 400 and 445 nm. The V stands for visible UV.

vacuum UV (100–200 nanometers)	The portion of the electromagnetic spectrum ranging between 100 and 200 nm. UVV does not transmit in air.
viscocity	The state or quality of having a cohesive and sticky fluid consistency.
vitrification	The act of changing pure opaque quartz into clear non-porous quartz through a fusion process.
watt	One joule per second.
watt density	Refer to irradiance.
waveguide	Directs microwaves toward the bulb in microwave UV systems.
wavelength	The measured cycle length of a wave in the direction of propagation.

Section 10

DeviceNet Specifications

Introduction

This section covers the specifications and requirements for the CoolWave 2 DeviceNet Interface Module Revision 0.62. This specification describes the unit configuration, unit initialization, the DeviceNet Network Model and the interface to the Nordson Coolwave2 module. It describes the functionality required of the network interface module. It does not describe implementation details or specify the requirements for the PCB or enclosure.

Definitions

Network Host: The DeviceNet network Host (commonly a scanner card in a Programmable Controller).

Network Slave: A DeviceNet device which implements server functionality in a DeviceNet system.

Programmable Controller: Programmable Logic Controller – the DeviceNet Network Host.

Reference Documents

The CIP Networks Library Volume 1: Common Industrial Protocol, Edition 3.1, ©2007 ODVA

The CIP Networks Library Volume 3: DeviceNet Adaptation of CIP, Edition 1.3, ©2007 ODVA

Governing Body

Open DeviceNet Vendor Association, Inc. (www.odva.org) ODVA is an independent supplier organization that manages the DeviceNet specification and supports the worldwide growth of DeviceNet.

System Operation

MAC ID / Baud Rate Configuration

Three rotary switches are defined for user configuration of the device. The three rotary switches are defined as follows:

Rotary switches S2 (MSD) and S3 (LSD) are used to select the DeviceNet MAC ID address. The valid range of addresses is 0 – 63. All combinations above 63 set the device address to the last address the device was powered up at and allow software configuration tools to modify the MAC ID address.

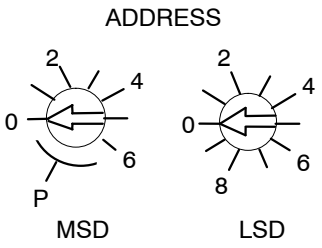


Figure 10-1 MAC ID Switches S2 and S3

Rotary switches S1 (BAUD) is used to select the DeviceNet Baud Rate. The valid range of baud rates is 0–3 (0=125K, 1=250K, 2=500K). All values above 2 set the baud rate to the last baud rate the device was powered up at and allow software configuration tools to modify the baud rate.

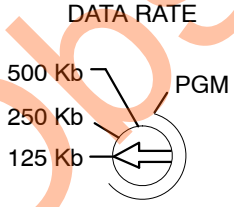


Figure 10-2 Baud Rate Switch S1

LED Operation

There are two LEDs on the rear panel. The first bicolor LED indicates Network Status as listed in the following table:

Table 10-1 Network Status LED Operation

Color	State	Indication
None	Off	No Power
Red	Solid	Unrecoverable Fault
	Flashing	Output error or configuration error
Green	Solid	Normal runtime operation
	Flashing	Device is in idle or not allocated to a master

The second bicolor LED indicates Module Status as listed in the following table:

Table 10-2 Module Status LED Operation

Color	State	Indication
None	Off	No Power
Red	Solid	Fatal Error
	Flashing	• If the Network Status Led is Solid Red, DeviceNet Power is not present • Baud Rate / Mac ID switch value changed, next power up uses a new configuration
Green	Solid	Normal Operation
Red/Green	Flashing	Device is in self test mode

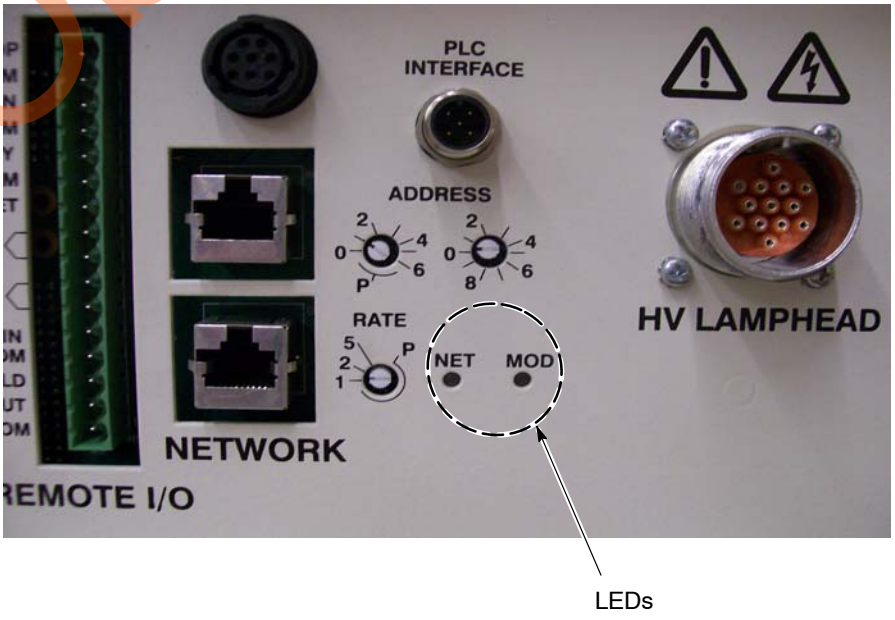


Figure 10-3 DeviceNet Status LEDs

DeviceNet Interface

Overview

DeviceNet is a low cost and open industrial network which links industrial devices (such as limit switches, photoelectric sensors and motor starters) to machine controllers over the Controller Area Network (CAN). DeviceNet eliminates expensive hardwiring and provides improved communication between devices as well as important device level diagnostics.

The following sections describe the network Object Model (the interface from the DeviceNet point-of-view).

Configuration

The unit supports the standard DeviceNet MAC ID and Baud Rate selections. MAC ID and Baud Rates can be selected from user accessible rotary switches or through DeviceNet configuration software.

See page 10-2 for more details. All configuration data is stored in non-volatile memory.

Initialization

The unit provides standard duplicate MAC ID detection processing during power-on initialization.

Group 2 Only Slave Operation

The unit supports allocation of the DeviceNet Group 2 Master/Slave connection set through the Group 2 Unconnected message port.

Certification

The unit must be certified as a compliant DeviceNet device through an ODVA certified testing facility. This device is not required to pass SEMI-SIG optional conformance testing.

Identity Object (01_{HEX} – 1 Instance)

The Identity Object provides descriptive information.

Class Attributes (Instance 0)

Attribute ID	Name	DeviceNet Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get

Instance Attributes (Instance 1)

Attribute ID	Name	DeviceNet Data Type	Data Value	Access Rule
1	Vendor Number	UINT	416_{DEC}	Get
2	Device Type	UINT	64_{HEX}	Get
3	Product Code Number	UINT	100_{DEC}	Get
4	Product Major Revision Product Minor Revision	USINT USINT	1 1	Get
5	Status Word	WORD	0	Get
6	Serial Number	UDINT	Unique 32 Bit Value	Get
7	Product Name	String of USINT	“CoolWave2”	Get

Common Services

Service Code	Implemented for		Service Name
	Class Level	Instance Level	
$0E_{HEX}$	Yes	Yes	Get_Attribute_Single
05_{HEX}	No	Yes	Reset –– no attribute data –– Normal: Class 1, Instance 1, 1 byte data = 0 Out of Box: Class 1, Instance 1, 1 byte data = 1

Message Router Object (02_{HEX} _ 1 Instance)

No supported attributes or services.

DeviceNet Object (03_{HEX} – 1 Instance)

Class Attributes (Instance 0)

Attribute ID	Name	DeviceNet Data Type	Data Value	Access Rule
1	Revision	UINT	2	Get

Instance Attributes (Instance 1)

Attribute ID	Name	DeviceNet Data Type	Data Value	Access Rule
1	Mac ID	USINT	63	Get / Set
2	Baud Rate	USINT	0	Get / Set
5	Structure of: Allocation Choice Byte Master Mac ID	 BYTE USINT	 0xFF 0	 Get Get
6	MAC ID Switch Changed (since last power up)	BOOL	0	Get
7	Baud Rate Switch Changed (since last power up)	BOOL	0	Get
8	Actual MAC ID Switch Value (0–99)	USINT	63	Get
9	Actual Baud Rate Switch Value (0–9)	USINT	0	Get

Common Services

Service Code	Implemented for		Service Name
	Class Level	Instance Level	
$0E_{HEX}$	Yes	Yes	Get_Attribute_Single
10_{HEX}	No	Yes	Set_Attribute_Single

Assembly Object (04_{HEX} – 2 Instances)

Class Attributes (Instance 0)

Attribute ID	Name	DeviceNet Data Type	Data Value	Access Rule
1	Revision	UINT	2	Get
2	Max Instance	UINT	112	Get
100	Polled Input Assembly Instance (valid values are 100)	UINT	100	Get / Set
101	Polled Input Size	UINT	14	Get
102	Polled Output Assembly Instance (valid values are 112)	UINT	112	Get / Set
103	Polled Output Size	UINT	4	Get

Instance Attributes (Instances 100 and 112)

Attribute ID	Name	DeviceNet Data Type	Data Value	Access Rule
3	Data	USINT	0	Get / Set

Instance 100 – Input Assembly 1 (Common)					
Byte Index	**Description**	**DeviceNet Data Type**	**Class ID**	**Instance ID**	**Attribute ID**
0	Exception Status: Defined in S–Device Supervisor Object	USINT	0x30	1	12
1	System Ready: 0 – Not Ready; 1 – Ready	USINT	0x64	0	100
2 – 3	Units Present Bitmap: Bit 0 – Master Bit 1 – Slave 1 Bit 15 – Slave 15 0 – Not present; 1 – Present	UINT	0x64	0	102
4 – 5	Fault Bitmap: Bit 0 – Master; Bit 1 – Slave 1 Bit 15 – Slave 15 0 – OK; 1 – Fault	UINT	0x64	0	101
6 – 7	Lamp Number 0: Master 1–15: Slaves	UINT	N/A	N/A	N/A
8	Lamp State: 1 – Off 2 – Filament On Time Delay 3 – Standby 4 – Lamp Start 5 – Lamp On 6 – Fault 7 – Reset 8 – Cool Off 9 – Lamp Cool 10 – Test 11 – Start Power Delay	USINT	0x64	varies	103
9	Lamp Power Level: 0 –100%	USINT	0x64	varies	106
10 – 13	Lamp Fault: 32–bits Defined in S–Device Supervisor Object	UDINT	0x64	varies	104

Instance 101 – Input Assembly 2 (Master/Slave 1–2)					
Byte Index	**Description**	**DeviceNet Data Type**	**Class ID**	**Instance ID**	**Attribute ID**
0	Exception Status Defined in S–Device Supervisor Object	USINT	0x30	1	12
1	Status Bitmap See Below	USINT	0x64	0	100, 101, 102
2	Master Lamp State 1 – Off 2 – Filament On Time Delay 3 – Standby 4 – Lamp Start 5 – Lamp On 6 – Fault 7 – Reset 8 – Cool Off 9 – Lamp Cool 10 – Test 11 – Start Power Delay	USINT	0x64	0	101
3	Master Lamp Power Level: 0 –100%	USINT	0x64	0	102
4	Slave 1 Lamp State: 1 – Off 2 – Filament On Time Delay 3 – Standby 4 – Lamp Start 5 – Lamp On 6 – Fault 7 – Reset 8 – Cool Off 9 – Lamp Cool 10 – Test 11 – Start Power Delay	USINT	0x64	1	103
5	Slave 1 Lamp Power Level: 0 –100%	USINT	0x64	1	104
6	Slave 2 Lamp State: 1 – Off 2 – Filament On Time Delay 3 – Standby 4 – Lamp Start 5 – Lamp On 6 – Fault 7 – Reset 8 – Cool Off 9 – Lamp Cool 10 – Test 11 – Start Power Delay	USINT	0x64	2	103
7	Slave 2 Lamp Power Level: 0 –100%	USINT	0x64	2	104

System Bitmap (default in bold)								
Bit Value	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
1 (ON)	Master Faulted	Slave 1 Faulted	Slave 2 Faulted	n/a	**Master Present**	**Slave 1 Present**	**Slave 2 Present**	**System Ready**
0 (OFF)	**Master OK**	**Slave 1 OK**	**Slave 2 OK**	**n/a**	Not Present	Not Present	Not Present	Not Ready

Instance 112 – Output Assembly 1 (Common)					
Byte Index	**Description**	**DeviceNet Data Type**	**Class ID**	**Instance ID**	**Attribute ID**
0	Master Lamp Command (See Notes): 1 – Off / Stop 2 – On / Start 3 – Standby 5 – Reset	USINT	0x64	0	110
1	Light Intensity Command: 20 – 100%	USINT	0x64	0	111
2 – 3	Lamp Status Select: 0: Master 1–15: Slaves	UINT	N/A	N/A	N/A
NOTE: Receive_Idle condition (0 byte length message) is treated as a DeviceNet fault condition by the CoolWave2 unit. **NOTE:** Commands other than those listed are not implemented, and will be ignored by the CoolWave2 unit.					

Common Services

Service Code	Implemented for		Service Name
	Class Level	Instance Level	
$0E_{HEX}$	Yes	Yes	Get_Attribute_Single
10_{HEX}	No	Yes	Set_Attribute_Single

Connection Object (05_{HEX} – 2 Instances)

Class Attributes (Instance 0)

Attribute ID	Name	DeviceNet Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get

Instance Attributes (Instances 1 – 2)

Attribute ID	Name	DeviceNet Data Type	Data Value		Access Rule
			Instance 1 (EM)	Instance 2 (Poll)	
1	State	USINT	0 = NonExistent 3 = Established 5 = Deferred Delete	0 = NonExistent 1 = Configuring 3 = Established 4 = Timed Out	Get
2	Instance Type	USINT	0	1	Get
3	Transport Trigger	usint	83_{HEX}	82_{HEX}	Get
4	Produced Connection ID	uint	$10xxxxxx011_{BIN}$ xxxxxx = Node Address	$01111xxxxxx_{BIN}$ xxxxxx = Node Address	Get
5	Consumed Connection ID	uint	$10xxxxxx100_{BIN}$ xxxxxx = Node Address	$10xxxxxx100_{BIN}$ xxxxxx = Node Address	Get
6	Initial Comm. Character	USINT	21_{HEX}	01_{HEX}	Get
7	Produced Connection Size	uint	0 – 30	14 / 8	Get
8	Consumed Connection Size	uint	0 – 30	4	Get
9	Expected Packet Rate	uint	2000 msec	0	Get / Set
12	Watchdog Timeout Action	USINT	3 = Deferred Delete	0 = Timeout	Get
13	Produced Connection Path Length	UINT	0	6	Get
14	Produced Connection Path	USINT Array	NULL	20h 04h 24h 65h 30h 03h	Get
15	Consumed Connection Path Length	UINT	0	6	Get
16	Consumed Connection Path	USINT Array	NULL	20h 04h 24h 70h 30h 03h	Get

Common Services

Service Code	Implemented for		Service Name
	Class Level	Instance Level	
$0E_{HEX}$	Yes	Yes	Get_Attribute_Single
10_{HEX}	No	Yes	Set_Attribute_Single

S–Device Supervisor Object (30_{HEX} – 1 Instance)

Class Attributes (Instance 0)

Attribute ID	Name	DeviceNet Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get

Instance Attributes (Instance 1)

Attribute ID	Name	DeviceNet Data Type	Data Value	NV?	Access Rule
3	Device Type	SHORT STRING8	“Generic”	NV	Get
4	SEMI Standard Revision Level	SHORT STRING8	“E54–0997”	NV	Get
5	Manufacturer’s Name	SHORT STRING20	“Nordson Inc.”	NV	Get
6	Manufacturer’s Model Number	SHORT STRING20	“CoolWave2 “	NV	Get
7	Software Revision Level	SHORT STRING6	“1.01“	NV	Get
8	Hardware Revision Level	SHORT STRING6	“Rev A“	NV	Get
11	Device Status	USINT	0	V	Get
12	Exception Status	BYTE	0	V	Get
13	Exception Detail Alarm	STRUCT	0…0	V	Get
14	Exception Detail Warning	STRUCT	0…0	V	Get
15	Alarm Enable	BOOL	1	NV	Get / Set
16	Warning Enable	BOOL	1	NV	Get / Set

Common Services

Service Code	Implemented for		Service Name
	Class Level	Instance Level	
$0E_{HEX}$	Yes	Yes	Get Attribute Single
10_{HEX}	No	Yes	Set Attribute Single
05_{HEX}	No	Yes	Reset
06_{HEX}	No	Yes	Start
07_{HEX}	No	Yes	Stop
$4B_{HEX}$	No	Yes	Abort
$4C_{HEX}$	No	Yes	Recover
$4E_{HEX}$	No	Yes	Perform_Diagnostics

- The Coolwave2 enters the “Nordson Off State” as a result of S−Device Supervisor commands “Reset”, “Stop” or “Abort”.
- The S−Device Supervisor “Start” command transitions to the S−Device “Executing” state which allows the Nordon commands: “On, Ready, Standby and Stop” via the I/O data.
- The S−Device Supervisor command “Perform_Diagnostics” has no supported behavior.

Exception Detail Alarm / Warning

Both the Exception Detail Alarm and the Exception Detail Warning use the same 9 byte array.

Table 10-3 Exception Detail Structure Definition

Bytes 1–8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Common Exception Detail Size	= 2 (2 bytes to follow)							
Common Exception Detail Byte 0	0	0	0	0	EEPROM Exception	0	0	0
Common Exception Detail Byte 1	0	0	0	0	0	0	0	0
Device Exception Detail Size	= 0 (0 bytes to follow)							
Manufacturer's Exception Detail Size	= 4 (4 bytes to follow)							
Manufacturer's Exception Detail Byte 0	Lamp Out	Magnetron Fault Current	Slave unit fault	Current Imbalance	Magnetron over current	Filament Fuse	Magnetron Fault	Local Net config error
Manufacturer's Exception Detail Byte 1	Power Regulation Fault	unassigned	Slave Unit not present	Magnetron Voltage Fault	DeviceNet Bus OFF	Duplicate MAC ID	PC Board hardware fail	Unassigned
Manufacturer's Exception Detail Byte 2	HV Cable unplugged	Lamphead over temp	MSTOP open	RF Detector Fault	RF Detector missing	Power Unit over temp	External Interlock	Low Lamphead Pressure
Manufacturer's Exception Detail Byte 3	Unassigned	Unassigned	Unassigned	Mag Filament Open	Phase Controller Fault	RF Detector Failed	Phase Control at Limit	Low magnetron current

Lamp Object (64_{HEX} – 16 Instances)

Class Attributes (Instance 0)

Attribute ID	Name	DeviceNet Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get
100	System Ready: 0 – Not Ready 1 – Ready 255 – DeviceNet Disabled (not reported over DeviceNetJ)	USINT	0	Get
101	Faulted Node Bitmap: Bit 0 – Master Bit 1 – Slave 1.....Bit 15 – Slave 15	UINT	0	Get
102	Units Present Bitmap: Bit 0 – Master Bit 1 – Slave 1.....Bit 15 – Slave 15	UINT	1	Get
103	Master Lamp State 1 – Off 2 – Filament On Time Delay 3 – Standby 4 – Lamp Start 5 – Lamp On 6 – Fault 7 – Reset 8 – Cool Off 9 – Lamp Cool 10 – Test 11 – Start Power Delay	USINT	0	Get
104	Master Lamp Fault See S–Device Supervisor for bit definitions	UDINT	0	Get
105	Master Light Intensity Level Set (0–100%)	USINT	0	Get
106	Master Magnetron Power Level Actual (0–100%)	USINT	0	Get
110	Master Lamp Command: 1 – Off 2 – On 3 – Standby 5 – Reset	USINT	0	Get / Set
111	Light Intensity Command 20–100% (0–255% accepted)	USINT	0	Get / Set

Instance Attributes (Instances 1–15)

Attribute ID	Name	DeviceNet Data Type	Data Value	Access Rule
103	Slave Lamp State See “Master Lamp State” definition above	USINT	0	Get
104	Slave Lamp Fault See S–Device Supervisor for bit definitions	UDINT	0	Get
105	Slave Light Intensity Level Set (0–100%)	USINT	0	Get
106	Slave Magnetron Power Level Actual (0–100%)	USINT	0	Get

Common Services

Service Code	Implemented for		Service Name
	Class Level	Instance Level	
$0E_{HEX}$	Yes	Yes	Get Attribute Single
10_{HEX}	Yes	No	Set Attribute Single

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