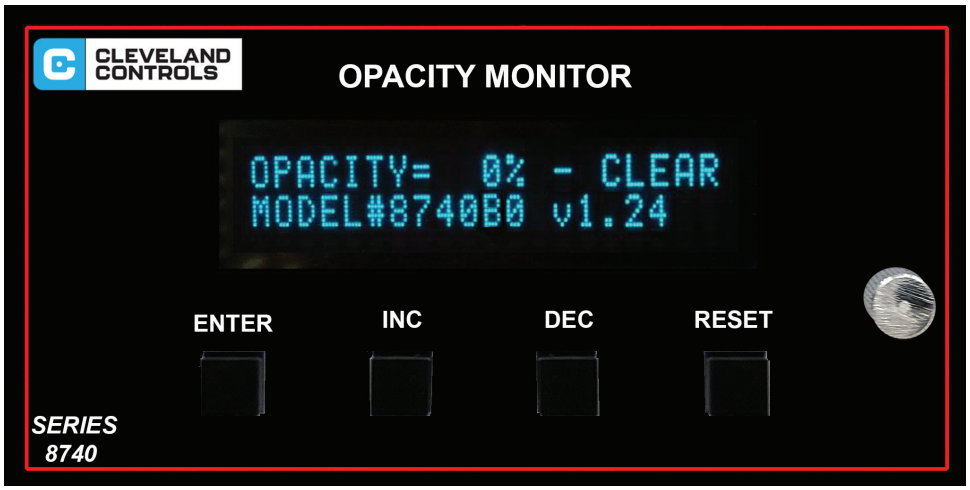
1/2 DIN UNIVERSAL OPACITY MONITOR

SERIES A-08740-B INSTRUCTION MANUAL



WARNING Do not operate or service this equipment before reading this Operator's Manual. Failure to do so could result in serious injury.

Please obtain written approval from Cleveland Controls before performing any alterations to hardware, wiring or software.

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IM-Series-A-08740-B0-Opacity-Monitor_Manual_09-2023

CLEVELAND CONTROLS™

DOCUMENTATION NUMBER AND REVISION LOG	
MANUAL	**REVISION DATE**
IM-A-08740-B-00	06/01/2023
IM-A-08740-05	12/27/2021
IM-A-08740-04	11/01/2011
HARDWARE	**REVISION NUMBER**
Electronics Unit	
P/N 32112 LED Light Source Assembly	
P/N 32113 Receiver Assembly	
P/N 27367 Sight Glass Assembly (qty. of 2)	
P/N 31726 Purge Air Blower Kit	
CURRENT SOFTWARE VERSION	**RELEASE DATE**
1.24	**01/01/2023**
1.23	05/10/2004

STORAGE, HANDLING & UNPACKING	
The following components may be shipped individually.Specific purchase orders may include some or all of the following items.	
P/N 32121	Electronics Unit
P/N 32112	Light Source Assembly
P/N 32113	Receiver Assembly
P/N 27367	Sight Glass Assembly (qty. of 2)
P/N 31726	Purge Air Blower Kit with (2) 6’ lengths of flex conduit, the blower, an air inlet filter, & (4) fittings
P/N 20458	Series L-05500 Audible/Visual Alarm
PDF on website	Documentation: Instruction Manual IM-Series-A-08740-B0-Opacity-Monitor_Manual_09-2023

SYMBOLS USED IN THIS MANUAL	
The following symbols may be used in this manual to denote certain conditions.	
DANGER	Danger symbol indicates an immanently hazardous situation, which, if not avoided, will result in death or serious injury.
WARNING	Warning symbol indicates a potentially hazardous situation, which, if not avoided, could result in death or serious injury.
CAUTION	Caution symbol with the safety alert symbol indicates a potentially hazardous situation, which, if not avoided, could result in minor or moderate injury.

DOCUMENTATION NUMBER AND REVISION LOG	
MANUAL	**REVISION DATE**
CAUTION	Caution used without the safety alert symbol indicates a potentially hazardous situation, which, if not avoided, may result in property damage.

DANGER SAFETY WARNINGS

Failure to comply in full with the following safety requirements can result in equipment damage and personal injury/death.

1. Read the entire manual to become familiar with the use and operation of this device.
2. Only qualified personnel should attempt to install, wire, commission, startup, service or operate this device.
3. This device is not suitable for use in an explosive ambient atmosphere.
4. Before working on this device, be sure that you understand the processes affected by this device completely.
5. Before working on this device, be sure that any process affected by this device is secure and safe for servicing.
6. Take appropriate precautions to avoid electric shock when working with this device near water.
7. Exercise caution while wiring or working on this device. Multiple voltage sources may be present: take appropriate precautions to avoid electric shock.
8. RFI (radio frequency interference) can affect adversely the operation of this device and devices that are connected together as a system. Do not use radios near this equipment: examples include, but are not limited to; citizen band radios (CB), walkie-talkies, transceivers, and amateur radios (HAM).

WARNING WIRING TIPS

1. Wire with extreme caution!
2. All wiring must conform to the National Electrical Code and to local code regulations. Verify all electrical ratings on equipment.
3. Connecting high voltage to the low voltage circuits will damage the circuitry!
4. Mount the unit in such a manner that the wiring cable from the main electronics does not touch or approach any high magnetic source. If mounted near a high magnetic source (such as motor starters, 3Ω transformers, ignitors, etc.), electronic interference may cause the display to read incorrectly.

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IMAGES, DRAWINGS & TABLES

1.0 INTRODUCTION

1.1 DESCRIPTION OF OPERATION

The Cleveland Controls Model A-08740-B 1/2 DIN Universal Opacity Monitor provides reliable, continuous measurement of the density of confined particulates such as dust or smoke. The basic system includes the ½ DIN electronics unit and two breeching components with sight glass assemblies which must be mounted in the stack or duct. The breeching components are an LED light source that directs a beam through the measured particulate, and a light sensor that receives the beam, detects changes in opacity, and sends a proportional signal to the electronics unit. The electronics produces a digital readout of percent opacity and a 4-20 mA DC output signal suitable for recording, display, or indication. Modbus communications, for interface with a SCADA system or other controls, and a serial printer port are standard on all models. SPDT contacts are provided for an optional remote alarm (recommended: Cleveland Controls L-05500-00). The operator can select manual or automatic alarm reset. The system is easy to calibrate and requires no routine maintenance other than occasionally cleaning the sight glass.

The electronics unit can be installed in any dry, convenient area within 250 feet of the light source and receiver units. The breeching components are easy to install because the wide-beam light source and narrow-view receiver do not require precise alignment. A traverse and mounting pipe, plus any required purge connections and/or air supplies, are not included.

Auxiliary Function:

The Burner Cutoff Auxiliary Function is a delayed-off timer that shuts the burner down if an alarm condition (defined as opacity exceeding 20%) persists for 120 seconds. The timer can be reset manually only after reduction of opacity: it cannot be reset when opacity is above 20%. This feature meets the requirements of the New York City air pollution control code for alarm and burner control functions. In addition, an audible alarm with adjustable trip point and delay is mounted on the front face of the electronics unit.

The Overfire Air Timer Auxiliary Function is a delayed-off timer that provides relay contacts for the control of smoke-reduction air in coal-fired installations. Whenever opacity exceeds the alarm trip point, the relay is energized immediately. It remains energized as long as the alarm condition persists. After the alarm condition is corrected, the relay remains energized for an adjustable period up to five minutes.

P/N 31726 Purge Air Blower Kit is an accessory for positive pressure flue gas systems. Sight glass lenses at the ends of the traverse pipe can become cloudy due to water from the flue gas condensing on the lenses when the flue gas pressure exceeds ambient air pressure. Cloudiness results in false opacity alarms. The lenses can be purged with instrument air (not plant air) if sufficient volume is available, but usually it is not. The best solution is a blower to provide ambient air at low pressure (not compressed) to prevent condensation on the lenses. The Purge Air Blower Kit provides a single blower which is wired to run whenever the burner is running. It can be connected to fittings near the lenses. It operates with 120/230 V ac. The complete kit includes the blower with air inlet filter, four fittings, and two 6-ft lengths of 1-inch liquid-tight flexible conduit for tubing connections to the traverse pipe near the light source and receiver lens. Purchase separately.

1.2 SPECIFICATIONS

Power requirements: 120 V ac ± 10%, 50/60 Hz.

Ambient temperature ranges: 32 ºF–130 ºF (0-54 ºC) for electronics unit. 32 ºF–160 ºF (0-70 ºC) for light source and receiver units.

Fuse: Two, @ 1 Amp.

Measurement range: 0 to 100% opacity.

Retransmit Output range: 4-20 mA dc, 750 Ω maximum load. Directly proportional to measurement range, where 4 mA = 0% and 20 mA = 100%. Output is grounded (not isolated.)

Resolution: Digital meter reads 0-100% opacity with 1% resolution.

Response time: 1 second for 90% of actual change in opacity.

Accuracy: ± 5% opacity under all specified operating conditions.

LED light source to receiver distance: minimum 4 ft. (1.20 m.), to maximum 15 ft. (4.57 m.).

LED light source lamp life: 1 year minimum.

Spectral response of photocell: 350–1100 nM.

Cable length: 250 ft. (76 m.) maximum.

Alarm timer: adjustable 0-300 second delay.

Alarm trip point: adjustable 0-99% opacity.

Alarm reset: automatic; field-convertible to manual.

Alarm contacts: isolated SPDT, 10 Amp, 120 V ac resistive, fail safe.

Purge Delay timer: adjustable 1-600 second delay.

NYC Burner Cutoff (optional): fixed 20% trip point and fixed 2-minute (120-second) delay.

NYC Burner Cutoff contacts: isolated SPDT, 10 Amp, 120 V ac resistive, fail safe.

Overfire air timer (optional): maintains contact closure after smoke abatement for a period adjustable from 1-300 seconds.

Overfire air contacts: isolated SPDT, 10 amp, 120 V ac resistive, fail safe.

Housing for enclosed models: NEMA 1.

Relative Humidity: 0-90%, non-condensing.

Modbus Communication: RTU. 9600 or 19200 Baud rate. N/8/1 (no parity, 8 data bits, 1 stop bit).

Printer port: RS232 serial port, DB9-M connector, 9600 baud, N81 (no parity, 8 data bits, 1 stop bit).
Output adjustable, generated every 0-60 minutes, where 0 = disabled.
Output format: 5 sequence #, blank space, 3 digit opacity, “%” symbol, carriage return, line feed.
Example: 01234 011% c/r l/f

Shipping Weight: 12 lbs., approx.

Approvals: NYC DEP. UL & CUL pending.

SPECIFICATIONS ARE SUBJECT TO CHANGE.

1.3 NOMENCLATURE

The basic catalog number for the A-08740-B Universal Opacity Monitor is shown below. Replace suffixes **A** and **B** with selections from the table below.

The standard base unit includes one electronics unit, one pair of LED light source and receiver units, and two sight glass assemblies. Any auxiliary function that was purchased (NYC burner cutoff timer or overfire air timer for stokers) is also included. Standard features include: adjustable alarm trip point and delay, field-selectable auto/manual alarm reset, re-transmitted 4-20 mA dc output, Modbus communication, a serial printer port, and a contact closure for a remote alarm. Please note that the printer and remote alarm are not included and must be supplied by the customer. However, the Cleveland Controls P/N 20458 Series L-05500-00 Audible/Visual Alarm can be purchased separately. Also available separately, the Cleveland Controls P/N 31726 Purge Air Blower Kit is used in positive flue gas pressure applications.

Model A-08740-B Universal Opacity Monitor is the direct replacement for the obsolete Model A-08711 Opacity Monitor and all subsequent models.

A - 0 8 7 4 0 - *B - A - B

A : Auxiliary Functions for Specific Applications

A = 0. None.

A = 1. Burner Cutoff Timer with audible alarm & “Burner Status” LED on panel face. NYC DEP approved.

A = 2. Overfire Air Timer with “Overfire Air” LED for stoker applications.

B : Mounting/Enclosure Options

B = 0. Open-mount package for OEM applications. ****TBD**

B = 1. Cabinet: surface-mount on wall (NEMA 1). ****TBD**

B = 2. Cabinet: semi-flush mount on panel (NEMA 1).

* Current Model Designation

**Not available at this time.

2.0 INSTALLATION

2.1 MOUNTING

Mount the electronics/display unit in a dry location where the ambient temperature is within the specified temperature range, 32 °F - 130 °F (0 - 54 °C).

- Mount the unit away from excessive vibration.
- Do not mount in a wiring cabinet that has any power wiring in excess of 120 V ac.
- Mount the unit in such a manner that the wiring cable from the main electronics does not touch or approach any high magnetic source. If mounted near a high magnetic source, electronic interference may cause the display to read incorrectly.

Referring to **Figure 2**, mount the LED light source and receiver units directly opposite each other on the particulate passage. Select a position where a true, low-turbulence particulate sample is present, and where the sight glasses are safely and conveniently accessible for cleaning. For applications where soot on the sight glass might present a problem, apply purge air as shown in **Figure 3** and **Figure 4**.

The width of the passage must not exceed 15 feet (4.57 meters). The length of the wires to the control unit must not exceed 250 feet (76 meters).

Stack Units, left to right: **P/N 32112 Light Source** and **P/N 32113 Receiver**: These stack-mounted units are included with the base electronics/display unit and two **P/N 27367 Sight Glass Assemblies**.

2.2 WIRING

WARNING

The following information on wiring is generally applicable to all models. Refer also to the wiring diagrams in this manual (Figure 5 - Figure 8). Field wiring consists of 120 V ac control wiring, dc signal wiring, and Modbus wiring.

120 V ac Control wiring connecting the opacity monitor to the power source must be 14 AWG minimum, and must not be run in conduit with low voltage signal wiring. Signal wiring (dc) and Modbus wiring may be run in the same conduit if practical.

Dc wiring is at voltage levels of 24 V dc or less. Unless otherwise specified, all signals are 4-20 mA dc. Each signal requires a shielded 2-wire pair, 16 AWG minimum.

To wire the **LED** light source and receiver, loosen the two (2) screws on the back cover and remove it, giving access to the field wiring terminals. Refer to Figures 5-7 and wire the units exactly as shown. The wires may be no longer than 250 feet (76 meters).

While no *damage* results if the wires are connected to the wrong unit, or if the polarity of any of the wires is reversed, the unit will not function. Connecting 120 V ac to the LED light source or receiver may result in serious damage. If the light source does not come on when 120 V ac is applied, remove the power immediately and recheck the field wiring.

The voltage on the LED light source wires is approximately 4–10 V dc. If these wires are shorted to each other, the light source power supply will shut down. Shielded wire must be used on the receiver, and the shield must not be shorted to ground. A grounded shield may result in erratic operation or a shorted 4-20 mA output.

RS-485 Modbus wiring: a plus terminal is provided for the plus signal, a minus terminal for the minus signal, and a shield (shd) for shield wire. Generally, Belden 9841™ shielded cable or equivalent is suggested for RS-485 communications.

3.0 OPERATION & MAINTENANCE

3.1 DISPLAYS AND INDICATORS

3.1.1 Continuous Display Screen

When power is applied to the unit, the continuous display screen lights. It provides a continuous display of particulate density from 000% Opacity (no particulates detected) to 100% Opacity (particulates are dense enough to block all light), in 1% increments. The display window indicates the parameters and messages shown in Tables 2-4 in this manual.

3.1.2 Status Messages

The “Clear” message appears on the first line of the display to indicate that opacity is below alarm trip point. As soon as the trip point is exceeded, the “Clear” message goes out and the blinking “Smoke” message come on. On the second line of the display, the alarm delay timer countdown appears. The blinking “Alarm” display is activated if the excessive opacity persists after the alarm delay period expires. If automatic alarm reset mode is selected, the Clear message will resume after the smoke has cleared to the point that the monitor detects an opacity percentage less than the alarm trip point. If manual alarm reset mode is selected, press the reset button to reset the alarm in all Standard and Overfire Air Timer models. See Figures 10 and 13.

Units equipped with the the **Burner Cutoff Auxiliary Function for NYC have** 2-minute shutdown and alarm options: reset both the main and NYC alarms by first pressing the reset button, and then pressing the “Dec” key to reset the NYC alarm, and the “Inc” key to reset the main alarm. If the main alarm is in automatic reset mode, it will be necessary to reset only the NYC alarm.

3.1.3 Output Functions

A 4-20 mA signal corresponding to 0 to 100% opacity provides for remote recording, control, or indication. SPDT alarm contacts are provided for remote alarm or control. The alarm relay is normally energized for fail safe operation. Refer to lines 11a through 11c on Tables 2, 3, and 4 for calibration of the retransmitted output. Note that the output can be varied from the low (4 mA dc) and high (20 mA dc) values by ±0.5 mA dc.

3.2 FIELD CONFIGURATION ON CONTINUOUS DISPLAY SCREEN

The scrolling display permits the operator to view and change parameters. Press the “Enter” button repeatedly to scroll through the parameters, which appear on the bottom line of the display. With a parameter visible, press the “Inc” button to increase its value. Press the “Dec” button to decrease its value. The new value becomes effective immediately: pressing “Enter” again brings up the next parameter.

After 10 seconds of inactivity, the display reverts to the default screen except during calibration mode.

Following an alarm event, press the “Reset” button to clear the “Alarm” message and restore the “Clear” message to the display if the unit is a Standard or Overfire Air Timer model configured (on the printed circuit board) for manual alarm reset. If the unit is configured for automatic alarm reset, the “Clear” message will replace the “Alarm” message automatically as soon as the excessive opacity is cleared.

Units equipped with the the Burner Cutoff Auxiliary Function for NYC are equipped with the 2-minute shutdown and alarm options: reset both the main and NYC alarms by first pressing the “Reset” button, and then pressing the “Dec” key to reset the NYC alarm, and the “Inc” key to reset the main alarm. If the main alarm is in automatic reset mode, it will still be necessary to reset the NYC alarm.

The scrolling display includes the parameters and messages shown Tables 1 through 4.

3.3 CALIBRATION ON CONTINUOUS DISPLAY SCREEN

For a summary of the calibration information below, refer to the cover photo,Figures8, and Tables 1-4.

3.3.1 AUTO CALIBRATION MODE

To calibrate the LED light source and receiver units, press the "Enter" button until the "Enter Cal Menu?" message appears. While holding down the "Inc" button, press the "Dec" button simultaneously to display the "Calibrate Opacity" screen. While holding down the "Inc" button, press the "Dec" button simultaneously to display the "Auto-Cal Purge" screen and initiate the purge countdown from the **purge delay value** (which is already configured: see section **3.2** above, and **line 5** in Tables 2 - 4). Following the countdown, the "Calibrate Phase-1" message appears, along with a countdown from 04 to 00, and the LED light source lamp goes out. Following the countdown, the "Calibrate Phase-2" message appears and the LED light source lamp comes on and varies in intensity as it adjusts to the diameter of the stack. While the adjustment is in progress, a countdown from "40" displays on the screen, but calibration may be complete before it reaches "00". At the end of the calibration process, either the default screen display or a calibration error screen appears. "**Cal Err #1**" means that the receiver has not detected enough light from the LED light source. "**Cal Err #2**" means that the receiver has detected too much light from the LED light source. In either case, the process conditions responsible for the error message must be corrected, and then the calibration process must be repeated until successful.

To calibrate the retransmitted 4-20 mA dc signal, connect a 4-20 mA meter to the retransmit terminals, and then follow the steps above until the "Calibrate Opacity" screen appears. Next, press "Enter" to display the "Calibrate Retrans" message. While holding down the "Inc" button, press the "Dec" button simultaneously to display the "Set Retrans Low" screen. Observing the meter reading, use the "Inc" and "Dec" keys to correct the value. The output can be varied from 4 mA by ± 0.5 mA dc. When satisfied, press the "Enter" key again and the "Set Retrans High" message appears. Observing the meter reading, use the "Inc" and "Dec" keys to correct the value. The output can be varied from 20 mA by ± 0.5 mA dc.

3.3.2 MANUAL CALIBRATION MODE

T**o calibrate the LED light source and receiver units**, press the "Enter" button until the "Enter Cal Menu?" message appears. While holding down the "Inc" button, press the "Dec" button simultaneously to display the "Stack Clear?" screen. Check the stack, and press "Enter" to confirm that it is clear. The "Calibrate Phase-1" message is displayed, along with a countdown from 04 to 00, and the LED light source lamp goes out. Following the countdown, the "Calibrate Phase-2" message appears and the LED light source lamp comes on and varies in intensity as it adjusts to the diameter of the stack. While the adjustment is in progress, a countdown from "40" displays on the screen, but calibration may be complete before it reaches "00". At the end of the calibration process, either the default screen display or a calibration error screen appears. "Cal Err #1" means that the receiver has not detected enough light from the LED light source. "Cal Err #2" means that the receiver has detected too much light from the LED light source. In either case, the process conditions responsible for the error message must be corrected, and then the calibration process must be repeated until successful.

To calibrate the retransmitted 4-20 mA DC signal, connect a 4-20 mA meter to the retransmit terminals, and then follow the steps above until the "Calibrate Opacity" screen appears. Next, press "Enter" to display the "Calibrate Retrans" message. While holding down the "Inc" button, press the "Dec" button simultaneously to display the "Set Retrans Low" screen. Observing the meter reading, use the "Inc" and "Dec" keys to correct the value. The output can be varied from 4 mA by ±0.5 mA dc. When satisfied, press the "Enter" key again and the "Set Retrans High" message is displayed. Observing the meter reading, use the "Inc" and "Dec" keys to correct the value. The output can be varied from 20 mA by ± 0.5 mA dc.

3.4 OTHER ADJUSTMENTS ON CONTINUOUS DISPLAY SCREEN

MODBUS ADDR: Set the Modbus address from 001– 247, using the "Inc" key to increase the value or the "Dec" key to decrease the value.

BAUD RATE: Select a baud rate of 9600 or 19200, using the "Inc" or the "Dec" key to toggle between these values.

PRINT INTERVAL: Select a print interval value between 0 and 60 minutes to regulate printed report frequency. A print interval of "0" disables the printer output.4.0 Miscellaneous

4.0 MISCELLANEOUS

4.1 RETRANSMISSION OF PROCESS VARIABLE

Refer to the overall wiring diagrams (Figures 6-9). The terminals for the retransmission of the process variable are located on the printed circuit board. They are marked “4-20 ma.”

4.2 MODBUS COMMUNICATIONS

Refer to the overall wiring diagrams (Figures 6-9). Terminals for Modbus communication are located on the lower left of the printed circuit board. They are marked “RS-485 +, -, SHD.” These terminals provide information with Modbus protocol using RS-485.

TheModbus address assignments are shown in Figure 14.

4.3 TROUBLESHOOTING (DIAGNOSTIC LED’S)

4.31 Diagnostic LED’s

LED’s are provided for onboard diagnostic of the I/O (Input/Output). The Relay Status and “Processor Running” LED’s are identified in Photo 4.

The “Processor Running” LED indicates the state of the microprocessor by blinking at different rates as shown in Photo 4.

4.32 Checksum Error

When the microprocessor values do not match the values stored in memory, “Checksum Error” is displayed. All logic functions stop. To correct the Checksum Error, turn the power off and then back on. If this procedure doesn’t rectify the error, reenter all control parameters. If the problem persists, contact the sales office where you purchased the unit.

5.1 CONTACT US

http://www.clevelandcontrols.com

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Telephone: (216) 398-4414
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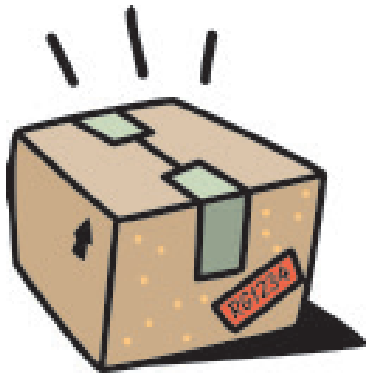
e-mail: customerservice@clevelandcontrols.com



Please follow this procedure. It expedites handling of the returned item, and avoids unnecessary additional charges for inspection and testing to determine the problem before repairing it.

5.2 REPAIRS

Damaged or defective units can be returned to the factory for repair. However, factory authorization must be obtained before shipping whether warranty or non-warranty service is required, and all units must be shipped prepaid. A letter of transmittal that includes the following information should accompany the returned unit:

1. Name and telephone number of contact person for any questions about the unit.
2. Indicate whether warranty or non-warranty service is requested.
3. Attach purchase order for all out-of-warranty repairs.
4. Indicate original purchase order number and date of purchase.
5. Location, type of service, and length of time in service of the unit.
6. Description of the faulty operation of the device and circumstances of the failure.
7. Complete shipping instructions for the return of the repaired instrument.
8. Return Goods Authorization number provided by the factory when you called.

Clearly label the shipping container:

RETURN FOR REPAIR
Model _____
RG # _____

Ship prepaid to the Cleveland Controls Customer Service Dept.
(address above in Paragraph 5.1

5.3 STANDARD TERMS AND CONDITIONS OF SALE

AGREEMENT OF SALE: Acceptance by Seller of any order placed for the good described on the reverse side hereof shall be subject to Seller's Standard Terms and Conditions of Sale and is conditioned upon the Buyer's acceptance of these Standard Terms and Conditions.

TERMS OF CONTRACT: Any terms or conditions of the Buyer's order which are inconsistent with these Standard Terms and Conditions shall not be binding on the Seller and shall not be considered applicable to the sale or shipment of goods covered by this Acknowledgment or Sales Contract. Unless Buyer shall notify Seller in writing to the contrary within ten (10) days after the mailing of this Acknowledgment or Sales Contract by Seller, acceptance of these Standard Terms and Conditions by Buyer shall be indicated and, in the absence of such notification, the sale and shipment by Seller of the goods covered hereby shall be subject to these Standard Terms and Conditions.

PRICES: Prices are subject to change to the extent permissible under applicable federal law. Sales contracts which call for delivery in the future will be billed at prices in effect at the time of shipment. Shipping weights shown are approximate and subject to change without notice. Prices of products do not include supervision of erection or adjustment after installation by Buyer. MINIMUM BILLING ON ANY ORDER IS $150.00 U.S. FUNDS.

SHIPMENT AND PAYMENTS: All prices and shipments are F.O.B. the Seller's factory such that the risk of loss and risk of liability during shipment passes to the Buyer upon delivery of the equipment to the carrier. As discussed under the section, "Title and Ownership," the Seller shall retain title to the equipment. No freight is allowed on any shipments. Shipments and deliveries hereunder shall at all times be subject to the approval of Seller's Credit Department, and at any time Seller may require payment in advance or satisfactory security or guarantee that invoices will be promptly paid when due. If Buyer fails to comply with any terms of payment, Seller, in addition to its rights and remedies but not in limitation thereof, reserves the right to withhold further deliveries or terminate this Agreement, and any unpaid amount thereon shall become due immediately. Standard terms of payment are Net 30 days unless otherwise negotiated prior to placement of order. Special terms of payment shall be as set forth on the quotation, or acknowledgment for order.

Pro rata payments shall become due as shipments are made. If shipments are delayed by the Buyer, payments shall become due on the date when the Seller is prepared to make shipment. If, in the judgment of the Seller, the financial condition of the Buyer at any time does not justify continuance of production or shipment on the terms of payment specified, the Seller may require full or partial payment in advance. Where the Buyer of the plant equipped is outside the territory of the United States of America, all remittances shall be made in U.S.A. funds. If the order is placed with complete specifications and instructions to fabricate, and then shipment is postponed by buyer, the order will be invoiced on date of shipment which was originally scheduled. If held for shipment, a charge may be made for storage in excess of four weeks after scheduled shipping date at the discretion of the Seller. PARTIAL SHIPMENTS: The Seller reserves the right to ship and invoice units as manufacture of unit items is completed.

Alternately, invoices may be rendered on net 30 day terms as unit items are completed, the equipment then being held for release by Buyer. It is sometimes necessary for certain instruments and/or controllers, etc., to be specially packed or for other reasons shipped separately, and therefore must be mounted in the panel at the job site. The Seller reserves the right to make exceptions to mounting such equipment in the panel before shipment, even though the Proposal is based on a completely assembled, piped and

/or wired panel. The Seller will not accept any charges for labor and/or material required to unpack, mount in the panel, pipe and/or wire equipment shipped separately.

TITLE AND OWNERSHIP: The Seller shall retain title, and hold a lien against, the equipment furnished under the terms and conditions of this proposal until the full and final payment shall have been made to the Seller, by the Buyer. In the event of a default by the Buyer on any of the terms, payments or conditions which are on his part to be performed, then the Seller shall have the right, without notice, to repossess any or all of the above mentioned equipment wherever the same may be found, and in doing so, shall not be held as a trespasser.

DELAYS AND DEFAULTS: Where date of delivery is given, we will endeavor to make shipments as near the date as possible, but we cannot be held responsible for any loss or inconvenience caused by delay or failure to deliver. Delays or defaults in delivery by Seller of the goods covered by this Sales Contract shall be excused so far as the same is caused by fire, strikes, accident, governmental regulation, or any delays unavoidable or beyond reasonable control of Seller. In no event shall Seller be liable for any consequential, special, or contingent damages on account of any default or delay in delivery.

ACCELERATED OR DELAYED PAYMENTS: There will be no reduction in price for payments more favorable to Cleveland Controls than the standard terms. If payments are not made in conformance with the standard terms, the quoted price shall, without prejudice to the right of Cleveland Controls to immediate payment, be increased by an amount equal to the lesser of 1 ½ percent per month or fraction thereof on the unpaid balance or the highest legal rate.

NON-CANCELLATION: Orders are not subject to suspension, reduction, or cancellation, except on terms that will indemnify Seller against loss.

RENEGOTIATION: Unless advised by Buyer in writing, Seller understands that Buyer's order and this Sales Contract are not renegotiable under the Renegotiation Act of 1951.

SPECIFICATIONS: Seller relies on specifications and other data furnished by the Buyer, an architect, contractor, or consulting engineer in all phases of the work covered by this Sales Contract. Seller shall be responsible to check quantities only. Alterations

to or changes in specifications, approval of samples, changes in delivery instructions and all other instructions must be submitted in writing to Seller.

In the event Seller performs design or engineering work at the request of Buyer, an architect, contractor, consulting engineer, or representative in any phase of the work covered by this Sales Contract, Seller shall not be responsible for any damages claimed by Buyer as a result of alleged errors or defects in such design or engineering work.

WARRANTY AND LIMITATION OF LIABILITY: The warranty applies to all components except those components which may be destroyed by negligence or abnormal use. Seller warrants that the goods supplied by it have been manufactured in accordance with its standard manufacturing practices and conform to the contract or catalog description for such goods. Seller further warrants that the goods supplied by it are fit for the ordinary purpose or purposes specified in its catalog for which such goods are used when installed in accordance with Seller's recommended installation procedures. Except as stated herein, Seller makes no express warranty with respect to goods supplied by it and Seller makes no warranty that the goods are fit for any particular purpose. When the use of materials not manufactured by Seller is suggested by Seller's recommended installation procedures or otherwise, Seller makes no express warranty with respect to such materials nor that such materials are merchantable or fit for any particular purpose. Seller will, at its sole option, credit, repair or replace, any goods supplied by it which its examination shall disclose to its satisfaction are defective in workmanship or material and are returned to it within one year from the date of shipment and any claim not made within this period shall conclusively be deemed waived by Buyer. Credit, repair, or replacement will be preconditioned upon examination of the goods by Seller, and, if requested by Seller, return of the goods to Seller at its direction and expense. In those instances in which a part or product is returned to the Seller, all transportation charges are to be paid by the Buyer. No goods are to be returned to Seller without its written consent. Seller shall not be liable for any expense incurred by Buyer in order to remedy any defect in its goods. Seller shall not be liable for any consequential, special, or contingent damage or expense, arising directly or indirectly from any defect in its goods or from the use of any defective goods. The remedies set forth herein shall constitute the exclusive remedies available to Buyer and are in lieu of all other remedies.

The responsibility for the performance and service of equipment included in this proposal which is not manufactured by the Seller and is not a part of equipment manufactured by the Seller will be the responsibility of the manufacturer of that equipment.

EXPORT and RE-EXPORT: The Buyer certifies that it will not re-export these commodities except in compliance with all applicable U.S. Department of Commerce Export Administration Regulations (EAR), International Traffic in Arms Regulations (ITAR) and laws administered by the Office of Foreign Assets Controls (OFAC). Diversion contrary to U.S. law is prohibited. The Buyer will verify compliance with U.S. sanctions laws and certifies that neither the end-user, any beneficial owners of the Buyer, nor any party involved in the transaction is identified on any U.S. government sanctions lists, including but not limited to the Denied Persons List, Unverified List, Entity List, Specially Designated National List, Debarred List, Nonproliferation Sanctions List, and Sectoral Sanctions Identifications List. The Buyer will comply with all prohibitions from 15 CFR Parts 736 and 746, including but not limited to those concerning prohibited exports, re-exports, imports, and sales to or from certain countries. Materials purchased from the Seller will not be exported or re-exported to any country or end-user without the required licenses or approvals of the United States Government.

CLAIMS: Claims for shortage of goods or for mistakes or errors in billing must be presented within forty-five (45) days from the date of shipment of goods and must state the packing slip number and container number applicable to the claim. Any claim not so presented will be conclusively deemed waived.

TAXES: Any federal, state, local or other government tax or charge on the sale, shipment, or installation of the goods covered by this Sales Contract shall be added to the price and paid by Buyer or, in lieu thereof, the Buyer shall furnish Seller with tax- exemption certificates acceptable to the taxing authority. Buyer agrees to reimburse and save Seller harmless from all such state and local taxes, including interest and penalties thereon, which may at any time be payable to any governmental unit with respect to the sale of any goods covered by this Sales Contract.

CORRECTIONS: Typographical or clerical errors contained in this Sales Contract, including prices, are subject to correction by Seller.

FAIR LABOR STANDARDS: These goods were produced in compliance with all applicable requirements of sections 6, 7, and 12 of the Fair Labor Standards Act, as amended and of the regulations and orders of the United States Department of Labor issued under Section 14 thereof.

APPLICABLE LAW: All questions arising out of this Sales Contract, which shall be deemed an Ohio Contract, shall be governed by the laws of the State of Ohio.

EXCLUSIVE TERMS: All proposals are based on, and all products are sold on, the terms and conditions contained herein. No other representation by the Seller or its representatives is valid. This Sales Contract shall constitute the complete contract between the parties. No one has authority to depart from the terms and conditions set forth herein, nor to make any representations or arrangements other than those printed hereon unless the same are written on the face of this Sales Contract or are given in writing with it or in pursuance of it, and are fully approved in writing by an officer or authorized employee of the Seller. Others made thereon, or contracts resulting there from, are not binding until and unless as so accepted.

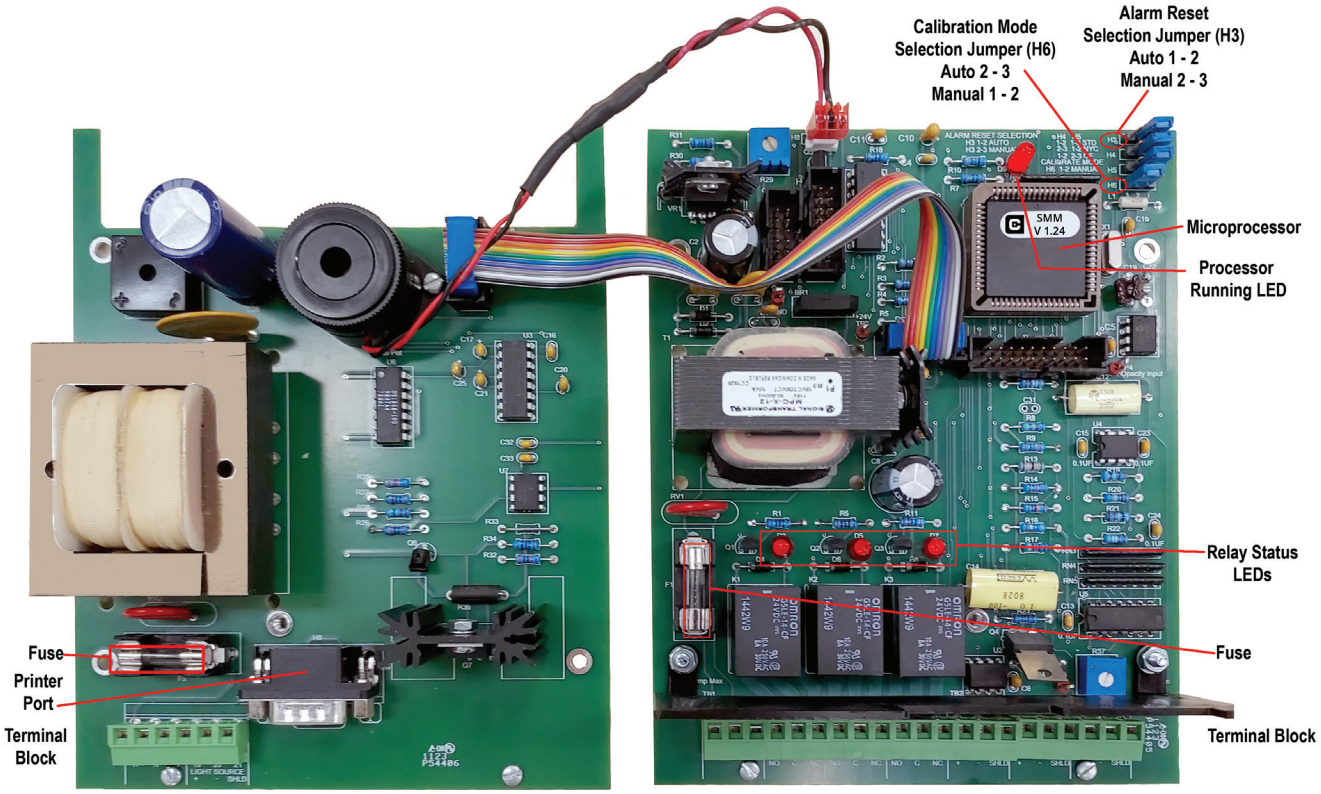
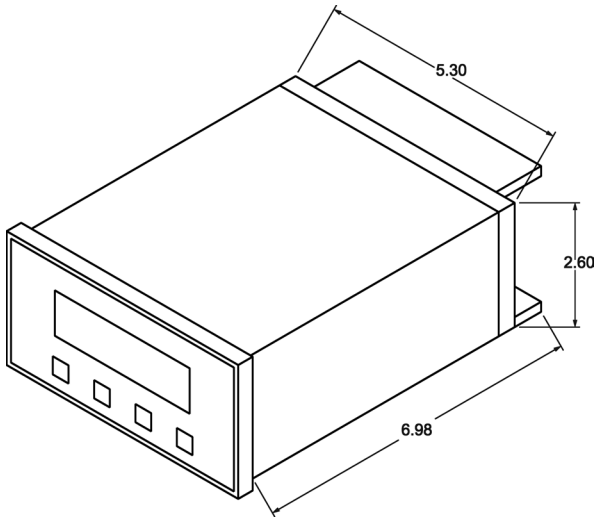


Photo 4: Printed Circuit Board Assembly for A-08740-B Opacity Monitor. Field wiring is shown in Figures 5-8.



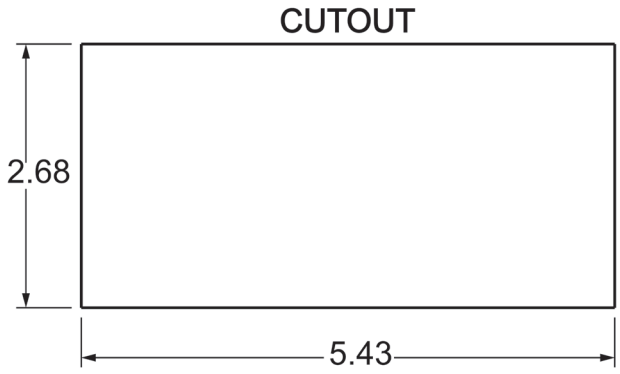


Figure 1: Housing dimensions and panel cutout for A-08740 1/2 DIN Opacity Monitor.

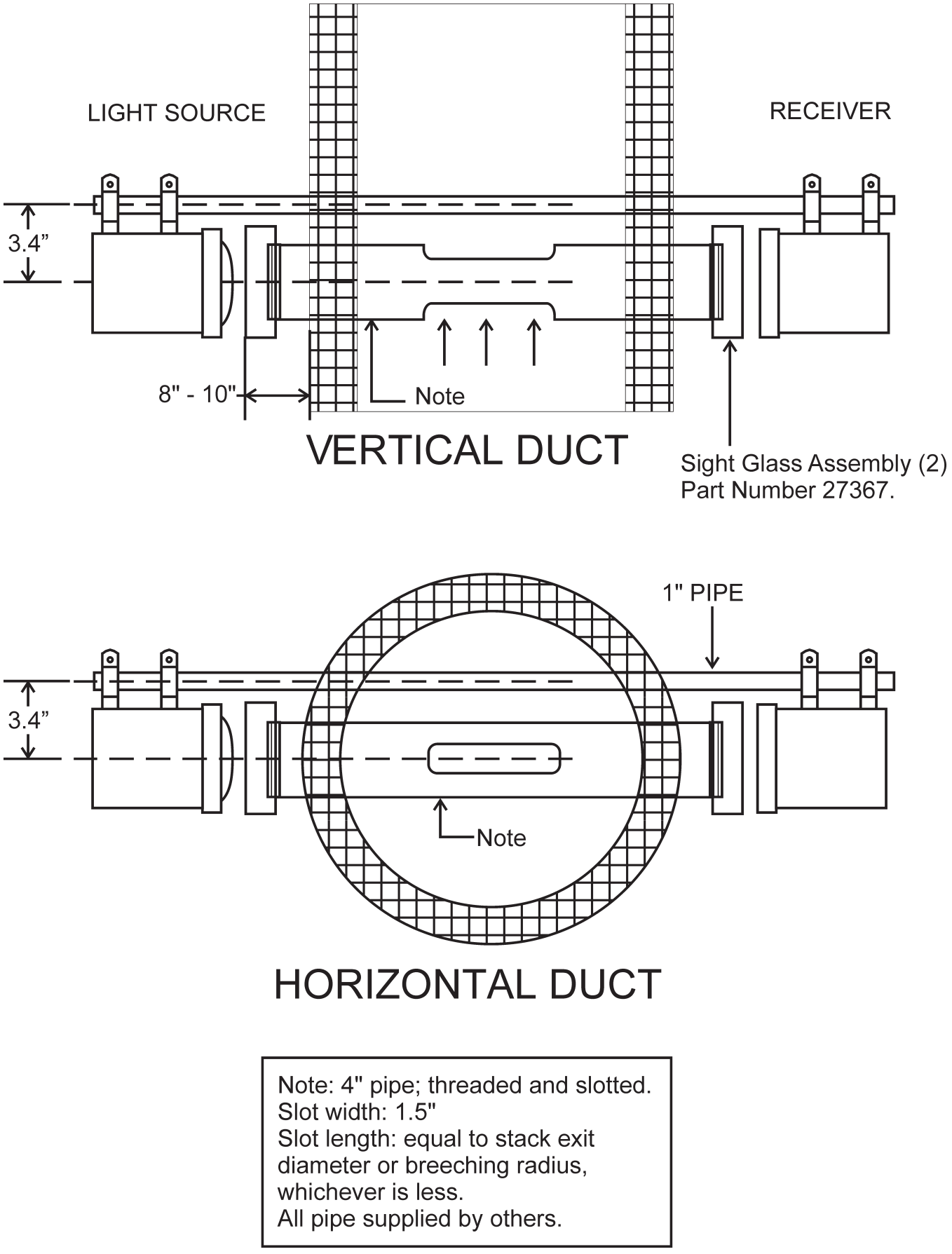


Figure 2: Mounting the Breeching Units

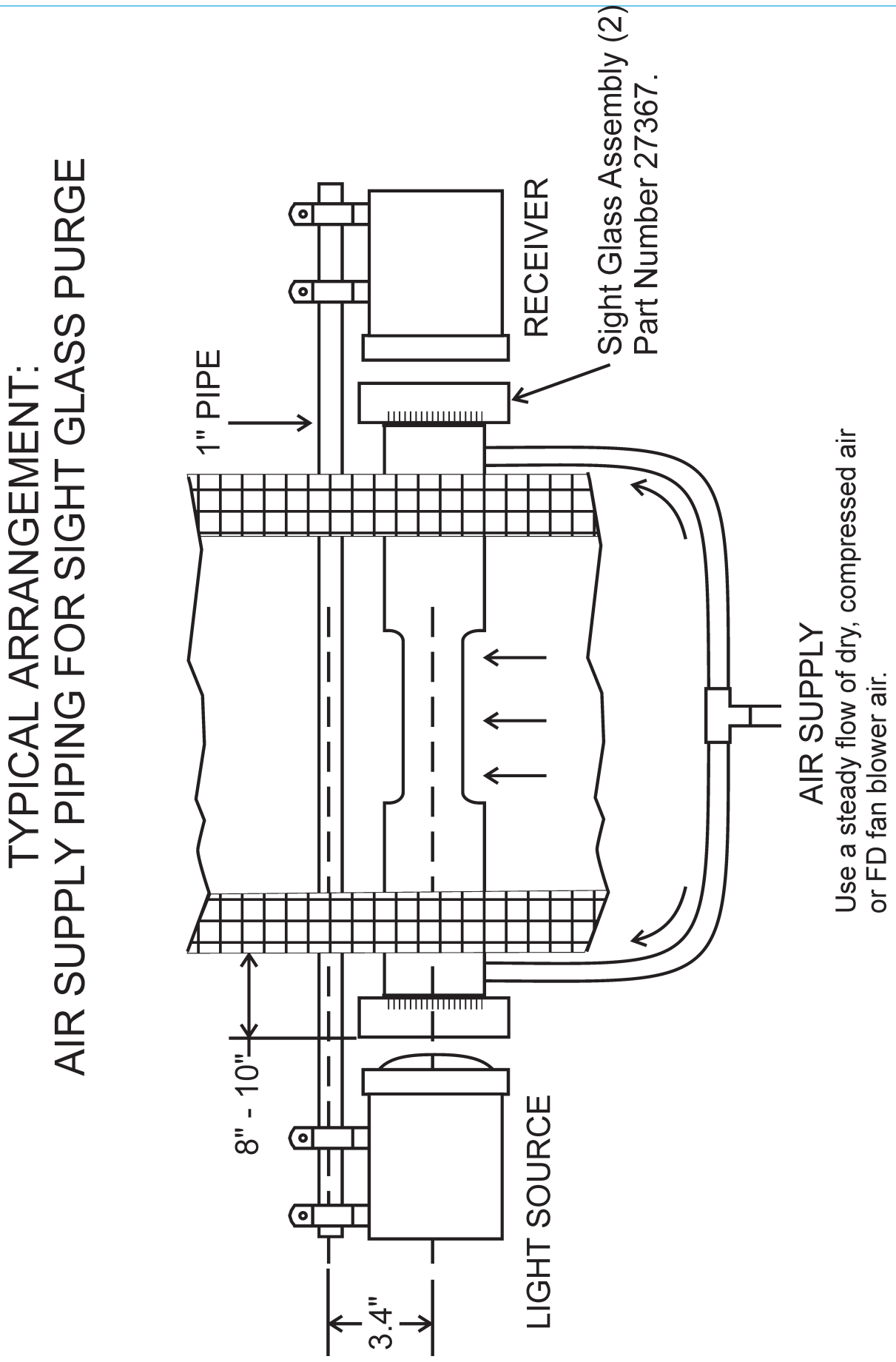


Figure 3: Typical Air Supply Arrangement for Sight Glass Purge

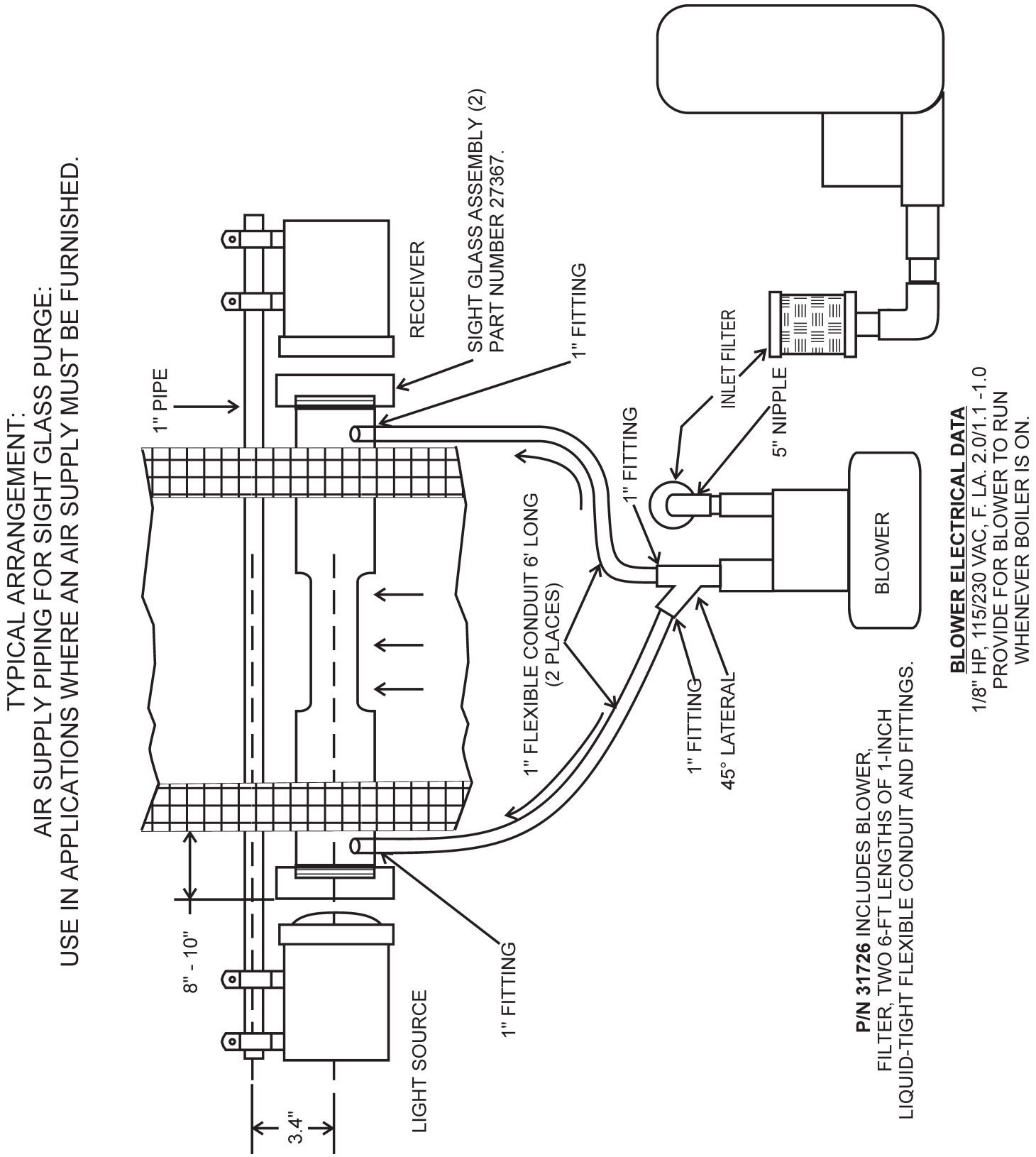
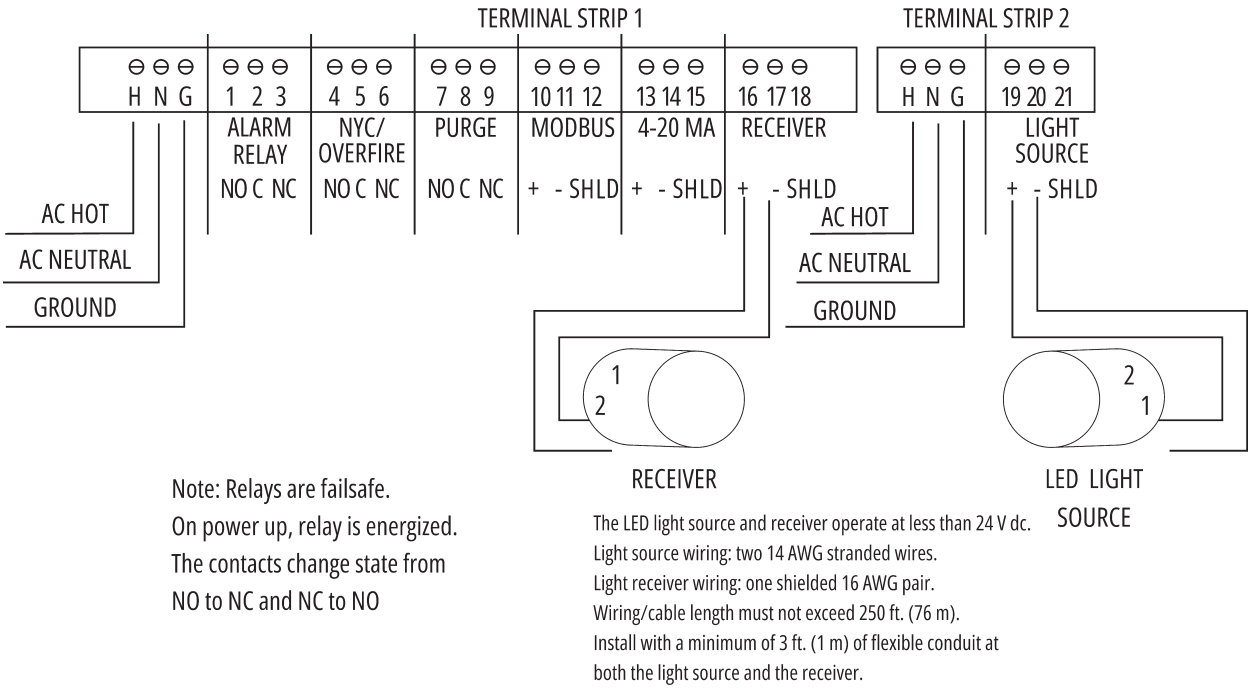


Figure 4: Typical Air Supply Arrangement for Sight Glass Purge with Blower (P/N 31726)



Note: Relays are failsafe.
On power up, relay is energized.
The contacts change state from
NO to NC and NC to NO

The LED light source and receiver operate at less than 24 V dc.
Light source wiring: two 14 AWG stranded wires.
Light receiver wiring: one shielded 16 AWG pair.
Wiring/cable length must not exceed 250 ft. (76 m).
Install with a minimum of 3 ft. (1 m) of flexible conduit at
both the light source and the receiver.

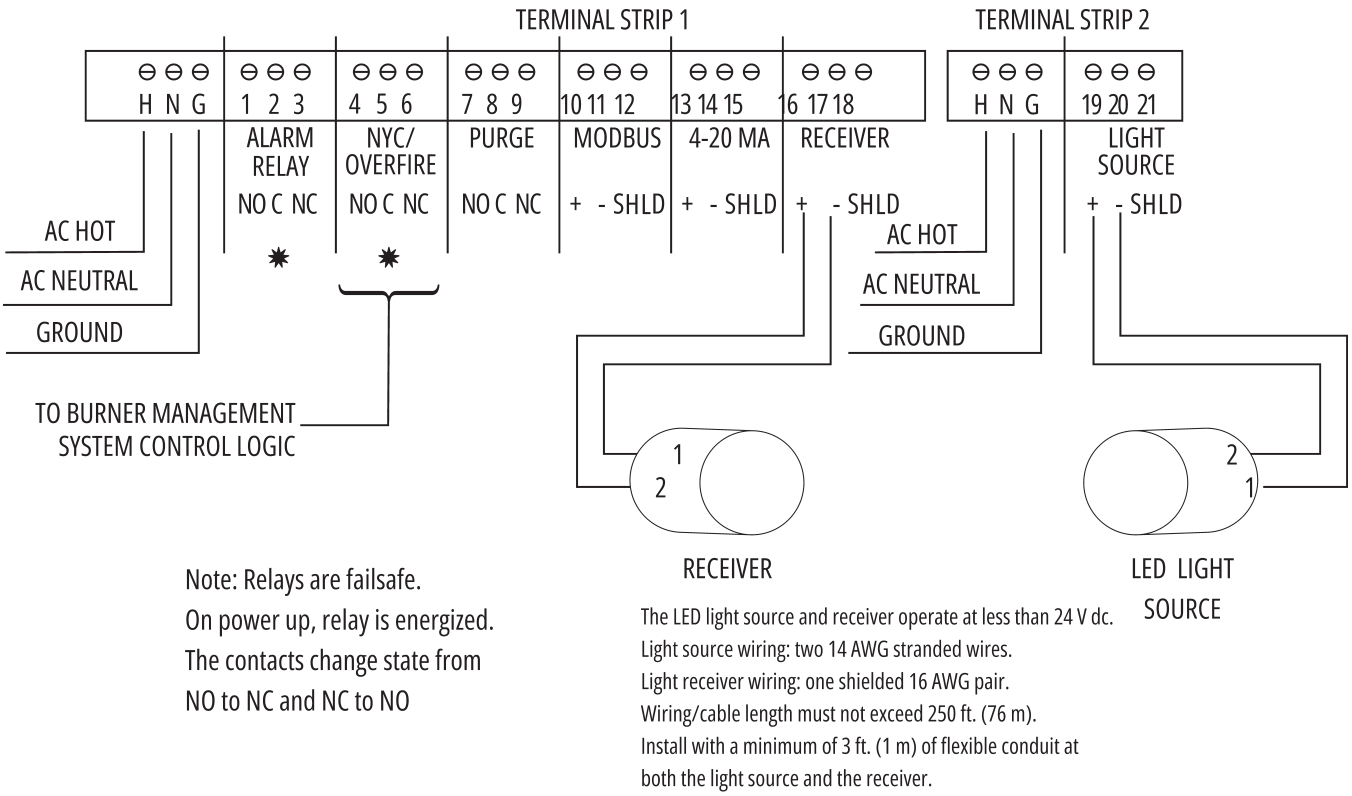
A-08740-B0 Universal Opacity Monitor
FIELD WIRING FOR BASIC MODELS (NO AUXILIARY FUNCTIONS)

*Notes:

Relay is failsafe: on power up, the relay is energized. The contacts change state from NO to NC and NC to NO.

The LED light source and receiver operate at less than 24 V dc. LED light source wiring: two 14 AWG stranded wires. Light receiver wiring: one shielded 16 AWG pair. Wiring cable length must not exceed 250 ft. (76 m.) Install with a minimum of 3 ft. (1 m.) of flexible conduit at both the light source and the receiver.

Figure 5: Field Wiring for Universal Opacity Monitor, basic model (no auxiliary functions).

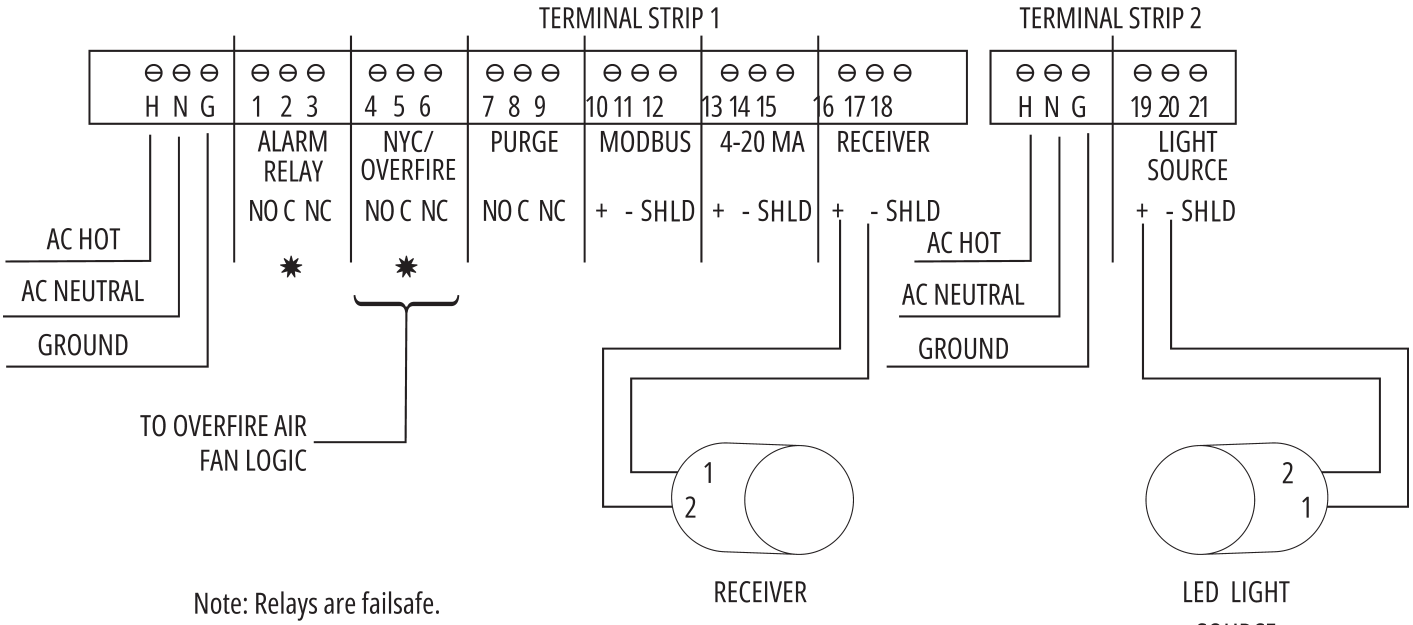


Note: Relays are failsafe.
On power up, relay is energized.
The contacts change state from
NO to NC and NC to NO

The LED light source and receiver operate at less than 24 V dc.
Light source wiring: two 14 AWG stranded wires.
Light receiver wiring: one shielded 16 AWG pair.
Wiring/cable length must not exceed 250 ft. (76 m).
Install with a minimum of 3 ft. (1 m) of flexible conduit at both the light source and the receiver.

A-08740-B0 Universal Opacity Monitor
FIELD WIRING: MODELS WITH NYC BURNER SHUTOFF FUNCTION

Figure 6: Field Wiring for Opacity Monitor equipped with NYC burner cutoff function.



Note: Relays are failsafe.
On power up, relay is energized.
The contacts change state from
NO to NC and NC to NO

The LED light source and receiver operate at less than 24 V dc.
Light source wiring: two 14 AWG stranded wires.
Light receiver wiring: one shielded 16 AWG pair.
Wiring/cable length must not exceed 250 ft. (76 m).
Install with a minimum of 3 ft. (1 m) of flexible conduit at
both the light source and the receiver.

A-08740-B0 Universal Opacity Monitor
FIELD WIRING: MODELS WITH OVERFIRE AIR TIMER FUNCTION

Figure 7: Field Wiring: Universal Opacity Monitor equipped with Overfire Air Timer function for stoker applications.

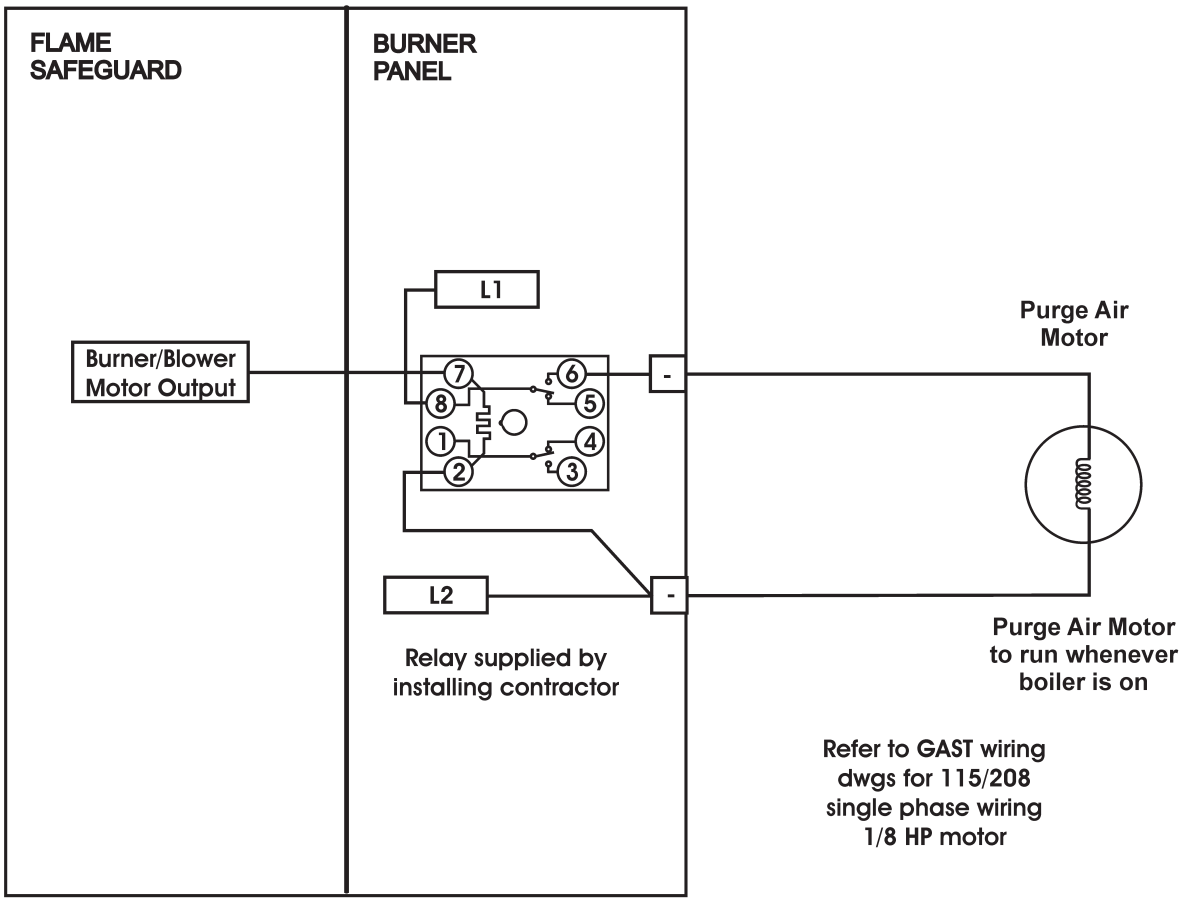


Figure 8: Field Wiring: Universal Opacity Monitor equipped with Purge Air Blower System.

CONTINUOUS DISPLAY SCREENS		
Display	Name	Function
Opacity	Opacity	Displays opacity level as 000-100%.
Cal%	Calibration	Unit is in opacity calibration mode.
Clear	Clear	Opacity is within permissible limits.
Smoke	Smoke	Flashes when opacity has exceeded the trip point.
Alarm	Alarm	Flashes when opacity has exceeded the trip point for longer than the delay period.
/	Micro-flipper	Indicates that microprocessor is running.
Delay:	Delay	Adjustable period during which process exceeds trip point before monitor goes to alarm condition.
Cutoff:	Cutoff	120-second period during which process exceeds trip point before monitor goes to alarm condition
*NYC Cutoff:	NYC Cutoff	Displayed when monitor goes to alarm condition after 120-second period in which process exceeds trip point. Models equipped with NYC burner cutoff function only.
*Ovrfir	Overfire	Displayed as monitor initiates adjustable period after smoke is cleared during which contacts used to run overfire air blower are closed. Models equipped with overfire air timer function only.
* = Optional Features		

Table 1: Summary of Continuous Display Screen. (Also see detailed tables on next nine pages.)

Scrolling Display Screen: press “Enter” key to scroll through the following screens which display status messages and permit adjustment of parameters.

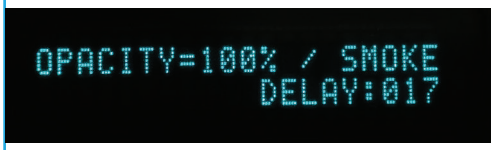
Screen	Function	Adjustment Procedure
1a		**Default Screen:** Line 1: OPACITY = XXX% / CLEAR Line 2: blank when line 1 reads “Clear”. Displays on Line 1 in operating mode when opacity is below the alarm trip point. Microprocessor flipper (/) spins. When “Clear” appears on line 1, there is no line 2 display.
1b		**Default Screen:** Line 1: OPACITY = XXX% / SMOKE Line 2: timer countdown appears (see screen 4 below). “Smoke” Blinks on Line 1 in operating mode immediately when opacity exceeds the alarm trip point.
1c		**Default Screen:** Line 1: OPACITY = XXX% / ALARM Line2: “Delay = T/O” (T/O = timed out.) “Alarm” Blinks on Line 1 in operating mode when opacity exceeds the alarm trip point and the adjustable time delay has expired.
2		**Model : 8740B0 V_1.24__** Displays the model number of the standard opacity monitor and current software version: Units are factory-configured. If it is necessary to configure the unit again in the field, unplug it and reset the jumpers. Plug the unit in again. Please keep in mind that devices may be needed that are not available in the field.
3		**Alarm Trip:** Displays the alarm trip point (opacity level at which alarm mode activates). Adjust while the unit is powered. Press “Inc” or “Dec” key to adjust the setting. Set from 0-99% opacity.
4		**Delay Time :** In alarm mode, displays the delay period before the blinking “alarm” message replaces the continuous “smoke” message. Adjust while the unit is powered. Press “Inc” or “Dec” key to adjust the setting. Set from 1-300 seconds.
5		**Purge Delay Time:** Displays the purge delay timer setting only when the monitor is set up in AUTO CAL mode. Determines the time allowed for purging of the system. When the delay period expires, the calibration cycle commences. Adjust while the unit is powered and in AUTO CAL mode. Press INC or DEC key to adjust the setting from 1 - 600 seconds.

Table 2a: Scrolling Display Screens for Standard Models A-08740-A0-0X (1a through 5)

Continuation of Scrolling Display Screen for Opacity Models A-08740-A0-0X

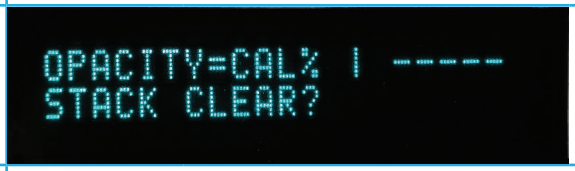
Screen	Function	Adjustment Procedure
6		**Modbus Addr:** Displays the modbus address. Adjust while the unit is powered. Press “Inc” or “Dec” key to adjust the setting. Set from 001 to 247.
7		**Baud Rate:** Displays the baud rate. Adjust while the unit is powered. Toggle between 9600 and 19200, using “Inc” or “Dec” key to adjust the setting.
8		**Print Interval**: Displays the print interval. Adjust while the unit is powered. Press “Inc” or “Dec” key to adjust the setting. Set from 00 to 60.
9		**Enter Cal Menu?** Prompts user to return to default screen or begin calibration procedure. Press “Inc” and “Dec” keys simultaneously to display “Calibrate Opacity” screen. Press “Enter” to return to default screen.
10a		**Calibrate Opacity**: Prompts user to begin calibration of light source and receiver units or to advance to “Calibrate Retrans?” screen, line 11 below. Press “Inc” and “Dec” keys simultaneously to access calibration mode of the light source and receiver units. Press “Enter” key to display “Calibrate Retrans” screen.
10b1		**Stack Clear?** Displays only when monitor is set up in MANUAL CAL mode. Prompts the operator to check the stack before calibration commences. Press “Enter” to confirm that the stack is clear.
10b2		**Auto-Cal Purge:** Displays only when monitor is set up in AUTO CAL mode. Counts down from value set in line 5 above. Automatically advances to next screen when purge is completed. Observe countdown from purge delay value to 00.
10c		**Calibrate Phase-1:** First phase of calibration: light source lamp is off. Observe countdown from 04 to 00.
10d		**Calibrate Phase-2:** Second phase of calibration: light source lamp is on. Observe countdown from 40 to 00.

Table 2b: Scrolling Display Screens for Standard Models A-08740-A0-0X (6 through 10d)

Continuation of Scrolling Display Screen for Opacity Models A-08740-A0-0X

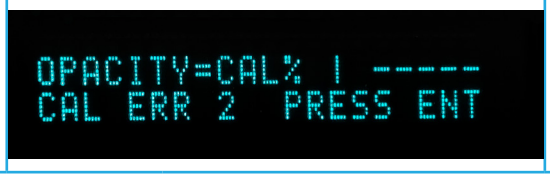
Screen		Function	Adjustment Procedure
11a			**Calibrate Retrans?** Prompts user to begin calibration of the 4-20 mA dc retransmitted output or return to the default screen. Press "Enter" to return to default screen. To proceed with calibration, connect a 4-20 mA meter to the retransmit terminals. Press "Inc" and "Dec" keys simultaneously to display "Set Retrans Low" screen.
11b			**Set Retrans Low:** Prompts user to calibrate the low end of the retransmitted output: 4 mA dc. Observe meter reading, and adjust as necessary by pressing "INC" and "DEC" keys until the meter reading is correct. The output can be varied from 4 ma DC by ±0.5 mA DC.
11c			**Set Retrans High:** Prompts user to calibrate the high end of the retransmitted output: 20 ma DC. Observe meter reading, and adjust as necessary by pressing "INC" and "DEC" keys until the meter reading is correct. The output can be varied from 20 ma DC by ±0.5 mA DC.
12			**Cal Err #1:** This message displays in calibration mode if the receiver does not detect sufficient light. Resolve process conditions and recalibrate.
13			**Cal Err #2:** This message displays in calibration mode if the receiver detects too much light. Resolve process conditions and recalibrate.

Table 2c: Scrolling Display Screens for Standard Models A-08740-A0-0X (11a through 13)

Scrolling Display Screen: press “Enter” key to scroll through the following screens which display status messages and permit adjustment of parameters.

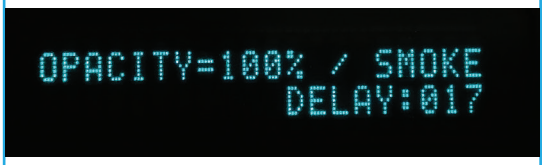
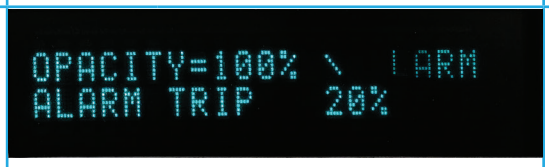
Screen	Function	Adjustment Procedure
1a		**Default Screen:** Line 1: OPACITY = XXX% / CLEAR Line 2: blank when line 1 reads “Clear”. Displays on Line 1 in operating mode when opacity is below the alarm trip point. Microprocessor flipper (/) spins. When “Clear” appears on line 1, there is no line 2 display.
1b		**Default Screen:** Line 1: OPACITY = XXX% / SMOKE Line 2: timer countdown appears (see screen 4 below). “Smoke” Blinks on Line 1 in operating mode immediately when opacity exceeds the alarm trip point.
1c		**Default Screen:** Line 1: OPACITY = XXX% / ALARM Line2: “Delay = T/O” (T/O = timed out.) “Alarm” Blinks on Line 1 in operating mode when opacity exceeds the alarm trip point and the adjustable time delay has expired.
2		**Model :** **8740B0 V_1.24__:** Displays the model number of the standard opacity monitor and current software version: Units are factory-configured. If it is necessary to reconfigure the unit, unplug it, reset the jumpers and plug it in again. Keep in mind that devices may be needed that are not available in the field.
3		**Alarm Trip:** Displays the alarm trip point (opacity level at which alarm mode activates). Adjust while the unit is powered. Press “Inc” or “Dec” key to adjust the setting. Set from 0-99% opacity.
4		**Delay Time :** In alarm mode, displays the delay period before the blinking “alarm” message replaces the continuous “smoke” message. Adjust while the unit is powered. Press “Inc” or “Dec” key to adjust the setting. Set from 1-300 seconds.
5		**Purge Delay Time:** Displays the purge delay timer setting only when the monitor is set up in AUTO CAL mode. Determines the time allowed for purging of the system. When the delay period expires, the calibration cycle commences. Adjust while the unit is powered and in AUTO CAL mode. Press INC or DEC key to adjust the setting from 1 - 600 seconds.

Table 3a: Scrolling Display Screens for Standard Models A-08740-A0-1X with burner shutoff functions (1a to 5)

Continuation of Scrolling Display Screen for Opacity Models A-08740-A0-0X

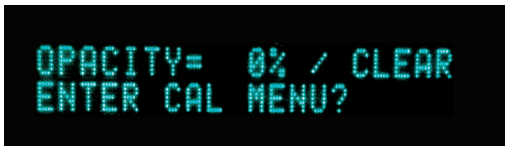
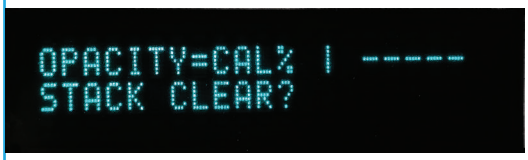
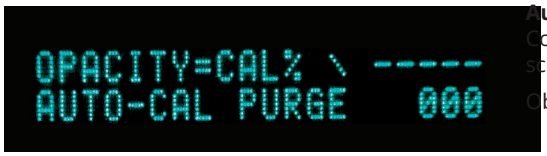
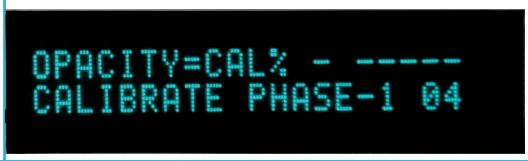
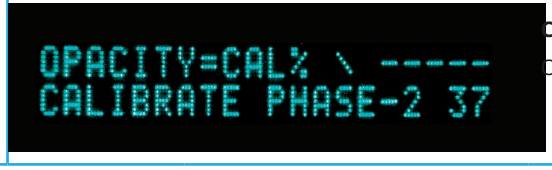
Screen	Function	Adjustment Procedure
6		**Modbus Addr:** Displays the modbus address. Adjust while the unit is powered. Press “Inc” or “Dec” key to adjust the setting. Set from 001 to 247.
7		**Baud Rate:** Displays the baud rate. Adjust while the unit is powered. Toggle between 9600 and 19200, using “Inc” or “Dec” key to adjust the setting.
8		**Print Interval**: Displays the print interval. Adjust while the unit is powered. Press “Inc” or “Dec” key to adjust the setting. Set from 00 to 60.
9		**Enter Cal Menu?** Prompts user to return to default screen or begin calibration procedure. Press “Inc” and “Dec” keys simultaneously to display “Calibrate Opacity” screen. Press “Enter” to return to default screen.
10a		**Calibrate Opacity**: Prompts user to begin calibration of light source and receiver units or to advance to “Calibrate Retrans?” screen, line 11 below. Press “Inc” and “Dec” keys simultaneously to access calibration mode of the light source and receiver units. Press “Enter” key to display “Calibrate Retrans” screen.
10b1		**Stack Clear?** Displays only when monitor is set up in MANUAL CAL mode. Prompts the operator to check the stack before calibration commences. Press “Enter” to confirm that the stack is clear.
10b2		**Auto-Cal Purge:** Displays only when monitor is set up in AUTO CAL mode. Counts down from value set in line 5 above. Automatically advances to next screen when purge is completed. Observe countdown from purge delay value to 00.
10c		**Calibrate Phase-1:** First phase of calibration: light source lamp is off. Observe countdown from 04 to 00.
10d		**Calibrate Phase-2:** Second phase of calibration: light source lamp is on. Observe countdown from 40 to 00.

Table 3b: Scrolling Display Screens for Standard Models A-08740-A0-1X with burner shutoff functions (6 to 10d)

Continuation of Scrolling Display Screen for Opacity Models A-08740-A0-0X

Screen	Function	Adjustment Procedure
11a		**Calibrate Retrans?** Prompts user to begin calibration of the 4-20 mA dc retransmitted output or return to the default screen. Press “Enter” to return to default screen. To proceed with calibration, connect a 4-20 mA meter to the retransmit terminals. Press “Inc” and “Dec” keys simultaneously to display “Set Retrans Low” screen.
11b		**Set Retrans Low:** Prompts user to calibrate the low end of the retransmitted output: 4 mA dc. Observe meter reading, and adjust as necessary by pressing “INC” and “DEC” keys until the meter reading is correct. The output can be varied from 4 ma DC by ±0.5 mA DC.
11c		**Set Retrans High:** Prompts user to calibrate the high end of the retransmitted output: 20 ma DC. Observe meter reading, and adjust as necessary by pressing “INC” and “DEC” keys until the meter reading is correct. The output can be varied from 20 ma DC by ±0.5 mA DC.
12		**Cal Err #1:** This message displays in calibration mode if the receiver does not detect sufficient light. Resolve process conditions and recalibrate.
13		**Cal Err #2:** This message displays in calibration mode if the receiver detects too much light. Resolve process conditions and recalibrate.

Table 3c: Scrolling Display Screens for Standard Models A-08740-A0-1X with burner shutoff functions (11a to 13)

Scrolling Display Screen: press “Enter” key to scroll through the following screens which display status messages and permit adjustment of parameters.

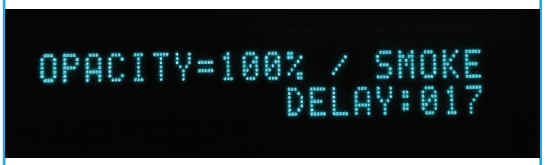
Screen	Function	Adjustment Procedure
1a		**Default Screen:** Line 1: OPACITY = XXX% / CLEAR Line 2: blank when line 1 reads “Clear”. Displays on Line 1 in operating mode when opacity is below the alarm trip point. Microprocessor flipper (/) spins. When “Clear” appears on line 1, there is no line 2 display.
1b		**Default Screen:** Line 1: OPACITY = XXX% / SMOKE Line 2: timer countdown appears (see screen 4 below). “Smoke” Blinks on Line 1 in operating mode immediately when opacity exceeds the alarm trip point.
1c		**Default Screen:** Line 1: OPACITY = XXX% / ALARM Line2: “Delay = T/O” (T/O = timed out.) “Alarm” Blinks on Line 1 in operating mode when opacity exceeds the alarm trip point and the adjustable time delay has expired.
2		**Model :** **8740B0 V_1.24__:** Displays the model number of the standard opacity monitor and current software version: Units are factory-configured. If it is necessary to reconfigure the unit, unplug it, reset the jumpers and plug it in again. Keep in mind that devices may be needed that are not available in the field.
3		**Alarm Trip:** Displays the alarm trip point (opacity level at which alarm mode activates). Adjust while the unit is powered. Press “Inc” or “Dec” key to adjust the setting. Set from 0-99% opacity.
4		**Delay Time :** In alarm mode, displays the delay period before the blinking “alarm” message replaces the continuous “smoke” message. Adjust while the unit is powered. Press “Inc” or “Dec” key to adjust the setting. Set from 1-300 seconds.
5		**Purge Delay Time:** Displays the purge delay timer setting only when the monitor is set up in AUTO CAL mode. Determines the time allowed for purging of the system. When the delay period expires, the calibration cycle commences. Adjust while the unit is powered and in AUTO CAL mode. Press INC or DEC key to adjust the setting from 1 - 600 seconds.

Table 4a: Scrolling Display Screens for Standard Models A-08740-A0-2X with overfire air timer functions (1a to 5)

Continuation of Scrolling Display Screen for Opacity Models A-08740-A0-0X

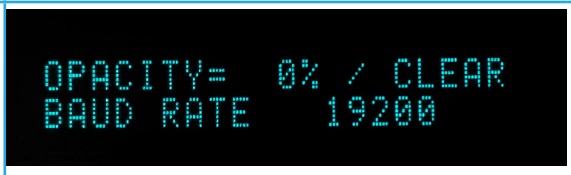
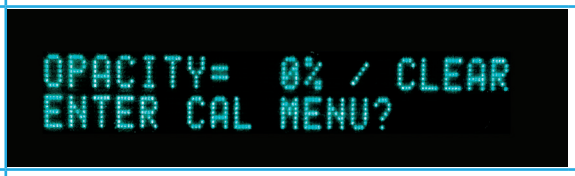
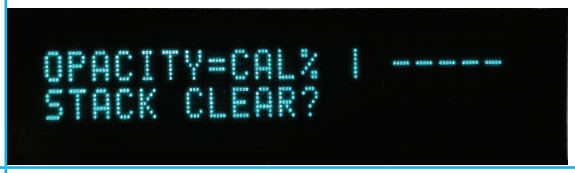
Screen	Function	Adjustment Procedure
6		**Modbus Addr:** Displays the modbus address. Adjust while the unit is powered. Press “Inc” or “Dec” key to adjust the setting. Set from 001 to 247.
7		**Baud Rate:** Displays the baud rate. Adjust while the unit is powered. Toggle between 9600 and 19200, using “Inc” or “Dec” key to adjust the setting.
8		**Print Interval**: Displays the print interval. Adjust while the unit is powered. Press “Inc” or “Dec” key to adjust the setting. Set from 00 to 60.
9		**Enter Cal Menu?** Prompts user to return to default screen or begin calibration procedure. Press “Inc” and “Dec” keys simultaneously to display “Calibrate Opacity” screen. Press “Enter” to return to default screen.
10a		**Calibrate Opacity**: Prompts user to begin calibration of light source and receiver units or to advance to “Calibrate Retrans?” screen, line 11 below. Press “Inc” and “Dec” keys simultaneously to access calibration mode of the light source and receiver units. Press “Enter” key to display “Calibrate Retrans” screen.
10b1		**Stack Clear?** Displays only when monitor is set up in MANUAL CAL mode. Prompts the operator to check the stack before calibration commences. Press “Enter” to confirm that the stack is clear.
10b2		**Auto-Cal Purge:** Displays only when monitor is set up in AUTO CAL mode. Counts down from value set in line 5 above. Automatically advances to next screen when purge is completed. Observe countdown from purge delay value to 00.
10c		**Calibrate Phase-1:** First phase of calibration: light source lamp is off. Observe countdown from 04 to 00.
10d		**Calibrate Phase-2:** Second phase of calibration: light source lamp is on. Observe countdown from 40 to 00.

Table 4b: Scrolling Display Screens for Standard Models A-08740-A0-2X with overfire air timer functions (6 to 10d)

Continuation of Scrolling Display Screen for Opacity Models A-08740-A0-0X

Screen	Function	Adjustment Procedure
11a		**Calibrate Retrans?** Prompts user to begin calibration of the 4-20 mA dc retransmitted output or return to the default screen. Press “Enter” to return to default screen. To proceed with calibration, connect a 4-20 mA meter to the retransmit terminals. Press “Inc” and “Dec” keys simultaneously to display “Set Retrans Low” screen.
11b		**Set Retrans Low:** Prompts user to calibrate the low end of the retransmitted output: 4 mA dc. Observe meter reading, and adjust as necessary by pressing “INC” and “DEC” keys until the meter reading is correct. The output can be varied from 4 ma DC by ±0.5 mA DC.
11c		**Set Retrans High:** Prompts user to calibrate the high end of the retransmitted output: 20 ma DC. Observe meter reading, and adjust as necessary by pressing “INC” and “DEC” keys until the meter reading is correct. The output can be varied from 20 ma DC by ±0.5 mA DC.
12		**Cal Err #1:** This message displays in calibration mode if the receiver does not detect sufficient light. Resolve process conditions and recalibrate.
13		**Cal Err #2:** This message displays in calibration mode if the receiver detects too much light. Resolve process conditions and recalibrate.

Table 4c: Scrolling Display Screens for Standard Models A-08740-A0-2X with overfire air timer functions (11a to13)

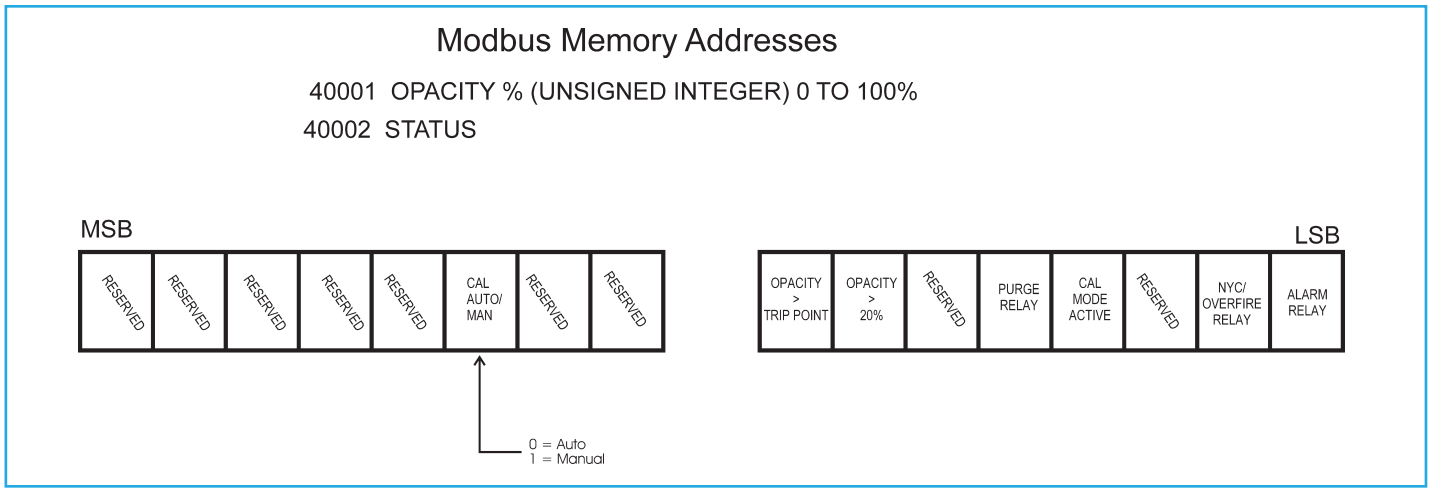


Table 5: Modbus Memory Addresses

ON/OFF TIMING	STATUS/FAULT
1 SECOND	Microprocessor is functioning properly.
0.1 SECOND	BROWN OUT: RESET VOLTAGE HAS DROPPED BELOW THE PROPER LEVEL. Turning the power off and then back on may clear up this fault. If it does not, contact Cleveland Controls.
0.05 SECOND	WATCH DOG TIMER RESET: AN ERROR HAS OCCURRED IN THE MICROPROCESSOR. Turning the power off and then back on may clear up this fault. If it does not, contact Cleveland Controls.

Table 6: “Processor Running” LED

Troubleshooting		
Component	**Symptom**	**Possible Problem**
Control Unit	Alarm or Opacity section of the control unit is not operating properly.	Main Pc. Board is faulty: replace.
		One of the alarm or opacity controls is faulty: %, Set 100%, Delay, or Trip Point Control.
	The 4-20 ma output is not operating properly.	4-20 ma field wiring is faulty.
		Main Pc. Board is faulty: replace.
Display Assembly	The control unit can be calibrated by monitoring the 4-20 ma output, but not by watching the “per cent Opacity” display.	Display assembly is faulty: replace.
	Some of the number segments on the “per cent Opacity” display do not go on or off properly.	
Light Source Assembly	Lamp does not light but 4-10 V DC is present at the lamp terminals.	Lamp is burned out: replace.
	Lamp does not light and no voltage is present at Terminals 1 and 2, but voltage is present at the control unit terminals 19 and 20.	The interconnecting wire is open.
	Lamp does not light, and no voltage is present at Terminals 19 and 20.	Light source fuse is blown: replace.
		Main fuse is blown: replace.
		Main p.c. board is faulty: replace.
Receiver Assembly	Light source is operating properly but unit will not calibrate.	Receiver assembly is faulty: replace.
		Main p.c. board assembly is faulty: replace.
		Interconnecting wiring is open.

Table 7: Troubleshooting

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