



EMS WatchDog PS-1 Premium Manual



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Limited Warranty

EMS warranty: If you cannot find it or you have misplaced it, contact EMS at sales@emsct.com and request the current Limited Warranty document.

Warnings and Safety Guidelines

Guidelines for User Safety and Equipment Protection

This manual is intended to help trained, competent personnel install this equipment. Only a technician or engineer trained in the local and national electrical standards should perform tasks associated with the electrical wiring of this device.

Warnings

- Under no circumstances will Environmental Monitor Service, Inc. be liable or responsible for any consequential damage that may arise because of the installation or use of this equipment.
- All examples and diagrams shown in the manual are intended to aid understanding. They do not guarantee operation.
- Environmental Monitor Service, Inc. accepts no responsibility for actual use of this product based on these examples.
- Due to the great variety of possible applications for this equipment, the user must assess the suitability of this product for specific applications.
- Make sure to have safety procedures in place to stop any connected equipment safely if the controller should malfunction or become damaged for any reason.
- Do not replace electrical parts or try to repair this product in any way.
- Only qualified factory-trained service personnel trained in its operation should open the device's housing or carry out repairs.
- The manufacturer is not responsible for problems resulting from improper or irresponsible use of this device.
- You may cause an electric shock, fire, or damage the equipment if you ignore any of these safety precautions.

Customer Service

Before you ship equipment to our factory, please call or email our Service Response Center at 1-800-864-2814 ext 14. When you call in, our Customer Service Representative will determine a course of action.

E-mail: techsupport@emsct.com

Claims for Damaged Shipments

Inspect all instruments thoroughly on receipt. Check the material in the container(s) against the enclosed packing list. If the contents are damaged and/or the instrument fails to operate correctly, notify the carrier and Environmental Monitor Service immediately.

The following documents are necessary to support claims:

Original freight bill and bill of lading

Original invoice or photocopy of original invoice, Copy of packing list

Photographs of damaged equipment and a container

You may also want to keep a copy of these documents for your records.

Refer to the instrument name/EMS number, serial number, sales order number, and your purchase order number on all claims. Upon receipt of a claim, we will advise you of the disposition of your equipment for repair or replacement.

Shipping Discrepancies

Check all containers against the packing list immediately on receipt. If you find a shortage or other discrepancy, notify the carrier and Environmental Monitor Service immediately. WE will not be responsible for shortages against the packing list unless they are reported promptly.

EMS is not responsible for shortages against the packing list unless you report them within 3 days of receipt of your shipment.



Installation – Mechanical

Choose an Installation Site

The primary considerations for choosing a site for the PS1 WATCHDOG are accessibility, ambient environmental conditions, and locating the unit to obtain a representative process sample. Review the excerpt from the *Federal Register* in the appendix for suggestions before selecting an installation site. Also consider the following general guidelines.

Consider the height of the sensors from Platforms, walkways, decks, etc. A platform or walkway must be available for access to the weather covers. The optimum condition is to have the mounting flanges and weather covers approximately 5 feet above the floor. Railings and other obstructions should allow the weather cover to swing clear as shown in the installation drawings.

Locate the stack-mounted units in an area with ambient temperatures between -4 o to +130o F. (Consult the factory for other temperature ranges.) Clean, dry areas are desirable. Avoid areas with condensation.

Maintenance intervals depend on the installation environment. Intervals can vary from 2 to 3 months in clean environments, to twice a month in dirty environments. Lens cleaning depends on ambient conditions and the cleanliness of the purge air.



Locate the instrument to avoid excessive vibration or shock.

Locate the control unit in an easily accessible area with temperatures between +32 °F and 122 °F. To allow the operator to read and/or change controls, do not mount the unit higher than five feet above floor level.

Stack exit: Locate the transceiver more than two stack diameters down from the stack exit.

Drawing Notes

Reviewing the drawings and procedures provided will help you produce an error-free installation. However, you must also observe these essential additional points. The beam of the instrument must be kept in the horizontal plane; the transceiver cannot be rotated more than $\pm 10^\circ$ from vertical. Install the weather covers plumb (vertically).

Installation and wiring diagrams are found at the end of this manual. Please review all drawings before starting installation or wiring. If you have any questions, please get in touch with our service department for assistance at 203-935-0102 ext. 14 or email techsupport@emsct.com

Sensors Height from Platforms, Walkway/ Decks, Etc.,

A platform or walkway must be available for access to the weather covers. The optimum condition is to have the mounting flanges and weather covers approximately 5 feet above the floor. Railings and other obstructions should allow the weather cover to swing clear as shown in the installation drawings.

Alignment of Stack Flanges

Stack flange alignment is the first step in successful installation. The Beam Alignment Procedure describes the final beam alignment adjustments.

Sample Area

To achieve a representative sample, accepted practice is to place the instrument's measurement path directly in the stack's centroidal area. Choose a location where the gases are not stratified in the stack or duct. (See *Federal Register excerpt* in Appendix A).

Where a bend is involved, the path should be chosen to be the plane of the bend. Avoid locations where large amounts of condensed water may be present.

Installation Considerations

Factory Selection of Internal Optical Elements

EMS factory personnel test optical and electrical systems to configure and calibrate all systems. Once EMS receives site information from the user, the selection and appropriate projection, as well as other optical considerations, are site-specific. The user should not attempt the internal alignment of individual optical elements. Minor changes (+/-10%) in the flange-to-flange calibration distance discovered by the user may be compensated for by contacting the EMS factory (or EMS service personnel in the field) to ensure appropriate optical elements can be compensated or receive a recommendation on how to proceed.

CAUTION: Completing internal optics, electronics, etc., may require returning the equipment to the factory. EMS has special tooling not available to the user. Under normal conditions, once the user has received the system from EMS, there should be no need to perform any internal optical service.

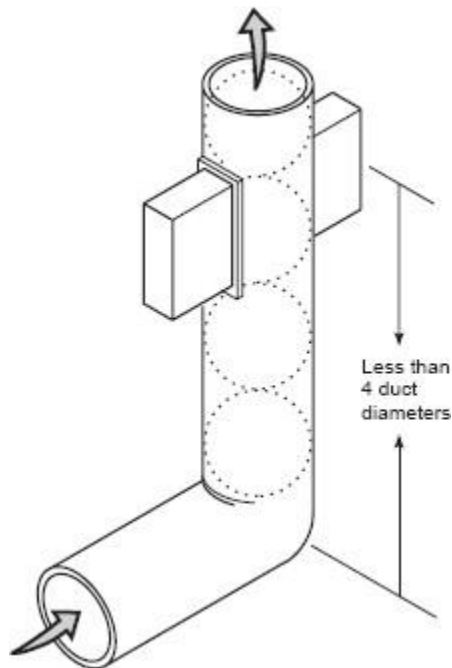
Before Startup

Complete the following before attempting startup.

- Check that all parts have the identical serial numbers.
- Measure and record flange-to-flange distance to verify it is the same as the final check-out sheet.
- If you are using a recorder, DAS, etc., DO NOT CONNECT THEM NOW. Leave outputs and inputs from other sources disconnected until you have thoroughly checked the system according to the following instructions. After you verify system operation, connect and test external connections.
- Read the instructions first to familiarize yourself with the instrument before attempting startup.
- The air purge and Weather cover system, Transceiver, Retro reflector, and Service module must be installed, and power applied.
- The control unit must be installed and wired to the service module and the customer's equipment, as applicable.
- All wiring and mechanical installations must be completed per the drawings provided in this manual. Check all wiring and apply power to both the control unit and the stack maintenance module.
- Beam Alignment procedure has been completed.

Measurement Location

- Ideally, locate the transmitter eight to ten stack diameters down from the stack exit and four diameters downstream from any bends, junctions, or other obstructions in the stack or duct. For best results, mount the transceiver and retroreflector modules so the light beam is precisely perpendicular to the stack or duct and the beam goes through the center.
- Do not install the transmitter downstream of a wet scrubber. The water droplets introduced to the gas stream by such equipment will interfere with the opacity readings. For accurate measurement under these conditions, choose a location upstream of a wet scrubber or downstream of the scrubber, where reheating the gas vaporizes the water droplets.



- The stack exit correlation is significant to verify. If possible, verify all dimensions with actual measurements. Measure and record inside stack dimensions at the measuring point and the stack exit, and compute the Optical Path Length Ratio (O.P.L.R.). Check that the calculated O.P.L.R. and the O.P.L.R. found in the Factory OPLR Check step, as described later in this section, are within +/- 2%.

Appendix B to 60-Performance Specifications

(2) You must install the opacity monitor at a location where the opacity measurements are representative of the total emissions from the affected facility. You must meet this requirement by choosing a measurement location and a light beam path as follows:

- (i) **Measurement Location.** Select a measurement location that is (1) at least four duct diameters downstream from all particulate control equipment or flow disturbance, (2) at least two duct diameters upstream of a flow disturbance, (3) where condensed water vapor is not present, and (4) accessible to permit maintenance.
- (ii) **Light Beam Path.** Select a light beam path that passes through the centroidal area of the stack or duct. Also, you must follow these additional requirements or modifications for these measurement locations:

If your measurement location is in a:	And is:	Then use a light beam path that is:
1. Straight vertical section of stack or duct	Less than four equivalent diameters downstream from a bend	In the plane defined by the upstream bend (see figure 1–1).
2. Straight vertical section of stack or duct	Less than four equivalent diameters upstream from a bend	In the plane defined by the downstream bend (see figure 1–2).
3. Straight vertical section of stack or duct	Less than four equivalent diameters downstream, and is also less than one diameter upstream from a bend.	In the plane defined by the upstream bend (see figure 1–3).
4. Horizontal section of stack or duct	At least four equivalent diameters downstream from a vertical bend	In the horizontal plane that is between 1/3 and 1/2 the distance up the vertical axis from the bottom of the duct (see figure 1–4).
5. Horizontal section of duct	Less than four equivalent diameters downstream from a vertical bend	In the horizontal plane, that is between 1/2 and 2/3 the distance up the vertical axis from the bottom of the duct for upward flow in the vertical section, and is between 1/3 and 1/2 the distance up the vertical axis from the bottom of the duct for downward flow (Figure 1–5).

- (iii) **Alternative Locations and Light Beam Paths.** You may select locations and light beam paths, other than those cited above, if you demonstrate, to the satisfaction of the Administrator or delegated agent, that the average opacity measured at the alternative location or path is equivalent to the opacity as measured at a location meeting the criteria of sections 8.1(2)(i) and 8.1(2)(ii). The opacity at the

Alternative Locations and Light Beam Paths

An alternative location is considered equivalent if (1) the average opacity value measured at the alternative location is within ± 10 percent of the average opacity value measured at the location meeting the installation criteria, and (2) the difference between any two average opacity values is less than 2 percent opacity (absolute). Use the following procedure to conduct this demonstration: simultaneously measure the opacities at the two locations or paths for a minimum period (e.g., 180 minutes) covering the range of normal operating conditions, and compare the results. You may measure the opacities at the two locations or paths at different times, but they must represent the same process operating conditions. You may use alternative procedures to determine acceptable locations if the Administrator approves them.

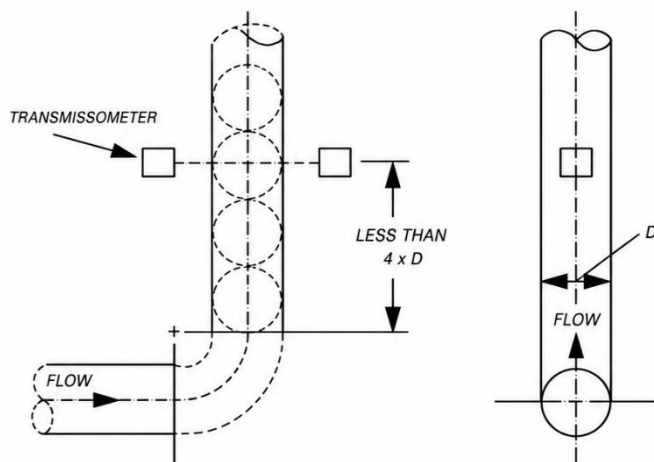


Figure 1-1. Transmissometer location downstream of a bend in a vertical stack.

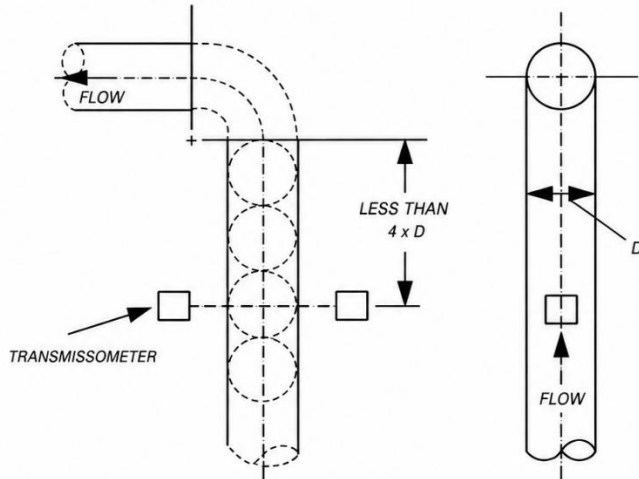


Figure 1-2. Transmissometer location upstream of a bend in a vertical stack.

Light Beam Path Between Vertical Stack Bends

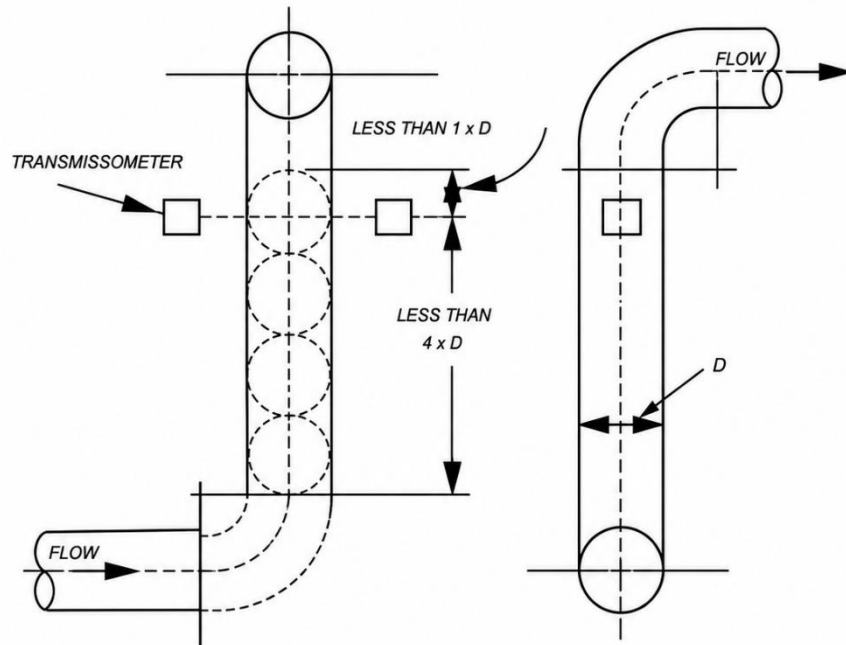


Figure 1-3. Transmissometer location between bends in a vertical stack.

Light Beam Path After a Horizontal Duct Bend

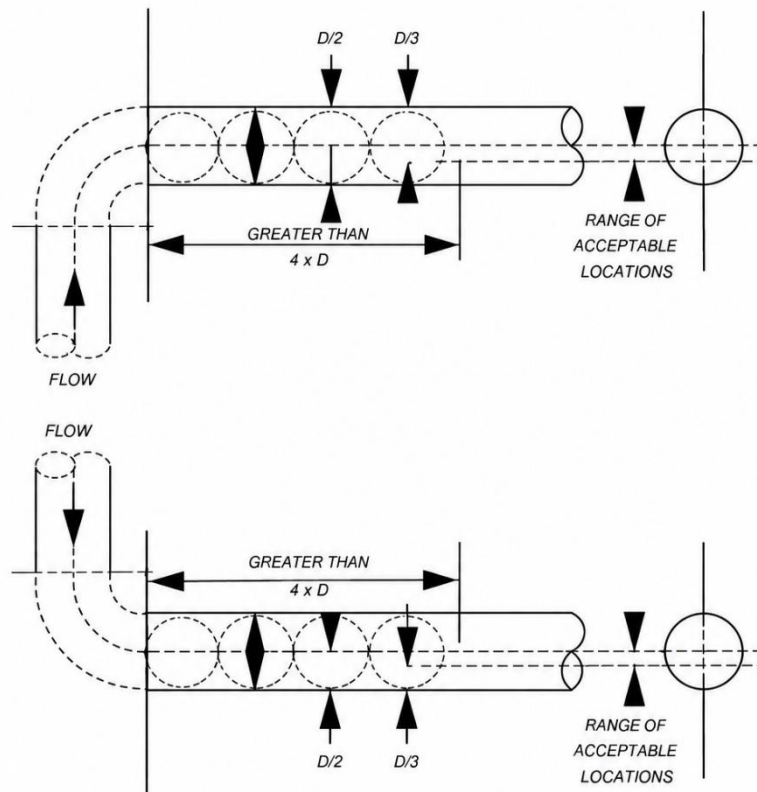


Figure 1-4. Transmissometer location greater than four diameters downstream of a vertical bend in a horizontal stack or duct.

Installation and Alignment - Stack Flanges

For an opacity monitor, the customer is required to supply and install two 3" I.P.S. flanges at eye level, directly across from each other. The flange faces, mounted on pipe stubs, should be approximately 6" to 8" from the stack or insulation. On completion of the installation, the flanges must be aligned so that the total deviation of the light source flange relative to a common centerline does not exceed $+1^{\circ}$ and the retro reflector flange does not exceed $+3^{\circ}$.

Mount flanges approximately 5 feet above the deck of platforms, the roof, or the walkway.

Where conditions permit, this may be accomplished by using a piece of 2 1/2" pipe suspended across the stack, protruding far enough to allow you to slip the 3" flange pipe assemblies over each end and weld them in place, as shown on the following page.

You can adjust any deviation within the previously specified limits during installation and alignment of the light source and retroreflector using the system's alignment adjustments.

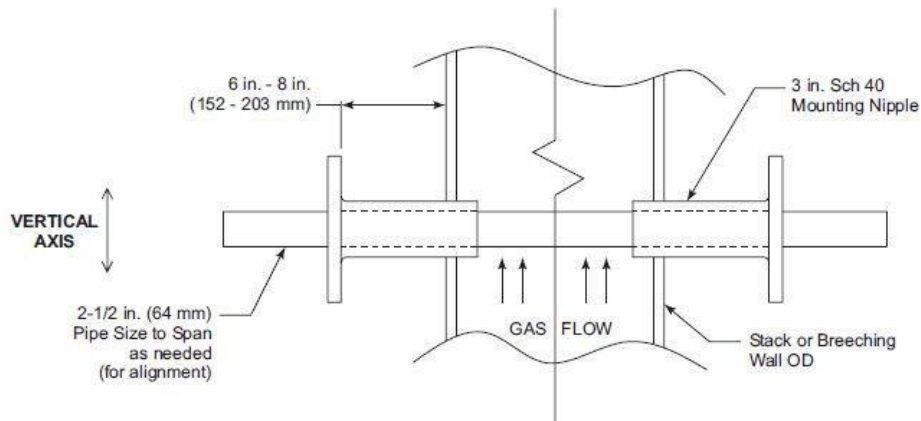
Where installations do not permit this method, the following procedure will achieve the same results. You can purchase an alignment tool from the factory to ensure accurate alignment.

Accurately locate one 3 1/2" diameter hole (large enough to accept the 3" pipe) and the other hole approximately 1/2" diameter, directly across from each other.

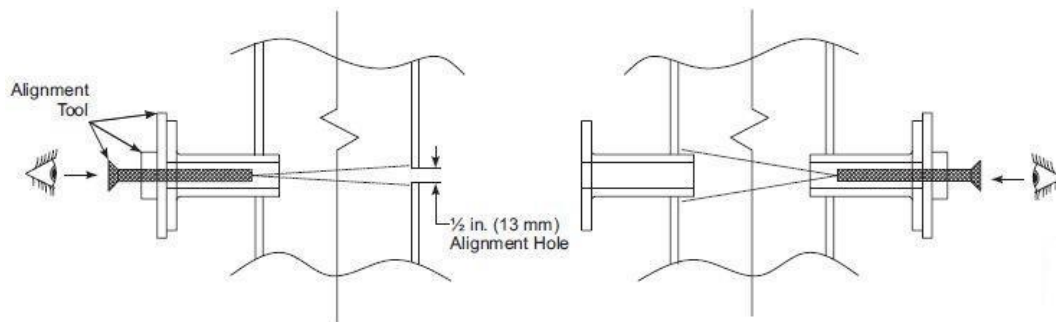
Attach the alignment tool to the flange/pipe assembly, insert the pipe into the 3 1/2" hole in the stack wall, align the assembly with the 1/2" diameter hole on the opposite side by viewing through the alignment tool, and weld the pipe in place. Use care when welding to maintain alignment.

Stack Flange Alignment Diagram

STACKS UNDER 6 FEET ACROSS



STACKS OVER 6 FEET ACROSS

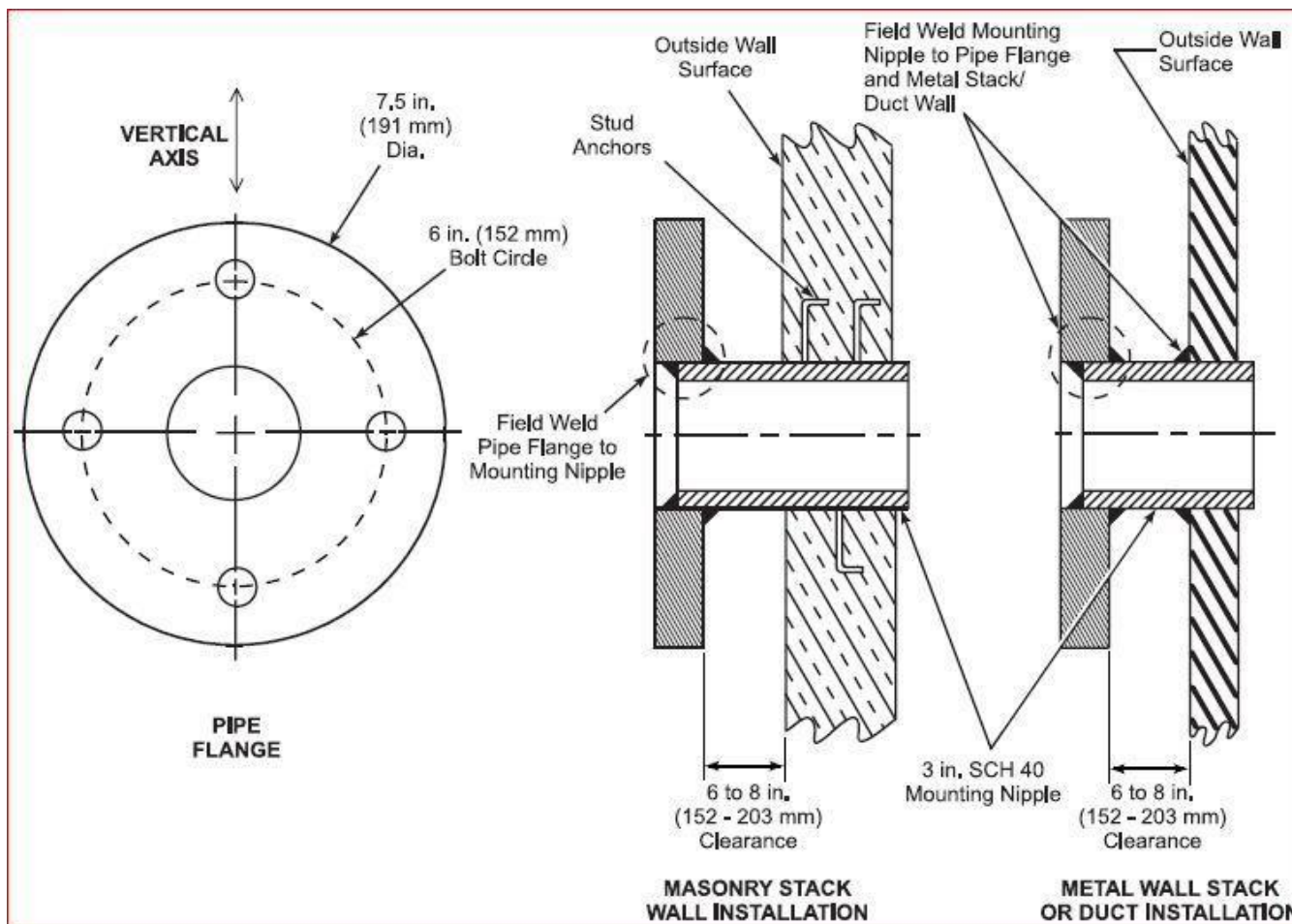


NOTE

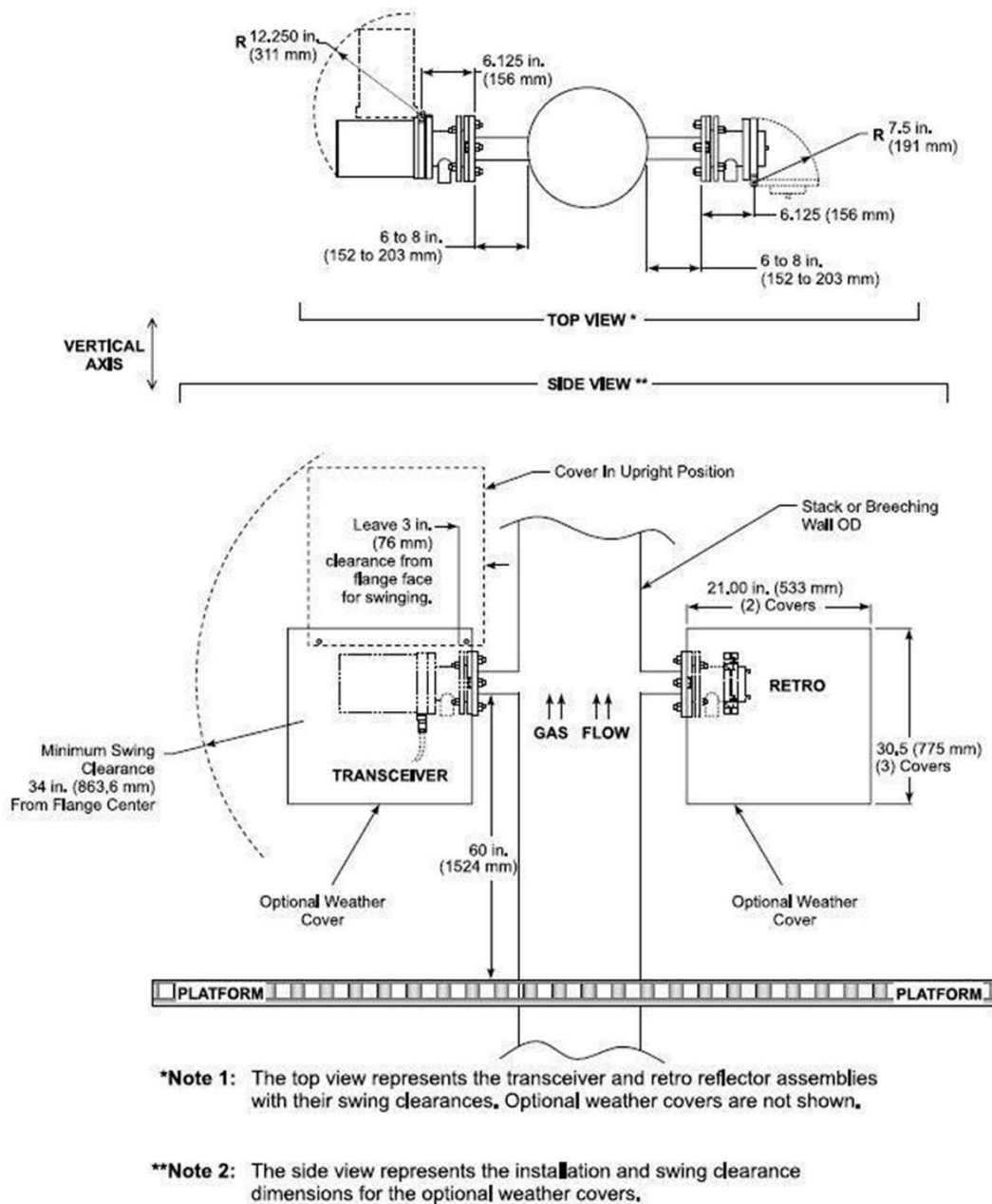
If installed path length is not within 10% of the factory set path length, return the unit to the factory so the path length can be reset.

Installation and Alignment - Stack Flanges

Enlarge the 1/2" diameter hole to approximately 3 1/2" to accept the other flange/pipe assembly. Proceed in the same manner, installing the assembly with the alignment tool attached, and weld in place, maintaining concentric alignment with the 3" pipe previously installed on the opposite wall.



Mounting of Air Plenums and Weather Covers



Mounting Air Plenums and Weather Covers

WARNING! CONTROL UNIT, TRANSCEIVER & RETRO SERIAL NUMBERS MUST MATCH.

After you select the installation site and meet the platform requirements, install and align the mounting flanges as described on the previous pages. Install the flanges with the mounting faces on the vertical plane.

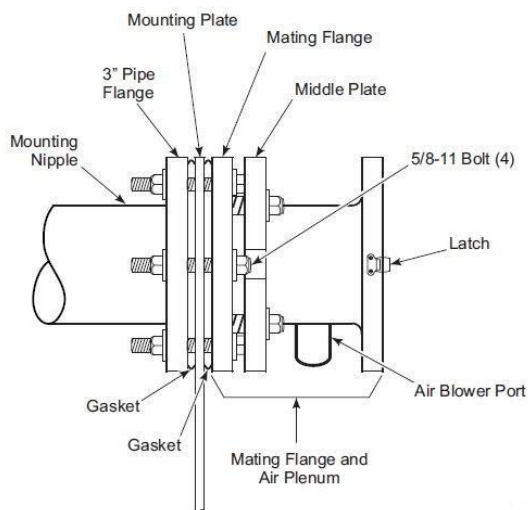
Before installing the Transceiver, Retro reflector, or any type of weather cover, remove the air plenum from both the Transceiver and retro reflector. Removal makes installation easier and reduces the risk of damage, particularly when you use mechanical attachment for the air plenums and optional weather covers.

If the transceiver and retro reflector have been shipped from the factory with the air plenum attached, unclip both hold-down latches, swing open, and lift up & off the hinge pins. Place the Transceiver and retro in a safe place.

The air plenum attaches to the customer-supplied 3" pipe flange with four 2 1/2" long 5/8-11 bolts. Working from the 3" flange, the correct assembly is the gasket, then the air plenum.

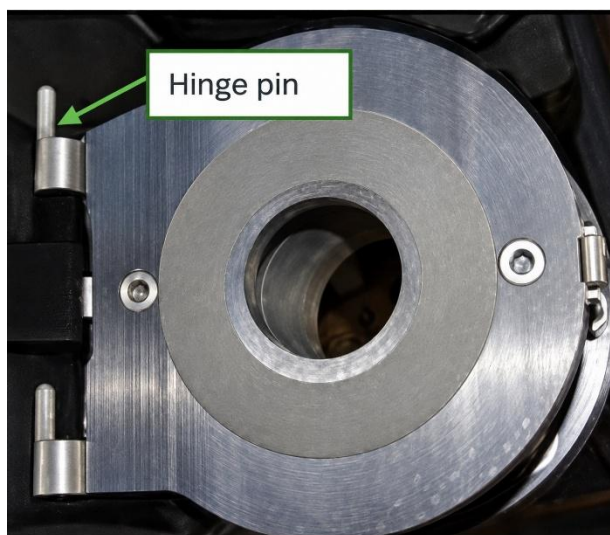
If you have weather covers, remove the two (2) weather cover hood hinge pins located on the lower right- and left-hand corners of the hood. The air plenum and weather cover attach to the 3" pipe flange with four (4) 2 1/2" long 5/8-11 bolts. Working from the 3" flange, the correct assembly is gasket, weather cover, mounting plate, gasket, mating flange & air plenum. Place the 5/8-11 bolt through the top hole of the middle plate. Place a flat washer between the middle plate and mating flange and pass the bolt through. Slip a split lock washer over the bolt and secure with a nut. Repeat for the remaining three mounting bolts.

You can now connect any wiring or air hoses.



Transceiver and Retro Reflector Assembly

Attach the Transceiver and Retro Reflector to the air plenum assembly by placing them on the hinge pins.



Close the transceiver & retro reflector and secure in place with the two hold-down latches.

Power up the air-purge blowers now to prevent stack particulate from accumulating in the nipple and air-purge housing.

Caution: If the installation location has positive pressure, use the air-purge system continuously during installation to prevent process gases from contaminating optical surfaces or overheating instrument electronics. If you shut off the system for more than momentary interruptions, you may damage the instrument. Failure to provide a continuous air purge may void the warranty.

Complete all wiring from the control unit to the transceiver now.

NOTE: THE AIR PLENUM ASSEMBLY FOR BOTH TRANSCEIVER AND RETRO MUST BE INSTALLED AS ABOVE, I.E., THE PINS ON THE LEFT SIDE POINTING UP!

Air Flow Switch

If you have an airflow alarm when the system is powered on, check the airflow switch. With the blower running and the source under normal conditions, disconnect the switch leads and place an ohmmeter across them. The switch should be closed, with resistance under 2 ohms, if the flow is enough to overcome the stack pressure and the blower inlet is clear. Cover the air cleaner inlet and verify the switch opens. Replace the leads when the test is complete.

Stack Exit Correlation Computations

NOTE: Stack exit correlation is important to verify. If possible, verify all dimensions with actual measurements. Using the instructions below, verify that the values match those displayed on the about page (see the Controller manual for details).

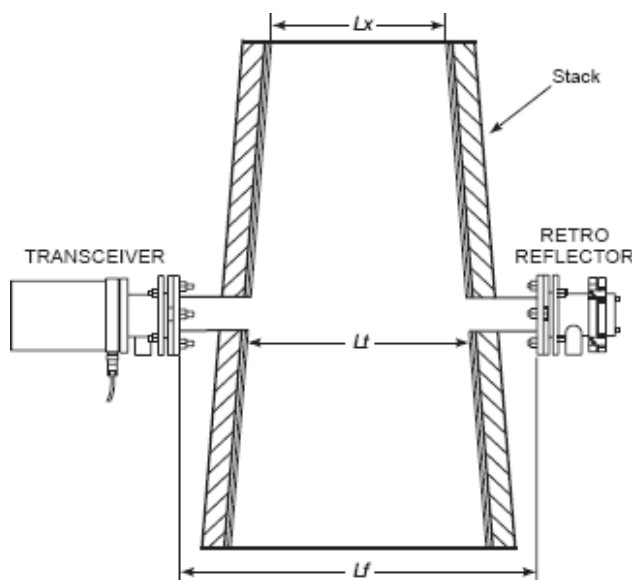
L_x/L_t is the ratio of the inside diameter at the top of the stack to the inside diameter of the stack where the instrument is located. If the ratio is greater than 1.0, the exit opacity will be greater than the opacity at the instrument location. The controller uses this correction factor to calculate the stack exit opacity. It is not practical to have an L_x/L_t factor much greater than 2.0 because the error of the instrument increases as L_x/L_t becomes greater.

L_x = inside stack diameter at stack exit.

L_t = inside stack diameter at the transmitter location.

L_f = flange-to-flange distance between the transceiver and retroreflector unit. Measure and record L_x and L_t , and compute the Optical Path Length Ratio (OPLR).

Check that the calculated value and the OPLR found on the about page are within $\pm 2\%$.



Example: A stack with a 120 in. (3048 mm) stack exit ID and a 120 in. (3048 mm) path length.

ORLR cannot be changed in the field due to EPA regulations. If these numbers exceed 4%, contact the EMS Service department for instructions.

$$OPLR = \frac{L_x}{2 \times L_t}$$

$$OPLR = \frac{120}{2 \times 120} = 0.50$$

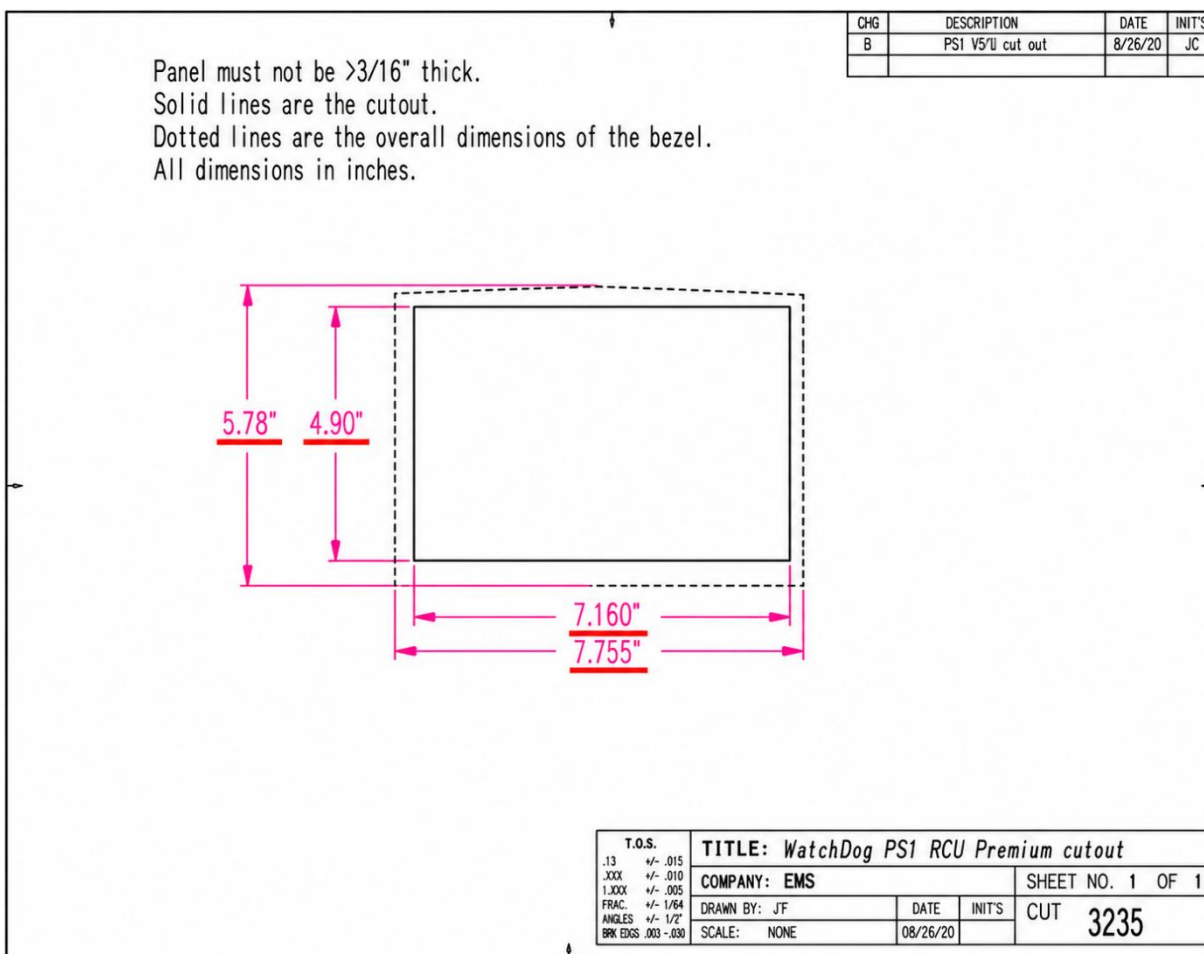
Control Unit Cutout and Dimensions

Control Unit Mounting

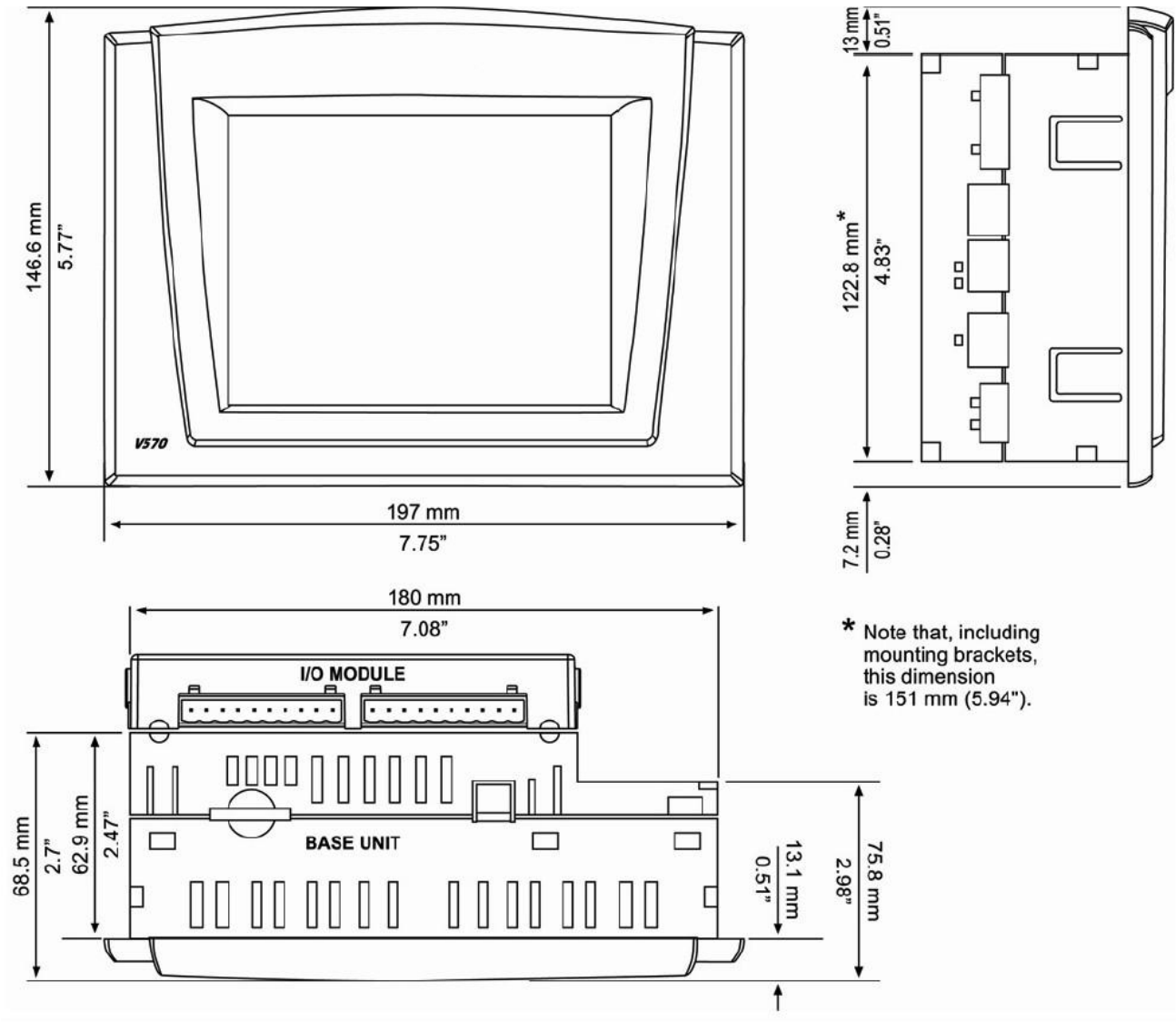
Mount the control unit at eye level for best viewing of the display.

The drawing section shows the cutout for panel mounting. Insert the control unit through the cut-out hole. Insert the panel mounting hardware in the slots provided on each side of the control unit from the rear. Tighten the screws until the control unit is securely held in place.

NOTE: RCU IS PROVIDED WITH AN EMS 24VDC POWER SUPPLY. CONTROL UNIT CUTOUT (V570)



Control Unit Dimensions (570)



Standard Supplied Purge Blower Electrical and Pressure Information

Standard Blower

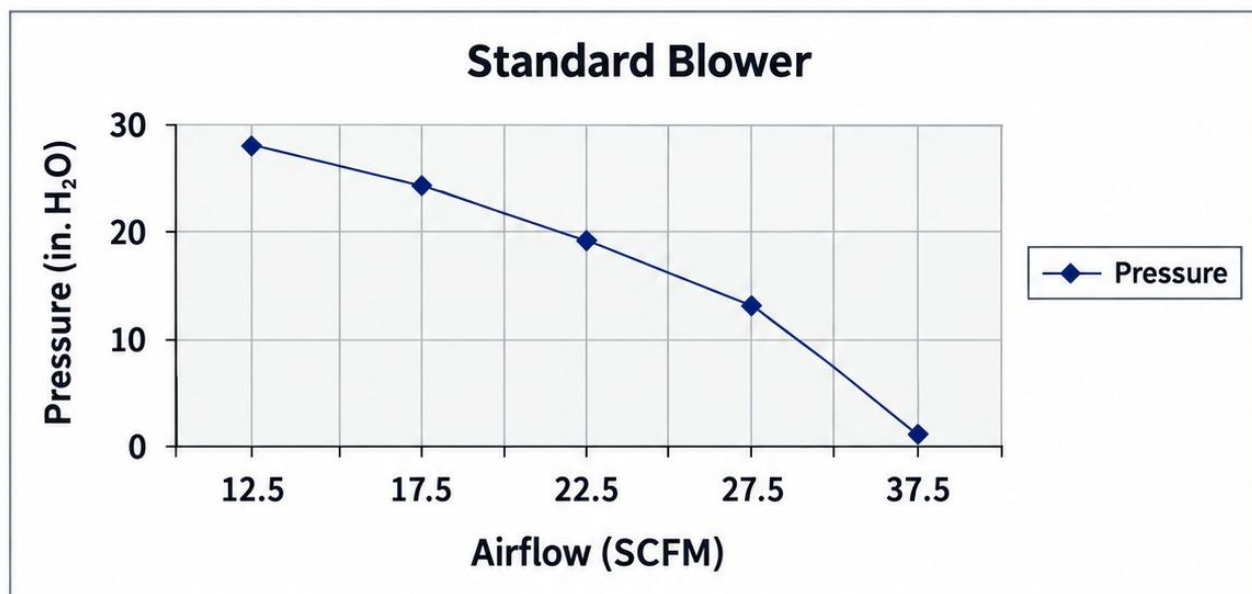
Electrical Specifications & Pressure Performance

Electrical specifications

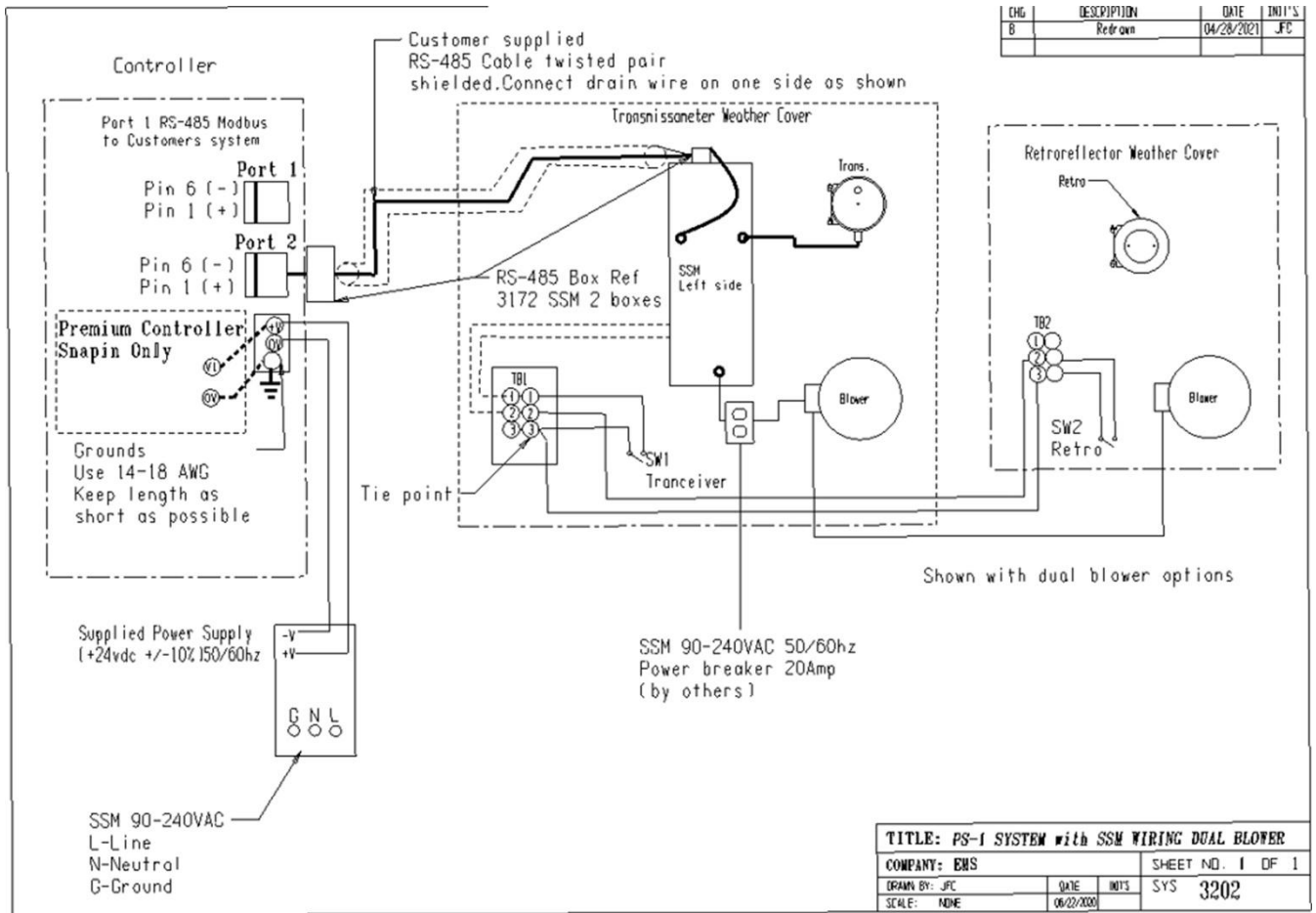
Single-phase supply	110 VAC, 50/60 Hz	220 VAC, 50/60 Hz
Running current (A)	3.4	1.7
Horsepower (HP)	0.25	0.25

Shorted amps (as shown)	≈10 A	≈20 A
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Pressure performance



Typical System Wiring Dual Blower



Controller Modbus Network Wiring

Use cables to network devices that meet the specs of Belden Cable P/N 89841 Multi-Conductor – EIA Industrial RS-485 PLTC/CM or equivalent:

- 24AWG stranded (7x32) tinned copper conductors, FEP insulation, twisted pairs, overall Beldfoil shield (100% coverage) plus a tinned copper braid shield (90% coverage), 24 AWG drain wire, FEP jacket.
- Impedance of 120 ohms
- Network cables cannot exceed 1219 meters 4,000 ft.
- If a Longer distance is required, a wireless option should be considered. Please contact the factory.

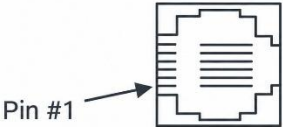
Port 1: RS-485 to Customer's DAS, Recorder, Etc.

Use RS-485 to create a multi-drop network containing up to 32 devices. Note: port #1 is set to RS485

Note that the ports are not isolated. If you use the controller with a non-isolated external device, avoid voltages exceeding +/- 10V. To avoid damaging the system, all non-isolating device ports should relate to the same ground signal.

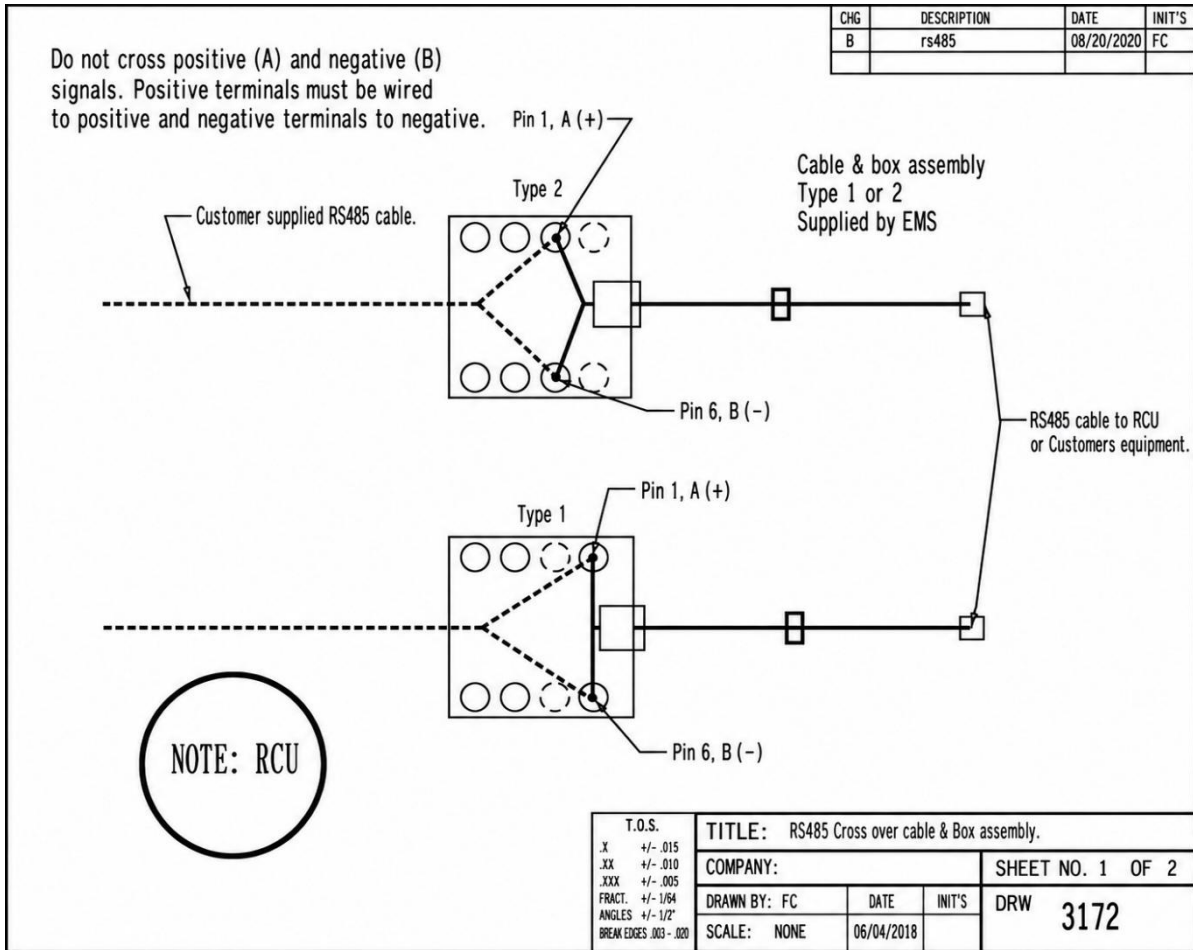
- Use shielded, twisted pair cables.
- Minimize the stub (drop) length leading from each device to the bus.
- Ideally, the main cable should be run in and out of the network device.

Do not cross positive (A) and negative (B) signals. Wire positive terminals to positive and negative terminals to negative.

Diagram	Pin Number	Function
	1	A signal (+)
	2	(RS232 signal)
	3	(RS232 signal)
	4	(RS232 signal)
	5	(RS232 signal)
	6	B signal (-)

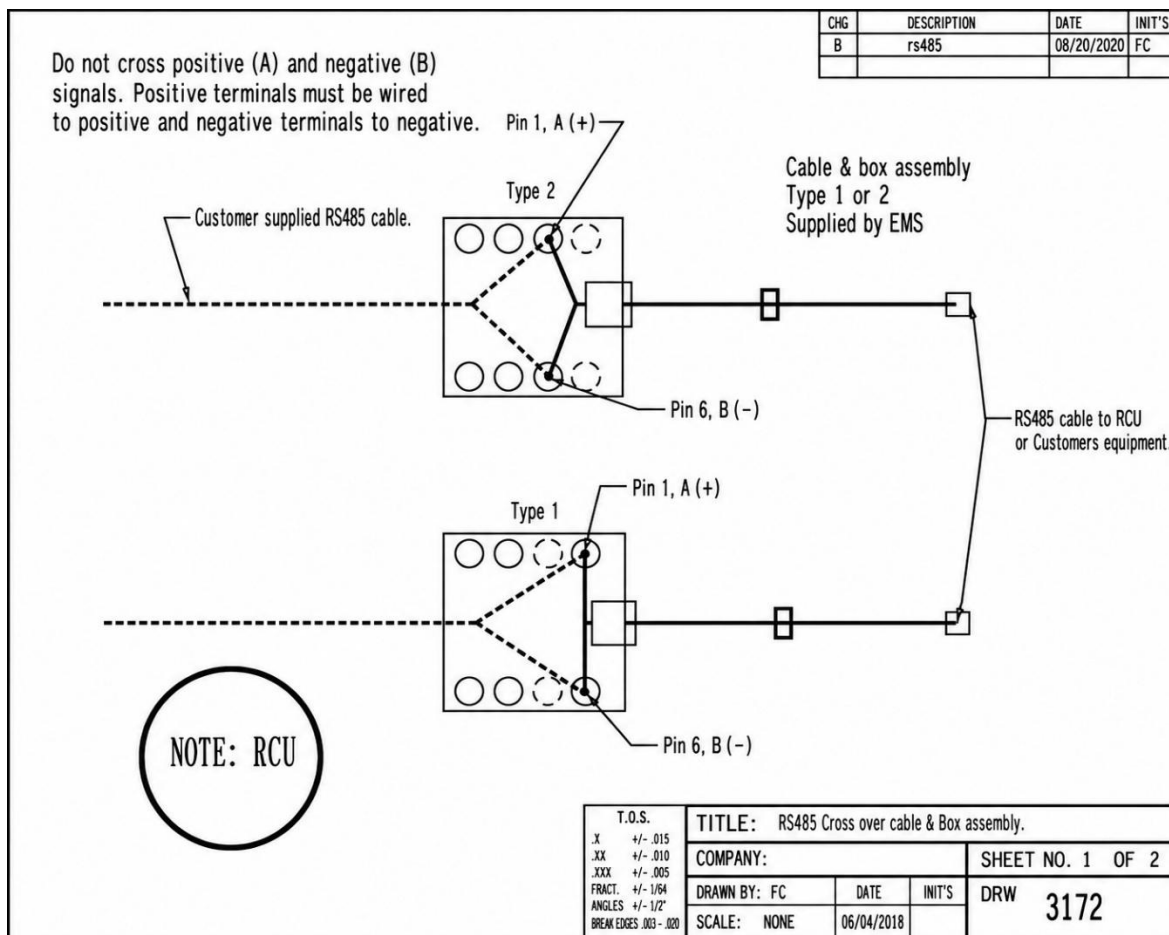
Communication Box Wiring at the RCU

Important! The communication boxes may be configured differently. Identify which one you have using the drawing below. It's critical that the correct "pins" are used; **THE WIRE COLORS DO NOT MATTER.**



Communication Box Wiring at the Smart Service Module

Important! The communication boxes may be configured differently. Identify which one you have using the drawing below. It's critical that the correct "pins" are used; **THE WIRE COLORS DO NOT MATTER.**



Controller Relays & Inputs

NOTE: Snap-in module; supply 24 VDC power to OV, V2 for analog I/Os, and OV, V1 for digital outputs. An external jumper also needs to be wired from OV to Common (only from the 4 20 output groups) for the 4-20mA outputs to function.

V570 Controller

EMS WatchDog PS-1 Premium Analog output wiring list

Ch 1-4, Analog 4-20mA outputs Com -COM	4-20mA Outputs
Positive 4-20mA output CH1 - Aout0	
Positive 4-20mA output CH2 - Aout1	
Positive 4-20mA output CH3 - Aout2	
Positive 4-20mA output CH4 - Aout3	

EMS WatchDog PS 1 Premium Relay Group 2 output wiring list

Group 2 Relays	
In CAL to DAS (6 Minutes) - 08	Do not mix voltages in a group. Relays are Normally Open. Relays close when energized. Rate Voltage 30Vdc or 250Vac. Output current - 3A Max per output, 8A Max for Common (resistive load).
Zero solenoid command contact (3 Minutes) - 09	
Span solenoid command contact (3 Minutes) - 10	
High mg Alarm - 11	
High Opacity Alarm - 12	
High Opacity/mg Alarm Silence - 13	
Fault relay, Normal=0; Fault on When = 1 - 14	
Early warning Opacity - 15	
Early warning mg - 16	
COM for Relays 08-16	

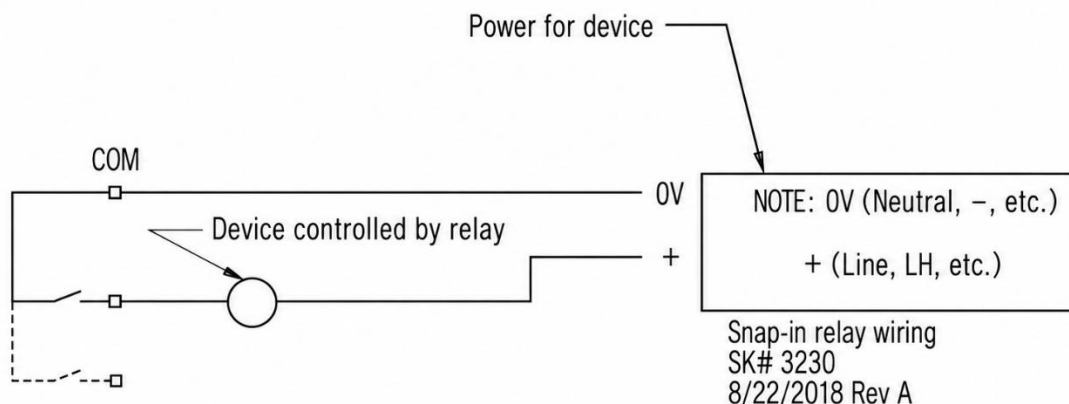
EMS WatchDog PS 1 Premium Digital Input wiring list

Remote CAL Initiate - I3
Remote Alarm Silence - I4

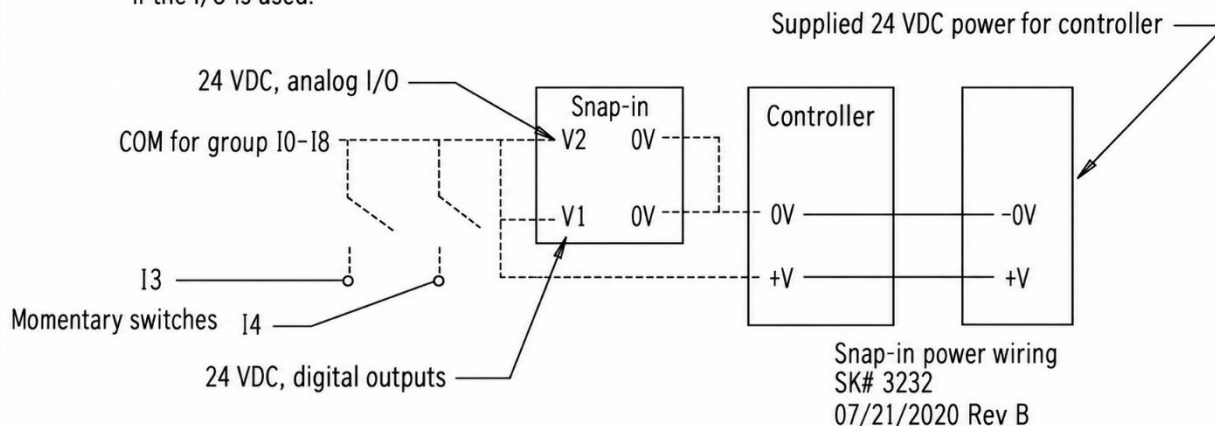
Snap-In Typical Relay and Power Wiring

Controller snap-in digital outputs:
Typical wiring for an external device.
Power must come from the same source.
Do not use AC COM with DC COM or vice versa.

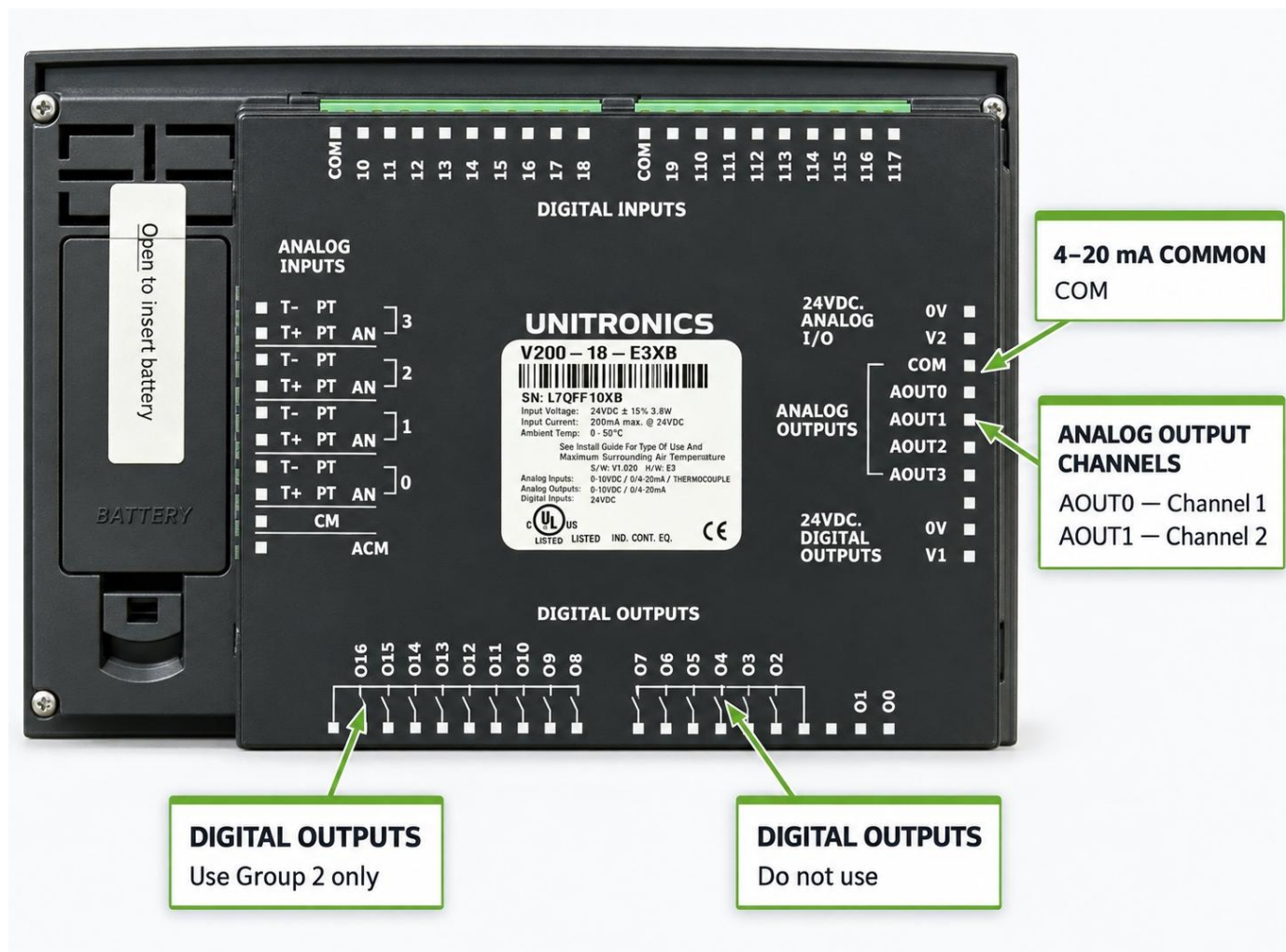
Depending on the model, relays are arranged in one or two groups. Refer to the manual for the required group and relay numbers.



Install the jumpers as shown if the I/O is used.



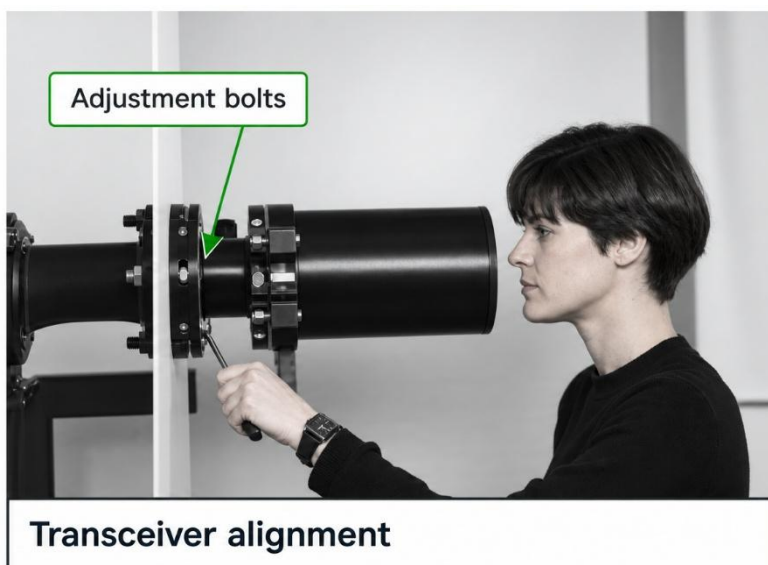
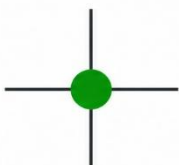
Controller Snap-In Connections



Beam Alignment Procedure

Note: Alignment cannot be done unless the power is applied to the stack-mounted service module. The control unit does not have to be connected or powered. For alignment accuracy, the stack should be at normal temperature.

- 1) If not already on, turn on the power to all air purge systems and the service module.
- 2) Align the Reflector mating flange so it is plumb and parallel to the 3" 150# mounting flange. Use the three adjusting nuts on the air purge plenum flange to accomplish this. The adjusting nuts have nylon locking inserts to prevent loosening by vibration.
- 3) Move to the Transceiver and determine monitor alignment by looking through the viewing port located on the rear of the transceiver and observing whether the beam image is in the center of the crosshair (bullseye).



System Description

Transmissometer / Retro Reflector

The EMS is a precision, double-pass, dual-beam transmissometer consisting of a transceiver (transmitter/receiver) mounted on one side of a stack or duct and a passive reflector mounted on the opposite side. The transceiver houses the LED source, photo detectors, and all measurement/reference optics used in opacity measurement.

RCU

The RCU provides instrument control functions, opacity readings, alarms, analog outputs, communications, system information, and more. The color viewing screens are visible in both low-light and bright-light environments. The RCU is rated NEMA 4X/IP65 when panel-mounted. Battery backup for all memory is typically 7 years.

Mount the control unit in a clean, temperature-controlled environment, with a maximum and minimum temperature of +0 °C to +50 °C (+32°F to +122°F). The EMS control unit provides instrument control functions, opacity readings, alarm and fault indicators, analog outputs, and diagnostics with contact closures.

Cabling to Smart Service Module

Belden P/N 82841 cable is recommended.

Port 2: RCU to SSM 6-pin RJ25 connector, Pin 1 (+), Pin 6 (-). RS-485 cabling may be up to 2000 feet in length.

Port 1: 6-pin RJ25 connector, Pin 1 (+), Pin 6 (-). RS-485 cabling may be up to 2000 feet in length.

Premium System Specifications

EMS PS-1 WatchDog Premium Specifications:	Environmental Monitor Service, Inc.
5.7" Color Graphic Display	Viewing area, LED Backlight
Enclosure Cutout	IP65/NEMA4X (when panel mounted), 91 x 122.5 mm (3.6" x 4.8"). Power 24Vdc +/- 10%.
Sensors	NEMA 4 Anodized Aluminum
EMS provides a 24 VDC supply	Input: 90-240 VAC, 50/60 Hz, 0.55 amp +10%
Color Graphic Display	4.3" Viewing area, LED Backlight
Approvals	CE, UL, cUL
Measurement Ranges	-5 to 100% Opacity, 0-2 Optical Density, 0-2000 mg
Display Resolution	0.1 for Opacity and mg, 0.001 O.D.
Process Display screens	Selectable Display pages.
Battery backup	7 years typical at 25 °C
4-20mA Outputs	Four (4), 800 ohms max, individually customer-selected F.S. ranges and modes.
Relay Contacts	9 relays for alarms, Field programmable.
Alarm Reset	Automatic and manual.
Cal cycle initiate	Manual on demand, Remote initiated, or Internal Clock.
Opacity Exit Correlation (Lx / 2*Lt)	0.3 to 1.0
Environment	Operational temperature 0 to 50°C (32 to 122°F).
Network	Protocol: MODBUS RTU mode, type RS-485

Premium System Specifications Continued

PS-1 Transceiver/ Reflector:	
Enclosure	NEMA 4 watertight enclosure.
Path Length	Distance-dependent.
Optical System	PS-1 Double Pass
Reflector	Distance-dependent.
Light Source Aging Compensation	Automatic
Light Source Life	62,000 hours (> 7 years). Field-replaceable without removal
Ambient Temperature Limits	0 to +130°F (-17 to +54 °C) (Cold weather option available).
Process Gas	Up to 750 °F (400 °C),
Alignment Verification	Built-in through-the-lens system standard
Mounting Flanges	3inch IPS, 150# flange. Others available.
Ambient Light Immunity	Solid-state modulation (Meets ASTM D6216)
Design and performance:	Meets or exceeds 40 CFR 60 Appendix B, PS-1, and ASTM D 6216
Spectral Response	Peak 500 to 600nm, with less than 10% of peak response outside 400 to 700 nm.
Angle of View/Angle of Projection	AV <4o, AP <4o.
Calibration Error/accuracy	+/- 1% of full scale
Response time	< 10 seconds
24-Hour Zero/ Calibration Drift	< 0.5% / < 0.5%
Operational Period	Over PS-1 required 336 Hrs.
Zero/Span Calibration	Manual or automatic with a zero mirror and a neutral density filter
Process gas	Up to 750°F (400°C) standard; higher available - contact factory.

Control Unit Glossary of Terms

OUTPUT TYPE SETUP – “Output type” refers to the 4-20mA outputs.

- Instant opacity, z/s outputted during calibration cycle.
- Average, opacity average z/s outputted during cal cycle.
- Last - instant opacity; last value is held during cal cycle.
- Note: Last should be used if you are using the output for a process control signal.

ALARM AUTO/MANUAL SETUP – Press the return/enter button to enter. Choose 1-auto or 2-manual.

- Auto means that when the high opacity alarm has been activated, and when the level of smoke drops below the alarm point, the alarm contacts 02 & 04 and the icon will reset automatically.
- Manual reset means that when the high opacity alarm has been activated, pushing the return/enter button will de-energize contact 04, but 02 will remain energized. When the smoke level drops below the alarm point, push the return/enter button, and both 02 & 04 will de-energize.

OUTPUT SCALING SETUP – Press the return/enter button to enter.

- Set Ch 1 or 2 to the desired opacity range, i.e., for 4mA to represent minimum opacity and 20mA to represent maximum opacity. Use 20mA (99.9) to represent 100%.
- Note; For CFR 40, PS-1 set the 4mA to -5% To get negative values press +/- once for negative then button 5 then +/- again for the decimal placement. i.e, Ch.1 4 mA: -5.0 % 20mA: 99.9%

MODBUS I.D. SETUP – Press the return/enter button to input the node number (1 to 32) desired. Press the return/enter button to set, then press ESC to exit.

Control Unit Page Description

Control Unit Screens

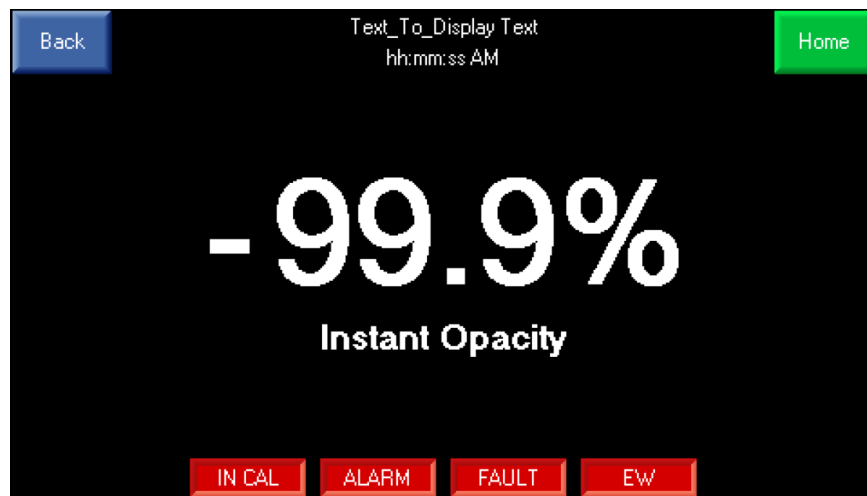
General Page Layout

Mount the control unit at eye level for best viewing of the display.

Cutout for panel mounting is shown in the drawing section. Insert the control unit through the cutout hole. Insert the panel mounting hardware in the slots provided on each side of the control unit from the rear. Tighten the screws until the control unit is securely held in place.

Wire the control unit per the drawing section and energized power. NOTE: CONTROLLER REQUIRES 24VDC.

- 256-Color Touch panel, QVGA TFT display (or CSTN)
- Display 'touchable' images, text, and graphs according to real-time conditions and historical values
- 'Touch' properties can be assigned to all text and graphic on-screen elements
- Data entry/modification via keypad
- LCD illuminated screen
- Virtual keyboard
- Info mode: view/modify I/O status, integer values, and system data via the panel



Company Information Page

When you first apply power, the company info page is displayed. Wait a few seconds, and the Home page will appear. Or touch "EMS" to go immediately to the Home page.

Ph. 203.935.0102

Email: sales@emsct.com, Techsupport@emsct.com Website: www.emsct.com

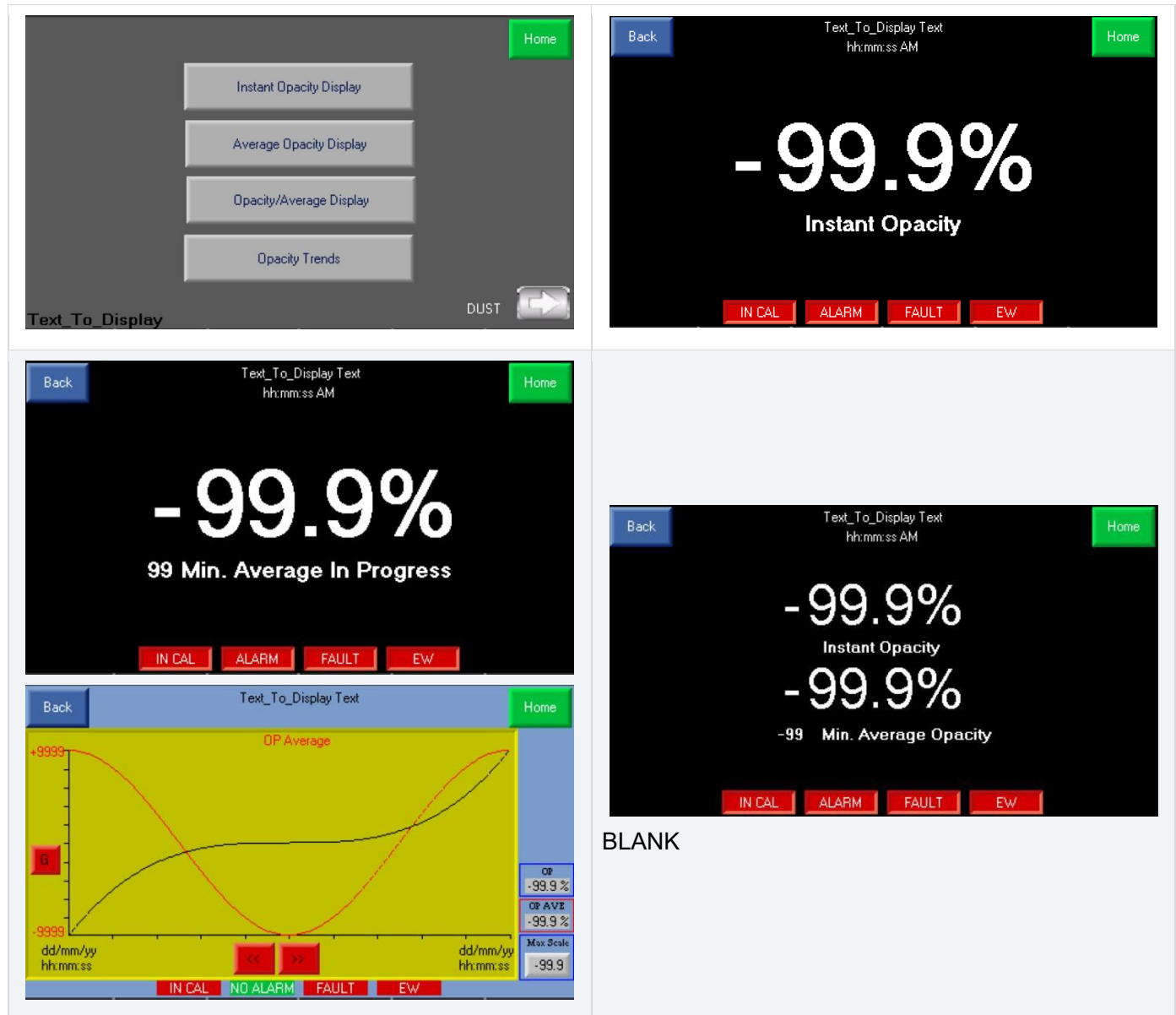


Home Page

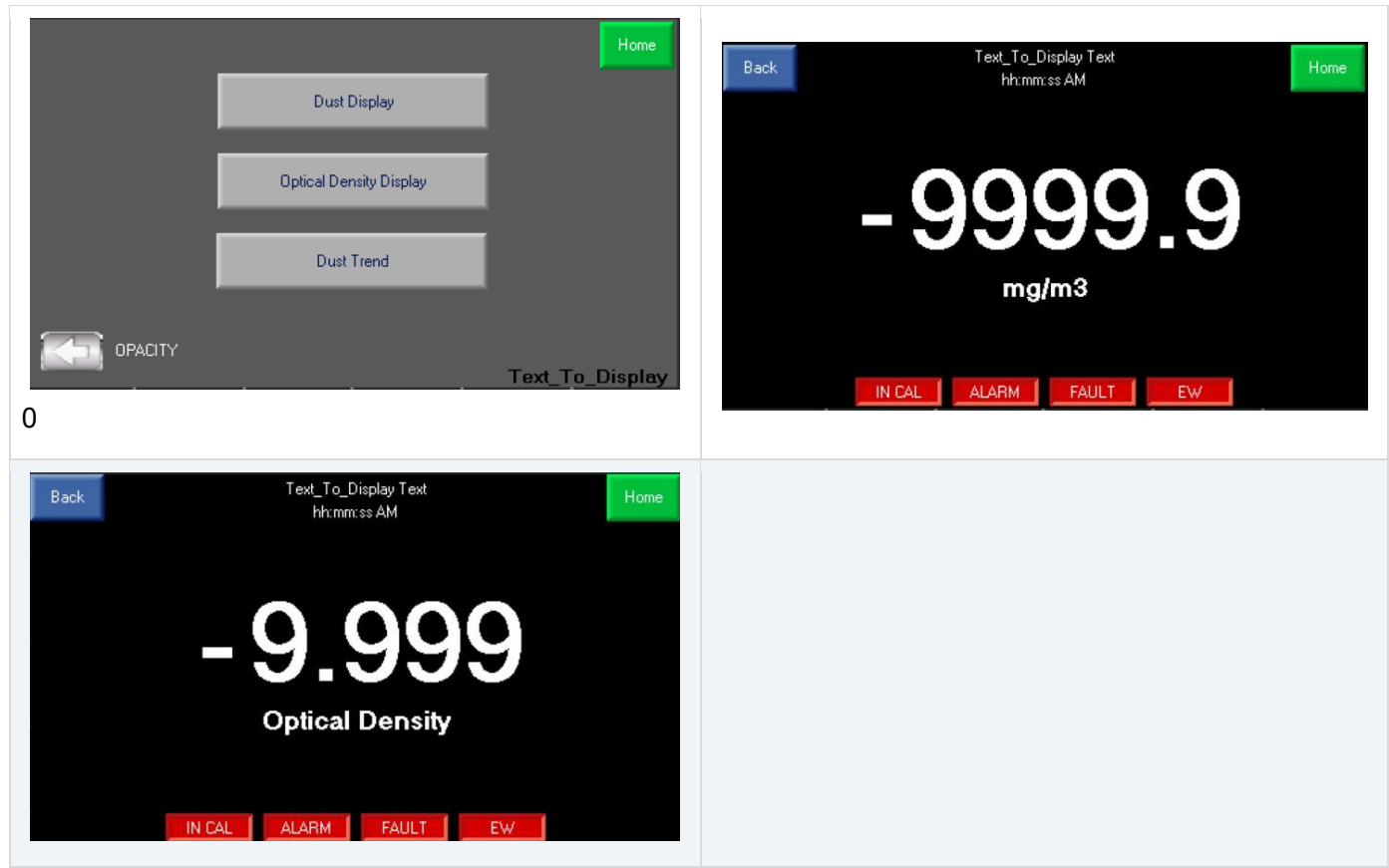
Touch the icon to go to the sections. About
 Fault Alarms Displays Settings Diagnostics
 Calibration Contact Us
 Clean Screen



Opacity Displays



Dust Displays



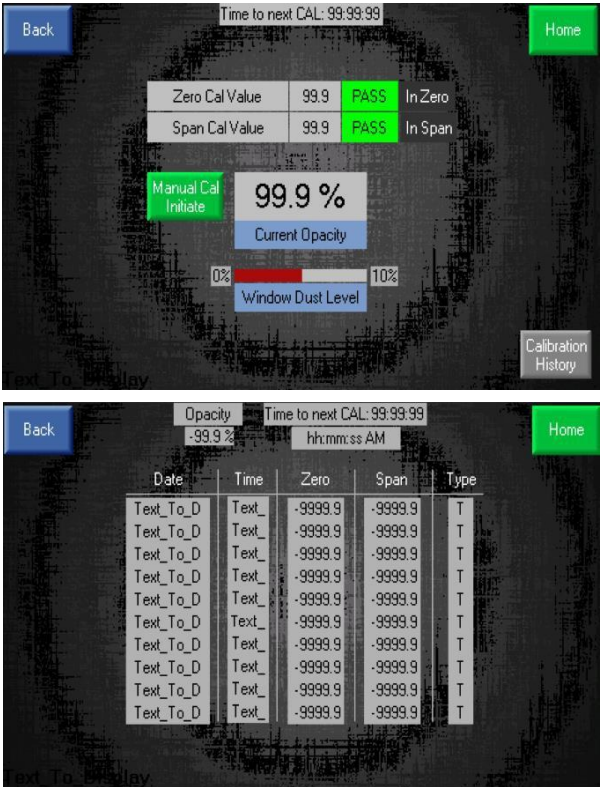
Calibration Page



Touch the Cal Icon on the home page. Initiate a Z/S check by pressing the Green Manual Cal Initiate button (It will turn Yellow). The zero is 3 minutes, and the span is 3 minutes, for a 6-minute calibration cycle. The Right column will show In Zero, and at about 30 seconds, it will update the Green Pass or the Red Fail icon. *The values are entered at setup in the tech screen under "Zero cal value, Span Cal Value".* If these values are within +/- 2% Opacity, the green Pass will be shown; if it is not, it will show Red Fail and trigger the fault system. Fail will remain in memory until after the values are corrected and another cal is initiated.

The current opacity and window dust are displayed below for your convenience. The system will automatically return to monitoring the process at the Average point from the start of the calibration. You will know this because the Manual Cal Initiate icon will return to Green. You do not need to stay on this screen after initiation; we recommend returning to the usual screen.

NOTE: If a failure is displayed, Environmental Monitor Service, Inc. can assist you. Call our service department at (203) 935-0102, or email techsupport@emsct.com

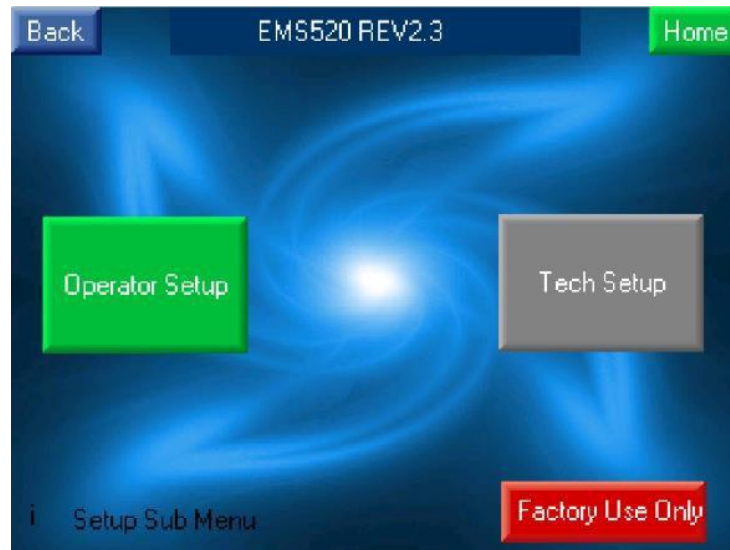


Settings Page

From the Home screen Touch the Settings icon to get to this page.

For Operator setup, press the button and enter the default password 1111 when indicated, and press the return arrow.

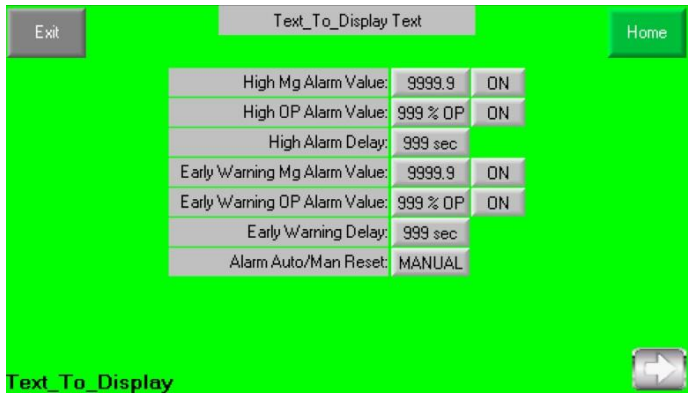
For Tech setup, press the button and enter the default password 1234 when indicated, and press the return arrow.



Operator Setup

You can touch all raised buttons and change their values. All flat buttons are read-only.

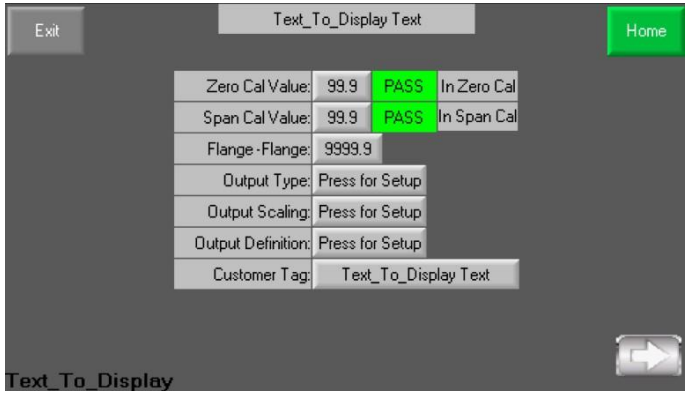
You can turn the opacity and mg alarms on or off by touching the appropriate alarm ON/OFF button.



Tech Setup and Backup/Restore

You can touch all raised buttons and change their values. Instructions are at the bottom of the screen when required.

All flat buttons are read-only.



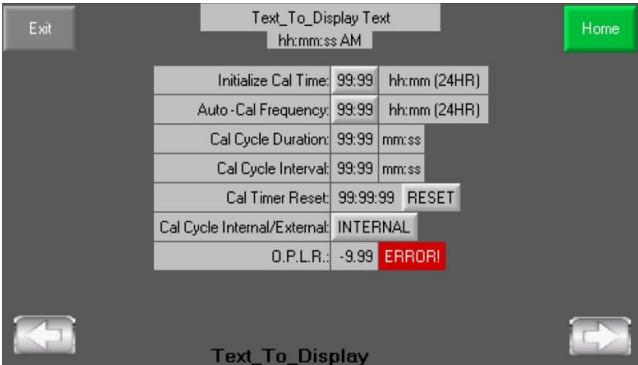
Tech Setup Screen 2 and Output Settings

Tech Setup Screen 2

All raised buttons can be touched, and you can change their values. Instructions are at the bottom of the screen when required.

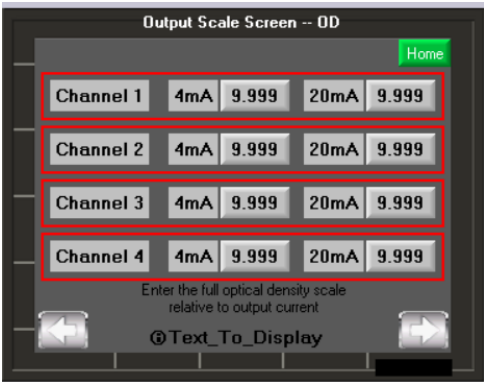
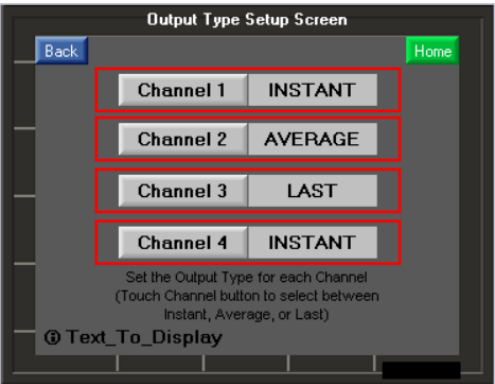
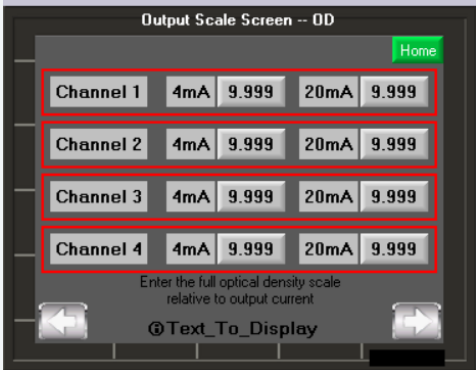
All flat buttons are read-only. Cal time is in 24-hour clock format.

Note: In internal mode, the clock controls the cycle. In external mode, the internal clock is disabled, and only an external input activates the cycle.



All raised buttons can be touched, and their values can be changed. Instructions are at the bottom of the screen when required.

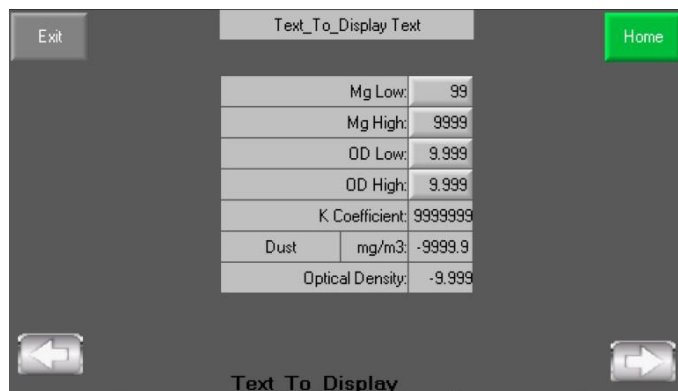
All flat buttons are read-only.



Tech Setup Screens 3 and 4

You can touch all raised buttons and change their values.

All flat buttons are read-only.



Exit Home

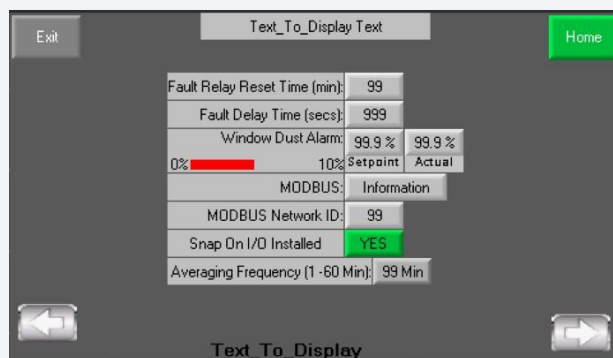
Text_To_Display Text

Mg Low:	99
Mg High:	9999
OD Low:	9.999
OD High:	9.999
K Coefficient:	9999999
Dust	mg/m3: -9999.9
Optical Density:	-9.999

Text_To_Display

You can touch all raised buttons, and you can change their values. Instructions are at the bottom of the screen when required.

All flat buttons are read-only.



Exit Home

Text_To_Display Text

Fault Relay Reset Time (min):	99		
Fault Delay Time (secs):	999		
Window Dust Alarm:	99.9 %	99.9 %	
0%	10%	Setpoint	Actual
MODBUS:	Information		
MODBUS Network ID:	99		
Snap On I/O Installed	YES		
Averaging Frequency (1 - 60 Min):	99 Min		

Text_To_Display

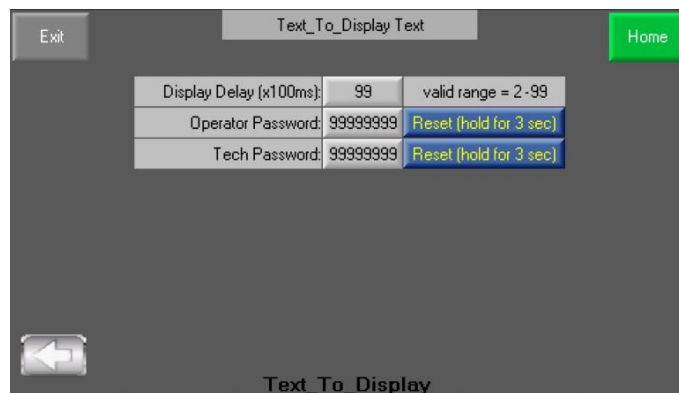
Change Passwords

Only the tech can change passwords. The default for Operator is (1111) and for Tech is (1234). To change passwords, press the raised button and enter the new password (up to 8 digits).

The tech can reset to the default value by holding the reset button for 3 seconds.

CRITICALLY IMPORTANT!

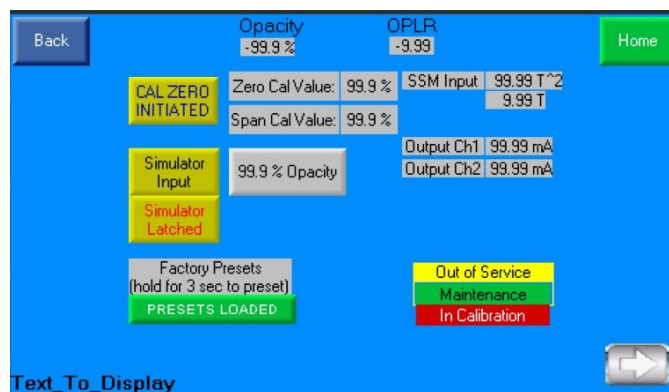
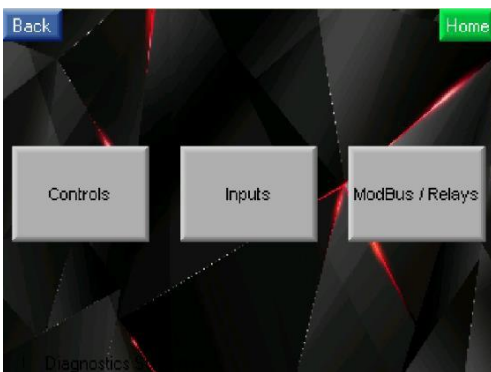
THE TECH (GATEKEEPER) OF THE CONTROL UNIT, AT HIS DISCRETION, CAN CHANGE BOTH PASSWORDS; HOWEVER, THE PASSWORD MUST BE SECURED AGAINST LOSS. IF THE GATEKEEPER'S PASSWORD IS LOST, CONTACT THE FACTORY FOR THE PROCEDURE TO RESET TO DEFAULT SETTINGS. THIS PROCEDURE IS IN PLACE TO PROTECT THE INTEGRITY OF THE DATA COLLECTED AND THE OPERATION OF THE UNIT.



Diagnostics Page

These pages are intended for use by EMS Factory-trained technicians, and this manual does not include a detailed explanation of their use.

To access the Controls page, you must enter the tech password.

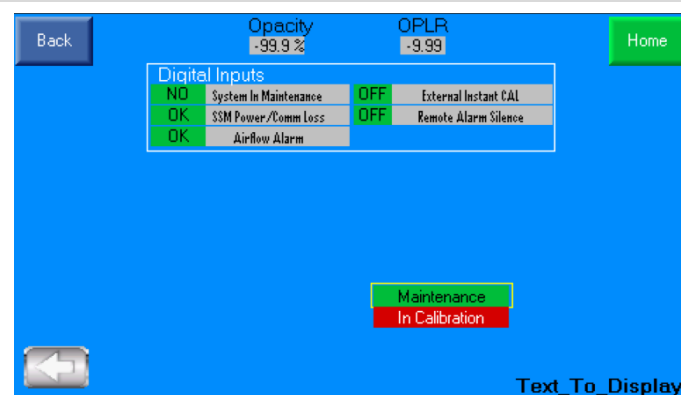


WARNING: pre-set returns all selections to default. Do not use unless instructed by the EMS service engineer.

Touch the Relays button in the sub-menu to check relay conditions. Relay # is de-energized if gray, and energized if green.

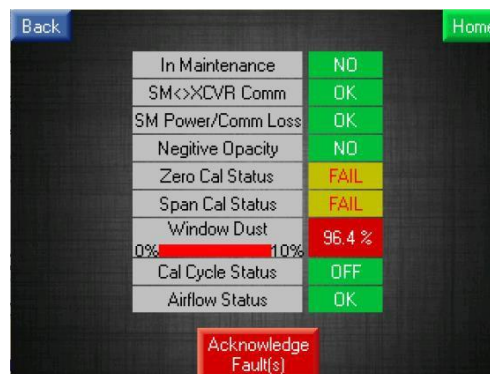


Touch the Digital in the sub-menu button, or the right arrow, to check input conditions. Inputs are gray if NO input, RED if input is active.



Fault Page

If one or more faults are detected, a “FAULT” button will appear on any display screen. Touch it, and the fault screen will be displayed, indicating the fault(s). Pressing the Acknowledge button will de-energize the fault relay. If, after the time set in Tech Screen 4, the relay has not been repaired, it will energize.



Alarm Page

Resetting the count clears the alarm count column.

The default alarm relay operation is Auto (automatic). To change it to manual, navigate to the “Operator Setup Screen 1” page.

Alarm Item/Status (green = ok // red = a Statu	Relay	Alarm Setpoint	Actual Value	Alarm Count	Count Reset
Hi Mg Alarm	O11	500.0	82.4	0	
High Opacity Alarm	O12	20 %	17.2 %	0	
High Opacity/Mg Alarm	O13	ice			
Opacity Early Warn	O15	10 %	17.2 %	0	
Mg Early Warning	O16	100.0	82.4	0	

Buttons: Early Warning Reset, Process Alarm Reset

Alarm Screen

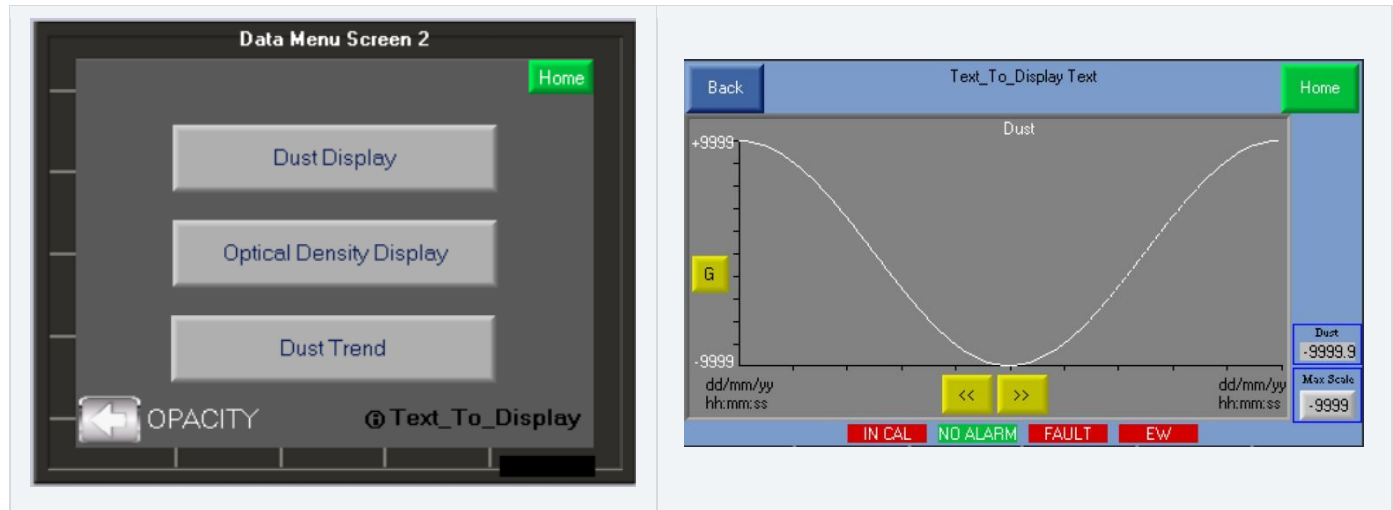
Alarm Reset Selection



Selecting the alarm reset to automatic or manual is done by pressing the button next to “Alarm Auto/Man Reset.”

Display Page

You can set the max scale on each trend screen for: Opacity -5 to 99.9, Dust 0 to 2000.



About Page

The About page displays the basic setup information.

Back	Text_To_Display Text		Home
EMS SN:		9999SP	
Date Mfd:		Text_To_Display	
Flange-Flange:		9999.9	
Path Length ID:		9999.9	
Stack Exit ID:		9999.9	
O.P.L.R.:		-9.99	ERROR!
Controller ID #:		9999999999	
MODBUS ID:		99	
Project Rev:		Text_To_Display	

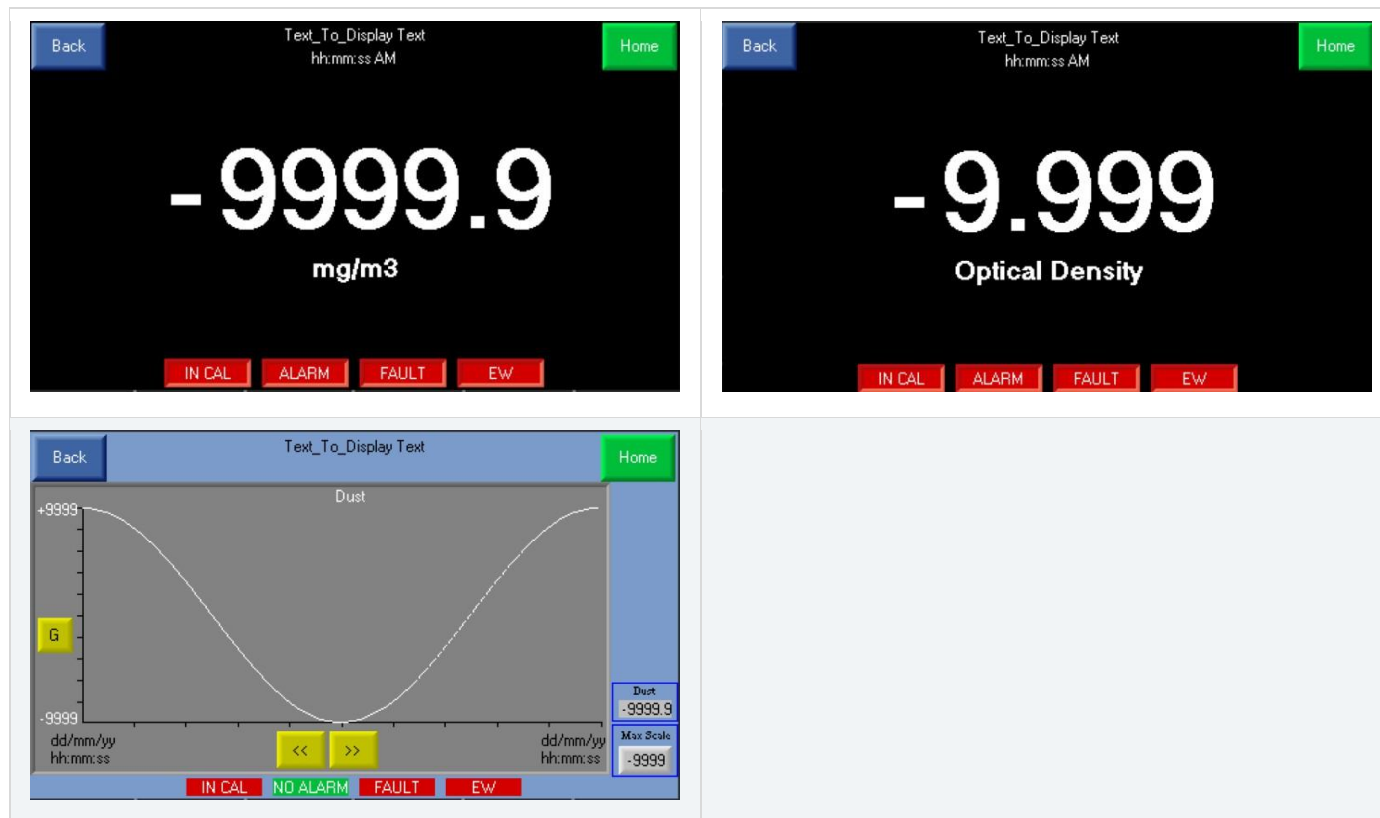
RCU Modbus Address Information

MB = Modbus Poll Read Discrete inputs (10001....20000) MI = Modbus Poll Read Holding (40001...50000)

Read:	Address:	Example:
Instantaneous opacity	MI 230	integer
Average opacity %	MI 231	integer
Instantaneous O.D. Display	MI 232	(0-2.0)
Instantaneous Mg	MI 233	(0-2000)
Window dust	MI 234	0-10%
OPLR Calculated	MI 245	OPLR
Opacity Last	MI 246	For process control. In the cal, the last value going in is held.
Read: Common fault individual blocks:		
Mg High alarm	MB 235	No alarm =0. Alarm =1
Opacity high alarm	MB 236	No alarm =0. Alarm =1
Opacity Early warning alarm	MB 239	No alarm =0. Alarm =1
Mg Early warning alarm	MB 240	No alarm =0. Alarm =1
In maintenance	MB 241	In Maint. =0, Not In Maint. =1
SM Power status	MB 242	Lost power to SM=0, Power OK =1
Negative opacity	MB 244	Positive opacity =0, Negative Opacity =1
Zero Cal Fail	MB 245	Fail =1, Not fail =0
Span Cal Fail	MB 246	Fail =1, Not fail =0
No Air flow (Modbus only)	MB 247	OK =0, Not OK =1
DAS In Cal	MB 248	Not Cal = 0, In Cal = 1
Zero Cal	MB 230	Off=0, On =1
Span Cal	MB 231	Off=0, On =1
Write:		
Remote Cal. Initiate	MB 249	Initiate cal =1

Displays Associated with Dust.

THIS GUIDE IS INTENDED TO GIVE AN OVERVIEW OF THE DUST CAPABILITY, OPERATION, AND SETUP OF THE EMS PREMIUM MONITORING SYSTEM. THE ANALYZER IS SHIPPED WITH THE FACTORY CALIBRATION, BUT FOR MORE ACCURACY, IT SHOULD BE CALIBRATED ON-SITE USING METHOD 5 OR 17 ISOKINETIC TESTING. INSTRUCTIONS ON HOW TO ACCOMPLISH CALIBRATION ARE FOUND LATER IN THE MANUAL.



O.D, & Mg Modbus Map

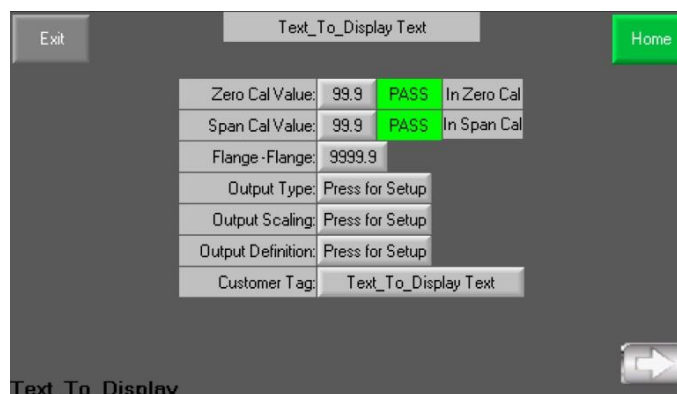
MB = Modbus Poll Read Discrete inputs (10001....20000) MI = Modbus Poll Read Holding (40001...50000)

Read:	Address:	Example:
Instantaneous O.D. Display	MI 232	(0-2.0)
Instantaneous Mg	MI 233	(0-2000)

Dust Output Setup Screens

Before you can change the Correlation of the Premium controller, you must prepare an O.D. output for data collection during stack testing. For this example, we will choose Channel 3.

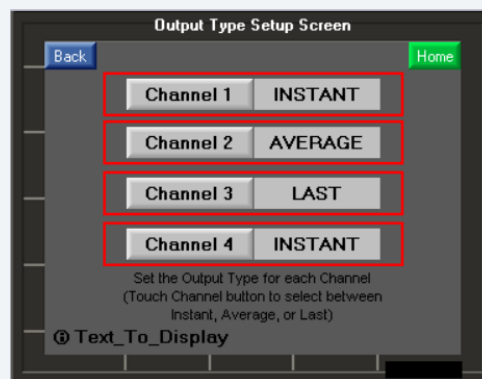
First, choose the output channel you want to collect the O.D. data. From the Home screen, go to Settings, Tech Setup (password 1234), Tech Setup screen 1. Output Scaling button - “Press for Setup”.



At the bottom right, press the right arrow until the Output Scale screen displays OD.

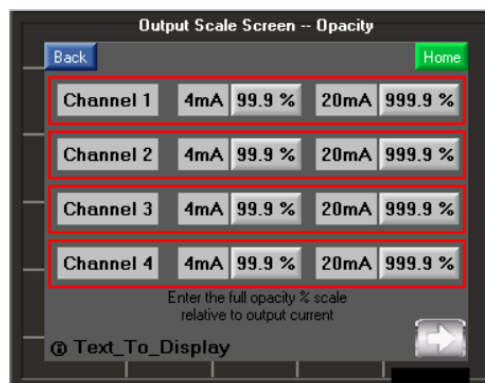
Channel 3 on 5.7 or Channel 1 on 4.3 – Press the button in the column next to “4mA” until 0.000 is displayed. In the right column, set 20 mA to 1.000. After entering the range, press the Right arrow for the Output Scale Screen: Mg.

5.7 has four mA outputs; 4.3 has two mA.



Channel 3 on 5.7 or Channel 1 on 4.3 Mg. Press the button in the column next to “4mA” until 0.0 is displayed in the right column “20mA for 900.

5.7 has four mA outputs, 4.3 has two mA.



Dust Correlation O.D. vs mg/m³

Example Output Settings for Dust					
CH#	Output Definition	Output Type	Output Scale % Op.	O.D.	Mg F.S.
Ch1	% Opacity	Instant/zs	-5-99.9		
Ch2	mg/m3	Instant/zs			0-2000
Ch3	O.D.	Last/hold during zs		0-1.000	
Ch4	% Opacity	Last/hold during zs	0-99.9		

After testing and completing a chart of OD vs. mg/m³ (or Nm³), complete the final steps to set up the mg/m³ output and display for Correlated values.



From the home page, select the Settings Icon , Tech Setup (password 1234), then scroll to “screen 3”.

On the sample chart, the origin is 0Mg and the plot is a linear graph between the origin and the test results (OD, mg). (Note: decimal points not allowed.)

Assume 300 mg/m³ and the corresponding OD = .300. Plot the graph and extend the line to about three times the typical stack dust level. In this case, 1000 mg/m³ for the full scale.

Enter mg Low 0, Mg High 1000, OD Low 0.000.

The screenshot shows the 'TEST BOILER 1' screen with a 'Home' button in the top right. The screen displays the following settings:

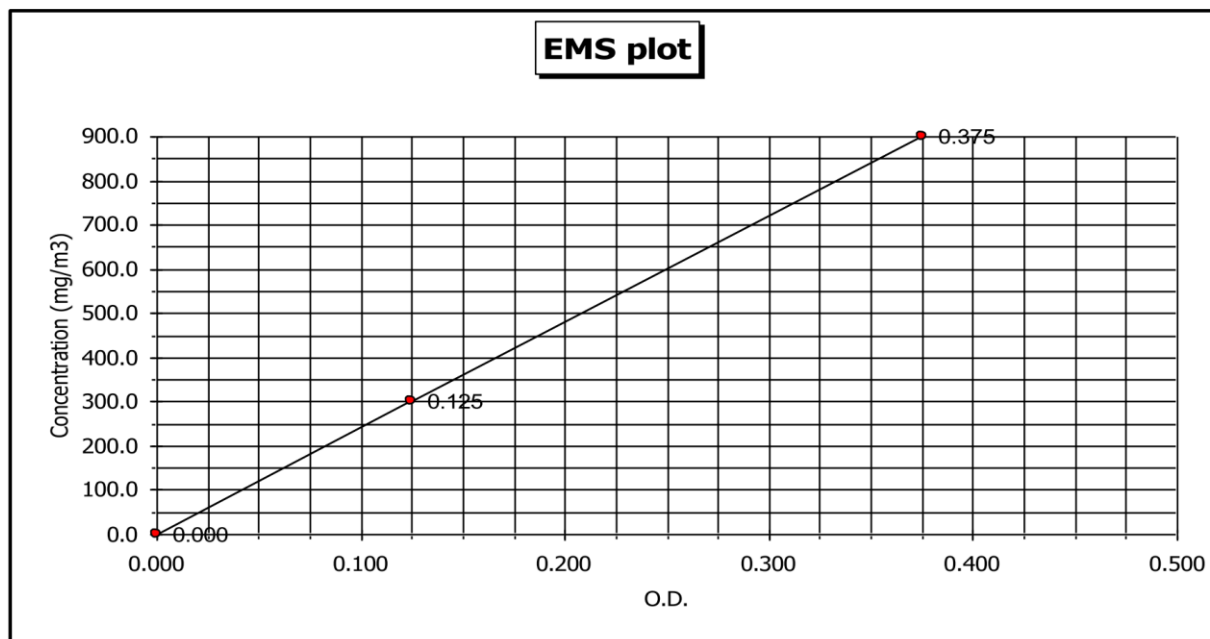
Mg Low:	0
Mg High:	900
OD Low:	0.000
OD High:	0.375
K Coefficient:	2400
Dust	mg/m3: 195.1
Optical Density:	0.081

Navigation buttons 'Exit' (top left) and 'Home' (top right) are visible. At the bottom, there are left and right arrow buttons and the text 'Tech Setup Screen 3'.

Sample Calibration Graph

From the lab results (Method 5 or 17 Isokinetic testing), draw a line from 0.0 to the point (OD, mg).

You can now use the graph to calibrate the monitor mg/m³ output; it remains valid until the user changes the source characteristics.



Example after the Stack Test

Use the values from the Lab test for mg and the corresponding monitor readings for OD (Optical Density) to plot the graph as above. The origin is 0.0, and the plot is linear from the origin to the test results (OD, mg). Assume we had 300 mg/m³ and the corresponding OD = 0.125. Plot the graph and extend the line to about 3 times the typical stack dust level. In this case, 3 x 300 = 900 mg/m³ for the full scale.

Lo mg = 0	Hi mg = 900
Lo OD = 0	Hi OD, = 0.375
4 mA = 0	20 mA = 900

Page 1-Explanation of the Relationship between Optical Density and Particulate Density

According to Bouguer's Law, the particulate or dust density contained within an optical path is directly proportional to the measured optical density of that path. The proportionality constant varies with the gravimetric density of the particulate matter, its size distribution, and its optical properties. The constant can be calculated if all data are known. However, this is typically not the case. In practice, it is much easier to determine the proportionality constant and offsets for each installation experimentally. The data does not always correlate best with a line through the origin (i.e., without offset).

The correlation coefficient and offset of the linear relationship between optical density and particulate density, typically mg/nM3, are determined from a linear regression analysis of a data set including simultaneous measurements of optical density and dust density. Such data should cover as large a range of operating variables as possible. Calibration, in terms of dust loading, is valid as long as the particle size distribution and composition do not change significantly. This condition is generally fulfilled in emissions from sources with high-efficiency particulate control equipment.

To establish calibration accuracy over a range of emission rates and process conditions, obtain a large number of calibration points (at least 12 to 15) using Method 5 or 17 Isokinetic. Then you can obtain the regression line and associated confidence limits. A substantial amount of data has been developed for correlating optical density with dust loading for a variety of applications. You can use this data as a starting point for characterizing any specific source. Figure 1 illustrates a calibration curve developed for a cement kiln equipped with an electrostatic precipitator. The 95% tolerance intervals at the 95% confidence level are indicated. Figure 2 shows the same calibration curve after correction to standard conditions (temperature and pressure on a dry basis. Use the corrected calibration curve when gas temperature, pressure, and water concentration are constant. Figure 3 shows a similar calibration curve obtained on a lignite-fired boiler, and Figure 4 shows a calibration curve for a bituminous coal-fired power station.

Calibration Curves

Figure 1

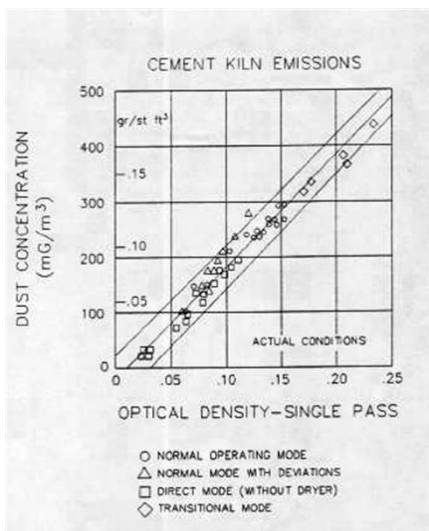


Figure 2

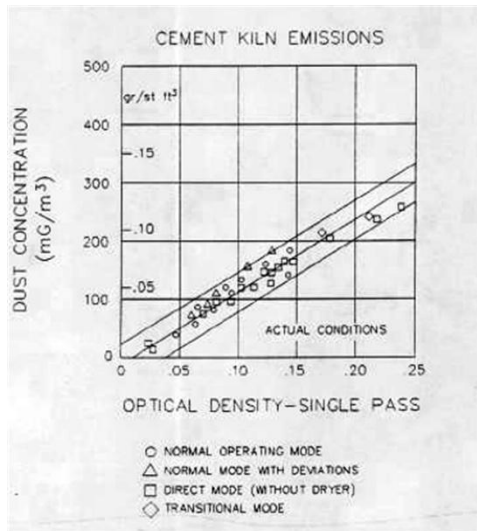


Figure 3

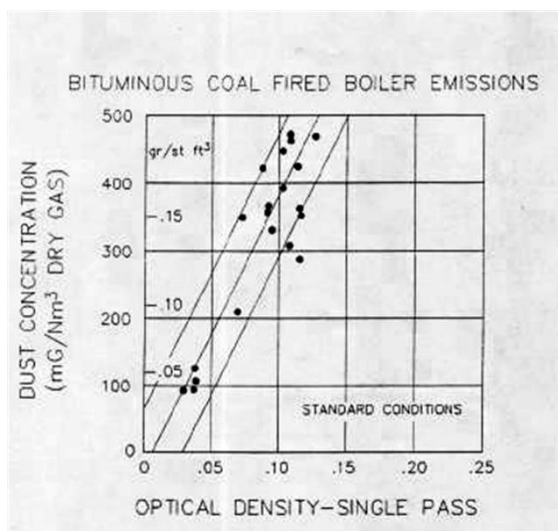
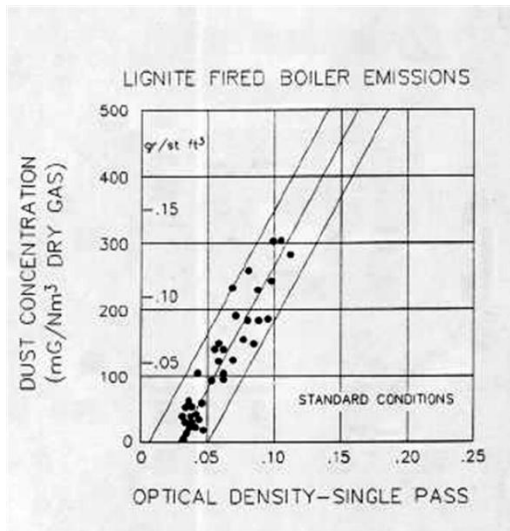


Figure 4



Page-2 Explanation of the Relationship between Optical Density and Particulate Density

Transmissometers have been used in numerous installations worldwide to continuously monitor both opacity and particulate concentration, based on correlations between optical density measurements and dust loading. In dust-monitoring applications, instrument calibration is typically checked by manual testing about once a year.

Table 1-1 summarizes the error levels observed for different statistical analyses of several correlation lines for typical emission sources. Four different error definitions are shown. These error definitions are described more fully as follows:

- a. **Standard deviation expressed as the square root of the mean.**
- b. **Type 1 error is the 95% confidence level that the true mean of all observed optical data for a given particulate concentration will lie within the limit.**
- c. **Type 2 error is the 95% confidence level that the following observation will fall within the limit.**
- d. **Type 3 error is the 95% confidence level that 95% of all possible observations (95% tolerance) will fall within the limit.**

Type 3 error specifications are typically applied in Europe, while the type 2 error definition is most common for US applications. Type 1 error yields the fewest errors, ranging from 5 to 21% in the data.

Table 1-1. Particulate Concentration and Error Levels

Emission source	Observations	Correlation coefficient	Mean particulate concentration (mg/m ³)	Standard deviation (mg/m ³)	Error levels at mean particulate concentration (mg/m ³)		
					Type 1: 95% confidence — true mean	Type 2: 95% confidence — next single value	Type 3: 95% confidence — 95% of all possible values
Cement	39	0.985	179.9	±13.9	±9.0 (5.0%)	±54.2 (31.8%)	±68.6 (38.1%)
Bituminous coal	20	0.760	322.3	±85.5	±40.2 (12.2%)	±184.0 (57.1%)	±475.4 (147.5%)
Lignite	35	0.915	111.2	±31.4	±10.6 (9.5%)	±64.6 (58.1%)	±78.1 (70.2%)
Municipal incinerator	15	0.909	90.3	±29.5	±16.4 (18.2%)	±65.7 (72.7%)	±88.5 (98.0%)
Kraft recovery	12	0.957	76.4	±12.6	±16.1 (21.1%)	±57.9 (76.0%)	±81.6 (106.8%)
Hogged fuel	13	0.750	206.0	±61.8	±39.0 (18.9%)	±145.6 (70.7%)	±201.2 (97.6%)
Bituminous coal	11	0.974	252.3	±56.4	±38.4 (15.2%)	±133.2 (52.7%)	±379.5 (150.4%)

Page-3 Explanation of the Relationship between Optical Density and Particulate Density

The following correlation data from different emission sources allow a comparison of stack opacities at equal particulate concentrations and stack diameters. Some calculated opacities for a concentration of 150 mg/nM3 and a stack exit diameter of 10.12 ft (3 m) are summarized in Table 1-2—comparison of stack opacities for different emission sources under equalized conditions.

Table 1-2

Particulate Concentration, Optical Density, and Opacity

Emission source	Mean particulate concentration (mg/m ³)	Single-pass optical density at mean particulate concentration	Diameter at measurement site (m)	Calculated at 150 mg/m ³ and a 10.12 ft stack diameter	
				Optical density	Opacity (%)
Cement	179.9	0.1029	1.95	0.1320	26.2
Lignite	111.2	0.0580	3.25	0.0722	15.3
Municipal incinerator	90.3	0.0235	4.00	0.0293	6.6
Kraft recovery	76.4	0.0746	3.66	0.1200	24.2
Hogged fuel	206.0	0.1290	1.52	0.1854	34.8
Bituminous coal	252.3	0.1432	4.88	0.0523	11.3

Alarm Matrix

Alarm Reset Sequences

Output states: 0 = open; 1 = closed.

Test step	High mg alarm (O11)	High opacity alarm (O12)	mg/opacity alarm silence (O13)	E.W. opacity alarm (O15)	E.W. mg alarm (O16)
Automatic reset without pressing the reset button					
Start at 0%; use a test value above the high setpoints.	0	0	0	0	0
Above the high mg setpoint (150 mg), after the delay (AL).	1	1	1	1	1
Above the high opacity setpoint (20%), after the delay (AL).	1	1	1	1	1
Return to 0%.	0	0	0	0	0
Automatic reset: press the reset button before returning to zero					
Start at 0%; use a test value above the high setpoints.	0	0	0	0	0
Above the setpoint, after the delay (AL).	1	1	1	1	1
Above the setpoint; E.W. reset button pressed.	1	1	1	1	1
Above the setpoint; process alarm reset button pressed.	1	1	0	1	1
Return to 0%.	0	0	0	0	0
Manual reset after returning to zero					
Start at 0%; use a test value above the high setpoints.	0	0	0	0	0
Above the setpoint, after the delay (AL).	1	1	1	1	1
Return to 0%.	1	1	1	1	1
Process alarm reset button pressed.	0	0	0	1	1
E.W. reset button pressed.	0	0	0	0	0
Manual reset before returning to zero					
Start at 0%; use a test value above the high setpoints.	0	0	0	0	0
Above the setpoint, after the delay (AL).	1	1	1	1	1
Process alarm reset button pressed.	1	1	0	1	1
E.W. reset button pressed.	1	1	0	1	1
Return to 0%.	1	1	0	1	1
Process alarm reset button pressed.	0	0	0	1	1
E.W. reset button pressed.	0	0	0	0	0

Off Stack Zero Calibration

Use this procedure if a clear stack condition is not possible and the zero appears incorrect, or if the flange-to-flange distance on site differs from the original factory setup.

1. Remove the transceiver and retro reflector from the hinge pins, remove the service module, and install the system on E.M.S. Opacity portable off-stack test stands (p/n 2788) at the correct flange-to-flange distance plus 11 inches. The additional 11 inches compensates for air plenum spacing, as the air plenums are not used for the off-stack zero calibration. This measurement is called the “plenum-to-plenum measurement.”



2. Clean transceiver and retro windows.
3. Clean the transceiver and Retro front lenses
4. Install the Transceiver and Retro on their respective stands. Connect all the system components and apply power.
5. Align the Transceiver



6. Follow the instructions for "Clear stack calibration" found in Vol. 6—Section 3 SSM manual.
7. If “routine Clear stack calibration” had to be performed, proceed to cal zero reflector adjustment.

SSM Clear Path Adjustment

Clear-Stack Setup Procedure

1 Prepare and open Setup

- Ensure the monitor's optical path is clear before making adjustments.
- On the SSM, open the Setup screen. When prompted, enter password 5566.



2 Enter and save the clear value

- Scroll to the clear/span value page and press Enter (↵) to enter the actual clear-value percentage.
- After entering the desired clear-stack value, press F1 to save it.



3 Finish and check zero

- The clear-stack procedure is complete. Press ESC to return to the main display.
- It is common to adjust zero iris after a clear-stack procedure. Refer to the zero reflector adjustment procedure.

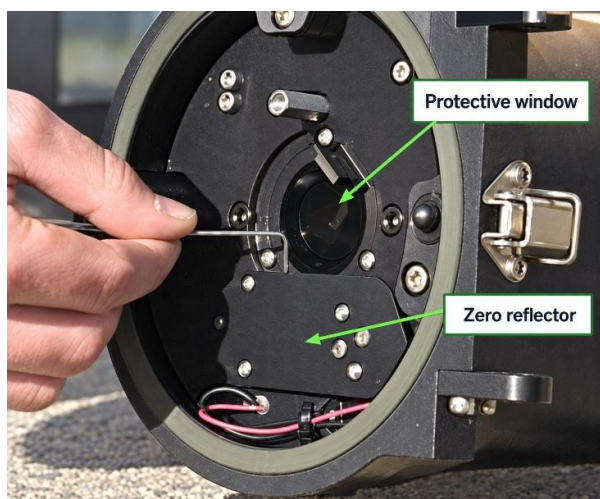


Environmental Monitor Service, Inc. is available to assist you. Call our service department at (203) 935-0102 or email techsupport@emsct.com for details and to schedule a start-up.

Transceiver Cal Zero Reflector Adjustment

After a clear or off-stack zero has been performed, adjust the cal zero reflector.

1. Find and record the zero offset value found in the Tech Setup, Tech Setup Screen 1, "Zero Cal Value".
2. On the SSM, observe the correlated opacity on the digital display.
3. Swing open the transceiver.
4. Initiate a zero with the F1 button on the SSM to raise the zero reflector into place. Observe and record the zero value after 30 seconds. Press the F1 button until the zero reflector returns to its resting position.
5. If required, insert a 1/16" Allen wrench into the adjustment set screw located on the top of the zero reflector. Turn the set screw clockwise 1/8 turn.
6. Remove the Allen wrench and initiate a zero (step 4), and after 15 seconds, observe that the reading is moving toward the desired value. (If the value is away from the desired value, repeat step 4; turn set screw C.C.W.)
7. Repeat steps 4 -6 each time, making small 1/8-turn increments until the desired value is reached. Cycle 2-3 times more, waiting 15 to 20 seconds between cycles to ensure the unit repeats the desired value +/- 0.5% Opacity. Swing the transceiver into the operating position and secure it in place. Record the zero-final value.



Micro-Turn Audit Kit

Using the Online Zero Reflector

The "Micro-turn" 200 on - line test and audit system P/N 1232 may be used for:

- Opacity audit
- Linearity checks and adjustments
- System accuracy verification
- Service online or off-stack

The "Micro-turn" 200 on-line test and audit system P/N 1232 contains a test reflector, three neutral density filters, filter certification certificates, and a carrying case. Insert the Micro-turn 200 on-line test reflector over the transceiver lens.



Filter Certification

EMS recommends QA/QC testing of the filters at intervals of no more than 6 months. EMS offers filter certification, replacement, and additional Neutral Density Filters.

EMS calibrates Neutral Density Filters for Micro-turn 200 on a Perkin-Elmer Lambda Series 6 / PECSS Spectrophotometer per Federal Environmental Protection Agency specifications. These specifications are contained in the Code of Federal Regulations 40 CFR 60, Appendix B, Performance Specification 1, Attenuator Calibration. Scan the filters over the visible region from 380 to 780 nanometers in one-nanometer steps, and weight the resulting filter transmittances to the Source C Human Eye Response by multiplying each value by its associated response factor. Convert the corrected transmittance values to % Opacity, and record the value on the filter and related chart.

Preventive/Corrective Maintenance

Preventive/Corrective Maintenance Schedule

Daily:

Check Zero/Span marks are within specification (+/- 2%) Check for fault conditions

Monthly or as Required:

Clean transceiver and retro windows. Check alignment; correct if necessary. Check air filters and replace if necessary.

Quarterly:

All daily and monthly checks

Perform COM Audit per EPA regulation 40 CFR, 60 App. B, PS-1. Replace air filters

Check all air hoses and clamps for tightness and wear; correct as necessary. Check weather cover gaskets for leakage.

Check all bolts for tightness.

Check that all electrical connections are secure. Check the air blower for excessive noise.

Ensure the airflow switch operates correctly.

Yearly:

Clear the stack or off-stack zero. All quarterly checks

Remove the transceiver and retro, and clean the air plenum. Replace any worn hoses and gaskets

Clean inner optics if necessary. Check all system operations.

General

Adjust corrective and preventive maintenance schedules to site-specific conditions to ensure maximum availability of accurate measurement data. Routine checks should be implemented to:

Observe and correct the operation of the air-purge system, giving particular attention to keeping the optical path within the mounting flanges clear of dirt build-up.

Observe and correct the operation of peripheral accessory equipment such as recorders, computers, etc.

Observe and correct the stack zero measurement whenever a clear stack condition exists. Exercise care to ensure both transmittance and opacity measurements are at their prescribed values.

Verify that instrument operating manuals are available and that maintenance logs are properly maintained and reviewed.

Every 3-5 Years:

EMS recommends a periodic interval, depending on the severity of the sensor locations, of 3-5 years between overhauls of our opacity system to keep them working at their optimal level. Overhauls become necessary because, over time, dust, outgassing of electronic parts, and the removal of protective covers manifest themselves as overall optics degradation, causing more frequent adjustments and poor performance of the opacity monitor.

To schedule call EMS service department 203.935.0102 ext. 14 or email; techsupport@emsct.com

Spare Parts

CONTACT THE FACTORY FOR RECOMMENDATIONS. EMAIL: sales@emsct.com. PH. 203-935-0102

EMS PS1 System — Recommended Spare Parts		
Recommended spares for a new system. Serial numbers are required to ensure the correct order. Contact EMS for a customized quote for your facility.		
Recommended quantity / reference	Part number	Description
1. PS1 WatchDog		
1 per 4 instruments or 1 per plant	3107	LED XT DP source assembly; serial-number dependent.
1 per 4 instruments or 1 per plant	1466	Transceiver/retroreflector latch, spring, and gasket repair kit.
1 per 4 instruments or 1 per plant	2684	24 VDC, 25 W, 1 A output DIN-rail-mounted power supply.
2. Recommended Spares — Procedure 3 Requirements		
1 per 4 instruments or 1 per plant	3193	SSM PS1 digital assembly with port #2.
1 per 4 instruments or 1 per plant	3195	Calibration zero complete reflector iris assembly with rotary solenoid.
1 per 4 instruments or 1 per plant	2935	Spare retro assembly, drop-on-pin type, 3–15 ft, with aperture kit.