OPM4001 Opacity/Dust Density Enhanced Controller Installation and Operation Manual
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TECHNICAL SUPPORT HOTLINE

For assistance with problems, please call the Customer Support Center (CSC).

Phone: 1-800-433-6076  1-440-914-1261

In addition to CSC, you may also contact Field Watch. Field Watch coordinates Emerson Process Management’s field service throughout the U.S. and abroad.

Phone: 1-800-654-RMST (1-800-654-7768)

Emerson Process Management may also be reached via the Internet through e-mail and World Wide Web:

E-mail: GAS.CSC@emerson.com

World Wide Web: www.raihome.com

Warnings and Safety Guidelines for user safety and equipment protection.

This manual is intended to aid trained and competent personnel in the installation of 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 EMERSON PROCESS MANAGEMENT BE LIABLE OR RESPONSIBLE FOR ANY CONSEQUENTIAL DAMAGE THAT MAY ARISE AS A RESULT OF INSTALLATION OR USE OF THIS EQUIPMENT.

▪ ALL EXAMPLES AND DIAGRAMS SHOWN IN THE MANUAL ARE INTENDED TO AID UNDERSTANDING. THEY DO NOT GUARANTEE OPERATION.

▪ EMERSON PROCESS MANAGEMENT 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 IN A SAFE MANNER 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.
SECTION 1 SYSTEM DESCRIPTION

TRANSMISSOMETER / RETRO REFLECTOR

The OPM4001 is a precision, double-pass, dual beam Transmissometer that consists of a transceiver (transmitter/receiver) mounted on one side of a stack or duct and a passive reflector mounted on the opposite side. The light source, photo detectors, and all measurement/reference optics used in opacity measurement are housed in the transceiver.

NORMAL MODE OF OPERATION

The Dual beam measurement system has a stack mounted Transmissometer sensor system consists of an optical transceiver mounted on one side of the stack and a retro reflector mounted on the other. To avoid errors due to ambient light, the wide band lamp (See Drawing) is electronically modulated and projects a collimated beam of light, which is split into a reference beam, and a measurement beam by an optical Beam splitter. The reference beam is directed to the reference detector, RD. The measurement beam is projected across the stack to a Retro reflector that returns the beam back across the stack to a beam splitter and directs the measurement beam to the measurement detector, MD. A portion of the returning light is also sent to the TTL (Thru the Lens) bulls-eye target viewed through a window provided at the rear of the Transmissometer. The bulls-eye is used to correct changes in alignment and is unique in that no moving parts are used!

The ratio of the measurement and reference detectors is used to provide Transmittance $T^2$ signal. Because the same light source is used for both detectors, and a Measurement / Reference ratio is used throughout for the calculations, the monitor is insensitive to variations in light intensity. Since all measurements are made on a ratio basis, all resulting computations are independent of the absolute intensity of the light source or contamination of the optics associated with the collection and focusing of the energy from the lamp. The $T^2$ signal is converted to a current format and sent to the control unit for processing. At the control unit the signal is processed to read 0-100% Opacity, provide alarms and outputs.
INTERNAL CALIBRATION SYSTEM, ZERO MODE

Zero and span calibration checks can be initiated manually, automatically or by a PLC or computer. During the zero calibration mode a calibrated zero reflector is placed in front of the transceiver optical package testing all optical surfaces and electronic components to assure zero point has not changed.

INTERNAL CALIBRATION SYSTEM, SPAN MODE

In the span mode a Span filter of known Neutral Density is placed in the measurement path and produces a specific upscale reading in accordance with the latest E.P.A. requirements. The zero and span cycle provides a continuous check of all the optical components and surfaces, the main lamp, the detector, interconnecting wiring, control unit and computation analysis.
The RCU provides instrument control functions, opacity readings, alarms, analog outputs, communications, system information and more. The color 5x7” viewing screen can be seen in low light levels and bright. The RCU is rated NEMA 4X/IP65 when panel mounted. Battery backup for all memory is typically 7 years.

The control unit should be mounted in a control room environment i.e., clean, temperature with max/min of +0° to +50° C (+32° to + 122° F). The OPM4001 ENHANCED control unit provides instrument control functions, opacity readings, alarm and fault indicators, analog outputs, and diagnostics with contact closures.

### OPTIONAL AIR PURGE WEATHER COVER SYSTEM

The transceiver and reflector may be mounted in weather covers. The weather covers are fairly compact to allow movement around them even on a three-foot walkway or platform. They protect the stack-mounted components from dirt, moisture; stack temperatures within the specified ambient temperatures limits, and errant air currents around the stack.

The air purge system constantly circulates air past the optical window. The air flow is directed through the hose to an air plenum on the stack side of the optical window. The air flow in the air plenum area results in reduced pressure and increased velocity. This venturi effect tends to continually draw the air around the optical window into the purge air stream, thereby keeping the lens clean for long periods.

### ALIGNMENT SYSTEM

The OPM4001 ENHANCED includes a built-in through-the-lens alignment system. The alignment target can be viewed through a window on the transceiver. Adjustments to changes in alignment are provided by a 3-point alignment system, which is integral to the air plenum.

### CABLING

The standard cabling used between the stack-mounted units and the control unit is at a minimum 6-pair, #20 AWG, twisted, shielded. Separation distances approximately 1000FT, more pairs or larger gage than 20 AWG is also acceptable.
## SYSTEM SPECIFICATIONS

<table>
<thead>
<tr>
<th>REMOTE CONTROL UNIT:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Enclosure</td>
<td>Panel mounted IP65/NEMA4X Dimensions: 197X146.6X68.5mm (7.75&quot; X 5.77&quot; X2.7&quot;).</td>
</tr>
<tr>
<td>Approvals</td>
<td>CE and UL Listed</td>
</tr>
<tr>
<td>Digital Display</td>
<td>LED backlight, Instant and Average Opacity -5 to 99% Opacity</td>
</tr>
<tr>
<td>Ambient Temperature Range</td>
<td>0 to +50° C (+32 to + 122° F)</td>
</tr>
<tr>
<td>Power Requirements</td>
<td>Power 20.4 to 28.8VDC &lt; 10% ripple, 20va</td>
</tr>
<tr>
<td>Alarm Time Delay &amp; set point</td>
<td>Field programmable.</td>
</tr>
<tr>
<td>Alarm Reset</td>
<td>Manual or Automatic</td>
</tr>
</tbody>
</table>
| Analog Outputs (4)   | Four 12-bit Analog outputs 4-20mA, Field selectable range -5.0 to 100%.
Ch1 and Ch2 Individually field selectable for Instant % opacity, or 6 minute average with z/s checks or without checks for process control. |
<p>| Exit Correlation (Lx / Lt) | 0.3~1.0 OPLR |
| Calibration check options | Selectable internal timed or computer initiates or push button on demand. |
| Communication        | Remote access, RS485 MODBUS networking. |
| Battery Backup       | 7 years typical |</p>
<table>
<thead>
<tr>
<th><strong>TRANSCEIVER/ REFLECTOR:</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Enclosure/Power Requirements</strong></td>
<td>NEMA 4X. Power 120 or 240VAC +/- 10%, 50/60Hz. 65va for transceiver, 65va for Service module.</td>
</tr>
<tr>
<td><strong>Path Length</strong></td>
<td>2 to 50 feet (0.6 to 4.6 15.2 meters)</td>
</tr>
<tr>
<td><strong>Reflector</strong></td>
<td>Type 1 (plastic) reflector assembly, long path Glass.</td>
</tr>
<tr>
<td><strong>Alignment Verification</strong></td>
<td>Built-in through-the-lens system standard</td>
</tr>
<tr>
<td><strong>SOURCE Aging Compensation</strong></td>
<td>Automatic</td>
</tr>
<tr>
<td><strong>SOURCE Expected Life</strong></td>
<td>70,000 hours (Field proven for &gt; 8 years)</td>
</tr>
<tr>
<td><strong>Ambient Temperature Limits</strong></td>
<td>-40 to +130°F (-40 to +54°C)</td>
</tr>
<tr>
<td><strong>Process Gas</strong></td>
<td>Up to 750°F (400°C) higher available contact the factory.</td>
</tr>
<tr>
<td><strong>Mounting Flanges</strong></td>
<td>3 inch IPS, 150# flange (other sizes available)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>DESIGN AND PERFORMANCE:</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Peak and Mean Spectral Response</strong></td>
<td>Photopic; 515 to 585 nm, less than 10% of peak response outside the desired 400 to 700 nm region. USDEP 40 CFR 60 appendix B, PS-1 and ASTM D 6216 specifications.</td>
</tr>
<tr>
<td><strong>Angle of View</strong></td>
<td>&lt;4.0° from optical axis</td>
</tr>
<tr>
<td><strong>Angle of Projection</strong></td>
<td>&lt; 4.0° from optical axis</td>
</tr>
<tr>
<td><strong>Calibration Error</strong></td>
<td>&lt; ±2% of full scale</td>
</tr>
<tr>
<td><strong>Response time</strong></td>
<td>&lt; 10 second</td>
</tr>
<tr>
<td><strong>Zero Drift</strong></td>
<td>&lt; 1% (24 hours)</td>
</tr>
<tr>
<td><strong>Calibration Drift</strong></td>
<td>&lt; 1% (24 hours)</td>
</tr>
<tr>
<td><strong>Operational Period</strong></td>
<td>6 Months</td>
</tr>
</tbody>
</table>
SECTION 2 INSTALLATION CONSIDERATIONS

BEFORE START UP

You must complete the following before start up is attempted.

Measure and record flange-to-flange distance to verify it is the same as final check out sheet.

If you are using a recorder, DAS, etc., DO NOT CONNECT THEM NOW. Outputs and inputs from other sources should be left off until system has been completely checked according to the following instructions. After system operation has been verified connect and test external connections.

Read the instructions first to familiarize yourself with the instrument before attempting start up.

The air purge and Weather cover system, Transceiver, Retro reflector, Service module must be installed and power applied.

Control unit must be installed and wired to the service module and customers equipment as applicable.

All wiring and mechanical installations must be complete per drawings provided in this manual. All wiring must be checked and power applied to both the control unit and the stack maintenance module.

Beam Alignment procedure has been completed.

ENVIRONMENT

Locate the control unit in an easily accessible area with temperatures between +32° to 122° F. To permit the operator to read and/or change controls, the unit should not be mounted higher than five feet from floor level.
MOUNTING THE AIR PLENUM AND WEATHER COVERS

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

After the installation site has been selected and the platform requirements have been met, the mounting flanges should be installed and aligned as described on Drawings OPM6130 and 6131. Flanges should be installed with the mounting faces on the vertical plane.

1) Before installing the Transceiver, Retro reflector or any type of weather cover remove the air plenum from both the Transceiver and retro reflector. Removal will make the installation easier and less chance of damage while mechanical attachment of the air plenums and optional weather covers when provided.

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

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

4) If you have weather covers remove the two (2)-weather cover hood hinge pins located on the upper right and left hand corner of the hood. The air plenum and weather cover are attached to the 3" pipe flange by 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.

5) Any wiring or air hoses can be connected now.
6) Attach the Transceiver and Retro reflector to the air plenum assembly by placing them on the hinge pins.

7) Close transceiver & retro and secure in place with the two hold down latches.

8) The air-purge blowers should be powered up at this time to prevent stack particulate from accumulating in the nipple and air-purge housing.

**Caution:** If installed location has a positive pressure the air-purge system must be used continuously during installation to prevent process gases from contaminating optical surfaces or over heating instrument electronics. If the system is shut off for more than momentary interruptions, the instrument may be damaged. Failure to provide continuous air-purge may void the warranty.

All wiring from the control unit to the transceiver should be completed at this time.

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

MAINTENANCE MODULE SWITCHES SHOULD BE IN THE NORMAL OPERATING POSITIONS:

- Zero/Operate - Operate
- Span/Operate - Operate
- Normal/Test - Normal
- Opacity/T² - Opacity

9) If not already on, turn on the power to all air purge systems and service module.

10) Align the Reflector mating flange so it is plumb and parallel to the 3" 150# mounting flange. Use the 3 adjusting nuts on the air purge plenum flange until this is accomplished. The adjusting nuts have nylon locking inserts to prevent loosening by vibration.

11) 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 cross hair (bulls-eye).
AIR FLOW SWITCH

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

CONTROL UNIT

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

Cut out for panel mounting is shown in the drawing section. 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.

Wire the control unit per drawing section and Energized power.

NOTE: CONTROLLER REQUIRES 24VDC.

- 5.7” 256-Color Touch panel, QVGA TFT display (or CSTN), 197X146.6X68.5mm (7.75” X 5.77” X2.7”)
- 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
SECTION 3 BEFORE START UP

You must complete the following before start up is attempted.

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

STACK EXIT CORRELATION COMPUTATION

The stack exit correlation is especially important to verify. If possible all dimensions should be verified by actual measurements.

Measure and record inside stack dimensions at the measuring point and at the stack exit, and compute the Optical Path Length Ratio (O.P.L.R.). Verify that the calculated and the value of O.P.L.R. found in the About page are within +/- 2%.

- Lx = Stack exit inner diameter, Lt = Inner diameter of the effluent path
- Example: A stack with a 120" stack exit I.D. and a 120" path length

$$OPLR = \frac{Lx}{2 \times Lt}$$

$$OPLR = \frac{120}{2 \times 120} = 0.50$$
SECTION 4 CONTROL UNIT PAGE DESCRIPTION

CONTROL UNIT SCREENS

GENERAL PAGE LAYOUT

1. Go to previous page
2. Unit tag, boiler#, location, etc.
3. Go to Home page
4. Time of day
5. Fault alarm, touch to go to fault page.
6. High opacity display only
7. In Cal display only during a cal cycle.
8. Air flow alarm
9. Right arrow, touch to go to next page (if on the left side of the page goes to previous page.
10. Value of measurement.
11. Type of measurement
12. Name of the page
CONTROL UNIT GLOSSARY OF TERMS

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

- Instant opacity, z/s outputted during cal cycle.
- Average, 6 minute 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 process control signal.

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

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

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

- Set Ch 1 or 2 to desired opacity range i.e, for 4mA to represent minimum opacity and 20mA to represent maximum opacity. The 20mA value of 99.9 is used to represent 100%.
- Note; For CFR 40, PS-1 the set 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 return/enter button to enter and input the node number (1 to 32) desired press Press return/enter button to to set then ESC to exit.
**COMPANY INFORMATION PAGE**

When power is first applied the company info page is displayed. Wait a few seconds and the Home page will appear. Or touch "LOGO" and it will immediately go to the Home page.

**HOME PAGE**

Touch the icon to go to the sections.

- Calibration
- Fault
- Alarms
- Settings
- Displays
- Diagnostics
- About

**CLEAN SCREEN**

To clean the screen press the clean screen icon on the home page, green blank page will come in to view with a countdown clock starting at 10 seconds. Use appropriate cleaner and cloth to clean this screen. When done it will automatically return to the home screen.
**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 span is 3 minutes long for calibration cycle of 6 minutes. The Right column will show In Zero and at about 30 seconds will update the Green Pass or the Red Fail icon. The values are entered at set up 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 is displayed below for your convenience. The system will automatically return to monitoring the process at the 6 minute point from cal start. You will know this because the Manual Cal Initiate icon will return to Green. It is not necessary to stay in this screen after initiation and recommended to return to the screen normally displayed.

**FAULT PAGE**

Acknowledge Fault button: when in fault pressing the Ack button will temporarily open the fault contact 14.

After time limit (set in tech screen 4: default 1 minute) if any fault is showing the relay will close, energize. If all faults are cleared the relay will auto reset to open, de-energize.
From the Home 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 return arrow.

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

All raised buttons can be touched and values changed.
All flat buttons are read only.
The opacity and mg alarms can be turned on or off by touching the appropriate alarm.

TECH SETUP AND BACKUP/RESTORE

All raised buttons can be touched and values changed.
Instructions are on the bottom of the screen when required.
All flat buttons are read only.
All raised buttons can be touched and values changed.
Instructions are on the bottom of the screen when required.

All flat buttons are read only.

Cal time is in 24hr clock format.

Note: If in internal the clock will control the cycle. While in external the internal clock is disabled and only an external input will activate the cycle.

Clone backup/restore

If not already there, Enter SD Password: 123

Backup: After startup is complete and all controller changes are made, enter a new file name with 8 characters and/or numbers only, no more, no less. Touch “Backup PLC -> SD” System backup all changes to the S.D. card.

Restore: to restore put the name of your backup and touch “Restore SD -> PLC. This will take several minutes to complete the backup.
All raised buttons can be touched and values changed. Instructions are on the bottom of the screen when required.

All flat buttons are read only.
SET LOCAL TIME AND DATE

To set to local time touch and hold any part of the Yellow back ground until Info Mode appears.

1. Touch “Enter Info Mode” at Enter Password page, enter 1111, and touch the return button.
2. Touch “Time & Date” button.
3. Enter the “Date” dd/mm/yy.
4. Enter the time in 24hr hh:mm:ss. Press ESC until Tech page returns.
All raised buttons can be touched and values changed. Instructions are on the bottom of the screen when required.

All flat buttons are read only.
CHANGE PASSWORDS

Only the tech can change passwords the default for Operator is (1111) and for Tech (1234). To change passwords touch raised button and enter new password (up to 8 numbers are provided).

The tech can reset to 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 IT IS CRITICAL THAT THE PASSWORD IS SECURED AGAINST LOSS. IF GATEKEEPER’S PASSWORD IS LOST CONTACT THE FACTORY FOR 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 to be used by Rosemount Factory trained technicians and detailed explanation of their use is not in the scope of this manual.

Touching the Controls button for control page requires the tech password.

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

Touch the Relays button in the sub menu for conditions of the relays to be checked, relay # is de-energized if gray energized if green.

Touch the Digital in the sub menu button, or the right arrow for checking input conditions. Inputs are gray if NO input, RED if input is active.
ALARM PAGE

The count reset clears the alarm count column.

Alarm Relay Auto/Manual operation default is Auto (automatic). To change it selected in the operator control page. See Appendix B for alarm relay matrix.

Auto/Manual select.
Touch the buttons to go to the display of interest.

Pages are:

1. Instant Opacity
2. 6 minute Average Opacity
3. Split opacity screen (Instant/Average)
4. Dust (mg/m³)
5. Optical Density
6. Op/Ave Trend (Red= Ave, Blue= Instant)
7. Dust Trend. Dust max scale can be changed by touching the scale button and entering the F.S (do not exceed 2000).
About page displays the basic setup information.
### SECTION 5 MODBUS AND ANALOG OUTPUTS

#### MODBUS ADDRESS INFORMATION

**MB** = Modbus Poll Read Discrete inputs (10001….20000)

**MI** = Modbus Poll Read Holding (4001…50000)

#### Read:

<table>
<thead>
<tr>
<th>Description</th>
<th>MB/MI</th>
<th>Example, Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0% to 99.9% instantaneous opacity</td>
<td>MI 230</td>
<td>181 = 18.1%</td>
</tr>
<tr>
<td>0% to 99.9% average opacity</td>
<td>MI 231</td>
<td>182 = 18.2%</td>
</tr>
<tr>
<td>O.D. 0-2.0</td>
<td>MI 232</td>
<td>2000 = 2.0 O.D.</td>
</tr>
<tr>
<td>Mg 0-2000</td>
<td>MI 233</td>
<td>20000 = 2000mg</td>
</tr>
<tr>
<td>Window dust</td>
<td>MI 234</td>
<td>0-10%</td>
</tr>
<tr>
<td>Relay 02 Zero to SM (6)</td>
<td>MB 230</td>
<td>Zero, not cal = 0, in cal =1</td>
</tr>
<tr>
<td>Relay 03 Span to SM (3)</td>
<td>MB 231</td>
<td>Span, not cal = 0, in cal =1</td>
</tr>
<tr>
<td>Relay 08 DAS in cal (6)</td>
<td>MB 232</td>
<td>Zero, not cal = 0, in cal =1</td>
</tr>
<tr>
<td>Relay 09 DAS in Zero (3)</td>
<td>MB 233</td>
<td>Zero, not cal = 0, in cal =1</td>
</tr>
<tr>
<td>Relay 10 DAS in span (3)</td>
<td>MB 234</td>
<td>Span, not cal = 0, in cal =1</td>
</tr>
<tr>
<td>Relay 11 (High alarm) [Mg]</td>
<td>MB 235</td>
<td>No alarm =0. Alarm =1</td>
</tr>
<tr>
<td>Relay 12 (High alarm) [OP]</td>
<td>MB 236</td>
<td>No alarm =0. Alarm =1</td>
</tr>
<tr>
<td>Relay 13 (High alarm Audible) [OP &amp; Mg]</td>
<td>MB 237</td>
<td>No alarm =0. Alarm =1</td>
</tr>
<tr>
<td>Relay 14 (Fault)</td>
<td>MB 238</td>
<td>No fault =0. Fault =1 (See fault list in manual)</td>
</tr>
<tr>
<td>Relay 15 (Opacity EW)</td>
<td>MB 239</td>
<td>No alarm =0. Alarm =1</td>
</tr>
<tr>
<td>Relay 16 (mg EW)</td>
<td>MB 240</td>
<td>No alarm =0. Alarm =1</td>
</tr>
</tbody>
</table>
### Read; Common fault individual blocks:

<table>
<thead>
<tr>
<th>Block</th>
<th>MB</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>In maintenance</td>
<td>241</td>
<td>In Maint. =0, Not In Maint. =1</td>
</tr>
<tr>
<td>SM Power status</td>
<td>242</td>
<td>Lost power to SM=0, Power OK =1</td>
</tr>
<tr>
<td>T2 Signal lost/low</td>
<td>243</td>
<td>Signal OK =0, Lost signal =1</td>
</tr>
<tr>
<td>Negative opacity</td>
<td>244</td>
<td>Positive opacity =0, Negative Opacity =1</td>
</tr>
<tr>
<td>Zero Cal Fail</td>
<td>245</td>
<td>Fail =1, Not fail =0</td>
</tr>
<tr>
<td>Span Cal Fail</td>
<td>246</td>
<td>Fail =1, Not fail =0</td>
</tr>
<tr>
<td>No Air flow (Modbus only)</td>
<td>247</td>
<td>OK =0, Not OK =1</td>
</tr>
<tr>
<td>Cal cycle</td>
<td>248</td>
<td>Off = 0, On = 1</td>
</tr>
</tbody>
</table>

### Read/Write:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>MB/MI</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote Cal. Initiate</td>
<td>249</td>
<td>Initiate cal =1</td>
</tr>
<tr>
<td>Alarm Set point [OP]</td>
<td>235</td>
<td>(Format: 1 - 100)</td>
</tr>
<tr>
<td>Alarm Set point [Mg]</td>
<td>236</td>
<td>5000 =500</td>
</tr>
<tr>
<td>Alarm delay</td>
<td>237</td>
<td>(Format: 1-360 seconds)</td>
</tr>
<tr>
<td>Early Warning Set point [OP]</td>
<td>238</td>
<td>(Format: 1 - MI 236)</td>
</tr>
<tr>
<td>Early Warning Set point [Mg]</td>
<td>239</td>
<td>900 = 90</td>
</tr>
<tr>
<td>Early Warning delay</td>
<td>240</td>
<td>(Format: 1-360 seconds)</td>
</tr>
</tbody>
</table>
RS/485 COMMUNICATIONS AND CONNECTION

**Port 2**, 6-pin R J25 connector Pin 1 (+), Pin 6 (-). RS-485 cabling may be up to 2000 feet in length. Belden P/N 3106A cable is recommended. **Note**: Cable drawing and pin out at the end of drawing section.

If not specified in the original order default is as follows. **NOTE**: The following communication parameters cannot be changed in the field the controller must be returned to the factory.

- **Baud Rate**: 9600
- **Data Bits**: 8
- **Parity**: None
- **Flow Ctrl**: None
- **Timeout**: 0.2 seconds.
**ALARM RELAY DESCRIPTIONS**

Alarm outputs are SPST relays. Relays are rated at: 30Vdc, 3Amp max per relay and 8Amp max per common. Common for Relays 08-16 should not be connected to other commons on the controller.

### OPM4001 ENHANCED Relays

#### Group 1 Relays
- (Zero solenoid to SM) 02
- (Span solenoid to SM) 03

#### Group 2 Relays
- In CAL to DAS (6 Minutes) - 08
- 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 Hi mg - 15
- Early warning Opacity - 16
- COM for Relays 08-16

Relays: Max 30Vdc, 120Vac
8A max/COM
3A max/relay

Relays: Max 30Vdc or 120Vac, 8A
ANALOG OUTPUT CONNECTIONS
OUTPUT CHANNELS #1, 2, 3 AND 4

**OPM4001 ENHANCED Analog output wiring list wiring list**

| Common for mA outputs - ACM |
| Positive 4-20mA output CH1 - Aout0 |
| Positive 4-20mA output CH2 - Aout1 |
| Positive 4-20mA output CH3 - Aout2 |
| Positive 4-20mA output CH4 - Aout3 |

**4-20MA**

The OPM4001 ENHANCED comes with four, 4-20mA output channels. The ranges are set during factory testing to the information supplied by the customers. Field changes can be made in the setup page. Maximum output Loop compliance is 500 Ohms.

*Channel 1* is dedicated to the Service Module display with F.S. -5 to 99.9% opacity.

*Channel 2, 3 and 4* can be used for DAS, recorder etc. To utilize the current loops (max 500 ohms total). F.S. ranges are customer selected.
The service module is used to pass signals to and from the transceiver and control unit and display opacity via digital meter, initiate maintenance zero and span cycles and insertion of external current meter in the transceiver to control unit 4-20mA loop.

**OPACITY / T2** - This switch selects the display of the stack digital meter. In the Opacity mode the digital displays % Opacity from the control unit. In the T^2 mode it is the signal out of the transceiver in % Transmittance ^2.

**OPERATE / ZERO** - This switch controls the zero mirror solenoid. In the operate position the mirror is not in the measuring path and is considered normal operation. When the mirror solenoid is energized the mirror is placed in the measurement path and is considered a maintenance condition, i.e. signal is not representative of the stack smoke. The control unit will indicate a Fault.

- Energizing and observe the digital meter to test the systems response to zero % opacity.
- Energize in conjunction with the span filter to observe the upscale span % opacity calibration point.

**OPERATE / SPAN** - This switch controls the span filter solenoid. In the operate position the span filter is not in the measuring path and is considered normal operation. When the span filter solenoid is energized the span filter is placed in the measurement path and is considered a maintenance condition, i.e., signal is not representative of the stack smoke. The control unit will indicate a Fault.

- Energize in conjunction with the zero mirror to observe the upscale span calibration point.

**NORMAL / TEST** - This switch controls the EXTERNAL mA METER connections. In the normal mode the terminals are shorted. In the test mode the terminals are open and the current loop from the transceiver is interrupted allowing the use of an external current meter to be placed in series with the transceiver current output. When this is in the test mode position it is considered a maintenance condition and fault condition. If no current meter is in the test jacks the loop current the control unit will indicate full scale and the control unit will indicate a Fault.
SECTION 6 CLEAR PATH ADJUSTMENTS

CLEAR ON STACK ZERO AND SPAN CALIBRATION

A clear stack condition must exist to perform this calibration. Power must have been on for no less than 30 minutes. Do not attempt these adjustments in inclement weather. After the cover is removed from the transceiver normal levels of day light in the area will not affect the calibration.

To complete this procedure the following items are required: Audit device Micro-turn 200 on-line test kit (p/n 1A99993H24) with a high filter of at least 0.8 O.D.

1. Swing both the retro and transceiver open and clean the protective windows. Return both to the closed position.

2. Verify alignment, returning beam is centered on the TTL target.

3. On the transceiver remove the screw below the target viewing window and pulling the housing straight back until it clears the optical plate.

4. On the Service Module make sure the normal/test switch is in the normal position.

5. NOTE: All adjustments are on the 222-1667 PC Board (p/n 1A99993H03 for replacement).

6. Adjust the 20 turn Zero potentiometer on board 222-1667 (p/n 1A99993H03 for replacement) marked "PT -1", CW for an upscale reading >15%, then slowly CCW for 0-1% opacity.

7. Install the Micro-turn 200 on-line test reflector on the transceiver and screw the device to the transceiver with the mounting screw. With the thumbwheel adjust the on-line reflector for the same opacity as in previous step and lock it in place.

8. Place the highest value filter (for best results at least a 0.8 O.D.) in the slot provided. Adjust the Span potentiometer on board 222-1667 (p/n 1A99993H03 for replacement) marked "PT -3" for the filters correlated value on the service module opacity display equals to the correlated value. See section six (6) for filter correlation formulas.

9. Remove the filter and adjust the Zero potentiometer PT-1 for 0-1%.

10. Insert the High filter again adjust PT-3 for its value, repeat steps until the values come within 0.5 % Opacity.

11. Remove the on-line test reflector and replace the transceiver cover and secure the transceiver in place. You must complete "Zero Reflector Adjustment" procedure next.
ZERO REFLECTOR ADJUSTMENT

After a clear or off stack zero has been performed the zero reflector needs to be adjusted.

1. Find and record the zero offset value found in the setup page under "Zero Cal Value".

2. On the service Module place the Opacity/ T2 switch in the Opacity position to observe the correlated opacity on the digital display.

3. Swing open the transceiver and initiate a zero with the zero switch on the service module to raise the zero reflector into place. Observe and record the zero value after 30 seconds. Return the mirror to normal resting position by returning the zero switch to operate position.

4. 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.

5. Remove the Allen wrench and initiate a zero utilizing the zero switch on the service module and after 15 seconds observe the reading is moving toward the desired value. (If value is away from desired repeat step 4 turn set screw C.C.W.)

6. Repeat steps 4 & 5 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 assure unit repeats desired value +/- 0.5% Opacity. Swing transceiver into operate position and secure in place. Record the zero final value.
SPAN FILTER VALUE

1. With the zero switch in zero, place the span switch in span. Span is not adjustable, final value is a function of filter value, transceiver calibration and OPLR. Record the final value.

2. Return both zero and span switches to operate, normal/test to normal, T2/Opacity to Opacity.

RECORD THE ZERO/SPAN VALUES

1. To record the final values you will need to enter the zero and span into the TECH set up page. This completes the calibration.

OFF STACK ZERO CALIBRATION

This procedure may be used if: A clear stack condition is not possible and the zero appears to be incorrect or if the flange to flange distance on site are different than the original factory set up.

Remove the transceiver and retro reflector from the hinge pins, remove the service module and install the system on OPM Opacity portable off stack test stands (1A99993H37) and 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.

1. Clean transceiver and retro windows.

2. Connect the control unit with the control to service module test cable kit and apply power to the system.

3. The retro reflector must be level.

4. Follow instruction for "Clear on stack zero and span calibration".
SECTION 7 MICRO-TURN AUDIT KIT

USING THE ON LINE ZERO REFLECTOR (OPTION)

The "Micro-turn" 200 on-line test and audit system (p/n 1A99993H24) may be used for:

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

The "Micro-turn" 200 on-line test and audit system (p/n 1A99993H24) contains a test reflector, three neutral density filters, filter certification certificates and carrying case.

Filter certification, replacement or additional Neutral Density Filters are available by calling 203-935-0102 ext 10. Ask for Neutral Density Filter certification information. If not regulated by EPA regulations in your State to a more frequent schedule it is suggested you re-calibrate Neutral Density Filters used for Opacity Audits at the minimum of 6 months. Filters are tested per USA Code of Federal Regulations 40CFR60 Appx. B, Performance Specification 1, Section 7.1.3 Attenuation Calibration. Filter certification

Neutral Density Filters for Micro-turn 200 are calibrated 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. The filters are scanned over the visible region from 380 to 780 nanometers in one nanometer steps and the resulting transmittances of the filter are weighted to the Source C Human Eye Response by multiplying each value by its associated response factor. The corrected values of transmittance are converted to % Opacity and the value is recorded on the filter and associated chart.
FILTER CORRECTION FORMULA

If you have an OPLR (correlation factor) other than 0.5 your slides will read differently. To calculate what the slide will read with another OPLR use the formula:

\[
O_{P2} = \left( 1 - \left( 1 - \frac{O_{P1}}{100} \right)^{M_2^{0.5}} \right) \times 100
\]

Where:

- \( O_{P1} \) = Standard filter Value in %
- \( M_2 \) = OPLR for your instrument
- \( O_{P2} \) = Standard Filter value at your OPLR in %

Example:

Standard filter value is 23.1% what will it read at OPLR of 1.5?

\[
O_{P2} = \left( 1 - \left( 1 - \frac{23.1}{100} \right)^{1.5^{0.5}} \right) \times 100 = 54.5\%
\]
SECTION 8 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 replace if necessary

Quarterly:
All daily and monthly checks 
Replace air filters (8 pack 1A99993H09)

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 all electrical connections are secure
Check air blower for excessive noise
Assure that airflow switch is operating properly
Yearly:

Clear stack or off stack zero

All quarterly checks

Remove transceiver and retro, clean air plenum

Replace any worn hoses and gaskets

Clean inner optics if necessary

Check all system operations

General

Corrective and preventive maintenance schedules should be adjusted according to site specific conditions to ensure the 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. Care should be exercised to ensure that 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:

It is recommends periodical, depending on the severity of the sensor locations 3-5 years between overhaul of our opacity system to keep them working at their optimal level. Overhauls become necessary do to the fact that over time dust, out gassing of electronic parts, removing protective covers, etc., manifest itself as overall optics degradation causing more frequent adjustments and poor performance of the opacity monitor.
Control unit preventive maintenance

Preventive maintenance consists of cleaning the instrument regularly and inspecting it occasionally for broken or damaged parts. Regular maintenance will improve the reliability of your instrument and prevent breakdowns.

Cleaning - Accumulations of dirt and dust on components act as an insulating blanket preventing efficient heat dissipation. Dust on circuit boards and wires can cause arcing and short circuits, resulting in damage to components or even instrument failure. Clean your instrument with clean high-pressure air before this happens!

The control unit chassis provides protection from dust and dirt and should be in place during normal operation of the instrument.

Exterior - Dust the chassis with a soft cloth. Dust the front panel with a soft paintbrush. Dirt clinging to the surface can be removed with a soft cloth dampened with a mild detergent and water solution. Avoid using abrasive cleaners, as they will scratch the housing and front panel.

Interior - Dust in the interior of the control unit should be removed before it builds up enough to cause arcing and short circuits during periods of high humidity. Dust is best removed from the interior by the type of canned air used for computer cleaning. Dirt clinging to the surfaces can be removed with a soft paintbrush.

Visual Inspection - Inspect the interior occasionally for broken connections, improperly seated semiconductors, damaged or improperly installed circuit boards, heat damaged components, etc. If heat damaged components are found, care must be taken to find the cause of the excessive heat and measures must be taken to prevent recurrence of the damage.

Semiconductor Checks - Periodic checks of the semiconductor devices in this instrument are not recommended. The best check of semiconductor performance is actual operation of the instrument.

Weather cover/blower preventive maintenance

Periodically - Check and inspect all hoses and wire connections inside the weather covers.

Air Filter - Remove and inspect replace the filter cartridge as necessary (8 pack p/n 1A99993H09).
<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control unit reads 99%, Alarm icon is on, Fault message T2 4-20mA FAULT, service module meter in T2 reads -20 or higher.</td>
<td>Transceiver current loop to the control unit is open</td>
<td>Service module Operate/test switch must be in Operate.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check wiring for open from control unit AN3 &amp; ACM to terminal 17 &amp; 16 at service module location.</td>
</tr>
<tr>
<td>Alignment is good but control unit reads high opacity or erratic in normal, zero &amp; span mode, service module meter in opacity reads high or erratic.</td>
<td>1- Reference voltage TP-2 on signal processor 1667 is lower than 9.3V</td>
<td>1- Adjust lamp drive PT-2 on the power modulator 1668 until Reference voltage TP-2 on signal processor 1667 is 10.0 +/- 0.2Volts.</td>
</tr>
<tr>
<td></td>
<td>2- Main lamp out</td>
<td>2- Replace main lamp assembly</td>
</tr>
<tr>
<td>Control unit reads High, zero/span values are OK</td>
<td>1- Smoke</td>
<td>1- Correct process</td>
</tr>
<tr>
<td></td>
<td>2- Alignment is out</td>
<td>2- Adjust alignment until centered on target.</td>
</tr>
<tr>
<td>High dust alarm and/or cal fail cal message</td>
<td>Transceiver window and/or zero mirror is dirty</td>
<td>Clean window and or zero mirror</td>
</tr>
<tr>
<td>Control unit reads High, zero/span values are OK, alignment is good</td>
<td>Dirt built up in flanges</td>
<td>Swing open transceiver &amp; Retro. Clean flanges with push rod.</td>
</tr>
<tr>
<td>Air purge icon on in the lower right corner of the Main Display</td>
<td>No air flow</td>
<td>Replace air blowers as necessary</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Replace air filters as necessary</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tighten hose clamps as necessary</td>
</tr>
<tr>
<td>No stack power fault message</td>
<td>Service module lost power or failed</td>
<td>Check power, check SM fuse. Replace as needed</td>
</tr>
</tbody>
</table>
## TROUBLE SHOOTING - CONTINUED

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance Mode message</td>
<td>Maintenance switch or maintenance function is on</td>
<td>Return all to operate positions.</td>
</tr>
<tr>
<td></td>
<td>1- Control unit zero/span key was pressed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2- Service module zero/operate switch in zero, span/operate switch in span</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3- Service module test/operate switch in test</td>
<td></td>
</tr>
<tr>
<td>Control unit blank</td>
<td>Control unit fuse open</td>
<td>Replace and check for shorts in the power supply or individual boards.</td>
</tr>
<tr>
<td>Part Number</td>
<td>Description</td>
<td>Section</td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>1A99993H03</td>
<td>OPM T Signal processor with detector board assembly installed.</td>
<td>X</td>
</tr>
<tr>
<td>1A99993H04</td>
<td>Power Supply/Modulator Board-PCB</td>
<td>X</td>
</tr>
<tr>
<td>1A99993H06</td>
<td>Zero reflector iris assembly with rotary solenoid, reflector tape and zero arm for Opacity Transceiver</td>
<td>X</td>
</tr>
<tr>
<td>1A99993H08</td>
<td>Replacement Air flow switch for air purge blower.</td>
<td>X</td>
</tr>
<tr>
<td>1A99993H09</td>
<td>8 Pack Air filter replacement element (ID 1.5 OD 4.5 HT 5.875 Black)</td>
<td>X</td>
</tr>
<tr>
<td>1A99993H11</td>
<td>P1 - Service Module output cable assembly</td>
<td>X</td>
</tr>
<tr>
<td>1A99993H12</td>
<td>P2 - Transceiver output cable assembly</td>
<td>X</td>
</tr>
<tr>
<td>1A99993H13</td>
<td>Service Module Assembly with Digital display, local zero/span and test jacks</td>
<td>X</td>
</tr>
<tr>
<td>1A99993H30</td>
<td>OPM4000 series control unit to service module 10' test cable.</td>
<td>X</td>
</tr>
<tr>
<td>1A99993H35</td>
<td>OPM3000/4000 Series Opacity Detector Board-PCB</td>
<td>X</td>
</tr>
<tr>
<td>Part Number</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>-------------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>1A99993H36</td>
<td>Retro Assembly Drop on pin type 3-15Ft.</td>
<td>X</td>
</tr>
<tr>
<td>1A99993H37</td>
<td>Off the Stack Opacity Test Stand for OPM3000/4000 series.</td>
<td>X</td>
</tr>
<tr>
<td>1A99993H39</td>
<td>Pair of Opacity Air plenum Plant Air Adaptors, accepts 1/4” or 1/2” NPT</td>
<td>X</td>
</tr>
<tr>
<td>1A99993H40</td>
<td>OPM3000/4000 Series Air Plenum Assembly (with lift-off hinge), opacity fits either Transceiver or Retro.</td>
<td>X</td>
</tr>
<tr>
<td>1A99993H41</td>
<td>OPM3000/4000 Series Opacity Transceiver protective window kit, 3-screws, 1-150x50mm lens, 1-O-ring, 1-lens retaining ring.</td>
<td>X</td>
</tr>
<tr>
<td>1A99993H42</td>
<td>OPM3000 Control unit s/n 850 up.</td>
<td></td>
</tr>
<tr>
<td>1A99993H43</td>
<td>OPM4001 Base Control Unit Spare/Replacement</td>
<td>X</td>
</tr>
<tr>
<td>1A99993H44</td>
<td>OPM4001 Enhanced Control Unit Spare/Replacement</td>
<td>X</td>
</tr>
<tr>
<td>1A99993H45</td>
<td>OPM SD Standard Backup Card (2GB)</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>OPM4000 Series Service Module Zero-Span controller main PC board.</td>
<td>X</td>
</tr>
</tbody>
</table>
SECTION 10 DRAWINGS

It is recommended to print drawings with the highest print quality.
Figure 3.

OPM6127 1OF3 – CONTROL UNIT TO SENSOR WIRING/DUAL BLOWER
OPM6127 30F3 – CONTROL UNIT TO SENSOR WIRING /NO BLOWER

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**Title:** OPM4001 Enhanced System Wiring /O Blower

**Company:** Rosemount Analytical

**Sheet No. 3 of 3**

**Drawn by:** [Name]

**Date:** [Date]

**Scale:** [Scale]

**Part:** OPM6127
RS485: PIN OUT

Use RS485 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 controller is used with a non-isolated external device, avoid potential voltage that exceeds +/- 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. Positive terminals must be wired to positive and negative terminals to negative.
### Section 11 Alarm Matrix

<table>
<thead>
<tr>
<th>Auto alarm reset without pushing rest button.</th>
<th>High mg Alarm 011: 0=open, 1= closed</th>
<th>High Op AL 012: 0=open, 1= closed</th>
<th>mg/Op Alarm silence 013: 0=open, 1= closed</th>
<th>E.W. Op AL 015: 0=open, 1= closed</th>
<th>E.W. mg Alarm 016: 0=open, 1= closed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start 0%, use test value above High set points.</td>
<td>0 0 0 0 0 0</td>
<td>1 1 1 1 1 1</td>
<td>1 1 1 1 1 1</td>
<td>1 1 0 1 1 1</td>
<td>0 0 0 0 0 0</td>
</tr>
<tr>
<td>&gt; Hi Mg 150mg set point after delay satisfied (AL)</td>
<td>1 1 1 1 1 1</td>
<td>1 1 1 1 1 1</td>
<td>1 1 1 1 1 1</td>
<td>1 1 0 1 1 1</td>
<td>0 0 0 0 0 0</td>
</tr>
<tr>
<td>&gt; Hi Op 20% set point after delay satisfied (AL)</td>
<td>1 1 1 1 1 1</td>
<td>1 1 1 1 1 1</td>
<td>1 1 1 1 1 1</td>
<td>1 1 0 1 1 1</td>
<td>0 0 0 0 0 0</td>
</tr>
<tr>
<td>Return to 0%</td>
<td>0 0 0 0 0 0</td>
<td>1 1 1 1 1 1</td>
<td>1 1 1 1 1 1</td>
<td>1 1 0 1 1 1</td>
<td>0 0 0 0 0 0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Auto alarm reset pushing rest button before returning to zero.</th>
<th>High mg Alarm 011: 0=open, 1= closed</th>
<th>High Op AL 012: 0=open, 1= closed</th>
<th>mg/Op Alarm silence 013: 0=open, 1= closed</th>
<th>E.W. Op AL 015: 0=open, 1= closed</th>
<th>E.W. mg Alarm 016: 0=open, 1= closed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start 0%, use test value above High set points.</td>
<td>0 0 0 0 0 0</td>
<td>1 1 1 1 1 1</td>
<td>1 1 1 1 1 1</td>
<td>1 1 0 1 1 1</td>
<td>0 0 0 0 0 0</td>
</tr>
<tr>
<td>&gt; set point after delays satisfied (AL)</td>
<td>1 1 1 1 1 1</td>
<td>1 1 1 1 1 1</td>
<td>1 1 1 1 1 1</td>
<td>1 1 0 1 1 1</td>
<td>0 0 0 0 0 0</td>
</tr>
<tr>
<td>&gt; set point EW, Reset button pushed</td>
<td>1 1 1 1 1 1</td>
<td>1 1 1 1 1 1</td>
<td>1 1 1 1 1 1</td>
<td>1 1 0 1 1 1</td>
<td>0 0 0 0 0 0</td>
</tr>
<tr>
<td>&gt; set point Process Alarm, Reset button pushed</td>
<td>1 1 1 1 1 1</td>
<td>1 1 1 1 1 1</td>
<td>1 1 1 1 1 1</td>
<td>1 1 0 1 1 1</td>
<td>0 0 0 0 0 0</td>
</tr>
<tr>
<td>Return to 0%</td>
<td>0 0 0 0 0 0</td>
<td>1 1 1 1 1 1</td>
<td>1 1 1 1 1 1</td>
<td>1 1 0 1 1 1</td>
<td>0 0 0 0 0 0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Manual alarm reset after returning to zero.</th>
<th>High mg Alarm 011: 0=open, 1= closed</th>
<th>High Op AL 012: 0=open, 1= closed</th>
<th>mg/Op Alarm silence 013: 0=open, 1= closed</th>
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<td>1 1 1 1 1 1</td>
<td>1 1 1 1 1 1</td>
<td>1 1 0 1 1 1</td>
<td>0 0 0 0 0 0</td>
</tr>
<tr>
<td>&gt; set point after delays satisfied (AL)</td>
<td>1 1 1 1 1 1</td>
<td>1 1 1 1 1 1</td>
<td>1 1 1 1 1 1</td>
<td>1 1 0 1 1 1</td>
<td>0 0 0 0 0 0</td>
</tr>
<tr>
<td>Return to 0%</td>
<td>1 1 1 1 1 1</td>
<td>1 1 1 1 1 1</td>
<td>1 1 1 1 1 1</td>
<td>1 1 0 1 1 1</td>
<td>0 0 0 0 0 0</td>
</tr>
<tr>
<td>Process Alarm reset button pushed</td>
<td>0 0 0 0 0 0</td>
<td>1 1 1 1 1 1</td>
<td>1 1 1 1 1 1</td>
<td>1 1 0 1 1 1</td>
<td>0 0 0 0 0 0</td>
</tr>
<tr>
<td>EW reset button pushed</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
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</tbody>
</table>

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<tr>
<th>Manual alarm reset before, than after returning to zero.</th>
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<td>1 1 1 1 1 1</td>
<td>1 1 1 1 1 1</td>
<td>1 1 0 1 1 1</td>
<td>0 0 0 0 0 0</td>
</tr>
<tr>
<td>&gt; set point after delay satisfied (AL)</td>
<td>1 1 1 1 1 1</td>
<td>1 1 1 1 1 1</td>
<td>1 1 1 1 1 1</td>
<td>1 1 0 1 1 1</td>
<td>0 0 0 0 0 0</td>
</tr>
<tr>
<td>Process Alarm reset button pushed</td>
<td>1 1 0 0 1 1</td>
<td>1 1 0 0 1 1</td>
<td>1 1 0 0 1 1</td>
<td>1 1 0 0 1 1</td>
<td>0 0 0 0 0 0</td>
</tr>
<tr>
<td>EW reset button pushed</td>
<td>1 1 0 0 1 1</td>
<td>1 1 0 0 1 1</td>
<td>1 1 0 0 1 1</td>
<td>1 1 0 0 1 1</td>
<td>0 0 0 0 0 0</td>
</tr>
<tr>
<td>Return to 0%</td>
<td>1 1 0 0 1 1</td>
<td>1 1 0 0 1 1</td>
<td>1 1 0 0 1 1</td>
<td>1 1 0 0 1 1</td>
<td>0 0 0 0 0 0</td>
</tr>
<tr>
<td>Process Alarm reset button pushed</td>
<td>0 0 0 0 0 0</td>
<td>1 1 0 0 1 1</td>
<td>1 1 0 0 1 1</td>
<td>1 1 0 0 1 1</td>
<td>0 0 0 0 0 0</td>
</tr>
<tr>
<td>EW reset button pushed</td>
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<td>0 0 0 0 0 0</td>
<td>0 0 0 0 0 0</td>
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