

## Opacity sensor



## Operating Instructions

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## CAUTIONS AND WARNINGS

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**CAUTION:** The discrete output must not be connected to outputs from other sensors (i.e. outputs from multiple sensors must not be connected in parallel). Parallel connections may damage sensor output circuitry.

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**IMPORTANT:**

This product is an accessory or part of a system. Always read and follow the manufacturer's instructions for the equipment before connecting this product. Comply with all applicable codes and safety regulations. Failure to do so may result in damage, injury or death.

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## CERTIFICATIONS:

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Pending

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## PRODUCT OVERVIEW

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The OPAX opacity sensor combines an infrared light source and photodiode receiver to achieve high-speed measurement of relative opacity in on-line applications. The OPAX effectively evaluates container opacity with a user adjustable threshold setting that controls the level at which the sensor output activates. The modulated infrared light source in the OPAX is directed through a sample. The diffused light returning to the sensor receiver is measured. When the level meets or exceeds the threshold, the discrete output changes state. Due to the fast response of the sensor, it is suitable for use in high-speed applications. The sensor provides a discrete output that automatically configures to NPN and PNP. A PLC or a computer can be used to monitor the status of the discrete output signal indicating that the container meets established opacity requirements. A position sensor (LASER-MARK) may be used to indicate to the PLC when a sample is in position and sensor output is valid.

The OPAX is a reliable, compact sensor with high-speed sensing capabilities. Two seven segment displays provide visual representation of the relative opacity from 00 to 99. The calibration feature and 3 LED intensity settings provide for flexible operation over a wide range of opacity levels.

## Specifications

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|--|---|
| Infrared light source                      | 880nm                                   |
| Sensing distance (transmitter-to-receiver) | 50mm...200mm                            |
| Sensitive area (sensor lens dia.)          | 18mm                                    |
| Response time                              | <150uS                                  |
| Switching Frequency                        | 6kHz                                    |
| LED Intensity                              | 3 levels                                |
| Relative intensity display range           | 00 to 99                                |
| Sensitivity                                | Adjustable                              |
| Signal level                               | Two 7 segment digits                    |
| Detection threshold                        | Two 7 segment digits                    |
| Digital Output                             | Auto-Detect PNP / NPN                   |
| Output Function                            | NO/NC selectable                        |
| Analog Output                              | 0...5V                                  |
| Security                                   | LOCK / UN-LOCK keypad                   |
| Power indicator                            | Green LED                               |
| Detect indicator                           | Red LED                                 |
| Programming indicator                      | Yellow LED                              |
| Data retention                             | EEPROM non-volatile memory              |
| <b>OPAX-1000 (receiver)</b>                |   |
| Dimensions                                 | 51mm x 61mm x 25mm (2.0" x 2.4" x 1.0") |
| Weight                                     | 95 g (0.21 lbs.)                        |
| <b>OPAX-1000 (transmitter)</b>             |   |
| Dimensions                                 | 8mm dia. x 38mm (.312" dia. x 1.5")     |
| Weight                                     | 95g (0.21 lbs.)                         |
| <b>LASER-MARK</b>                          |   |
| Dimensions                                 | 83 mm x 18 mm (3.3" x .7")              |
| Weight                                     | 200 g (.5 lbs.)                         |
| Supply Voltage                             | 10...24 VDC                             |
| Operating Current                          | 60 mA                                   |
| Short Circuit Protection                   | Discrete output                         |
| Overload / Reverse Polarity Protection     | Supply voltage                          |
| Operating temperature                      | -20°C...55°C                            |
| Storage temperature                        | -20°C...70°C                            |
| Housing                                    | Metal alloy                             |
| Mechanical protection                      | IP65 NOT FOR PRESSURE WASHDOWN          |

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## QUICKSTART GUIDE

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1. The display range is 00 through 99. The decimal points indicate the LED intensity level. The RED LED above the display indicates that the opacity level drops below the threshold setting.
2. Connect cable to power supply observing correct polarity. Connect the remote light source to the connector on the base of the sensor. Reference wiring diagram.
3. Apply power; sensor will initialize and perform its power up sequence.
4. Best results are achieved when the measurement is made through the center of the container. The light source must be positioned directly across from the sensor with the container passing between. To prevent scatter from adjacent containers, the sensor and the light source should be positioned 1cm to 2.5cm from the container surface as it passes through the light beam.
5. Place a sample container between the sensor and the light source and note the relative opacity reading on the display.
6. Various adjustments may be made to increase or decrease sensitivity; refer to the Sections Calibration Adjustment and LED Intensity Level. Refer to Section: Threshold, to alter threshold setting.
7. User programmable parameters are discussed in detail in the following sections.

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## OPERATION

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### Power up

Upon power up, the sensor initializes by turning on all segments on the display and sequencing through red, yellow and green on the status LED located above the display.

### Intensity display mode

During normal operation, the sensor display will indicate the relative opacity of a target within its field of view. The range of the relative opacity display is 00 through 99. The decimal points on the display indicate the LED output intensity. No decimal points indicate low, one decimal point indicates medium and two decimal points indicate high intensity.

### Calibration Adjustment

The calibration feature allows the displayed measurement to be adjusted to the desired value by the user.

#### *Adjusting the measured value:*

1. Place target in sensor's field-of-view. The sensor will display the current reading.
2. Press either key (for less than 3 seconds); while the current reading is displayed the value is flashed slowly indicating that the sensor is in the adjustment mode.
3. Press T/+ to increment the reading and P/- to decrement the reading.
4. Stop pressing either key and the sensor returns to normal operating mode in 3 seconds.

#### **Note:**

- While adjusting the reading, when a limit is reached the display flashes at a faster rate.
- The selected gain is stored in memory and is retained when power is removed.

## Local Lock

The local lock feature allows the sensor to be locked out, preventing adjustments by unauthorized personnel. To lock the sensor, press the P/- and T/+ buttons for 3 seconds until LL is displayed. To un-lock the sensor, press the T/+ and P/- for 3 seconds until LL is not displayed. While the sensor is locked, pressing either P/- or T/+ will result in LL (Local Lock) indication on the display.

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## Programmable Parameters

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All adjustments made to these parameters are stored in memory and are retained when power is removed. To enter programming mode press and hold the P/- key for several seconds, the current threshold setting will be displayed. Press and release the P/- key to scroll through the various settings. Press and release the T/+ key to change a particular setting. Press and hold the P/- for several seconds to return to the normal intensity display mode. The user programmable items are described below.

### Threshold

When the relative opacity level exceeds the threshold setting the red status LED will turn on and the discrete output will activate, indicating this condition. When the relative opacity level drops below the threshold (as determined by the hysteresis setting), the red LED will extinguish and the discrete output will de-activate. The threshold setting allows the user to select the detection level. The default setting is 15.

To adjust the threshold, enter programming mode, press and hold the P/- key for several seconds, the current threshold setting will be displayed. Press and release the T/+ key to increase the threshold level, to decrease the threshold level, continue to hold the T/+ key until the value approaches 99 then wraps around to 00.

### LED Intensity Level (U)

The LED intensity is indicated on the display as U1, U2 and U3 for low, medium and high intensity. Press and release the T/+ key to toggle through the 3 intensity levels. The default setting is U2, medium intensity.

### Hysteresis Level (H)

The hysteresis setting is indicated by H0 through H9. The hysteresis level is how far below the threshold the signal must drop to de-activate or un-detect. The hysteresis can be set from 0 to 9. For example, if the threshold is set at 25 and the increases to 25 or higher, the sensor will detect and activate its output. With the hysteresis set to 4, the signal must drop to 20 to un-detect. This feature is useful in cases where there may be variation within a target that might cause the intensity to increase above the threshold slightly; the hysteresis allows the output to remain activated until the level increases significantly. Press and release the T/+ key to change the hysteresis setting. The default setting is 2.

### Discrete Output Configuration

This setting allows the user to select either normal open (no) or normally closed (nc) configuration. The normally open configuration de-activates the output during normal un-detect operation, and activates the output upon detect. The normally closed configuration activates the output during normal un-detect operation, and de-activates the output upon detect. Press and release the T/+ key to toggle through the selections. Default is normally open.

## Extend Output Pulse (P)

This feature allows extending the minimum length of time that the discrete output remains active following target detection. The sensor response can be in the 25uS (microsecond) range, i.e. a target can move through the sensing range in 25uS and the discrete output would active for only that duration. A slower acquisition system (PLC) may not sample its inputs at a fast enough rate to capture the signal. The discrete output pulse can be extended from 0 to 90mS (milliseconds) in 10 mS increments as indicated by P0 through P9 on the display. Press and release the T/+ key to toggle through the selections.

## Null Offset (nu)

**NOTE:** *Always perform the null function when changing LED intensities.* The null feature allows the sensor to be “zeroed”. Block the light from the transmitter then press and hold the T/+ key to null the sensor. The display will flash the value that is being subtracted.

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## I/O Signals

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### Discrete Output

The discrete output is a PNP/NPN configuration allowing the user to provide a load on this output that is either pulled high to VDC or low to ground. The sensor monitors this level and automatically determines whether to operate the PNP/NPN driver. This output is typically connected to a PLC. The output remains active as long as the intensity level exceeds the threshold, in high-speed applications it may be useful to use the Extend Output Pulse feature to lengthen the signal duration to meet acquisition requirements of the PLC.

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### Analog Output

The analog output is 0-5V with 20mV resolution (8-bit). Any standard analog input channel typically available on a PLC may monitor this output. The analog output signal is useful in applications where simply triggering on the threshold is insufficient. For example, constant real-time monitoring of intensity in process allows minor fluctuations or trends to be detected permitting corrective action to be taken.

### Remote Lock/Unlock Input

The remote lock feature allows the user to lock out the local controls (keys) to prevent operators from making unauthorized adjustments. This signal line must be connected to VDC to lock the sensor. This line may be left unconnected if the lock feature is not used. While the sensor is locked, pressing either P/- or T/+ will result in rL (remote Lock) indication on the display.

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## Bracket Assembly

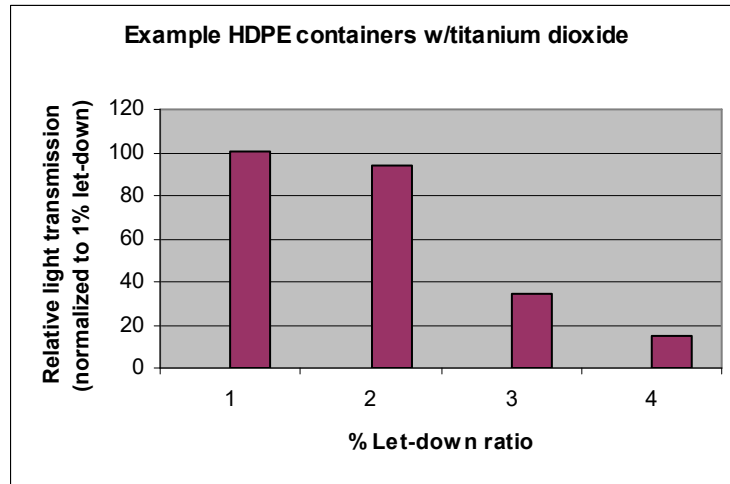
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The OPAX-1000B bracket assembly provides a means of mounting the OPAX-1000T transmitter, the OPAX-1000R receiver and LASER-MARK sensor. The transmitter side is adjustable along the top rail, allowing easy adjustment of spacing between the transmitter and receiver. Two 6mm nuts are provided for mounting of the bracket to user equipment.

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## Example of HDPE measurements

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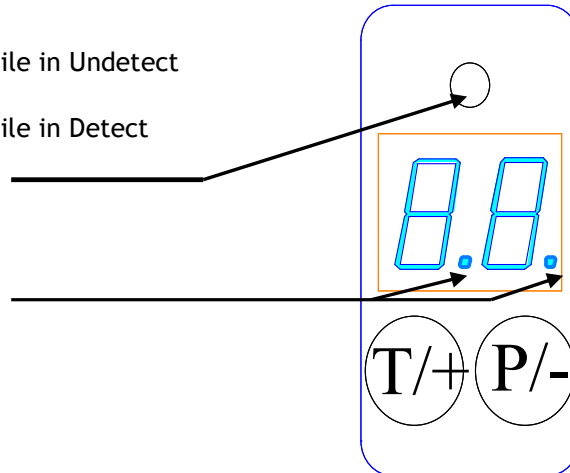
## Display Indicators

### Indicators

- Green LED      Threshold Mode while in Undetect
- Red LED        Detect
- Yellow LED     Threshold Mode while in Detect

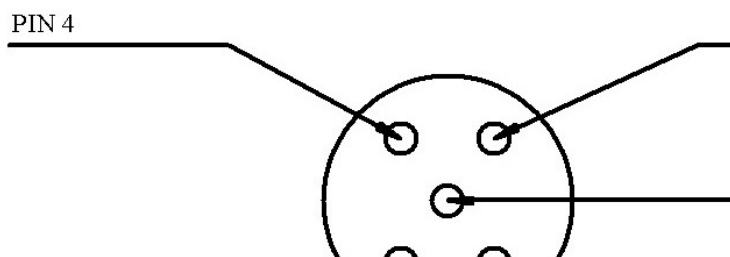
### Display decimal points

- None illuminated LED low intensity
- One illuminated LED medium intensity
- Two illuminated LED high intensity



## M12 connector pin assignments

| M12 Connector | Wire Color | Description                     |
|---------------|------------|---------------------------------|
| Pin 1         | Brown      | Power 10 to 24VDC               |
| Pin 2         | White      | Discrete output, PNP/NPN, NO/NC |
| Pin 3         | Blue       | Ground                          |
| Pin 4         | Black      | Analog output (0-5V)            |
| Pin 5         | Yellow     | Remote lock                     |





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## Ordering information

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OPAX-1000R      Opacity sensor receiver



OPAX-1000T      Opacity sensor transmitter (light source)



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## Accessories

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**LASER-MARK**  
Position sensor



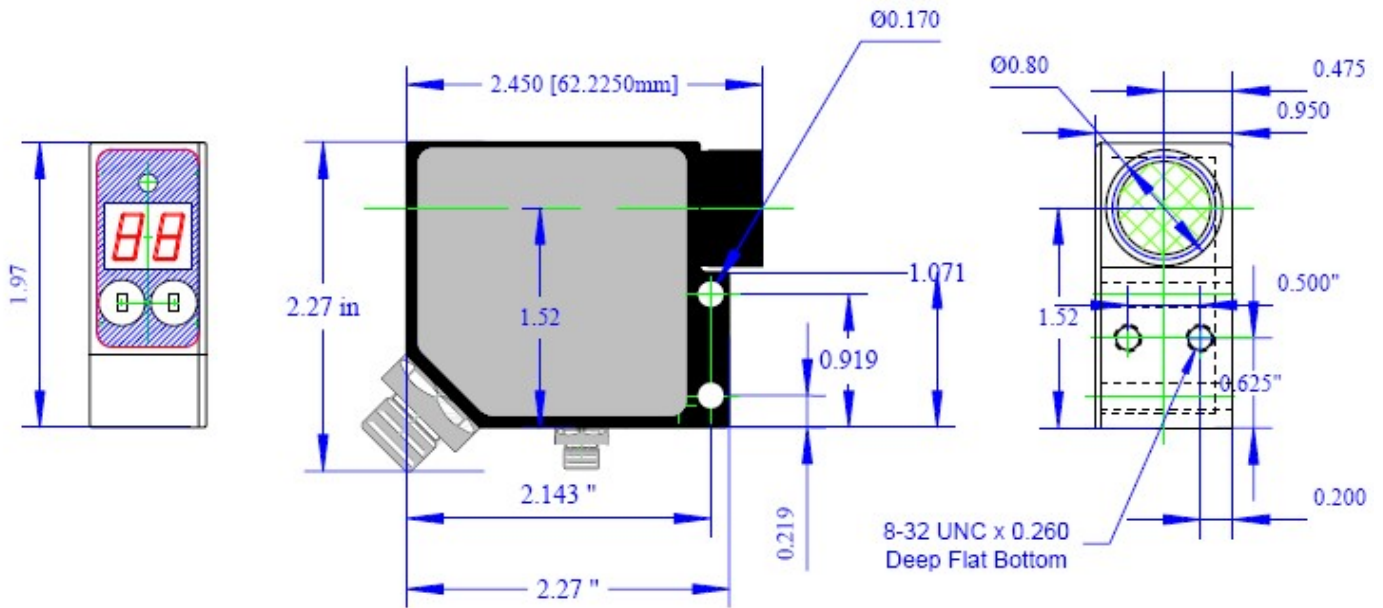
**OPAX-1000B**  
Bracket



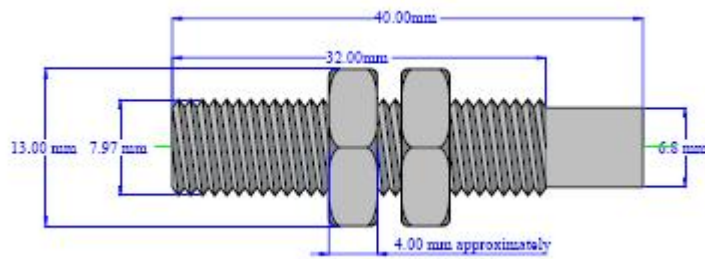
**UVX 300-C**  
5 meter cable with M12  
5-pin connector

# Dimensional Details

## OPAX-1000R



## OPAX-1000R



### **WARRANTY**

EMX Industries Incorporated warrants all products to be free of defects in materials and workmanship for a period of two years under normal use and service from the date of sale to our customer. This warranty does not cover normal wear and tear, abuse, misuse, overloading, altered products, damage caused by incorrect connections, lightning damage, or use other than intended design.

There is no warranty of merchantability. There are no warranties expressed or implied or any affirmation of fact or representation except as set forth herein.

EMX Industries Inc. sole responsibility and liability, and the purchaser's exclusive remedy shall be limited to the repair or replacement at EMX Industries option of a part or parts found not conforming to the warranty. In no event shall EMX Industries Inc. be liable for damages of any nature, including incidental or consequential damages, including but not limited to damages resulting from non-conformity, defect in material or workmanship.

*effective date January 1, 2002*

