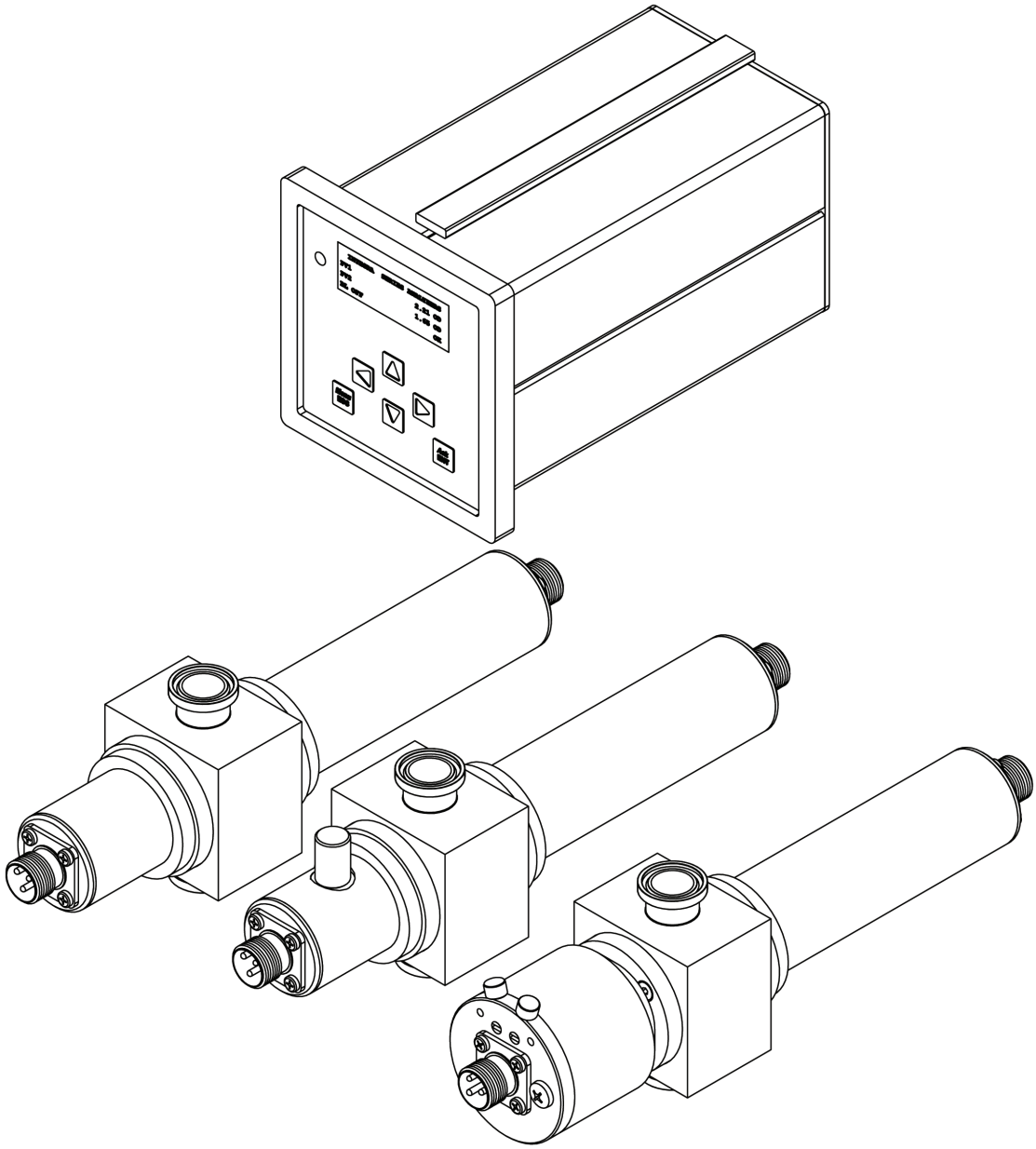
Operating Instructions

Model OUM960 UV Analyzer/ Model OUSAF44 UV Inline Sensor

Analyzer/Sensor to measure UV Spectral Absorbance



P/N 71002849 Rev 3
BA924C/07/en/0609

Endress+Hauser

People for Process Automation

Table of Contents

1. SAFETY INSTRUCTIONS 5

1.1 Designated Use 5
1.2 Installation, Start-Up and Operation 5
1.3 Operational Safety 5
1.4 Return 6

2. GENERAL INFORMATION 7

2.1 How the Model 960 UV Analyzer Works 7
2.2 Concentration and Absorbance Units 7
2.3 Easy Interfacing 7

3. INSTALLATION 9

3.1 Model OUM960 Analyzer Installation 9
3.2 Model OUM960 Cables and Wiring 10
3.3 DC Input Power Option 11
3.4 Model OUSAF44 Sensor Installation 12
3.5 Cable OUK40 Structure and Termination of Measurement Cable 13
3.6 Post-Connection Check 14

4. OPERATION 15

4.1 Quick Operation Guide 15
4.2 Display and Operating Elements 15
4.2.1 Operating Elements 15
4.2.2 Operation Legend 16
4.3 Local Operation 16
4.3.1 Measuring Mode 16
4.3.2 Configuration Mode 18
4.4 Remote Operation 19

5. COMMISSIONING 20

5.1 Function Check 20
5.2 Switching On 20
5.3 Analyzer Configuration and Operation 21
5.3.1 Factory Default Setting 22
5.3.2 Sensor Calibration 22
5.3.2.1 Liquid Calibration Procedure 22
5.3.2.2 Easycal™ Set up and Calibration 24
5.3.3 Change Pathlength Setting 27
5.3.4 Setup Output Span 27
5.3.5 Output Relay Set Point and Configuration 28
5.3.6 Current Output Calibration 30
5.3.7 Date and Time Setting 30
5.3.8 Configuration and Use Digital Input 31
5.3.9 Process Control 32
5.3.9.1 Access of Process Control 32
5.3.9.2 Baseline (AutoZero) 32
5.3.9.3 Optical Zero 33
5.3.9.4 Lamp Switch 33
5.3.9.5 Optical Check 33
5.3.9.6 Password Protection 35

5.3.9.7 Process Value Correlation 36

6. MAINTENANCE 39

6.1 MAINTENANCE OUTLINE 39
6.2 MERCURY LAMP REPLACEMENT FOR OUSAF44 40
6.3 OUSAF44 MEASUREMENT DETECTOR/FILTER REPLACEMENT 42
6.4 MEASUREMENT FILTER REPLACEMENT (EASYCAL™ ASSEMBLY) 43
6.5 MEASUREMENT FILTER REPLACEMENT (STANDARD AND CAL ROD ASSEMBLIES) 44
6.6 SENSOR WAVELENGTH CHANGE 45
6.7 SENSOR WINDOW AND GASKET REPLACEMENT 45
6.8 SENSORS WITHOUT PRECISION OPTICAL PATH LENGTH ADJUSTER OPTION 46
6.9 SENSORS WITH PRECISION OPTICAL PATH LENGTH ADJUSTER OPTION 47

7. REPLACEMENT PARTS LIST 51

7.1 MODEL OUM960 UV ANALYZER 51
7.2 MODEL OUSAF44 UV INLINE SENSOR /OUA260 FLOW CELL 51

8. TECHNICAL INFORMATION 52

8.1 UV ANALYZER OUM960 52
8.1.1 Input 52
8.1.2 Output 52
8.1.3 Power Supply 52
8.1.4 Performance 53
8.1.5 Environment 53
8.1.6 Mechanical Construction 53
8.2 UV ABSORBANCE SENSOR OUSAF44 53
8.2.1 Input and Output 53
8.2.2 Mechanic Construction 53
8.2.3 Environment 55
8.2.4 Power Supply 55
8.2.5 Optical Specifications 55

9. ORDERING INFORMATION 56

9.1 UV ANALYZER OUM960 56
9.2 UV ABSORBANCE SENSOR OUSAF44 57
9.3 MODEL OUA260 FLOW CELL 58
9.4 MODEL OUK40 UV SENSOR CABLE SET 59

1. Safety Instructions

1.1 Designated Use

Integra Model OUM960 is an analyzer for determining the UV absorbance of a liquid medium.

The analyzer is particularly suited for use in the following areas:

- Bio-Technology industry
- Waste water processing
- Chemical processing industry
- Food industry
- Pharmaceutical industry

Any other use than the one described here compromises the safety of persons and the entire measuring system and is, therefore, not permitted. The manufacturer is not liable for damage caused by improper or non-designated use.

1.2 Installation, Start-Up and Operation

Please note the following items:

- Installation, electrical connection, start-up, operation and maintenance of the measuring system must only be carried out by trained technical personnel. The technical personnel must be authorized for the specified activities by the system operator.
- Technical personnel must have read and understood these Operating Instructions and must adhere to them.
- Before commissioning the entire measuring point, check all the connections for correctness. Ensure that electrical cables and hose connections are not damaged.
- Do not operate damaged products and secure them against unintentional commissioning. Mark the damaged product as being defective.
- Measuring point faults may only be rectified by authorized and specially trained personnel.
- If faults can not be rectified, the products must be taken out of service and secured against unintentional commissioning.
- Repairs not described in these Operating Instructions may only be carried out at the manufacturers or by the service organization.

1.3 Operational Safety

Relevant regulations and standards have been met. As the user, you are responsible for complying with the following safety conditions:

- Installation instructions
- Local prevailing standards and regulations.

EMC

This instrument has been tested for electromagnetic compatibility in industrial use according to applicable standards.

Protection against interference as specified above is valid only for an instrument connected according to the instructions in these Operating Instructions.

1.4 Return

If the device requires repair, please contact your Endress+Hauser representative. Please use the original packaging, if possible.

Notes on safety icons and symbols

Safety icons

Warning!
This symbol alerts you to hazards. They can cause serious damage to the instrument or to persons if ignored.

Caution!
This symbol alerts you to possible faults which could arise from incorrect operation. They could cause damage to the instrument if ignored.

Note!
This symbol indicates important items of information.

Electrical symbols

⎓ **Direct Current (DC)**
A terminal at which DC is applied or through which DC flows.

~ **Alternating Current (AC)**
A terminal at which (sine-form) AC is applied or through which AC flows.

Ground connecting
A terminal is already grounded using a grounding system.

Protective earth terminal
A terminal which must be grounded before other connections may be set up.

Alarm relay

Input

Output

2. General Information

The Model OUM960 UV analyzer is used in conjunction with a Model OUSAF44 sensor to measure the spectral absorbance of process liquid in the UV region of the electromagnetic spectrum.

Dependent upon the optical pathlength of the connected sensor, the instrument can measure up to 50 Optical Density (OD) units.

The Model OUM960 UV analyzer is manufactured from state of the art digital electronics. Plant interface is through quick disconnect screw terminals on the back of the module. The user interface is comprised of a 6-button tactile feel keypad and 4 x 20 character alphanumeric LCD display.

2.1 How the Model 960 UV Analyzer Works

The Model OUSAF44 sensor generates two photocurrent (nA) detector signals based upon the amount of UV energy present at its lamp source (reference) and measurement point internally. The Model OUM960 unit computes the logarithmic ratio of these two signals and determines the absorbance of the liquid passing through the sensor. The absorbance value is expressed in optical density units (OD) and is displayed on the front panel. Two galvanic isolated analog current outputs, proportional to the OD reading, are simultaneously transmitted for connection to other instrumentation and recording devices.

2.2 Concentration and Absorbance Units

The concentration of an optically absorbing material in a mixture can be determined since it is related to the amount of light absorbed from a beam of light passing through it. The absorbance of a substance is directly proportional to the concentration of the material that causes the absorption. The Lambert-Beer Law describes this relationship of absorbance (A) to concentration. Essentially, the amount of radiation transmitted through the absorbing material decreases logarithmically with its increasing concentration.

$$\text{Where } A = \log\frac{1}{T} = \log\frac{Io}{Ir} \quad \text{and} \quad T = \frac{Ir}{Io}$$

The above assumes that the optical pathlength remains constant. The optical density (OD) however, is defined as Absorption per unit length. Normalizing to an optical pathlength of 1cm, it follows that:

$$OD = \frac{1}{L}(A)$$

Where OD = Optical Density
A = Absorbance
= pathlength in cm

2.3 Easy Interfacing

The Model OUM960 UV analyzer incorporates a front panel display and two analog current output signals. The display on the front panel is an alphanumeric 4 x 20 character LCD. The display may be configured for process variable or analog current output measurements. Optical Density (OD) readings are normalized to a 1cm pathlength.

There are two analog current outputs from the unit. The range of each can be independently set to be any range within the measurement range of the instrument. One output is configured to operate with measurement baseline shift commands, while the other tracks full scale of the instrument.

The analog current outputs (4-20mA) will operate with loads up to 750 ohms. These outputs are galvanically isolated and conform to NAMUR Standard[i].

Model OUM960 is supplied as standard with four digital inputs and three digital output relays.

The digital inputs can be configured to perform a variety of functions such as baseline and sensor lamp off/on.

The outputs can be connected to a PLC for inclusion in a control scheme, for simple valve operation or for local indication (alarms) and annunciation. Alarm status indication is provided on the front panel display.

All digital inputs are optically isolated.

[i] **i** NAMUR Standard Limit Detection when enabled is set to ERROR if the signal level is above 21 mA or below 3.6 mA for more than 4 seconds. The ERROR status is cleared when the signal returns to the normal 4-20 mA range.

3. Installation

3.1 Model OUM960 Analyzer Installation

Before starting installation, inspect the analyzer, sensor, and supplied cable set for any signs of shipping damage. Report any visual damage or discrepancies to Endress+Hauser Conducta and the Shipper immediately.

The Model OUM960 Analyzer is a ¼ DIN enclosure which can be installed in a variety of panels, wall or bench top housings. Refer to figure 3.1 for mounting dimensions. Mount or install the Analyzer into an enclosure or area that is not subject to excessive vibration or shock and will protect the instrument from materials such as water and chemicals. Allow enough clearance behind it for cable access.

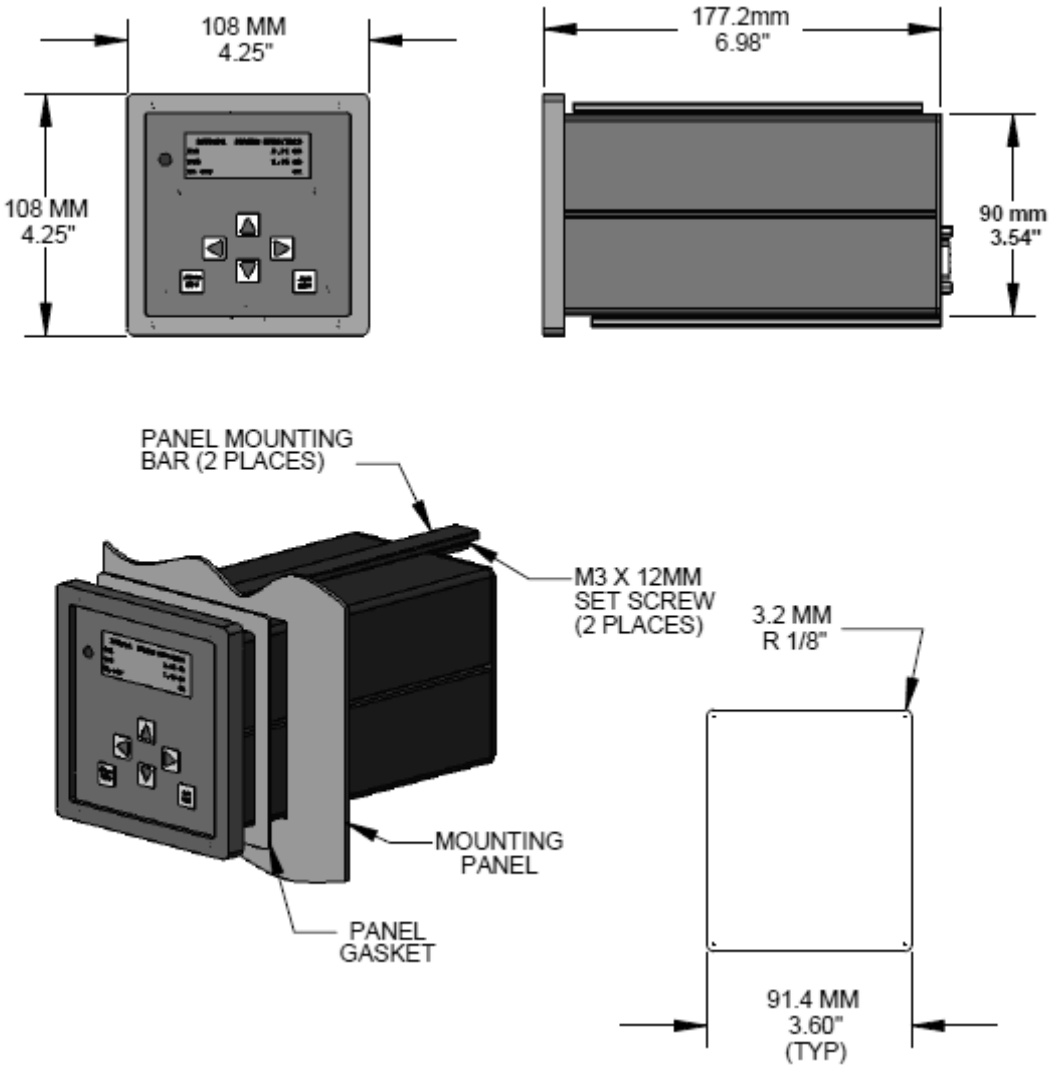


Figure 3.1: Model OUM960 Analyzer Mounting

3.2 Model OUM960 Cables and Wiring

All wiring terminals are located on the back panel of the Model OUM960. The analyzer/sensor interconnection cables supplied with the system have all been pre-terminated and labeled for ease of installation. The Model OUM960 has two (2) analog current outputs of 4 to 20mA. Both are capable of driving loads up to 750 ohms.

In addition to the analog outputs, three (3) galvanic isolated digital outputs (N.O.) are available. These outputs are rated for both AC and DC voltages up to 280 volts at 125mA. These outputs are intended for dry contact or pilot applications.

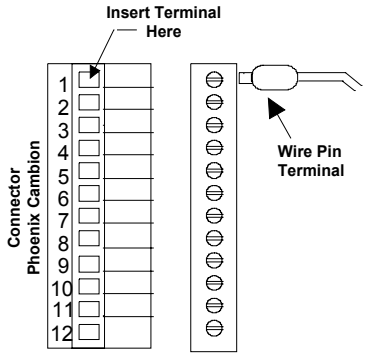


Figure 3.2: Wire Terminal Preparations

Cables installed for signal connection (i.e. analog outputs, lamp fail output) should be shielded twisted pairs.

Warning!
When routing the cables, separate signal cables from power wiring!

Caution!
Use dry contact only when connect digital input to analyzer!

Refer Figure 3.3 for wiring connection.

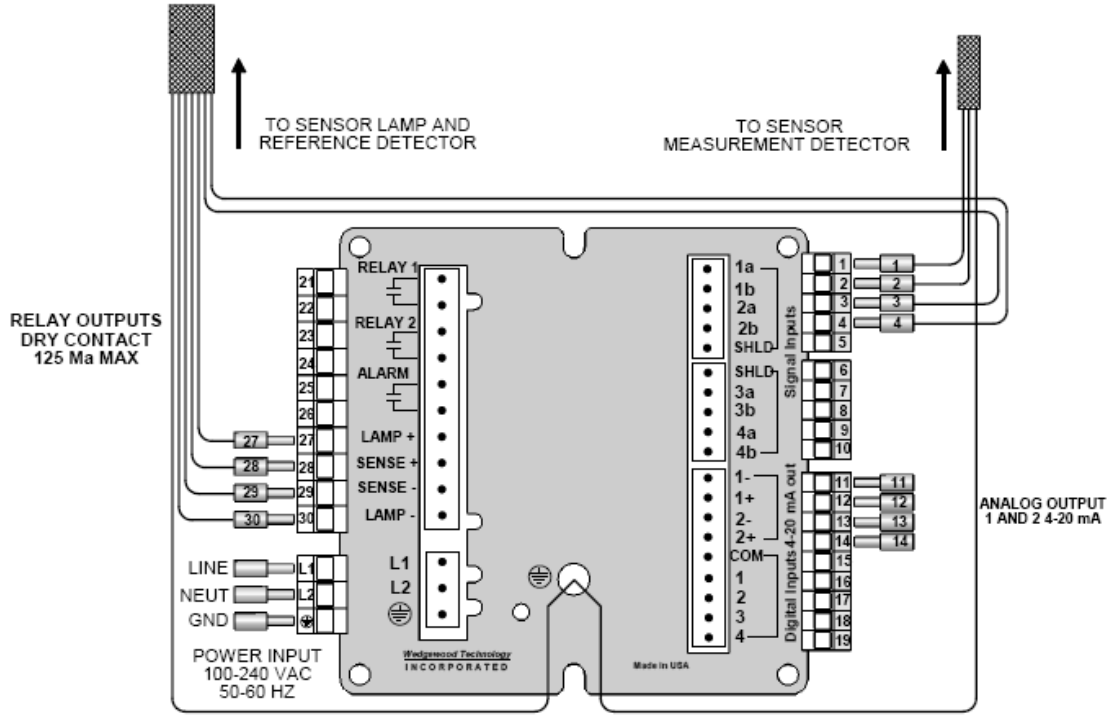


Figure 3.3: Model OUM960/OUSAF44 Wiring Diagram (AC Input Version)

3.3 DC Input Power Option

For instruments supplied for 24VDC operation, only the power input connection is changed. Figure 3.4 shows the connection detail for a 24VDC unit.

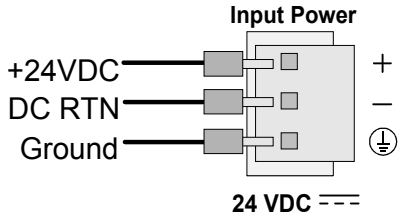


Figure 3.4: Integra DC Power Connection

3.4 Model OUSAF44 Sensor Installation

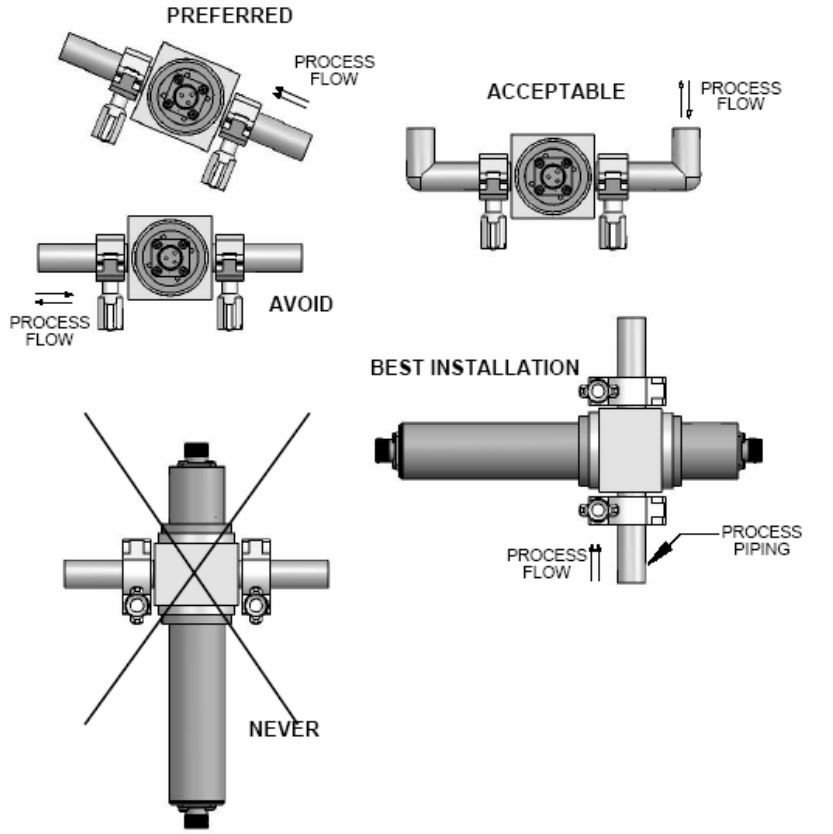


Figure 3.5: Recommended Orientation for Sensor Installation

Sensors can be installed either directly in a process line or in a by-pass line. They can be mounted either vertically or horizontally. If mounted horizontally, the sensor lamp and detector housings must be horizontal. This will insure that the optical window surfaces are in a vertical position, which will help prevent build up on the window surfaces. The sensor should be located upstream of pressure regulators. Operating sensors under pressure will help to avoid the possibility of air or gas bubble evolution, which can cause measurement noise and error.

When installing, allow adequate space for the connection of cables at the ends of the lamp and detector housings. Access to these areas is also important for connection/disconnection purposes. Sensor bodies should be supported when in line and care should be taken to ensure they are protected against damage caused by external forces such as carts on adjacent walkways.

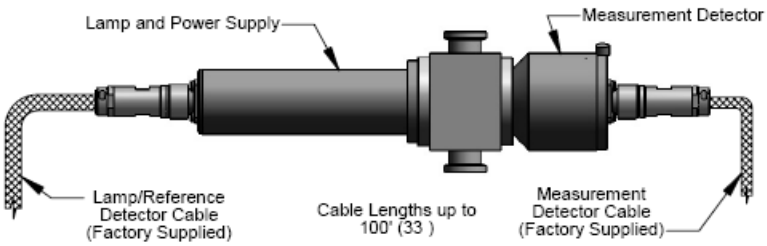


Figure 3.6: Typical OUSAF44/45/46 Sensor With Cables Connected.

3.5 Cable OUK40 Structure and Termination of Measurement Cable

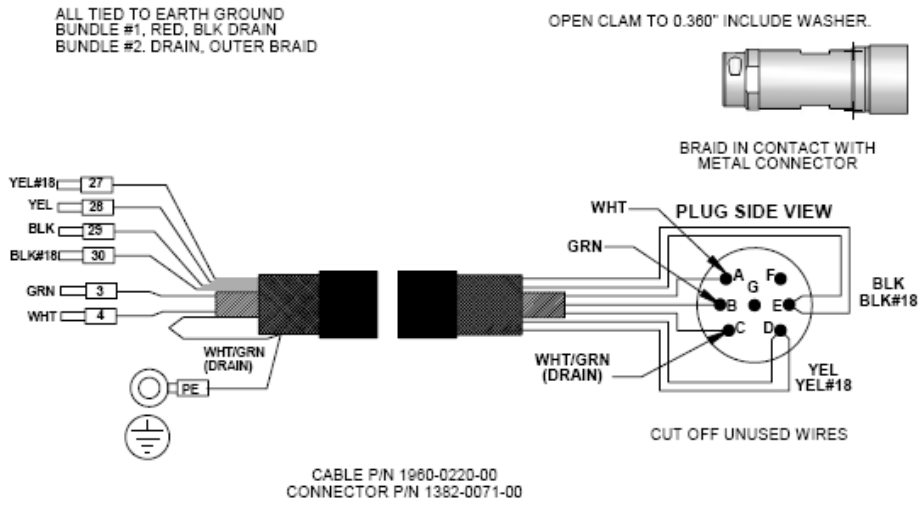


Figure 3.7: OUSAF44 Cable at Lamp Side

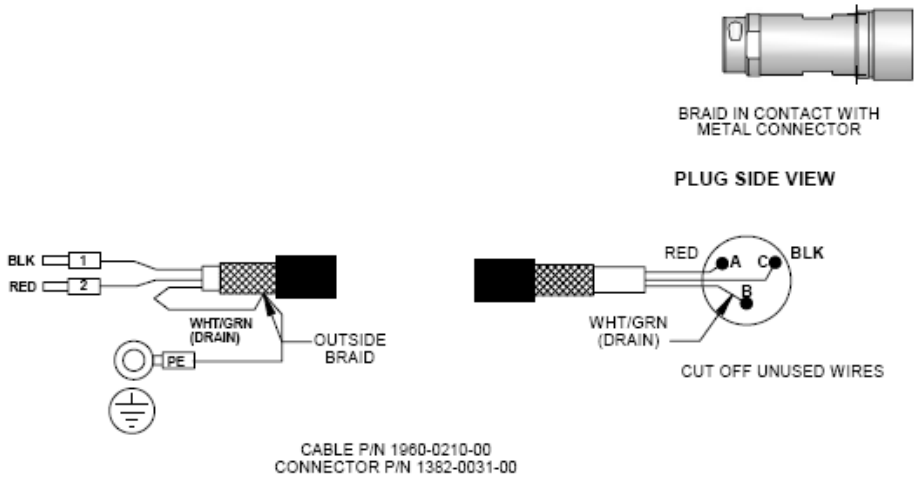


Figure 3.8: OUSAF44 Cable at Detector Side

3.6 Post-Connection Check

After wiring up the electrical connection, carry out the following checks:

Device Status and Specifications	Remark
Is the analyzer or the cable externally damaged?	Visual inspection

Electrical connection Remarks	Remark
Are the installed cables strain-relieved?	
No loops and cross-overs in the cable run?	
Are the signal cables correctly connected according to the wiring diagram?	
Are all screw terminals tightened?	
Are all cable entries installed, tightened and sealed?	
Are the PE distributor rails grounded (if present)? Grounding at place of installation	Grounding at place of installation

Caution!
Improper grounding will lead to unreliable measurement result!

4. Operation

4.1 Quick Operation Guide

User has the following ways of operating the analyzer:

- On site via the keypad
- Via the digital input interface to perform process control functions remotely.

4.2 Display and Operating Elements

4.2.1 Operating Elements

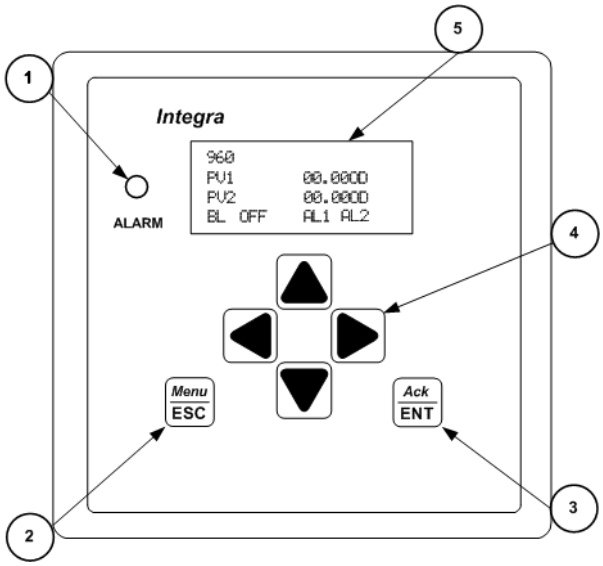


Figure 4.1: Operating Controls

1. LED for lamp warning functions and limit relay status.
2. Menu/ESC key serves two functions. Pressing Menu/ESC will always exit out of a screen and will not save any changes Entered. Pressing Menu/ESC from the main PV[ii] or Output screen will open the Sub-Menu screen.
3. Ack/ENT key accepts changes in a screen and continue forward through the screen
4. 4 keys navigate the user through the menus and screens.
5. LC display for displaying the measured values and configuration data LED.

[ii] **PV** is the Process Value for PV1 and PV2 and corresponds to Output 1 and Output 2 respectively.

4.2.2 Operation Legend

In this manual, the following operation legend will be used when describing operation procedure.

Enter/Acknowledge key

Escape/Menu key

Left or Right key

Up or Down key

Figure 4.2: Operation Legend for Operation Instruction

4.3 Local Operation

4.3.1 Measuring Mode

The analyzer normally operates in measuring mode. Here, the relays and alarm LED are triggered by the analyzer according to process status. The analyzer will take configurable digital input to trigger certain function like BaseLine Zero[iii], Optical Zero[iv] etc...

During the measuring mode, the LCD screen will display as figure 4.3. The process value, unit and analyzer label will be displayed permanently. BaseLine, Alarm and Lamp Status will be display when conditions are met.

Figure 4.3: LCD display on measuring mode

[iii] **BaseLine Zero** when enabled offsets the PV to zero. This often used to subtract background absorbance prior to initiating a process.

[iv] **Optical Zero** is established during calibration and the set with a non-absorbing liquid in the flow cell. i.e. de-ionized water.

Table 4.1 shows the status display description and display condition.

Status Area Name	Displayed symbol	Description and Display criteria
Analyzer Label	"xxxxxxxxxxxx"	Editable up to 12 characters for user analyzer indentification.
Process Unit	"OD"	Display "OD" under normal condition,
	"xxxxxx"	Displays user configured engineering unit if PV correlation function is activated.
Over Range Symbol	"OVER"	Displays if measurable range is reached.
BaseLine Status	"BL OFF"	Displays if BaseLine is not activated.
	"BL ON"	Displays if BaseLine function is activated.
	"BL SFT"	Displays if BaseLine and BaseLine Shift function are both activated.
Alarm	"AL x"	Displays if corresponding relays (1, 2, or both) are triggered.
Lamp Status	"LAMP LOW"	Flash if reference voltage is lower than 80% of initial value.
	"LAMP FAIL"	Displays if lamp reference signal is lost.
	"LAMP OFF"	Displays if lamp is turned off.
Cable Status	"CABLE FAULT"	Displays if lamp or signal cable has a faulty connection.

Table 4.1: Operation screen under measuring mode

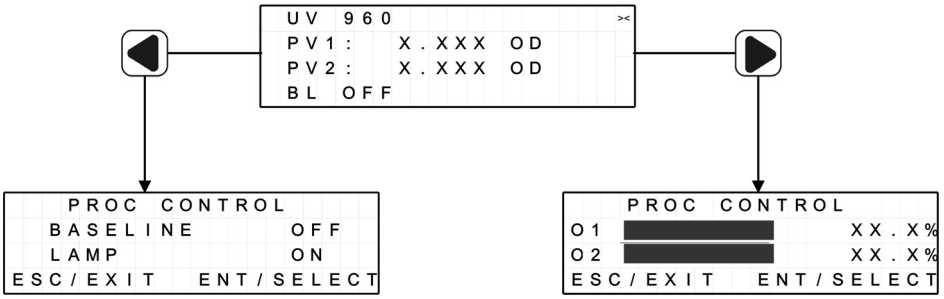


Figure 4.4: Operations under Measuring Mode

Under measuring mode, press button will let you enter the process control screen, where user can operate process control routine. The detail of process control function will be listed in Chapter 6.

4.3.2 Configuration Mode

The configuration and calibration functions are arranged as function groups.

- Use Menu ESC key to enter the function group menu from measurement screen.
- Use ▼ ▲ arrow key to select the group from process set-up, maintenance, or system data.
- Use Ack ENT to confirm the change and input the value.
- If a modified setting is confirmed with Menu ESC, the old setting is retained.

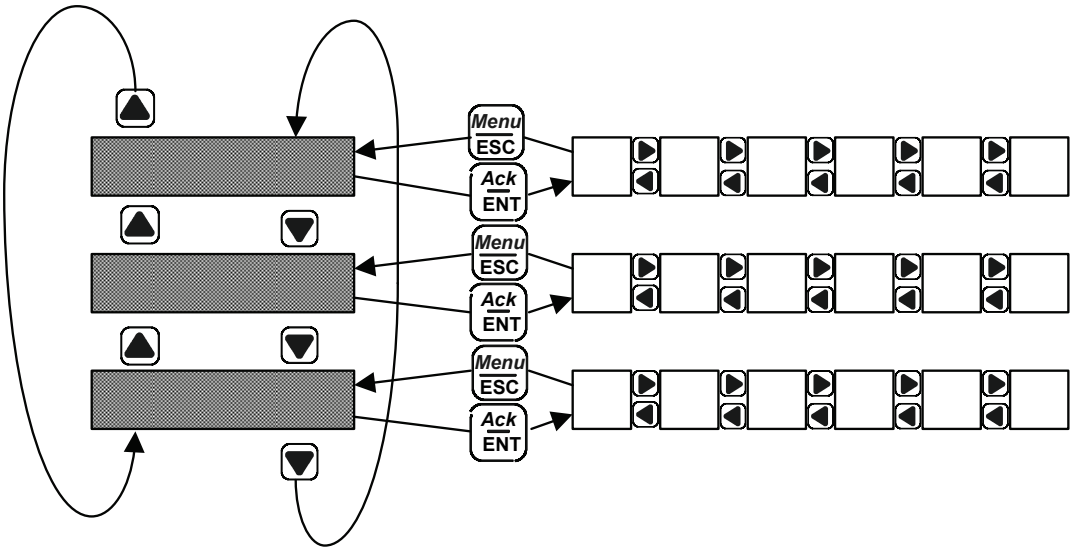


Figure 4.5: Diagram of configuration structure

Input data

During the system configuration and set up procedure, user will need to input the data into the screen.
In the data input screen

- Use ◀ ▶ to move the cursor to select the digit to edit.
- To change the decimal point of the input data, place the cursor on decimal point, use ▼ ▲ to move the decimal point to the left or right.

Figure 4.6: Decimal Point Position Placement

4.4 Remote Operation

Remote operation function will provide user the ability to use off site dry contact to perform the process control. Short input channel pin to COMMON pin will trigger the input the channel.

Refer section 5.3.8 to configure and use digital input function for remote control.

Digital Input #	Description and Display criteria
1	Lamp On/Off
2	Enable BaseLine function
3	Update BaseLine value
4	Optical Zero
	Hold current process measurement (both display and analog output)

Table 4.2: Digital Input Functions

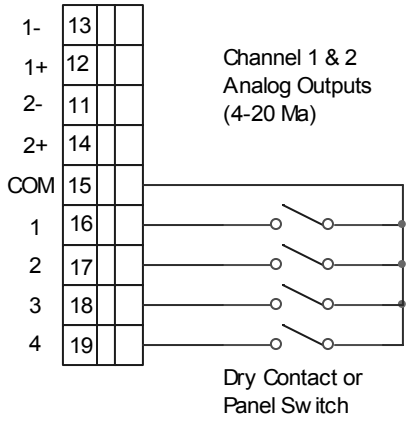


Figure 4.7: Typical Digital Input Wiring Diagram

5. Commissioning

5.1 Function Check

Warning!

- Check all connections for correctness.
- Make sure that the supply voltage is identical to the voltage written on the technical information!

5.2 Switching On

Familiarize yourself with the operation of the analyzer before it is first switched on. Please refer in particular to the "Safety Instructions" and "Operation" sections. After power-up, the device performs a diagnosis for 30 seconds and then goes to the measuring mode.

Lamp Initial Set-Up

The first time the analyzer is turned on with a new UV lamp, a “LAMP LOW” symbol will be shown on the display screen. The front LED will be flashing and lamp alarm relay will be toggled. To remove this warning message, the lamp status has to be initialized from the software. The lamp low indicator shows as follows:

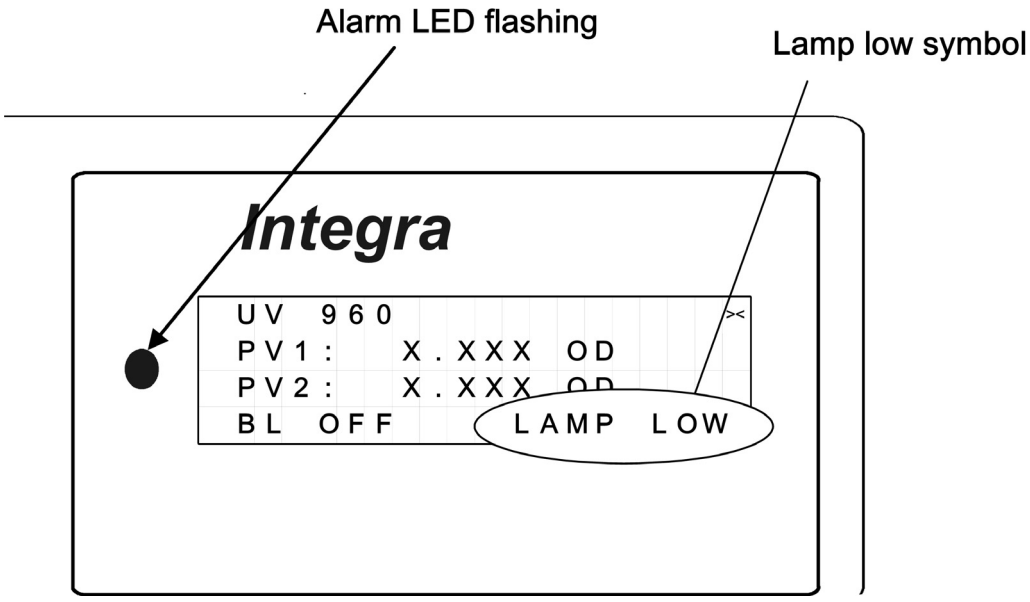


Figure 5.1: Lamp status during start-up

Reset New UV Lamp	
PROCESS SET-UP x MAINTENANCE SYSTEM DATA ESC/EXIT ENT/SELECT	Press Menu ESC, enter function group selection menu. Move the cursor to MAINTENANCE and press Ack ENT to enter.
MAINT:LAMP REPLACE LAMP HOURS XX.X SEE MANUAL ESC/EXIT ENT/SELECT	Press ◀ ▶ to navigate to LAMP REPLACE, and press Ack ENT.
REF VOLTAGE X.XXX TIME LEFT 30:00 MIN ESC/EXIT ENT/START	The current lamp voltage will be displayed on the right upper corner. The timer will start counting down once the Ack ENT is pressed to warm up the lamp.
	Wait 30 minutes until the timer goes to 0:00
REF VOLTAGE X.XXX LAMP TIME XX HR LOW VOLTAGE X.XXX ESC/EXIT	The current lamp voltage will be displayed in the first line and lamp low threshold voltage will be calculated and display on the third line.
	Press Ack ENT to accept the setting and use Menu ESC to go back to measurement screen. The LED and lamp alarm relay will be reset.

5.3 Analyzer Configuration and Operation

After power-up and lamp setting, you must verify analyzer configuration settings which are required for correct measurement.

The analyzer/sensor will be Plug& Play if system was ordered together as a complete solution!

If OUM960 UV analyzer ordered with OUSAF44 UV sensor and OUK40 cable from Endress+Hauser, the factory will perform:

- New lamp set up
- Pathlength adjustment in analyzer according to sensor order
- Calibrate analyzer with LiquidCal or Easycal™ (if ordered)

If application data has been given, factory will perform optical density to engineering unit correlation and deliver correlation data with analyzer. Span and relay setting also can be performed in factory if requested.
If analyzer ordered separately, the factory default setting will be loaded into the analyzer when analyzer is delivered.

5.3.1 Factory Default Setting

Parameters	Factory Default Value
Measurement Unit	OD
Measurement Pathlength	10mm
Output Span 1	2.0000 OD
Output Span 2	2.0000 OD
Relay 1 Set Point/Status	1.0000 OD/ Disabled
Relay 2 Set Point/Status	1.0000 OD/ Disabled
Process Value Correlation	Off (Curve #0)
BaseLine	Disabled
Password	Disabled

Table 5.1: Factory Default Setting

5.3.2 Sensor Calibration

Model 960 analyzer supports 2 different calibration procedures: Liquid Calibration and Easycal™.

5.3.2.1 Liquid Calibration Procedure

A liquid solution of a known optical density (at the wavelength of the sensor) must be used for instrument calibration. The following procedure is used in factory when Easycal™ option is not ordered. Calibration liquid can be chosen by user in field depending on application.

Potassium Dichromate ($K_2Cr_2O_7$) is most often used as an optical standard for calibration of UV analyzers. A solution consisting of 182ml of 0.1N $K_2Cr_2O_7$, diluted with DI water to a 1L volume, has an absorbance of approximately 10 OD at 280 nm. Successive dilution will provide a series of calibration solutions for sensor calibration at more than one point.

D-Tryptophan is a common protein used for optical calibration of UV analyzers at 280nm. A solution can be made consisting of 1.000 grams of Tryptophan and 200ml of de-ionized water placed in to the beaker and heated on a magnetic stirrer. As the Tryptophan dissolves add de-ionized water to a volume of about 450ml. The Tryptophan dissolves slowly. Continue the stirring, maintaining a temperature of about 30°C until the Tryptophan is completely in solution. Transfer this solution into a 1000ml volumetric flask and dilute with de-ionized water to a final volume of 1000ml. This is a concentration of 1000ppm D-Tryptophan in water and is used as the basic standard or mother solution from which successive dilutions can be prepared. A solution diluted to 100ppm is about 2.6 OD at 280nm.

When preparing solutions, it is very important to measure the optical absorbance of every solution prepared (at the wavelength of the sensor) on a certified laboratory spectrophotometer.
The Liquid Calibration screen appears only if an Easycal™ system is not installed and configured in the System Data section.

Liquid Calibration Procedure	
MAINT:SENSOR CAL ESC/EXIT ENT/SELECT	Enter MAINTENANCE sub-menu to access SENSOR CAL function. Press Ack/ENT to ent.
xLIQUID CAL SIMULATOR DEFAULT OD ESC/EXIT ENT/ACCEPT	Use ▼▲ to select LIQUID CAL, Press Ack/ENT to enter liquid calibration process.
LIQUID CAL PV:0.000 OD ZERO SOL IN CELL ESC/EXIT ENT/READY	Fill the sensor with a zero fluid. Press Ack/ENT to record zero point.
LIQUID STD VALUE FROM: X.XXX OD TO: X.XXX OD ESC/EXIT ENT/CHANGE	Enter the value of the standard solution being used to calibrate the system. The solution should be approximately ½ of the full range of the system. Press Ack/ENT to continue.
LIQUID CAL PV:X.XXX OD LIQUID STD IN CELL ESC/EXIT ENT/READY	Fill the sensor with the standard calibrating solution. Wait until OD reading increase and stabilize. Press Ack/ENT to record the data.
REF ROD CAL PV:0.000 OD ZERO SOL IN CELL ESC/EXIT ENT/READY	Remove the calibration solution, and rinse repeatedly with a zero solution. OD reading should decrease and stabilize. Press Ack/ENT to proceed.
REF ROD CAL PV:X.XXX OD INSERT REF ROD ESC/EXIT ENT/READY	Remove the cover screw on the measurement detector and install the reference rod. Press Ack/ENT to proceed.
LIQUID CAL CONFIRM LIQUID X.XXX OD REF ROD X.XXX OD ESC/EXIT ENT/ACCEPT	Remove the reference rod and install the cover screw on the measurement detector. Press Ack/ENT to proceed. The unit records the values of the calibration solution and ref rod value and displays these values. The standard solution is used for calibration, while the ref rod is for checking calibration. Press Ack/ENT to accept these values.

5.3.2.2 Easycal™ Set up and Calibration

All OUSAF44 sensors can be fitted with the optional **Easycal™** Liquid-Free NIST Traceable Calibration System to allow fast and precise calibration of the UV system. This option is available in new systems and as a retrofit item for existing units in the field. Check accessories chapter 7 for retrofit item ordering information.

Each **Easycal™** unit contains two traceable filters – a nominal 0.5 AU and 1 AU (Absorbance Unit) – which are placed into the optical measurement path of the instrument either separately or together. These filters are scanned with a traceable source and their actual absorbance at individual (measurement) wavelengths is ascertained.

The **Easycal™** system allows traceable calibration without using liquid standards. It is very important to refer to the actual values of the **Easycal™** optical filters as noted on the Calibration Certificate supplied with the unit. These absorbance values should be entered into the Model OUM960 as part of the configuration setup. The **Easycal™** screen appears only if it is installed and configured in the System Data section.

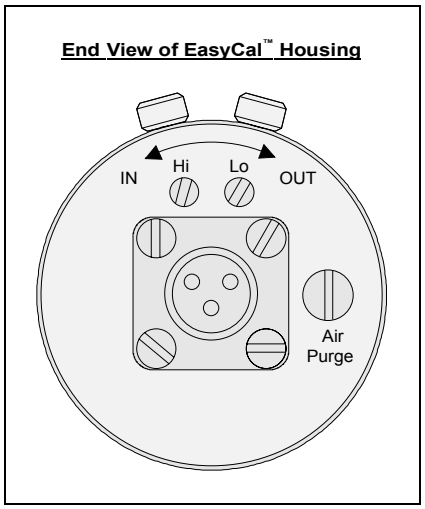
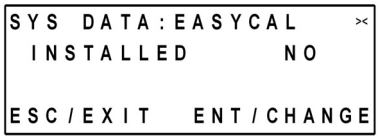
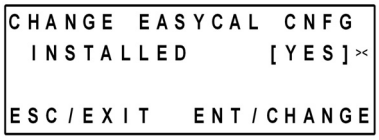
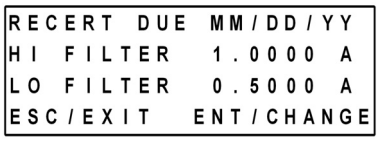
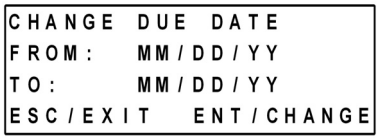
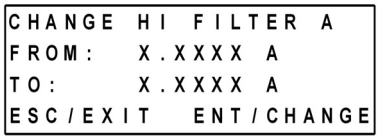
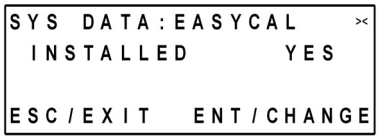


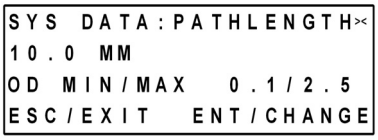
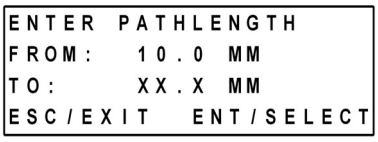
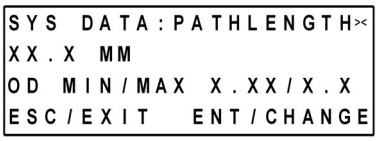
Figure 5.2: Easycal™ Housing and Controls

Easycal™ Installation	
	Enter SYSTEM DATA sub-menu to access CHANGE EASYCAL CNFG function. Press Ack/ENT to continue.
	Use ◀▶ to select [YES] or [NO] to decide if the Easycal™ is installed. To install, select [YES] and confirm.
	This screen displays the present NIST Filter Absorbance values and the re-certification date. Press Ack/ENT to change the date and filter values starting with the next screen.
	Move cursor to edit the day, month and year. Save data and move to next step.
	Refer NIST filter high absorption value listed on NIST filter certificate delivered with Easycal™. The value should be close to 1.0000 AU. Press Ack/ENT to continue and use the same procedure to input the low filter absorption value, close to 0.5000 AU.
	After put in both filter data use Ack/ENT to confirm the setting. Easycal™ data installation is finished.

Easycal™ Calibration Procedure	
MAINT:SENSOR CAL ESC/EXIT ENT/SELECT	Enter MAINTENANCE sub-menu to access SENSOR CAL function. Press Ack/ENT to change. If Easycal has been installed. Analyzer will automatically enter Easycal™ procedure.
EASYCAL FILTER DATA HI:X.XXXA LO:X.XXXA CERT DUE DD/MM/YY ESC/EXIT ENT/READY	Both high and low NIST filters absorption value will be displayed in this screen. User set certificate due date is displayed also. Press Ack/ENT after review the data.
EASYCAL CALIBRATE 0.000 A ZERO CALIBRATE ESC/EXIT ENT/READY	Assure both high and low filters are in OUT position. Press Ack/ENT to record zero point.
EASYCAL CALIBRATE X.XXX A PLACE HI FILTER IN ESC/EXIT ENT/READY	Move HI filter adjustment screw to IN position. Press Ack/ENT to record high filter value.
EASYCAL CALIBRATE X.XXX A PLACE HI+LO FIL IN ESC/EXIT ENT/READY	Move LO filter adjustment screw to IN position. Press Ack/ENT to record HI+LO value.
EASYCAL CALIBRATE X.XXX A PLACE LO FILTER IN ESC/EXIT ENT/READY	Move HI filter adjustment screw to OUT position. Press Ack/ENT to record low filter value and perform calibration calculation.
LO X.XXX A XX.X% HI X.XXX A XX.X% HI+LO X.XXX A XX.X% ESC/EXIT ENT/ACCEPT	The screen then displays the low, high and high+low readings and % deviation from the certified value of each value. Review the deviation level and press Ack/ENT to accept the calibration result.

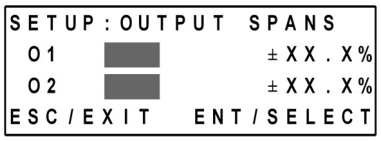
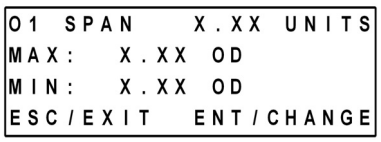
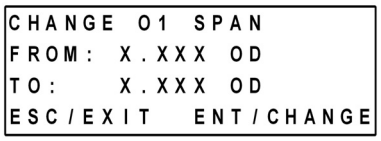
5.3.3 Change Pathlength Setting

If sensor pathlength needs to be changed by user, the corresponding change will need to be performed to OUM960 analyzer also. Refer to Chapter 6 Sensor and Analyzer Maintenance to perform sensor pathlength adjustment. This section only covers corresponding analyzer setting to match the measurement result.

Pathlength Setting	
	Enter SYSTEM DATA sub-menu to access PATHLENGTH function. Press Ack ENT to continue.
	The FROM value is the present pathlength Value. Use ◀▶ to position the cursor and ▼▲ to select wanted digit. Repeat for each digit position. When new pathlength has been selected, press Ack ENT to confirm the change.
	The SYS DATA: PATHLENGTH is displayed together with the new values for pathlength and OD MIN/MAX.

5.3.4 Setup Output Span

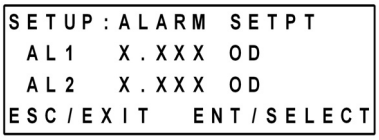
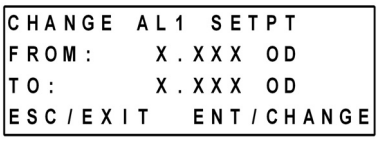
The 4~20mA span setting will provide user capability to achieve maximum resolution for preferred measurement range.

Change 4~20mA Output Span	
	Enter PROCESS SET-UP sub-menu to access OUTPUT SPANS function. Use ▼▲ to move the cursor to O1 and press Ack ENT to select.
	This screen will display the current output span MIN/MAX span based on pathlength or process value correlation setting. Press Ack ENT to change the span.
	In this screen the current value for span is the FROM value. Position the cursor as done previously and select the number for that position. Repeat as needed for each digit position. When the new span has been entered, press Ack ENT and confirm the sanity check to accept.

Use same procedure above to change Channel 2 output span.

5.3.5 Output Relay Set Point and Configuration

Change Output Relay Set Point

Change Relay Set Point	
	Enter PROCESS SET-UP sub-menu to access OUTPUT SPANS function. Use ▼▲ to move the cursor to ALx and press Ack/ENT to select.
	In this screen the current value for span is the FROM value. Position the cursor as done previously and select the number for that position. Repeat as needed for each digit position. When the new relay set point has been entered, press Ack/ENT and confirm the sanity check to accept.

Configure Output Relays

The Alarm Setup screen allows configuration of PV, Hi/Lo/Off, and NO/NC operation. ▼▲ is used to select the parameter and ◀▶ is used to change the state. Press Ack/ENT to continue.

Functions		Description
Trigger Condition	HIGH	Triggered if process value higher than set point.
	LOW	Triggered if process value higher than set point.
	OFF	Relay disabled
Input Mapping	PV1	Process value #1
	PV2	Process value #2
Relay Operation Mode	NO	Normally open
	NC	Normally close
Hysteresis		Set relay hysteresis
Delay		Delay trigger timer (Sec)

Table 5.2: Output Relay Configuration

Configure Output Relay	
MAINT:ALARM CONFIG xAL1 DISABLED AL2 DISABLED ESC/EXIT ENT/SELECT	Enter from MAITENANCE sub-menu. Scroll to the ALARM CONFIG screen. Use ▼▲ to select the ALx line. Press Ack/ENT to select and confirm.
ALARM 1 SETUP SOURCE [PV 1] CONFIG OFF ESC/EXIT ENT/CHANGE	The 'ALARM 1 SETUP' screen will appear. Select the SOURCE option, PV1 or PV2.
ALARM 1 SETUP SOURCE PV 1 CONFIG [OFF] ESC/EXIT ENT/CHANGE	Next with ▼▲ select the CONFIG option. Use ◀▶ to select OFF, HIGH and LOW.
ALARM 1 SETUP STATE [N/O] ESC/EXIT ENT/CHANGE	Press ▼▲ to scroll down to ALARM 1 SETUP STATE screen. ◀▶ selects either normally open (N/O) or normally closed (N/C) alarm state of the relay contacts. Select the N/O option and press Ack/ENT to accept and confirm.
CHANGE ALARM 1 DELAY FROM: XX SEC TO: XX SEC ESC/EXIT ENT/CHANGE	The CHANGE ALARM 1 DELAY is next displayed. Set the needed delay. Delay time unit is second. Press Ack/ENT to accept and confirm.
CHANGE ALARM 1 HYSTS FROM: X.XXX OD TO: X.XXX OD ESC/EXIT ENT/CHANGE	The CHANGE ALARM 1 HYSTS option controls the alarm hysteresis. If the alarm set point is set 1.00 OD and the hysteresis is 0.100 OD, an alarm condition exists at 1.00 OD and will stay in alarm until the PV is 0.90 OD or less. Hysteresis can be called the deadband between an alarm on and off condition. Set the hysteresis to 0.100 OD and press Ack/ENT to accept and confirm.

5.3.6 Current Output Calibration

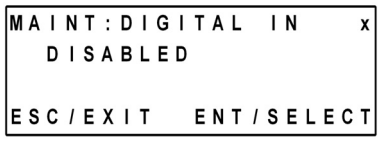
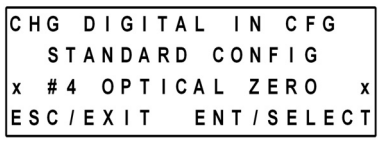
This function calibrates 4~20mA current output to assure the measurement accuracy.

Calibrate 4~20mA Output	
MAINT:OUTPUT CAL xOUTPUT 1 OUTPUT 2 ESC/EXIT ENT/SELECT	Enter MAINTENANCE Sub-Menu to access OUTPUT CAL function. Move cursor to OUTPUT 1 and press Ack/ENT to select this channel.
OUTPUT 1 CAL +/-2% x4MA TRIM 20MA TRIM ESC/EXIT ENT/ACCEPT	Move the cursor up and down to select the value need to be trimmed. Use ◀▶ to trim 4mA or 20mA. The trimming resolution is 1% per step. Press Ack/ENT to accept and confirm the trimming.
	Follow same procedure to trim OUTPUT 2.

5.3.7 Date and Time Setting

Set Clock	
MAINT:SET CLOCK xCUR DATE MM/DD/YY CUR TIME HH/MM/SS ESC/EXIT ENT/SELECT	Enter MAINTENANCE sub-menu to access SET CLOCK function. Use ▼▲ to select the CUR DATE line.
CHANGE DATE FROM: MM/DD/YY TO: MM/DD/YY ESC/EXIT ENT/CHANGE	Press Ack/ENT to select the DATE option and then the CHANGE DATE Screen is displayed with the current date. Use ◀▶ to position the cursor and ▼▲ to change the mm/dd/yy numbers. When the wanted date is entered, press Ack/ENT to accept and confirm.
CHANGE TIME FROM: HH/MM/SS TO: HH/MM/SS ESC/EXIT ENT/CHANGE	Press Ack/ENT to select the TIME option and then the CHANGE TIME Screen is displayed with the current time. Use ◀▶ to position the cursor and ▼▲ to change the hh/mm/ss numbers. When the wanted time is entered, press Ack/ENT to accept and confirm.

5.3.8 Configuration and Use Digital Input

Configure Digital Input	
	Enter MAINTENANCE sub-menu to access DIGITAL IN function. Press Ack ENT to continue.
	The following screen displays the current configuration of the external digital inputs. Use the to scroll through the **DISABLE** and **STANDARD CONFIG** When disabled the external digital inputs are inoperative.
	When in **STANDARD CONFIG**, the digital inputs are configured as; 1 Lamp On-Off 2 Baseline On-Off 3 Baseline Update 4 Hold/Optical Zero Digital Input #4 can be set as Optical Zero function if wanted. Press Ack ENT to accept and confirm.

5.3.9 Process Control

From main measurement screen, press to enter process control screen.

Functions	Status	Description	Remote Trigger
BaseLine	ON	Enable baseline	Digital Input 2
	UPDATE	Update baseline value	Digital Input 3
	OFF	Disable baseline	Digital Input 2
Lamp Switch	ON	Turn on lamp	Digital Input 1
	OFF	Turn off lam	Digital Input 1
Optical Zero	-	Make current measurement at 0.	Digital Input 4
Optical Check	-	Start sensor check	-

Table 5.3: Process Control Functions

5.3.9.1 Access of Process Control

The authorization to access the process control functions can be configured in OUM960 analyzer. The access control is password protected. See 5.3.9.6 for password protection.

Configure Process Control Access	
SYS DATA:ACCESS >< BASELINE Y LAMP Y OPT ZERO Y OPT CHK Y ESC/EXIT ENT/CHANGE	Enter SYSTEM DATA sub-menu to access ACCESS function. Press Ack ENT to continue.
OPERATOR SCRN ACCESS BASELINE [YES] xLAMP ON/OFF [YES]x ESC/EXIT ENT/CHANGE	Select the option to configure. Note: The Response is in brackets [ ]. With bracketed responses use for changes. Select 'YES' for each option. There are 4 options to configure. When all changes are made, press Ack ENT to accept and confirm the entries and return to top screen.

5.3.9.2 Baseline (AutoZero)

To operate the baseline function, the Process Control Screen must be assigned as an authority for the user. If assigned the authority, use to open the Process Control Screen. Use to select baseline and select as follows: To initiate a new baseline use "On", to remove an existing baseline use "Off". To change an existing baseline setting to a new setting use "Update". If the baseline was previously "On" when a power interruption occurred, the analyzer will retain its last saved baseline setting and return to that setting when power is restored, and the analyzer and the baseline control will remain "On". Baseline function replaced the AutoZero function in the 600 series analyzer.
If a Baseline Shift value has been entered, activating the baseline shift will cause the 4~20mA output channel 2 to "Shift" to the entered % value. Both PV display would indicate "0" The PV screen will also indicate BL SFT in lieu of BL ON when a shift value has been entered (>0%).

Change BaseLine Shift Value	
SETUP:BASELNE SHIFT SHIFT XX% ESC/EXIT ENT/SELECT	Enter PROCESS SET-UP sub-menu to access BASELINE SHIFT function. The current Baseline Shift "%" Percentage value will be displayed. Press Ack ENT to continue.
CHANGE BASELNE SHIFT FROM: XX% TO: XX% ESC/EXIT ENT/SELECT	Use ◀ ▶ to position the cursor and ▼ ▲ to select wanted number. When the new percentage value has been entered, press Ack ENT change and confirm. The channel 2 4~20mA output will "Shift" to the % of full scale selected when the baseline is activated. Hence, a 0% baseline shift value will output a 4ma (zero) signal and a 50% baseline shift value will output a 12ma (midscale) signal.

5.3.9.3 Optical Zero

Optical Zero is a function to provide an over all zero to offset the initial background optical noise in OUSAF44 UV sensor. User can also use optical zero to setup the process zero (e.g. DI water optical density etc.).

5.3.9.4 Lamp Switch

Use this function to switch lamp on and off.

Note!
Lamp alarm relay status will be affected.

5.3.9.5 Optical Check

Use Cal Rod to check Calibration Reference Rod and Cal Rod Check

A Calibration Reference Rod is supplied with each standard sensor (a sensor without **Easycal**™) to allow calibration "Check" of the instrument without requiring the use of calibration solutions. The Reference Rod screws into the detector housing of the sensor, providing partial blockage of the sensor light path and therefore simulating absorbance in the optical chain. The cross-sectional view of an OUSAF44 measurement detector shown below illustrates the placement and the blocking effect that the Reference Rod has in relationship to the sensor's detector. This partial blockage of light to the detector provides an effective, stable and repeatable checking technique.

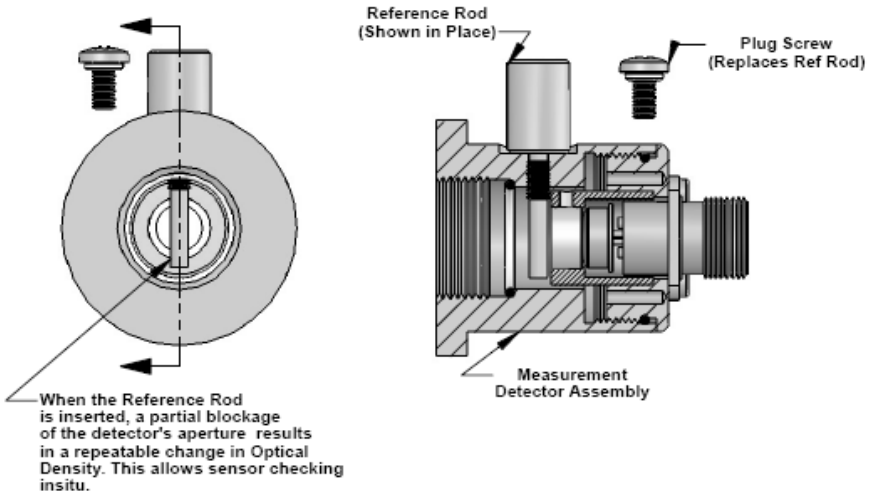


Figure 5.3: Cross Sectional view of Detector with Reference Rod

When used in conjunction with an initial liquid standard calibration procedure, the reference Rod can be deemed a secondary standard for routine system checking. Calibration can be traced to the controlled standard used to verify the original calibration solutions and can therefore satisfy validation procedures. During initial calibration of a sensor/analyzer pair, liquid standards must be used to calibrate the full-scale response of the system. After calibration, by filling the sensor with water and ensuring the analyzer reads zero, a value for the reference rod can be obtained by inserting the Reference Rod into the sensor detector housing and noting the analyzer display reading. At any time in the future, reinserting the reference rod and checking that the analyzer reads the same with the sensor filled with water can check the analyzer calibration.

Note!
All analyzers must be re-calibrated with liquid standards if there are any changes made to the optical chain, including replacement of seals or lamp.

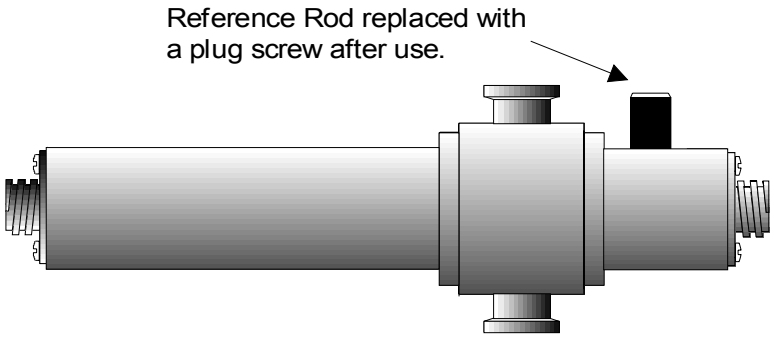


Figure 5.4: Typical Inline UV Sensor with Reference Rod

When not being used, the Reference Rod access hole is plugged with a gasket and stainless steel screw to maintain the environmental integrity of the detector housing.

All Model OUM960 UV analyzers with standard OUSAF44 sensors (without **Easycal**™ option) are calibrated at the factory using liquid standards. Please refer to the Test Sheet accompanying your instrument for the factory determined reference rod value.

5.3.9.6 Password Protection

OUM960 support the password function to protect the analyzer from unauthorized operation.

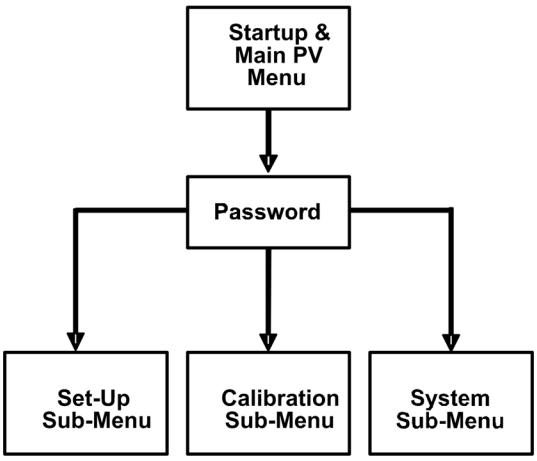


Figure 5.5: Password protection level

Password Protection	
SYS DATA:PASSWORD >< ESC/EXIT ENT/CHANGE	Enter SYSTEM DATA sub-menu to access PASSWORD function. Press Ack ENT to continue.
ENTER OLD PASSWORD >< 0000 ESC/EXIT ENT/CHANGE	When in the ENTER OLD PASSWORD screen, the CURSOR highlights the left digit position. Use the ◀▶ to wanted digit position. Use ▼▲ to scroll thru 0-9 for each digit position. Move the cursor to the desired digit and enter a number. When the old password number has been entered, press Ack ENT to accept. Note: When "0000" is set a password, the password protection mode is disabled.
ENTER NEW PASSWORD >< XXXX ESC/EXIT ENT/CHANGE	When in the Ack ENT ER NEW PASSWORD screen, the CURSOR highlights the left digit position. Use the ◀▶ to wanted digit position. The ▼▲ scrolls thru 0-9 for each digit position. Move the cursor to the desired digit and enter a number. Repeat as wanted for each cursor position. Any password number up to 4 digits can be entered. When the password number has been selected, press Ack ENT twice to accept. The Password for MENU access is now the number entered.

5.3.9.7 Process Value Correlation

In the OUM960 analyzer software, the user can define and store 3 linearization tables to correlate the optical density measurement to specified process parameter measurement. Each table supports up to 16 points of measurement value. User can switch correlation curves to fit different applications.

Caution!
The overall course of the curve must be continuously rising. Horizontal or vertical segments or a zigzagging of the curve are not permitted.

Data points may be entered into the linearization table randomly; the software performs sorting automatically as needed. It is possible to increase accuracy in a certain segment of a linearization table later. To do so it is not necessary to enter all data points again, but to enter only additional data points.

Process Value Correlation Set Up	
SETUP:PV CORRELATE PV1: X.XXX OD PV2: X.XXX OD ESC/EXIT ENT/CHANGE	Enter PROCESS SET-UP sub-menu to access PV CORRELATE function. Press Ack/ENT to continue.
SETUP:PV CORRELATE CURVE [#X] 0 POINTS ESC/EXIT ENT/CHANGE	The next screen asks which curve (1-3) you want to edit and store the correlation table. Scroll with ◀ ▶ to select curve number. Press Ack/ENT to continue.
xSAMPLE IN CELL? SAMPLE EDIT? MANUAL ENTRY ESC/EXIT ENT/SELECT	If the original sample value is not put in yet. Select SAMPLE IN CELL? By scrolling with ▼ ▲ to select. Press Ack/ENT to continue.
PV: X.XXX OD CURVE #X SAMPLE #X IN CELL ESC/EXIT ENT/READ	The next screen asks if process sample is in the cell and displays measurement value. If this value is within the Min/Max acceptable press Ack/ENT to read and store.
CURVE #X ANOTHER SAMPLE? ESC/EXIT ENT/YES	The next screen asks if another sample is to be measured. Press Ack/ENT to read another sample, press Menu/ESC if finished all samples.
CURVE #X (XX POINTS) SAVE DATA ESC/EXIT ENT/ACCEPT	Confirm the number of point to build correlation curve and press Ack/ENT to store original sample data.

SAMPLE IN CELL? xSAMPLE EDIT? MANUAL ENTRY ESC/EXIT ENT/SELECT	SAMPLE EDIT is used to put in the target correlation value and unit. Press Ack/ENT to continue to put in data.
CHANGE OD #X FROM: X.XXX TO: X.XXX ESC/EXIT ENT/CHANGE	The next screen asks if the user would like to change the original sample point OD value. If this value needs to be changed, use ▼▲ and ◀▶ to change value. Press Ack/ENT to continue.
ENTER USER VALUE #XX FROM: X.XXX TO: X.XXX ESC/EXIT ENT/CHANGE	The next screen is for entry of target correlation values that can be assigned to the original correlated measured value. i.e. 1.32 measured units to 9999.9 units. The FROM value is the last entered value on the 'ENTER USER VALUE' screen. Enter the new value using ▼▲ and ◀▶ to position the cursor and select the number for each required position. If a different position is required for the decimal point, do this first. Press Ack/ENT twice to change and accept.
	Repeat above procedure until all correlation points have been entered.
ENTER UNITS FROM: XXXXXX TO: XXXXXX ESC/EXIT ENT/CHANGE	When all the sample points have been edited, the Change Units screen is next. The engineering unit can be entered is limited to 6 alpha-numeric characters.(i.e. gr/l, %, mg/l, cel/cc, etc.). Press Ack/ENT twice to change and accept entry.
CURVE #x (x POINTS) MAX: X.XX unit MIN: X.XX unit ESC/EXIT ENT/ACCEPT	The Max/Min values are calculated for entered values and units. These values are the new limits for output span and relay setting and the displayed Process Display PV value and units.

Note!
If the OD to correlation unit table is predefined and does not need liquid sampling, use MANUAL EDIT option to enter the table to analyzer. The procedure is similar to SAMPLE EDIT.

Switch Correlation Curves	
SETUP:RUN CAL CURVE CAL CRRVE #X ESC/EXIT ENT/CHANGE	Enter PROCESS SET-UP sub-menu to access RUN CAL CURVE function. Press Ack/ENT to continue.
CHANGE CAL CURVE FROM: X TO: X ESC/EXIT ENT/CHANGE	The next screen asks which curve (0-3) you want to execute. Curve #0 is the default OD measurement. Curves 1-3 are user defined. Scroll with ▼▲ to select curve number. Press Ack/ENT to select and confirm. NOTE: Entering a curve with Process Correlate will automatically set it as the current active curve.

6. Maintenance

6.1 Maintenance Outline

Once the unit is in operation, there is no requirement to access the interior of the Model OUM960 UV analyzer housing for normal day-to-day operation and calibration.

Certain maintenance procedures need to be performed for OUSAF44 sensor. The service and maintenance interval time is application dependant.

Note!
Check list of maintenance!

- Lamp Replacement
- O-Ring Replacement
- Filter (NIST) Replacement
- Pathlength Adjustment
- Sensor window and gasket replacement

Caution!
The procedures described in this section should only be carried out by qualified maintenance staff.

Model OUSAF44 sensors contain sensitive optical components and should be handled carefully. Particular care must be taken to prevent contamination of these components.

Caution!
Clean all optical components with a suitable lint free lens cleaning tissue and ethanol.

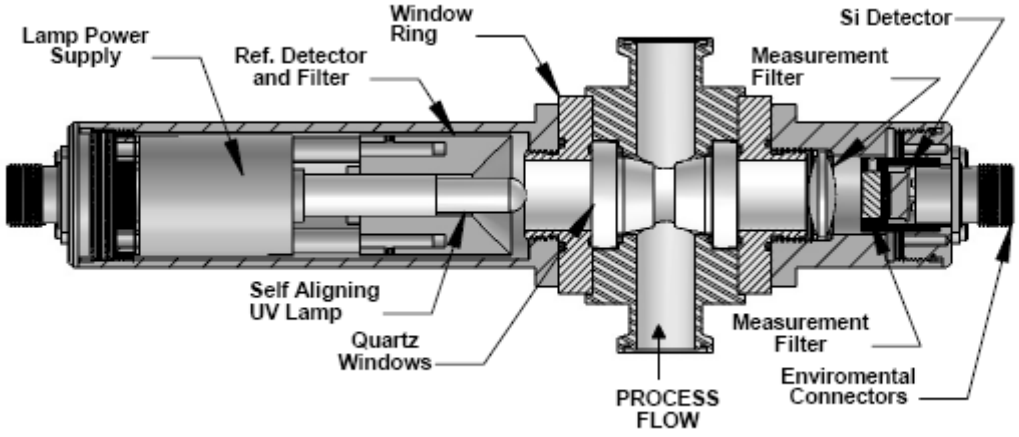


Figure 6.1: Cross-Sectional View of a Typical OUSAF44 UV Sensor

6.2 Mercury Lamp Replacement for OUSAF44

Caution!
Whenever maintenance is performed on the sensor, remove all cables and power to the sensor. Never view the mercury lamp when powered directly without proper eye protection.

To replace the mercury lamp, proceed as follows (Refer to Figure 6.3: Illustrative lamp replacement procedure):

1. Remove the lamp housing from the sensor by unscrewing the housing CCW.
2. Remove the lamp assembly from the housing by unscrewing the lamp assembly CCW. If tight, use the cable connector body flange as a "nut" to gain access.
3. Allow the lamp to cool. Loosen and remove the lamp retaining set-screw.
4. Grip the lamp body in the gap between the lamp power supply and the mirrored reflector. Push the lamp towards to reflector until the lamp is free of the socket. Grip the glass section of the lamp from the end and remove it through the reflector.
5. With the lamp removed, inspect the lamp assembly for any cable fraying or reflector damage. When cleaning any of the optical surfaces use ethanol and soft, lint free tissue.

Caution!
Clean the new lamp and the mirror with ethanol and lens tissue. After cleaning, do not touch these optical surfaces. When handling the lamp, use lens tissue or wear talc-free latex gloves.

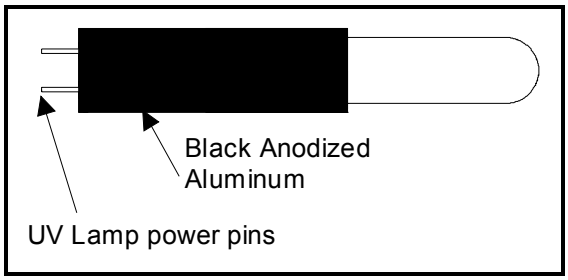


Figure 6.2: UV Plug-in Lamp OUSAF44/46 Versions

6. The lamp is replaced by inserting it through the reflector and mating it to it's socket. Make certain that the lamp pins are in line with the socket connectors. Gently insert the lamp into the socket making sure that it seats completely.
7. After the lamp has been replaced, reinsert the lamp retaining set screw. This screw is just to hold the lamp in place, do not over tighten as the lamp could be damaged or broken.
8. The complete lamp and power supply assembly is now refitted into the lamp housing and onto the sensor.

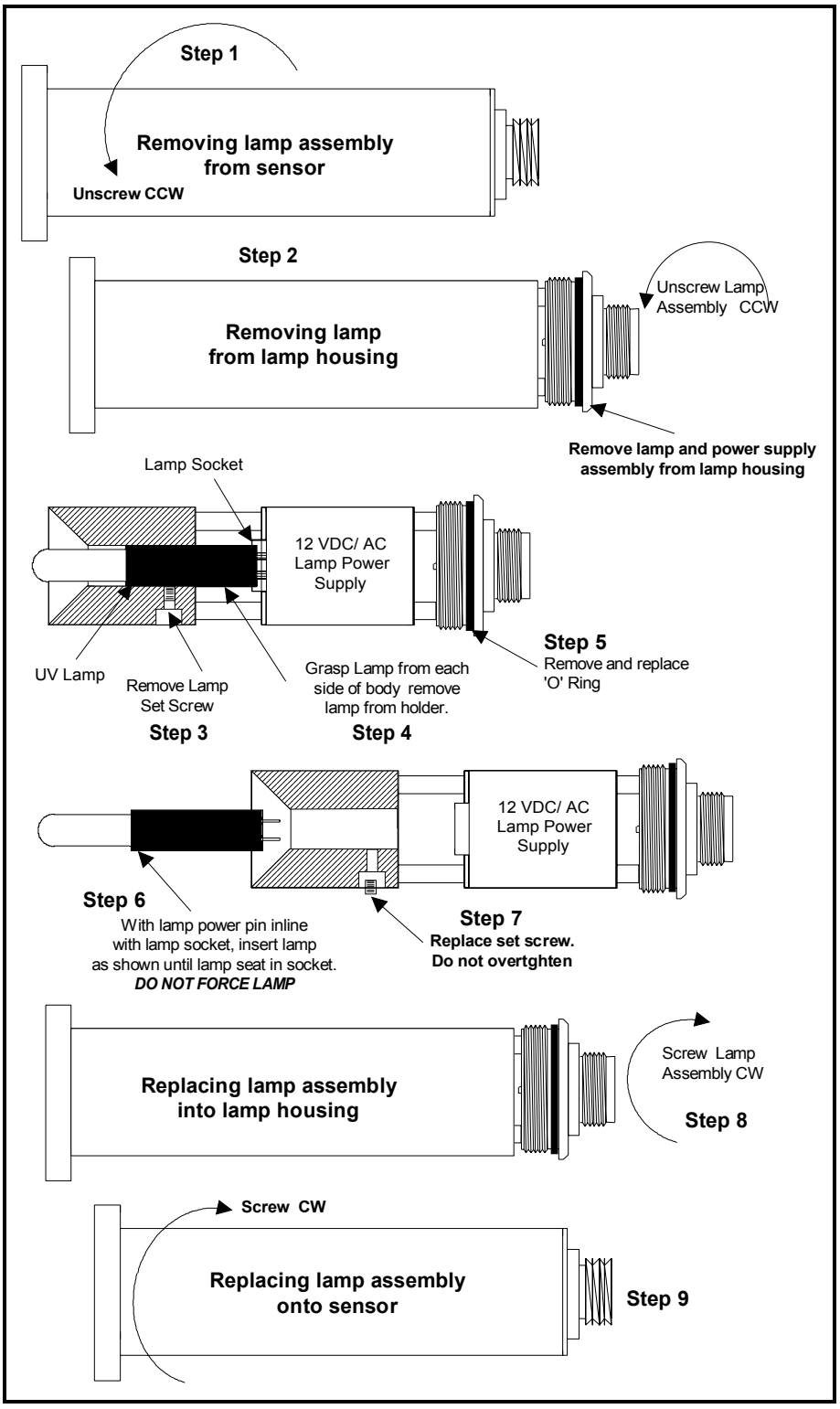


Figure 6.3: Illustrative Standard Lamp Replacement Procedure

6.3 OUSAF44 Measurement Detector/Filter Replacement

The measurement filter is replaced using the following procedure (refer to figure 6.4 for a view of the assembly):

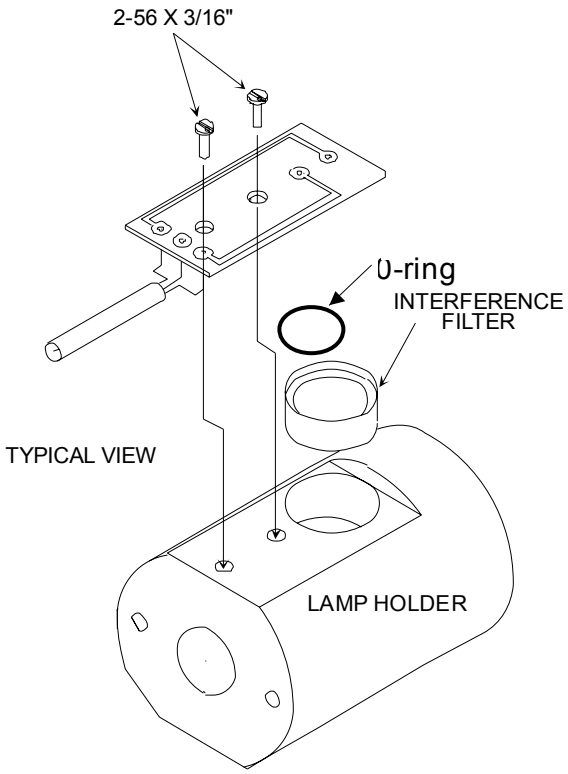


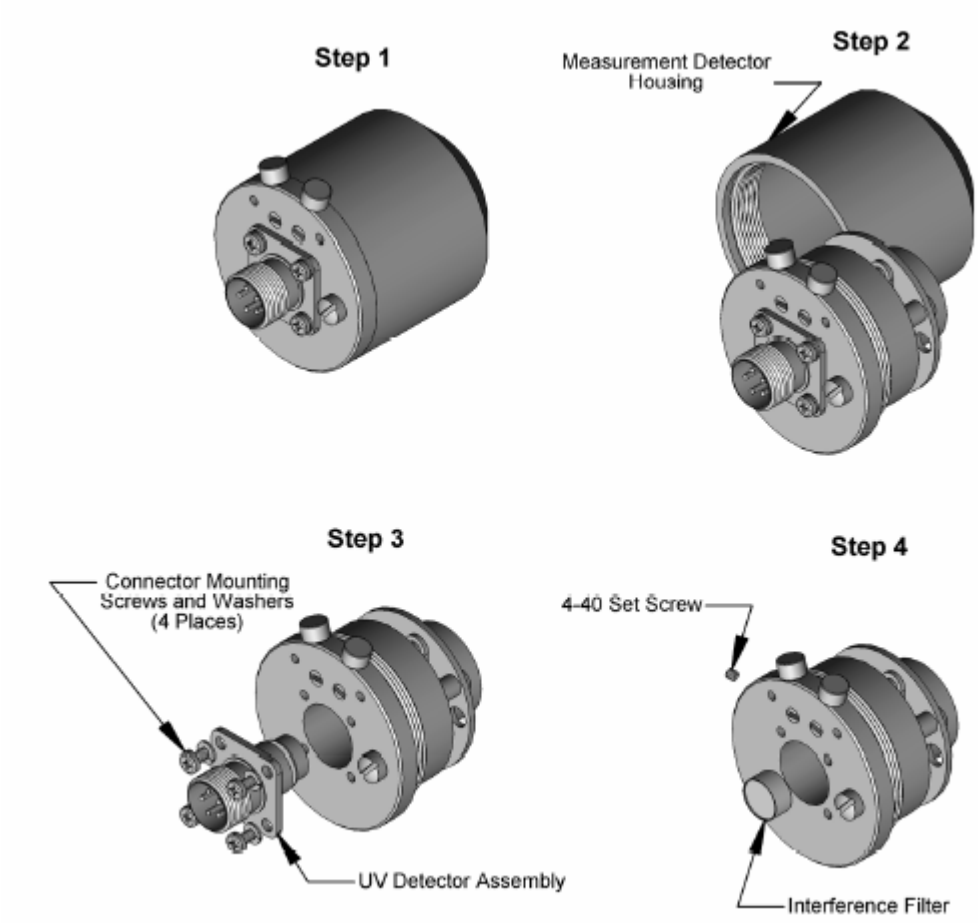
Figure 6.4: Reference Detector/Filter Replacement

1. Remove the measurement detector housing from the sensor.
2. Loosen and remove the 4 screws holding the measurement detector back plate onto the back of the measurement detector housing. Take care to retain all screws, washers and the sealing "O" ring.
3. Withdraw the back plate assembly from the housing.
4. Remove the 2 black anodized screws holding the detector assembly to the back plate and carefully separate, protecting the interconnecting connecting cable.
5. Remove the 2 screws holding the detector PCB to the back of the filter holder and separate.
6. Remove the two setscrews holding the filters into the holder; turn the filter holder over and drop the filters into your hand.
7. Fit the new filters into the detector/filter holder taking care to ensure that they are installed "shiny" or "mirrored" side towards the light source and that the correct wavelength value is installed in the correct side. Lightly tighten the retaining setscrews.
8. Clean the detector faces and the filter faces with ethanol and lens tissue. Check and clean all other components as necessary. Install the detector PCB making sure that the wavelength to channel orientation it is correct.
9. Re-assemble the detector housing in the reverse order, ensuring that the orientation of the detectors is correct to allow use of the reference rod and that all O-Ring seals are correctly fitted and seated.
10. Replace the measurement detector housing onto the sensor.
11. Calibration of the connected analyzers is required after detector replacement.

6.4 Measurement Filter Replacement (Easycal™ Assembly)

The measurement filter is replaced using the following procedure (refer to figure 6.5 for the exploded-view of the assembly):

1. Remove the Detector Assembly from the flow cell.
2. Un-screw the back-plate assembly from the detector housing as shown. If tight, use the cable connector body flange as a "nut" to gain access.
3. Remove the four (4) screws form the detector connector and remove the detector as show and remove the detector.
4. Loosen the measurement filter retaining set screw and with the assembly held vertically, softly tap the assembly until the filter falls out.
5. With the assembly still in the vertical position, insert the new filter until it is seated. Lightly tighten the filter retaining set screw to hold the filter in place. DO NOT OVER TIGHTEN AS FILTER DAMAGE WILL RESULT.
6. Insert the measurement detector assembly and secure with 3 x M3-08 screws and washers.
7. Using a fourth M3-08 screw, attach the connector dust cover to the connector flange and Easycal™ back plate assembly.
8. Refit the detector housing to the assembly.



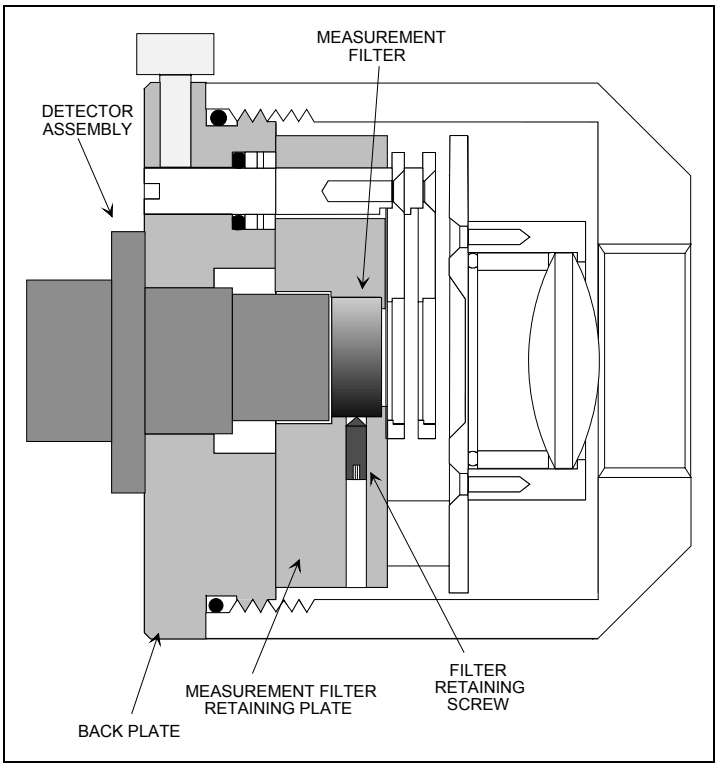


Figure 6.5: Easycal™ Measurement Detector Assembly

6.5 Measurement Filter Replacement (Standard and Cal Rod Assemblies)

The measurement filter is replaced using the following procedure (refer to figure 6.5 for a cross sectional view of the assembly):

1. Unscrew and remove the outside casing from the **Easycal™** Measurement Detector Housing Assembly. If tight, use the cable connector body flange as a "nut" to gain access.
2. Loosen measurement filter retaining set-screw.
3. Insert measurement filter, mirror side first, into the housing and locate in the filter retaining plate.
4. Tighten the measurement filter retaining set-screw snug against the filter and ensure the filter is held in place.
5. Insert the measurement detector assembly and secure with 3 x M3-08 screws and washers.
6. Using a fourth M3-08 screw, attach the connector dust cover to the connector flange and **Easycal™** back plate assembly.
7. Refit the detector housing to the assembly.

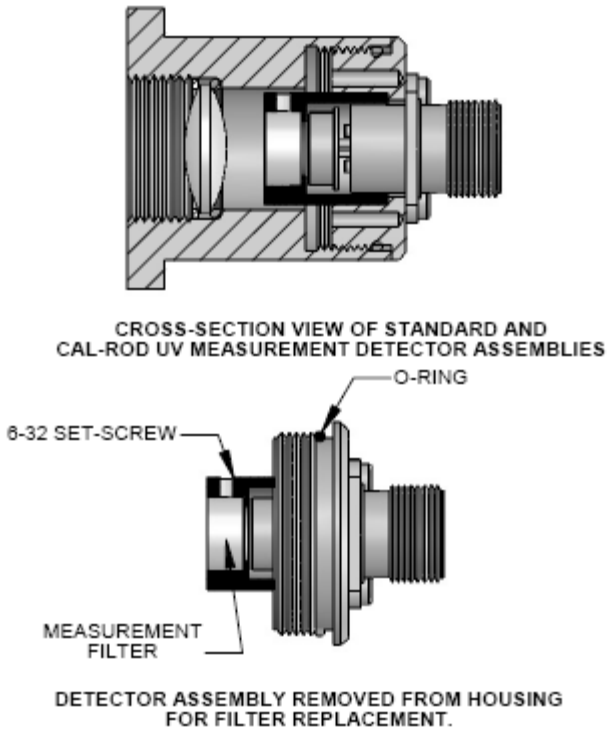


Figure 6.6: Filter/Detector Replacement Standard-Cal Rod

6.6 Sensor Wavelength Change

Should it be required to change the operating wavelength of the sensor, both the measurement and reference filters must be changed. When changing filter wavelength, follow the same procedures as describe above.

6.7 Sensor Window and Gasket Replacement

Sensor optical pathlength is established by the window type(s) used. Each analyzer-sensor pair is configured for a given pathlength. Windows must be replaced with the same type to maintain pathlength. The illustration below is a typical flowcell assembly. Figure the available window types and possible pathlengths for sensors up to 2" line sizes.
Replacement of windows or window seals, changing window spacing or other maintenance requiring the disassembly of the sensor uses the following procedure:

Note:
To replace and/or change the windows and seals, the sensor must be removed from the process line.

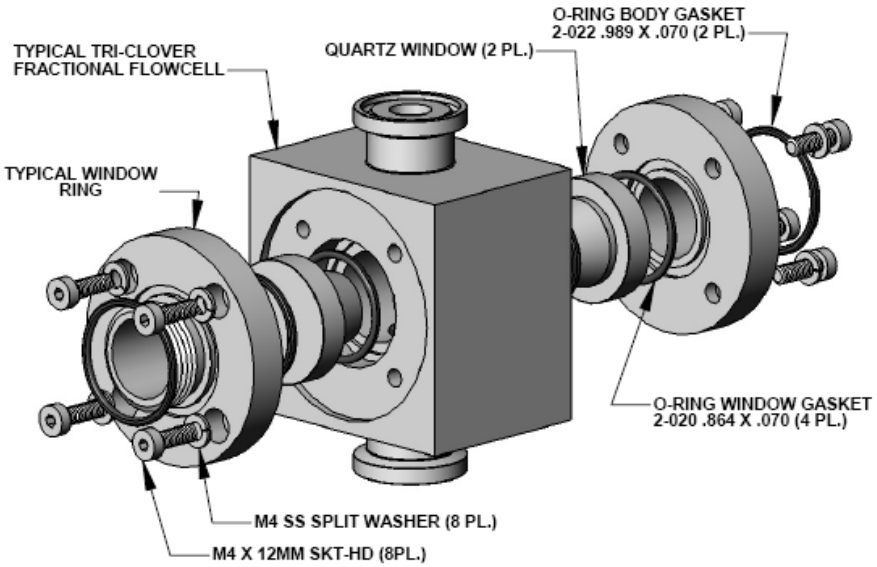


Figure 6.7: Typical Flowcell/Window Replacement

6.8 Sensors without Precision Optical Pathlength Adjuster Option

1. Remove the lamp and the detector housings from the sensor body.
2. Remove the 4 socket head screws from each window retaining ring and remove the rings. Be careful to loosen the screws evenly and alternately around the window retaining ring. If the window is ‘stuck’, apply Acetone to the window seal area and let soak for several minutes. This may assist in freeing the windows from the seals.
3. Gently push/ease the windows out of the sensor.
4. Inspect the window area and clean as necessary. Inspect the windows for any signs of abrasive wear or chipping. If any is apparent, replace the windows. Discard the 'O' rings and replace with new ones of the same material type. Re-assemble the sensor in the reverse order, taking care to cross-tighten the window retaining ring screws evenly to prevent uneven seating. If the sensor pathlength has been changed, the analyzer module must be configured to reflect the new pathlength. After every re-assembly of an OUSAF44 sensor, it is necessary to carry out a liquid or Easycal™ calibration with its associated analyzer.

Note!
Upon re-assembly, insure that the lamp assembly is mounted on to the side of the flow cell with the “shorter” length of the two windows.

5. Remove the lamp and the detector housings from the sensor body.
6. Remove the 4 socket head screws from each window retaining ring and remove the rings. Be careful to loosen the screws evenly and alternately around the window retaining ring. If the window is ‘stuck’, apply Acetone to the window seal area and let soak for several minutes. This may assist in freeing the windows from the seals.
7. Gently push/ease the windows out of the sensor.
8. Inspect the window area and clean as necessary. Inspect the windows for any signs of abrasive wear or chipping. If any is apparent, replace the windows. Discard the 'O' rings and replace with new ones of the same material type. Re-assemble the sensor in the reverse order, taking care to cross-tighten the window retaining ring screws evenly to prevent uneven seating. If the sensor pathlength has been changed, the analyzer module must be configured to reflect the new pathlength. After every re-assembly of an OUSAF44 sensor, it is necessary to carry out a liquid or Easycal™ calibration with its associated analyzer.

Note!
Upon re-assembly, insure that the lamp assembly is mounted on to the side of the flow cell with the “shorter” length of the two windows.

6.9 Sensors with Precision Optical Pathlength Adjuster Option

Systems fitted with an Easycal™ calibration system may also be fitted with pathlength “adjusters” to allow trimming of the optical pathlength to the exact distance required for measurement. The precision pathlength adjuster is not required for systems being calibrated using liquid standards.

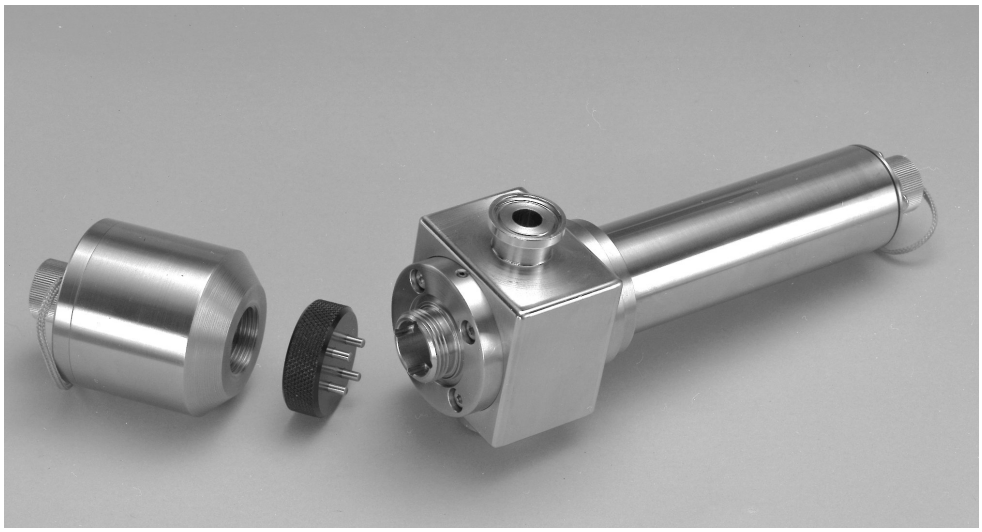


Figure 6.8: OUSAF44 Sensor with Precision Pathlength Adjuster Option

1. Remove the lamp and the detector housings from the sensor body.
2. Remove the 4 socket head screws from each window retaining ring and remove the rings. Be careful to loosen the screws evenly and alternately around the window retaining ring. If the window is ‘stuck’, apply Acetone to the window seal area and let soak for several minutes. This may assist in freeing the windows from the seals.
3. Gently push/ease the windows out of the sensor.
4. Inspect the window area and clean as necessary. Inspect the windows for any signs of abrasive wear or chipping. If any is apparent, replace the windows.
5. Assemble window actuators into window rings, adjusting to their widest position (rotated all the way into the window ring). Insert the locking set-screws into the sides of the window rings, but do not tighten.
6. Install a new “O” seal and window into one side of the flow cell.
7. Place the Thrust Washer into its seat in the actuator ring and install the complete window ring onto the flowcell, taking care to align the screw holes properly.
8. Install and tighten the four socket head screws to secure the window ring to the flow cell.
9. Repeat the above for the other side.
10. Once both windows are installed and the rings secured, clean and insert the pathlength gauge into the cell down through one of the tube entries until it is between the window faces.
11. Using the Pathlength Adjusting Tool, narrow the pathlength by carefully screwing in the actuator on each side (in small increments) until the pathlength gauge just touches both windows. Do not over tighten.
12. Carefully withdraw the pathlength gauge and tighten the locking set-screws to hold the actuator in place.
13. If possible, pressure test assembled flow cell at two times (2X) process pressure. Re-check with pathlength gauge and adjust pathlength as needed. Pressure testing cycles the compression of the window o-rings and actuator upon assembly. This will compensate for any initial changes in the pathlength.

Note!
Some window faces may not be parallel to each other. This is normal, especially with fire-polished quartz windows. Take care to ensure pathlength gauge does not scratch window faces.

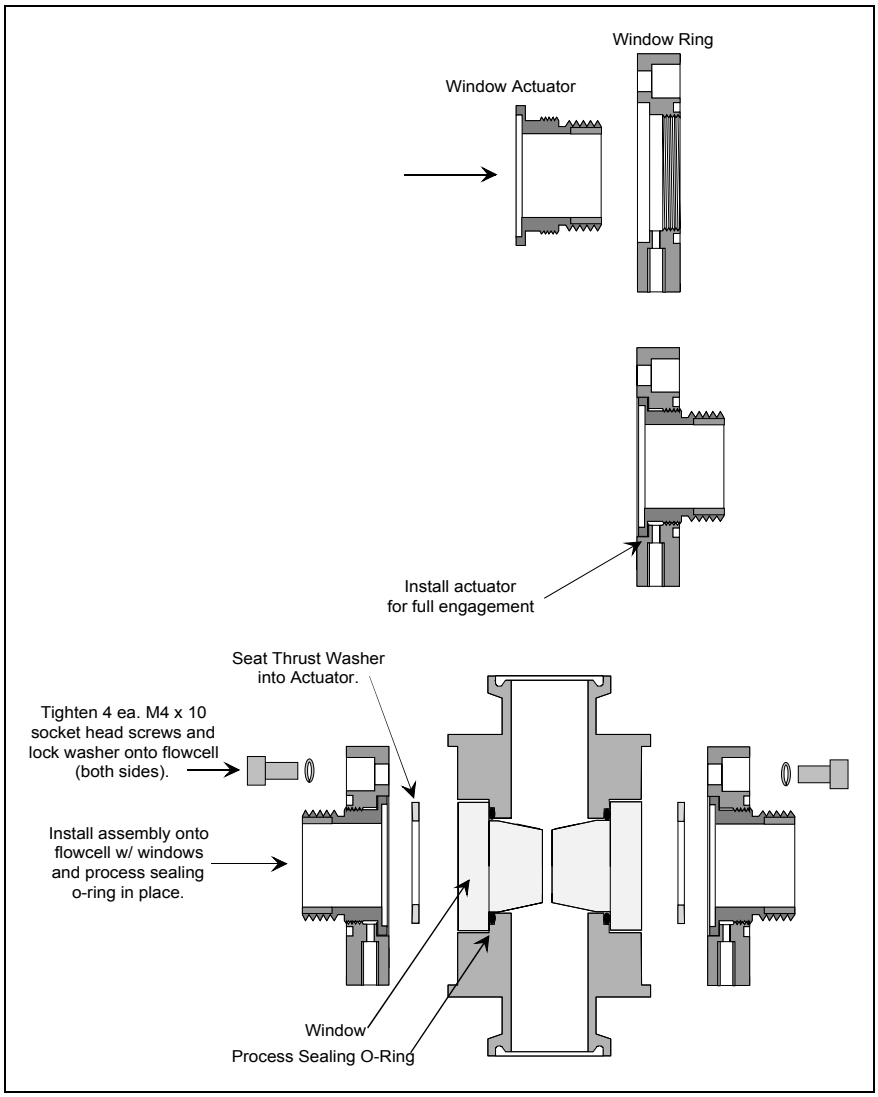


Figure 6.9: Assembling the Precision Pathlength Adjustment Rings into the Sensor

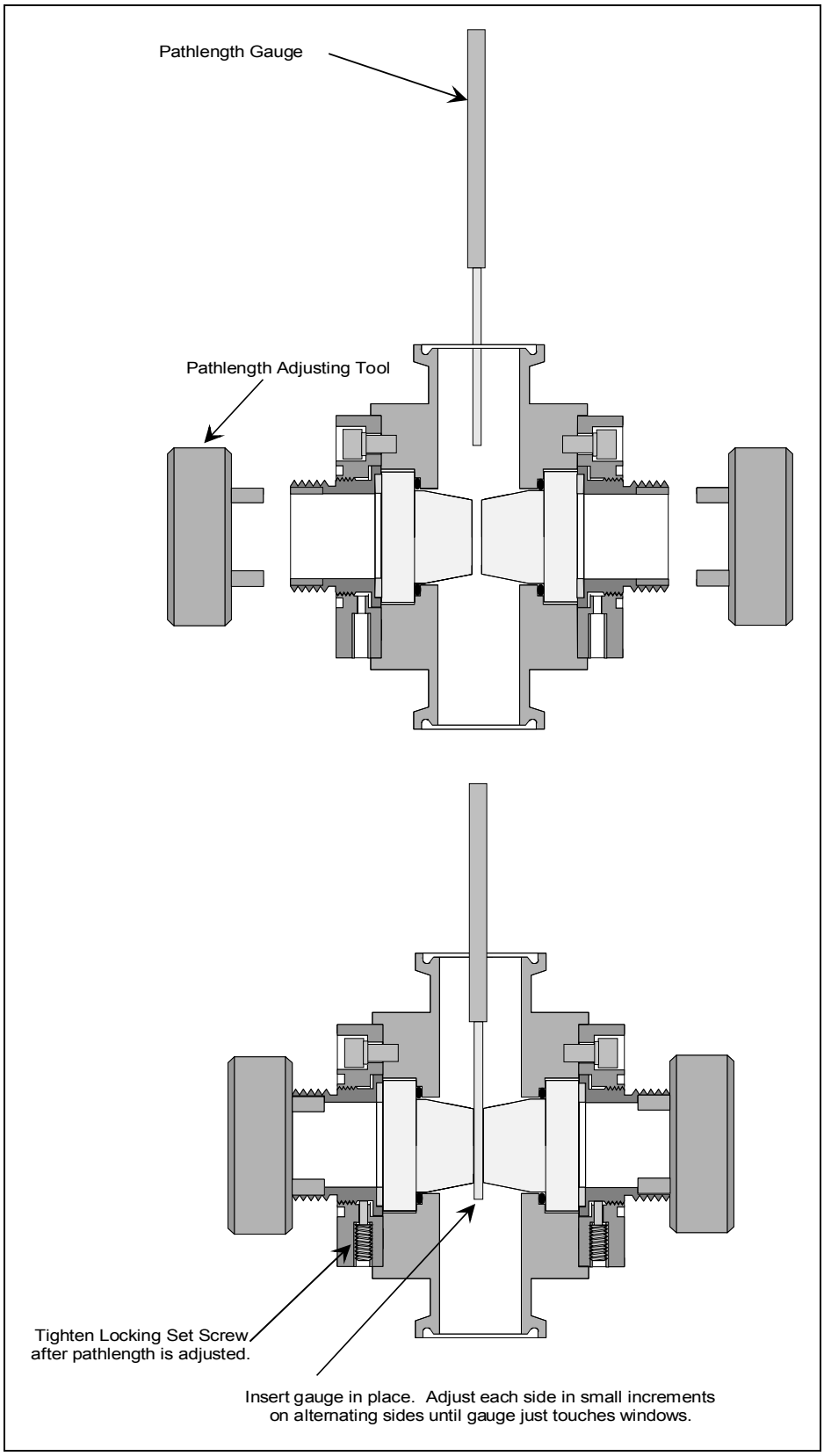


Figure 6.10: Adjusting Pathlength in the Flow cell

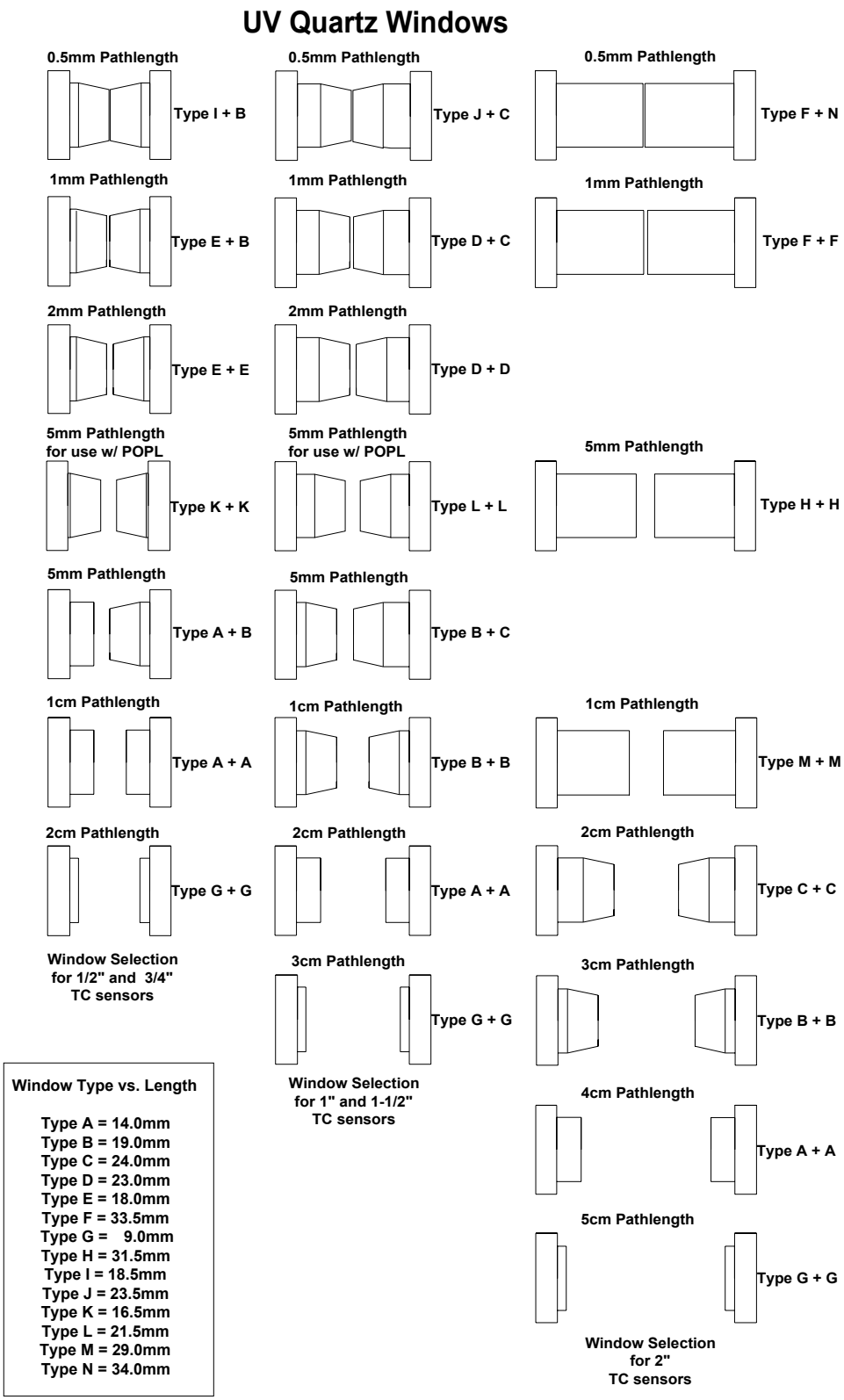


Figure 6.11: Window Type vs. Sensor Pathlength

7. Replacement Parts List

7.1 Model OUM960 UV Analyzer

DESCRIPTION	Reference No.	Part Number
Fuse, AC Input 3.15A GDA Ceramic	1678-0017-00	63006917
Fuse, DC Input 1A MST	1678-1000-00	63006930
Fuse, Relays/Alarm 125mA MSF	1678-0125-00	63006925

7.2 Model OUSAF44 UV Inline Sensor /OUA260 Flow Cell

DESCRIPTION	Reference No.	Part Number
Replacement Mercury Lamp, Phosphor Coated (276, 280nm)	1415-0150-00	63006614
Replacement Mercury Lamp, Uncoated (254, 295, 302, 313, 365nm)	1415-0160-00	63006615
Reference Detector (Pre 1999 units)	1405-0030-00	63006514
Reference Detector PCB (1999 onward units)	A020-0050-00	63009351
Measurement Detector Assembly (TMW)	A012-0760-10	63009331
Detector Lens, Quartz	1417-0001-00	63006617
254nm Interference Filter	1410-0254-00	63006537
276nm Interference Filter	1410-0276-00	63006540
280nm Interference Filter Set (1 reference, 1 measurement)	A003-0280-00	63009149
295nm Interference Filter	1410-0295-00	63006545
302nm Interference Filter	1410-0302-00	63006547
313nm Interference Filter	1410-0313-00	63006548
365nm Interference Filter	1410-0365-00	63006553
Type 'A' Quartz Window	1420-0140-01	63006635
Type 'B' Quartz Window	1420-0190-03	63006649
Type 'C' Quartz Window	1420-0240-03	63006659
Type 'D' Quartz Window	1420-0230-03	63006654
Type 'E' Quartz Window	1420-0180-03	63006644
Type 'F' Quartz Window	1420-0335-01	63006665
Type 'G' Quartz Window	1420-0090-01	63006630
Type 'H' Quartz Window	1420-0315-01	63006663
Type 'I' Quartz Window	1420-0185-03	63006647
Type 'J' Quartz Window	1420-0235-03	63006657
Type 'K' Quartz Window	1420-0165-03	71000344
Type 'L' Quartz Window	1420-0215-03	63006652
Type 'M' Quartz Window	1420-0290-01	63006662
Type 'N' Quartz Window	1420-0340-01	63006667
Window Gasket Kit, Viton (USP Class VI)	A000-0660-01	63009112
Window Gasket Kit, Kalrez	A000-0660-04	63009113
Window Gasket Kit, EPR(EPDM)	A000-0660-05	63009114
Window Gasket Kit, PTFE Encapsulated Viton	A000-0662-16	63009121
Certified POPL Retrofit Kit for 0.5nm Pathlength	A004-4420-00	71000047
Certified POPL Retrofit Kit for 1nm Pathlength	A004-4420-01	63011917
Certified POPL Retrofit Kit for 2nm Pathlength	A004-4420-02	63009163
Certified POPL Retrofit Kit for 5nm Pathlength	A004-4420-05	63009164

8. Technical Information

8.1 UV Analyzer OUM960

8.1.1 Input

Measured Variable	Dual Channel Current from Model OUSAF44 Inline Sensor
Range	Up to 5 AU/50 OD dependent upon sensor pathlength and sensor type
Digital Input	4 Channels, dry contact
Keyboard	6 push buttons keyboard

8.1.2 Output

Current Output	2 channel, 4~20mA NUMAR compatible	
Resolution	12bit	
Isolation	O1 to PE	500 VDC
	O2 to PE	500 VDC
	O1 to O2	500 VDC
Signal on Lamp Alarm	3.6mA or 21.5mA in case of error	
Actual Current Output Range	3.8mA to 20.5mA	
Load	750 ohm Max.	
Front Panel Display	4x20 Character LC display	
Alarm LED	On front Panel, Red LED	
General Relay Output	2 Channel, Solid State Relays 250VAC 125mA max.	
Relay Operation	Above/Below trigger configurable; NO/NC configurable	
Relay Delay	0~60 sec configurable	
Lamp Alarm Relay	1 Channel, NC	
Lamp Power Supply	12V DC, 1.5A Max.	

8.1.3 Power Supply

Supply Voltage	85~265 VAC, 24VDC as option
Power Consumption	12 VA Max.
Mains Fuse	3.15 A

8.1.4 Performance

Sensor Photo Current Input	1mA to 100pA
Linearity	0.3% Max.
Repeatability	0.3% Max.
Accuracy	0.3% Max.
Initial Drifting	<0.5% for first 24 hours

8.1.5 Environment

Temperature (Performance)	0~55°C
Temperature (Operation)	0~70 55°C
Relative Humidity	95%
Degree of Protection	IP 65 (front panel), IP 30 (housing)

8.1.6 Mechanical Construction

Dimensions	L x W x D: 102 x 102 x 177 mm
Weight	1.213 kg
Material	Aluminum (polyester coating on front panel)
Degree of Protection	IP 65 (front panel), IP 30 (housing)

8.2 UV Absorbance Sensor OUSAF44

8.2.1 Input and Output

Measured Input Variable	Process UV absorption and optical density
Output Signal	Photo detector current (100pA~ 1uA)

8.2.2 Mechanic Construction

Weight	1.225 kg (flow cell not included)
Housing Material	Stainless steel 316L

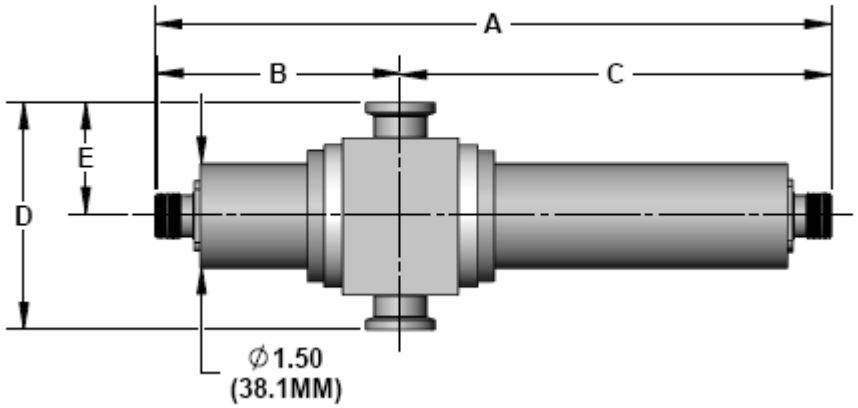


Figure 8.1: Model OUSAF44 Std. Inline Sensor Dimensions

Connection Size	A	B	C	D	E
1/4" - 3/4"	10.5" (266.7 mm)	3.75" (95.3mm)	6.75" (171.5 mm)	3.25" (82.5 mm)	1.63" (41.5 mm)
1" - 1 1/2"	10.88" (276.2mm)	3.94" (100.0mm)	6.94" (176.2mm)	3.25" (82.5 mm)	1.63" (41.5 mm)
2"	11.63" (295.3mm)	4.31" (109.5mm)	7.31" (185.7mm)	3.25" (82.5 mm)	1.63" (41.5 mm)

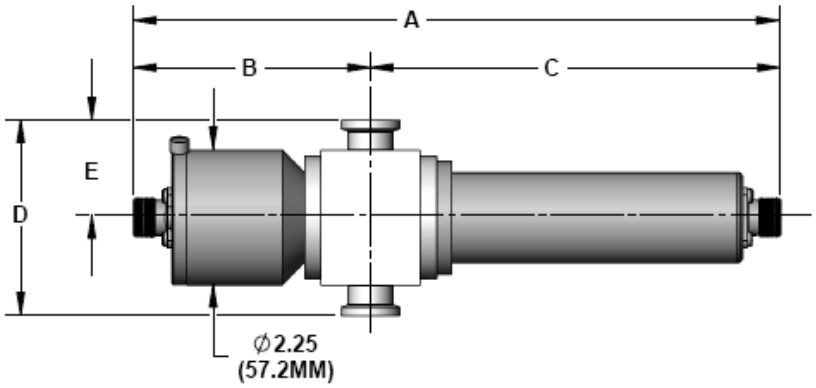


Figure 8.2: Model OUSAF44 NIST Inline Sensor Dimensions

Connection Size	A	B	C	D	E
1/4" - 3/4"	10.5" (266.7 mm)	3.75" (95.3mm)	6.75" (171.5 mm)	3.25" (82.5 mm)	1.63" (41.5 mm)
1" - 1 1/2"	10.88" (276.2mm)	3.94" (100.0mm)	6.94" (176.2mm)	3.25" (82.5 mm)	1.63" (41.5 mm)
2"	11.63" (295.3mm)	4.31" (109.5mm)	7.31" (185.7mm)	3.25" (82.5 mm)	1.63" (41.5 mm)

8.2.3 Environment

Temperature	0~55°C
Temperature (Process)	0~90 °C Continuous up to130°C for 2 hours
Relative Humidity	95%
Degree of Protection	IP 65
Maximum Pressure in Flow Cell	33 Bar/500 psi. 100 Bar option available

8.2.4 Power Supply

Supply Voltage	12 VDC
Power Consumption	4 VA continuous 8 VA start up in-rush

8.2.5 Optical Specifications

	Line Size	**Pathlengths Available**
Wavelengths Available	254, 276, 280, 295, 302, 313, 326 and 365nm	
Filters	Interference filters, 10 nm BW, stray light .01% maximum.	
Detectors	UV enhanced Silicon detectors, hermetically sealed.	
Lamp	Pre-Focused Low pressure Mercury lamp, (2000 hour half life, 3000 hour typical)	

9. Ordering Information

9.1 UV Analyzer OUM960

	Sensor Type
	A OUSAF44/AF45
	B OUSAF46 (Two Analyzers Required and Provided

	Power Supply
	1 100-250 VAC
	4 24VDC

	Transmitter Units
	A Optical Density
	Y Special Version

	Calibration Options
	1 Spare Part – Electronic Calibration Only
	2 Calibrated With Sensor
	9 Special Calibration

OUM960					Complete Order Code

9.2 UV Absorbance Sensor OUSAF44

	Wavelength / Optical Filter Option
A	254 nm
B	280 nm
C	295 nm
D	302 nm
E	313 nm
F	365 nm
Y	Special Version

	Calibration / Validation
0	Standard
1	EasyCal

	Lamp Housing Approval
A	Standard
B	FM Div I (please specify transmitter)
C	ATEX II 2G Eexd IIC T5 (please specify transmitter)

	Calibration Options
0	Isolated Order / Spare Part
1	Assembly to Flow Cell
9	Special Version

OUSAF44					Complete Order Code

9.3 Model OUA260 Flow Cell

	Sensor
A	OUSAF4x
B	OUSAF12/OUSAF22/OUSAF23
C	OUSAF13
D	OUSTF10
E	B60x
	Process Connection
A1	TriClamp®316/316LSS
A2	TriClamp® Kynar
B1	Flange ASME RFF Class 150, 316SS
B2	Flange ASME RFF Class 300, 316SS
D1	Female NPT, 316/316SS
D2	Female NPT, Kynar
E1	Swagelok BVCO
E2	Swagelok Tube
F1	Tube Stub
Y9	Special Version
	Mean Diameter
A	0.25"
B	0.375"
C	0.5"
D	0.75"
E	1" Low Volume
F	1" Standard
G	1.5"
I	2"
J	2.5"
K	3"
L	4"
Y	Special Version
	Optical Pathlength
01	0.5 mm with POPL
03	1mm with POPL
04	2mm with Standard
05	2mm with POPL
06	5mm Standard
07	5mm with POPL
08	10mm Standard
09	20mm Standard
10	30mm Standard
11	40mm Standard
12	50mm Standard
13	60mm Standard
14	70mm Standard
15	80mm Standard
16	90mm Standard
80	Not Needed (B60x)
99	Special Version
	Window Material
A	Pryex (not available for UV sensors)
B	Quartz
C	Sapphire
X	Without Windows (B60x only)
	Sealing Material
1	EPDM – FDA, USP Class VI
2	Kalrez – FDA, USP Class VI
3	Silicone - FDA
4	Viton – FDA, USP Class VI
9	Special Version
	Air Purge
A	Not used
B	Standard
Y	Special Version
	Certification
1	Basic Documentation Package
3	Life Sciences Documentation (includes 3.1)
Y	Special Version
	Options
A	No Options
B	Mounting Holes
C	Cleaning Port
D	Manual Wiper
E	Pneumatic Wiper
Y	Special Version
OUA260	Complete Order Code

9.4 Model OUK40 UV Sensor Cable Set

	Sensor
1	OUSAF44
2	OUSAF46

	Transmitter
A	OUS900 Series
B	OUS600 Series
C	OUS700 Series

	Cable Length
10	10 ft/3m
15	15 ft/4.5m
25	25 ft/7.5m
50	50 ft/15m
88	Custom length per foot
89	Custom length per meter

	Barrier
A	No Hazardous Area
B	FM, Busbar IS Barrier (included)
C	ATEX, Busbar IS Barrier (included)
D	FM, DIN Rail IS Barrier (included)
E	ATEX, DIN Rail IS Barrier (included)

OUK40					Complete Order Code

WARRANTY

Endress+Hauser Conducta Inc., warrants its products to be free from defects in workmanship and material. Endress+Hauser Conducta Inc liability is limited to replacing the instrument or any part thereof that is returned by the original purchaser, transportation paid, to the factory within one (1) year after the date of shipment, provided that Endress+Hauser examination shall disclose that a defect existed under proper and normal use.

Endress+Hauser Conducta Inc. shall not be liable for consequential or incidental damages.

www.endress.com/worldwide

Endress+Hauser

People for Process Automation