Model 662 UV Analyzer
and the
Model AF44 UV Inline Sensor
Installation and Operation
Manual

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1. General Information

The Model 662 UV Analyzer in conjunction with an AF44 UV Inline Sensor is used to measure the spectral absorbance of a liquid flowing in a pipe. Dynamic range of the instrument is determined by the optical pathlength within the sensor. A range of optical filters is available to configure the instrument to measure at a specific wavelength. A unique Low-Pressure Mercury Vapor lamp, designed specifically for the AF44 Inline sensor, is used to generate UV energy for the measurement.

The transmitter and sensor both comply under the European Community Product Safety and EMC Directive (CE Mark).

1.1 How the Model 662 Works

The Model AF44 sensor generates two photo current signals based upon the amount of UV energy present at its lamp source (reference) and measurement point internally. The Model 662 unit computes the logarithmic ratio of these two signals and hence determines the absorbance of the liquid passing through the sensor. The absorbance value in optical density units (OD) is displayed on the front panel and proportional analog output signals are simultaneously transmitted for connection to other instrumentation and recording devices.

1.2 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.

where $A = \log \frac{1}{T} = \log \frac{Io}{Ir}$

and $T = \frac{Ir}{Io}$

The above assumed that the optical pathlength remained 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
L = pathlength in cm

1.3 Easy Interfacing

The Model 662 UV Analyzer incorporates a front panel display and two analog output signals. The display on the front panel indicates Optical Density (OD) normalized to a 1cm pathlength. The 4 to 20mA analog output tracks with the range switch located on the module's front panel and can drive an output of up to 400 ohms load. A separate 0 to 2Vdc analog output is also provided for local control and/or recording, and is to be used with high impedance devices (10,000 ohms per volt minimum). Both outputs are available simultaneously. This 0 to 2 VDC output is the primary calibrated signal of the instrument. It always tracks the maximum span of the instrument and is unaffected by the position of the range switch or autozero setting. The display value and current output are derived from this signal.

2. Description of the Model 662 UV Analyzer

2.1 Specifications

Signal Inputs Dual Channel current from the AF44 Inline Sensor Series

Ranges 5 Selectable Full-scale Ranges shown below for each sensor pathlength.

RANGE	0.5MM PL	1MM PL	2MM PL	5MM PL	1CM PL	2CM PL
A	0-50 OD	0-20 OD*	0-10 OD*	0-5 OD	0-2 OD*	0-1 OD*
B	0-20 OD	0-10 OD	0-5 OD	0-2 OD	0-1 OD	0-0.5 OD
C	0-10 OD	0-5 OD	0-2 OD	0-1 OD	0-0.5 OD	0-0.2 OD
D	0-5 OD	0-2 OD	0-1 OD	0-0.5 OD	0-0.2 OD	0-0.1 OD
E	0-2 OD	0-1 OD	0-0.5 OD	0-0.2 OD	0-0.1 OD	0-0.05 OD

*Increase this range 50% with Hi OD Selected

Accuracy ±2% (±1% typical)

Linearity ±1% of range

Repeatability ± 0.5%

Auto Zero Range 90% of full-range

Auto Zero Repeatability ±0.1% of highest range decreasing to ±2.5% of lowest range

Display 3½ Digit LCD Display

Signal Outputs Lamp Fail Relay Contact N.O., 1A 115VAC resistive load
4-20mA Tracking to Range Selected, 400 ohm max load
0-2VDC (0-3V for HI OD), tracking to maximum range, 10,000 ohm min load.

Power 115/230 VAC +/- 10%, 50/60 Hz, 14VA, (Optional 20-28VDC, 12 W)

Operating Environment Temperature; 0-55 ^{o}C Humidity; 0-90% RH, Non-condensing

Dimensions Type 4 DIN Cassette Module, 3U high by 14 hp wide

Approvals CE, T Mark (Safety and EMC) EN 61010, EN 55011, EN 50082-1

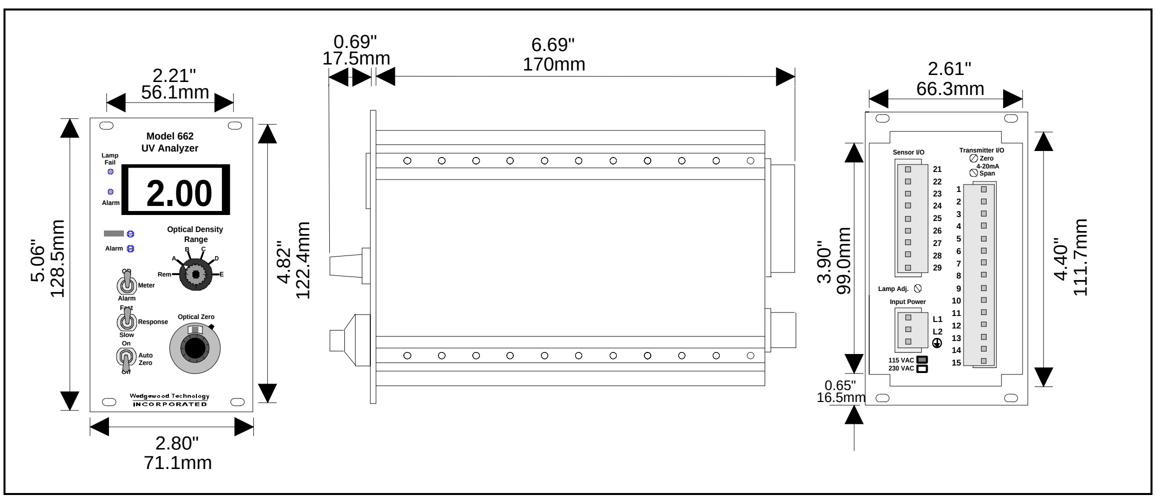


Figure 1 - Model 662 UV Analyzer Dimensions

2.2 Front Panel Controls and Their Function

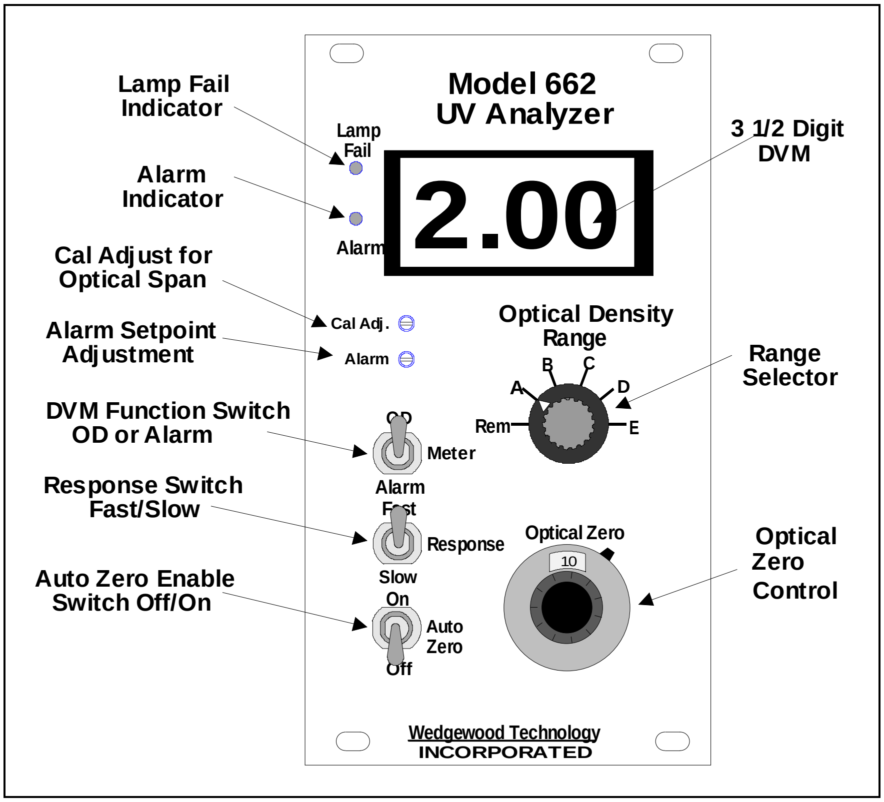


Figure 2 - Model 662 UV Analyzer Front Panel Controls

The Model 662 front panel controls are shown in figure 2. The function of each control is as follows:

Lamp Fail Indicator: When the Lamp Fail indicator is illuminated, the UV lamp output has decreased to at least 50% of its original value and it is advisable to change it for a new one. Should a lamp fail indication occur while the instrument is in process, it is not necessary to stop immediately to attend to the problem. The process run can be completed before lamp replacement.

Alarm Indicator: When the Alarm Indicator is illuminated, the measured OD has exceeded the Alarm limit previously set on the instrument. The alarm relay is also energized.

Cal Adjust for Optical Span: The cal adj. is used during calibration of the system using a liquid standard or an EasyCal™ system. It sets the span of the system.

Alarm Setpoint Adjustment: This control adjusts the alarm set point. The set value is displayed on the front panel meter with the DVM Function Switch (OD or Alarm) in the Alarm position.

DVM Function Switch (OD or Alarm): Selects the Alarm set point or the process OD signal to be displayed on the panel DVM.

Response Switch Fast/Slow: Selects either Fast (>0.1 sec) or Slow (<1.0 sec) response for 10 to 90% changes in the measured range.

Auto-Zero Enable, Switch Off/On: The Model 662 is designed with an Auto Zero capability that can be initiated either locally or remotely. When initiated, the input signal is sampled and held in non-volatile memory. The stored value will remain in memory even after a power down condition. When power is re-applied, after a 2 second delay, the stored Auto-Zero value is activated. Every time the Auto Zero switch is cycled from OFF to ON, the stored zero value is updated with a new OD value. The accuracy of the Auto-Zero is typically ±0.1% of full range of the instrument, decreasing to ±2.5% at lowest range. The Auto Zero function is operative only on the 4 to 20mA output channel and the front panel display. The voltage output channel always monitors the full span of the instrument. The Auto Zero function can be controlled remotely when the Range Select switch is in the Rem (Remote) position. *When operating remotely, the Auto Zero front panel switch must be in the OFF position.*

Optical Zero Control: This control adjusts the analog voltage output and the front panel DVM to 0.00 VDC when the sensor is filled with a zeroing fluid (i.e. distilled water).

Range Select: The Range Select switch sets the full-scale OD value for the 4-20mA analog output. The selected range depends on the sensor pathlength. When in the Rem. (Remote) position, the full-scale range of the system is selected remotely via the rear panel transmitter I/O connector. If the Rem position is selected with no selection connections on the back of the instrument, the range is automatically switched to “A”. Switching to Rem also activates the remote auto zero function. *When operating remotely, the Auto Zero front panel switch must be in the OFF position.* The full-scale ranges are as follows for each switch position:

RANGE	0.5MM PL	1MM PL	2MM PL	5MM PL	1CM PL	2CM PL
A	0-50 OD	0-20 OD*	0-10 OD*	0-5 OD	0-2 OD*	0-1 OD*
B	0-20 OD	0-10 OD	0-5 OD	0-2 OD	0-1 OD	0-0.5 OD
C	0-10 OD	0-5 OD	0-2 OD	0-1 OD	0-0.5 OD	0-0.2 OD
D	0-5 OD	0-2 OD	0-1 OD	0-0.5 OD	0-0.2 OD	0-0.1 OD
E	0-2 OD	0-1 OD	0-0.5 OD	0-0.2 OD	0-0.1 OD	0-0.05 OD

*Increase this range 50% with Hi OD Selected

Table 1 - Range Switch Analog Output vs. Pathlength

2.3 Rear Panel Controls

Rec. Zero: This control allows independent adjustment of the current output to 4.00mA when the voltage output is 0.00Vdc. It can also be used to offset the 4 to 20mA zero signal value.

Rec. Span. This control independently adjusts the span of the current output and has a range of +/-5% at 20.00mA.

Lamp Adj. This adjusts the voltage output to the lamp as measured across terminal 26 and 27 on the rear panel Sensor I/O connector.

3. Description of the Model AF44 UV Inline Sensor

3.1 Specifications

Tri-Clover Sensors

Line Size	Pathlengths Available								
¼"	0.5mm	1mm	2mm	5mm	1cm				
½"	0.5mm	1mm	2mm	5mm	1cm				
¾"	0.5mm	1mm	2mm	5mm	1cm				
1"	0.5mm	1mm	2mm	5mm	1cm	2cm	3cm		
1½"	0.5mm	1mm	2mm	5mm	1cm	2cm	3cm		
2"	0.5mm	1mm		5mm	1cm	2cm	3cm	4cm	5cm

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, (Patent Pending) (1000 hour life, 3000 hour typical)
Flowcell Material 316L Stainless Steel (polished interior to Ra > 15µinch and sterilizable) or Kynar™
Windows Fused Quartz
Seals 'O' Ring seals. Viton, Silicone, EPR , EDPM, Kalrez
Pathlength 0.5mm to 50 mm (line size dependent -see table above)
Maximum Pressure 33 BAR, 500 psi (line connection limited, Stainless Steel cells) 100 Bar option available
Operating Temperature 0 to 90 ºC continuous, up to 130 ºC for 2 Hours (Stainless Steel)
Cable Length 10 ft, 25 ft standard - up to 100 feet (33 meters) maximum

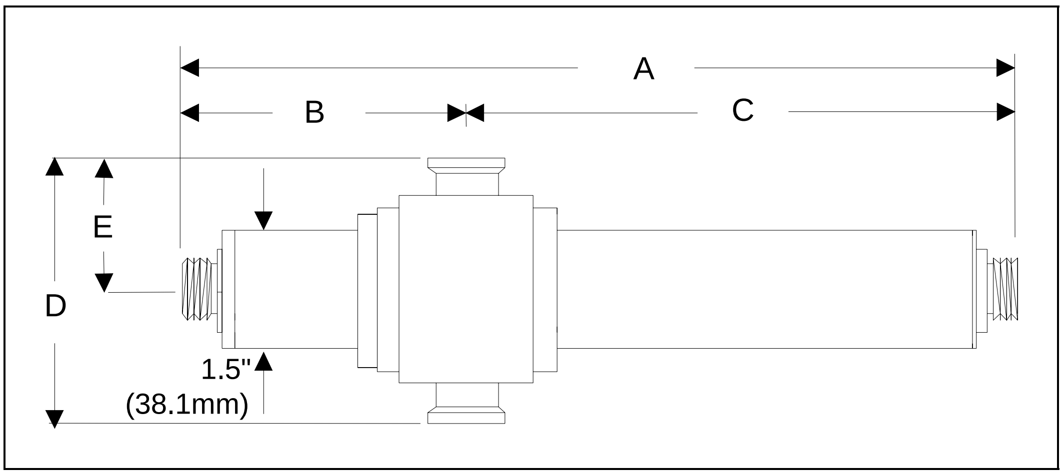


Figure 3 - Model AF44 Std. Inline Sensor Dimensions

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)

Table 2 - Model AF44 Std. Inline Sensor Dimensions

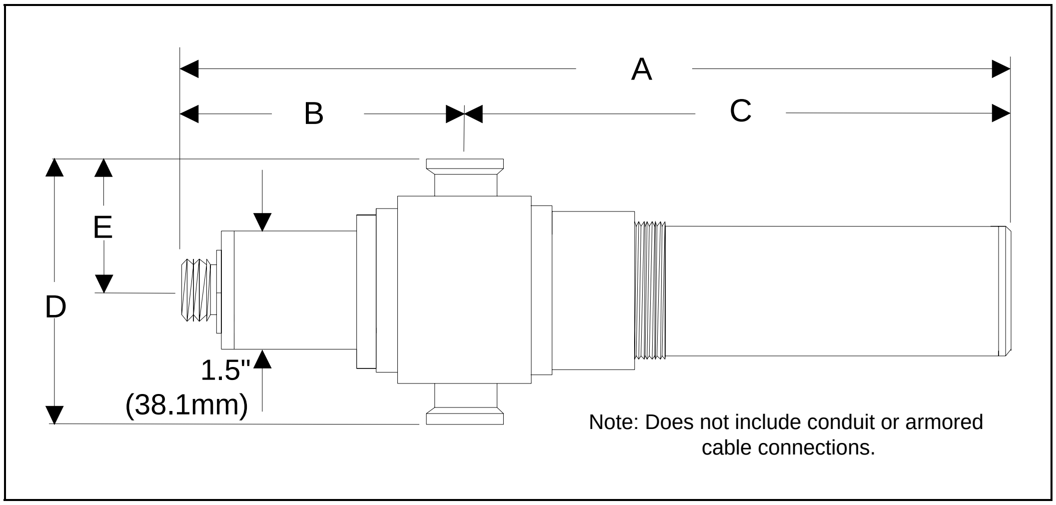


Figure 4 - Model AF44 EXP-1 Inline Sensor Dimensions

Connection Size	A	B	C	D	E
1/4" - 3/4"	11.85” (301.0mm)	3.75” (95.3mm)	8.10” (205.8 mm)	3.25” (82.5 mm)	1.63” (41.5 mm)
1" - 1 1/2"	12.24” (310.9mm)	3.94” (100.0mm)	8.30” (210.8mm)	3.25” (82.5 mm)	1.63” (41.5 mm)
2"	12.96” (329.2mm)	4.31” (109.5mm)	8.65” (219.7mm)	3.25” (82.5 mm)	1.63” (41.5 mm)

Table 3 - Model AF44 EXP-1 Inline Sensor Dimensions

3.2 Calibration Reference Rod Feature

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 obscuration of the sensor light path and therefore simulating absorbance in the optical chain. The cross-sectional view of an AF44 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.

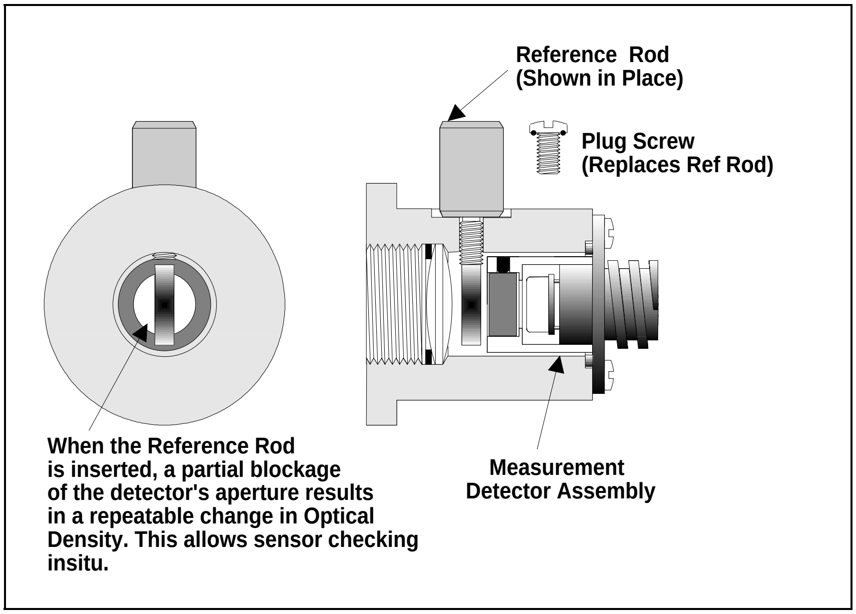


Figure 5 - Cross Sectional view of Detector with Reference Rod

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.

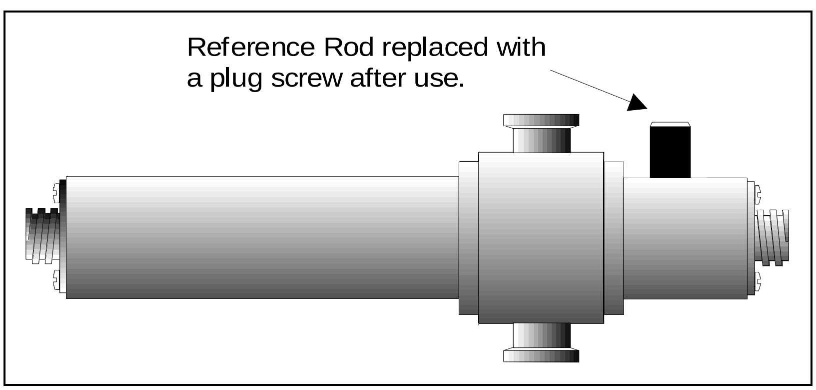


Figure 6 - Typical Inline UV Sensor with Reference Rod

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 662 UV Analyzers with standard AF44 sensors are calibrated at the factory using liquid standards. Please refer to the Test Sheet accompanying your instrument for the factory determined reference rod value.

3.3 EasyCal™ Liquid-Free NIST Traceable Calibration System

All AF44 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 units in the field.

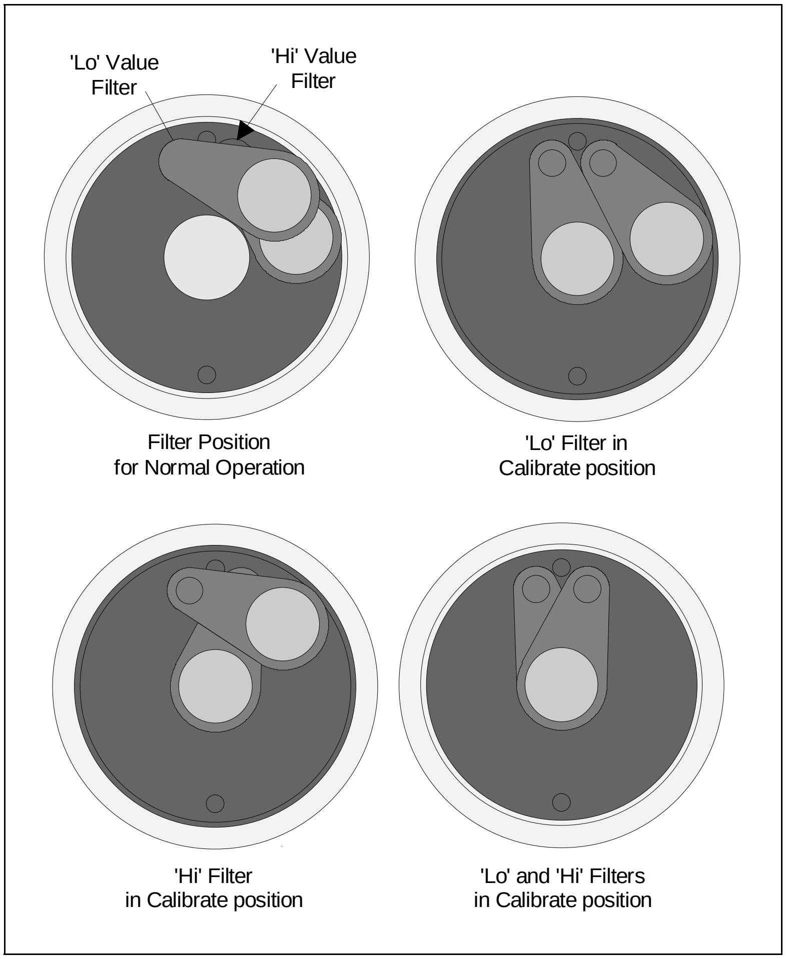


Figure 7 - Calibration Filter Operation

Each EasyCal™ unit contains two traceable filters - a nominal 0.5 A and 1 A - 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 wavelengths is ascertained.

3.4 Precision Optical Pathlength Adjustment System

Systems fitted with an EasyCal™ unit 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 8 – AF44 Sensor with Precision Pathlength Adjuster Option

4. Installation

4.1 Model 662 Transmitter Installation

Before beginning installation, inspect the transmitter, sensor, and supplied cable set for any signs of shipping damage. Report any visual damage or discrepancies to Wedgewood Technology and the Shipper immediately.

The Model 662 UV Analyzer transmitter is a 3U, 14 hp DIN enclosure, Type 4, which can be installed a variety of panel, wall and benchtop housings. Refer to figure 1 for mounting dimensions. Mount or install the transmitter 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.

4.2 Model 662 Cables and Wiring

All wiring terminals are located on the back panel of the Model 662. The transmitter/sensor interconnection cables supplied with the system have all been pre-terminated and labeled for ease of installation. Refer to Figure 10 for a full terminal function description.

The Model 662 has terminals for 2 analog outputs - a voltage output of 0 to 2Vdc and a current output of 4 to 20mA. The voltage output is intended for connection to local indicators and recorders and for system calibration purposes. Resistive dividers can be used to scale the Voltage delivered to such devices as long as the total resistive load remains 10,000 ohms or greater.

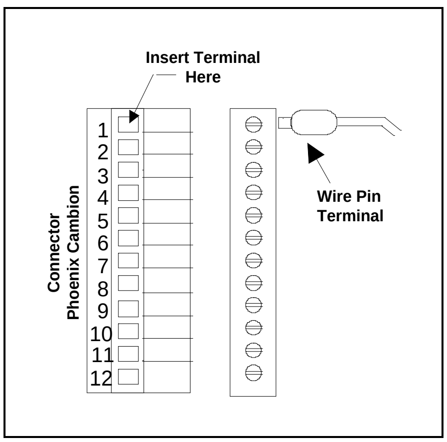
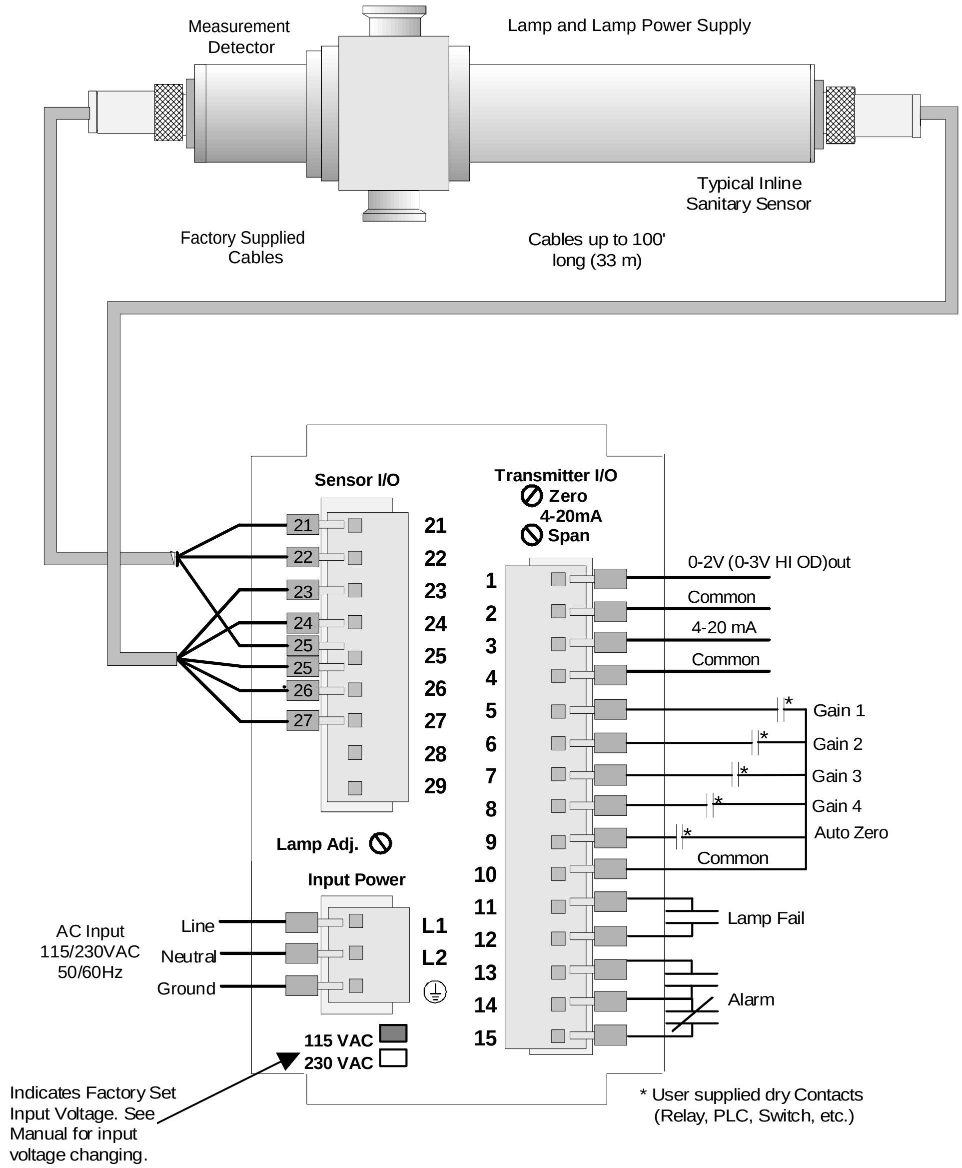


Figure 9 - Wire Terminal Preparation

Cables installed for signal connection (i.e. analog outputs, lamp fail output) should be shielded twisted pairs. When routing the cables, separate signal cables from power wiring.

Prepare all cable ends as per figure 9 and terminate as per figures 10-12.



Sensor I/O
21. Meas. Det
22. Meas. Det
23. Ref. Det
24. Ref. Det
25. Shield
26. Lamp Pos.
27. Lamp Neg.
28. N.C.
29. N.C.

Input Power
L1 - Line
L2 - Neutral
⏚ - Ground

Transmitter I/O
1. VDC Out
2. Common
3. 4-20 mA Out
4. Common
5. Gain Set 1
6. Gain Set 2
7. Gain Set 3
8. Gain Set 4
9. AutoZero Set
10. Set Common
11. Lamp
12. Fail
13.
14. Alarm
15.

CAUTION
Service of this instrument to be performed by qualified personnel only! Consult instrument's manual for installation and service instructions.

Input Power Requirements
115VAC 50/60Hz 14VA
230VAC 50/60Hz 14VA

Wedgewood Technology, Inc.
100 Industrial Way
San Carlos, CA 94070 USA

Figure 10 - Model 662/AF44 Wiring Diagram (AC Input Version)

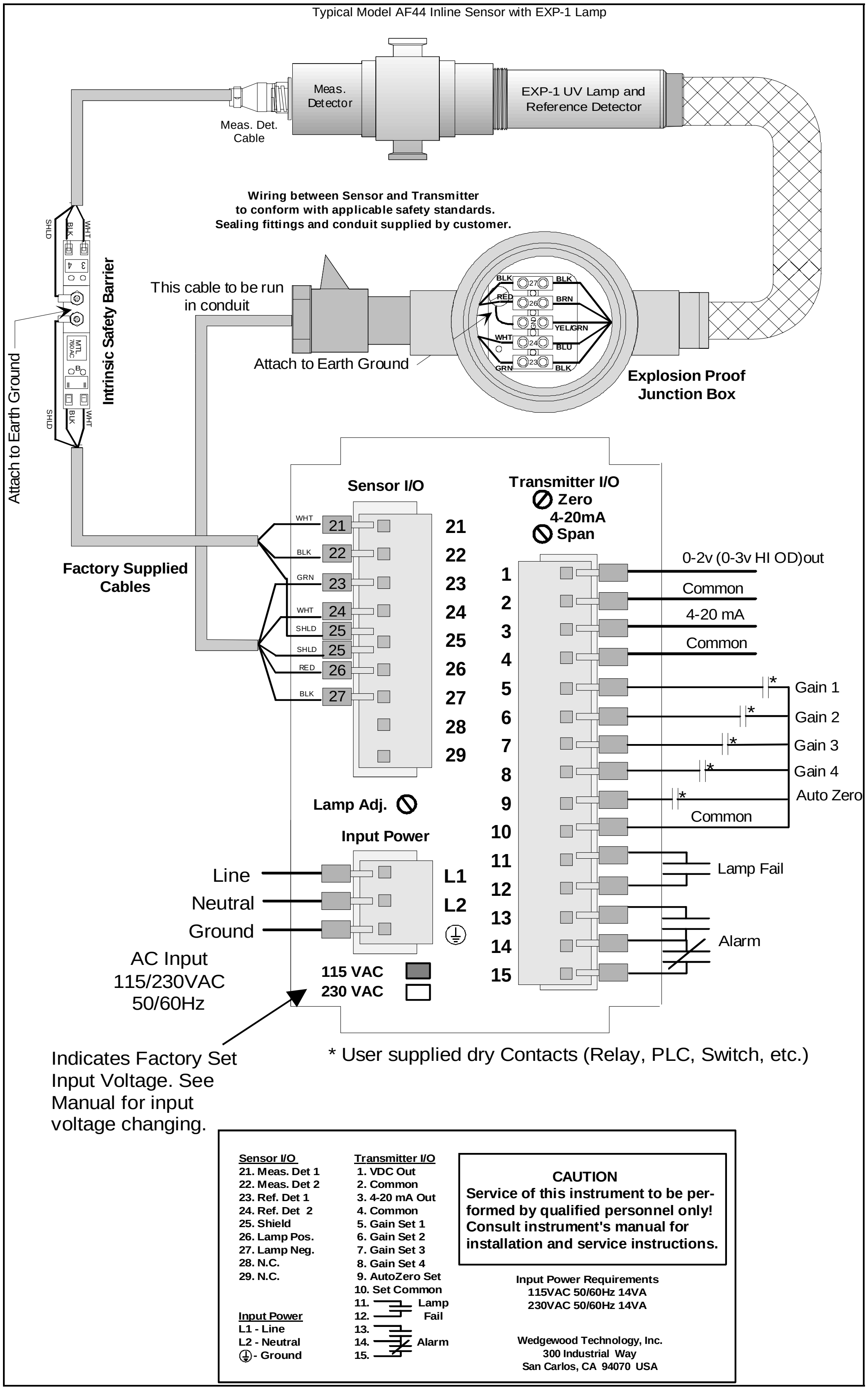


Figure 11 - Model 662/AF44 EXP-1 Wiring Diagram (FM Approved Version)

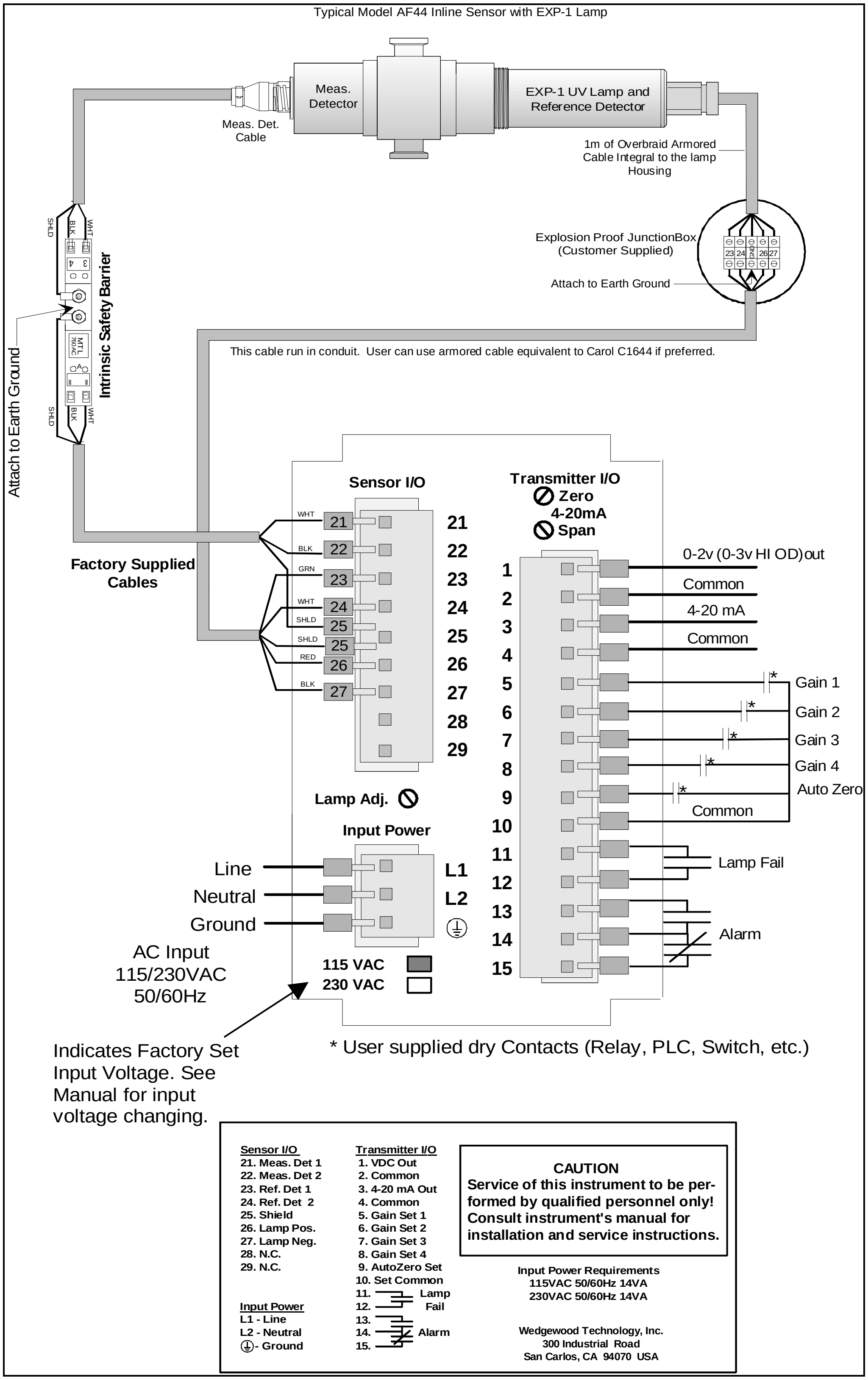


Figure 12 - Model 662/AF44 EXP-1 Wiring Diagram (CENELEC Approved Version)

4.3 DC Input Power Option

For instruments supplied for 24VDC operation, only the power input connection is changed. Figure 13 shows the connection detail for a 24VDC unit.

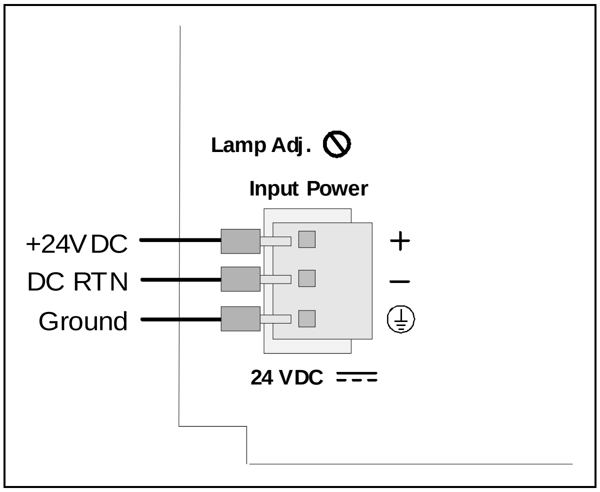


Figure 13 - Model 662/AF44 Wiring Diagram (DC Input Version)

4.4 Model AF44 Sensor Installation

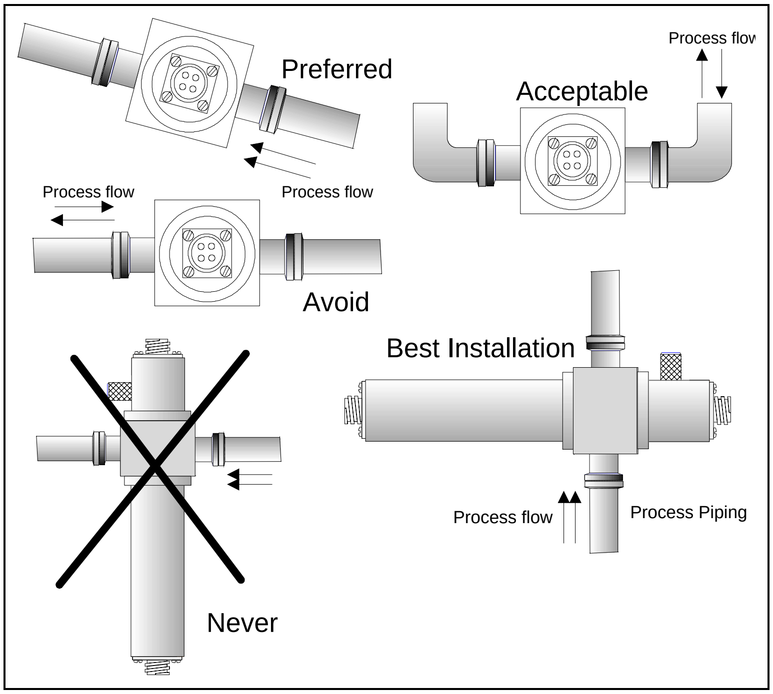


Figure 14 - Sensor Installation

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, adequate space should be allowed 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.

5. Operation of the Model 662 UV Analyzer

5.1 Initial Start-Up

To start up the instrument, follow the steps detailed below:

1. Ensure the sensor is connected and the connectors are properly secured with their locking ferrules.
2. Connect power to the transmitter and leave for 30 minutes to warm-up the sensor.
3. Either fill the sensor with de-ionized water or ensure the sensor is clean and dry internally.
4. Check the Lamp Voltage setting. Connect an accurate multimeter across the Lamp Output terminals on the back of the instrument (Terminals 26 and 27) and adjust the **Lamp Adj.** Control immediately below the terminal strip to give an output of 12Vdc ±0.1 at the terminals. Once set, disconnect the multimeter.
5. Select position **"A"** on the transmitter front panel **Range Select** switch.
6. Set the **Auto Zero** switch to the "**Off**" position.
7. If the sensor is fitted with EasyCal™, ensure both filters are in the "Out" position.
8. Connect an accurate multimeter to the 0 to 2Vdc output (Terminals 1 and 2) on the back of the instrument and adjust the front panel "**Optical Zero**" control for a reading of 0.000V. The front panel display should read 0.00/0.0 ±1 count.

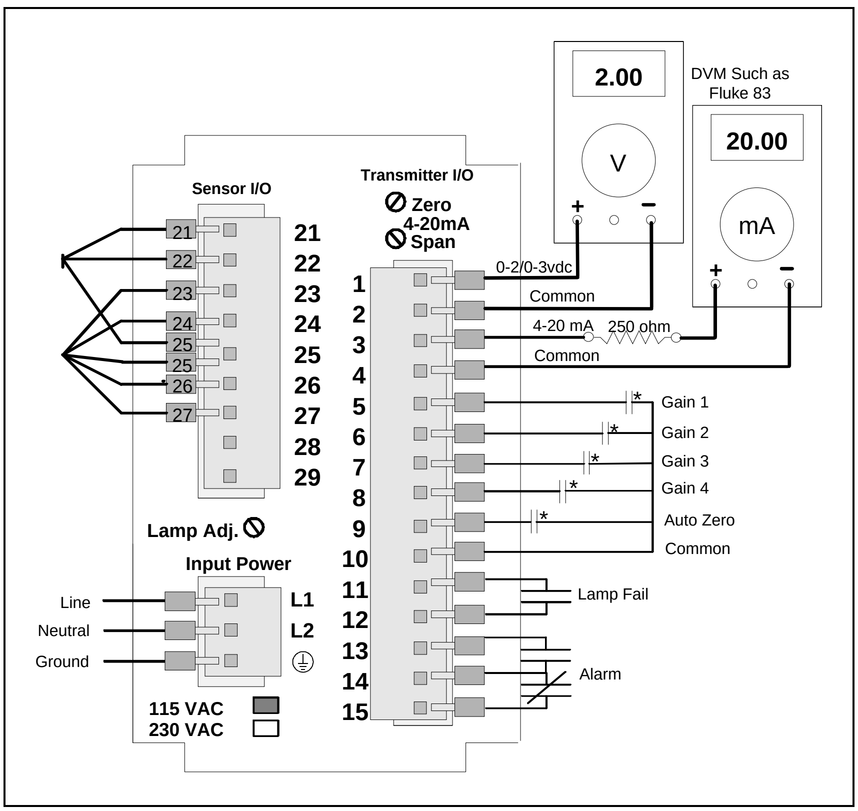


Figure 15 - Start-Up/Calibration Test Set-up

9. Connect an accurate multimeter to the Analog 4 to 20mA output (Terminals 3 and 4), in series with a 250 ohm load. The 250 ohm load is only necessary if the instrument is not connected to any other device.
10. Adjust the "**4 to 20mA Zero**" control located on the rear panel to give a 4.00mA reading on the multimeter.

11. Select position **“E”** on the transmitter front panel **Range Select** switch.

RANGE	0.5MM PL	1MM PL	2MM PL	5MM PL	1CM PL	2CM PL
E	2.00 OD 0.080VDC	1.00 OD 0.100VDC	0.50 OD 0.100VDC	0.20 OD 0.080VDC	0.100 OD 0.100VDC	0.050 OD 0.100VDC

Table 4 - Range Switch Position “E” Display/Analog Output vs. Pathlength

12. Adjust the front panel "**Optical Zero**" control for a reading on the multimeter (refer to table 4) connected to the Voltage output of the system. Check the display for correct reading according to the sensor pathlength (refer to table 4).
13. Adjust the "**4 to 20mA Span**" control located on the rear panel to give a 20.00mA reading on the multimeter connected to the mA output.
14. Readjust the front panel "**Optical Zero**" control for a reading of 0.000Vdc reading on the Voltage output multimeter, 0.00/0.0 on the front panel display.
15. Check the calibration of the system in the following way:
    A. For standard sensors
        1. Remove the plug screw and seal from the detector housing and insert the reference rod supplied with the system.
        2. Select position **“A”** on the transmitter front panel **Range Select** switch.
        3. Compare the reading on the front panel display with the factory determined value as noted on the systems test sheet (± 1%). The **Cal Adj.** control on the front panel may be used to make slight adjustments to the instrument until the two values are the same. This step ensures the calibration of the instrument is the same as when the unit left the factory.
        4. Remove the calibration rod and replace the plug screw and seal.
    B. For Sensors with EasyCal™
        1. Select position **“A”** on the transmitter front panel **Range Select** switch.
        2. Unlock and rotate the "**Hi**" filter into the optical path until it reaches the stop.
        3. Compare the reading on the front panel display with the factory determined value for the filter as noted on the EasyCal™ Calibration Certificate. The **Cal Adj.** control on the front panel may be used to make slight adjustments to the instrument until the two values are the same. This step ensures the calibration of the instrument is the same as when the unit left the factory.
        4. Rotate the "**Hi**" filter out of the optical path until it reaches the stop and lock into its storage postion.
16. Disconnect the test multimeter setup.
17. The instrument is ready for use. Note: if a multimeter is not available, the output can be adjusted against other connected devices such as a chart recorder, PLC or data acquisition system.

5.2 Operating Auto-Zero

The auto-zero function, when operated, will force the display reading to zero and the 4 to 20mA output to 4mA. It is operated locally by setting the transmitter front panel **Auto-Zero Switch** to **“On”**. Returning the switch to the “Off” position will remove any auto-zero offset and the instrument will read normally again.

Note: The switch will be inoperative if the front panel **Range Select** switch is set to **“Rem”**.

5.3 Using the Fast/Slow Response Feature

The response switch is used to introduce some filtering to the optical density measurement where the process stream is "noisy" and causing the reading to fluxuate. The **"Fast"** position should always be used in preference to the **"Slow"** position if the reading is acceptable, as this will give the fastest response time to changes in UV absorbance in the process. The **"Slow"** position will stabilize readings on the instrument display and analog outputs, but will not be effective in processes where there is gross interference of the measurement from entrained gas bubbles.

5.4 Adjusting The Alarm Set Point

The Model 662 UV Analyzer is equipped with an alarm front panel indicator and relay output. When the alarm set point is exceeded, the indicator illuminates and the relay is activated. To set the alarm setpoint, switch the **Meter Switch** on the transmitter front panel to **"Alarm"**. The front panel display will then show the current value of the alarm set point in OD. Change this value to any desired value by adjusting the **Alarm** adjustment control on the front panel with a trimpot screwdriver or similar. Remember to put the **Meter Switch** back to **"OD"** when finished.

5.5 Putting the Unit into Operation

Once the initial start up checks and adjustments have been made, the unit is fully ready to read optical density of liquid in the sensor flow cell. To ensure you get the performance you require, check the following:

- Select the required range on the transmitter front panel **Range Select** switch.
- Set the transmitter front panel **DVM Function Switch** in the **"OD"** position.
- Set the transmitter front panel **Response Switch** to the desired position.
- Set **Auto-Zero** if necessary.

Refer to Figure 2 for the location of the front panel controls.

6. Calibration

Note: Calibration should be carried out by qualified personnel. If it is necessary to open the transmitter case for any reason, care should be taken as line Voltage levels are present on the internal circuit boards and cables.

When calibrating instruments used in a validated process, there is often a requirement to first establish the state of the measurement before any adjustments are made. Procedures vary from facility to facility, but most require that a point within the range of the instrument be observed and documented for deviation either against a liquid standard or one of the EasyCal filters. Note that the primary measurement channel of the Model 662 instrument is reflected in output on the Voltage output and assessments of instrument calibration condition should made against this channel. The current output is often used as a subrange of the instrument and has the added complication that autozero acts upon it. Before such a check is made, the sensor should be put into a zero condition (typically filled with clean water) and any zero drift should be assessed on the Voltage output. Checking zero point change on the current output can be misinterpreted dependent upon the range selected.

6.1 Use of Liquid Standards for Calibration

A liquid solution of a known optical density (at the wavelength of the sensor) must be used for instrument calibration. 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. 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.

Note: *The primary output of a 662 transmitter is the Voltage output signal. Both the display value and the 4 to 20mA output signal are derived from this Voltage output signal. For the most complete calibration, the Voltage output must be adjusted first, with the display reading and the 4 to 20mA output signal adjusted to match.*

1. Connect the transmitter and sensor as shown in figure 15 (earlier in this manual).
2. Connect power to the transmitter and leave for 30 minutes to warm-up the sensor.
3. Fill the sensor with de-ionized water.
4. Select position **"A"** on the transmitter front panel **Range Select** switch.
5. Set the **Auto Zero** switch to the "**Off**" position.
6. Adjust the front panel "**Optical Zero**" control for a reading of 0.000V on the multimeter connected to the Voltage output of the instrument. Check that the front panel display reads zero +/- 1 digit.
7. Adjust the "**4 to 20mA Zero**" control located on the rear panel to give a 4.00mA reading on the multimeter connected to the current output of the instrument.
8. Rinse and fill the sensor with a calibration solution of approximately mid-scale optical density value of the full-scale range of the sensor (i.e. for 5mm sensors, use a 2.5 OD solution.). Refer to the original test sheet from the factory for pathlength details.

RANGE	0.5MM	1MM PL	2MM PL	5MM PL	1CM PL	2CM PL
A	25 OD	10 OD	5.0 OD	2.5 OD	1.0 OD	0.5 OD

Table 5 – Mid-Scale Values of "A" Range vs. Pathlength

9. Adjust the front panel **"Cal Adj"** control for the correct reading on the multimeter connected to the Voltage output of the instrument using the following formula.

$$\frac{CAL\_Solution\_OD}{Sensor\_Max\_OD} \times 2(\times 3\_\ for\_Hi - OD\_systems = V\_Output)$$

10. Check that the front panel display reads the correct value +/- 1 digit on the front panel DVM. If the reading is off, the DVM span can be adjusted to bring the reading in line with the Voltage output. **Only trained personnel should attempt this adjustment.** Power down the instrument and remove the cable connectors on the rear of the instrument. Remove the instrument back panel and slide out the top cover plate, exposing the instrument internals. Re-connect the electrical connections and apply power to the instrument. Allow the unit to stabilize. Adjust the front panel display to read the correct value by carefully turning the control located on the display board.

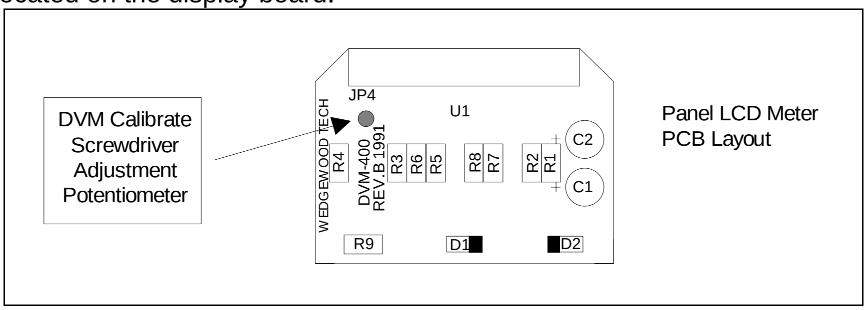


Figure 16 - Display Reading Calibration

11. Adjust the rear panel **"4 to 20mA Span"** control for the correct current reading on the multimeter using the following formula.

$$\left[\frac{CAL\_Solution\_OD}{Sensor\_Max\_OD} \times 16\right] + 4 = mA\_Output$$

12. Re-check zero and span settings. Rinse and fill the sensor at least three times when pouring calibration solutions to insure any residual solution is flushed out.
13. Thoroughly rinse the sensor with water to remove all traces of the calibration solution.
14. Disconnect the test multimeter setup.
15. Fill the sensor with de-ionized water.
16. Adjust the front panel "**Optical Zero**" control for a reading of 0.00/0.0 on the front panel display.
17. Remove the plug screw and seal from the detector housing and insert the reference rod supplied with the system.
18. Select position **"A"** on the transmitter front panel **Range Select** switch.
19. Note the value on the front panel display. Keep this value safely as it can be used at a later date to check calibration with the calibration reference rod.
20. Remove the calibration rod and replace the plug screw and seal.

The sensor is now fully calibrated.

6.1.1 Calibration Method To Provide Improved Accuracy On Both Outputs

This method will improve accuracy of the 4 to 20mA signal when both outputs are utilized for process monitoring and the selected range is one other than “A”.

1. Connect power to the transmitter and leave for 30 minutes to warm-up the sensor.
2. Fill the sensor with de-ionized water.
3. Select the required position on the transmitter front panel **Range Select** switch.
4. Set the **Auto Zero** switch to the "**Off**" position.

5. Adjust the front panel "**Optical Zero**" control for a reading of 0.000V on the multimeter connected to the Voltage output of the instrument. Check that the front panel display reads zero +/- 1 digit.
6. Adjust the "**4 to 20mA Zero**" control located on the rear panel to give a 4.00mA reading on the multimeter connected to the current output of the instrument.
7. Rinse and fill the sensor with a calibration solution of approximately mid-scale optical density value of the overall range of the sensor.
8. Adjust the front panel **"Cal Adj"** control for the correct reading on the multimeter connected to the Voltage output of the instrument using the following formula. The current output may be overrange depending upon the output range position selected.

$$\frac{CAL\_Solution\_OD}{Sensor\_Max\_OD} \times 2(\times 3\_\ for\_Hi - OD\_systems = V\_Output)$$

9. Check that the front panel display reads the correct value +/- 1 digit on the front panel DVM. If the reading is off, the DVM span can be adjusted to bring the reading in line with the Voltage output. **Only trained personnel should attempt this adjustment.** Power down the instrument and remove the cable connectors on the rear of the instrument. Remove the instrument back panel and slide out the top cover plate, exposing the instrument internals. Re-connect the electrical connections and apply power to the instrument. Allow the unit to stabilize. Adjust the front panel display to read the correct value by carefully turning the control located on the display board. See figure 16.
10. Rinse and fill the sensor with a calibration solution of approximately 80% (but no more than) of full-scale optical density value of the selected range of the sensor.
11. Adjust the rear panel **"4 to 20mA Span"** control for the correct current reading on the multimeter connected to the current output using the following formula.

$$\left[\frac{CAL\_Solution\_OD}{Range\_Max\_OD} \times 16\right] + 4 = mA\_Output$$

12. Re-check zero and span settings. Rinse and fill the sensor at least three times when pouring calibration solutions to insure any residual solution is flushed out.
13. Thoroughly rinse the sensor with water to remove all traces of the calibration solution.
14. Disconnect the test multimeter setup.

The sensor is now fully calibrated.

6.1.2 Reference Rod Check

A good time to check calibration is after an operation such as CIP has been performed on the piping where the instrument sensor is installed. After CIP, there is often a water flush operation and a final rinse with de-ionized water. During this final rinse is an ideal time to check the instrument calibration by first zeroing and then inserting the Reference Rod. The reading on the instrument with the Reference Rod inserted should be the same as when calibration was carried out. If necessary, the span control can be adjusted (slightly) until the display reads the previously established value for that sensor with the reference rod inserted.

Reference Rods are engraved with the sensor serial number to allow a crosscheck to ensure the correct rod is always used for any particular sensor. Using a rod from another sensor *may* cause inaccuracies.

6.2 Use of EasyCal™ Liquid-Free NIST Traceable Calibration System

The EasyCal™ system allows traceable calibration without using liquid standards. It is very important to refer to the actual values of the EasyCal™ internal calibration media as noted on the Calibration Certificate supplied with the unit.

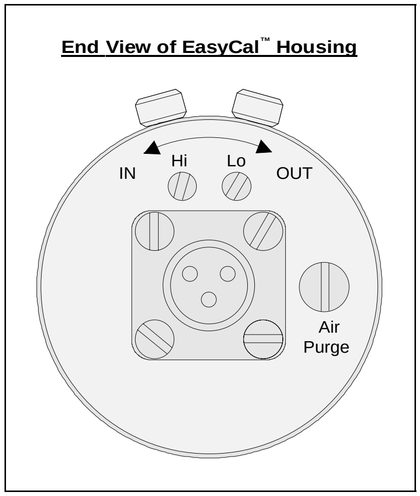


Figure 17 - Position of the "Hi" and "Lo" Filter Positioning Controls

1. Connect the transmitter and sensor as shown in figure 15 (earlier in this manual).
2. Connect power to the transmitter and leave for 30 minutes to warm-up the sensor.
3. Ensure the sensor is either clean and dry or filled with a stable zero liquid (such as DI Water).
4. Select position **"A"** on the transmitter front panel **Range Select** switch.
5. Set the **Auto Zero** switch to the "**Off**" position.
6. Adjust the front panel "**Optical Zero**" control for a reading of 0.000V on the multimeter connected to the Voltage output of the instrument. Check that the front panel display reads zero +/- 1 digit.
7. Adjust the "**4 to 20mA Zero**" control located on the rear panel to give a 4.00mA reading on the multimeter connected to the current output of the instrument.
8. Unlock and swing the **"Hi"** filter into the measurement path within the measurement detector housing by turning the **"Hi"** filter positioning screw towards the **"IN"** position until it hits the stop. Temporarily lock the filter into place.
9. Refer to the EasyCal™ Calibration Certificate for the correct instrument reading based upon the pathlength of the sensor.
10. Adjust the front panel **"Cal Adj"** control for the correct reading on the multimeter connected to the Voltage output of the instrument using the following formula.

$$\frac{Hi\_Filter\_OD}{Sensor\_Max\_OD} \times 2(\times 3\_\ for\_Hi - OD\_systems = V\_Output)$$

11. Check that the front panel display reads the correct value +/- 1 digit. If the reading is off, the DVM span can be adjusted to bring the reading in line with the Voltage output (see figure 16). **Only trained personnel should attempt this adjustment.** Power down the instrument and remove the cable connectors on the rear of the instrument. Remove the instrument back panel and slide out the top cover plate, exposing the instrument internals. Re-connect the electrical connections and apply power to the instrument. Allow the unit to stabilize. Adjust the front panel display to read the correct value by carefully turning the control located on the display board.

12. Adjust the rear panel **"4 to 20mA Span"** control for the correct current reading on the multimeter using the following formula:

$$\left[\frac{Hi\_Filter\_OD}{Sensor\_Max\_OD}\times 16\right]+4=mA\_Output$$

13. Unlock and swing the **"Hi"** filter out of the measurement path within the measurement detector housing by turning the **"Hi"** filter positioning screw towards the **"OUT"** position until it hits the stop and lock.
14. Re-check the zero setting and check the span with the **"Hi"** filter once more.
15. Ensure the **"Hi"** filter is locked in it's **"OUT"** position.
16. Unlock and swing the **"Lo"** filter into the measurement path within the measurement detector housing by turning the **"Lo"** filter positioning screw towards the **"IN"** position until it hits the stop. Temporarily lock the filter into place.
17. Check the reading on the instrument display. It should be equal to the value stated on the EasyCal™ Calibration sheet (within the stated accuracy of the system).
18. Unlock and swing both the **"Hi"** filter into the measurement path (so that both filters are in the **"IN"** position) within the measurement detector housing by turning their positioning screws towards the **"IN"** position until they hit the stop.
19. Check the reading on the instrument display. It should be equal to the sum of both the **"Hi"** filter value and **"Lo"** filter value as stated on the EasyCal™ Calibration sheet. Note that there is a possibility that a slight offset will be observed when both filters are in the measurement path. This is quite normal. The value should be within the stated accuracy of the system
20. Lock both the **"Lo"** and **"Hi"** filters in their **"OUT"** position.
21. Disconnect the test multimeter setup.
22. The sensor is now calibrated.

6.2.1 Using the EasyCal™ System to Check Calibration and Operation of the UV Analyzer

1. Ensure the sensor flow path is either dry or is filled with de-ionized water.
2. Adjust the front panel "**Optical Zero**" control for a reading of 0.00/0.0 on the front panel display.
3. Select position **"A"** on the transmitter front panel **Range Select** switch.
4. Unlock and swing the **"Hi"** filter into the measurement path within the measurement detector housing by turning the **"Hi"** filter positioning screw towards the **"IN"** position until it hits the stop.
5. Check the reading on the instrument display. It should be equal to the value stated on the EasyCal™ Calibration sheet (within the stated accuracy of the system).
6. Unlock and swing the **"Lo"** filter into the measurement path within the measurement detector housing by turning the **"Lo"** filter positioning screw towards the **"IN"** position until it hits the stop.
7. Check the reading on the instrument display. It should be equal to the value stated on the EasyCal™ Calibration sheet (within the stated accuracy of the system).
8. Unlock and swing both the **"Hi"** and **"Lo"** filters into the measurement path within the measurement detector housing by turning their positioning screws towards the **"IN"** position until they hit the stop.
9. Check the reading on the instrument display. It should be equal to the sum of both the **"Hi"** filter value and **"Lo"** filter value as stated on the EasyCal™ Calibration sheet. Note that there is a possibility that a slight offset will be observed when both filters are in the measurement path. This is quite normal. The value should be within the stated accuracy of the system
10. Lock both the **"Lo"** and **"Hi"** filters in their **"OUT"** position.

7. Model 662 Transmitter and Sensor Maintenance

7.1 Model 662 Transmitter

Once the unit is in operation, there is no requirement to access the interior of the Model 662 UV Analyzer housing for normal day-to-day operation and calibration.

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

7.1.1 Accessing the Interior of the Model 662 Instrument

Before opening up the instrument case, **remove power to the instrument**. Inside the instrument, there are two circuit boards, the Measurement/CPU Board attached to the left hand side panel, and the Power Supply Board attached to the right. Remove the front panel and rear panel screws on the right side of the module only (as viewed from the front). Fold out the right hand side panel and remove the top and bottom panels. Take care not to stress the interconnecting cables between the two circuit boards.

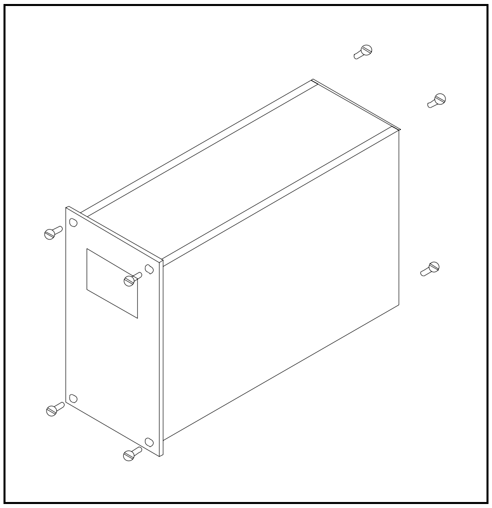


Figure 18 - Disassembly of the Analyzer Module

7.1.2 AC Input Voltage Selection

AC Input Voltage is selected using a switch on the Power Supply Board. See figure 19 for the Power Supply Board layout and position of the selector switch. Use a small screwdriver to rotate the switch to the desired position. When changing the input power voltage, it is necessary to change the fuse to the correct rating.

7.1.3 Fuse Replacement

The instrument's fuse is a plug-in type. It is located on the Power Supply Board inside the instrument. See figure 19 for the Power Supply Board layout and position of the fuse.

Fuse failure is normally caused by improper voltage selection and/or faulty wiring. **Always replace the fuse with one of the correct rating for the input power supply**.

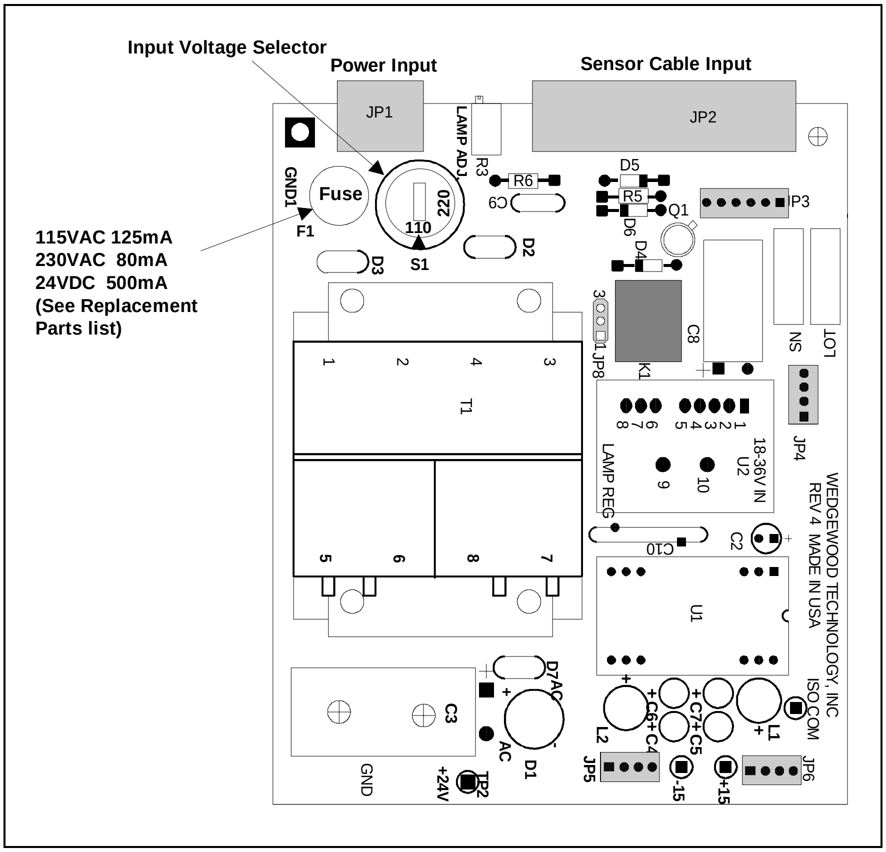


Figure 19 - AC/DC Power Supply PCB

7.1.4 Changing Between Standard and High OD Range

The Model 662 has the capability of operating in Hi-OD mode, allowing a 50% increase in Range "A" measurement.

To convert to Hi-OD operation, a jumper must be changed on the measurement and CPU board inside the analyzer. Refer to figure 20 for the position of this jumper.

7.1.5 Changing Pathlength Setup

If the sensor pathlength is changed, the Range Selection jumpers on the measurement and CPU board must be changed to match the new pathlength. Figure 20 shows the location of these jumpers and their positions for all standard pathlengths of the Model AF44 sensor.

Whenever a sensor has its pathlength changed, a calibration of the analyzer and sensor must be carried out before the unit is put back into service.

7.1.6 Checking and Setting Lamp Voltage

Lamp Voltage should be checked whenever cables are replaced or cable length is changed. To check the Lamp Voltage setting, connect an accurate multimeter across the Lamp Output terminals on the back of the instrument (Terminals 26 and 27). Adjust the **Lamp Adj.** Control immediately below the terminal strip to give an output of 12Vdc ±0.1 at the terminals. Once set, disconnect the multimeter.

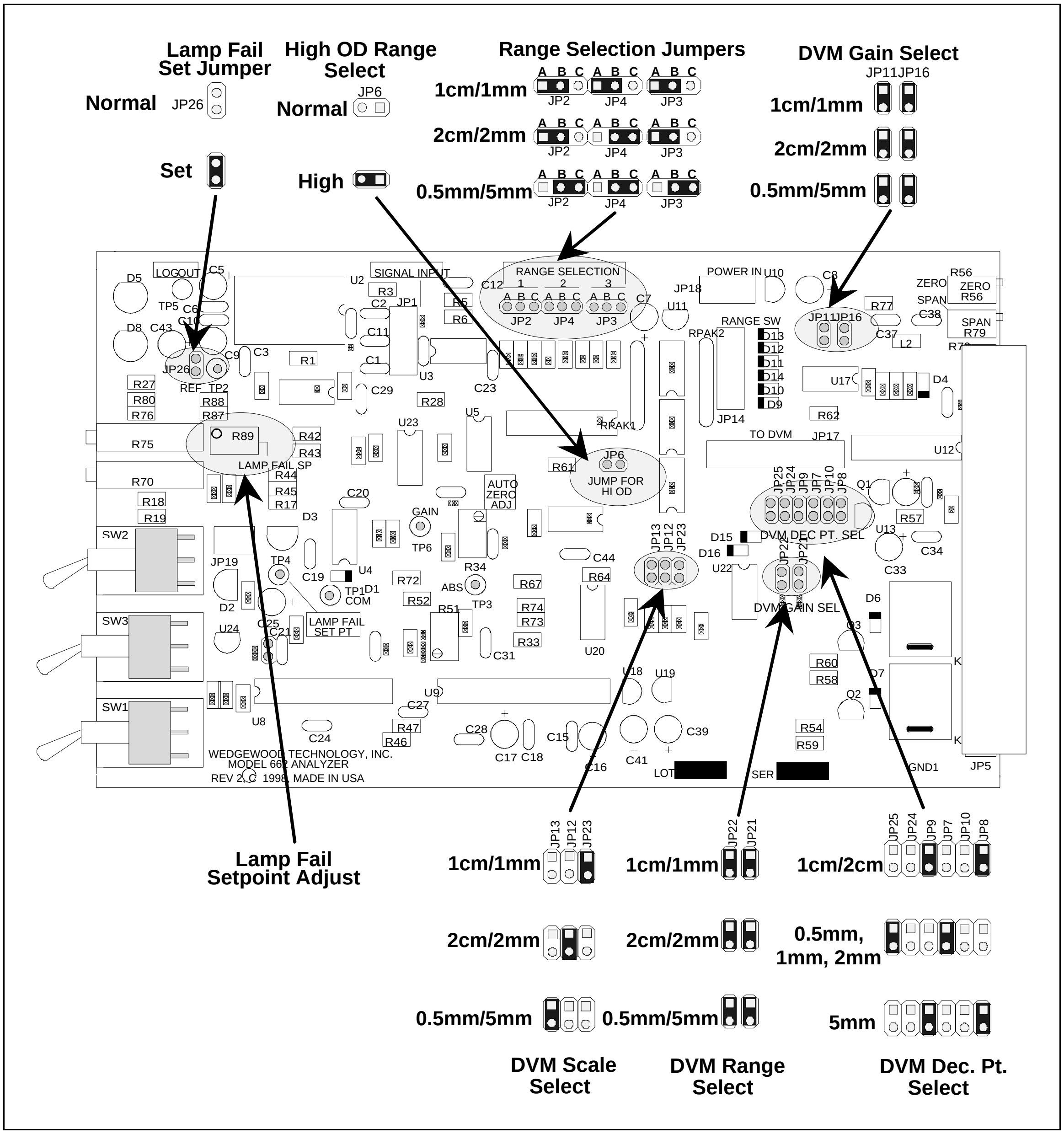


Figure 20 - Measurement and CPU Circuit Board Jumper Location

7.2 Model AF44 Sensor

Model AF44 sensors contain sensitive optical components and should be handled carefully. Particular care must be taken to prevent contamination of these components. Clean all optical components with a suitable lint free lens cleaning tissue and ethanol.

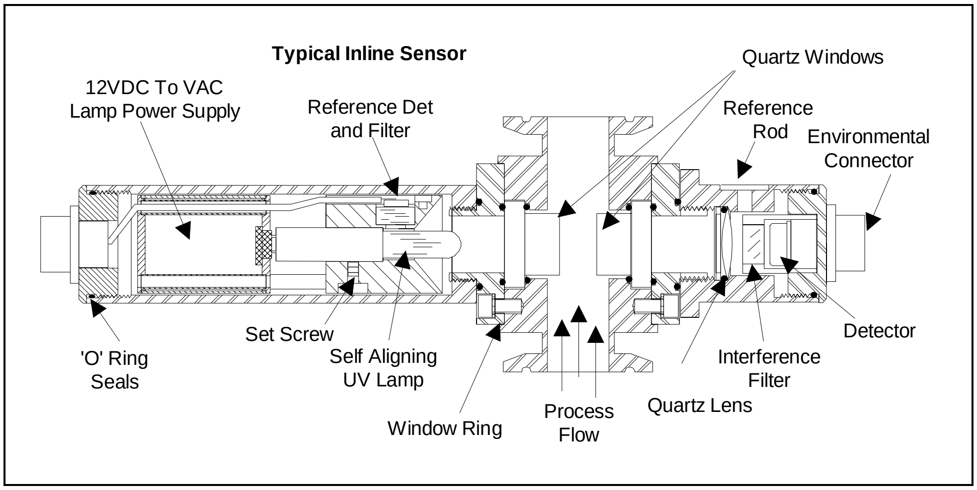


Figure 21 - Cross-Sectional View of a Typical AF44 UV Sensor

7.2.1 Mercury Lamp Replacement

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 23 for an 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.

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.

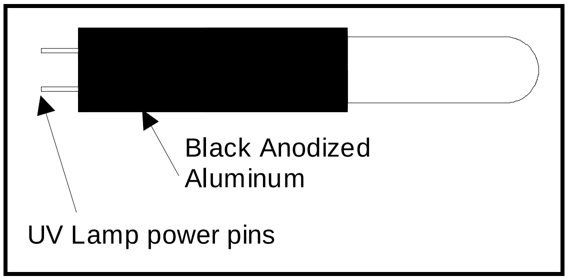


Figure 22 - UV Plug-in Lamp

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.

7.2.2 Lamp Fail Setpoint Adjustment (Units manufactured after 9/01/98)

Whenever a lamp is replaced, it is necessary to check and adjust the lamp fail setpoint of the transmitter based upon the new lamps' initial light output. **Only carry out this procedure if a new lamp has been fitted to the sensor.**

1. Open the transmitter case as described earlier in this section.
2. With the sensor connected, power up the transmitter and allow to warm-up for 15 minutes.
3. Install a jumper on the pins of JP26, located in the upper left corner of the circuit board.
4. Adjust the Lamp Fail Set Point Adjustment Control R89 until the lamp fail LED on the front panel just illuminates.
5. Remove the jumper from JP26. The Lamp Fail indicator will extinguish.
6. Power down the unit and reassemble the transmitter.

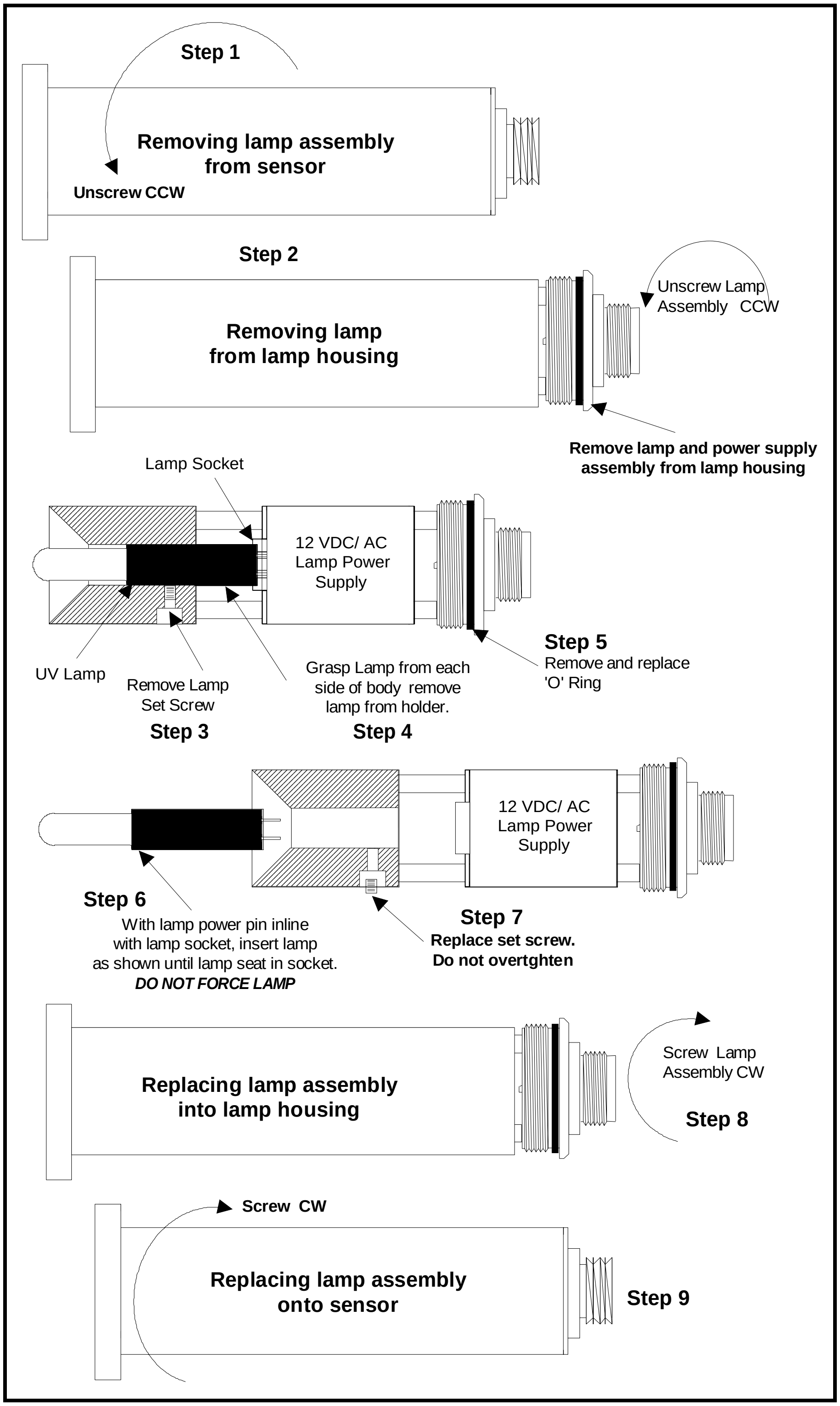


Figure 23 - UV Lamp Replacement

7.2.3 Measurement Detector Replacement

Replacement measurement detectors are supplied as integral units fitted to the measurement detector cable connector. The measurement detector assembly is replaced using the following procedure (refer to figure 21 for a cross sectional view of the assembly):

1. Remove the measurement detector housing from the sensor.
2. Loosen and remove the 4 screws holding the measurement detector connector into the back of the measurement detector housing. Take care to retain all screws, washers and the sealing “O” ring.
3. Withdraw the connector from the housing, bringing the measurement detector with it.
4. Before installing the new detector assembly, it is recommended to clean the detector face with ethanol and lens tissue. Check inside the housing for any contamination and clean as necessary.
5. Replace the Detector assembly into the detector housing, fitting and seating the “O” ring correctly and tightening down the screws evenly. Don’t forget to refit the connector cover retaining ring under one of the screws.
6. Replace the measurement detector housing onto the sensor.

7.2.4 Measurement Filter Replacement (Standard Assembly)

The measurement filter is replaced using the following procedure (refer to figure 21 for a cross sectional view of the assembly):

1. The measurement detector and filter assembly screws into the end of the detector housing. To remove, simply unscrew. If tight, use the cable connector body flange as a “nut” to gain access.
2. To remove the filter, loosen the 6-32 setscrew retaining the filter, and carefully ease the filter out of its holder.
3. Check the holder for cleanliness and clean with lint free lens tissue and ethanol as necessary.
4. Check the filter is clean and free of fingermarks etc. Clean carefully as necessary.
5. Fit the replacement filter into the filter holder with the “shiny” or “mirrored” side facing outwards, away from the detector and tighten the setscrew to hold it in place.
6. Before re-assembling the detector housing, it is recommended to clean the detector lens with ethanol and lens tissue. The detector lens is located in the measurement detector housing at the opposite end to the connector and detector/filter arrangement. To remove the detector lens, carefully remove the lens retaining clip and drop the lens into your hand. Clean with lint free lens tissue and ethanol. Replace the lens in the housing, seat properly and reinstall the retaining clip
7. Replace the Detector assembly into the detector housing, fitting a new “O” ring.
8. Replace the complete measurement detector assembly onto the sensor.

7.2.5 Measurement Filter Replacement (EasyCal™ Assembly)

The measurement filter is replaced using the following procedure (refer to figure 24 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. **DO NOT OVERTIGHTEN**.
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™ backplate assembly.
1. Refit the outer casing to the assembly.

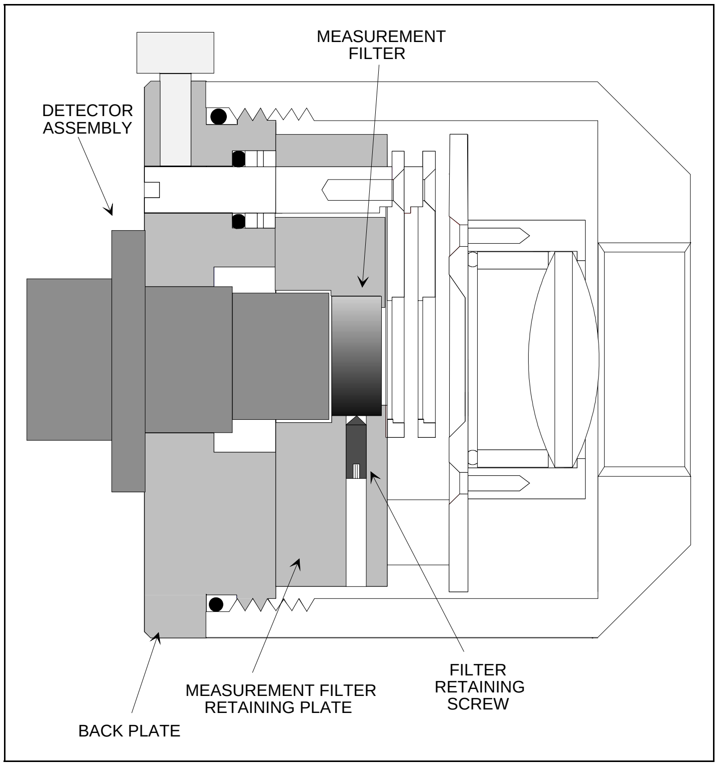


Figure 24 - EasyCal™ Measurement Detector Assembly

7.2.6 Sensor Wavelength Change

Should it be required to change the operating wavelength of the sensor, both the measurement and reference filters must be changed.

To change the measurement filter, use the procedure already described above.

To change the reference filter, use the following procedure:

For AF44 models manufactured after 1/1/99:
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. The reference detector and filter are located on the outside of the lamp reflector. The reference detector is mounted on a printed circuit board (PCB) and held in place with two screws. Remove the reference detector PCB; the filter is located just below it. Turn the reflector over and drop the filter into your hand.
4. Check the filter is clean and free of fingermarks etc. Clean carefully as necessary.
5. Fit the new filter into the reflector housing taking care to ensure it is installed “shiny” or “mirrored” side to the lamp.
6. Replace the reference detector PCB on top and refit onto the reflector housing.

7. The complete lamp and power supply assembly is now refitted into the lamp housing and onto the sensor.

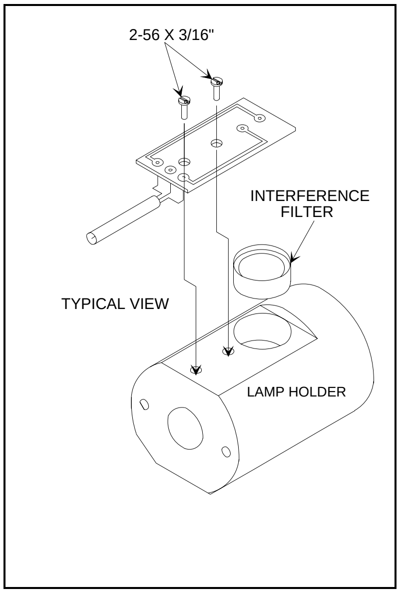


Figure 25 - Reference Detector/Filter Replacement

For AF44 models manufactured before 1/1/99:

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. The reference detector and filter are located on the outside of the lamp reflector and held in place with a retaining arm. Remove the screw and retaining arm. Carefully prize out the detector assembly from the reflector body. The filter is located just below it. Turn the reflector over and drop the filter into your hand.
4. Check the filter is clean and free of fingermarks etc. Clean carefully as necessary.
5. Fit the new filter into the reflector housing taking care to ensure it is installed “shiny” or “mirrored” side to the lamp.
6. Replace the detector on top and refit the retaining arm and screw.
7. The complete lamp and power supply assembly is now refitted into the lamp housing and onto the sensor.

7.2.7 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. Figure 26 represents the available window types and possible pathlengths for sensors up to 2" line sizes.

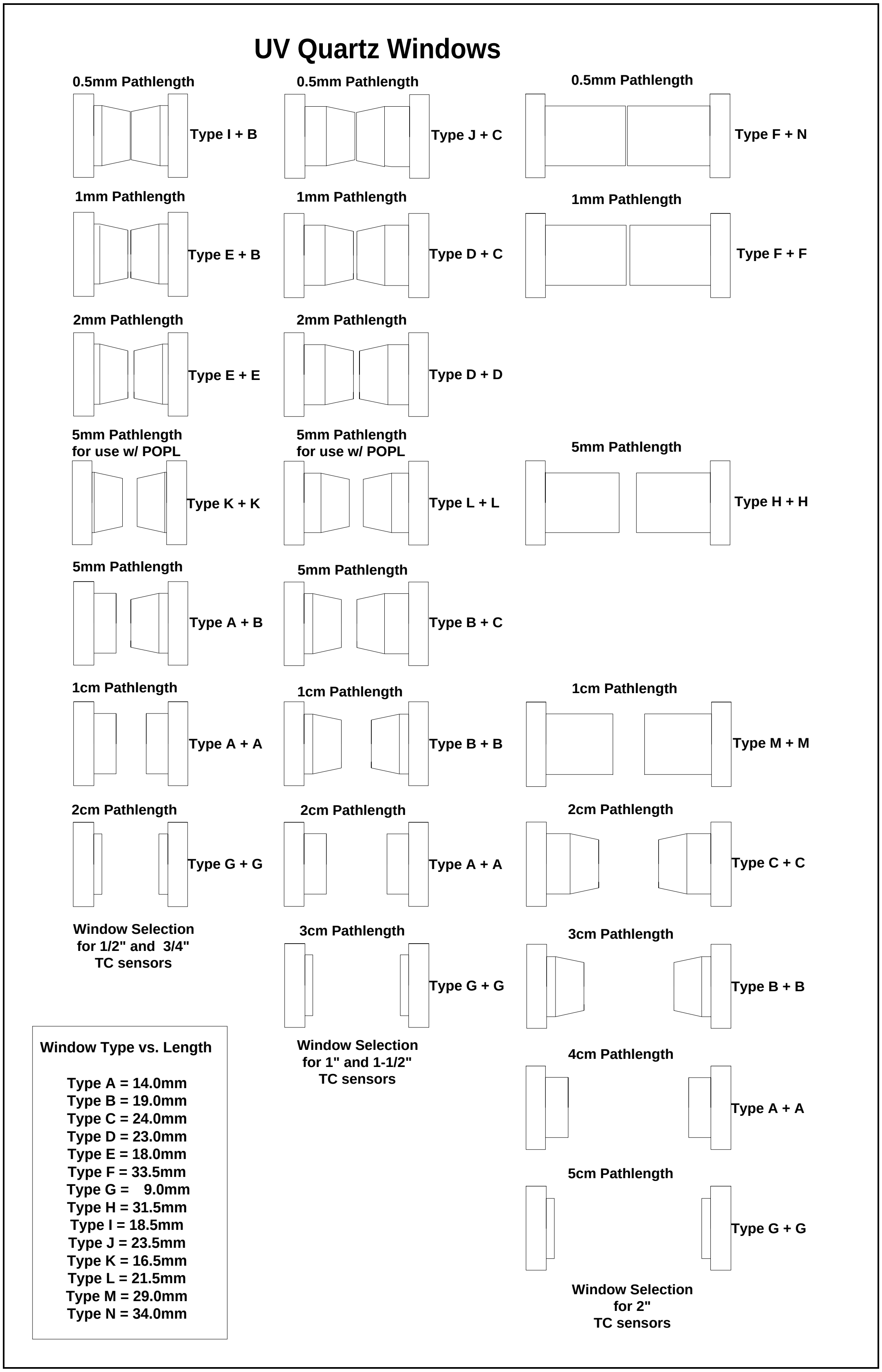


Figure 26 - Window Type vs. Sensor Pathlength

Replacement of windows or window seals, changing window spacing or other maintenance requiring the disassembly of the sensor uses the following procedure:

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

7.2.7.1 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 transmitter module must be configured to reflect the new pathlength. After every re-assembly of an AF44 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 flowcell with the "shorter" length of the two windows.

7.2.7.2 Sensors with 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.
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 flowcell.
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 flowcell.
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 overtighten**.
12. Carefully withdraw the pathlength gauge and tighten the locking set-screws to hold the actuator in place.
13. If possible, pressure test assembled flowcell 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.

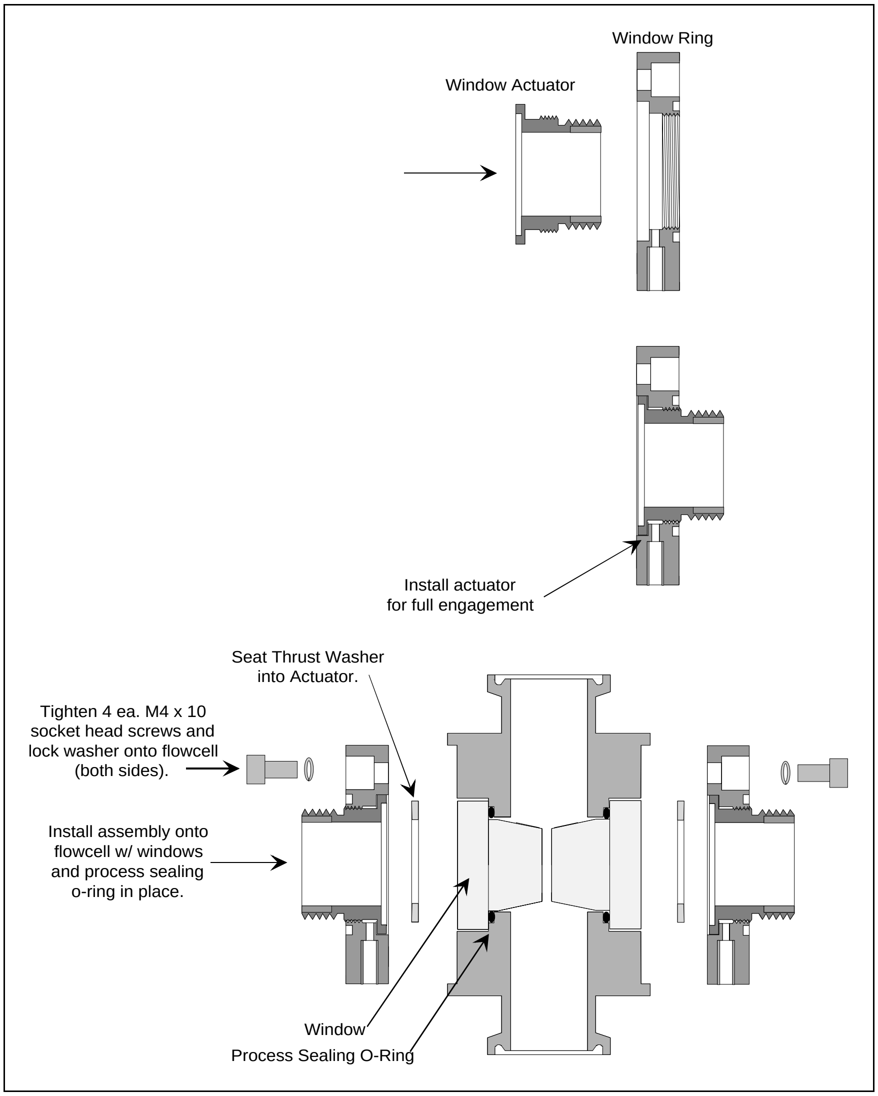


Figure 27 – Assembling the Precision Pathlength Adjustment Rings into the Sensor

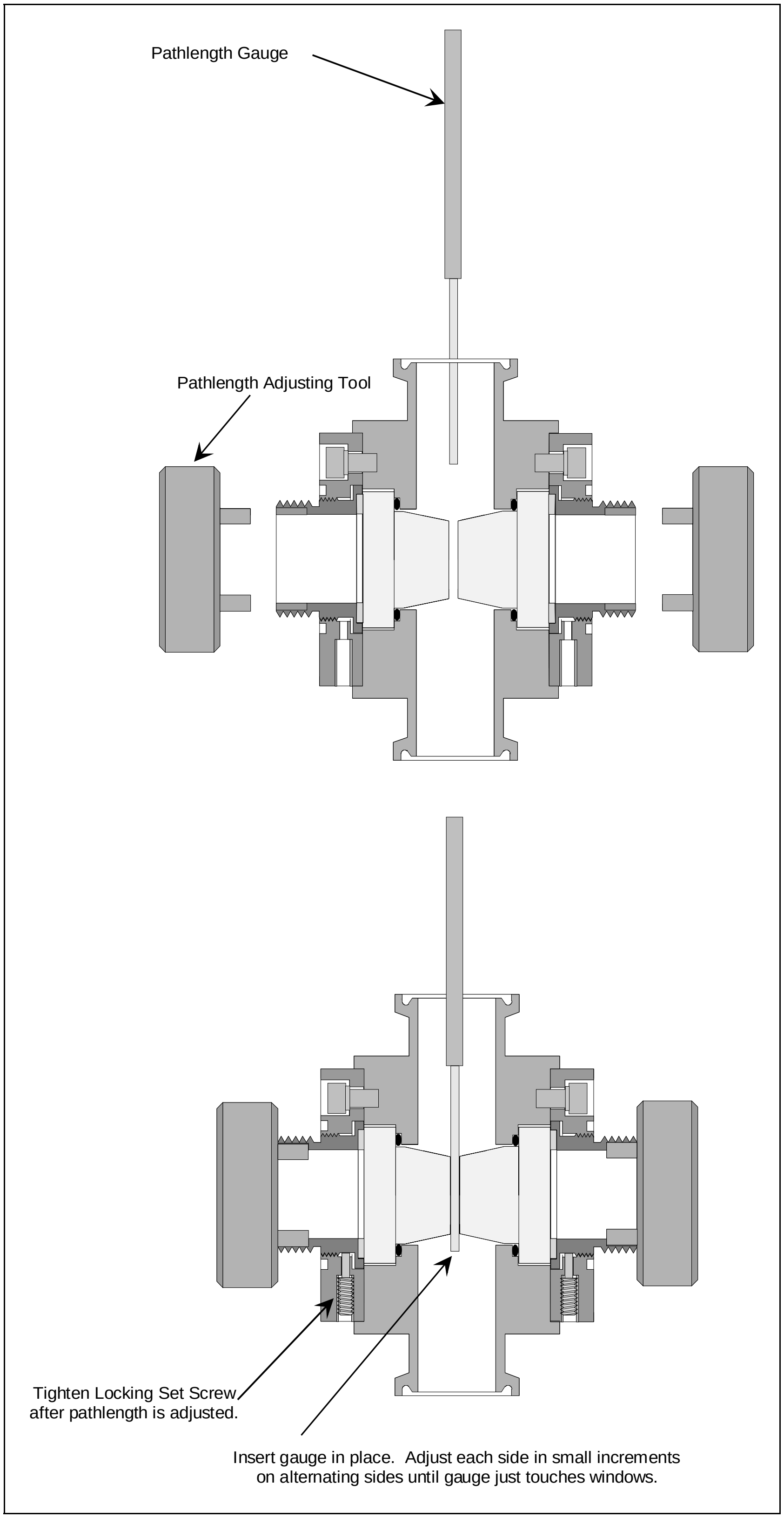


Figure 28 – Adjusting Pathlength in the Flowcell

8. REPLACEMENT PARTS LIST

8.1 Model 662 UV Analyzer

DESCRIPTION	PART NUMBER
Fuse, (125 VAC input) 125mA	1678-0125-00
Fuse, (230 VAC input) 80mA	1678-0080-00
Fuse, (24 VDC input) 500mA	1678-0020-00

8.2 Model AF44 Ultra-Violet Inline Sensor

DESCRIPTION	PART NUMBER
Replacement Mercury Lamp, Phosphor Coated (276, 280nm)	1415-0150-00
Replacement Mercury Lamp, Uncoated (254, 295, 302, 313, 365nm)	1415-0160-00
Reference Detector (Pre 1999 units)	1405-0030-00
Reference Detector PCB (1999 onward units)	A020-0050-00
Measurement Detector, UV Enhanced	A012-0760-10
Detector Lens, Quartz	1417-0001-00
254nm Interference Filter	1410-0254-00
276nm Interference Filter	1410-0276-00
280nm Interference Filter Set (1 reference, 1 measurement)	A003-0280-00
295nm Interference Filter	1410-0295-00
302nm Interference Filter	1410-0302-00
313nm Interference Filter	1410-0313-00
365nm Interference Filter	1410-0365-00
Type 'A' Quartz Window	1420-0140-01
Type 'B' Quartz Window	1420-0190-03
Type 'C' Quartz Window	1420-0240-03
Type 'D' Quartz Window	1420-0230-03
Type 'E' Quartz Window	1420-0180-03
Type 'F' Quartz Window	1420-0335-01
Type 'G' Quartz Window	1420-0090-01
Type 'H' Quartz Window	1420-0315-01
Type 'I' Quartz Window	1420-0185-03
Type 'J' Quartz Window	1420-0235-03
Type 'K' Quartz Window	1420-0165-03
Type 'L' Quartz Window	1420-0215-03
Type 'M' Quartz Window	1420-0290-01
Type 'N' Quartz Window	1420-0340-01
Window Gasket Kit, Silicon Rubber	A000-0662-00
Window Gasket Kit, Viton	A000-0662-01
Window Gasket Kit, Black Buna 'N'	A000-0662-02
Window Gasket Kit, Kalrez	A000-0662-03
Window Gasket Kit, EPR(EDPM)	A000-0662-05
Window Gasket Kit, TFE Encapsulated Viton	A000-0662-16

WARRANTY

Wedgewood Technology, Inc. warrants its products to be free from defects in workmanship and material. Wedgewood's 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 Wedgewood's examination shall disclose that a defect existed under proper and normal use. Wedgewood Technology, Inc., shall not be liable for consequential or incidental damages.