ABLE
Instruments & Controls

Model 910 Single Beam Photometer
and the
Model AF10-AF12 Solids Concentration Inline Sensor
Installation and Operation
Manual

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1. General Information

The Model 910 Single Beam Photometer is used in conjunction with the Model AF10 thru AF12 Solids Concentration Sensor to measure the spectral absorbance of process liquid in the visible/near infrared region of the electromagnetic spectrum.

Instrument performance is governed by 2 major factors - optical pathlength and measurement wavelength. The flowcell's optical pathlength is determined by a combination of window size selected and the line size of the sensor. The wavelength of the measurement is determined by the lamp and optical filters chosen. These determinations are made at the factory based upon application information supplied by the end user and/or sample testing.

The Model 910 Single Beam Photometer is manufactured with 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 display.

1.1 How the Model 910 Single Beam Photometer Works

The Model AF10-AF12 sensor generates a photo current (μA) detector signal based upon the amount of solids/color energy present at its measurement point internally. The Model 910 unit computes the logarithmic ratio of this signal and hence determines the absorbance of the liquid passing through the sensor. Optical filters may be fitted in front of the detector, limiting their response to the specific wavelengths selected for the application. The absorbance value is expressed in optical density units (OD) or correlated to other customer specified units. The solids unit is displayed on the front panel and an analog current output, proportional to the solids reading, is 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 910 Single Beam Photometer 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.

There are two analog current outputs from the unit. The range of each can be independently set to 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 are completely optically isolated preventing measurement interference from any connected auxiliary equipment.

The analog current outputs (4-20mA) will operate with loads up to 1,000 ohms.

Model 910 is supplied as standard with four digital inputs and three digital outputs.

The digital inputs can be configured to perform a variety of functions such as baseline shift 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 outputs are optically isolated.

Description of the Model 910 Single Beam Photometer

1.4 Specifications (Preliminary)

Signal Inputs	Single Channel Current from Model AF10/AF12 Inline Sensor
Range	Up to 5.0 AU
Accuracy	±1% of measurement range
Linearity	±1% of measurement range
Signal Outputs	General Alarm Relay Contact, 125mA 115 VAC resistive load 2 - Process Relay Contact, 125mA 115 VAC resistive load 2 - isolated 4-20 mA (0-1000 ohm load)
Power	100 to 250Vac, 50/60 Hz, 15 VA, (Optional 18-36 VDC, 10 W)
Operating Environment	Temperature; 0-55 °C Humidity; 0-90% RH

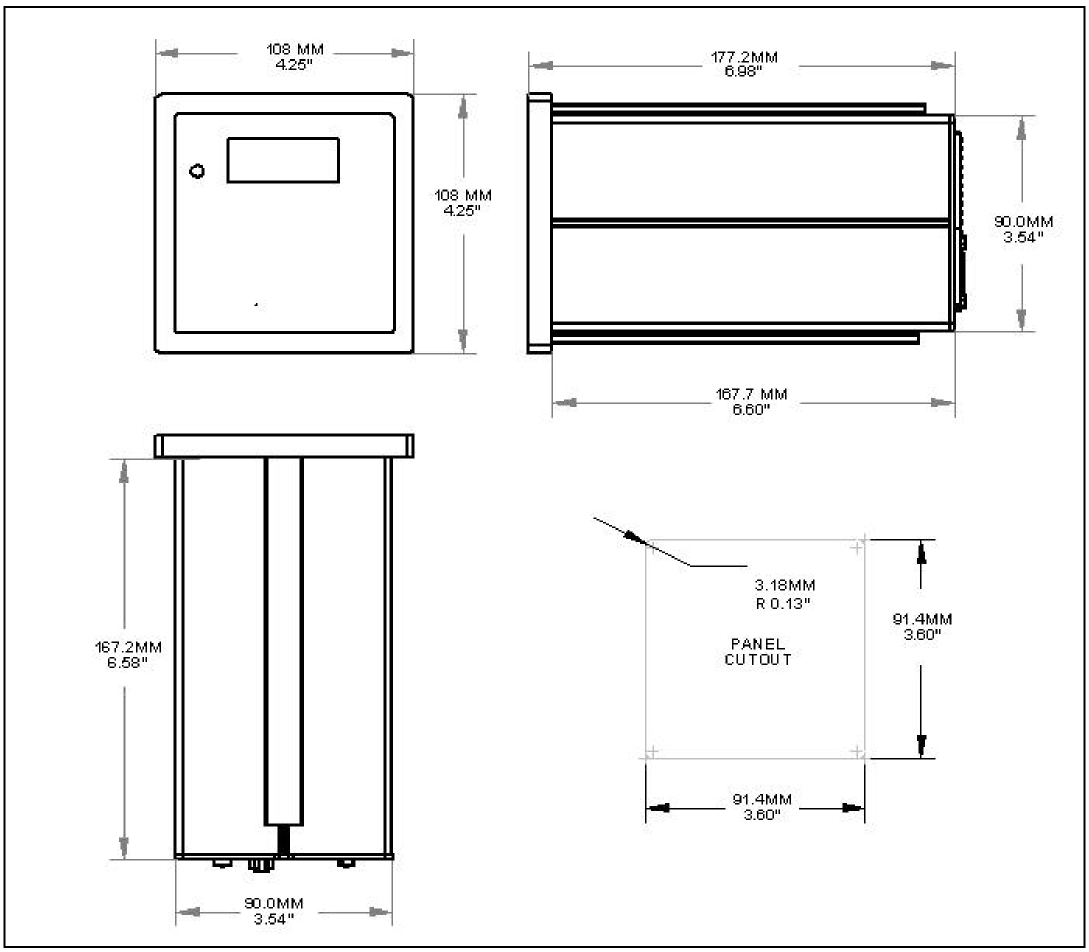


Figure 1 - Model 910 Monitor Dimensions

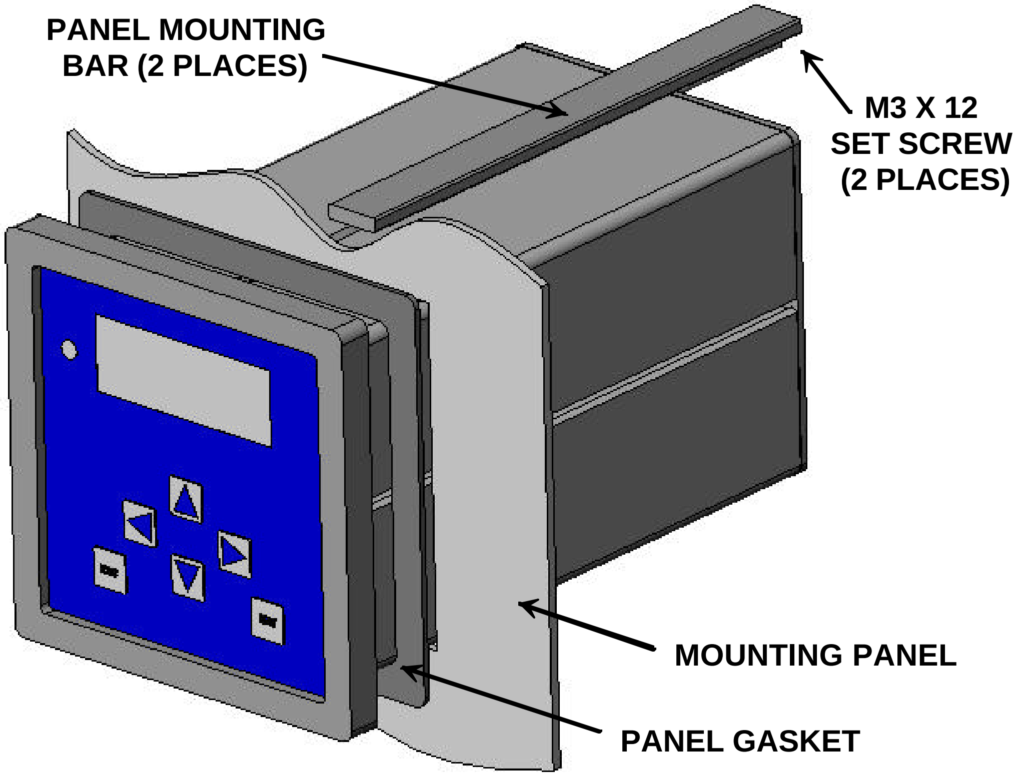


Figure 2 - Model 910 Monitor Mounting

2. Description of the Model AF10/AF12 Solids Concentration Inline Sensor

2.1 AF10/AF12 Specifications

Sensors	Line Size	Pathlengths Available				
Sanitary Triclover	**¼"**	**1mm**	**2mm**	**5mm**	**1cm**	
Female NPT	**½"**	**1mm**	**2mm**	**5mm**	**1cm**	
Sanitary BVCO	**¾"**	**1mm**	**2mm**	**5mm**	**1cm**	
Swagelok Compression	**1"**	**1mm**	**2mm**	**5mm**	**1cm**	**2cm**
ANSI FFF	**1½"**	**1mm**	**2mm**	**5mm**	**1cm**	**2cm**
ANSI RTJ	**2"**	**2cm**	**4cm**			
ANSI RFF	**2½"**	**2cm**	**4cm**			
Other styles available	**3"**	**4cm**	**5cm**	**6cm**		
	4"	**6cm**	**7cm**			

Not all sizes are available in all sensor styles. Other pathlengths are available by special order.

Detectors Silicon detectors, hermetically sealed.

Flowcell Material 316L Stainless Steel (polished interior to Ra < 16µinch
316 Stainless Steel
Kynar™
Other Materials Available.

Windows Pyrex, Fused Quartz, Sapphire

Seals 'O' Ring seals. Buna-N, Viton, Silicone, EPR , EPDM, Kalrez

Maximum Pressure Up to 100 BAR, 1500 psi

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 300 feet (100 meters) maximum

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

3. Installation

3.1 Model 910 Monitor Installation

Before beginning installation, inspect the monitor, 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 910 Monitor is a ¼ DIN enclosure which can be installed in a variety of panel, wall and bench top housings. Refer to figure 1 for mounting dimensions. Mount or install the monitor 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.

3.2 Model 910 Cables and Wiring

All wiring terminals are located on the back panel of the Model 910. The monitor/sensor interconnection cables supplied with the system have all been pre-terminated and labeled for ease of installation. Refer to Figure 5 for a full terminal function description.

The Model 910 has terminals for 2 analog current outputs of 4 to 20mA. Both are capable of driving loads up to 1,000 ohms.

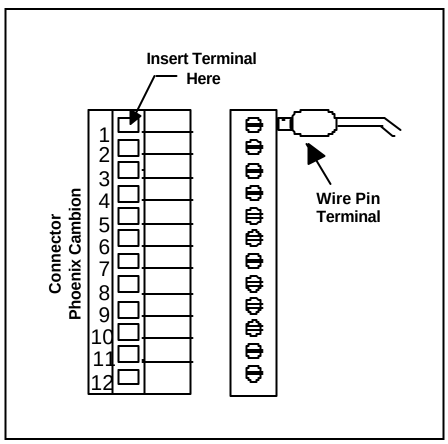


Figure 3 - Wire Terminal Preparation

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

Prepare all cable ends as per figure 3 and terminate as per figures 4 and 5.

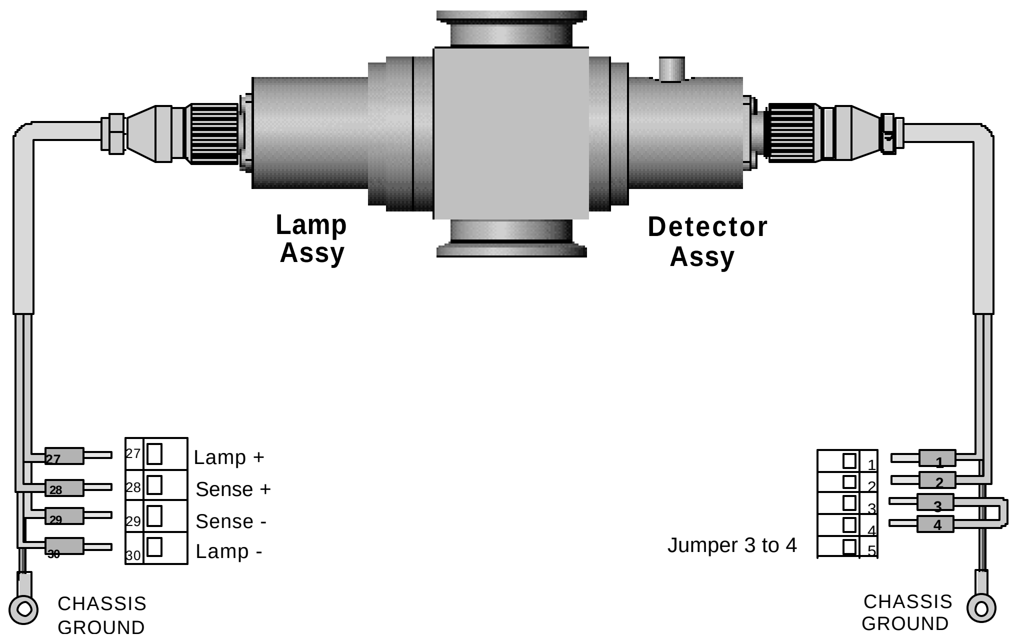


Figure 4 - AF10 Inline Sensor Wiring Diagram

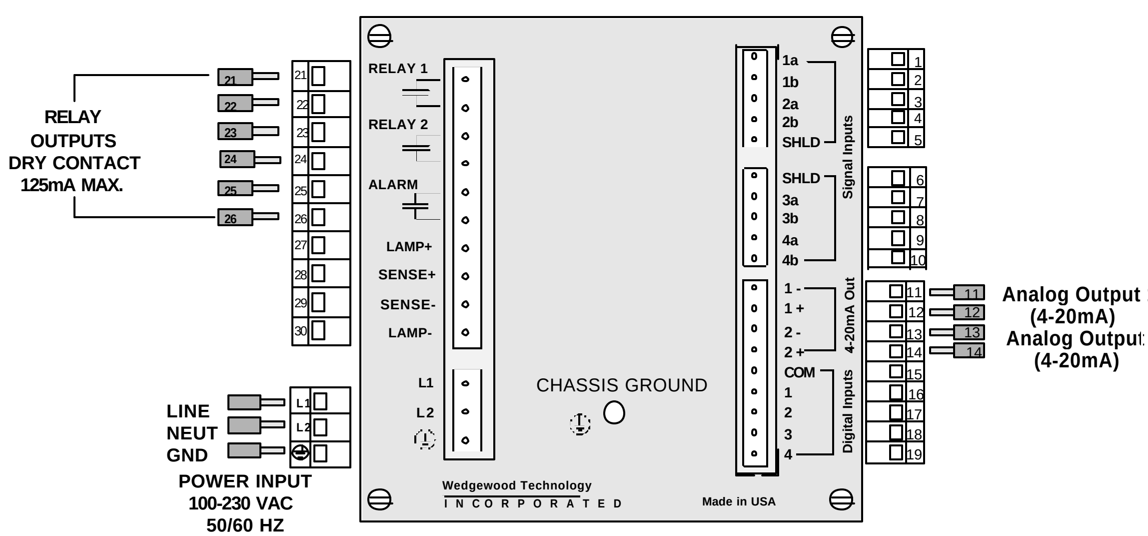


Figure 5 - Model 910 Wiring Diagram (AC Input Version)

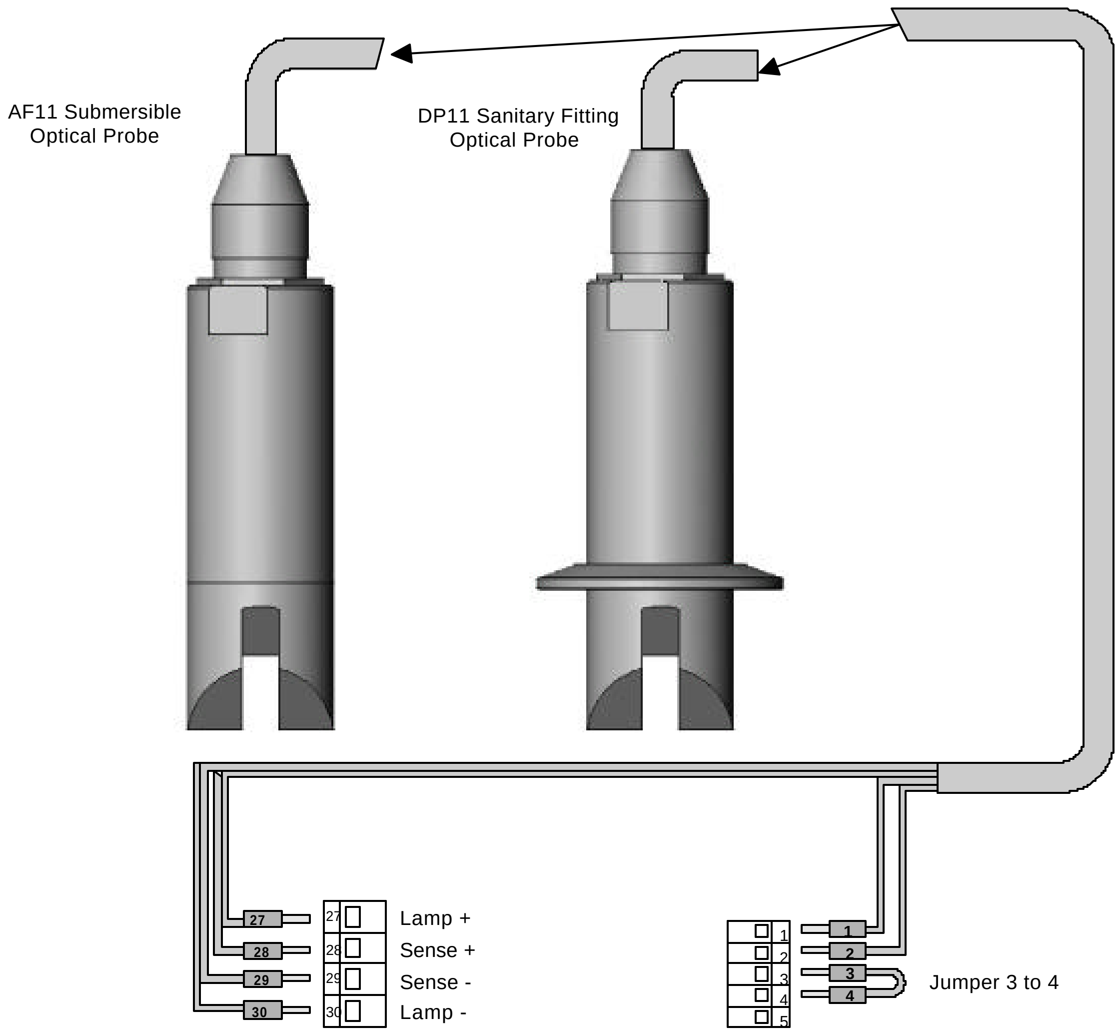


Figure 6 - AF11 and DP11 Sensor Wiring Diagram

3.3 DC Input Power Option

For instruments supplied for 24VDC operation, only the power input connection is changed. Figure 7 shows the connection detail for a 24VDC unit.

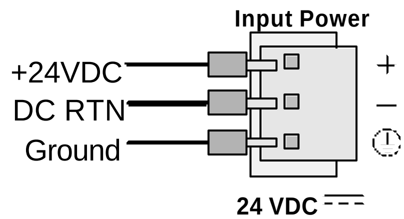


Figure 7 - Model 910 Wiring Diagram (DC Input Version)

3.4 Model AF10 Sensor Installation

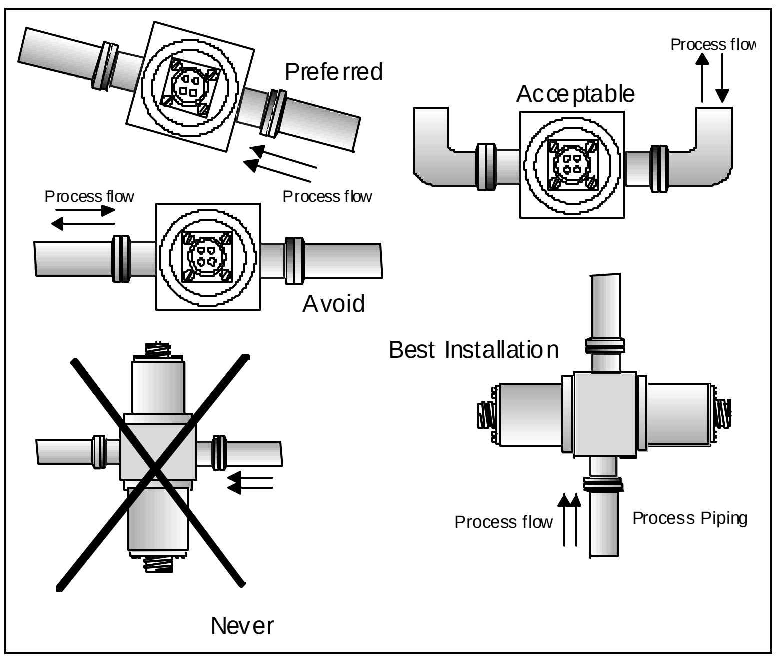


Figure 8 – AF10 Sensor Installation

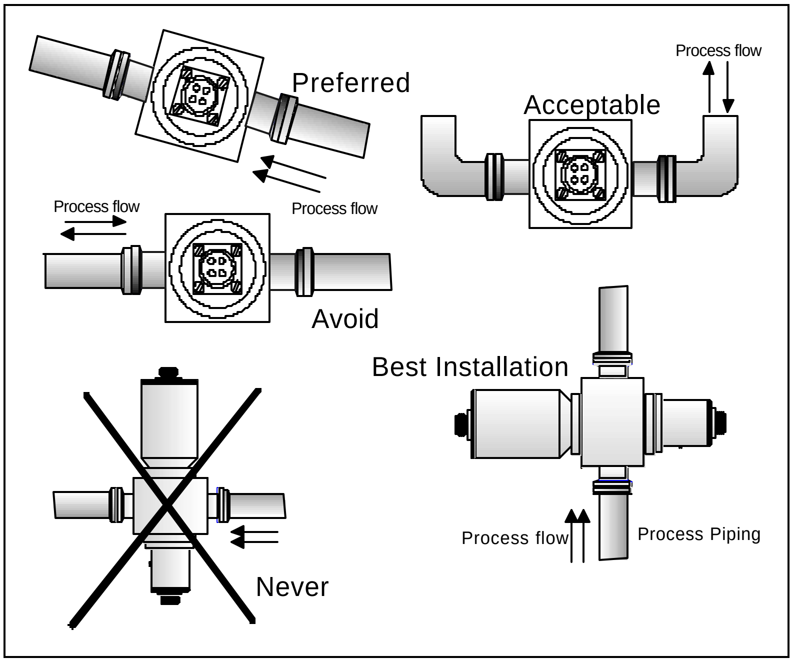


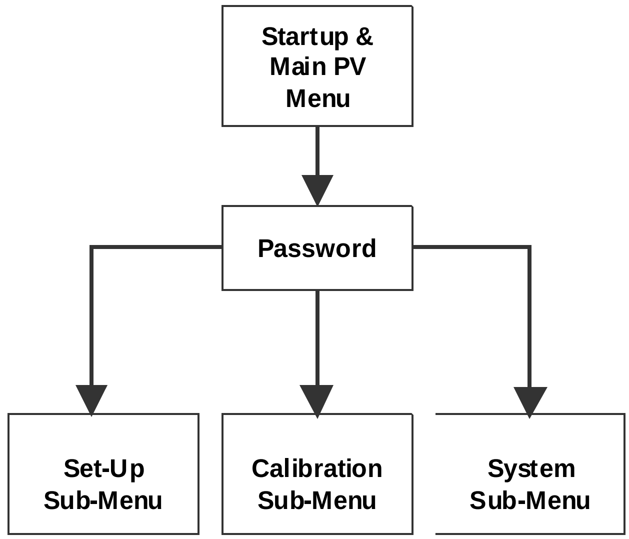
Figure 9 – AF12 Sensor Installation

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. Care should be taken to ensure they are protected against damage caused by external forces such as carts on adjacent walkways.

4. User Software Diagram and Description

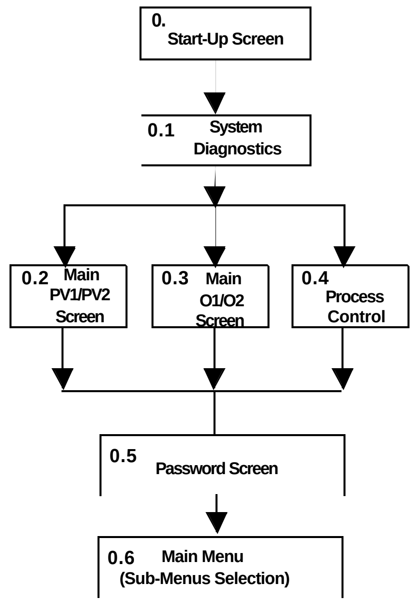
4.1 General Description



The Model 910 software consists of three levels. The Main PV/Output (Process Variable/Current Output) Screens, The Process Control/Calibration Check Screens (Privileged), and the Configuration Sub-Menu (Password Protected)

The following diagrams and descriptions will identify and describe the various display screens and functions. Menus are activated by pressing the Menu/Esc key. Selections, changes, and acknowledgements are activated by pressing the Ack/Ent key. Cursors and parameter changes are activated by using the up/down, and left/right keys. All user input changes are prompted with an "Are you sure?" acknowledge prompt. A press of the Menu/Esc key will not accept changes, and jump backwards through the menu. A press of the Ack/Ent key will accept changes, and continue forward through the display screen sequence.

4.2 Software Description by Display Screen



0. System Start-Up

The System Start-Up screen indicates the configuration of the monitor and the current version of the operating software installed.

0.1 System Diagnostics

The System Diagnostics screen performs routine checks on the lamp and detector cables and sensor. A count down timer is displayed while the diagnostics are performed. The LCD display's contrast may be adjusted by pressing the up/down arrow keys incrementally while in this screen. A cable fault alarm may be displayed if there is a disconnected cable and the lamp power is turned on.

0.2 Main PV1/PV2 screen

The Main PV1/PV2 screen displays the process variable 1 and 2 in the units configured. PV1 displays the configured full scale of the instrument (less baseline function), while PV2 displays the configured full scale of the instrument with the baseline function active. A press of the menu button will allow the user to access the Password/Sub-Menu Screens. A press of the left/right arrow keys will switch to the Output Screen. If enabled, the left/right arrow keys may also access Process Control or Optical Check screens.

The last line of the display shows the status of different functions. For example: If the Baseline (BL) function is on or off , Alarm condition is present (AL1, AL2, Lamp Fail, Cable Fault). The red alarm LED on the front panel will also be illuminated if an alarm condition is present.

0.3 Main O1/O2 Screen

The Main O1/O2 Screen displays the configured output full scale of the 4-20mA analog outputs. A bar graph and 0-100% number is displayed simultaneously. A press of the menu button will allow the user to access the Password/Sub-Menu Screens. A press of the left/right arrow keys will switch to the PV Screen. If enabled, the left/right arrow keys may also access Process Control or Optical Check screens.

0.4 Process Control Screen

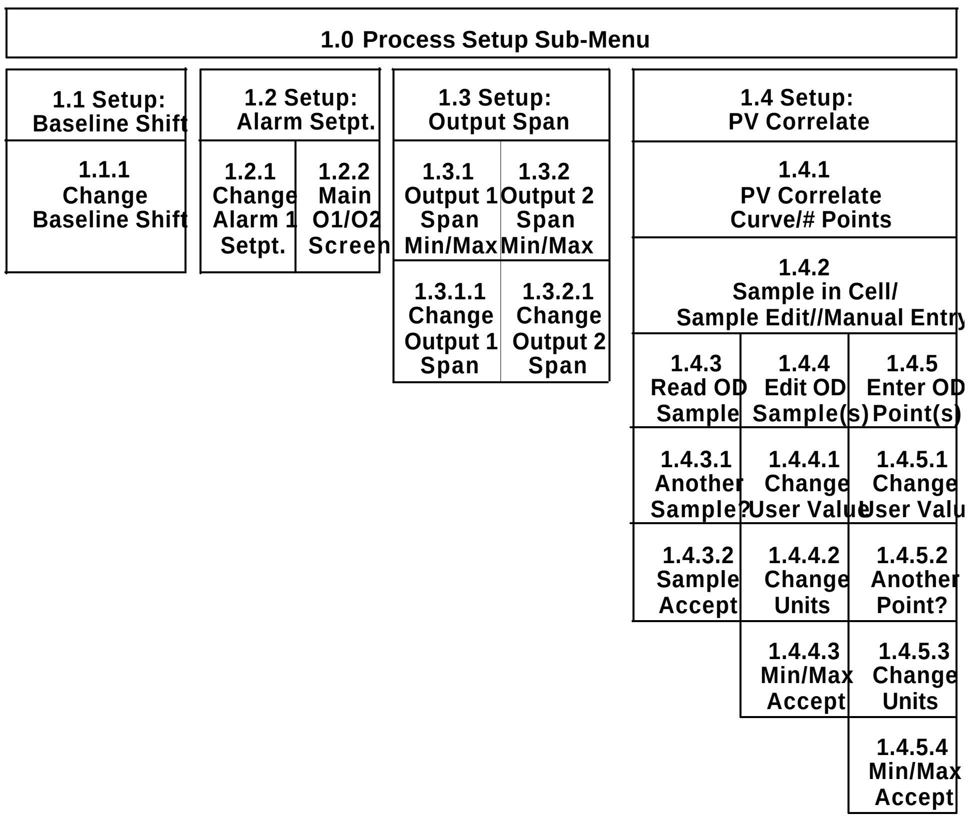
The Process Control screen may be accessed, if enabled, by pressing the left/right arrow key. This allows the user to change the state of the Baseline Control, and to power the Lamp on and off. The user can also quickly check the calibration of the system (with the EasyCal Filter system) or set the Optical Zero. Screen will prompt user for interaction. Press the up/down keys to scroll to the desired parameter, and use the left/right keys to change state. Press the Ack/Ent key to save.

0.5 Password Screen

This screen appears if the default password (0000) has been changed. This restricts the user from access to setup parameters and calibration functions. The password can be any number between 0000 and 9999.

0.6 Main Menu Screen

The main menu screen consists of three sub-menus. The Process (setup), Maintenance, and the System Data sub-menus. A selection is made by moving the up/down keys and by pressing Ack/Ent key.



1.0 Process Setup Sub-Menu

1.1 Baseline Shift

The Baseline Shift screen shows the current value used to offset the PV2 Analog Output. If 0% is selected, no offset is performed. When a value greater than 0% is selected (1-99%), the output is set to the level specified. (If set to 50%, then the Output would go to the midscale (12mA) level. The PV value on the main screen would show “0.000 units”. Pressing Ack/Ent will allow the user to drop to the Baseline Shift change screen.

1.1.1 Baseline Shift Change

Use the left/right keys to move the cursor, and the up/down keys to change the value between 0-99%. Use the Ack/Ent key to save changes.

1.2 Alarm Setpoint

The alarm setup screen shows the current value assigned to alarm 1 and 2. Pressing the up/down keys will move the cursor to either alarm 1 or 2 and pressing Ack/Ent will allow the user to drop to the alarm change setpoint screen.

1.2.2 Change Alarm Setpoint

The alarm setpoint change screen allows the user to input a value that is within the range of the instrument that has been set in the process units configured. Use the left/right keys to move the cursor, and the up/down keys to change the value. Use the Ack/Ent key to save changes.

1.3 Output Span

The setup output span screen shows the current output value (in percentage) of the analog 4-20mA outputs. Moving the up/down cursor to either output 1 or 2 and pressing Ack/Ent will allow the user to drop to the output span change screen.

1.3.1 Output Span Change

The output span change screen shows the current span setting along with the min/max settings permitted for the particular pathlength. Use the Ack/Ent key to change the current setting. Use the left/right keys to move the cursor, and the up/down keys to change the value. Use the Ack/Ent key to save changes.

1.4 PV Correlate

The PV correlate screen allows the user to change the units of measure, based upon optical density (OD) of the material. The user may select either direct entry (manual) or sample correlations. Press Ack/Ent to change correlation.

1.4.1 PV Correlate, Curve #

Moving the left/right cursor to select curve locations 1-3. If there is presently a saved curve, the number of points will be displayed. Ack/Ent will allow the user to drop to the output span change screen.

1.4.2 Sample in Cell, Sample Edit, Manual Entry

Moving the up/down cursor to either select Sample in Cell, Sample Edit, or Manual Entry. Sample in Cell will measure the OD of samples in the flowcell. Sample Edit will edit the values obtained in the Sample in Cell procedure. The user can assign User Values (Engineering Units) to the samples. Manual Entry allows the user to enter OD and User Values that have been pre-determined. Ack/Ent will allow the user to drop to the output span change screen.

1.4.3 Sample in Cell

Sample correlation requires a known concentration of material. The sample is placed into the sensor, and its optical density is then measured. User is prompted to measure the sample in flowcell. Press Ack/Ent to accept value.

1.4.3.1 Additional Samples

User will be prompted to do additional samples Press Ack/Ent for additional sample(s). Press Menu/Esc for no additional samples.

1.4.3.2 Sample Accept

User will be prompted to accept samples. Press Ack/Ent to save, press Menu/Esc to reject.

1.4.4 Edit OD Sample

User will be prompted to edit sample OD values. Press Ack/Ent to save, press Menu/Esc to reject.

1.4.4.1 Change User Value

User will be prompted to assign User (Engineering) Values. Press Ack/Ent to save, press Menu/Esc to reject. User will be proceed to edit screen if multiple points are stored.

1.4.4.2 Change User Units
User will be prompted to assign User (Engineering) Units. Press Ack/Ent to save, press Menu/Esc to reject.

1.4.4.3 Min/Max Accept Screen
Min/Max range values will be displayed in User Value/Units. Press Ack/Ent to accept values, press Menu/Esc to reject.

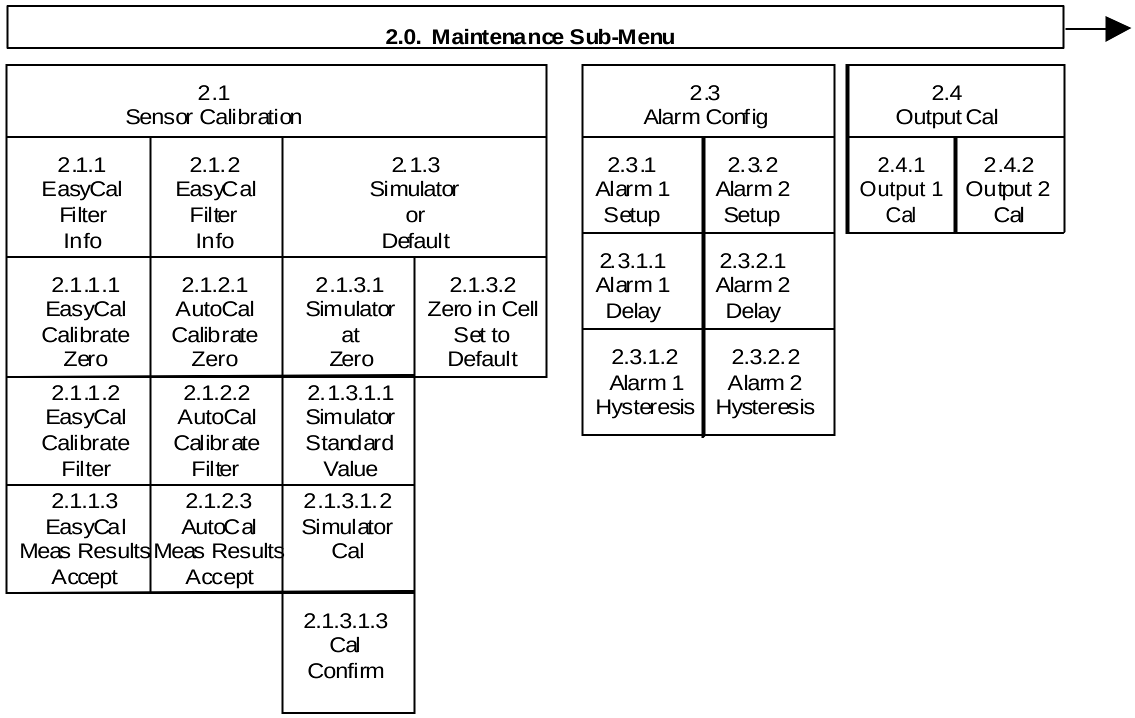
1.4.5 Manual Entry/Enter OD Point
Manual entry requires prior knowledge of the optical density of the material at a specific unit value (preferable at about mid-range). The value and units are then inputted and assigned for a direct correlation to optical density. Use the left/right keys to move the cursor, and the up/down keys to change the OD value. Use the Ack/Ent key to save changes.

1.4.5.1 Change User Value
User will be prompted to assign User (Engineering) Values. Press Ack/Ent to save, press Menu/Esc to reject.

1.4.5.2 Additional Points
User will be prompted to do additional points. Press Ack/Ent for additional points. Press Menu/Esc for no additional points.

1.4.5.3 Change User Units
User will be prompted to assign User (Engineering) Units. Press Ack/Ent to save, press Menu/Esc to reject.

1.4.5.4 Min/Max Accept Screen
Min/Max range values will be displayed in User Value/Units. Press Ack/Ent to accept values, press Menu/Esc to reject.



2. Maintenance Sub-Menu

2.1 Sensor Calibration

The Sensor calibration Screen may use either EasyCal/AutoCal Filter, Optical Simulator/Current Source or default Absorbance calibration techniques; depending upon configuration of the sensor. Press Ack/Ent to select.

2.1.1 EasyCal Filter Data

If an EasyCal is installed, the EasyCal calibration screen is shown. This screen shows the EasyCal filter value. Press Ack/Ent to proceed.

2.1.1.1 EasyCal Calibrate Zero

Establish a zero fluid reading in the flowcell, either air or liquid. Press Ack/Ent to proceed.

2.1.1.2 EasyCal Calibrate Filter

Place the EasyCal filter into the IN position. Absorbance reading should increase and stabilize. Press Ack/Ent to proceed.

2.1.1.3 EasyCal measurement results acceptance

The unit records the values of the filter and displays the value. Press Ack/Ent to except these values. Place the EasyCal filter into the OUT position.

2.1.2 AutoCal (EasyCal) Filter Data

If an AutoCal is installed, the AutoCal calibration screen is shown. This screen shows the EasyCal filter value. Press Ack/Ent to proceed.

2.1.2.1 AutoCal Calibrate Zero
Establish a zero fluid reading in the flowcell, either air or liquid. Press Ack/Ent to proceed. AutoCal will put the Filter into the IN position.

2.1.2.2 AutoCal Calibrate Filter
Absorbance reading should increase and stabilize. Press Ack/Ent to record. AutoCal will then put the Filter into the OUT position.

2.1.2.3 AutoCal measurement results acceptance
The unit records the values of the filter and displays the value. Press Ack/Ent to accept these values.

2.1.3 Simulator or Default Calibration
The Simulator/Default calibration screen is the default calibration screen if an EasyCal system is not installed. Simulator calibration uses a current source to set the OD decade response. Default uses the calculated nominal value for OD response.

2.1.3.1 Simulator at zero
Connect and set the current source for a “zero” OD value. Press Ack/Ent to proceed.

2.1.3.1.1 Simulator standard value
Enter the value of the standard value being used to calibrate the system. The value should be approximately ½ of the full range of the system.

2.1.3.1.2 Simulator Cal
Set the current source for a “standard” calibration OD value. Press Ack/Ent to proceed.

2.1.3.1.3 Simulator Confirm
Press Ack/Ent to accept these values. Menu/Esc to reject the values.

2.1.3.2 Default Cal –Zero in Cell
Establish a zero fluid reading in the flowcell, either air or liquid. Press Ack/Ent to accept.

2.3 Alarm Configuration
The Alarm Configuration (config) screen displays the current parameters for the 2 alarm circuits. To change the current parameters, a selection of alarm 1 or 2 with the up/down arrow keys and pressing Ack/Ent will open the Change Alarm Setup screen.

2.3.1 Alarm Setup
The Alarm Setup screen allows configuration of PV (source), Hi/Lo/Off (config), and NO/NC (state) operations. The up/down keys are used to select the parameter, and the left/right keys are used to change the state. Press the Ack/Ent to save and continue.

2.3.1.1 Alarm Delay
The Alarm Delay screen sets the amount of delay time before triggering the alarm (0-99 seconds). The alarm condition must be present for the entire delay time

before the alarm will trigger. Use the left/right keys to move the cursor, and the up/down keys to change the value. Press the Ack/Ent key to save and continue.

2.3.1.2 Alarm Hysteresis

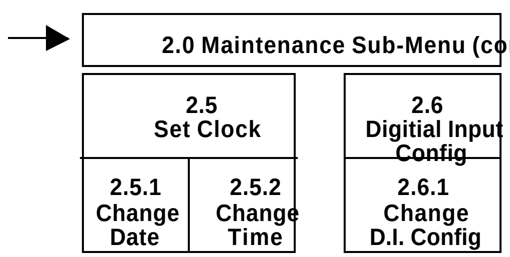
The Alarm Hysteresis screen sets the amount of "deadband" around the setpoint before an alarm will reset. This is configurable in the units set for the instrument, not to exceed full scale. Use the left/right keys to move the cursor, and the up/down keys to change the value. Press the Ack/Ent key to save.

2.4 Output Calibration

This screen sets the 4mA and the 20mA level adjustment for output 1 and 2. Up/Down keys select output 1 or 2, Press the Ack/Ent key to continue. A multimeter set to read mA and connected to the output in series with a suitable load (250 ohms) will allow the user to adjust the output current.

2.4.1 Output Cal Adjustment

This screen adjusts the 4ma and 20mA level by simulating zero and full scale output. A slight trim of either endpoint allows for signal error correction at the "load". While monitoring the appropriate 4-20mA output, press the up/down key to select 4mA or 20mA and the left/right key to change output. Press Ack/Ent to save.



2.5 Set Clock

Shows the current date and time. Select either with up/down keys and Ack/Ent to select parameter.

2.5.1 Change Date

Use the left/right keys to move the cursor, and the up/down keys to change the value. Press the Ack/Ent key to save

2.5.2 Change Time

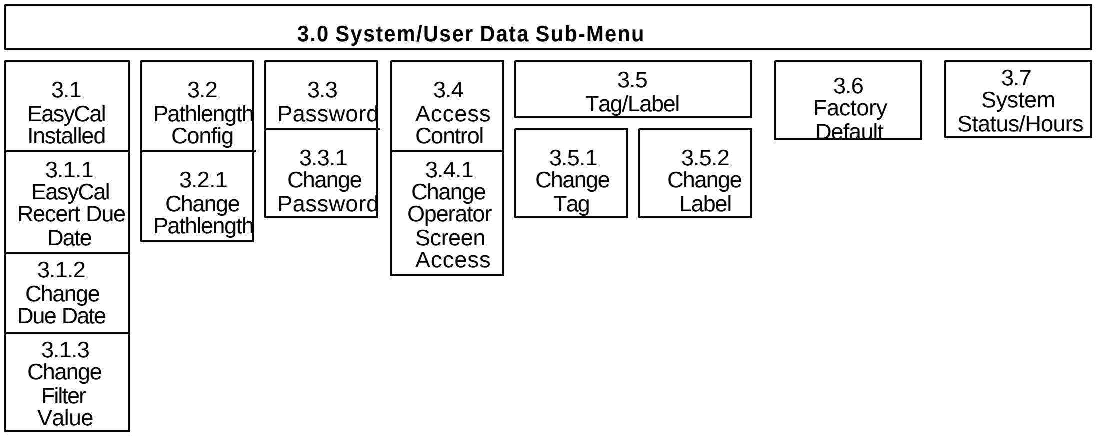
Use the left/right keys to move the cursor, and the up/down keys to change the value. Press the Ack/Ent key to save.

2.6 Digital Input Configuration

Screen shows current digital input configuration, Std UV setup, Autocal or Disabled. Ack/Ent to select parameter.

2.6.1 Change digital input screen

Use the left/right keys to make selection. In the AutoCal configuration, use the up/down keys to select input #4. Use the left/right keys to scroll through the options. Press the Ack/Ent key to change.



3.0 System User Data Sub Menu

3.1 EasyCal Installation

Screen shows whether an EasyCal unit has been installed. Press Ack/Ent to select parameter. Use the left/right keys to select the state, and Ack/Ent to change.

3.1.1 EasyCal Recert Due

The screen shows the user the recertification date on an EasyCal unit. Press Ack/Ent to change

3.1.2 Easycal Recert Date Change

The screen allows the user to change the date for recertification. Use the left/right keys to move the cursor, and the up/down keys to change the value. Press the Ack/Ent key to change.

3.1.3 EasyCal Filter Data

The screen allows the used to change absorbance value (A) for the filter (see EasyCal test sheet). Use the left/right keys to move the cursor, and the up/down keys to change the value. Press the Ack/Ent key to change.

3.2 Pathlength Config

Screen shows the current pathlength of the sensor. Press the Ack/Ent key to continue.

3.2.1 Change Pathlength

The change pathlength screen allows the user to change the pathlength from 0.5mm to 50mm. Use the left/right keys to move the cursor, and the up/down keys to change the value. Press the Ack/Ent key to change.

3.3 Password

This screen shows the current password. Press the Ack/Ent key to continue.

3.3.1 Password Change

This screen allows the user to pick a 4-digit password code. Any change in the default "0000" code prompts the user to enter the password when accessing the sub-menus. Use the left/right keys to move the cursor, and the up/down keys to change the value. Press the Ack/Ent key to change.

3.4 Access Control

Shows the current access to the cal check and process control screen. Press Ack/Ent to continue.

3.4.1 Change Access Control

Use the up/down keys to move the cursor, and the left/right keys to change the value. Press the Ack/Ent key to change.

3.5 Tag/Label

This screen shows the current tag and label test fields. Use up/down keys to select parameter and Ack/Ent to continue

3.5.1 Change Tag Screen

This screen allows user to change 12-character text field. Use left/right keys to move cursor to desired text/position, up/down keys to change. Press Ack/Ent key to change.

3.5.2 Change Label Screen

This screen allows user to change 12-character text field. Use left/right keys to move cursor to desired text/position, up/down keys to change. Press Ack/Ent key to change.

3.6 Factory Default

This screen allows the user to return the Model 910 to the factory default parameters. All configured screens (except sample correlation) will be reset.

3.7 System Status/Hours

This screen shows system run time in hours, calibration method, and software version installed.

5. Model 910 Single Beam Photometer Configuration/Operation

5.1 Monitor Front Panel and Controls

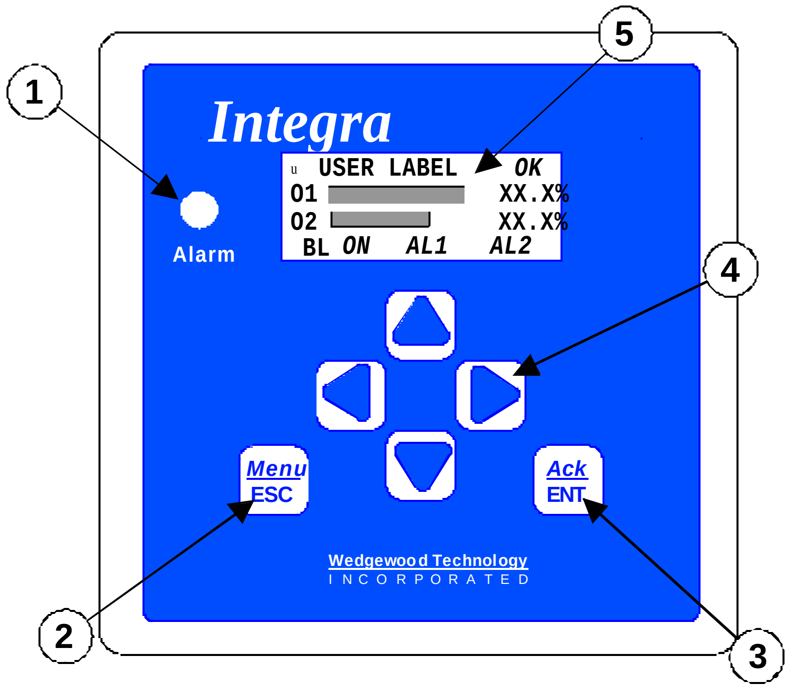


Figure 10 - Model 910 Front Panel

The front panel of the Model 910 monitor is shown in figure 10. A brief description of the features is as follows.

1. The Alarm LED indicator illuminates when one of the alarm conditions exists. The Lamp Fail, Alarm 1 and 2, and the Cable Fault alarms will trigger the LED.

2. The Menu/Esc key serves two functions. Pressing Menu/Esc will always exit out of a screen (back out) and will not save any changes entered. Pressing Menu/Esc from the main PV or Output screen will open the Sub-Menu screen.

3. The Ack/Ent key will accept changes in a screen and continue forward through the screen.

4. The up/down and left/right keys navigate the user through the menus and screens. Active keys are identified by small back-to-back arrows (⇳ up/down) (⇔ left/right) in the display to indicate movement through the screen. Highlighted and blinking cursors are also used to identify parameters that may be changed.

5. The LCD display is a backlit 4 line by 20 character type. All programming may be done through this interface. Alarm and status messages appear on the bottom line while in the PV or Output screen.

5.2 Monitor/Sensor Configuration

When shipped as a complete system, the Model 910 Single Beam Photometer and Sensor has been factory calibrated. If shipped separately, then the user must configure the monitor/sensor. The

Model 910 monitor may be configured with or without the sensor connected. The sensor must be connected, however, in order to calibrate the system.

Apply power to the monitor, and allow the self-diagnostics to be performed. When the PV screen appears, press the Menu/Esc key to access the password screen (if password is default, the Sub-Menu screen will appear). If password screen appears, enter the 4-digit password code by using the left/right keys to move the cursor and the up/down keys to change the digit. Press the Ack/Ent key to continue.

Select the System Data Sub-Menu using the Up/Down keys and press the Ack/Ent key to continue.

Go through each section in the System Data Sub-Menu and configure for the sensor being used. Refer to section 4 for a description of the software entries.

Continue through the Maintenance Sub-Menu and configure the Alarm, Output, and Digital Input screens. Do not perform calibration functions at this time.

Continue through the Process Sub-Menu and configure the Alarm Setpoint, and Output Span screens. Do not perform PV correlate (if required) at this time.

6. Calibration

6.1 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™ optical filters as noted on the Calibration Certificate supplied with the unit. These absorbance values should be entered into the Model 910 as part of the configuration setup. The EasyCal screen appears only if it is installed and configured in the System Data section. Refer to section 4 for software description.

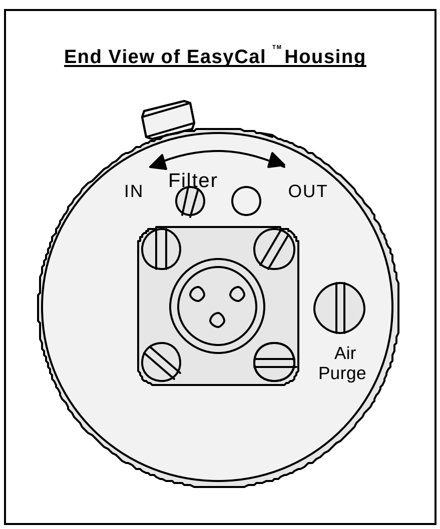


Figure 11 - Location of the Filter Positioning Control

6.1.1 EasyCal Calibration Procedure

1. Access the Maintenance Sub-Menu and Sensor Calibration Screen Sensor Calibration. Press Ack/Ent to change.
2. This screen shows the calibration filter values. Press Ack/Ent to proceed.
3. Establish a zero fluid reading in the flowcell, either air or liquid. Press Ack/Ent to proceed.
4. Place the Easycal filter into the IN position. Absorbance reading should increase and stabilize. Press Ack/Ent to proceed.
5. The unit records the value of the filter and displays the value. Press Ack/Ent to accept this value.
6. Place the Easycal filter into the OUT position. Calibration Complete

6.1.2 AutoCal Calibration Procedure

1. Access the Maintenance Sub-Menu and Sensor Calibration Screen Sensor Calibration. Press Ack/Ent to change.
2. This screen shows the calibration filter values. Press Ack/Ent to proceed.
3. Establish a zero fluid reading in the flowcell, either air or liquid. Press Ack/Ent to proceed. The AutoCal will place the filter to the IN position.
4. Absorbance reading should increase and stabilize. Press Ack/Ent to proceed.
5. The unit records the value of the filter and displays the value. Press Ack/Ent to accept this value.
6. Place the Easycal filter into the OUT position. Calibration Complete

6.2 Calibration Check

The Optical Check Screen may be accessed, if enabled, by pressing the left/right arrow key from the PV or Output Screen. Screen will prompt user for interaction.

6.2.1 EasyCal Check

1. Establish a zero fluid reading in the flowcell, either air or liquid. Press Ack/Ent to proceed.
2. Place the Easycal filter into the IN position. Absorbance reading should increase and stabilize. Press Ack/Ent to proceed.
3. Place the Easycal filter into the OUT position. Press Ack/Ent to proceed.

4. Unit will display “Pass” if within tolerance “Fail” if out of tolerance. Press Ack/Ent to proceed.

6.2.2 AutoCal Check

1. Establish a zero fluid reading in the flowcell, either air or liquid. Press Ack/Ent to proceed. The AutoCal will place the filter to the IN position.

2. Absorbance reading should increase and stabilize. Press Ack/Ent to proceed.

3. The AutoCal will place the filter to the OUT position. Press Ack/Ent to proceed.

4. Unit will display “Pass” if within tolerance “Fail” if out of tolerance. Press Ack/Ent to proceed.

6.3 Initial Start-Up

Upon initial startup, insure the unit is properly connected and calibrated. A confirmation of calibration may be performed by utilizing the calibration check (see section 6.2) function. If the lamp power is not “On” apply power through the Process Control screen and allow to warm up for 10 minutes. The Process Control Screen must be assigned as a privilege for the user. If privileged, use the left/right keys to open the Process Control Screen. Use the up/down keys to select Lamp and select “On” with the left/right keys. If the lamp power was previously “On” when a power interruption occurs, the monitor will retain its last state and return to that setting when power is restored.

6.4 Operating Baseline (Auto-Zero)

To operate the baseline function, the Process Control Screen must be assigned as a privilege for the user. If privileged, use the left/right keys to open the Process Control Screen. Use the up/down keys 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 monitor will retain its last saved baseline setting and return to that setting when power is reapplied, and the monitor and the baseline control is still “On”.

If a Baseline Shift value has been entered, activating the baseline shift will cause the PV2 Analog Output to “Shift” to the entered % value. The PV2 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%).

7. Model 910 Monitor and Sensor Maintenance

7.1 Model 910 Monitor

Once the unit is in operation, there is no requirement to access the interior of the Model 910 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 AC Input Voltage Selection

No AC Input Voltage selection is necessary. The monitor is equipped with a universal AC input power supply that will accept 100-250 VAC 50/60Hz.

7.1.2 Checking 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 Sense terminals on the back of the instrument.

7.2 Model AF10/AF12 Sensor

The AF10/AF12 sensor is designed for trouble free operation. To insure long life, the sensors should be installed in non-corrosive environments and away from the influence of wide temperature variations. These sensors can be operated in specified ambient temperatures at full specifications.

The sensors contain sensitive optical components and should be handled with care. Clean all optical components with dry lens cleaning tissue. If films or other contamination is to be removed, use lens tissue and ethanol for cleaning.

When the sensor is stored or not in use, never allow solutions to dry in the sensor. Purge the sensor with ethanol or other suitable solvent and air dry.

7.2.1 Standard AF10 Lamp and Detector Replacement

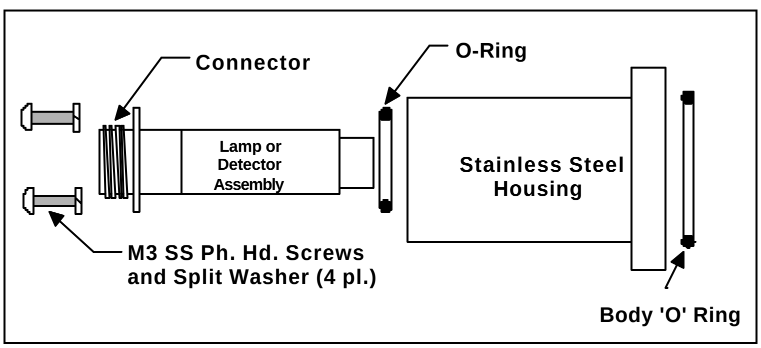


Figure 12 - Lamp and Detector Replacement (Exploded View)

The lamp and detector replacement parts are complete assemblies. To replace either assembly, remove the four M3 SS screws and washers and remove the defective component. Replace in the reverse order. When ordering replacement parts such as windows, gaskets, lamp or detector assemblies, etc., please reference the sensors Serial Number, line connection and size.

7.2.2 Gas Lamp Replacement

1. The lamp housing is attached to the sensor with a threaded window ring. The lamp housing is removed by unscrewing it from the window ring. Access to the assembly, is by separating the rear connector/endplate from the lamp housing. Removal of the lamp housing does not break the liquid integrity of the sample cell.

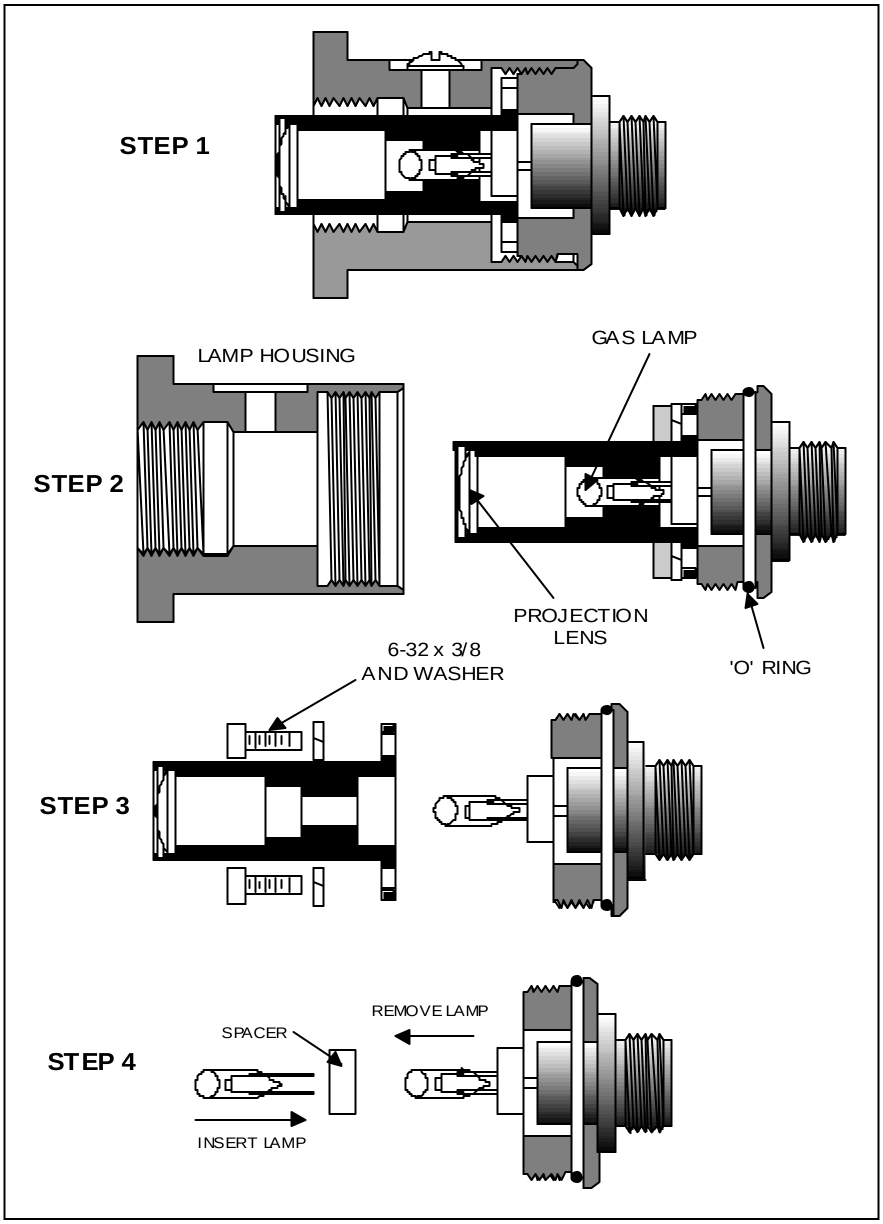


Figure 13 – Gas Lamp Replacement

2. After removal of the lamp housing, unscrew the lamp endplate from the lamp housing.

3. Unscrew the two 6-32 screws that mount the projection lens to the endplate. Carefully remove this assembly.

4. Remove the Bi-Pin Gas lamp from its spacer and socket. Replace with a new lamp. Clean the lamp with alcohol to remove any fingerprints or oil from the lamp. Re-assemble in the reverse order.

5. After lamp replacement, the lamp voltage should be checked. To check the Lamp Voltage setting, connect an accurate multimeter across the Lamp Sense terminals on the back of the Model 910.

7.2.3 AF12 Measurement Detector/Filter Replacement

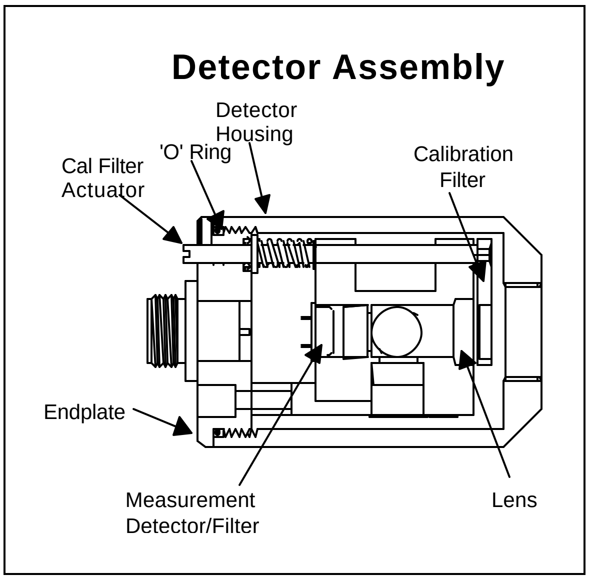


Figure 14 – AF12 Detector Assembly

1. **<u>The detector assembly is attached to the sensor with a threaded window ring. The detector assembly is removed by unscrewing it off the window ring. Removal of the detector assembly does not break the liquid integrity of the sample cell.</u>**

2. After removal of the detector assembly, unscrew the detector endplate from the detector housing.

3. To replace either filter, remove the retaining screw on the detector, and carefully remove the detector. Remove the o-rings in the cavity and gently tap the filter out of the detector block (note: the "mirror" side is directed towards the light source).

3. Replace filter/detector in reverse order.

5. After detector/filter replacement, the detector assembly may require alignment and the system to be re-calibrated.

7.2.4 Sensor Window and Gasket Replacement

1. Replacement of windows or window gaskets (o-rings) or other maintenance requires the disassembly of the sensor. Use the following procedure:

2. The lamp housing is attached to the sensor with a threaded window ring. The lamp housing is removed by unscrewing it from the window ring. Removal of the lamp housing does not break the liquid integrity of the sample cell.

3. The detector housing is attached to the sensor with a threaded window ring. The detector housing is removed by unscrewing it from the window ring. Removal of the detector housing does not break the liquid integrity of the sample cell.

4. After removing the detector housing and lamp housing, remove the 4 or 8 socket head screws from each window retaining ring and remove the ring.

5. While holding the sensor, gently remove the windows from the sensor body.

6. Inspect the windows and clean as necessary. Inspect for any signs of abrasive wear or chipping. If any is noted, the windows need replacement. The 'O' rings should be discarded and replaced with new o-rings of the same material type. Re-assemble the sensor in the reverse order.

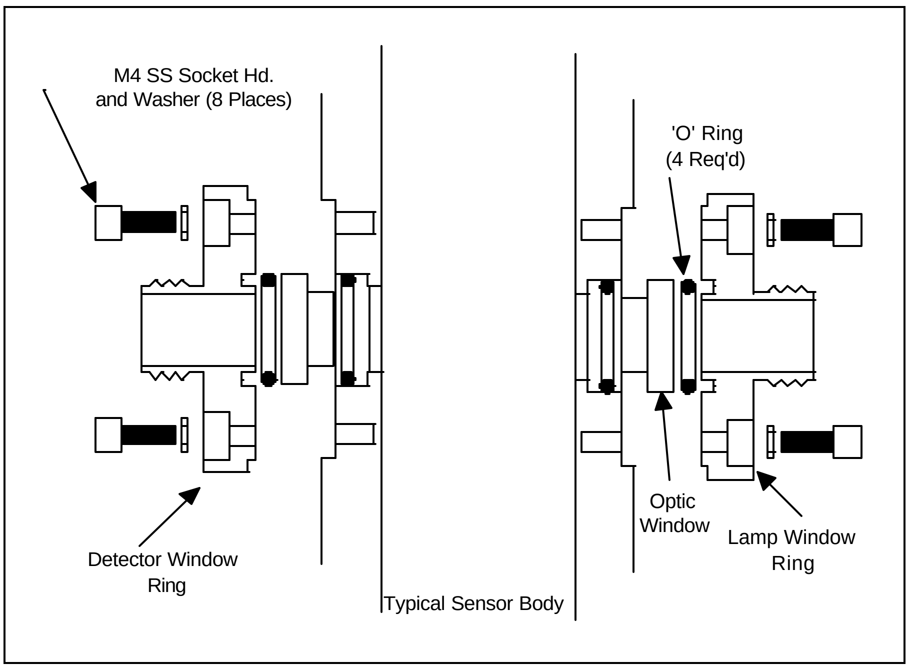


Figure 15 – AF10/AF12 Typical Window Assembly

After any maintenance on the sensor, system calibration should be checked as adjusted as necessary.

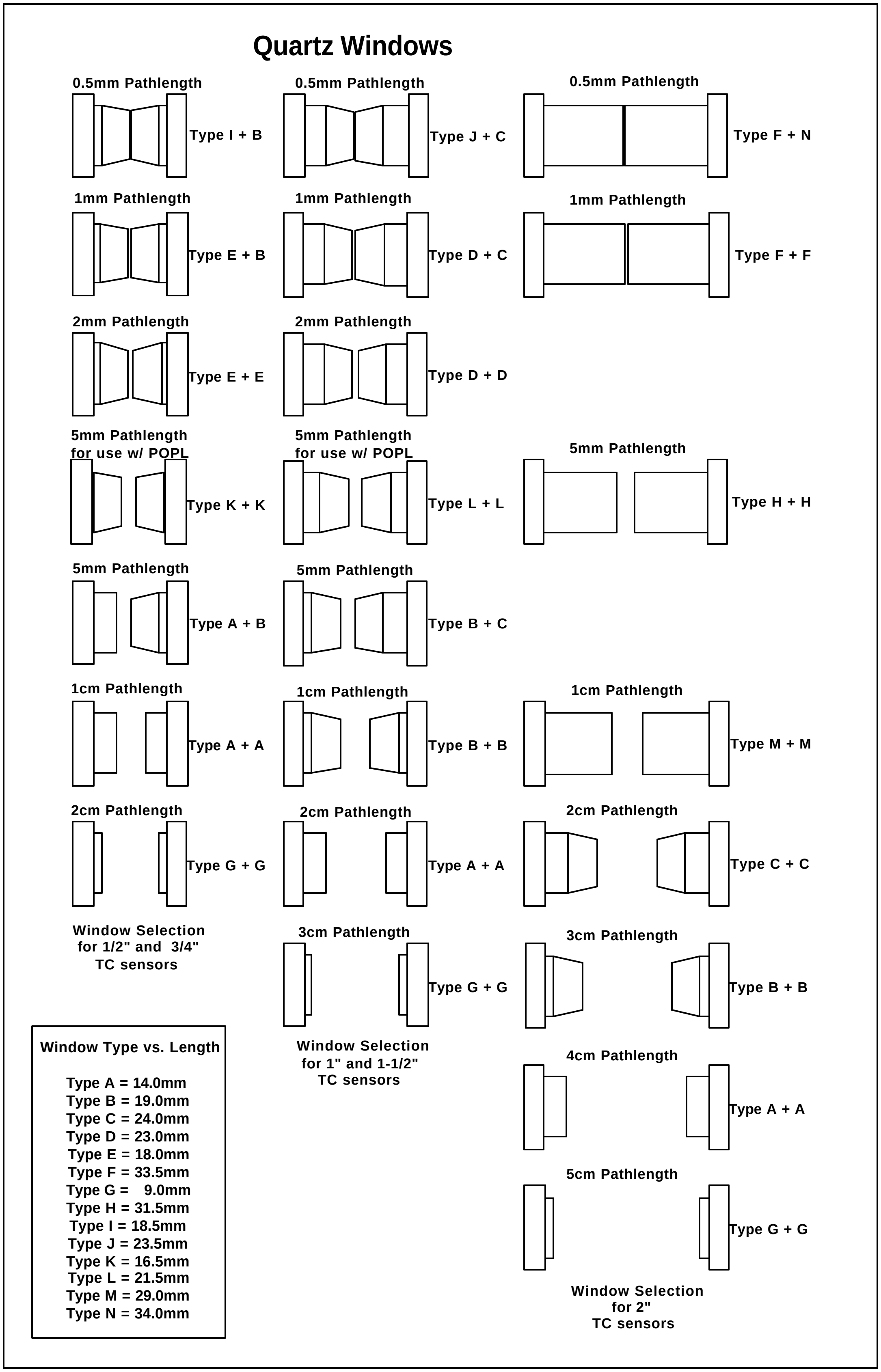


Figure 16 - Window Type vs. Sensor Pathlength

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.

7.2.4.1 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 monitor 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 monitor.

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.

7.2.4.2 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 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 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.

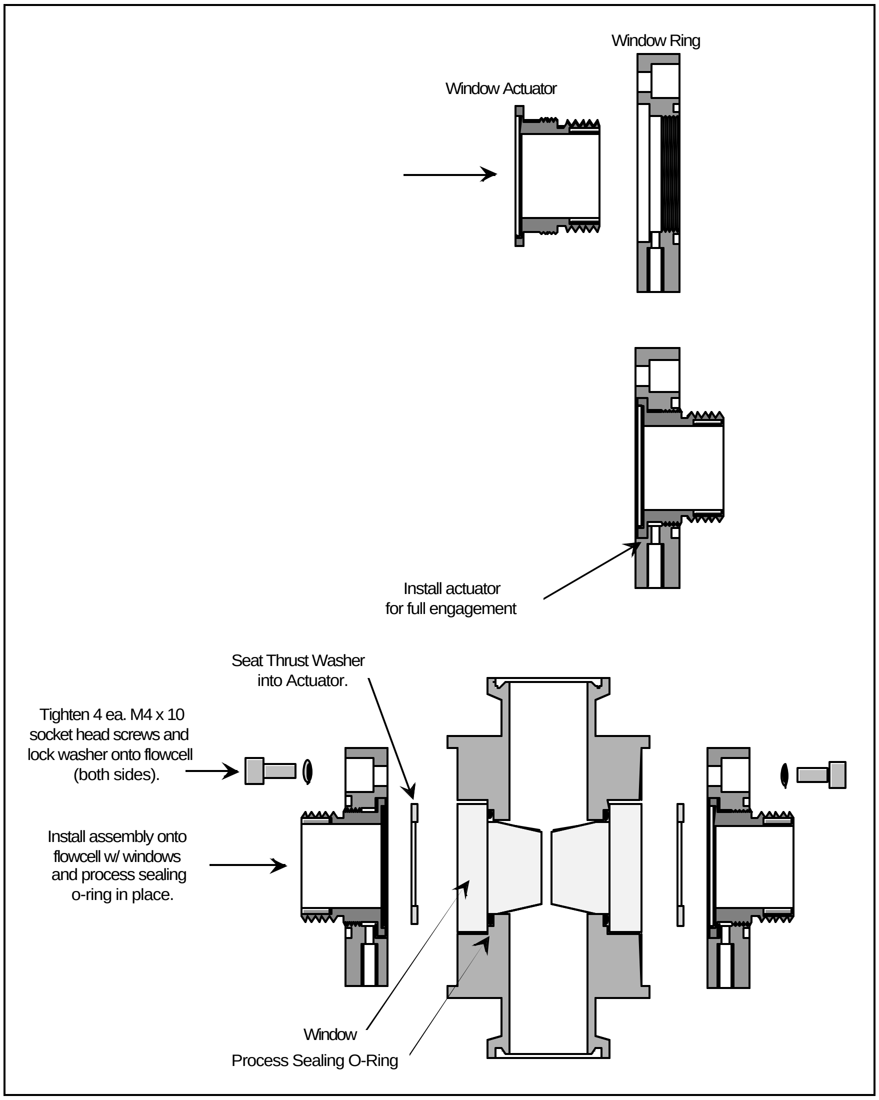


Figure 17 – Assembling the Precision Pathlength Adjustment Rings into the Sensor

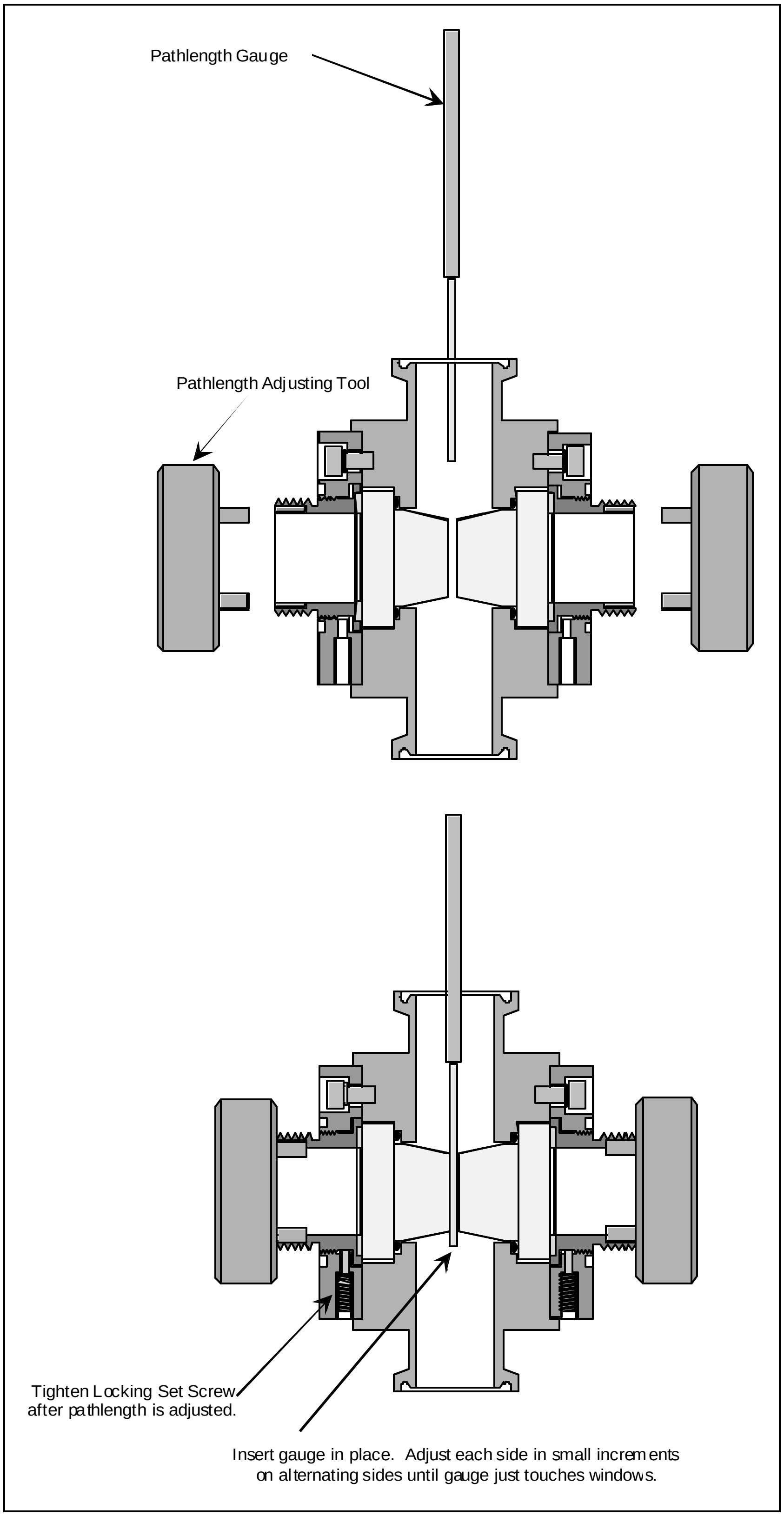


Figure 18 – Adjusting Pathlength in the Flowcell

8. REPLACEMENT PARTS LIST

8.1 Model 910 Single Beam Photometer

DESCRIPTION	PART NUMBER
Fuse, AC Input 3.15A GDA Ceramic	1678-0017-00
Fuse, DC Input 1A MST	1678-1000-00
Fuse, Relays/Alarm 125mA MSF	1678-0125-00

8.2 Model AF10-AF12 Solids Concentration Inline Sensor

DESCRIPTION	PART NUMBER
Std Incandescent Lamp Module (AMP)	A011-0610-01
Std Incandescent Lamp Module (AN)	A011-3610-01
Std Incandescent Lamp Module (TMW)	A011-0610-22
Incandescent Lamp for EXP-1 (Pin Term.)	A011-5100-02
High Luminescence Lamp Module (AMP)	A011-0680-01
High Luminescence Lamp Module (AN)	A011-3680-01
High Luminescence Lamp Module (TMW)	A011-0680-22
Replacement Lamp, Gas	1415-0021-00
AMP AF10 Detector Module	A012-0610-02
AN AF10 Detector Module	A012-3610-02
TMW AF10 Detector Module	A012-0610-22
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.

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