



**Model 950 Absorbance Monitor
and the
Model BT65 Series Insertable Sensor
Installation and Operation
Manual**



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1. General Information

The Model 950 Absorbance Monitor is used in conjunction with a Model BT65 Series Insertable Sensor to measure the spectral absorbance of process liquid in the visible/near infrared region of the electromagnetic spectrum.

The BT65 probe is available in both 25mm and 19mm sizes and is designed to fit 25mm and 19mm Ingold™ type ports in fermenters and bioreactors. A variety of insertion lengths and optical pathlengths (5, 10 and 20mm) are available to suit the wide variety of applications in the field. Mammalian cell culture, hybridoma production, bacterial fermentation and yeast fermentation with cell densities ranging from 1×10^6 per cm^2 to over 100 grams per liter are among the normal uses for the system. The probe is constructed of 316L stainless steel and is suitable for both CIP and SIP operations. The sensor is immune to color changes and the use of sapphire windows, in conjunction with a NIR lamp source, suppresses window blinding due to overgrowth. The Model 950 Absorbance Monitor and BT65 Insertion Probe is ideal for research, pilot and production biopharmaceutical applications.

The Model 950 Absorbance Monitor is manufactured from state of the art digital electronics. Plant interface is through quick disconnect screw terminals on the back of the module. The user interface is comprised of a 6-button tactile feel keypad and 4 x 20 character alphanumeric display.

1.1 How the Model 950 Absorbance Monitor Works

The Model BT65 sensor generates a photo current (μA) detector signals based upon the amount of solids/color energy present at its measurement point internally. The Model 950 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) / absorbance units (AU) or correlated to other customer specified units. The absorbance units are displayed on the front panel and an analog current output, proportional to the absorbance reading, is simultaneously transmitted for connection to other instrumentation and recording devices.

The Absorbance Monitor is typically used in applications where the process measurement exhibits high optical noise. This 'noise' can be due to very large particles, air bubbles and agitation noise that interfere with the measurement by causing rapid changes, both up and down in the optical density. The Model 950 with "Bubble Reject" greatly reduces or eliminates this 'noise'. The input signal to the instrument is digitized through high-speed electronic circuitry and then analyzed using a proprietary algorithm. This algorithm re-constructs a baseline absorbance value out of the complex input signal. The separation from optical 'noise' is carried out using a combination of signal filtering and signal averaging. The filtering element of the signal processing produces an absorbance value considered to be the closest to the real value over a specific time period. The filtering speed is manually selected based upon the degree of noise present in the process. In general, the greater the noise, the slower the filtering needed for adequate suppression. The more severe the noise suppression strategy, the longer the response time of the instrument.

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.

$$\text{where } A = \log \frac{I_o}{T} = \log \frac{I_o}{I_r}$$

$$\text{and } T = \frac{I_r}{I_o}$$

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 950 Absorbance Monitor 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 950 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 950 Absorbance Monitor

1.4 Specifications (Preliminary)

Signal Inputs	Single Channel Current from Model BT65 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

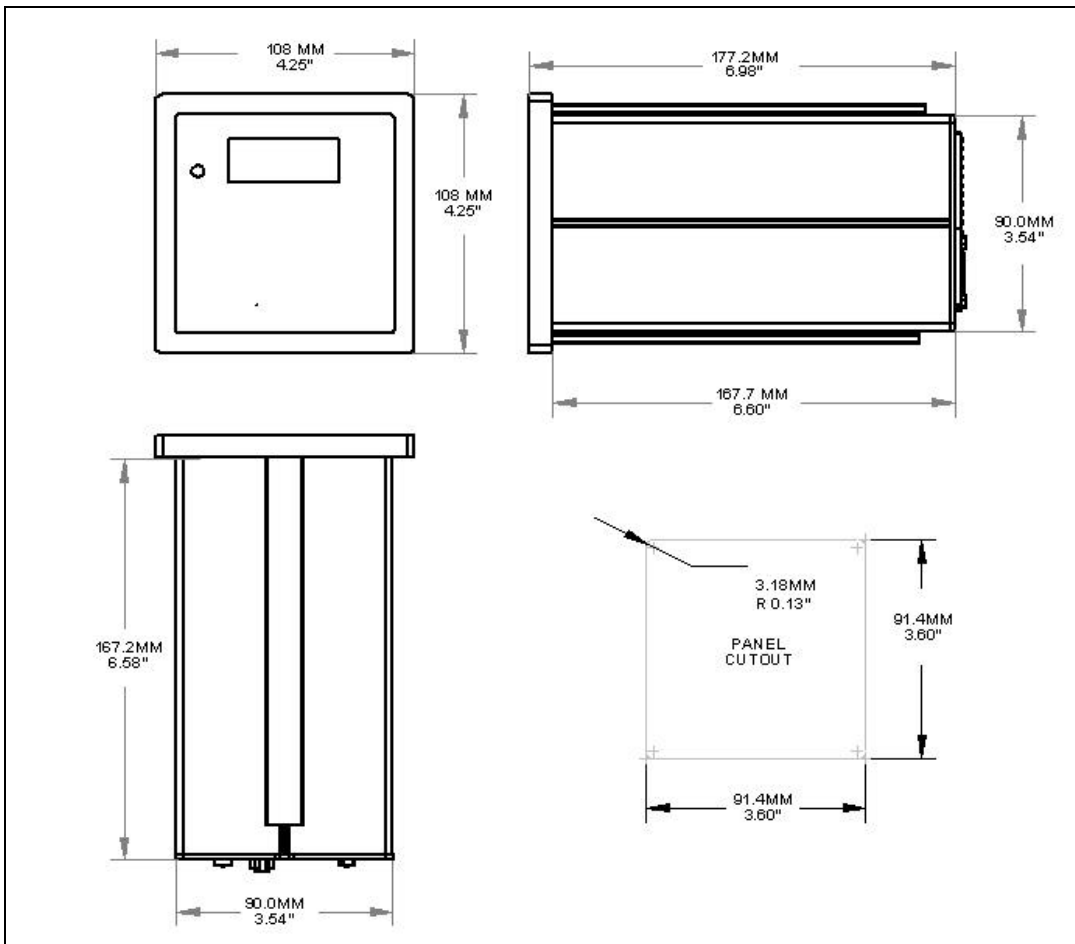


Figure 1 - Model 950 Monitor Dimensions

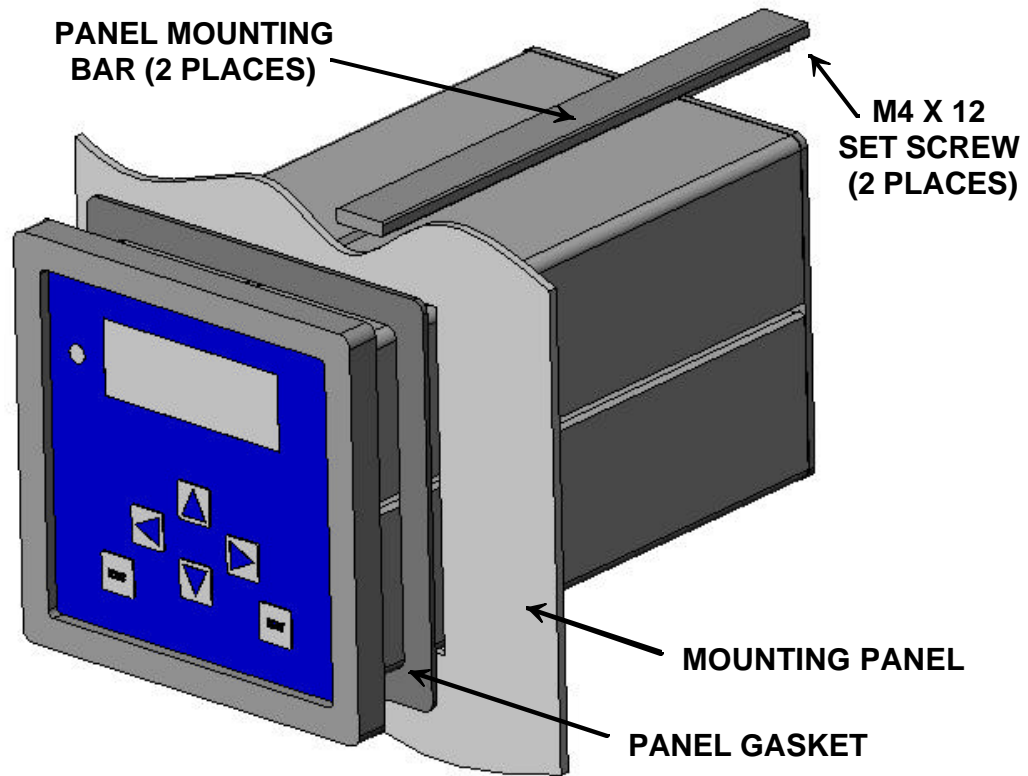


Figure 2 - Model 950 Monitor Mounting

2. Description of the Model BT65 Insertable Sensor

2.1 BT65 Specifications

Line Connection:	Standard 19 or 25mm Ingold™ Port
Optical Pathlengths	5mm, 10mm and 20mm
Light Source:	Pre-Focused Incandescent Lamp
Lamp Life:	50,000 Hours At Rated Voltage
Detector:	Hermetically Sealed High Temperature Silicon Photocurrent Cell
Optical Response:	Bandpass, 950 Nm To 1150 Nm
Flowcell Material	316L Stainless Steel, Polished To $R_a < 15\mu\text{Inch}$, $0.4\mu\text{m}$
Windows	Sapphire
Seals	EPDM
Maximum Operating Pressure	20 BAR, 300 psi
Operating Temperature	130°C Continuous
Cable Length	10ft and 25ft Standard - Up to 300 Feet (100 Meters) Maximum
Approvals	CE EN 61010, EN 55011, EN 50082-1
Options:	Special Probe Designs and Materials of Construction

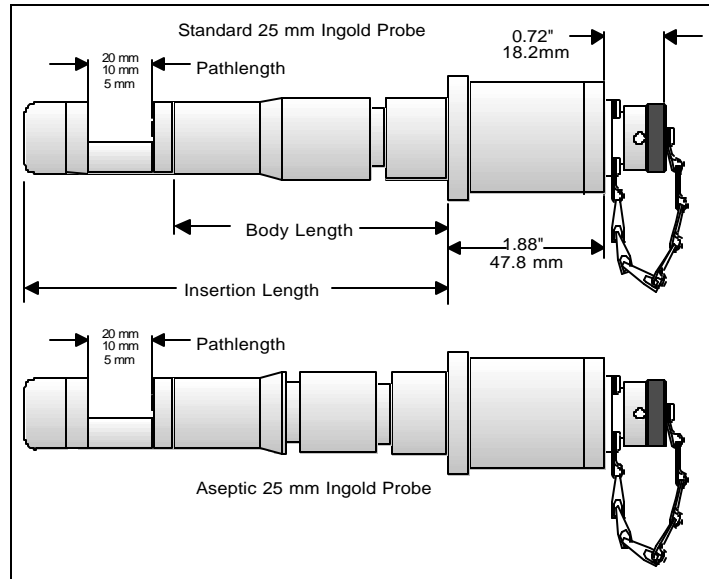


Figure 3 - Standard and Aseptic BT65 25mm Ingold Probes

Body Length	Insertion Length 5mm Pathlength	Insertion Length 10mm Pathlength	Insertion Length 20mm Pathlength
84mm	115mm	120mm	130mm
155mm	185mm	190mm	200mm
353mm	385mm	390mm	400mm
455mm	485mm	490mm	500mm
553mm	585mm	590mm	600mm
1023mm	1050mm	1055mm	1065mm

Table 1 - BT65 25mm Probe Insertion Lengths

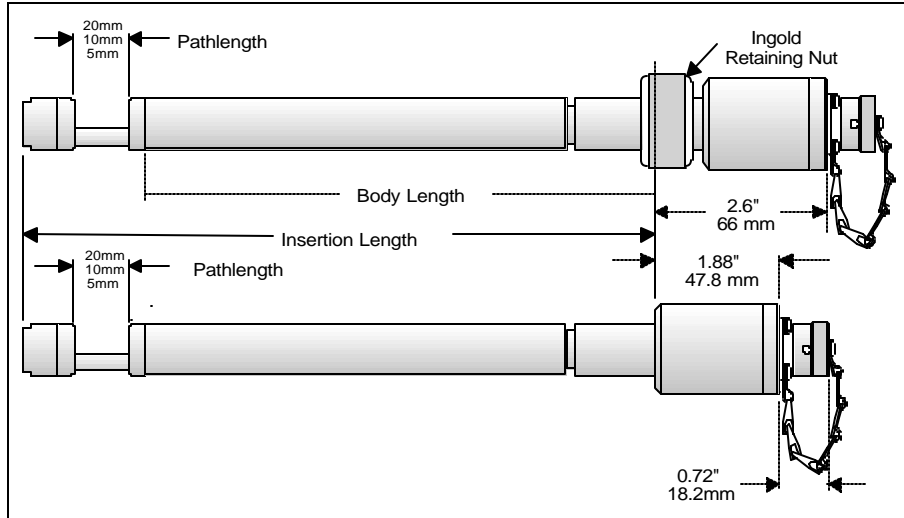


Figure 4 - BT65 19mm Std. and Ingold Probe Dimensions

Body Length	Insertion Length 5mm Pathlength	Insertion Length 10mm Pathlength	Insertion Length 20mm Pathlength
210mm	245mm	250mm	260mm
345mm	375mm	380mm	390mm

Table 2 - BT65 19mm Probe Insertion Lengths

3. Installation

3.1 Model 950 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 950 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 950 Cables and Wiring

All wiring terminals are located on the back panel of the Model 950. The monitor/sensor interconnection cables supplied with the system have all been pre-terminated and labeled for ease of installation. Refer to Figure 7 for a full terminal function description.

The Model 950 has terminals for 2 analog current outputs of 4 to 20mA. Both are capable of driving loads up to 1,000 ohms.

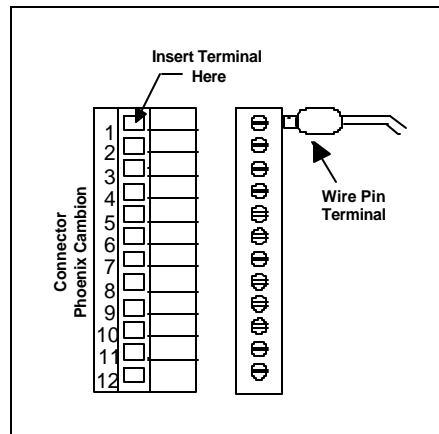


Figure 5 - Wire Terminal Preparation

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 power cables.

Prepare all cable ends as per figure 5 and terminate as per figures 6-8.

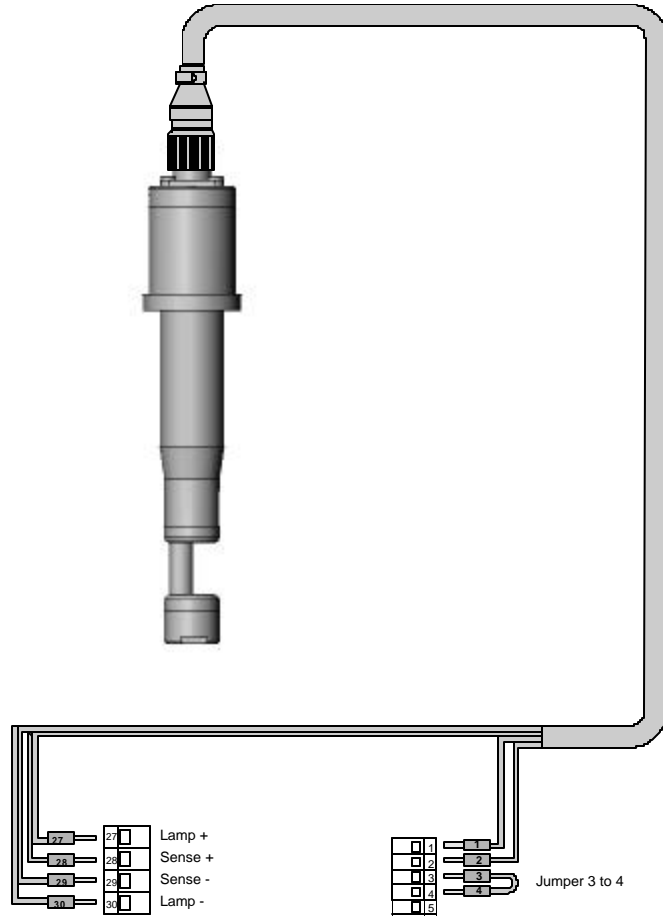


Figure 6 - BT65 Insertable Sensor Wiring Diagram

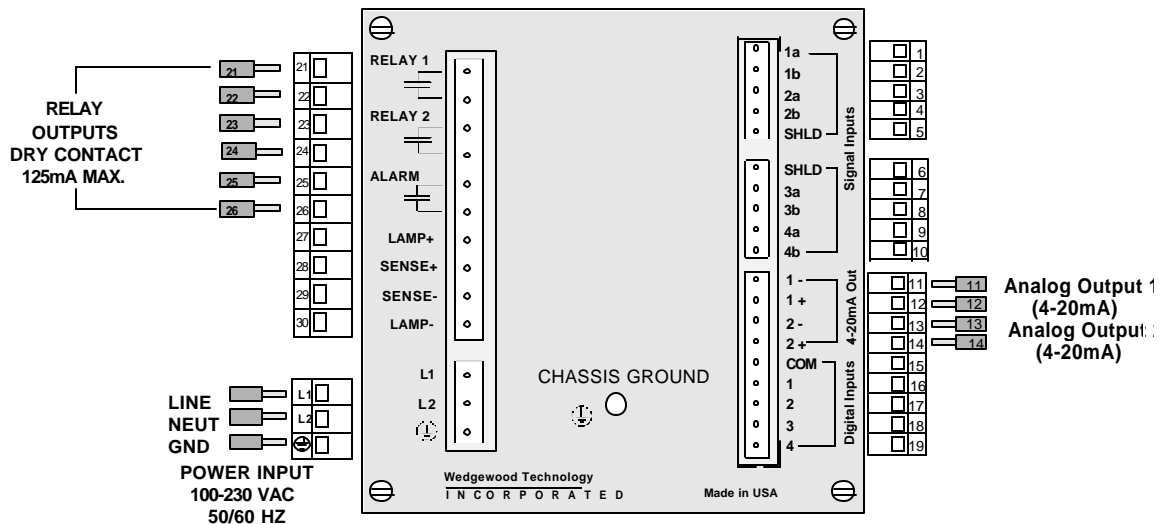


Figure 7 - Model 950 Wiring Diagram (AC Input Version)

3.3 DC Input Power Option

For instruments supplied for 24VDC operation, only the power input connection is changed. Figure 8 shows the connection detail for a 24VDC unit.

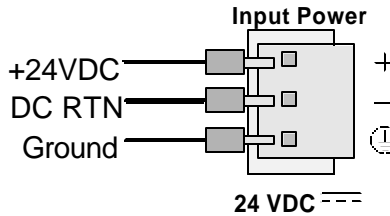


Figure 8 - Model 950 Wiring Diagram (DC Input Version)

3.4 Model BT65 Sensor Installation

The BT65 Sensors are usually installed in vessels through a 19mm or 25mm Ingold™ style port. The sensor can be mounted either vertically or horizontally. Locate the sensor in the vessel where a representative sample is present and interference from agitation and air injection devices are at a minimum.

When installing, adequate space behind the probe should be allowed for easy sensor cable connection and the sensor should be positioned so to avoid damage.

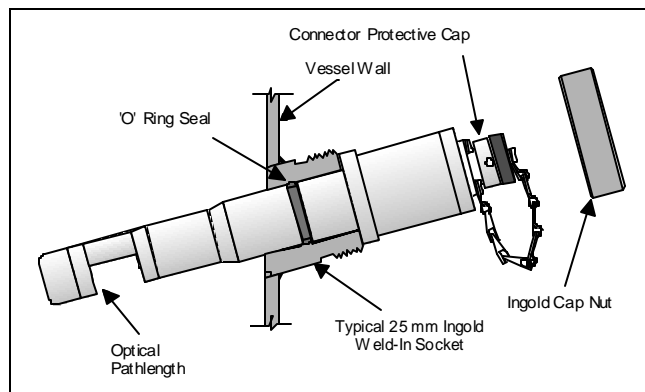


Figure 9 - Typical BT65 25mm Probe Installation

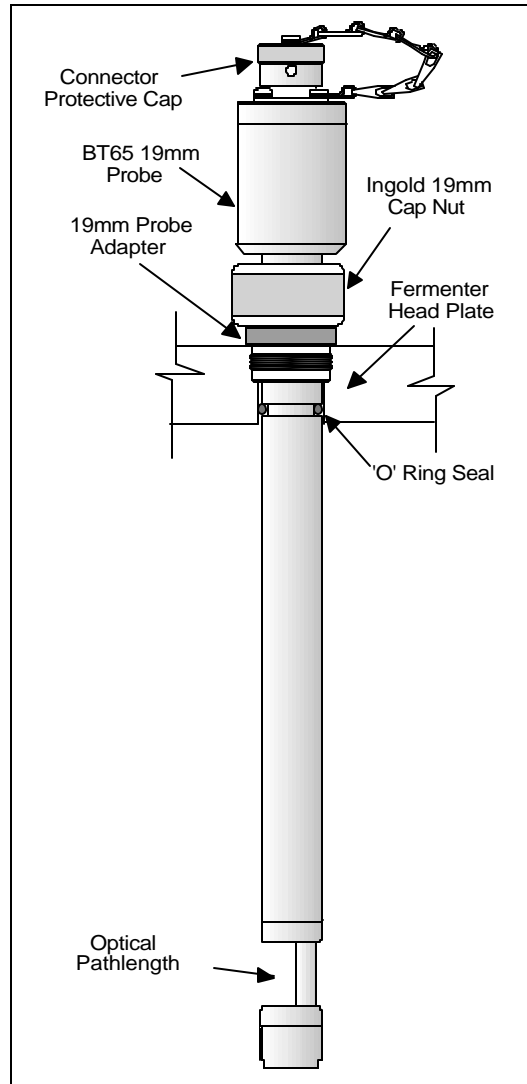
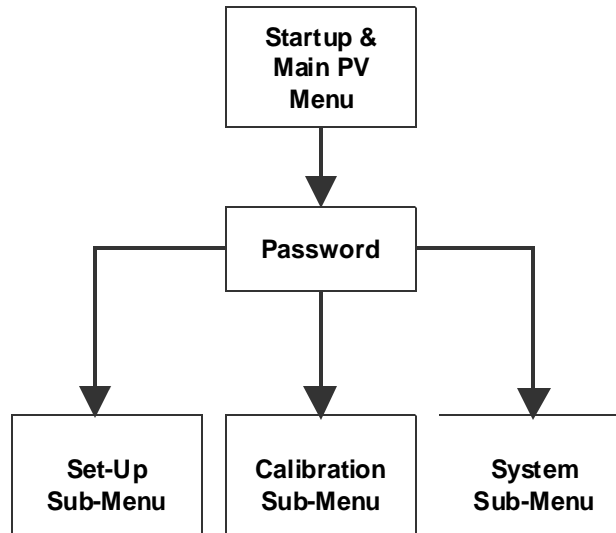


Figure 10 - BT65 19mm Probe Vertically Mounted

4. User Software Diagram and Description

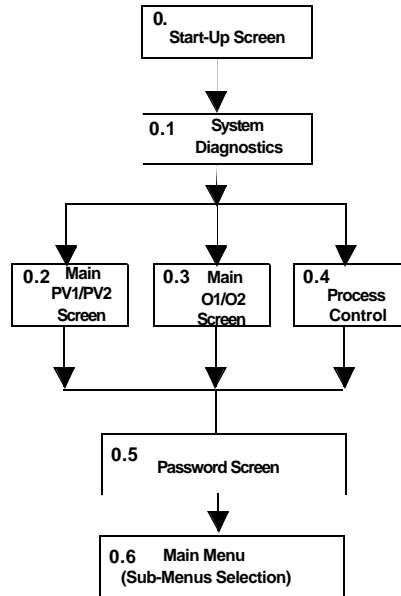
4.1 General Description



The Model 950 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, and 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 420mA 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 Setup: Bubble Reject		1.2 Setup: Baseline Shift		1.3 Setup: Alarm Setpt.		1.4 Setup: Output Span		1.5 Setup: PV Correlate		
1.1.1 Change Count		1.2.1 Change Baseline Shift		1.3.1 Change Alarm 1 Setpt.	1.3.2 Main O1/O2 Screen	1.4.1 Output 1 Span Min/Max	1.4.2 Output 2 Span Min/Max	1.5.1 PV Correlate Curve/# Points		
						1.4.1.1 Change Output 1 Span	1.4.2.1 Change Output 2 Span	1.5.2 Sample in Cell/ Sample Edit//Manual Entry		
						1.5.3 Read OD Sample	1.5.4 Edit OD Sample(s)	1.5.5 Enter OD Point(s)		
						1.5.3.1 Another Sample?	1.5.4.1 Change User Value	1.5.5.1 Change User Value		
						1.5.3.2 Sample Accept	1.5.4.2 Change Units	1.5.5.2 Another Point?		
								1.5.4.3 Min/Max Accept	1.5.5.3 Change Units	
										1.5.5.4 Min/Max Accept

1.0 Process Setup Sub-Menu

1.1 Bubble Reject

The bubble reject setup screen shows the current “count” value for filtering. The user can select from 0, 1, 5, 10, 30, and 60 count filtering. The “0” count provides no filtering, while the others values provide a nominal count in “seconds” filter parameter. Pressing Ack/Ent will allow the user to drop to the bubble reject change screen.

1.1.1 Bubble Reject Change

The bubble reject count may be changed by scrolling with the left/right keys to change. Use the Ack/Ent key to save changes.

1.2 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.

1.2.1 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.

1.3 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.

1.3.2 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.

1.4 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.

1.4.1 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.

1.5 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.

1.5.1 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.

1.5.2 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 and the user can then 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.

1.5.3 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.

1.5.3.1 Additional Samples

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

1.5.3.2 Sample Accept

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

1.5.4 Edit OD Sample

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

1.5.4.1 Change User Value

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

1.5.4.2 Change User Units

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

1.5.4.3 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.

1.5.5 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.

1.5.5.1 Change User Value

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

1.5.5.2 Additional Points

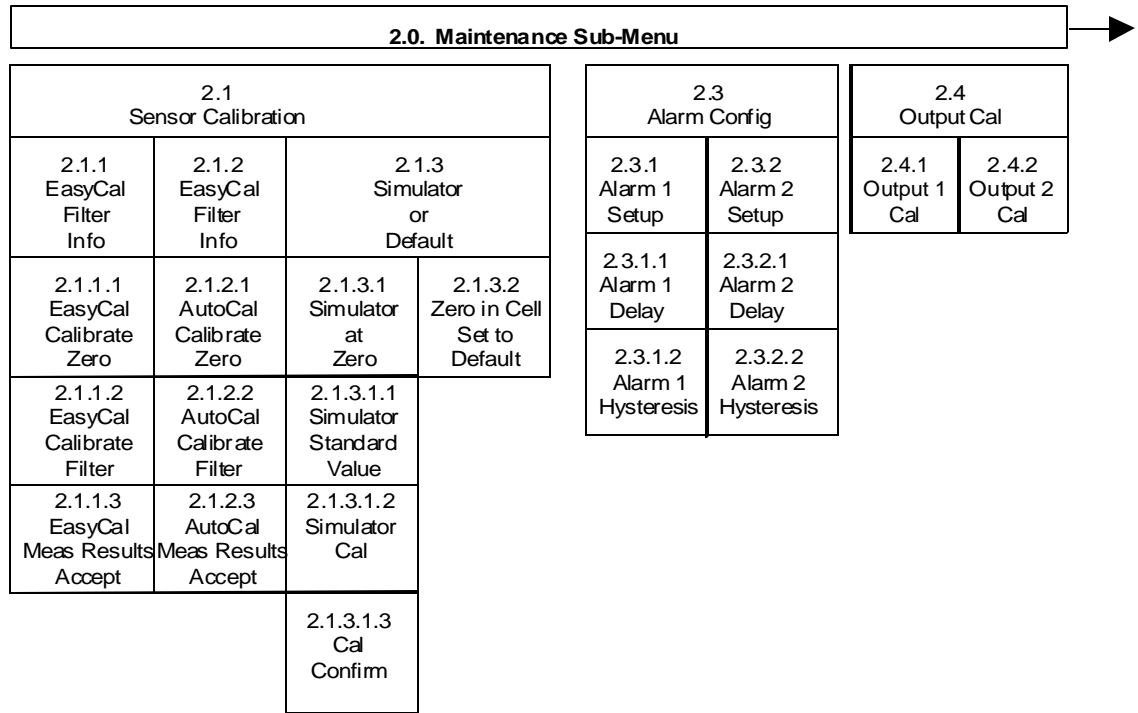
User will be prompted to do additional points. Press Ack/Ent for additional points. Press Menu/Esc for no additional points.

1.5.5.3 Change User Units

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

1.5.5.4 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 continue.

2.3.1.2 Alarm Hysteresis

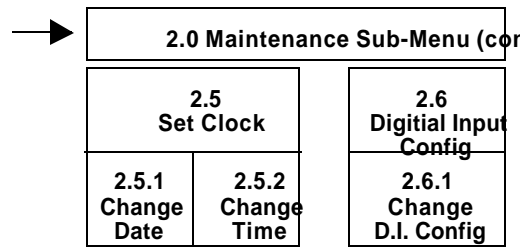
The Alarm Hysteresis screen sets the amount of “deadband” around the setpoint before an alarm will reset. This is configurable in the units set for the instrument, not to exceed full scale. Use the left/right keys to move the cursor, and the up/down keys to change the value. Press the Ack/Ent key to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

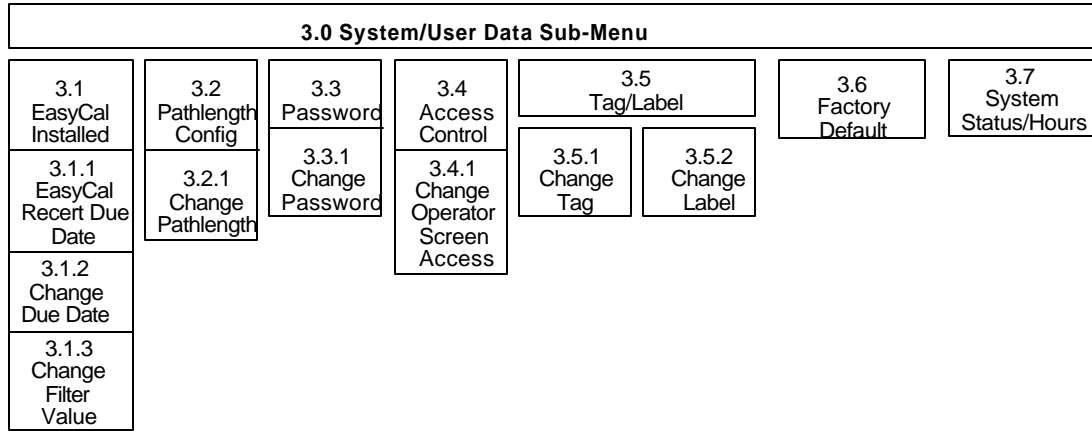
Use the left/right keys to move the cursor, and the up/down keys to change the value. Press the Ack/Ent key to save.

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 user 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 950 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 950 Absorbance Monitor Configuration/Operation

5.1 Monitor Front Panel and Controls

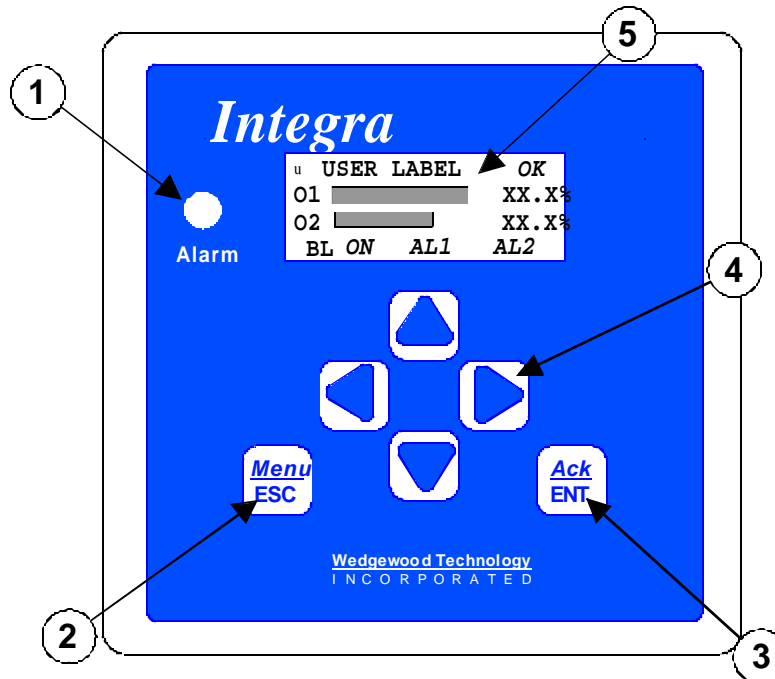


Figure 11 - Model 950 Front Panel

The front panel of the Model 950 monitor is shown in figure 11. 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 950 Absorbance Monitor and Sensor has been factory calibrated. If shipped separately, then the user must configure the monitor/sensor. The

Model 950 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

The EasyCal™ system allows traceable calibration without using liquid standards. It is very important to refer to the actual value of the EasyCal™ optical filter as noted on the Calibration Certificate supplied with the unit. This absorbance value should be entered into the Model 950 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.

6.1 BT65 EasyCal Calibration Procedure

When calibrating with this method, optical filters are used to simulate process changes on the sensor head. Optical filter calibration for an Model 950 with a Model BT65 probe is as follows:

1. Access the Maintenance Sub-Menu and Sensor Calibration Screen Sensor Calibration. Press Ack/Ent to change.
2. This screen shows the calibration filter value. Press Ack/Ent to proceed.
3. With the probe out of the process, place the Optical Zero Calibration fixture into the probe optical measurement path and allow the display reading to stabilize. If the Bubble Reject circuit is active, the readings will be delayed per the setting. Press Ack/Ent to proceed.
5. Place the Optical Span Calibration fixture into the probe optical measurement path. Absorbance reading should increase and stabilize. Press Ack/Ent to proceed.
4. The unit records the value of the filter and displays the value. Press Ack/Ent to accept this value.
5. Remove the Optical Span Calibration fixture. Calibration Complete

6.2 BT65 Calibration Check

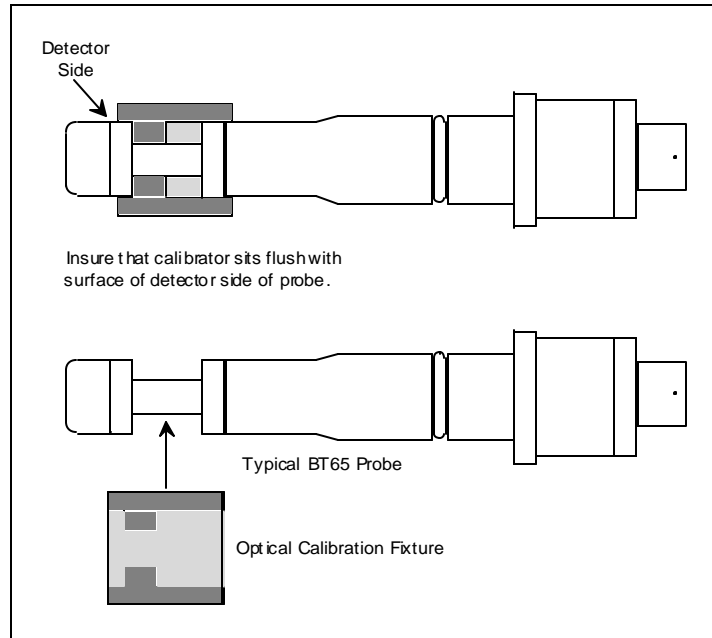


Figure 12 - Optical Filter Calibration Fixture on BT65 Probe

1. With the probe out of the process, place the Optical Zero Calibration fixture into the probe optical measurement path and allow the display reading to stabilize. If the Bubble Reject circuit is active, the readings will be delayed per the setting. Press Ack/Ent to proceed.
2. Place the Optical Span Calibration fixture into the probe optical measurement path. Absorbance reading should increase and stabilize. Press Ack/Ent to proceed.
3. Remove the Optical Span Calibration fixture. Place the Optical Zero Calibration fixture into the probe optical measurement path and allow the display reading to stabilize. 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 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%).

6.5 Initial Measurement Configuration

With the Model BT65 probe installed in the fermenter, determination of the best settings for system noise reduction and filtering can proceed. It is assumed that the optical zero has been adjusted in a clear liquid as previously outlined. The fermenter is charged with nutrient media and the agitator is operating. It is recommended that a chart recorder or the data acquisition unit be connected to the analog output to monitor the signal.

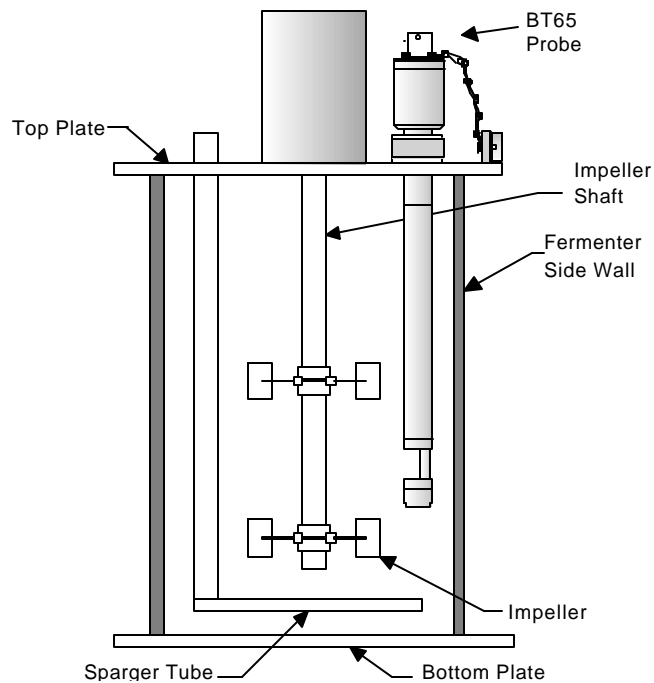


Figure 13 - BT65 Sensor Installed in Fermenter

7. Model 950 Monitor and Sensor Maintenance

7.1 Model 950 Monitor

Once the unit is in operation, there is no requirement to access the interior of the Model 950 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 BT65 Sensor

The BT65 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.

Under normal operating conditions, the Model BT65 probe requires only o-ring replacement. Inspect from time to time for signs of leakage, cable fraying, or any abnormal conditions. If sensor cleaning and/or maintenance are required, remove the sensor from service and perform the needed maintenance. Wedgewood Technology can provide the maintenance service at the factory if desired.

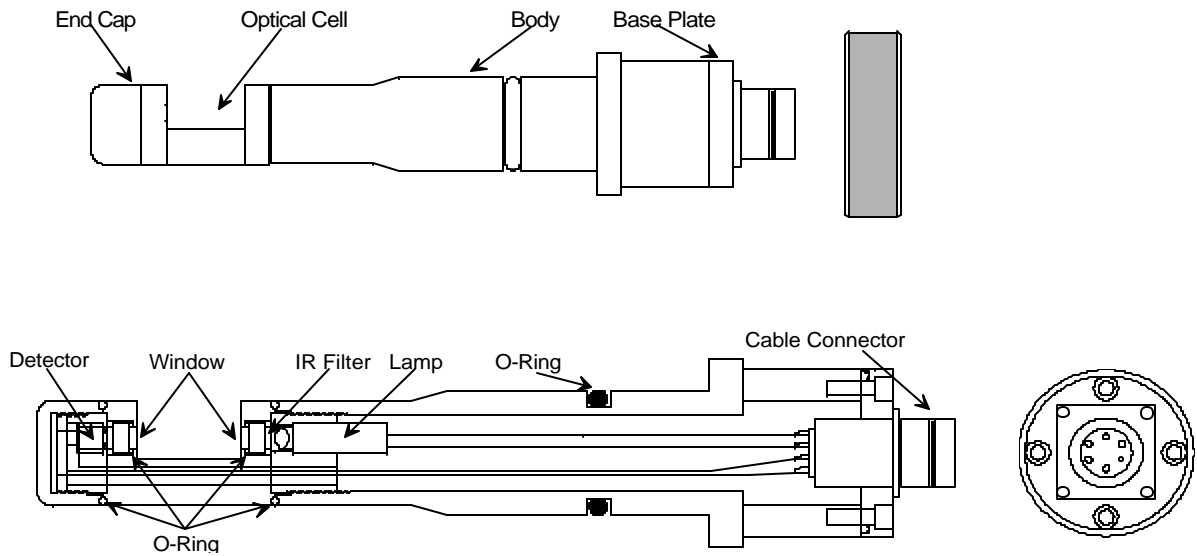


Figure 14 - Cell Probe Cross-Sectional View (Typical)

Please refer to figure 14 for a cross-sectional view of the sensor. The sapphire window and window seals are design for long life in their intended service. The lamp and detector replacement parts are complete assemblies. Field replacement parts and spares are available from the factory. Please reference the sensors Serial Number when ordering parts.

7.2.1 BT65 O-Ring and/or Lamp Replacement

Please refer to Figure 15 for a step-by-step disassembly/assembly procedure (procedure step numbers are noted on the figure). It is important to follow the procedure in order to achieve satisfactory results. Improper disassembly/assembly may cause damage and/or leakage to the probe.

1. Remove the four (4) socket head screws from the base plate of the probe. Pull the base plate off the probe housing, carefully unfolding the wires inside.
2. On older versions, disconnect the wire interconnect pins joining the internal cables to separate the base plate from the probe body. On newer versions, only remove wires as necessary to replace lamp or detector. Use the pin extractor supplied with the lamp or detector replacement kit to remove pin(s). *Refer to connector pin drawing (fig. 18) for installation/removal of pins.*
3. Grasp the optical cell with a flat piece of rubber to act as a grip. Using a wrench on the flats machined into the end cap, loosen and remove the end cap.
4. Using second piece of flat rubber, grasp the probe body and remove optical cell from probe body by rotating counter-clockwise.
5. Remove the lamp set screw.
6. Carefully withdraw the lamp from its holder.
7. The NIR filter is held in place by the lamp. Removal of the lamp allows the filter to also be removed.
8. Remove the two (2) 4-40 socket head screws from the lamp holder.
9. Remove the lamp holder.

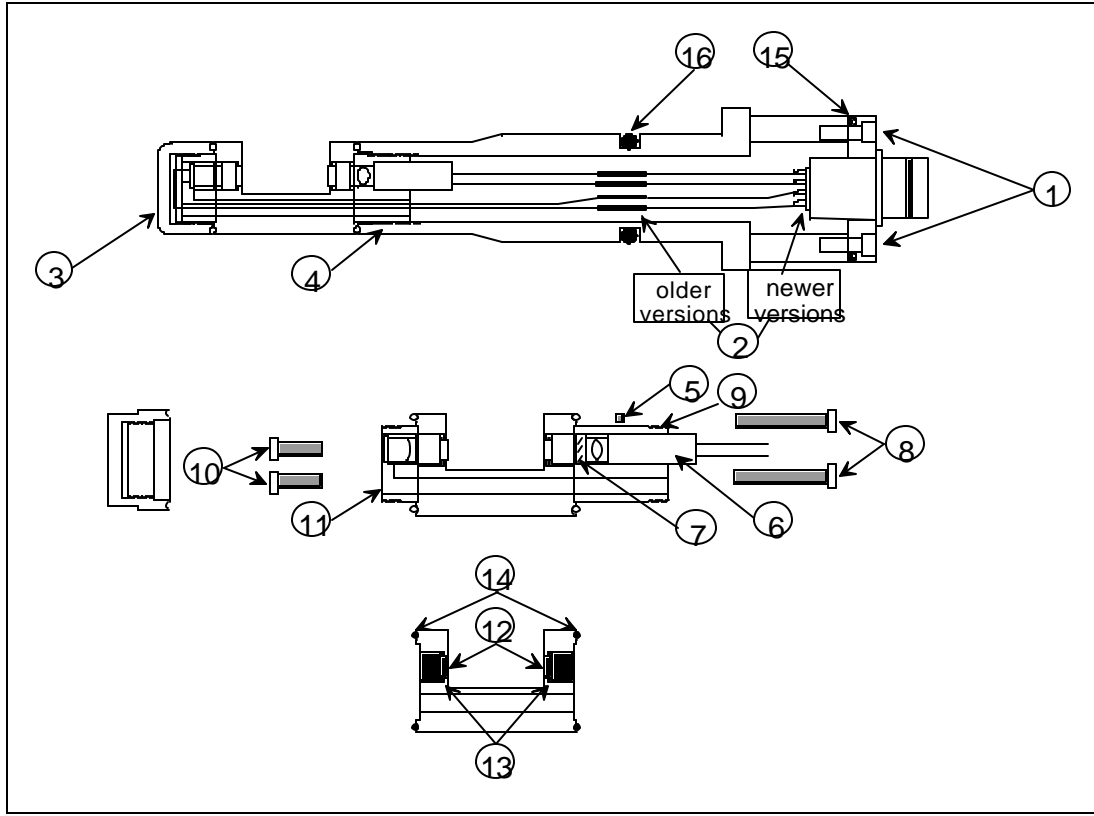


Figure 15 - Cell Probe Assembly/Disassembly Drawing

10. Remove the two (2) 4-40 screws from detector holder.
11. Remove the detector holder. The detector and wires may be left intact through the cell.
12. Gently push the windows out of their seats.
13. Remove the window 'O'-Rings.
14. Remove the cell 'O'-Rings.
15. Remove the base-plate 'O'-Ring.
16. Remove the body 'O'-ring.
17. Replace 'O'-Rings with the same size and type. Re-assemble probe in reverse order.
18. **TIGHTEN SCREWS AND ENDCAP/SAMPLE CELL TO THE SPECIFIED TORQUE SETTING IN TABLE 3. THIS INSURES THE PROPER SEALING FOR THE O-RINGS. EXCESSIVE TIGHTENING MAY CAUSE O-RING AND/OR THREAD DAMAGE. INSUFFICIENT TIGHTENING MAY CAUSE INSUFFICIENT O-RING COMPRESSION AND SUBSEQUENT LEAKAGE.**

Component	Torque (in/lbs)
Lamp Holder/Window O-Ring	10
Detector Holder/Window O-Ring	10
End-Cap/Sample Cell	30

Table 3

The End-Cap and sample cell may be tightened to specified torque by turning the End-Cap alone while holding the probe body with a flat piece of rubber.

Model BT65 sensors contain sensitive optical components and should be handled with care. Clean all optical components with a suitable lint free lens cleaning tissue and ethanol before reassembly.

After re-assembly, the probe should be re-connected to its associated Model 950 Monitor and recalibrated.

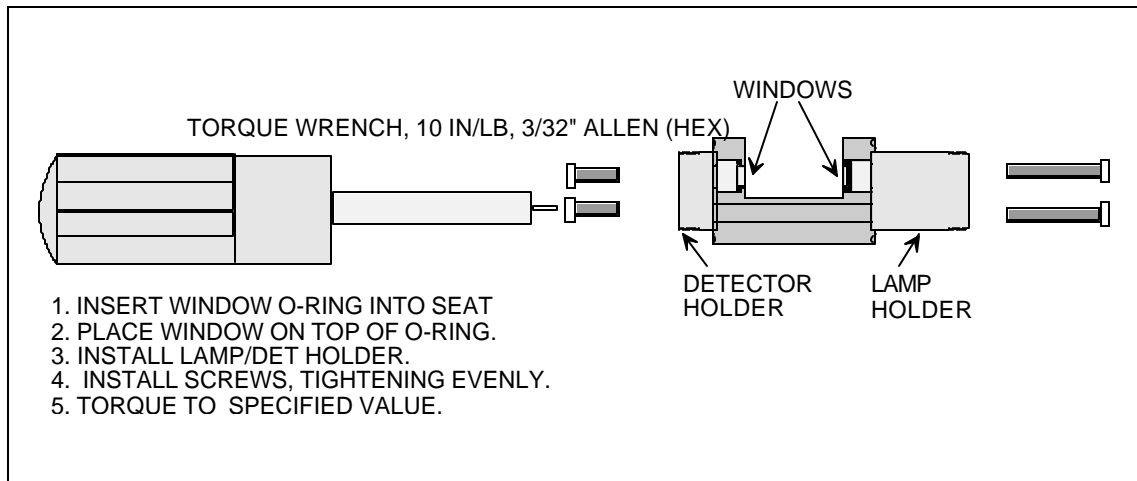


Figure 16 - Window O-Ring, Lamp/Detector Holder Torque Method

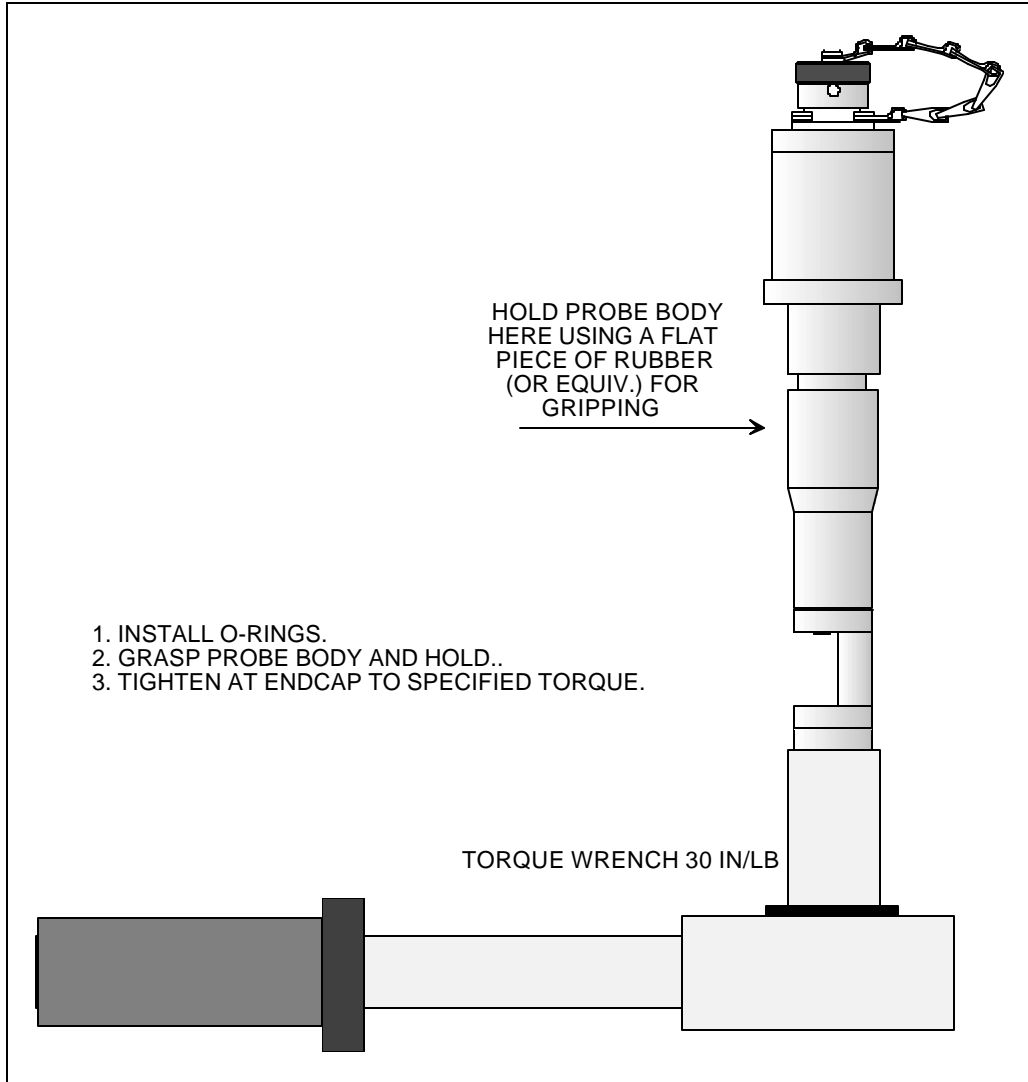


Figure 17 - End-Cap/Sample Cell Torque Method

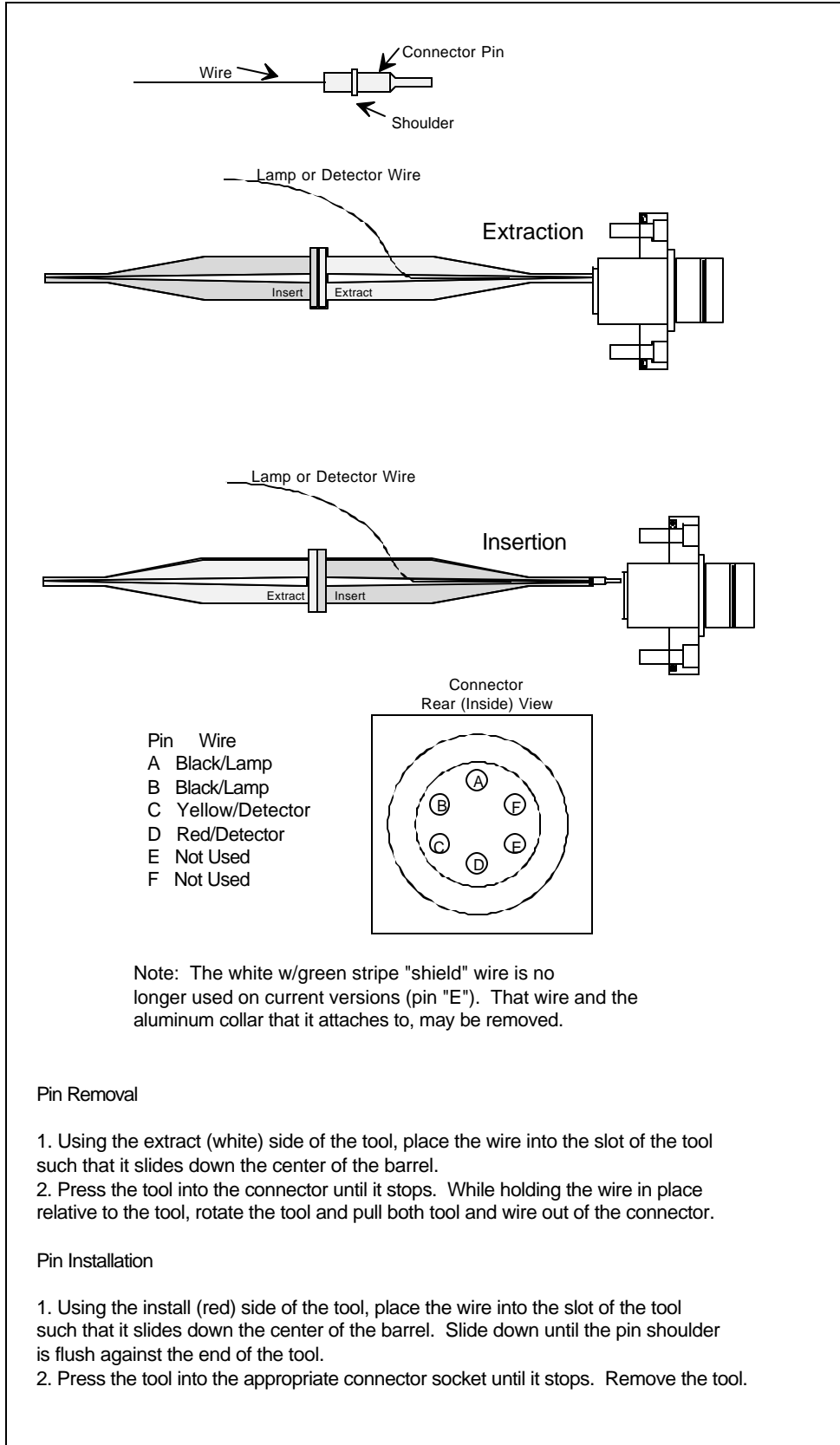


Figure 18 – Connector Pin Installation/Removal

8. REPLACEMENT PARTS LIST

8.1 Model 950 Absorbance Monitor

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 BT65 Insertable Sensor

DESCRIPTION	PART NUMBER
NIR Filter	3100-0080-00
Sapphire Window	3100-0060-70
O-Ring Gasket Kit, 25mm Probe, Silicone	A000-0650-00
O-Ring Gasket Kit, 25mm Probe, Viton	A000-0650-01
O-Ring Gasket Kit, 25mm Probe, EPR (EPDM)	A000-0650-05
O-Ring Gasket Kit, 19mm Probe, EPR (EPDM)	A000-0652-05
Lamp and Gasket Kit, 25mm Probe, Silicone	A011-0650-00
Lamp and Gasket Kit, 25mm Probe, Viton	A011-0650-01
Lamp and Gasket Kit, 25mm Probe, EPR (EPDM)	A011-0650-05
Lamp and Gasket Kit, 19mm Probe, EPR (EPDM)	A011-0651-05

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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