



CAI Model 5560L UV Fluorescence Oil-in-Water Analyzer USER'S MANUAL



Single Source Measurement
Flash Lamp Light Source
PMT Detector

California Analytical Instruments, Inc.
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PLEASE READ THE INSTRUCTIONS CAREFULLY BEFORE WORKING WITH THIS PRODUCT!

Safety Guidelines

This device has left our facility after careful testing of all the photometric transmitter's functions and safety features. The functioning and operational safety of the product can only be ensured if the user observes the usual safety precautions as well as the specific safety guidelines stated in these operating guidelines:

-  Before connecting the device to the electrical supply, ensure that the operating voltage stated on the power supply corresponds to the voltage supplied to the unit.
-  The functioning and operational safety of the instrument can only be maintained under the conditions specified in the specifications section of this manual.
-  If the instrument is moved from warm surroundings, condensate may form and interfere with the functioning of this instrument. In this event, wait until the temperature of the photometric transmitter equilibrates to the new temperature before putting it back into operation.
-  If there is any reason to assume that the product can no longer be employed without risk, it must be set aside and appropriately marked to prevent further use.
-  The safety of the user may be endangered if the instrument:
 - is visibly damaged
 - no longer operates as specified
 - has been damaged in transport
-  If you are in doubt, the product should be sent back to the factory.
-  The operator of this product must ensure that the following laws and guidelines are observed when using this product around dangerous substances:
 - EEC Directives
 - National Fire Protection Association
 - Safety data sheets of the chemical manufacturer
-  Photometric transmitter controls, maintenance, and repair work must only be carried out by a qualified technician.

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Revision History

Revision	Date	Revised By	Change Description
0.0	8-17-2018	N. Veile	➤ First issuance
0.1	10-10-2018	N. Veile	➤ Updated for Explosion Proof



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 Material: Copper free aluminum 28

 Surface Finish: Epoxy coated for aluminum 28

 Casting Method: Die cast (smoother, more uniform finish than sand casting) 28

 Ground Screws: Internal and external 28

 Cover Set Screw: Tamper resistant cover set screw for extra safety 28

 7.4.2 Calibration I Procedures 28



Section 1: Unpacking

Carefully unpack the system, making sure that all components have been removed from the shipping material. Inspect all components for damage; contact the carrier and CAI immediately if any of the components are damaged.

Confirm the contents of the package agree with the packing slip and invoice. Check and record the serial number of each component for future reference when ordering replacement parts.

If any items appear to be incorrect, damaged, or missing, please contact support at California Analytical Instruments at (714) 974-5560 before proceeding with installation and setup of the system.

Section 2: Theory of Operation

2.1 Fluorescence Theory

Molecules that fluoresce are considered fluorophores, their fluorescence can be an intrinsic quality or due to the addition of a fluorescent dye. Intrinsic fluorophores typically have multiple aromatic groups or pi bonds in their molecular structure, with examples being polyaromatic hydrocarbons (PAHs) or green fluorescent protein (GFP).

Fluorescence occurs when a molecule absorbs light energy at one wavelength and re-emits light at another, typically longer, wavelength. The wavelength where the maximum absorption occurs is called the excitation wavelength, and the wavelength where the maximum emission occurs is called the emission wavelength. The difference between the peak excitation and the peak emission is known as Stokes Shift, which is measured in nanometers. Each fluorophore has a distinct and individual shift. (Figure 2.1.1).

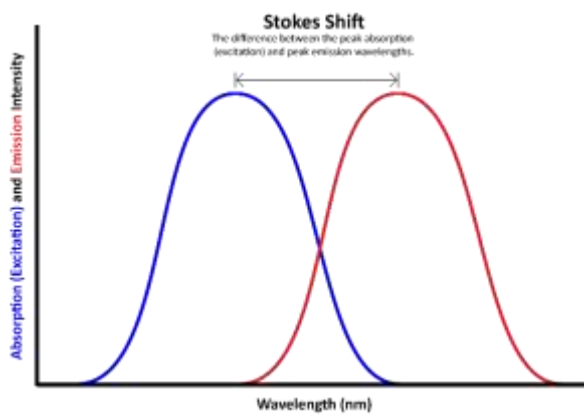


Figure 2.1.1



2.2 System Overview

The Model 5560L uses optical filters to provide specific excitation/emission wavelength ranges chosen to coincide with analyte fluorescence. The optical filters are located within the analyzer and are specific to each application. Therefore, the Model 5560L is a dedicated instrument that can only monitor the analyte for which it was originally equipped. In order to monitor a new analyte, the user must either return the unit to California Analytical Instruments for factory reconfiguration or purchase additional Model 5560L s.

2.2.1 Measurement Technique

This Model 5560L is configured to make a single source measurement. It utilizes one light source (flash lamp) to make a single fluorescence measurement. **Single Source - Source Reference Detector** configuration uses a source reference detector to quantify the energy emitted from the single light source (**Figure 2.2.1**).

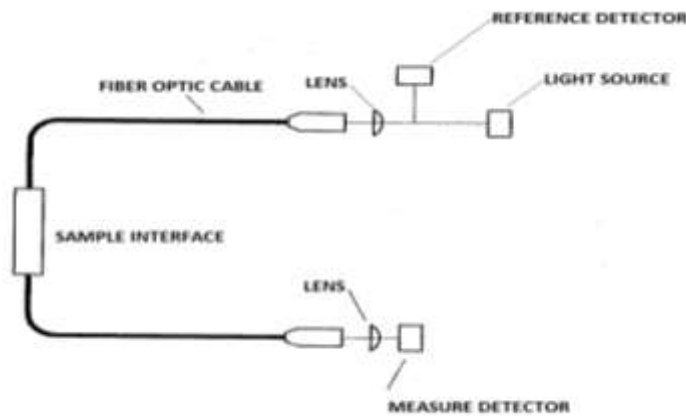


Figure 2.2.1: Single Source-Source Reference Detector configuration

NAME	DESCRIPTION
Light Source	Provides excitation energy. The light source for this configuration is a flash lamp.
Measure Detector	A detector that measures the emission from the sample.
Reference Detector	A detector that directly measures the intensity of light coming from the light source.
Excitation Filter	Located in front of the light source, a filter that passes only the wavelengths absorbed by the analyte of interest.
Emission Filter	Located in front of the measure detector, a filter that passes only the wavelengths emitted by the analyte of interest and blocks all unwanted light outside this band.



Section 3: Hardware Installation

Please follow the outlined sections below as a guideline for installing the Model 5560L and associated accessories.

3.1 Environmental

It is strongly recommended that the Model 5560L be installed in a clean, dry area where ambient temperature ranges from -4 to 90°F (-20 to 32°C). For systems to be installed in environments that exceed this temperature range, contact California Analytical Instruments at (714)974-5560 to discuss accommodations. Systems mounted in enclosures can be purged with clean, dry, oil-free air (or nitrogen).

3.2 Front Surface Fluorescence Probe

The fluorescence probe measures the fluorescence from the surface of the sample. The probe uses a special optical configuration that is designed to have a very sharp focus at the wetted end of the window, eliminating the need to penetrate into the sample for a measurement. Excitation energy from the MODEL 5560L is transmitted to the sample via an 81x 100um fiber bundle while emission energy is collected with a central 600um core fiber.

DO NOT subject the front surface fluorescence probe to extreme vibration or impact, this may cause damage to optical components.

3.3 Electrical

The following section gives an overview of the Model 5560L electrical specifications. A 13-position terminal block connector is provided. The USB type B connector is specified with the green circle. See Figure 3.3.1 for wiring positions and information.



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Figure 3.3.1

TERMINAL	CONNECTION	DESCRIPTION
1	4-20mA +	CURRENT LOOP OUTPUT FOR CHANNEL #1 SEE SECTION 4 FOR MORE INFORMATION 4-20mA (+) DESIGNATES POSITIVE CURRENT
2	4-20mA -	
3	4-20mA +	THESE TERMINALS ARE NOT APPLICABLE FOR THIS APPLICATION
4	4-20mA -	
5	ZERO (+)	SUPPLY EXTERNAL CONTACT CLOSURE 1 SEC CLOSURE WILL INITIATE INITIAL SET/SEE SECTION 4 10SEC CLOSURE WILL INITIATE AUTO TUNE/SEE SECTION 4
6	ZERO (-)	
7	ALARM +	NO CONTACT (60 VDC, 0.75 A MAX) SEE SECTION 9 FOR ALARM TRIGGER DETAILS
8	ALARM -	
9	RS-485 SHIELD	RS-485 SHIELD
10	RS-485-A	MODBUS OVER RS485 REFERENCE MODBUS MANUAL FOR MORE INFORMATION
11	RS-485-B	
12	12-48 VDC POWER (+)	12-48 VDC (8.5W MAX)
13	GND (-)	





Section 4: Operation

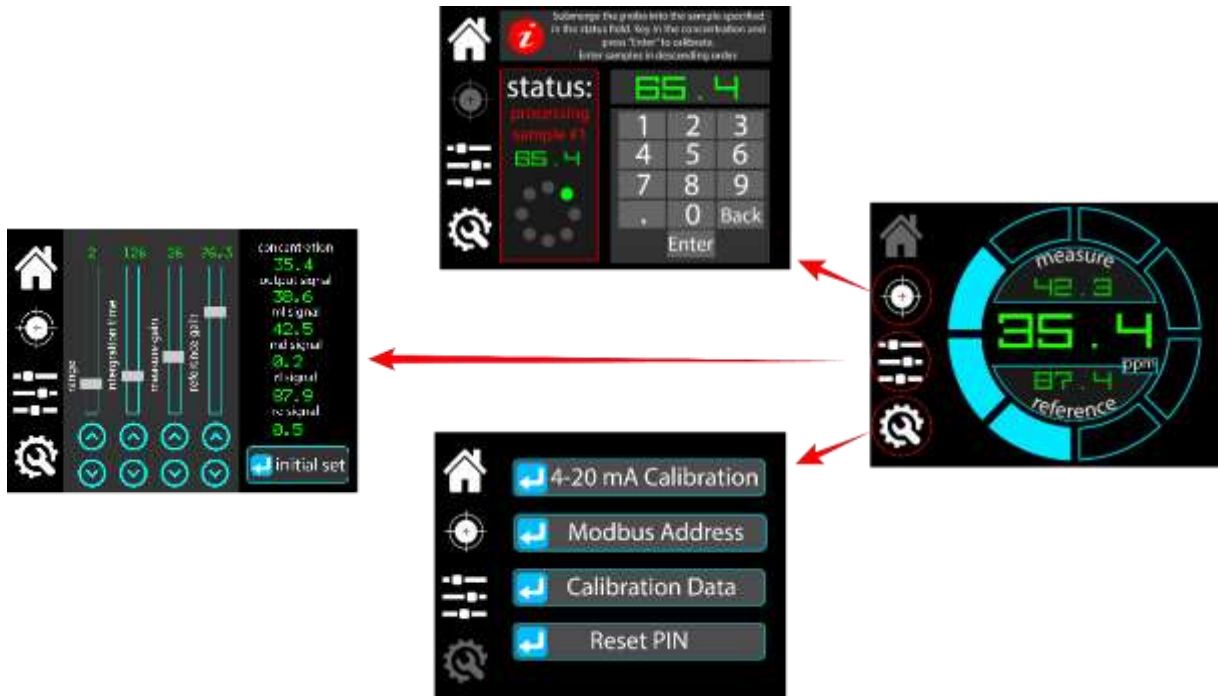
The following sections outline the operation of the Model 5560L. This section describes details of calibration and measurement

4.1 User Interface

The Model 5560L display is a 3.2", 320 x 240 capacitive touch screen display and is best viewed from directly in front. The display allows user access to the measurement, calibration, and diagnostic information of the Model 5560L.

The user interface is accessed via four buttons located on the left side of the display. These selections allow navigation to the following screens:

ICON	FUNCTION	DESCRIPTION
	Home Screen	Permits user to view measurement data
	Calibration Screen	Permits user to calibrate the Model 5560L. This screen is protected by a Personal Identification Number
	Tuner Screen	Permits user to view low level measurement data and manually tune the Model 5560L. This screen is protected by a Personal Identification Number
	Settings Screen	Permits user to view and modify various settings on the Model 5560L. This screen is protected by a Personal Identification Number

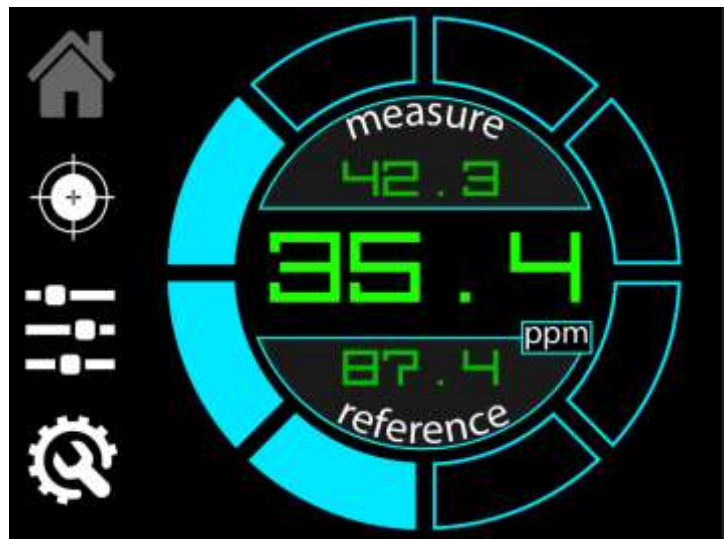


4.2 Home Screen

The Home Screen contains the output signal, measure signal, reference signal, and output signal gauge.

The output signal is the final measurement that is transmitted to the user via the display, 4-20mA, and Modbus outputs. This signal is derived from the ratio of the measure and reference signals.

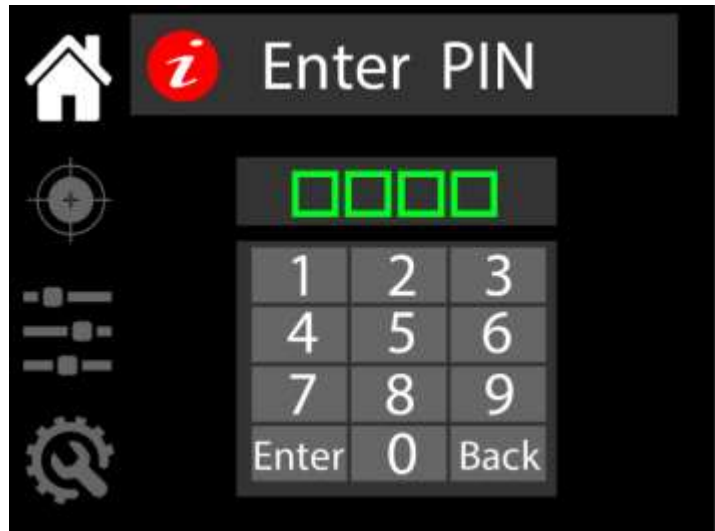
The measure signal displays the percent of light at the wavelength were the analyte fluoresces. While the reference signal displays the percent of light coming from the light source. The usable range for both measure and reference signals is 0-100%. In the event any of these signals are out of range, an alarm is issued and the signal color will change from GREEN to RED on the display.





4.3 User Access

Upon attempting to leave the home screen, you will be taken to the log in screen. After entering the correct PIN, you will be granted access to all features of the Model 5560L. The PIN is only required upon attempting to leave the home screen. **The default PIN from the factory is 0000.** See section 4.6.4 for instruction on setting a custom PIN.




4.4 Calibration

Before proceeding with calibration, allow the unit to warm up for at least 15 minutes. To proceed, you will need the following:

1. Integrated fluorescence probe
2. 1-5 representative samples
3. Appropriate PPE for handling samples
4. Follow Section 7.4.2 to verify how to prepare the Calibration Fluids.

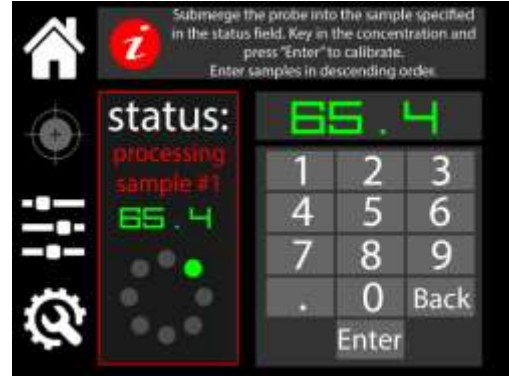
Procedure:

1. Select  , the Calibration Screen
2. Specify the number of calibration points and press enter when complete. 1-5 calibration points may be chosen. A single point calibration simply re-zeros the unit, existing calibration points are retained during a single point calibration.
3. Submerge the probe in the maximum concentration sample.
4. Key in the concentration, select “Enter” once complete to initiate the calibration procedure



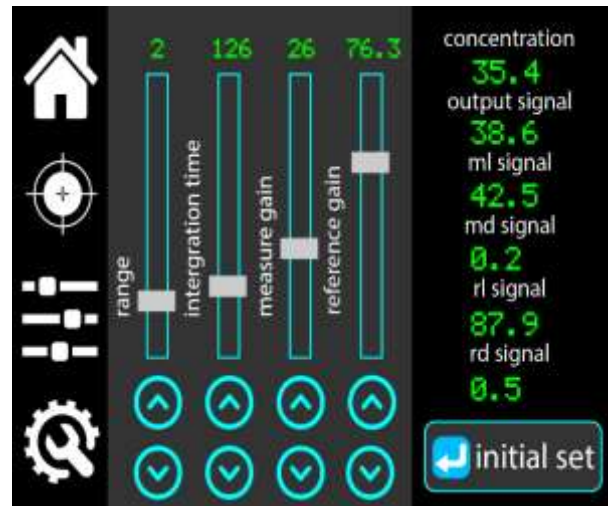


5. When prompted, remove the sample, and clean off the probe tip, and replace with the next sample in descending order.
6. Repeat steps 4-5 for each of the remaining samples.
7. Once all samples have been measured, a dialogue box will appear indicating that Auto-Tune is complete and you will be sent to the Calibration Data Screen for review.



4.5 Tuner

The Tuner gives the user full control of the settings that are automatically selected during Auto-Tune and also allows the user to view low level signals contained within the instrument. Course control of the settings is achieved by the slider feature, and fine control is permitted via the up/down arrows below the sliders. The settings/signals are described in this section.





TUNER SETTINGS	RANGE	(RANGE: 0-7) Adjusting will affect both the Measure and Reference outputs; increase this value to decrease Measure and Reference light output
	INTEGRATION TIME	(RANGE: 3-1,000 ms) Adjusting will affect both the Measure and Reference outputs; increase this value to increase Measure and Reference Light output
	MEASURE GAIN	(0-100%) Adjusting will affect ONLY the Measure outputs (PMT-equipped units); increase this value to increase Measure Light output
	REFERENCE GAIN	(RANGE: 0-100%) Adjusting will affect ONLY the Reference outputs; increase this value to increase Reference Light output
	INITIAL SET	Allows the user to normalize the unit without needing to fully recalibrate.

TUNER SIGNALS	CONCENTRATION	Display of the final, calibrated measurement output of the Model 5560L .
	OUTPUT SIGNAL	(RANGE: 0-65,000 counts) The Output Signal is the raw fluorescence signal from the sample at the wavelength of interest. This measurement is derived from the ratio of the measure and reference signals below.
	ML SIGNAL	(RANGE: 0-100%) The Measure Light Signal is a signal from the measure detector when the light source is turned ON. This is the primary signal used for determining the optical fluorescence of the sample.
	MD SIGNAL	(RANGE: 0-100%) The Measure Dark Signal is a signal from the measure detector when the light source is turned OFF. This signal is used to remove the effects of ambient light and electronic noise on the measure detector.
	RL SIGNAL	(RANGE: 0-100%) The Reference Light Signal is a signal from the reference detector when the light source is turned ON. This signal is used to remove the effects of light source drift over long periods of time.
	RD SIGNAL	(RANGE: 0-100%) The Reference Dark Signal is a signal from the reference detector when the light source is turned OFF. This signal is used to remove the effects of electronic noise on the reference detector.

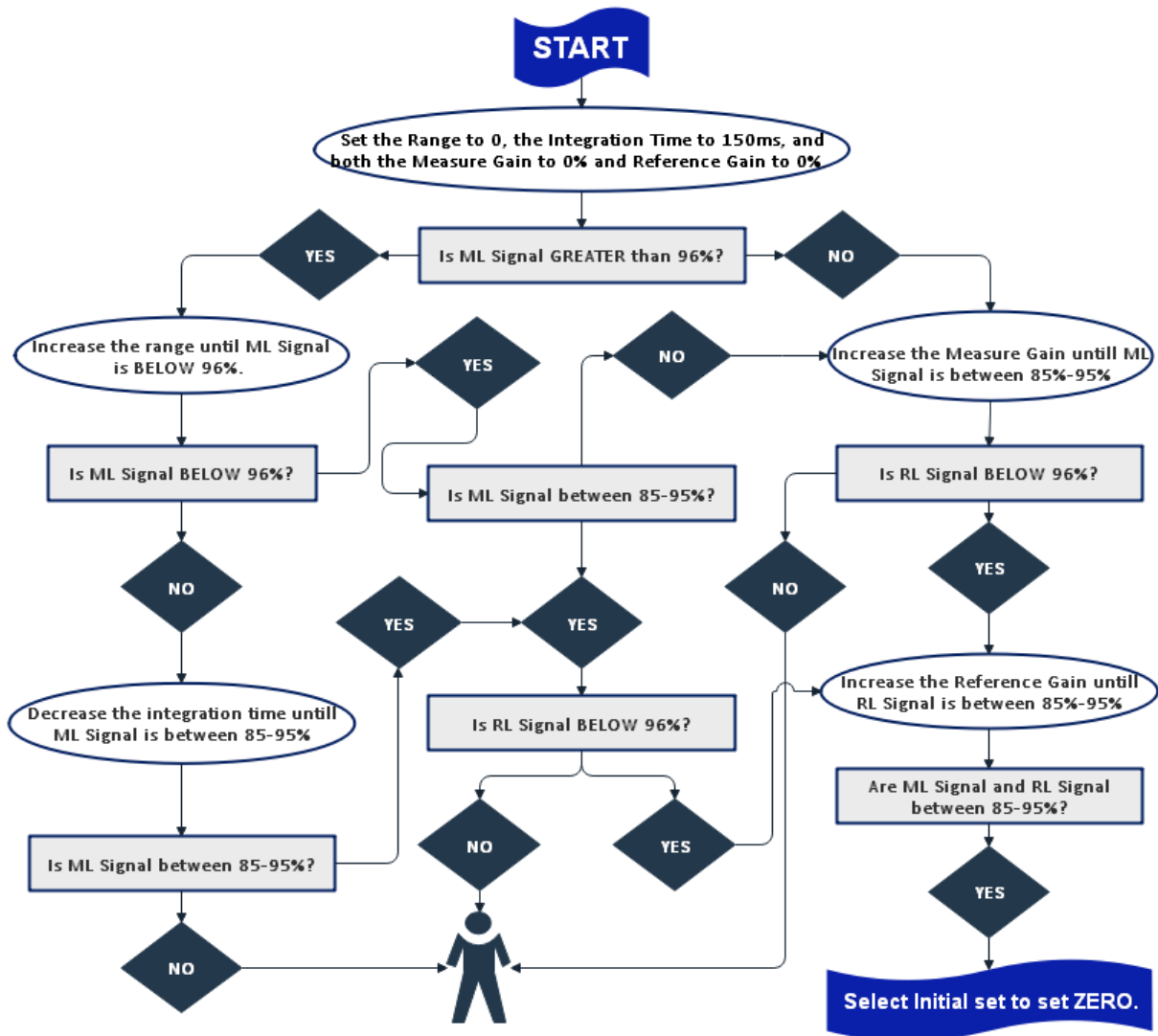
4.5.1 Manually Tuning the CAI Model 5560L

If Auto-Tune is not able to select appropriate settings, it might be necessary to manually adjust the Model 5560L settings independent of the Calibration Screen.

On the highest concentration sample, manually adjust the Measure Light and Reference Light between 85-95% of full scale. Minimize the Measure Dark and Reference Dark signals.

Procedure:

1. Supply power to the unit and allow it to warm up for at least 15 minutes.
2. Submerge the probe in the maximum concentration sample and perform the steps in the following flow chart.



4.6 Settings

Settings Screen allows the user to calibrate the 4-20mA outputs, modify the Modbus Address, review and edit calibration data, and set a new PIN. The following sections describe these features in detail.



4.6.1 Calibrating the 4-20mA Output

To calibrate the 4-20mA output, you will need the following:

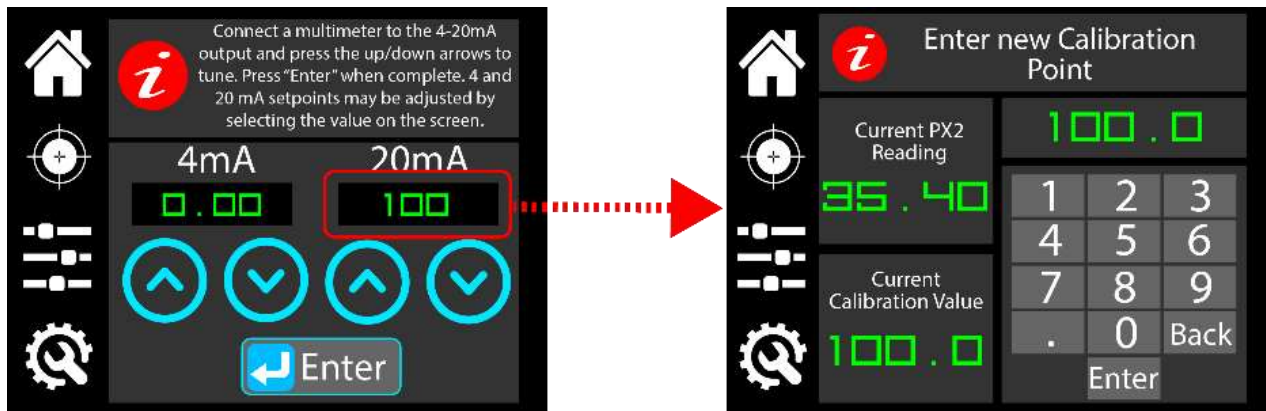
1. A multi-meter

Procedure:

1. Select “4 to 20mA Calibration” located in the Settings Menu.
2. To calibrate, touch the red (positive) lead to terminal position #1 (4-20mA +) and the black lead to terminal position #2 (4-20mA -). (Refer to [Figure 3.3.1](#))
3. Then, calibrate the 4 and 20mA outputs by selecting the up and down arrows while checking the output on the multi-meter.
4. Select “Enter” when finished.



4 and 20mA set-points may be adjusted by selecting the desired point and entering a new value.

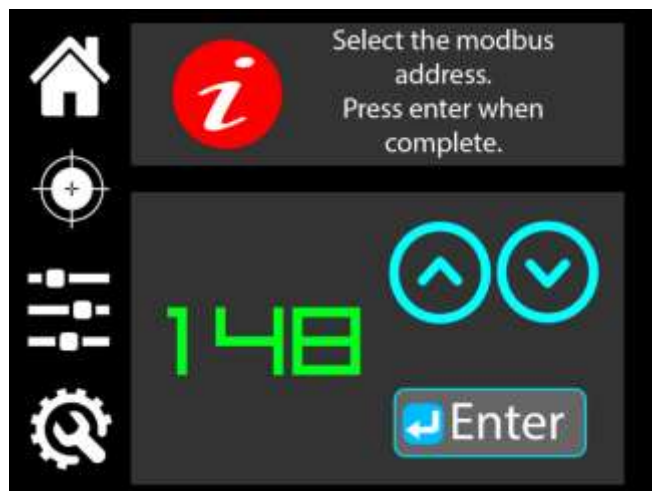


4.6.2 Editing the Modbus Address

The following procedure describes setting a new Modbus Address on the Model 5560L. The valid range of the Modbus Address setting is 1-255.

Procedure:

1. Select “Modbus Address” located in the Settings Menu.
2. Then, set the Modbus Address by selecting the up and down arrows until the desired value is displayed.
3. Select “Enter” when finished.



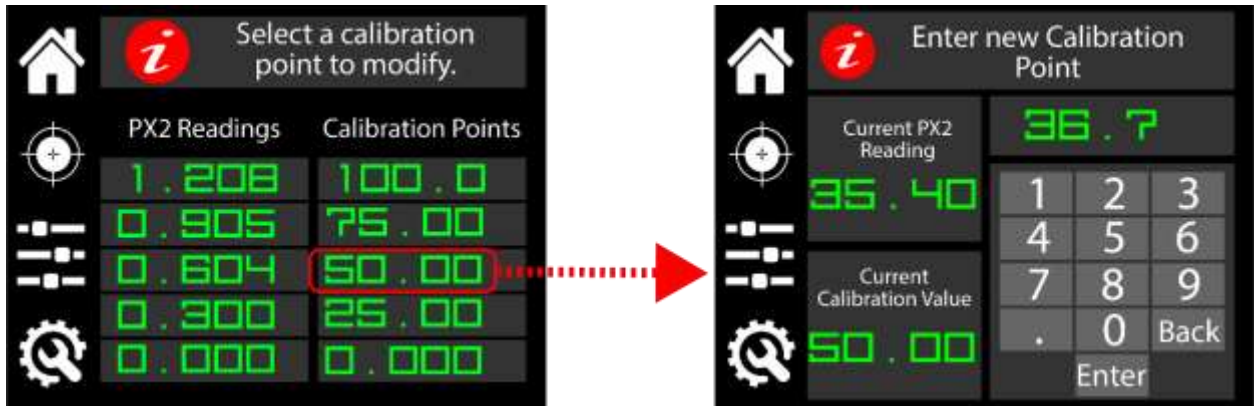


4.6.3 Editing the Calibration Points

The following procedure describes editing calibration points on the Model 5560L .

Procedure:

1. Select "Calibration Data" located in the Settings Menu.
2. Calibration data points may be adjusted by selecting the desired point and entering a new value.
3. Select "Enter" when finished.

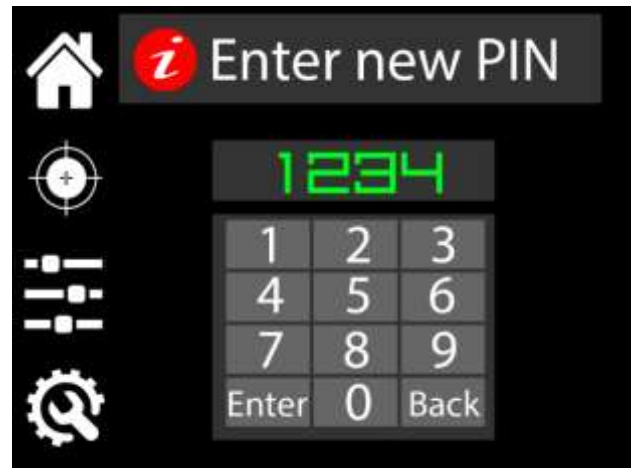


4.6.4 Resetting the PIN

The following procedure describes setting a new PIN on the Model 5560L .

Procedure:

1. Select "Reset PIN" located in the Settings Menu.
2. Key in the desired PIN
3. Select "Enter" when finished.





Section 5: Software

Section 5 describes the installation and operation of the MODEL 5560L Software. Please follow the instructions provided for proper installation.

5.1: Installing the MODEL 5560L Control Panel App

The MODEL 5560L Control Panel App must be installed before connecting the MODEL 5560L to a PC running Windows 7 or later. To install the MODEL 5560L Control Panel App:

1. Insert the provided USB flash drive into the USB port on the PC.
2. Select “Open folder to view files.”
3. Double click the “MODEL 5560L-Setup” file and select “Run” to proceed with the installation.

5.2: Connecting the MODEL 5560L to the PC

Before opening the MODEL 5560L Control Panel App:

1. Ensure that the Integrated fluorescence probe is connected to the MODEL 5560L.
2. Connect the MODEL 5560L to the PC with the Control Panel App installed using the provided USB cable.
3. **Supply power to the unit.**
4. Ensure that the MODEL 5560L device driver automatically installs (when connecting the unit to the PC for the first time, a notification should pop up indicating that the device driver has successfully installed).
 - If installation fails, please contact support at California Analytical Instruments at (636) 305-0666

Once the accessories are connected, the unit is powered on, and the driver is installed, open the MODEL 5560L Control Panel App.



5.3: Calibrating the Model 5560L

Refer to Section 7.4.2 for Calibration Fluid Preparation.

5.3.1 Calibration Using Auto Tune

Before proceeding with calibration, allow the unit to warm up for at least 15 minutes. To proceed, you will need the following:

1. Integrated fluorescence probe
2. 1-5 representative samples
3. Appropriate PPE for handling samples

The MODEL 5560L Control Panel App opens into **“Normal Mode”** by default, giving the user access to Auto-Tune. (Figure 5.3.1).



Figure 5.3.1: Model 5560L Control Panel App in Normal

The following procedure describes calibrating the Model 5560L.

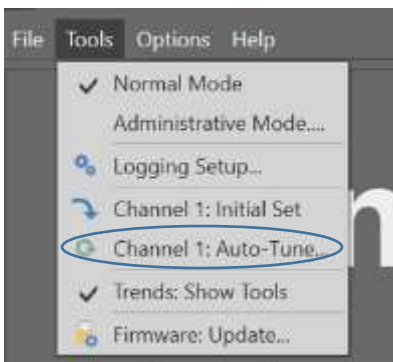


Figure 5.3.2

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Procedure:

1. Select **Tools > Auto-Tune** to begin
2. Specify the number of calibration points, note that selecting AUTO-SETUP will re-zero the unit allowing the previous calibration to persist.
3. Submerge the probe in the maximum concentration sample.
4. Fill in the concentration (numeric value only) in the first text box, and then select “#1 Test Sample.”

Figure 5.3.3

5. Remove the sample, clean off the probe tip, and replace with the next sample in descending order.
6. Repeat steps 4-5 for each of the remaining samples.
7. Once all samples have been measured, a dialogue box will appear indicating that Auto-Tune is complete. Selecting “OK” will hide the Auto-Tune Frame.



Figure 5.3.3

After Auto Tune is complete, the Model 5560L Control App will automatically apply the units of measurement to an engineering unit such as ppm, and the output will adjust to the calibrated scale. After the initial 5-point calibration is completed against the oil of interest, the end-user will need to only conduct a single point calibration in the future to ensure the Model 5560L is properly calibrated.

Section 5.4: Software Features

To gain full access to all of the MODEL 5560L’s features, such as the Tuner to manually adjust the Model 5560L’s settings or calibration, the user must log into the password-protected “**Administrative Mode.**” These features are otherwise hidden to protect them from being changed by unauthorized users.

Figure 5.4.1 depicts the various controls that can be accessed in Administrative Mode.

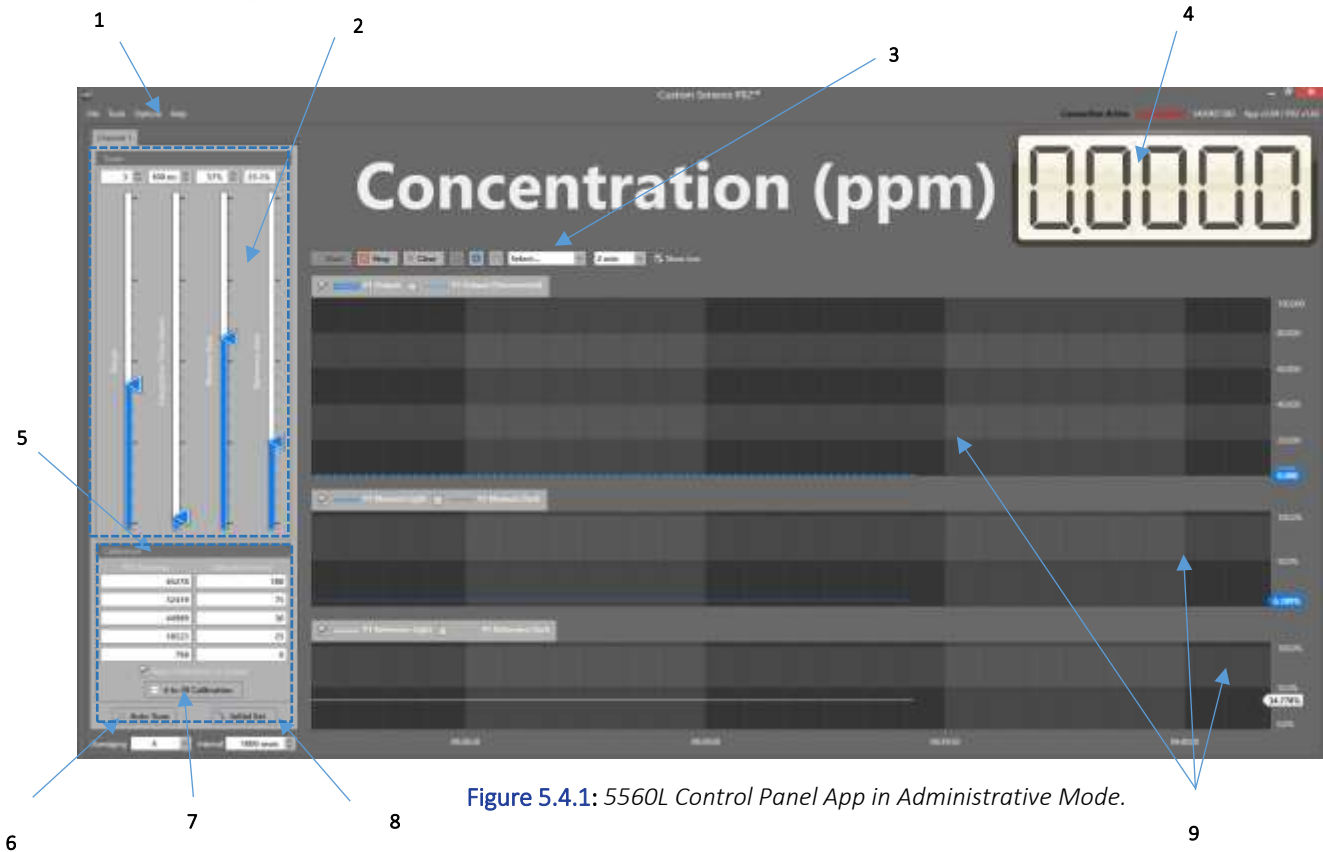


Figure 5.4.1: 5560L Control Panel App in Administrative Mode.

ITEM	SOFTWARE FEATURES	DESCRIPTION
1	MENU BAR	USER HAS ACCESS TO LOGGING SETUP, AUTO-TUNE, AND INITIAL SET
2	TUNER	GIVES USER FULL CONTROL OF THE MODEL 5560L SETTINGS
3	GRAPHING TOOL BAR	USER CAN MODIFY WHICH DATA IS VIEWED WITHIN THE MODEL 5560L CONTROL APP
4	OUTPUT VALUE	DISPLAYS THE NUMERIC VALUE. SHOWN IN COUNTS OR UNITS OF MEASUREMENT.
5	CALIBRATION FRAME	DISPLAYS THE OUTPUT VALUES, ALONG WITH THEIR CALIBRATION POINTS. AUTO-TUNE, INITIAL SET, AND 4-20mA CALIBRATION ARE ALSO LOCATED WITHIN THE FRAME.
6	AUTO-TUNE BUTTON	PROMPTS THE UNIT FOR CALIBRATION
7	4-20mA CALIBRATION BUTTON	PROMPTS THE UNIT FOR CALIBRATION OF THE 4-20mA OUTPUT
8	INITIAL SET	ALLOWS THE USER TO RESET THE FULL SCALE CALIBRATION POINT WITHOUT NEEDING TO RECALIBRATE THE UNIT.
9	GRAPHING AREA	DISPLAYS THE SELECTED DATA TO TREND

To access these settings first click on the “Tools” tab located on the menu bar. Once in the “Tools” tab, then click “Administrative Mode”. A password entry will appear as shown below in Figure 5.4.2.



Figure 5.4.2

THE PASSWORD FOR AUTHORIZED USERS IS “AppleBlossom” FOR THIS CONFIGURED MODEL 5560L SYSTEM.

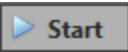
5.4.1 The Menu Bar


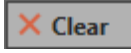



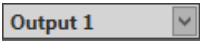
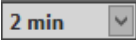
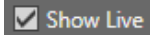
The Menu Bar can be found in the top left corner and extends to the top right corner of the MODEL 5560L Control Panel App window. It contains a number of dropdown menus where users have access to controls such as Logging Setup, Auto-Tune, and Initial Set while in Normal Mode.

MENU BAR	FILE	<p>Open historical data saved as Model 5560L files</p> <p>Save data from current session as a Model 5560L file (only viewable in app)</p> <p>Exit the app</p>
	TOOLS	<p>Normal Mode only displays graphs</p> <p>Administrative Mode displays graphs and manual adjustment controls (password protected)</p> <p>Logging Setup controls logging options</p> <p>Channel #1 Initial Set saves the full scale point</p> <p>Channel #1 Auto-Tune displays Auto-Tune panel</p> <p>Trends: Show Tools displays toolbar to adjust data view in app</p> <p>Firmware: Update initiates firmware update</p>
	OPTIONS	<p>Save All Settings saves all settings of the MODEL 5560L.</p> <p>Restore All Settings to previously saved settings</p>
	HELP	<p>Demo Mode allows users to open the app without a MODEL 5560L connected to the PC</p> <p>About the software, including version number</p>
	LOGGING STATUS	<p>Describes the logging status as either Disabled (default) or Active; hovering over the status will display the location where the current file is saved</p>
	VERSION	<p>The currently installed version of the MODEL 5560L Control Panel App and MODEL 5560L Firmware</p>

5.4.2 The Graphing Tool Bar

The Graphing Tool Bar controls how the data is viewed graphically within the MODEL 5560L Control Panel App. Changing these settings will **not** affect the .csv log file if logging is enabled through the Logging Setup menu.

GR		<p>Begins plotting data points on the graph. If “Show Live” is checked, the X-axis (time) will automatically update as the points are recorded, depending on the selected measurement interval. This selection also starts logging to the log file</p>

	Stops plotting data points on graph. As long as the graph is stopped, no new points will be plotted. The historical view feature will appear, and allow the user to look at all historical data collected during the current session. This selection also stops logging to the log file.
	Clears graph of all data points collected during the current session.
	Zooms out to view all historical data from the current session. This can only be selected if "Show Live" is unchecked. Or click Stop.
	Adds an event note to the graph at the moment the icon is clicked.
	Opens the current log file in Excel. If the log file is opened when logging is active, any data points collected while the file is open will populate once the file in Excel is closed.
	Select which graphs to display in the window. Options include Output 1, Measure 1, Reference 1, PCB Temperature, and Measurement Count
	Select the measurement interval. This will automatically adjust the X-axis (time) to display the selected interval.
	If this is checked, the graph will update with each new data point, and the X-axis will shift with time. If it is not checked, new data points will continue to be plotted on the graph, but the historical view scroll bar will appear and the user can scroll through older data from the current session.

5.4.3 The Tuner

The Tuner gives the user full control of the settings that are automatically selected during Auto-Tune. The following provides information on the Tuner Settings and Signals.

TUNER SETTINGS	RANGE	(0-7) Adjusting will affect both the Measure and Reference outputs; increase this value to decrease Measure and Reference light output
	INTEGRATION TIME	(3-5,000 ms) Adjusting will affect both the Measure and Reference outputs; increase this value to increase Measure and Reference Light output
	REFERENCE GAIN	(0-100%) Adjusting will affect ONLY the Reference outputs; increase this value to increase Reference Light output
	MEASURE GAIN	(0-100%) Adjusting will affect ONLY the Measure outputs (PMT-equipped units); increase this value to increase Measure Light output
	CALIBRATION	Manually adjust the MODEL 5560L's calibration points
	AVERAGING	(1-16) Adjusting will change the number of measurements averaged together to "smooth" readings
	INTERVAL	(250-60,000 ms) Adjusting will change the measurement interval (time between each individual measurement). This does not change the rate at which data is logged to file (see Section 5.5 for Log File Setup information).

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TUNER SIGNALS	OUTPUT	Display of the final, calibrated measurement output of the Model 5560L .
	OUTPUT (UNCORRECTED)	(RANGE: 0- 65,000 counts) The Output Signal is the raw fluorescence signal from the sample at the wavelength of interest. This measurement is derived from the logarithmic ratio of the measure and reference signals below.
	MEASURE LIGHT SIGNAL	(RANGE: 0-100%) The Measure Light Signal is a signal from the measure detector when the light source is turned ON. This is the primary signal used for determining the optical fluorescence of the sample.
	MEASUREDARK SIGNAL	(RANGE: 0-100%) The Measure Dark Signal is a signal from the measure detector when the light source is turned OFF. This signal is used to remove the effects of ambient light and electronic noise on the measure detector.
	REFERENCE LIGHT SIGNAL	(RANGE: 0-100%) The Reference Light Signal is a signal from the reference detector when the light source is turned ON. This signal is used to remove the effects of light source drift over long periods of time.
	REFERENCE DARK SIGNAL	(RANGE: 0-100%) The Reference Dark Signal is a signal from the reference detector when the light source is turned OFF. This signal is used to remove the effects of electronic noise on the reference detector.

5.4.4 Initial Set

The Initial Set feature, located inside the calibration frame, allows the user to reset the full-scale calibration point without needing to recalibrate the unit.

Important: Only select Initial Set when the probe is submerged in the highest concentration (100%) sample

5.4.5 Calibrate 4-20mA Output

To calibrate the 4-20mA output, the user must be logged into Administrative Mode. To proceed, you will need the following:

1. A multi-meter

Procedure:

2. Select “4 to 20 Calibration” located in the calibration frame.
3. To calibrate, touch the red (positive) lead to terminal position #1 (4-20mA +) and the black lead to terminal position #2 (4-20mA -).
4. Then, calibrate the 4 and 20mA outputs by selecting the up and down arrows while checking the output on the multi-meter. [Figure 5.4.5.1](#)
5. Select “Done” when finished.

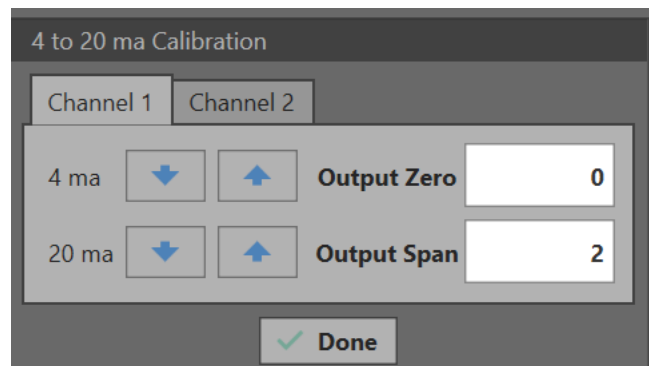


Figure 5.4.5.1



Section 5.5: Logging Data

The Logging Setup option, located in the Tools dropdown of the Menu Bar, contains all of the controls for the log file. The MODEL 5560L can create a .csv (comma separated value) file that can be opened in Excel. Features like Log Notes allow the user to add testing notes that are saved directly into the log file. Logging to file is disabled by default and must be activated by selecting the “Enable Logging” checkbox, as shown below in [Figure 5.5.1](#). Any data collected while the logging status reads “Logging Disabled” in the top right corner of the MODEL 5560L Control Panel App window, will **not** be saved to the log file. Before enabling logging, ensure that desired data is selected in the “Data to Log” drop down menu ([Figure 5.5.1](#)) If no data points are selected in this dropdown, then no data will be saved to the log file, even if logging is enabled. This will result in the creation of an empty .csv file.

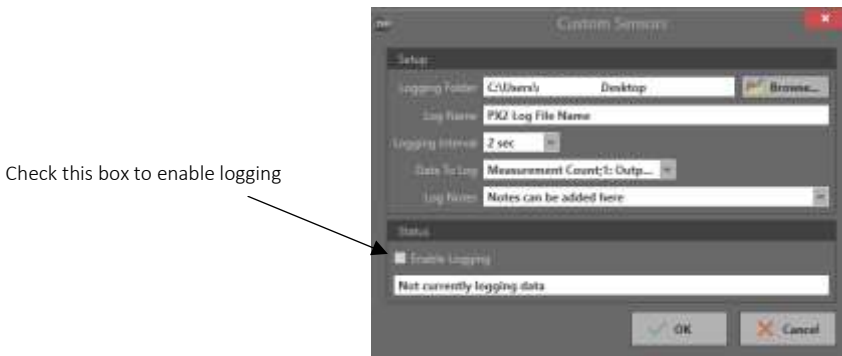


Figure 5.5.1

LOGGING SETUP	LOGGING FOLDER	Select where on the PC the log file is saved.
	LOG NAME	Enter in a name for the log file.
	LOGGING INTERVAL	Select how frequently data will be saved to the log file. This does NOT have to be the same as the measurement interval.
	DATA TO LOG	Select which pieces of data to save for each individual measurement.
	LOG NOTES	Enter in any testing notes prior to the start of logging. To change log notes, logging must be disabled and restarted once the notes have been updated.
	ENABLE LOGGING	Check “Enable Logging” to begin logging to file. Unchecking will disable logging. Every time logging is enabled or disabled for the same log file, a break will be added in the data to differentiate between data sets.

Additionally, users can change the interval at which data is saved to the log file using the “Logging Interval” dropdown. This **does not** adjust the measurement interval—for example, if the unit is set to take a measurement every second, the user can set the logging interval to every minute so that every 60th measurement is recorded in the log file.



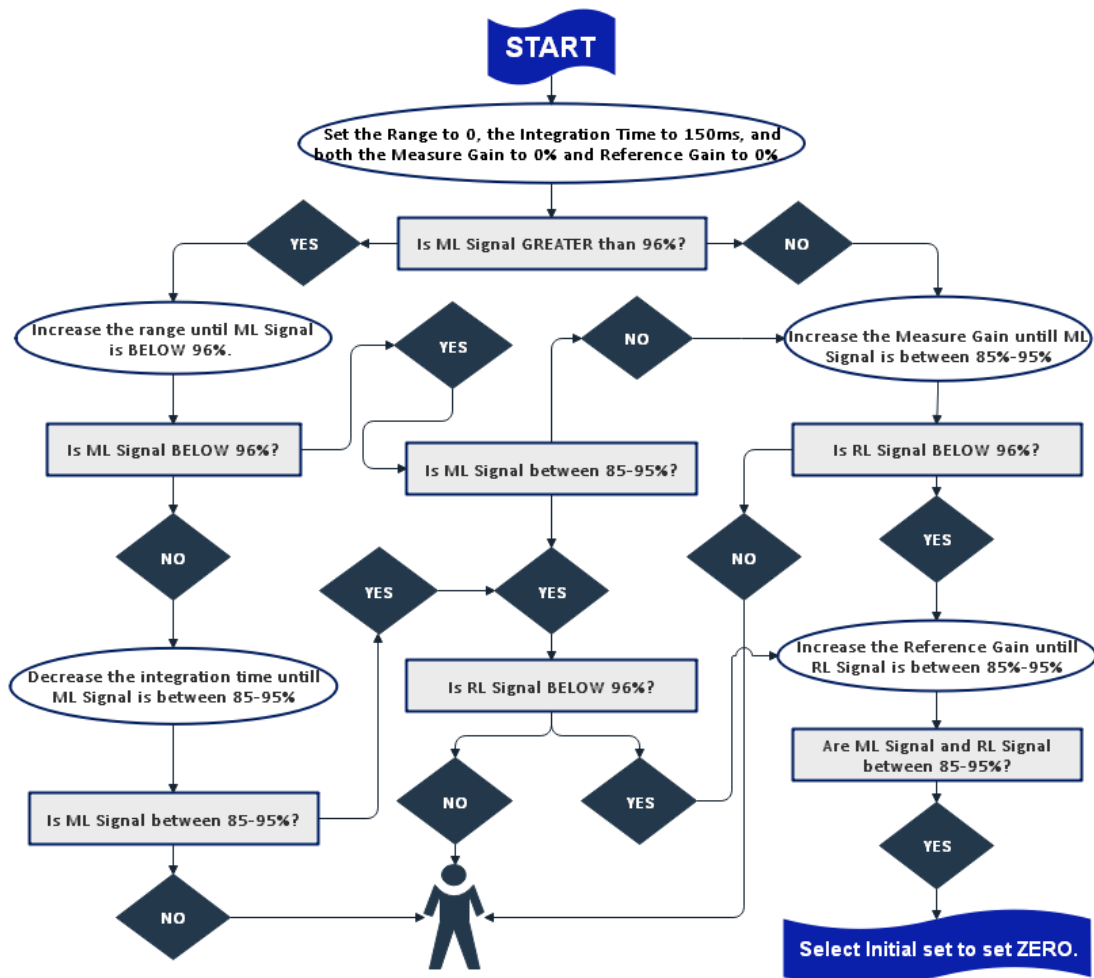
Section 5.6: Manually Adjusting of the Range and Gains

If Auto-Tune is not able to select appropriate settings, it might be necessary to manually adjust the MODEL 5560L settings independent of Auto-Tune.

On the highest concentration sample, manually adjust the Measure Light and Reference Light between 85-95% of full scale. Minimize the Measure Dark and Reference Dark signals.

Procedure:

1. Supply power to the unit and allow it to warm up for at least 15 minutes.
2. Log into Administrative Mode if you have not already.
3. In the Graphing Tool Bar, use the graph selection dropdown to check Output 1, Measure 1, and Reference 1 graphs to view. Check "OK."
4. Once all 3 graphs are displayed, make sure that "#1 Measure Dark" and "#1 Reference Dark" are also checked so that any dark current can be seen.
5. Next, submerge the probe in the maximum concentration sample.
6. Set up the unit according to the following flow chart





Saturating the PMT may have nonlinear results. The Integration Time should remain above the displayed value defined for each range.

RANGE	INTEGRATION TIME (MS)
0	26
1	52
2	78
3	102
4	127
5	152
6	178
7	555

5.6.1 Manually Determining Calibration Points

Once the unit has been set up, the calibration points can be determined and entered manually in the Calibration frame. The user must measure the samples, manually collect the data, and manually enter the calibration points.

Procedure:

1. Supply power to the unit and allow it to warm up for at least 15 minutes.
2. Log into Administrative Mode if you have not already.
3. Specify the number of calibration points.
4. Submerge the probe in the maximum concentration sample.
5. If both Measure Light and Reference Light are still 85-95% of full scale, select Initial Set. If not, refer to section 5.6 instructions to balance the Measure Light and Reference Light.
6. Record the approximate numerical uncorrected output value.
7. Remove the sample, clean off the probe tip, and replace with the next sample in descending order.
8. Repeat for each of the remaining lower concentration calibration samples.
9. Enter the recorded output values, along with their corresponding Calibration Points (sample concentrations) in the Calibration Frame as displayed in [Figure 5.6.1.1](#)
10. Select "Apply Calibration to Output" to adjust to the calibrated scale as shown in [Figure 5.6.1.1](#).



Calibration	
PX2 Readings	Calibration Points
65278	100
52419	75
44989	50
18523	25
798	0

Apply Calibration To Output

4 to 20 Calibration

Auto-Tune **Initial Set**

Figure 5.6.1.1.

Section 6: Alarm Conditions

The home screen alerts the user to changes in the Model 5560L 's operating status.

The Model 5560L 's signals will turn from **GREEN** to **RED** and the normally open contact closure is closed under the following alarm conditions:

1. The measurement detector is saturated at 100%.
2. The reference detector is saturated at 100%.
3. The reference light and dark signals are within 5% of each other.

In the event of an alarm, the unit must be recalibrated. Refer to **Section 4** for instructions.

Section 7: System Specifications

This section provides detailed specifications for the Model 5560L system purchased. In addition, this section may contain application specific notes on operability, functionality, etc.

7.1 Optical Configuration

The optical configuration listed is for a complete analyzer system. The detectors and light sources are internal to the photometric transmitter housing.

Optical Method	Fluorescence
Sample Interface Accessory	COMPLETE

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Light Source	Flash Lamp
Excitation Wavelength = COMPLETE	Emission Wavelength = COMPLETE
Detectors	PMT

7.2 Photometric Transmitter Specifications

Part Number	COMPLETE
Serial Number	COMPLETE
Configuration	Single Source Reference
Optical Connectivity	SMA-905
Mechanical	4.5" (11.4cm) W x 8.8" (22.5cm) L x 2.75" (7.0cm) H Weight: ~3.5lbs.
Power Requirement	24VDC nominal (12-48VDC), 8.5W max
Output	4-20mA, RS-485 (Modbus), or USB
Analog Loop Resistance	500 ohms at 24VDC
Operating Temperature	-4 to 90°F (-20 to 32C)
Storage Temperature	-4 to 122°F (-20 to 50C)
Measurement Range	COMPLETE
Response Time	1 second
Maximum Zero Shift	±0.1% full scale
Long Term Output Drift	±0.1% full scale
Repeatability	±0.1% full scale

7.3 Sample Interface Accessory Specifications (if included)

Sample Interface Accessory	Front Surface Fluorescence Probe
Optical Element Material	COMPLETE
Accessory Body Material	COMPLETE
Accessory Pressure Rating	COMPLETE
Accessory Temperature Rating	COMPLETE

7.4 Application Specific Information, Notes, and Specifications

This section lists all the application specific information related to specifications, operations, diagnostics, troubleshooting, and third-party integrated equipment. Additionally, integrated equipment will be supplied with all manufacturer-supplied documentation.

7.4.1 Enclosure Specifications

Hawk Explosion - Proof Enclosure Weight: 5 lbs (2.27 kg)

Window Size: 3.35" [85.0mm] diameter and External Mounting Holes: Two 0.33" [8.4mm]



Condor Explosion-Proof Enclosure Weight: 14 lbs (6.35 kg)

Window Size: 4.17" [106.0mm] diameter and External Mounting Holes: Four 0.33" [8.4mm]

Material: Copper free aluminum

Surface Finish: Epoxy coated for aluminum

Casting Method: Die cast (smoother, more uniform finish than sand casting)

Ground Screws: Internal and external

Cover Set Screw: Tamper resistant cover set screw for extra safety

Patent No.: US 8,227,692

7.4.2 Calibration Procedures

Refer to Insertion Tool Handling Guidelines.

CAI shall supply 2 x Nalgene Calibration Bottles with each unit ordered.

One will be used to hold the DI Water Zero fluid. The other will be used to hold the Oil-in-Water Span fluid. The cap of each of the Nalgene Brown Calibration Bottles (which stray ambient light cannot pass through) shall be fitted with Swagelok fitting that the UV Fluorescence Probe can be inserted through. The UVF Probe tip shall be immersed in the Zero and Span Fluids to set the calibration set-points.

The client will be responsible for preparing the span fluid using either the oil of interest, from their process, mixed with DI Water or a surrogate calibration fluid, (e.g. Quinine Sulfate in 18M Sulfuric Acid which is a highly UV Fluorescent solution) can be made using on-site laboratory support.

If the oil of interest will be used, a volumetric syringe is used to grab the necessary oil to mix with the DI Water to create the desired span solution. The oil is mixed with the water in a blender. The blender is activated to thoroughly mix the oil with the water to create a single-phase, homogeneous solution. This blended oil-in-water mixture is then poured into the Span Bottle and the Model 5560L probe is inserted through the Swagelok fitting to conduct the span calibration. This oil in water span solution can be diluted to make lower concentration span solutions to further calibrate the 5560L against. For the initial calibration, at least 2 x span solutions should be made (i.e. full-scale and mid-scale) in addition to the zero calibration.

If the end-user would prefer to use the Quinine Sulfate calibration technique, the following procedure should be applied.

- 18M Sulfuric Acid (liquid, CAS 7664-93-9)
- Quinine Sulfate (powder, CAS 22640)

Start with making the solvent. We need to make 500ml of 0.1M Sulfuric Acid. To do this, we need to add 2.78ml of 18M Sulfuric Acid to 497.22ml of water.

18M (Sulfuric Acid) x "X" = 0.1M (Sulfuric Acid) x 500ml (Total Volume). "X" = 2.78ml

Then continue with measuring the required amount of Quinine Sulfate:

To do this, we need to add 0.0005g of Quinine Sulfate to the 500ml of 0.1M Sulfuric Acid prepared above.

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Calculation is as follows:

$0.0005\text{g} = 1\text{ppm Quinine Sulfate} / 1,000,000 \times 500\text{ml of } 0.1\text{M Sulfuric Acid}$

If you are unable to accurately measure out 0.005g (your weight measurement device doesn't go so low), you can double the volume of your sample solutions.

1. Add 5.56ml of 18M Sulfuric Acid to 994.444 of Water
2. Add 0.001g of Quinine Sulfate to 1000ml of 0.1M Sulfuric Acid.