MODEL 3150
SUSPENDED SOLIDS ANALYZER

MODEL 35/35L
OPTICAL SUSPENDED SOLIDS SENSOR

REVISION – 2 December 2003

Insite Instrumentation Group, Inc
80 Whisperwood Blvd.
Suite 107
Slidell, LA 70458
Phone: (985) 639-0006
Fax: (985) 639-0014
E-mail: info@insiteig.com
www.insiteig.com

Table of Contents

Product Description

The Model 3150 Suspended Solids Analyzer is a handheld analyzer designed for the measurement of suspended solids in aqueous solutions. The microprocessor-based electronics of the Model 3150 analyzer provide a high degree of flexibility and ease of use. The instrument is designed to operate in a variety of applications. The sensor operates on the principle of single gap light absorption as a means of detecting the presence of suspended solids.

The Model 35 sensor has been designed for medium ranges (0 to 30,000 mg/l) as commonly found in aeration basins and activated sludge lines of wastewater treatment plants. The Model 35L sensor has been designed for low ranges (0 to 1500 mg/l) as commonly found in effluent streams. Both sensors utilize an infrared emitter to minimize color effects and compensates for emitter variations due to temperature by measuring source brightness.

The Model 3150 has built-in data logging. Up to 50 points may be logged with a time stamp. Each point may be labeled with a six character location description.

Packaging

The analyzer is housed in a watertight handheld enclosure and is designed for harsh environments.

Batteries and Charging

The Model 3150 is powered by a three cell rechargeable NIMH battery pack. A battery charger is included with the Model 3150. The red LED on the charger's connector indicates the batteries are in quick charge mode when illuminated or trickle charge when not illuminated. Fully discharged batteries will take about four hours to charge. The Model 3150 may be connected to the charger for extended periods of time without damage.

A fully charged battery can provide approximately 12 hours of continuous use. A low battery message appears on the display when recharge is necessary.

Automatic Shutoff

If no keys are pressed, the Model 3150 will automatically shut off after 15 minutes.
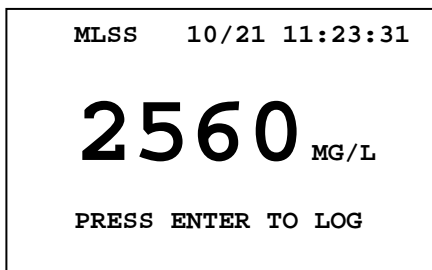
Display Backlighting

The Model 3150 has a backlit display, but this backlighting is the main power consumer of the analyzer. To conserve battery power, this backlight turns itself off after 2 minutes. It can easily be turned on again without disturbing the operating mode of the analyzer by pressing the ON key.
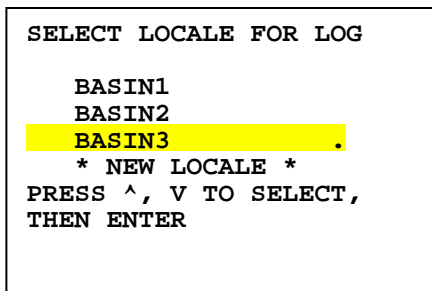
OPERATION

Run Mode

The RUN mode is the normal operating mode of the analyzer and is entered upon power-up. When the Run mode is entered, the analyzer will begin displaying the TSS value. When running in MLSS or RASS measurement modes (CAL1 or CAL2 modes for the Model 35L), the TSS reading takes about 15 seconds to stabilize. The display is continuously updated with the current date, time, TSS value, and measurement mode. In the event of an error or alarm condition the display will indicate the problem in plain English text.

```
   MLSS    10/21 11:23:31


    2560 MG/L

   PRESS ENTER TO LOG
```

The analyzer and sensor have been zero calibrated at the factory and given a default span. In most cases, the factory default span will read reasonable values, but a span value based upon lab analysis should be performed as soon as possible. Span calibration can be accomplished using the snapshot/span feature described later in this manual. Separate span values for MLSS and RASS samples are available to insure maximum accuracy throughout the plant.

Once a TSS reading is stable, the operator may log the current TSS value. Pressing the ENTER key will display the Select Log Locale screen.

```
SELECT LOCALE FOR LOG

   BASIN1
   BASIN2
   BASIN3          .
   * NEW LOCALE *
PRESS ^, V TO SELECT,
THEN ENTER
```

A log locale may be selected by pressing the UP and DOWN keys until the desired locale is highlighted. Pressing the ENTER key will display a Log conformation screen.

```
LOG  2560 TO BASIN3


PRESS ENTER TO LOG,
PRESS MENU TO CANCEL.
```

Pressing the ENTER key a second will log the TSS value to the selected locale along with a timestamp. Up to 50 TSS values may be logged at any one time. If 50 values have been logged and a new value is desired to be logged, a Log Full message will be displayed. The operator will have the option of overwriting the oldest log entry or cancel the log operation.

If a new locale entry is desired, highlight the NEW LOCALE selection and press the ENTER key. The operator is prompted to enter a six character locale description. Up to 50 locales may be entered. To return to the normal Run screen, press the MENU key.

```
    LOCALE ENTRY
    BASIN4


ENTER A LABEL OF
UP TO 6 CHARACTERS
USING ^, V AND ENTER
```

Main Menu

The Main Menu is accessed by pressing the "MENU" key while in the RUN mode of operation. There are five options available from the main menu. Use the arrow keys to switch between RUN, VIEW LOG, PC EXTRACT, SETUP, & TEST and then press the "ENTER" key to select.

```
     MAIN MENU
     RUN
     VIEW LOG
     PC EXTRACT
     SETUP
     TEST
PRESS ^, V TO SELECT,
THEN ENTER.
```

To return to the RUN MODE from the MAIN MENU, use the "ARROW" keys to move the cursor to the run option, then press the "ENTER" key.

View Log

This mode of operation allows the operator to view all logged D.O. values with locales and timestamps.

```
        LOGGED DATA
LOCALE   MG/L DAY TIME
BASIN1   2480 05 08:38
BASIN2   3260 05 08:02
BASIN3   2560 05 07:32
BASIN4   1940 05 06:29
PRESS ^, V TO SELECT,
THEN ENTER TO REMOVE.
```

The operator may scroll through the logged values by using the UP and DOWN arrow keys. The logged value may be removed by first highlighting the value and then pressing the ENTER key. Pressing the ENTER key a second will remove the selected entry or pressing the MENU key will cancel the remove.

PC Extract (requires optional download kit)

When the Model 3150 is in the PC extract mode, a PC may extract the logged data. The optional download kit includes a cable and an Excel spreadsheet with embedded extract function.

The InsiteIG TSSLog (version 2.1) spreadsheet is a convenient tool for extracting logged data from the Model 3150. It is a Microsoft Excel spreadsheet with an embedded Visual Basic program (macro) capable of reading the logged data from the Model 3150 through a serial port and sorting it into location worksheets. The user must have Microsoft Windows 98 or later versions with Microsoft Excel 97 or later versions to use this utility.

Installation

There are 3 steps that the user must complete before using the InsiteIG TSS Log Data spreadsheet for the first time:

1. **Copying the included files to the computer's hard drive:**
   - Insert the InsiteIG diskette in A:
   - Click Windows START button and select RUN
   - In the entry bar, type A:INSTALL
   - Click OK
2. **Enabling the use of "macros" in Microsoft Excel. (Excel 2000 and 2002 only, Excel 97 users can skip to step 3)**
   - Start Excel
   - Click on Tools…Macro…Security
   - Choose the Medium Security option
   - Click OK
3. **Registering the Serial port Control for use in Excel.**
   - Excel must be running
   - Click on View…Toolbars…Control Toolbox
   - A new toolbar will appear, click the last icon, which is a crossed wrench and hammer icon called "More Controls"
   - A list will appear. Scroll to the bottom and click "Register Custom Control…"
   - A box will appear with a list of files. Find MSComm32(.ocx). Click on it, then click OK.
   - Close the new toolbar (Click the X in upper right corner)

Startup

You should now be ready to use the InsiteIG TSSLog21.xls spreadsheet. The file is loaded into Excel like any other spreadsheet. The INSTALL routine copied the file to C:\InsiteIG\TSSLog, but the file can be moved using Windows Explorer if it is more convenient to the user. The file itself can be dragged to the Windows desktop for convenience, or a shortcut to the file can be created on the desktop. To create a shortcut from Windows Explorer, right-click on the file and choose "Create Shortcut". A shortcut will be added to the file list. Drag this shortcut to the desktop.

If you have adjusted MACRO security according to step 2 of the installation procedure, Excel will present a pop-up box every time you load the InsiteIG TSSLog21 spreadsheet. The box will ask if you would like to enable macros for this spreadsheet. You must choose ENABLE MACROS or the serial port function will not work!

Setting COM port

On the right side of the "Main" worksheet is a box for selecting the serial port to be used for communications with the Model 3150. Using the supplied cable, connect the Model 3150 to an available serial port 9 pin connector on your computer. If you know the "COM" number for your computer's connector, click this COM number on the spreadsheet. If not, the simplest approach is to find the correct number by trial and error. Turn on the Model 3150, press the MENU button, then choose the "PC Extract" option and press ENTER. The Model 3150 screen should read "Waiting for request from PC…"

You are now ready to click on the spreadsheet button that reads "Click here to retrieve data from the Model 3150". If you have chosen the wrong COM port, you will get a communications error box on the screen after about 5 seconds. Try choosing another COM port number in the spreadsheet, and click the "…retrieve.." button again.

Normal Operation

Once Excel has been properly configured for using this spreadsheet, the operation should be very intuitive. Pressing the "…Retrieve.." button causes all of the following actions to take place:
- The PC will read all stored data points (as many as 50) from the Model 3150. This action does not erase these data points from the Model 3150 memory.
- The newly extracted data points will appear on the "Main" worksheet of the Excel file for review. (Previously extracted data will be erased from the Main worksheet at this time. Only the currently extracted data appears on the Main Worksheet.) Each log point contains a location name, a time stamp, and a TSS value.
- All data will be archived by adding it to a worksheet named after the "locale" or location name given to each data point. If a worksheet for the location does not exist, it will automatically be created. If a data point has the same time stamp as one that has already been archived, a new entry will not be created in the worksheet.
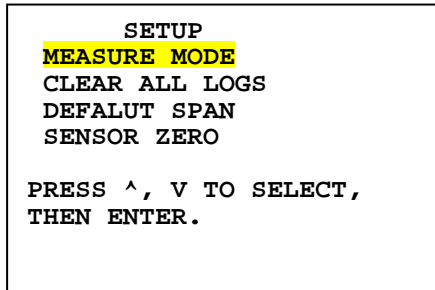
Note: The time stamp given to each point uses the month/day/hour/minute that was stored in the Model 3150. However the year is deduced from the PC system clock

Once the data is retrieved into the .xls file, it can be treated as any other spreadsheet data with normal Excel copy, graphing, and computational functions available.

The .xls file should be saved after every use for continued archiving of data.

Setup Mode

This mode of operation allows the user to customize the unit to the specific operation and needs of the facility. There are a total of nine options that may be adjusted.

```
           SETUP
 MEASURE MODE
 CLEAR ALL LOGS
 DEFALUT SPAN
 SENSOR ZERO


 PRESS ^, V TO SELECT,
 THEN ENTER.
```

Operation of the Setup MODE proceeds as follows:

First, after pressing the "MENU" key, use the "ARROW" keys to move the cursor to the setup option, then press the "ENTER" key.   A menu with four of the nine options will be displayed. The options are;
MEASURE MODE
CLEAR ALL LOGS
DEFAULT SPAN
SENSOR ZERO
SNAPSHOT
SENSOR SPAN
REMOVE LOCALE
REMOVE ALL LOCALES
SET CLOCK

Second, use the "ARROW" keys to move the cursor to the desired setup option, then press the "ENTER" key. When the user is finished making the adjustment, press the "MENU" key to return to the previous page.

Finally, to return to the RUN MODE, press the "MENU" key until the MAIN MENU is displayed. Use the "ARROW" keys to move the cursor to the run option, then press the "ENTER" key.

Measure Mode
The Model 3150 can operate in one of three measurement modes:
FAST – no data filtering, fast response and factory default span (useful for measuring blanket level depths).
MLSS - normal 15 second data filtering and low range span calibration factor.
RASSS – normal 15 second data filtering and high range span calibration factor.

Note:
MLSS mode will be displayed as CAL1 mode when using Model 35L sensor.
RASSS mode will be displayed as CAL2 mode when using Model 35L sensor.

Clear All Logs
This option will erase all logged data entries (but not the locale names).

Remove Locale

This option will remove a single locale and its data. After choosing this option, the list of locale names is presented. The operator may then choose the locale to remove.

Remove All Locales

This option will erase all locales and data from the log memory.

Set Clock

This option is used to set the real time clock used for time stamping of the logged data.

Sensor Calibration

To do a complete calibration, three steps are required. The analyzer must first be zeroed in clean water. Secondly, a sample/snapshot reading should be taken in a normal representative water sample. The sample water can then be given a laboratory analysis, and the span of the analyzer can be adjusted by recalling the snapshot and matching the reading to the analysis. As long as the lenses are kept clean, frequent recalibration should not be necessary. Every six months should be more than adequate for a complete calibration. The Model 3150 allows the operator to save both a low range (MLSS/CAL1) and a high range (RASSS/CAL2) span calibration. The Model 3150 will use the MLSS/CAL1 or RASSS/CAL2 span calibrations as selected by the measure mode.

Any optically based device for measuring suspended solids should only be span calibrated against a typical sample of the actual process water being measured. Synthetic laboratory standards will add unnecessary inaccuracies to the system and are not recommended. The Model 3150 utilizes its microprocessor memory in a unique way to make span calibration as easy and accurate as possible. This calibration is performed as a two step process. First, the SNAPSHOT function of the analyzer is used to store actual process conditions to the instrument's memory. Later, when standard laboratory analysis results are available for those previous conditions, the analyzer's SPAN function will recall the stored value and allow the user to adjust the span value accordingly.

The range of operation of the Model 35 sensor is 0-30,000 mg/l total suspended solids. Within this range, accuracy and repeatability are only specified over a range of +/- 50% of the user's point of calibration. Accuracy will be +/- 5% of the current reading or +/- 100 mg/l, whichever is greater. Repeatability will be +/- 1% of the current reading or +/- 20 mg/l, whichever is greater.

The range of operation of the Model 35L sensor is 0-1500 mg/l total suspended solids. Within this range, accuracy and repeatability are only specified over a range of +/- 50% of the user's point of calibration. Accuracy will be +/- 5% of the current reading or +/- 2 mg/l, whichever is greater. Repeatability will be +/- 1% of the current reading or +/- 2 mg/l, whichever is greater.

Sensor Zero

Each TSS sensor will have a unique zero reference. This calibration mode will calculate and store the zero reference for the current sensor.

Select the "Sensor Zero" option from the calibrate menu using the up and down arrow keys. Press the "ENTER" key. Submerge the sensor in clean water. It is important that the water used to zero the sensor be clean. At the very least use potable water for this, and distilled water is even better. Do not use plant process water of any type.   With the sensor submerged in clean water, press "ENTER". The analyzer will take about 15 seconds to zero. The display will return to the calibrate menu automatically when it is finished. Press the

"MENU" key to exit or use the up and down arrow keys to select another calibration mode.

Snapshot

This calibration mode simply stores a reading in a special memory location within the analyzer. The operator should take a physical sample of the process water from the same location so that it can be analyzed using standard laboratory techniques to determine suspended solids concentration. When the lab analysis is complete, this stored reading can be recalled in the SPAN mode. Matching the stored reading to the lab analysis adjusts the span of the analyzer.

With the sensor submerged in the process to be measured and stable, select the "Snapshot" option from the calibrate menu using the up and down arrow keys. Press the "ENTER" key. Pressing the "ENTER" key again will cause the analyzer to take a snapshot of the conditions. The analyzer will take about 15 seconds to obtain a sample value. The display will return to the calibrate menu automatically when it is finished. At this point, the calibration of the analyzer has NOT been altered; only the conditions of the process water have been stored in memory for future use. Press the "MENU" key to exit or use the up and down arrow keys to select another calibration function.

Sensor Span

This step is performed when an accurate laboratory value has been obtained from the sample previously taken during the Snapshot procedure.

Select the "Sensor Span" option from the calibrate menu using the up and down arrow keys and press the "ENTER" key. The value that was previously saved snapshot will be displayed. Use the up and down arrow keys to adjust the analyzer reading to the value of the laboratory analysis. Press the "ENTER" key when done. The system is now calibrated and ready for normal operation. Press the "MENU" key to exit or use the up and down arrow keys to select another calibration mode.

Default Span

This calibration mode will replace the current span calibration value (MLSS or RASSS) with the factory default value. This may be useful when using the system in a new application. If the analyzer has been properly zeroed in clean water, the analyzer will read values that are typical for an average waste treatment plant. No absolute accuracy is guaranteed after this procedure, but the numbers will, in the least, be useful for observing trends in the suspended solids concentration over time.

Select the "Default Span" option from the calibrate menu using the up and down arrow keys and press the "ENTER" key. Pressing the "ENTER" key again will cause the analyzer to use the factory default span calibration value. Press the "MENU" key to exit or use the up and down arrow keys to select another calibration mode.

Test Mode

This mode of operation allows the user to perform basic test functions to aid in troubleshooting. There are two tests which may be performed.

Operation of the Test MODE proceeds as follows. From the Main Menu use the arrow keys to move the cursor to the Test option, then press the "ENTER" key. Use the arrow keys to select the desired test, and then press the "ENTER" key.

View Sensor Data

This test is intended primarily to aid the InsiteIG technical support engineers in troubleshooting. Additional data may be displayed by pressing the ENTER key. Press the MENU key to exit.

Software Version

Software Version displays the current version of software in the analyzer. To exit, press the "MENU" key.

ERROR MESSAGES

During operation, the Model 3150 analyzer may determine that an error condition exists. If this happens, the display will contain an error message. The 3 possible error messages are as follows:

Sensor not Responding
This error message indicates that the analyzer is not receiving any data from the sensor. This would most likely be caused by a faulty sensor cable or possibly a faulty sensor or analyzer electronics.

Zero Sensor
The analyzer is indicating that a zero cal operation is required for proper operation. This can occur if the sensor was not properly zeroed and the current sensor reading is 5% above (negative) the pervious stored zero value.

Ambient Error
This error message will be displayed if the sensor is exposed to too much ambient light (exposed to direct sunlight). Or the sensor LED is faulty.

MAINTENANCE

The analyzer does not require any periodic maintenance. The sensor must be kept clean for accurate readings.

GUARANTEE AND REPAIR POLICY

Model 3150 Suspended Solids Analyzer & Model 35 suspended solids sensors and related items are guaranteed for one year against defective materials and workmanship. They will be replaced or repaired at InsiteIG's discretion free of charge during the guarantee period. Freight to our factory is to be paid by the customer.

All shipments are insured. If you receive a damaged unit, please notify InsiteIG so that we may authorize return of the equipment. Shipments to InsiteIG should be protected and insured by the customer.

Repairs to the equipment not covered by the guarantee will be billed per standard service charges. Please request service price sheet and/or spare parts price list.