INSTRUCTION SHEET
Chlorophyll *a* Sensor

Safety Precautions

Please read this entire instruction sheet before operating this sensor. Pay particular attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the sensor.

Do not use or install this sensor in any manner other than that which is specified in this instruction sheet.

Use of Hazard Information
If multiple hazards exist, this instruction sheet will use the signal word (Danger, Caution, Note) corresponding to the greatest hazard.

DANGER*—Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.*

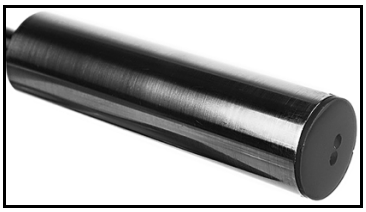
CAUTION*—Indicates a potentially hazardous situation that may result in minor or moderate injury or instrument damage.*

NOTE*—Information that requires special emphasis.*

Precautionary Labels
Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed.

This symbol, if noted on the instrument, references the instruction sheet for operational and/or safety information.

Introduction



The Chlorophyll *a* sensor is available as an option on the DataSonde 4a, 4X or MiniSonde 4a. The sensor is an in-situ optical fluorometer that determines chlorophyll *a* concentration in a given water sample. The sample is irradiated using blue (460 nm) light. Chlorophyll *a* absorbs the blue light energy and fluoresces or emits red (620–715 nm) light. The sensor directly measures the amount of red light emitted by the chlorophyll *a* in the water sample. The Sonde can either display the chlorophyll *a* signal as a scaled voltage from 0–5 V or as a concentration from 0–500 µg/L (micrograms/liter).

Maintenance

Important Note: *Do not use organic solvent solutions such as acetone or methanol with the Chlorophyll a sensor. These solvents will damage the plastic housing cap.*

The Chlorophyll *a* sensor requires periodic maintenance to remove contaminants such as oil, biological growth, dirt, etc. Sensor maintenance should be conducted after every deployment cycle, adjusting the deployment cycle length to account for the degree of fouling that occurs in the area. Maintenance should also be done before and after calibration.

1. Flush the entire instrument with clean fresh water. Use soapy water and a soft brush to clean the outside surfaces of the instrument.
2. Soak the entire instrument in freshwater for at least 30 minutes.
3. Visually inspect the optical windows. Use optical tissue or a cotton swap with soapy water to clean the optical windows. Rinse with freshwater.

Parameter Setup

Important Note: *The sensor has been characterized at the factory to display linear behavior between the gain zones. Do NOT change the values stored in the Sensor Setup tab. This may result in non-linear readings.*

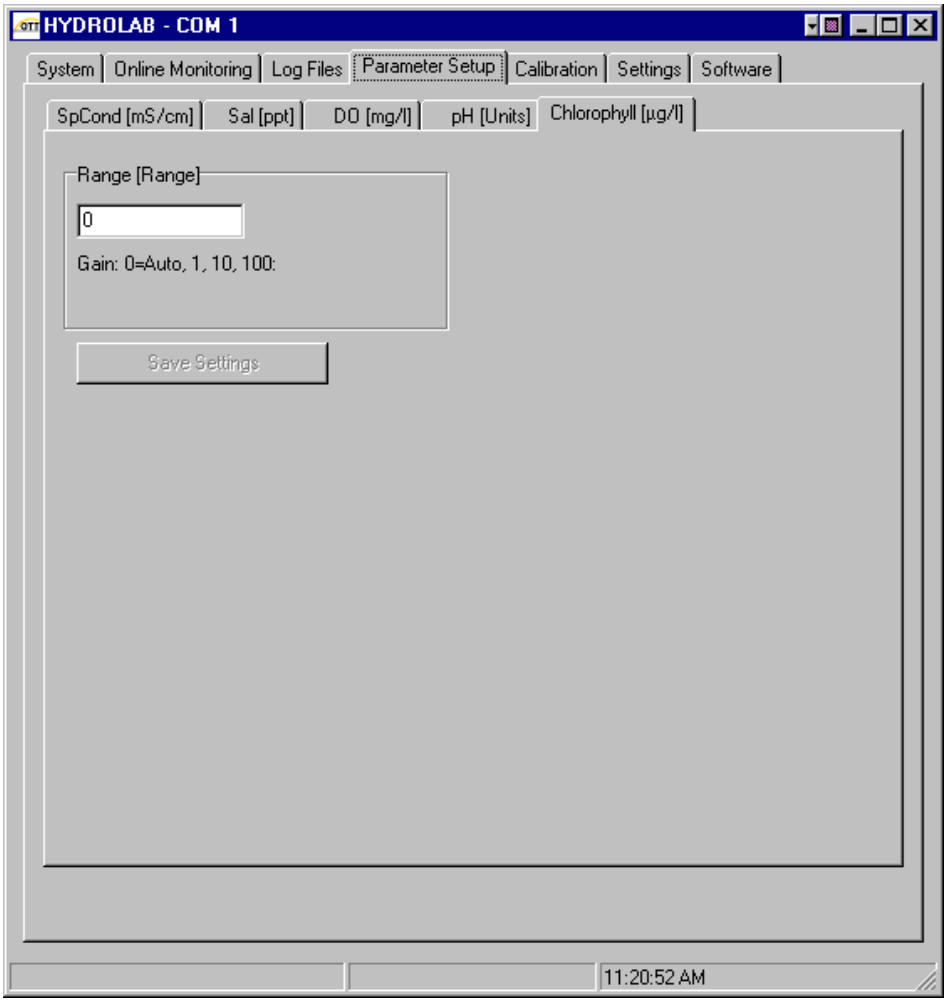
Note: *If a Hydrolab Surveyor is used to display the voltage in the X10 or X100 fixed gain settings or if the user changes the gain settings, then the Surveyor may require a RESET:HISTORY reset in order to display the proper resolution.*

The Chlorophyll *a* sensor functions using one of three gain settings:

- X1 gain provides a range of 0 to 500 µg/L
- X10 gain provides a range of 0 to 50 µg/L
- X100 gain provides a range of 0 to 5 µg/L

The factory-default will automatically switch the gain as needed. If necessary, the gain settings may be fixed to one of the three gain settings described above.

1. Connect the sensor to a PC.
2. Start Hydras 3LT. Wait for Hydras 3LT to establish communications with the sensor. Click the **OPERATE SONDE** button.
3. Click the Parameter Setup tab and select Chlorophyll µg/L.



4. To enable auto gain, enter zero. To enable a fixed gain, enter 1 for X1, 10 for X10, or 100 for X100. In most cases, it is recommended to leave the sensor in auto gain mode for maximum dynamic range.
5. Click the **SAVE SETTINGS** button.

Chlorophyll *a* Sensor Calibration

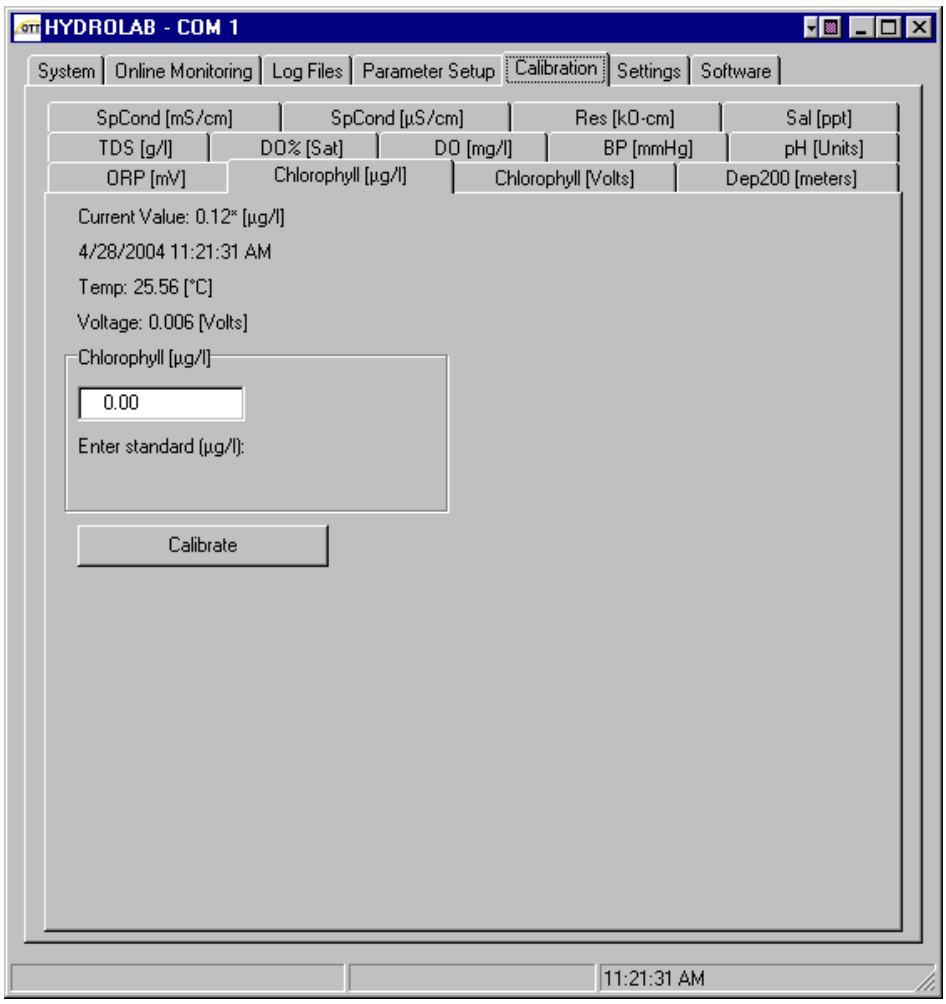
Chlorophyll *a* concentration is associated with an output voltage. This output voltage from the sensor may be displayed directly or scaled to reflect a user-defined concentration in µg/L.

There are two standard methods for calibrating the Chlorophyll *a* sensor. Each method requires a 2-point calibration. The first point to be calibrated must be 0 µg/L. The second point should be a non-zero value which is at least three times larger than the zero sample but within the linear range of the sensor. It is recommended that the non-zero sample represents an average or approximately 50% of the range of concentration the user expects to monitor. A Solid Standard is recommended for defining repeated non-zero samples.

Method 1

Use this method when a known calibration standard is applied to the sensor.

1. Connect the sensor to a PC.
2. Start Hydras 3LT. Wait for Hydras 3LT to establish communications with the sensor. Click the **OPERATE SONDE** button.
3. Click the Calibration tab and select Chlorophyll µg/L .



4. Place the sensor into a 0 µg/L baseline solution. Enter zero into the Chlorophyll µg/L field.
5. Click **CALIBRATE**. A" Calibrate Successful!" screen will be displayed.

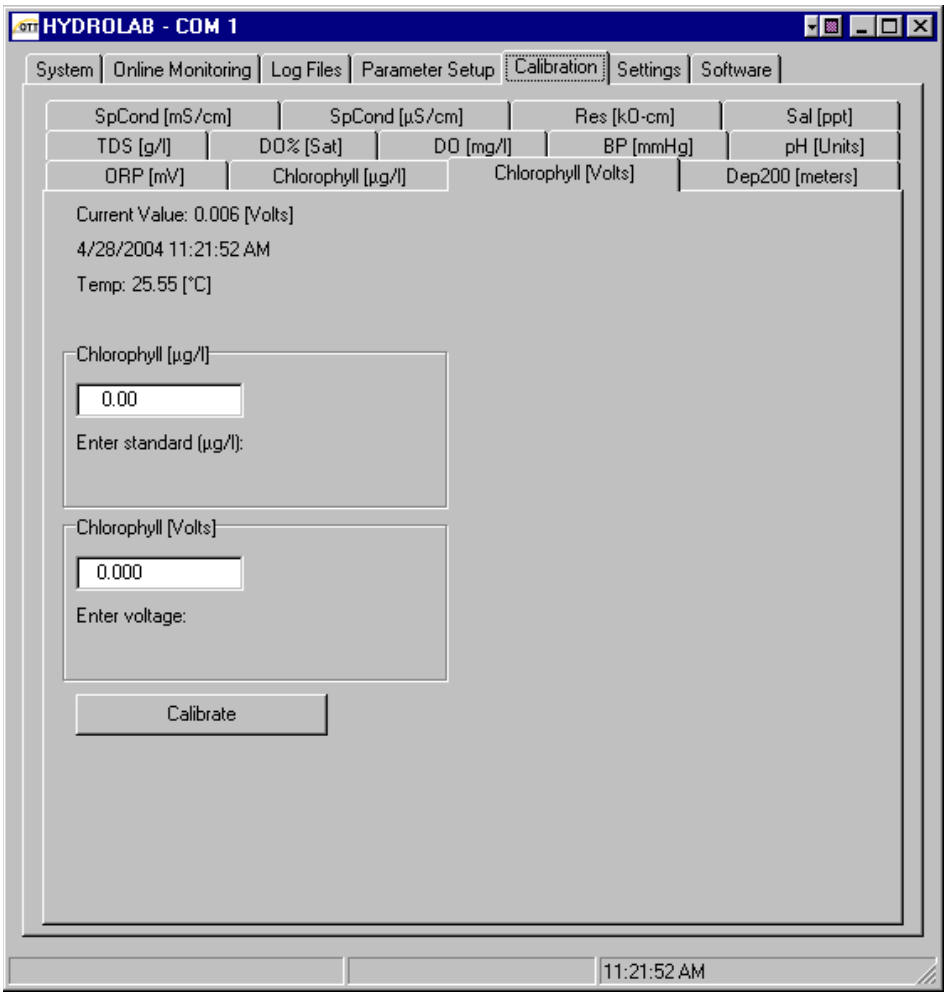
6. Place the sensor into a known µg/L solution or use the Solid Standard. Enter the chlorophyll value into the Chlorophyll µg/L field.
7. Press **CALIBRATE**. A "Calibrate Successful!" screen will be displayed.

Method 2

Note: Voltage values for zero and non-zero µg/L chlorophyll a samples are similar between different sensors, but not identical. When using Method 2, every sensor will have a unique voltage value for a given concentration.

Use this method when you have voltages for both a "zero" and "non-zero" µg/L chlorophyll *a* sample. Typically, both zero and non-zero samples are measured using the sensor in the field to get voltages and then the same samples are measured in the lab to get extracted values for chlorophyll *a*.

1. Connect the sensor to a PC.
2. Start Hydras 3LT. Wait for Hydras 3LT to establish communications with the sensor. Click the **OPERATE SONDE** button.
3. Click the Calibration tab and select Chlorophyll Volts.



4. Enter zero into the Chlorophyll µg/L field.
5. Enter the corresponding voltage into the Voltage field.
6. Press **CALIBRATE**. A "Calibrate Successful!" screen will be displayed.
7. Enter the non-zero value into the Chlorophyll µg/L field.
8. Enter the corresponding voltage into the Voltage field.
9. Press **CALIBRATE**. A "Calibrate Successful!" screen will be displayed.

Calibration Performance Check

The optional Solid Standard can be used as a calibration performance check. The Solid Standard can establish a correlation between a known chlorophyll *a* concentration found from laboratory measurement of a sample whose signal output voltage is recorded in the field. The Solid Standard can also be used to check sensor stability periodically.

The Solid Standard is a solid fluorescent device placed over the optical head. A flat head screw is used to adjust the magnitude of the fluorescent response from 0 to approximately 500 µg/L. The Solid Standard can be used to establish a correlation between a known concentration and the fluorometer output voltage. It can also be used to check the sensors stability and/or check for the effects of bio-fouling.

Using the Solid Standard

Note: *Solid Standards give unique responses for a given sensor. A given setting on a Solid Standard should only be used for the sensor on which it was calibrated.*

1. Make sure the optical surface of the sensor is clean and dry.
2. Immerse the sensor into a known chlorophyll *a* sample or known Rhodamine WT dye solution. Note the sensor output voltage.
3. Clean and dry off the sensor. Place the Solid Standard on the optical end of the sensor.
4. Rotate until the Solid Standard is aligned with the indexing mark on the sensor. A "clicking" sound will be heard when aligned properly.
5. Adjust the Solid Standard to produce the same output voltage from the sensor as in step two. Use the provided screwdriver to adjust the screw located on the side of the cube. Adjust the screw clockwise to increase the signal, and counter-clockwise to decrease the signal.
6. For future use, this Solid Standard can be used as a verification device for this sensor.

Specifications

Specifications are subject to change without notice.

Minimum Detection Limit	0.1 µg/L
Dynamic Range	Low sensitivity: 0–500 µg/L; Medium Sensitivity: 0–50 µg/L; High Sensitivity: 0–5 µg/L
Linearity	0.99 R^2
Range	0–500 µg/L
Accuracy*	± 3% or reading or ± 0.1 µg/L, whichever is greater
Resolution	0.01 µg/L
Warranty	Sensor is covered by a 1 year warranty

* The following exceptions are taken to the specified accuracy under IEC 1000-4-3:1996: Vertically-oriented radiated interference of 10 V/m between 20 and 600 MHz has been observed to ca use measurement shifts up to 5 V (with corresponding shifts in the analyte reading) when the Sonde with this sensor was exposed to the stated field. Horizontally-oriented radiation interferences of 10V/m between 50 and 150 MHz and between 450 and 600 MHz has been observed to cause measurement shifts up to 140 mV (with corresponding shifts in the analyte reading) when the Sonde with this sensor was exposed to the stated field. Radiated interference testing was performed in air. Normal operation of the Sonde under water is expected to decrease the impact of the radiation interference.

Accessories

Description	Cat. No.
Solid Standard	007205
Dye-Rhodamine, 8 oz. 21.33% ± 2.5% (w/w)	007273

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