Washington State Department of Ecology

Environmental Assessment Program

Standard Operating Procedures for Turner Designs Cyclops-7 Submersible Optical Brightener Sensors and Precision Measurement Engineering, Inc. Cyclops-7 Loggers

Version 1.0

Author – Paul D. Anderson, Trevor Swanson
Date – 4/1/14

Reviewer – Scott Collyard
Date -

QA Approval - William R. Kammin, Ecology Quality Assurance Officer
Date -

EAP091

APPROVED:

Signatures on File.

Please note that the Washington State Department of Ecology's Standard Operating Procedures (SOPs) are adapted from published methods, or developed by in-house technical and administrative experts. Their primary purpose is for internal Ecology use, although sampling and administrative SOPs may have a wider utility. Our SOPs do not supplant official published methods. Distribution of these SOPs does not constitute an endorsement of a particular procedure or method.

Any reference to specific equipment, manufacturer, or supplies is for descriptive purposes only and does not constitute an endorsement of a particular product or service by the author or by the Department of Ecology.

Although Ecology follows the SOP in most instances, there may be instances in which Ecology uses an alternative methodology, procedure, or process.

SOP Revision History

Revision Date	Rev number	Summary of changes	Sections	Reviser(s)

Environmental Assessment Program

Standard Operating Procedures for Tuner Designs Cyclops-7 Submersible Optical Brightener Sensors and Precision Measurement Engineering, Inc. Cyclops-7 Loggers

Introduction

Turner Designs Cyclops-7 optical brightener sensors are used by the Environmental Assessment Program (EAP) to measure optical brighteners (also known as fluorescent whitening agents) in water. They can be used for short term spot-sampling as the user moves from site to site throughout the course of a day, or long-term unattended monitoring at specified time intervals. Spot-sampling requires a Cyclops Explorer data cable and software as well as a hand held computer or a Turner Designs Handheld Databank Datalogger (Ecology does not currently have the DataBank). Unattended monitoring requires the user to set up a Precision Measurement Engineering, Inc. Cyclops-7 logger before deploying the instrument (usually in the lab or office).

Optical Brighteners

Cyclops-7 sensors use fluorometry to detect optical brighteners (OBs). Optical brighteners are added to most laundry detergents and many types of paper (including toilet paper). Optical brighteners represent about 0.15% of the total detergent weight (Hartel et al., 2008). Because household plumbing systems mix effluent from washing machines and toilets together, OBs are associated with human sewage in septic systems and wastewater treatment plants (Hartel et al., 2008).

If OBs are found in the environment, it is likely that other anthropogenic pollutants, such as bacteria from humans, are also entering the water. Optical brightener data can give the sampler more certainty that pollution sources are from or not from failing or malfunctioning on-site septic systems (OSS) or wastewater treatment plants (WWTP). Using fecal coliform as an example pollutant of concern, some possible field scenarios include:

1.) High FC and high OBs (suggests malfunctioning OSS or WWTP or leaky sewer pipe).
2.) High FC and low OBs (suggests other warm-blooded animals or human sources, such as an outhouse, that don't mix gray water and toilet water).
3.) Low FC and high OBs (suggests gray water in the storm water system).
4.) Low FC and low OBs (suggests no source of FC contamination).

One concern with OB detection is interference from organic matter. Organic matter can fluoresce and interfere with OB detection, especially if the total organic carbon (TOC) concentration is over 40 mg/L (Hartel et al., 2008). Because organic matter has broadband, featureless spectra and the emission spectra of OBs are in the 415 to 445 nm range (Hartel et al., 2008), Turner Designs OB sensors use a narrow emission spectrum of 445 nm. This allows for more confidence that only OBs are detected and not organic matter. Most streams in western Washington have TOC concentrations well below 40 mg/L and the OB sensor is designed to eliminate most of the organic matter interference, so the small amount of interference in some waters with organic matter should be considered acceptable in most studies. To ensure that any possible interference is minimal, TOC should be sampled when it is suspected to be of concern.

It should also be noted that OBs degrade quickly (minutes to hours) in UV light (Hartel et al., 2007); although some studies conflict on their photo-decay rates (Tavares et al., 2008). Confirmation of OBs in waters likely means that a source of OBs is nearby. Deployed Turner OB sensors instantaneously detect OBs in the field, so UV degradation during sample collection and transport will not be an issue.

1.0 Purpose and Scope

1.1 This document is the Environmental Assessment Program (EAP) Standard Operating Procedure (SOP) for using Tuner Designs Cyclops-7 Submersible Optical Brightener (OB) Sensors and Precision Measurement Engineering, Inc. (PME) Cyclops-7 Loggers.

1.2 The information hereafter should be used for quick reference and additional information and is not a substitute for Turner Design's Cyclops user's manual and/or the PME Cyclops-7 Logger user's manual. Consult the appropriate manual for a complete guide of the proper use, calibration, maintenance, storage, deployment, and troubleshooting of Cyclops-7 sensors and loggers.

2.0 Applicability

2.1 This SOP must be followed when using Cyclops-7 Submersible OB Sensors. This equipment is expensive and must be treated and maintained carefully. Anyone not following proper procedures is subject to losing rights to future use.

3.0 Definitions

3.1 Calibration: To standardize or correct sensors after determining, by measurement or comparison with a standard, the correct value.

3.2 Emission spectrum: The emission spectrum of a chemical is the spectrum of frequencies of electromagnetic radiation emitted due to an atom's electrons making a transition from a high energy state to a lower energy state.

3.3 Fluorescence: The intensity and wavelength distribution of emission spectrum after excitation by a certain spectrum of light. Fluorescence is used to identify the presence and the amount of specific molecules (like optical brighteners) in a medium.

3.4 NIST: National Institute of Science and Technology. NIST produces traceable standards and instruments that can be used to check the calibration of instruments.

3.5 Optical Brighteners: Also known as fluorescent whitening agents, optical brighteners (OBs) are commonly added to laundry detergents. When illuminated by near-ultraviolet light in the range of 360 to 365 nm OBs emit light in the blue range at 400 to 440 nm (Tavares et al, 2008) and make products and fabrics appear brighter. Laundry wastewater is the largest contributor of OBs to wastewater systems.

3.6 Optical tissue: Delicate task wipes that are lint free and will not scratch the surfaces that are being cleaned.

3.7 PTSA: A fluorescent dye, used as a calibration correlation standard, which emits wavelengths between 400 and 500 nm when irradiated with UV light.

3.8 Sensor: A converter that measures a physical quantity (such as optical brighteners) and converts it into a signal which can be read by an observer or by an instrument.

4.0 Personnel Qualifications/Responsibilities

4.1 You must be properly trained and show competency to use this equipment. A Cyclops-7 custodian can help fulfill the training requirement. See your supervisor for further details.

5.0 Equipment, Reagents, and Supplies

5.1 400 ppb PTSA calibration correlation standard
5.2 Deionized water
5.3 Turner Designs Cyclops-7 submersible sensor
5.4 3M™ Silicone Lubricant Spray
5.5 Optical Tissue (e.g. – Kimwipes)
5.6 Turner Designs Cyclops Explorer (cable, driver, and software)
5.7 Precision Measurement Engineering Inc. (PME) Cyclops-7 Logger
5.8 USB Flash Drive for Turner Designs Cyclops-7 submersible sensor, which includes:
   a. User's manual
   b. Quick Start Guide
   c. Calibration Procedure
   d. Cable Guide
   e. Accessory instructions
   f. Optical Specification Guide
   g. CE certificate
5.9 Tools and Equipment for use of PME Cyclops-7 Logger with Turner Designs Cyclops-7 submersible sensor
   a. Stainless steel cable (spool or appropriate length for deployment location)
   b. Stainless steel wire cutter
   c. Wire cutter
   d. Alan wrench set
   e. 2 - C batteries
   f. Copper ferrules
   g. Swage tool for ferrules
   h. ½" x 2' rebar
   i. Deployment case
   j. Electrical tape
   k. Small Phillips screwdriver

l. Small sledge hammer
m. 2 - 7/16" box wrenches
n. ½" box wrench

5.10 PME Cyclops-7 Logger software (includes software and User's Manual for the logger attached to the OB sensor).

5.11 Laptop or other appropriate field tablet

6.0 Summary of Procedure

6.1 Calibration

6.1.1 Note: This is a brief overview of the calibration process using the PME Cyclops-7 Logger software. Detailed information on calibration can be found in the PME Cyclops-7 Logger Manual starting on page 14. There is a brief description of the calibration process for the submersible sensor in the Turner Designs Cyclops-7 User's Manual. It is recommended that only the PME method is used and this is what will be described in section 6.1.5.

6.1.2 Calibration of the instrument is done in the manufacturing facility when it is produced. The calibration of the instrument by the user is done to get a correlation value to use in an equation that outputs concentration. The correlation calibration was performed by Ecology upon receipt from the manufacturer with a 400 ppb PTSA calibration correlation standard. The manufacturer does not recommend a recalibration interval because the calibration correlation does not adjust the actual calibration of the instrument.

6.1.3 In the absence of recommended recalibration intervals, the sensors will be checked quarterly with 400 ppb PTSA calibration correlation standard. If the calibration correlation has drifted, the instrument will be correlation calibrated again using the methods described below and in the PME Cyclops-7 Logger User's Manual. The instrument records temperature as well. Temperature is factory calibrated and will be checked quarterly with the NIST thermometer available at the Ecology Operations Center.

6.1.4 Required Calibration Order

6.1.4.1 Zero (blank) solution. Use ultra pure or deionized water.

6.1.4.2 400 ppb PTSA standard. Standard can be purchased from Turner Designs.

6.1.4.3 Temperature is factory calibrated.

6.1.5 Calibration Procedures

6.1.5.1 Start by cleaning the sensor and/or logger (see section 6.3).

6.1.5.2 Open the case of the logger (see manual for instructions).

6.1.5.3 Connect the logger to a computer using the provided RS232 cable and Cyc7Calibrate software (see the manual for instructions).

6.1.5.4 Enter the unit of measure and calibration value in the calibration portion of software.

6.1.5.5 Fill a clean 250-400 mL beaker with enough deionized water to ensure the optical window of the sensor is submerged.

6.1.5.6 Submerge the sensor end of the logger with the logger end cap attached. The logger will need to be held upright by the user unless something has been set up to keep the logger from falling over. Of particular concern while calibrating is the exposed circuitry of the logger. Great care needs to be taken to ensure that the inside of the logger is kept dry during the calibration process.

6.1.5.7 Click the calibrate button to zero the sensor.

6.1.5.8 Fill a separate clean 250-400 mL beaker with 400 ppb PTSA standard to ensure the optical window of the sensor is submerged.

6.1.5.9 Submerge the sensor end of the logger with the logger end cap attached. Follow the instructions of the onscreen messages to complete the calibration.

6.1.5.10 After the calibration is complete make sure to save the results to a designated record keeping location.

6.1.5.11 Disconnect the logger from the computer and close up the logger case.

6.2 Field Use

6.2.1 Methods for spot-sampling or long-term deployment vary and will be discussed in detail during training. Training will be conducted as needed by the custodian of the sensor and logger. Use of the equipment will be strictly limited to those staff that have been properly trained and demonstrated competency.

6.2.2 Spot-sampling will be conducted using the Cyclops Explorer cable and software. In addition the sensor will be protected during use with the sensor support and logger end cap for the PME logger set-up.

6.2.3 Long-term deployment will be conducted using the PME logger. Details of deployment options will be discussed during training. However, critical points are listed here to highlight the importance of observing these steps.

6.2.3.1 Prior to deployment the logger must be connected to the Cyc7Calibrate software to set the internal clock on the logger and the sample interval. If this is not done the time stamp could be wrong and the logger will sample at the last set sampling interval.

6.2.3.2 With the logger case open and batteries installed move the On/Off Switch to the On position. When this is done watch for the LED light next to the On/Off Switch to flash

5 times to indicate that the logger has started its logging operation. If the user does not wait for the 5 flashes there is no way to be certain that the logger is working until it is retrieved and the data is downloaded.

6.2.3.3 After retrieval the logger must be told to stop logging. To do this make sure the logger is dry, then open the case. On the circuit board near the On/Off Switch there is a file close button (see manual for a picture). This file close button must be pushed to tell the logger to stop logging. When this button is pushed the LED will flash continuously until the logger is switched off. It cannot be stressed enough how important this step is. If this step is not completed and the logger is switched off, the last open file will be lost (up to six hours).

6.3 Cleaning and preparing the sensor and/or logger for the next user.

6.3.1 Cleaning the Cyclops Sensor

6.3.1.1 The body of the Cyclops-7 submersible sensor is made of stainless steel and requires little cleaning. The sensor should be rinsed or soaked in deionized or tap water after each deployment. If rinsing does not provide adequate cleaning then soak the probe. If brushing is needed to fully clean the probe then use a soft bristle toothbrush taking care not to touch the optical sensor of the probe. Note: Turner Designs recommends that the sensor not be used or stored in a stainless steel container. Use of glass is preferred.

6.3.1.2 After soaking or rinsing, the optical sensor should be visually inspected. If further cleaning is needed use optical tissue (available in tool kit) to clean the window with soapy water.

6.3.1.3 Dry the body and optical window with optical tissue.

6.3.2 Cleaning the Cyclops Logger

6.3.2.1 Rinse the entire set up with tap water to remove any loose material that may be on the logger and sensor.

6.3.2.2 Remove the logger end cap and rinse the inside with tap water to remove anything that was missed with the previous rinse. If needed use a toothbrush to clean off material that is stuck to the logger end cap.

6.3.2.3 Unscrew the sensor support and slide it away from the logger housing. This area between the logger end cap and logger housing can collect sediment and other debris. Rinse this area well with water. If needed completely remove the sensor support and finish cleaning. While doing this take care to not break or damage the connector.

6.3.2.4 Decontamination for invasive species is required in all areas of the state. The type of decontamination varies based on the designation of the area you are working in. In most cases, washing with mild detergent while paying close attention to parts of the sensor and/or logger that are hard to reach, should suffice. For further information and

to determine the designation of the area you are sampling in see the Ecology Standard Operating Procedure EAP070 – Minimizing the Spread of Invasive Species (Parsons et al., 2012).

6.4 Short-term Storage (one day to three months)

6.4.1 Clean the sensor and ensure the end cap is in place to protect the optic window. It is recommended that the sensor be stored with at least the sensor support and logger end cap in place. The best storage option would be to have the sensor attached to the logger. This will ensure that all parts of the sensor are protected during storage. If for some reason the sensor is needed to be stored without any part of the logger see the custodian.

6.5 Long-term Storage (over three months)

6.5.1 Follow the short-term instructions. In addition, if the sensor is attached to the logger remove the two C cell batteries.

6.6 Troubleshooting

6.6.1 Consult the appropriate manuals. The manuals have a lot of useful information not covered in this SOP. Manuals can be found in Attachment 1 (Turner Designs) or Attachment 2 (PME) or at the custodian's desk.

6.6.2 Call the sensor/logger custodian if problems arise that the manuals can't help you with. If the custodian cannot solve your issue they will facilitate contact with the manufacturer.

6.7 Equipment Repair

6.7.1 In the event that any portion of the sensor or logger is broken, damaged, or is in need of repair contact the custodian. The custodian will deal with contacting the manufacturer and getting the sensor and/or logger repaired.

6.8 Communicating with the Logger and Sensor

6.8.1 Using a Computer and Cyc7Calibrate with the Cyclops-7 Logger Note: Detailed instructions are available in the user's manual.

6.8.1.1 Open the case of the logger.

6.8.1.2 With the RS232 cable plugged into the computer, open Cyc7Calibrate software.

6.8.1.3 Follow the onscreen instructions to plug the logger into the computer using one of the available COM ports listed in the drop down menu. If the logger fails to connect try selecting a different COM port.

6.8.2 Using a Computer and Cyclops Explorer with the Cyclops-7 Sensor

6.8.2.1 Install the driver and software according to manufacturer instructions (make sure to consult Ecology ITSO before installing).

6.8.2.2 Plug the sensor into the Cyclops-7 Explorer cable and if not already present attach the sensor support and logger end cap.

6.8.2.3 Open Cyclops Explorer and connect the Cyclops-7 Explorer USB plug to the computer. Make sure to have the power cord attached to the Cyclops-7 Explorer cable.

6.8.2.4 Connect the sensor to the software by selecting a COM port in the drop down menu. If the software shows a connection but the sensor will not respond try a different COM port.

6.9 File Management

6.9.1 Please see the PME Cyclops-7 Logger User's Manual for detailed instructions on file management starting on page 26, section 3.6. See also the SD card section starting on page 27, section 3.8. Pay particular attention to the specifics of the SD card removal.

7.0 Records Management

7.1 The custodian will maintain all records associated with sensors and loggers, including a log of calibration checks and equipment use. Any electronic records will be stored on an Ecology server to maintain data integrity.

7.2 If heavy use of the sensor/logger is anticipated, the custodian will maintain a calendar for reservations. Otherwise the sensor/logger will be available on a first-come-first-served basis for those who are trained and have demonstrated competence. A list of users will be maintained by the custodian.

8.0 Quality Control and Quality Assurance Section

8.1 An initial calibration to 400 ppb PTSA standard was performed when the sensors were received. After the initial calibration, the Cyclops-7 sensor will have its calibration checked once per quarter by the custodian. Records will be kept with the sensors and an electronic file will be maintained by the custodian. The results of the most recent calibration check should be consulted prior to use of the sensor. To check the zero of the sensor measure deionized water prior to and after each use.

8.2 When traveling from site to site, make sure the sensors optical window cap is in place. This cap protects the optical window from damage.

8.3 Although the equipment is and made for field use, it should be handled carefully at all times.

8.4 Further quality control and quality assurance procedures will be addressed thoroughly on a project-by-project basis in the Quality Assurance Project Plan.

9.0 Safety

9.1 The PTSA standard used for calibration is not hazardous, but can irritate eyes and other sensitive areas. See the Material Safety Data Sheet for more detailed information (Attachment 3 or http://www.turnerdesigns.com/t2/doc/MSDS/998-0127.pdf).

9.2 Wash hands thoroughly after calibration or after use in contaminated waters.

9.3 When using a logger in the field, be aware of your surroundings. Select an area in which you feel safe and secure from hazards.

9.4 For further field health and safety measures, please refer to the EAP safety manual (EAP, 2012).

10.0 Theft

10.1 Loggers deployed in small creeks and clear rivers are easily seen. To avoid problems with theft and vandalism, hide them carefully. Deploy loggers upstream or downstream of public access areas, private property, or places where boaters and swimmers can see them. Under overhanging vegetation or behind instream rocks and fallen trees are often good places to hide them, as long as water circulation is not limited.

10.2 Do not use large floats or anchors in smaller streams; they attract attention. Instead, note where the logger is and cover it as much as possible while maintaining good water flow past the sensors. Small cement blocks work well as anchors. If the logger is deployed in a large river, floats, line, and larger anchors may be necessary. See the custodian for further details.

10.3 If you cannot find a logger and suspect theft is the cause, visit the local police station and fill out a report. Ecology has also located lost equipment by running ads in local papers.

11.0 References

11.1 Environmental Assessment Program, 2012. Environmental Assessment Program Safety Manual. May 2012, revise January 2014. Washington State Department of Ecology. Olympia, WA.

11.2 Hartel, P.G., K. Rodgers, G.L. Moody, S.N.J. Hemmings, J.A. Fisher and J.L. McDonald, 2008. Combining Targeted Sampling and Fluorometry to Identify Human Fecal Contamination in a Freshwater Creek. Journal of Water and Health 6(1): 105-116.

11.3 Parsons, J., D. Hallock, K. Seiders, W.J. Ward, C. Coffin, E. Newell, C. Deligeannis, K. Welch, 2012. Standard Operating Procedures to Minimize the Spread of Invasive Species, Version 2.0. Washington State Department of Ecology, Olympia, WA. SOP Number EAP070. www.ecy.wa.gov/programs/eap/quality.html

11.4 Tavares, M.E., M.I.H. Spivey, M.R. McIver, and M.A. Mallin, 2008. Testing for Optical Brighteners and Fecal Bacteria to Detect Sewage Leaks in Tidal Creeks. Journal of the North Carolina Academy of Science 124(3): 91-97.

This page is intentionally left blank.

Attachment 1

TURNER DESIGNS

CYCLOPS

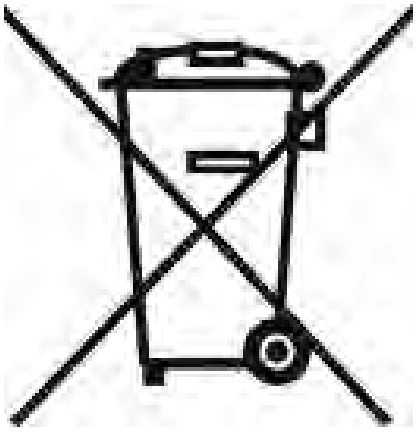
SUBMERSIBLE SENSORS

User's Manual

June 29, 2012
P/N 998-2100
Revision 2.1

TURNER DESIGNS
845 W. Maude Avenue
Sunnyvale, CA 94085
Phone: (408) 749-0994
FAX: (408) 749-0998

Table of Contents



WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT (WEEE) DIRECTIVE

Turner Designs is in the business of designing and selling products that benefit the well-being of our environment. Accordingly, we are concerned with preserving the surroundings wherever our instruments are used and happy to work with customers by complying with the WEEE Directive to reduce the environmental impact resulting from the use of our products.

WEEE Return Process:

To arrange the return of an end-of-life product, proceed as follows:

If you purchased your instrument through a Turner Designs Distributor please contact your local representative. They will instruct you where to return the end-of-life product.

If you purchased your instrument directly from Turner Designs please contact Turner Designs Customer Service
By Phone: 1-408-212-4041 or Toll Free: (877) 316.8049
By Email: Customer Service at support@turnerdesigns.com
Turner Designs will provide a WEEE RMA Number, a Shipping Account Number, and a Ship to Address. Package and ship the product back to Turner Designs.

The product will be dealt with per Turner Designs' end-of-life recycling program in an environmentally friendly way.

1. Introduction

1.1 Description

The Turner Designs Cyclops Submersible Sensor is an accurate single-channel detector that can be used for many different applications. It is designed for integration into multi-parameter systems from which it receives power and delivers a voltage output proportional to the concentration of the fluorophore, particle, or compound of interest.

The Cyclops voltage output can be correlated to concentration values by calibrating with a standard of known concentration.

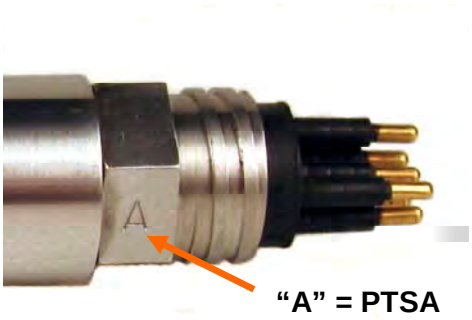
2. Inspection and Setup

2.1 Instrument Checklist

The Cyclops Submersible Sensor shipment package consists of:

- Cyclops Submersible Sensor:

  Configured and factory scaled for the specified analysis (see Identification Letter stamped on the connector for specified analysis):
  - "C" = Chlorophyll
  - "R" = Rhodamine
  - "F" = Fluorescein
  - "P" = Phycocyanin
  - "E" = Phycoerythrin
  - "U" = CDOM / FDOM
  - "O" = Crude Oil
  - "B" = Optical Brighteners
  - "T" = Turbidity
  - "G" = Refined Fuels
  - "A" = PTSA



- USB Flash Drive (per order) which includes:
  - User's Manual
  - Quick Start Guide
  - *in vivo* Calibration Procedure
  - Cable Guide
  - Accessory instructions
  - CE Certificate
  - Optical Specification Guide
- Calibration Certificate

2.2 Housing Configurations:

- Stainless Steel Cyclops-7 (P/N: 2100-000-"Identification Letter")
- Plastic or Titanium housings (recommended for highly corrosive environments or long term deployments).
  Titanium Cyclops-7 (P/N: 2100-000-"Identification Letter" T)
  Plastic Cyclops-7 (P/N: 2108-000-"Identification Letter")
  Plastic Cyclops-7 with Titanium connector (P/N: 2108-000-"Identification Letter"T)
- 6000 meter Cyclops-**6K (**P/N: 2160-000-"Identification Letter")

2.3 Optional Accessories include:

- Cyclops Pigtail Cables with Locking Sleeve *(see Appendix D for more information)*
  - 2 foot Pigtail Cable with Locking Sleeve (P/N 2100-750)
  - 5 meter Pigtail Cable with Locking Sleeve (P/N 2100-755)
  - 10 meter Pigtail Cable with Locking Sleeve (P/N 2100-751)
  - 25 meter Pigtail Cable with Locking Sleeve (P/N 2100-752)
  - 50 meter Pigtail Cable with Locking Sleeve (P/N 2100-753)

- DataBank Handheld Data Logger *(see Appendix G)* (P/N 2900-000)
- Flow Cap *(see Accessory Instructions on USB Flash Drive)*
  - Cyclops-7 Stainless Steel and Titanium (P/N 2100-600)
  - Cyclops-7 Plastic (P/N 2100-608)
  - Cyclops-**6K** (P/N 2160-600)
- Shade Cap *(see Accessory Instructions on USB Flash Drive)*
  - Cyclops-7 Stainless Steel and Titanium (P/N 2100-701)
  - Cyclops-7 Plastic (P/N 2100-708)
  - Cyclops-**6K** (P/N 2160-700)
- Solid Secondary Standard (SSS) for *in vivo* Chlorophyll, Phycocyanin, Phycoerythrin, Rhodamine, Fluorescein *(see Accessory Instructions on USB Flash Drive)*
  - Cyclops-7 Stainless Steel and Titanium (P/N 2100-900)
  - Cyclops-7 Plastic (P/N 2100-908)
  - Cyclops-**6K** (P/N 2160-900)
- Solid Secondary Standard (SSS) for UV Sensors (CDOM / FDOM, Optical Brighteners, Refined Fuels and Crude Oil) *(see Accessory Instructions on USB Flash Drive)*
  - Cyclops-7 Stainless Steel and Titanium (P/N 2100-904)
  - Cyclops-7 Plastic (P/N 2100-905)
  - Cyclops-**6K** (P/N 2160-901)

Solid Secondary Standard

Shade Cap

Flow Cap

2.4 Functional Test

To perform a functional check on the Cyclops, connect the interface colored wires to the power supply and multi-meter as shown in Figure 1 below.

Additional Equipment required for functional tests:
DC Power Supply, 3 - 15 VDC, >100 mA
Multi-meter to read 0 – 5 VDC

Note: Supply voltages greater than 15 VDC will result in damage to the sensor.

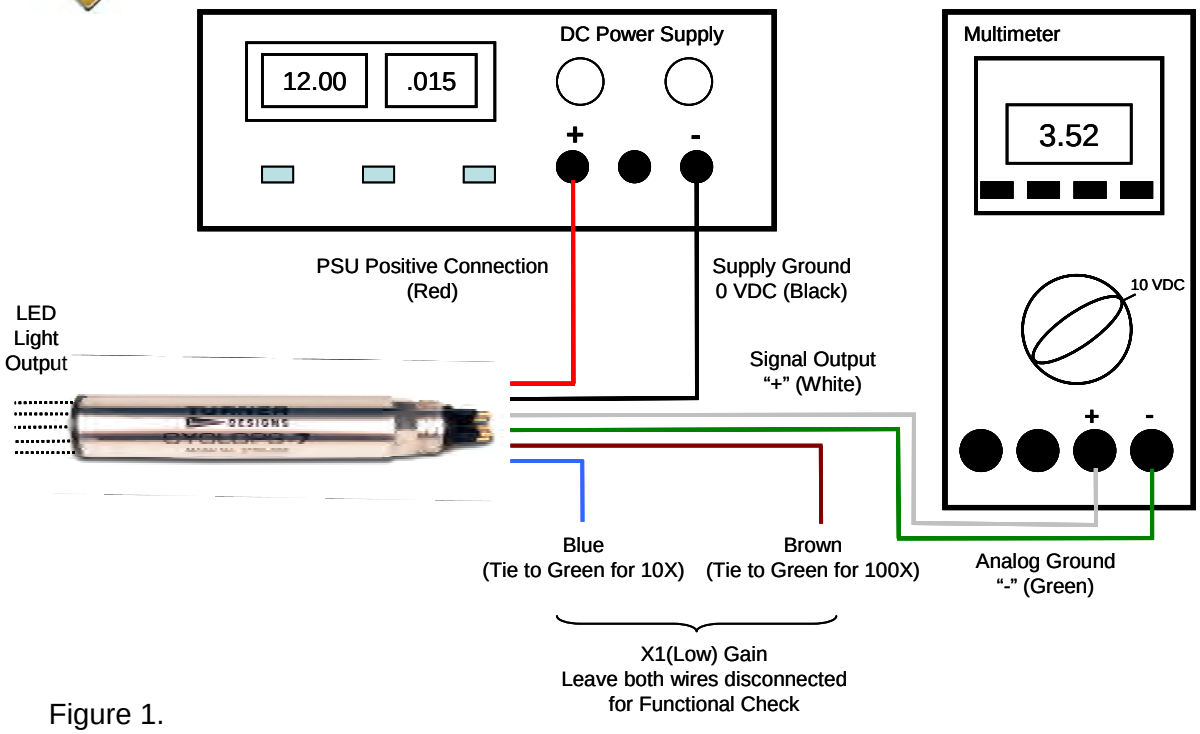


Figure 1.

With the Cyclops connected as shown in Figure 1 answer questions 1-3 by making the following functional tests:

1. Is the LED on?
   Hold a piece of white paper about ½ an inch in-front of the optical head to ensure the LED is on. ***Note: Cannot perform this test for Turbidity sensors because they use IR which is not visible*.**

2. Is there voltage output?
   The multi-meter should be reading some voltage >0 VDC

3. Does the voltage output change?
   Move the light source closer to your hand or a surface and check if the voltage output increases

3. Measurements with the Cyclops

3.1 Introduction

The following information will describe how to:

- Determine and set the appropriate gain
- Calibrate the Cyclops using standards with known concentrations
- Make measurements with the Cyclops
- Use the Solid Secondary Standard

Note: To make accurate and repeatable measurements it is important to keep the sensor clean; see section 5.1 for information on cleaning your sensor.

3.2 Setting the Gain

Gain setting refers to the sensitivity configuration of the sensor. There are three gain settings; X1, X10 and X100. As the gain increases, the sensitivity increases and the concentration range decreases.

3.2.1 Gain Determination Procedure

1) For *in vivo* applications, take a natural sample of water from a sampling station where you plan to deploy the Cyclops. Applying good measurement practices, store it properly and quickly transport it to a laboratory where you have the Cyclops connected to a multi meter and DC power source *(see Figure 1)*.

2) Pour the water sample into a clean glass beaker and submerge the optical end of the Cyclops *(see Appendix B for "Recommended Measurement Practices for using your Cyclops in the Lab" for how best to accomplish these steps)*.

3) Activate the X10 gain setting *(see Wiring Guide Appendix C)* if you believe the sample to represent a typical condition. You would like to obtain a signal from the sample that is significantly higher than a blank sample (de-ionized water or filtered seawater), but not a signal that is close to the maximum of 5 Volts.

4) If the sample signal is high, (>3.0 V for example) you may choose to use the X1 gain instead of the X10 gain setting so that you avoid going over scale once you deploy the Cyclops.

5) If the sample signal is very low (<0.3V) you may choose to use the X100 gain setting to achieve higher sensitivity but a smaller measurable range

This process is easier for dye tracing applications. Simply create the dye dilution of interest and record what signal level it provides on the three gain settings.

3.2.2 Static Gain Control

If integrating into a multi parameter system or data logger that is set up for “Static Gain Control”, which refers to the use of only one gain setting at a time, then you must determine which gain to use prior to deployment (see section 3.2.1) and have an integration cable made to activate that specific gain *(see Appendix C)*. For most applications the X10 gain will provide the best sensitivity, range, and resolution.

Customers wanting to dynamically change the gain ranges to achieve the optimum operating range should refer to “Method 2 – Dynamic Gain Control” in *Appendix E* on how to interface with a Data Collection System with programmable outputs.

3.2.3 Auto Gaining

Certain data loggers or multi parameter systems will have an auto gaining feature which will automatically adjust the sensitivity according to the voltage output from the Cyclops sensor. This feature maximizes the performance of Cyclops sensors allowing users to detect a broad range of concentrations, obtain the best resolution, and read minimum detection limits without having to rewire or manually change the sensor’s sensitivity. Turner Designs manufactures the DataBank Handheld Data Logger *(see Appendix G)* which has the auto gain feature and other functions that maximize the performance of Cyclops sensors.

3.3 Direct Concentration Calibration

Calibrating the Cyclops is a simple process requiring the use of calibration standards. The Cyclops can be calibrated using a single calibration standard which correlates the standard’s concentration to the voltage measured for that specific standard:

1) Connect the Cyclops to a power source and set the Cyclops to a gain setting *(see section 3.2.1 for explanation on how to determine gain)*

2) Measure the voltage from a blank sample for the configured gain setting. ***Note: A good blank to use for this application is ultra pure or deionized water.***

3) Use a standard of known concentration and create a correlation between the standard’s concentration and its voltage output

4) Once a correlation has been made, use the following equation to calculate concentration values for sample measurements for the calibrated gain:

$C_{Sample} = [(C_{Std})/(Volts_{Std} - Volts_{Blank})] * (Volts_{Sample} – Volts_{Blank})$

C_{Std} = Concentration value of standard used for calibration
C_{sample} = Concentration of sample
$Volts_{Std}$ = Voltage reading from standard concentration
$Volts_{Sample}$= Voltage reading from sample(s)
$Volts_{Blank}$ = Voltage reading from blank

4. Turbidity Cyclops

4.1 Introduction

The Turbidity Cyclops measures turbidity using an 850nm light source and detection of scattered light at a 90-degree angle which is similar to many modern day bench top turbidity meters. This unit provides a quick and accurate way to determine *in situ* turbidity, eliminating the collection and storage of samples and minimizing the potential error associated with sample handling and processing.

4.2 Calibration

Calibrating the Turbidity Cyclops is a simple process requiring the use of calibration standards. Turner Designs recommends purchasing Amco Clear Analytical Turbidity Standards for non-ratio instruments because these standards are non-toxic safe solutions consisting mainly of deionized water that comes prepared in a broad range of concentrations and has a shelf life guaranteed for one year. The Turbidity Cyclops can be calibrated using a single calibration standard which correlates the concentration to the voltage measured for that specific standard:

1) Connect the Turbidity Cyclops to a power source and set the Turbidity Cyclops to a gain setting *(see "Setting the Gain" section 3.2 for explanation on how to set the gain)*

2) Measure the voltage from a blank sample for the configured gain setting. ***Note: A good blank to use for this application is ultra pure or deionized water.***

3) Use a turbidity standard of known concentration (NTU) and create a correlation between the standard (NTU) and its voltage output

4) Once a correlation has been made, use the following equation to calculate turbidity values for sample measurements for the calibrated gain:

$$NTU_{Sample} = [(NTU_{Std})/(Volts_{Std} - Volts_{Blank})] * (Volts_{Sample} - Volts_{Blank})$$

NTU_{Std} = Concentration value of standard used for calibration
NTU_{Sample} = Concentration of sample
$Volts_{Std}$ = Voltage reading from standard concentration
$Volts_{Sample}$= Voltage reading from sample(s)
$Volts_{Blank}$ = Voltage reading from blank

5. Maintenance and Warranty

5.1 Maintenance

5.1.1 Rinsing

The Cyclops should be rinsed or soaked in fresh water following each deployment, ideally until it is completely clean again.

5.1.2 Care for the bulkhead connector

A light coat of Silicone spray should be used on the rubber of the male pins of the bulkhead to aid in sealing. The manufacturer recommends 3M™ Silicone Lubricant Spray or Loctite 8021 spray. ***Note: You should avoid using silicone grease. Do NOT use WD-40, it will destroy the connectors.***

5.1.3 Care for the optics

The optical window should be visually inspected after each deployment following a soaking in fresh water. If cleaning is needed, use optical tissue to clean the window with soapy water.

Note: The Cyclops should NOT come in contact with any organic solvents (i.e. acetone, methanol) or strong acids and bases.

The UV Cyclops models are the **ONLY** Cyclops sensors that can be calibrated with Quinine Sulfate standards made in Hydrosulfuric Acid. All other Cyclops models **CANNOT** be used in Hydrosulfuric Acid.

5.2 Warranty Terms

Turner Designs warrants the Cyclops and accessories to be free from defects in materials and workmanship under normal use and service for a period of 12 months from the date of shipment from Turner Designs with the following restrictions:

- Turner Designs is not responsible for replacing parts damaged by accident or neglect. Your instrument must be installed according to instructions in the User's Manual. Damage from corrosion is not covered. Damage caused by customer modification of the instrument is not covered.

- This warranty covers only Turner Designs products and is not extended to equipment used with our products. We are not responsible for accidental or consequential damages, except in those states where this limitation is not allowed. This warranty gives you specific legal rights and you may have other rights which vary from state to state.

- Damage incurred in shipping is not covered.

5.3 Warranty Service

To obtain service during the warranty period, the owner shall take the following steps:

1. Write, email or call Turner Designs Technical Support and describe as precisely as possible the nature of the problem.

   Phone: 1 (877) 316-8049
   Email: support@turnerdesigns.com

2. Carry out any adjustments or tests as suggested by Technical Support.

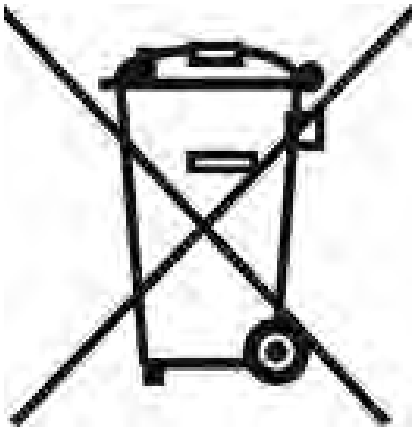
3. If proper performance is not obtained you will be issued a Return Materials Authorization number (RMA) to reference. Package the unit, write the RMA number on the outside of the shipping carton, and ship the instrument, prepaid, to Turner Designs. If the failure is covered under the warranty terms the instrument will be repaired and returned free of charge, for all customers in the contiguous continental United States.

   For customers outside of the contiguous continental United States who purchased equipment from one of our authorized distributors, contact the distributor. If you purchased directly, contact us. We will repair the instrument at no charge. Customer pays for shipping, duties, and documentation to Turner Designs. Turner Designs pays for return shipment (custom duties, taxes and fees are the responsibility of the customer).

5.4 Out-of-Warranty Service

Follow steps for Warranty Service as listed above. If Technical Support can assist you by phone or correspondence, we will be glad to, at no charge. Repair service will be billed on a fixed price basis, plus any applicable duties and/or taxes. Shipment to Turner Designs should be prepaid. Your bill will include return shipment freight charges.

Address for Shipment:
Turner Designs, Inc.
845 W. Maude Ave.
Sunnyvale, CA 94085



Appendix A: Specifications

Parameter	Specification
Linearity (full range)	0.99 R^2
Power Draw	@ 3V: Max 360 mW ≥ 5V: Max 265 mW
Input Voltage	3 – 15 VDC
Signal Output	0 – 5 VDC Analog
Temperature Range	Ambient: 0 to 50 °C Water Temp: -2 to +50 °C
Light Source	Light Emitting Diode
Excitation Wavelength	Visible – Chl, RWT, PC, PE, F UV – CDOM / FDOM, Oil, OB, RF, PTSA IR – Turbidity
Detector	Photodiode
Detection Wavelength	300 – 1100 nm
Warm up time	5 seconds
Housing Material - Cyclops-7	(Standard) 316 Stainless Steel (Optional) Titanium (Optional) Plastic
Housing Material - Cyclops-**6K**	Titanium
Dimensions - Cyclops-7	Stainless Steel and Titanium L: 4.3 in., 10.9 cm; D: 0.875 in., 2.22 cm
	Plastic L: 4.3 in., 10.9 cm; D: 1.25 in., 3.175 cm
Dimensions - Cyclops-**6K**	L: 6.6 in, 6.76 cm; D: 1.75 in, 4.45 cm
Depth Rating - Cyclops-7	600 meters
Depth Rating - Cyclops-**6K**	6000 meters
Weight - Cyclops-7	5 oz; 160 gm
Weight - Cyclops-**6K**	22 oz; 620 gm

Appendix B: Recommended Measurement Practices

Recommended Lab Practices for Measurements

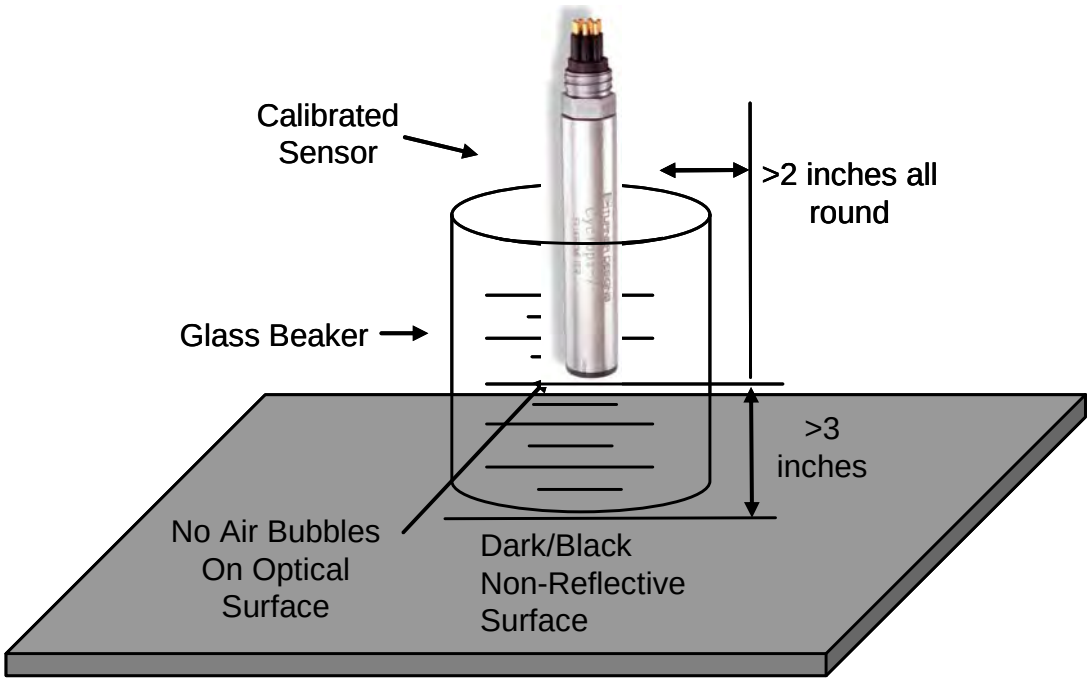
The following steps will improve the accuracy and repeatability of your measurements, especially at low concentration levels:

1. Use a non-fluorescent container for your water samples. ***Note: Plastic may fluoresce and interfere with the sample's fluorescence.***

2. If using a glass container, place the container on a non-reflective black surface.

3. Ensure that the sensor is more than 3 inches above the bottom of the container.

4. Ensure that the sensor is in the center of the container and has more than 2 inches clearance between the cirumference of the sensor and the inside surface of the beaker.



Appendix C: Wiring Guide

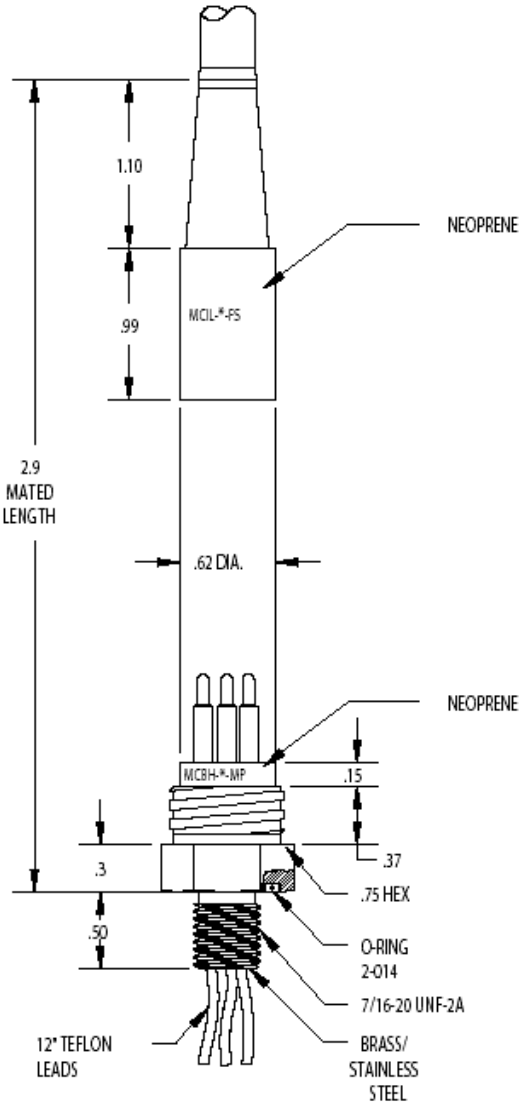
Cyclops-7 Wire	Pin Number	Function	Connection
Red	1	Supply Voltage 3 – 15 VDC	PSU – Positive Connection
Black	2	Supply Ground, 0VDC	PSU – Ground Connection
White	3	Signal Out to data logger "+" 0 – 5VDC	Multimeter Positive Connection
Green	4	Analog Ground "-", 0 VDC	Multimeter Negative Connection
Blue	5	X10 Gain, (Medium Sensitivity)	See table below
Brown	6	X100 Gain, (High Sensitivity)	See table below

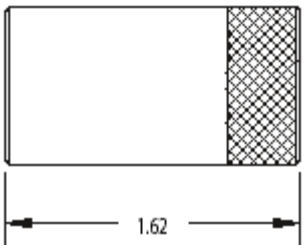
Gain Switching Table

Gain 10 (Blue)	Gain 100 (Brown)	Gain	Chl Range (μg/L)	RWT Range (ppb)	TRB Range (NTU)
Not connected	Not connected	X 1	0 - 500	0 – 1,000	0-3000
Connected to analog ground	Not connected	X 10	0 – 50	0 - 100	0-1000
Not connected	Connected to analog ground	X 100	0 – 5	0 - 10	0-100

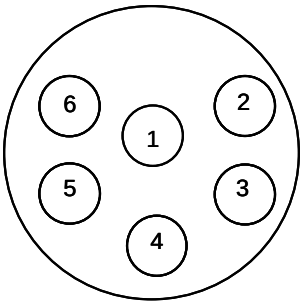
Appendix D: Pigtail Cable and Connector Information

Dimension details of 24” length cable with 20 gauge colored lead wire, connects to 6 pin male connector. (Cable manufacturer/Part No: IMPULSE/MCIL-6-FS)





Female locking sleeve, (Impulse P/No. MCDLS-F)



In-line connector contact configuration (connects to Cyclops).

A maximum cable length up to 300 meters can be connected to the Cyclops if the following conditions are met:

1) The cable is shielded and contains 20 gauge conductor size or greater (i.e. Beldon No. 8426 cable).
2) The 0-5 volt Analog output is connected to a device (i.e. Data Logger) with an input impedance of 1 MegOhm or greater.
3) The supply Voltage to the Cyclops is between 5 and 15 volts.

Appendix E: Controlling the Gain

The operating range can either be set to one of the 3 available ranges, which will be referred to as "Static Gain Control", or it can be dynamically changed to achieve the optimum operating range, referred to below as "Dynamic Gain Control". The first approach is applicable when using the Cyclops as a stand-alone sensor. The second approach is applicable when the Cyclops is integrated into a system with control capability.
Both methods are implemented by grounding “driving Low” the appropriate gain control pin. The X10 and X100 gain control pins are normally in a "High" state if they are not connected to anything. This means the Cyclops default is the X1 gain (largest concentration range) mode. The Cyclops can be put into higher gain, lower concentration range modes, by connecting either the X10 or X100 pin **(but not both at the same time)** to ground.

Method 1 - Static Gain Control

Connect the X10 or X100 pin to the analog ground pin of the Cyclops pigtail connector. See the Gain Switching Table in Appendix C to determine the required configuration for desired gain/measurement range. See Appendix D for Pigtail Cable and Connector information. Also, see “Setting the Gain” section 3.2 for more information on “Static Gain Control”.

Method 2 - Dynamic Gain Control

If you have a Data Collection System (DCS) that has programmable outputs you can use them to control the Cyclops gain settings. Following are three common output types found in DCSs and how to connect them to the Cyclops. Refer to your DCS manual to determine which is appropriate. (For those who want technical data: the Cyclops’s X10 and X100 gain control pins are connected internally to the input of a Schmitt trigger inverter, part number 74LVC1G14, and a 100K ohm pull-up resistor. Both use a 5-Volt power supply.)

Output type 1: Digital Signals

Logic signals can be used to drive the gain control pins. In most cases you can connect the digital signal output of the DCS directly to the Cyclops gain control pins. To drive them high, the voltage should be 3 VDC min – 5 VDC max. To drive them low, the voltage should be 1 VDC max – 0 VDC min. You may need to connect the Cyclops analog ground to the DCS ground.

Output type 2: Open Collector Signals

This type of output is either open or connected to ground. Connect the Cyclops gain control pins directly to these outputs. You may need to connect the Cyclops analog ground to the DCS ground.

Output type 3: Relays

Relays act as a controllable switch. Connect one end of the relay to the Cyclops analog ground. Connect the other end of the relay to the Cyclops gain control pin.

Appendix F: Linear Range, Quenching and Temperature Considerations

The linear range is the concentration range in which the fluorometer's output is directly proportional to the concentration of the signal. The linear range begins with the smallest detectable concentration and spans to an upper limit (concentration) that is dependent upon the properties of the material, filters used, and path length.

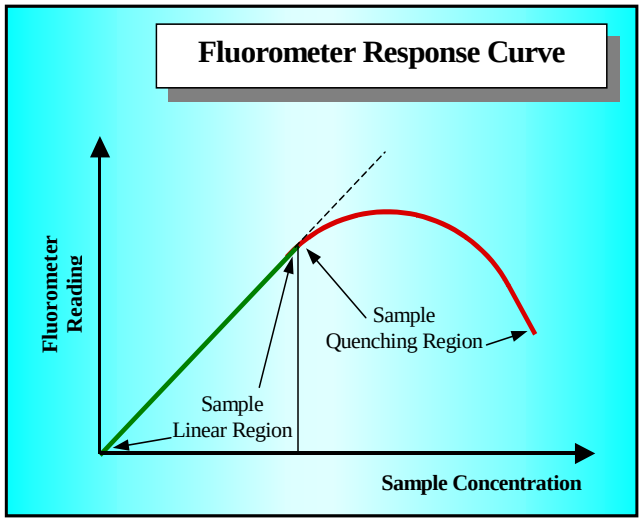
A non-linear relationship is seen at very high concentrations where the signal does not increase at a constant rate in comparison to the change in concentration (see figure below). At even higher concentrations, the signal will decrease even though the sample concentrations are continuing to increase. This effect is known as "signal quenching".

Linearity can be checked by diluting a sample 1:1 or some other convenient ratio. If the sample is still in the linear range, the reading will decrease in direct proportion to the dilution. If the reading does not decrease in direct proportion to the dilution, or if the reading increases, the sample is beyond the linear range.

Temperature Considerations

Fluorescence is temperature sensitive. As the temperature of the sample increases, the fluorescence decreases. For greatest accuracy, record the sample temperature and correct the sensor output for changes in temperature.

For further information on how temperature, light, water quality and the physiological state of the algal cells can all affect the measurement of chlorophyll, please refer to the application section of Turner Designs' website.



Graph showing Linear and Quenching Regions of the sample's response

Appendix G: Using the Cyclops Submersible Sensor with the DataBank

Cyclops sensors are analog output devices that produce a 0 – 5 volt signal that is proportional to the fluorophore being measured. Turner Designs offers the DataBank, a universal handheld meter, datalogger, and power supply that can be used to maximize performance of Cyclops sensors with functions such as:

- Auto gaining
- User defined calibrations
- Large internal memory
- Interval logging

The DataBank comes with intuitive GUI software that allows users to easily calibrate, set up logging, download data, and define parameters and values necessary to help configure the Cyclops for a specific application or study. Available options include GPS capability, external power, travel case, and car charger.

DataBank uses for different sampling protocols:

Multiple Site Measurements – measure fluorescence at different locations within your water system or across many systems; GPS enabled units provide latitude/longitude data per location

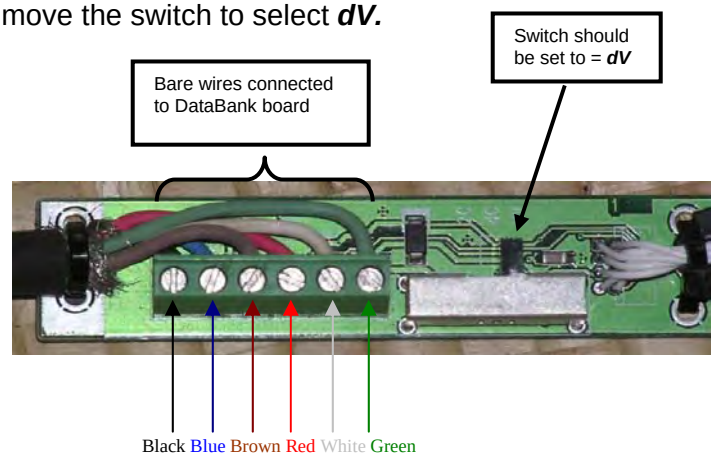
Profiling – purchase extended cables to allow for vertical profiling

Monitoring – deploy the Cyclops to a fixed location or depth and monitor the signal over time; set up logging to capture a signal within a specific time frame; download data while the sensor is deployed and continuously measuring; set up digital data output via HyperTerminal

For any application or sampling protocol, the DataBank facilitates and maximizes performance of all Cyclops sensors allowing versatility and flexibility in calibration, setup, and measurement.

Connecting the Cyclops to Turner Designs' DataBank:

Simply connect the bare wires from the Cyclops's pigtail to the DataBank board as shown below and move the switch to select ***dV.***



This page is intentionally left blank.

Attachment 2

Precision Measurement Engineering, Inc. • www.Turner Designs.com

Cyclops-7 Logger User's Manual

2013

(INTENTIONALLY BLANK)

Warranty

1-YEAR LIMITED WARRANTY

Precision Measurement Engineering, Inc. warrant that the Logger shall be free of defects in workmanship and materials, under normal use, for a period of one year from the date of shipment. This warranty is made only to the original purchaser. In the event a Logger covered by this warranty fails to operate according to our published specifications, then return it freight pre-paid to Precision Measurement Engineering or an authorized Service Provider. Precision Measurement Engineering (PME) will repair the unit at no charge to the customer and bear the cost of return shipment to customer. Carefully pack all components, as the customer is responsible for any freight damage.

This warranty does not apply to services or consumable / expendable items (such as batteries, fuses and ropes) required for general maintenance. The Cyclops-7 sensor, manufactured by Turner Designs, is warranted only to the limit of the warranties provided by their original manufacturer.

PME makes no warranty, either expressed or implied, that the sensors will be operable after they are exposed to adverse environmental conditions, such as bio-fouling, oil fouling, freezing temperatures or others.

This warranty is void if, in our opinion, the Logger has been damaged by accident, mishandled, altered, or repaired by the customer, where such treatment has affected its performance or reliability. In the event of such treatment by the customer, costs for repairs plus two-way freight costs (no COD shipments will be accepted) will be borne by the customer. In such cases, an estimate will be submitted for approval before repair work is started. Items found to be defective should be returned to PME carefully packed, as the customer will be responsible for freight damage.

Incidental or consequential damages or costs incurred as a result of the product malfunction are not the responsibility of PME.

For all warranty or non-warranty returns please obtain, complete, and submit a RMA to PME. This RMA form may be obtained at

http://www.pme.com/HTML%20Docs/RMAform.html

After submission of this form, then PME will respond with a RMA number. Please place this number on all shipments and related communications.

Safety Information

BURSTING HAZARD

Should water enter the Cyclops-7 Logger and come into contact with the enclosed batteries, then the batteries may generate gas causing the internal pressure to increase. This gas will likely exit via the same location where the water entered, but not necessarily. The Cyclops-7 Logger is designed to release internal pressure as the end cap is unscrewed, prior to the disengagement of the end cap threads. If internal pressure is suspected, then treat the Cyclops-7 Logger with extreme caution.

Revision History

Date	Revision Description
29-DEC-2011	Copied from miniDOT manual (Revised 20-DEC-2011)
10-JAN-2012	Added corrective action to LED flash table.
01-SEP-2012	Updated for new RS232 software – extensively revised
14-DEC-2012	Revised screen shots of Cyc7Calibrate and Cyc7Plot Removed Sec 3.7 Serial port commands and Appendix 1
17-JAN-2013	Pictures revised. Set Sample Interval description added
11-FEB-2013	Added description of sensor type tag on SD card holder
14-MAR-2013	Added more detailed description of calibration procedure. Added words concerning Turner's Solid Secondary Standard
09-MAY-2013	Added battery pack warning
28-AUG-2013	Reworded serial port driver to jspWin, removed Cyc7Service
05-NOV-2013	Reworded Chapter 2 software installation
11-NOV-2013	Removed Time Zone selection
13-NOV-2013	Updated description of how time is set
19-NOV-2013	Updated battery pack removal to remove SD card for 'C' pack
23-DEC-2013	Updated to include exchangeable sensor
24-DEC-2013	Replaced "exchangeable" with "interchangeable"
14-JAN-2014	Corrected 2-flash reference to Sec 3.11 to reference 3.8

CONTENTS

Chapter 1: Quick Start

1.1 Calibrate and Go

Your Cyclops-7 Logger has arrived completely ready to go. PME produces two types of loggers, one with sensor permanently installed and a logger with a connector that you will use to plug in your own sensor. In either case the logger/sensor are an un-calibrated state. The logger itself is set to measure temperature and concentration once every 10 minutes and record 4 files of measurements daily. You need only calibrate the sensor. In this condition the Cyclops-7 Logger will operate for roughly half a year before the internal battery is expended.

At the end of the deployment period you need only to open the logger, press the File Close button, switch off the power, and remove the SD card. Your temperature and concentration measurements, together with a time stamp indicating the time the measurement was made, are recorded in text files in the DATA directory on the SD card. These files can be copied from the SD card onto any host computer.

Files can be concatenated and displayed using the Cyc7Plot software supplied with the logger.

Follow these steps to start the deployment, logging Cyclops-7 output and Temperature once each 10 minutes:

1) If you have purchased an Interchangeable sensor, install your sensor as described in Chapter 3.
2) Calibrate the sensor/logger as described in Chapter 2, Cyc7Calibrate program.
3) Open the Cyclops-7 Logger (if not already open from calibration) as described in Chapter 3.
4) Slide the power switch to the ON. The LED will flash once. Observe the LED for up to 90 seconds. Sometime during this period it will flash 5 times indicating that logging has begun. If it flashes continuously, then see section 3.5 of this manual.
5) Inspect the o-ring seal for debris.
6) Close the Cyclops-7 Logger by screwing the white housing back onto the black end cap.
7) Deploy the Cyclops-7 Logger.

Follow these steps to end the deployment

1) Recover the Cyclops-7 Logger
2) Clean and dry all accessible surfaces.
3) Open the Cyclops-7 as described in Chapter 3.
4) Press the File Close button. The LED should begin continuous flashing.

5) Slide the power switch to the OFF position.
6) Remove the SD card (both screws must be removed to extract SD card). Use a card reader and a host computer to copy the files located in the DATA directory onto the host computer. These text files contain the measurements.
7) (Optional – but strongly recommended) Run Cyc7PLOT.jar program to see a plot of measurements, and to produce a concatenated file containing all the measurements. This file contains better time information and is much more useful than the files collected directly by the logger.

Remove the battery if storing the Cyclops-7 Logger for extended periods.

1.2 A Few Details

The previous section gives instructions for sampling at 10-minute intervals. However there are a few additional details that will enhance use of the Cyclops-7 Logger.

Sampling rate – The Cyclops-7 Logger records measurements at equal time intervals. The default time interval is 10 minutes. If a formatted SD card is placed in the Cyclops-7 Logger and the power is turned on, then the logger will record every 10 minutes. However, it is also possible to instruct the Cyclops-7 Logger to record at different intervals. This is accomplished by connecting a Windows computer to the logger and using software supplied for this purpose. See Chapter 2.

Sample intervals of less than 1 minute or longer than 1 hour are not allowed and will be rejected by the Cyclops-7 Logger software. The Cyclops-7 Logger will flash its LED repeatedly if it encounters a sample interval request outside this range.

Sample Time – The Cyclops-7 Logger records the time that each is made. It does this based on an internal clock. When your Cyclops-7 Logger arrives it is set by PME to UTC (formerly known as Greenwich mean time (GMT)). We suggest that you leave it always set to UTC so that there is never a time question in the recorded measurements. Subsequent software implements conversion to local time. You can reset Cyclops-7 Logger time to local time if you choose by using software. See Chapter 2.

The Cyclops-7 Logger internal clock will drift in the <10 ppm range (< about 30 seconds/month) so you should plan to reset it occasionally.

File Information – The Cyclops-7 Logger software creates 4 files daily. The number of measurements in each file will depend upon the sample interval. Files are named by the time (Unix epoch 1970) that the file is opened based on the logger's internal clock and expressed in hexadecimal format. (Use the Cyc7Plot program to concatenate these files into a more useful format. See Chapter 2)

Cleaning the Sensor – The sensor may be cleaned by unscrewing the black sensor guard and gently wiping the optical face.

Battery Life – The Cyclops-7 Logger consumes battery power mostly from the Cyclops-7 sensor, but also slightly from simply keeping track of time, writing files, sleeping, and other activities. The Cyclops-7 Logger will record approximately 30,000 total samples and will operate for up to a year when powered by the battery pack (2 X alkaline 'C' cells) supplied by PME.

Keep a general record of Cyclops-7 Logger number of samples. It is not possible to accurately determine the charge state of the battery pack from measurements of its terminal voltage. If you have a general idea of the number of samples already obtained on a battery, then you can make a guess as to how many more samples remain. Err on the side of caution.

The 2 X 'C' battery pack holds the batteries very tightly. The holder itself is glued to the aluminum chassis. Take care when changing batteries that the glue joint is not broken. Always use the paper tube supplied with the Cyclops-7 to contain the batteries. Use only new batteries as replacements.

Coin Cell Battery Life – The Cyclops-7 Logger uses a coin cell for backup of the clock when the power is switched off. This coin cell will supply roughly 2 years of clock operation, but this is only required if the main power is off. Should the coin cell discharge it must be replaced. Coin cells are not user-replaceable.

O-Ring and Seal – When the cover is screwed on, it passes along the o-ring located in the end cap several revolutions. Keep this o-ring lightly lubricated with silicone grease or oil compatible with buna-N o-ring material.

When the Cyclops-7 Logger is opened after deployment, a small number of water drops are deposited on the inner surface of the o-ring. When the pressure housing is screwed back on, these drops become trapped inside the Cyclops-7 Logger. Be sure to carefully dry the o-ring and adjacent surfaces (especially underneath) prior to closing the Cyclops-7. Re-lube the o-ring at this time. Remove any debris from the drying process.

Closing the Logger – The logger is much more difficult to open than to close. Screw the white logger housing onto the black cap until the housing touches the cap. No further tightening is necessary.

SD Card – If the retaining screws are lost or not re-installed, the SD card can be ejected from its socket if the Cyclops-7 Logger is dropped on its pressure housing end. The logger will be unable to log should this occur. If the retaining screw is lost the SD card can be taped in place using a bit of electrical tape. Use only SanDisk 2 GB SD cards as replacements.

THE SD CARD IS NOT HOT-SWAPPABLE. POWER MUST BE SWITCHED OFF PRIOR TO INSERTING OR REMOVING THE SD CARD. IF THIS IS NOT DONE, DAMAGE TO THE SD CARD MAY RESULT.

LED Indications – The Cyclops-7 Logger performs various tests as it begins logging operations. If any test fails the software flashes the LED light and re-conducts the test. In general if a test fails once it will continue to fail and the LED light will continue to flash. The following table gives the number of flashes and the reason these flashes appear.

LED Flash #	Reason	Corrective Action
1	Normal. Presented immediately after power is switched on. Indicates that the CPU has started its program.	None required. Normal operation.
2	Error. No SD Card or SD card not completely plugged in.	Plug SD card correctly. Install new SD card. Re-format SD card (Sec 3.8)
3	Error. Requested sampling interval less than 1 minute or greater than 1 hour.	Check CAL.TXT file on SD card (Sec 1.2).
4	Error. Clock not initialized.	Reset clock (See TIME command Sec 3.9 and Appendix 1).
5	Normal, presented once after roughly one minute, indicating that the miniDOT Logger is starting logging operation.	None required. Normal operation

In addition to LED flashing, the Cyclops-7 Logger internal software prints statements while doing internal testing just after the power is switched on. These statements can supply more information than the LED flashes. See Section 3.5 for additional information.

AutoRanging – The Cyclops-7 sensor has three output ranges: 1X, 10X and 100X. The best of these ranges is automatically selected by the logger based on the voltage measured of the sensor. The logger software remembers the best range and, at each sample time, first measures sensor output voltage using this range. Software then reviews this voltage to determine if the range was appropriate. In most cases the range will be appropriate and the measurement is recorded. However sometimes software determines that a different range would yield a better measurement. In this case software selects a new "best range" and re-measures the sensor output voltage using this range. This new best range becomes the range selected at the next sample time. The best range is determined as follows:

Sensor Voltage Divided by Range	Best Range
0.00 to 0.04	100X
0.04 to 0.4	10X
0.4 and higher	1X

Should the first voltage measurement be unacceptably close to the sensor maximum output voltage (an over-range condition) the first voltage is re-measured using range of 1X and the best range calculated. This range becomes the best range and software proceeds as above.

Calculation of Engineering Units – Engineering units are calculated from voltage measurements of the sensor and from information gained during calibration (see Chapter 4). The result of calibration is the following information:

Name	Definition
Vz1	Voltage output of sensor in zero solution on range 1X
Vz10	Voltage output of sensor in zero solution on range 10X
Vz100	Voltage output of sensor in zero solution on range 100X
S	Sensitivity of sensor

Vz1, Vz10, and Vz100 are measured with the sensor in a solution of zero concentration. S is determined from the voltage output of the sensor using the "best range", described above, with the sensor in a reference solution of known concentration. The user must enter the concentration value of this solution, given the name C. The sensor voltage is measured in this solution and given the name Vs. The following table shows how S is determined.

Range	S
1X	S = C / (Vs – Vz1)
10X	S = 10.0 * C / (Vs – Vz10)
100X	S = 100 * C / (Vs – Vz100)

Note that since only one calibration concentration is actually measured, there is only one S determined. However this S is used to compute engineering units from the other ranges should these be implemented by the logger during the measurement of samples.

Engineering units are computed as shown in the following table:

Range	EU
1X	EU = S * (Vs – Vz1)
10X	EU = S * (Vs– Vz10) / 10.0
100X	EU = S * (Vs– Vz100) / 100.0

Engineering units computed using the same range that was used to determine S will be more accurate than engineering units computed using other ranges since the sensor may not exactly implement ranges. For example the 100X range may actually be implemented by circuitry as 100.1X but the calculations would use 100X.

Chapter 2: Software

2.1 Overview

The Cyclops-7 Accessory Kit includes software to calibrate the sensor, and concatenate and display Cyclops-7 Logger data files. These programs are designed to operate on a Windows computer.

2.2 Software Installation

Software operation requires a Windows operating system computer. Both 32 and 64 bit computers are supported.

Install the software by copying the files below into any folder on your computer's hard drive.. There are four files and two folders:

- Cyc7Plot.jar – Concatenate logger data files and plot.
- Cyc7Calibration.jar – Facilitate calibration of sensor.
- jspWin.dll – library of java RS232 software interface to Windows operating system (32-bit is the default)
- 32 Bit PC Serial Driver folder
- 64 Bit PC Serial Driver folder

Cyc7Plot and Cyc7Calibration are Java language programs that require the host computer to have the Java Runtime Engine V1.6 or later installed. This engine is commonly required for internet applications and will likely already be installed on the host computer. Should this not be the case the JRE can be downloaded via internet from

http://www.java.com/en/download/inc/windows_upgrade_xpi.jsp

Cyc7Calibrate communicates with the host computer's serial port. It requires a serial port driver, jspWin.dll. The jspWin.dll in the files supplied is the 32 bit version. If your computer is operating a 64 bit JRE, delete jspWin.dll. In it's place copy the jspWin.dll from the 64 Bit PC Serial Driver folder. The correct (32 or 64 bit) jspWin.dll must be present in the same folder as Cyc7Calibrate.

If your computer does not have a serial port (these are called COM ports on Windows computers) you must supply a serial-to-USB adapter. These are supplied by PME or can be purchased from some other source. These adapters usually require that you install a driver. For PME's adapter follow instructions supplied with the adapter.

Click on Cyc7Plot or Cyc7Calibrate to run the program.

2.3 Cyc7Plot

Cyc7Plot performs two services:

- It concatenates all the measurement files it finds in the selected directory and writes these as CAT.TXT, and
- it displays the concatenated measurements.

When Cyc7Plot runs it presents the screen shown below.

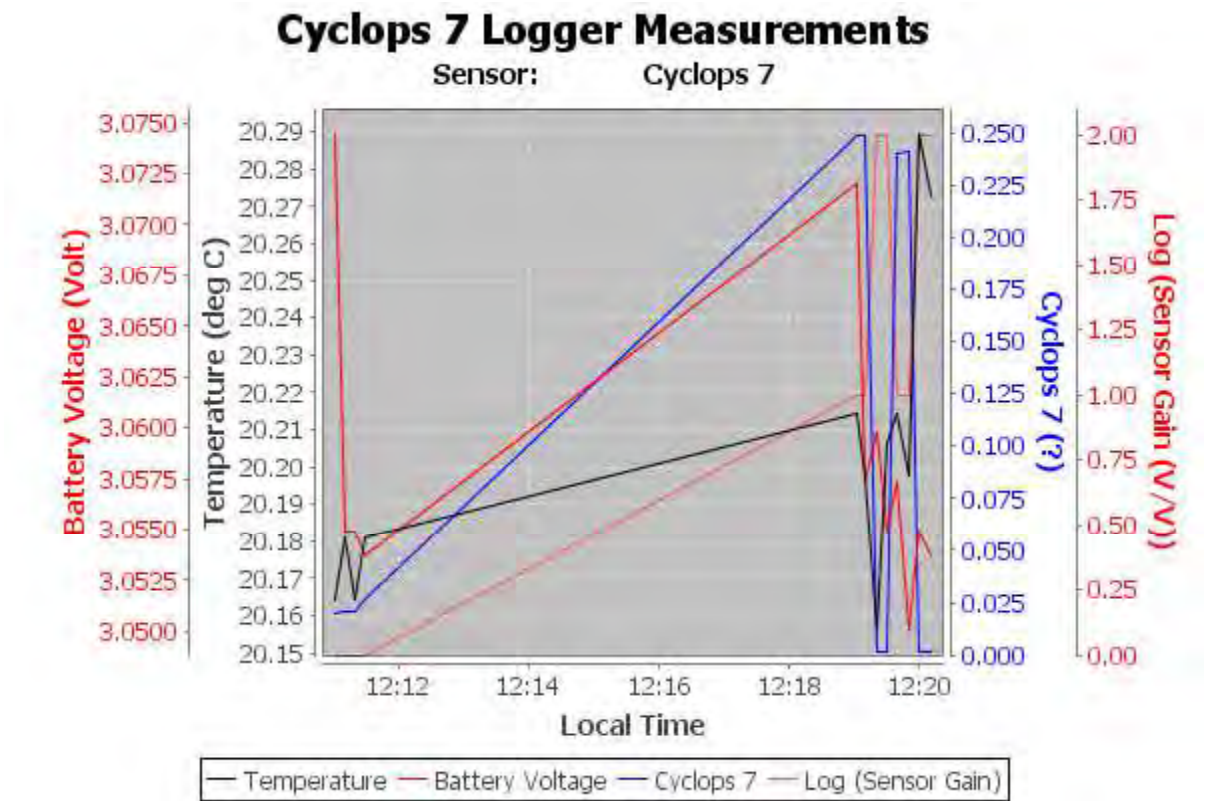
Select the DATA folder. This is the folder that contains your Cyclops-7 Logger measurement files. This folder MUST NOT contain any other files. This folder can be on the SD card from the Cyclops-7 or it can be from a copy of this on your computer's hard drive.

Press 'Process' to begin measurement processing. The software reads all Cyclops-7 Logger data files in the Data Folder, writes a CAT.TXT file in the same folder, and finally presents a plot of the measurements similar to the plot shown below.

Example CAT.TXT file:

```
Cyclops 7 Logger Concatenated Data File
Logger SN: 25
Concatenation Date: 2013Nov12 09:19:15 PST

            Unix Timestamp,              UTC_Date_&_Time,         Pacific Standard Time,  Battery Voltage,
                  (Second),                         (none),                       (none),           (Volt),
                1383234300,          2013-10-31 15:45:00,          2013-10-31 08:45:00,         3.371181,
                1383234360,          2013-10-31 15:46:00,          2013-10-31 08:46:00,         3.374844,
                1383234420,          2013-10-31 15:47:00,          2013-10-31 08:47:00,         3.378507,
                1383234480,          2013-10-31 15:48:00,          2013-10-31 08:48:00,         3.384612,
                1383234540,          2013-10-31 15:49:00,          2013-10-31 08:49:00,         3.385833,
                1383234600,          2013-10-31 15:50:00,          2013-10-31 08:50:00,         3.384612,
                1383234660,          2013-10-31 15:51:00,          2013-10-31 08:51:00,         3.382170,
```



You may zoom this plot by drawing a square from upper left to lower right (click and hold left mouse button) that defines the zoom region. To zoom completely out, attempt to draw a square from lower right to upper left. Right click on the plot for options such as copy and print.

The software may be run multiple times at the same time (select Data Folder, press Process, select new Data Folder, press Process...). In this case it produces multiple plots. Presently the plots are presented exactly on top of each other and so when a new plot appears it is not obvious that the old plot is still there. It is. Just move the new plot to see it. Closing any plot closes all.

The software can be re-run at any time. In this case it simply reads the Cyclops-7 Logger measurement files again and, after asking permission, overwrites the CAT.TXT file.

2.4 Cyc7Calibrate

The Cyc7Calibrate program provides these services:

- It enables time setting (based on internet timeserver clock),
- it enables sample interval setting,
- and it enables calibration of the sensor.

Often, sensor calibration depends on the actual material expected during the deployment. For example a CHL-a calibration done with one type of organism might

not apply well for a different organism. Sensors will likely be calibrated for each deployment situation. Turner C7 sensors are not factory calibrated.

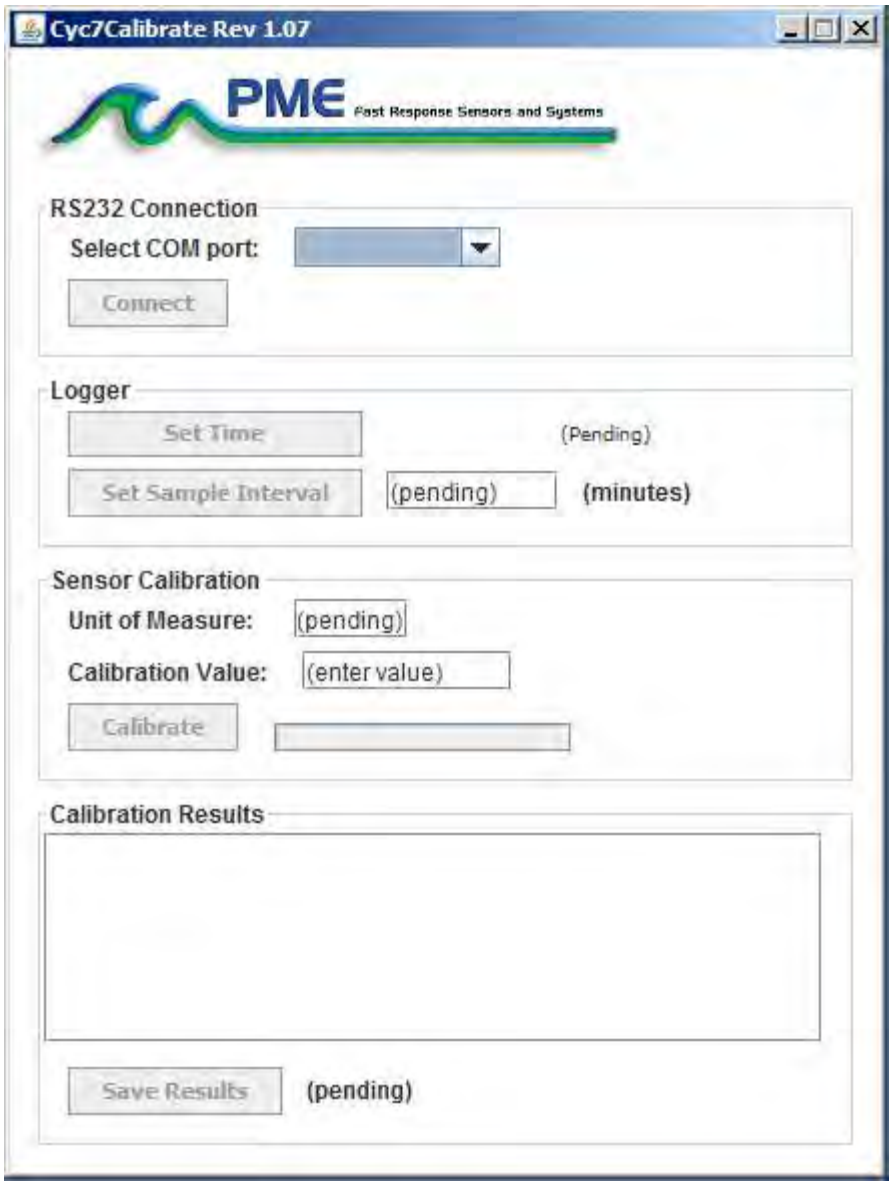
Cyclops-7 Loggers support various Turner Cyclops-7 sensors. The sensor type is shown on a small tag on the SD card holder.

When Cyc7Calibrate runs it first displays the following dialog.

Yes, the software really means it! The Cyclops-7 Logger MUST FIRST be connected to the computer COM port (or to a USB-to-COM adapter that is itself already connected to the computer with proper driver installed) and THEN the logger power turned on. When the logger is powered its internal software first checks to see if the logger is connected. If so, software becomes responsive to commands and presents a steady LED indication, if not software begins logging measurements and will NOT respond to Cyc7Calibrate commands.

See Chapter 3 for instructions on opening the logger and connecting the serial port.

After “OK” is pressed the Cyc7Calibrate user interface appears”



The first task is to connect to the Cyclops-7 Logger. This is accomplished by selecting the COM port (or to a USB-to-COM adapter) where the logger is connected. Connection is accomplished in response to the Connect button. Upon successful connection the button turns green and various information is read from the logger.

If the host computer is connected to the internet, the current difference between an internet time server's time and the Cyclops-7 Logger internal clock will be displayed next to the Set Time button. If this difference is acceptable the clock need not be set. If the computer is not connected to the internet a message will appear and the Set Time button will not be enabled.

To set the clock, click on the Set Time button. Software will set UTC time based upon an internet time server's clock. Time set will replace the time error displayed.

The Cyclops-7 sampling interval is set in response to the Set Sample Interval button. Enter the desired interval and click on the button. The value shown initially is the current value read from the logger.

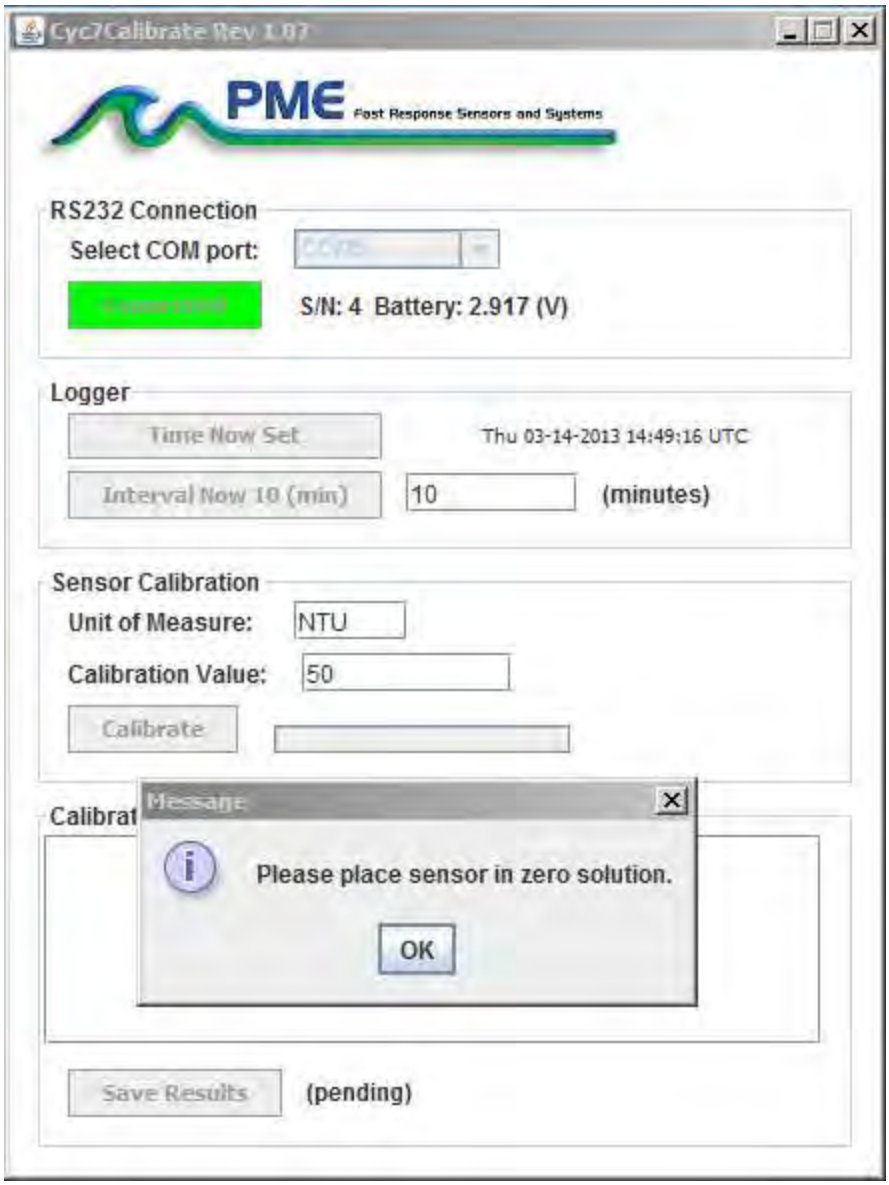
Sensor calibration requires that you provide two reference solutions. One solution will be the ‘zero’ (sometimes called the ‘blank’) solution and will contain none of the material being sensed. The other solution, the ‘calibration’ solution, will contain a known quantity of the material being sensed. It may also be that the calibration is a solid standard. This calibration quantity must be no more than the measurement range of the sensor on its 1X scale but it can be less. See Chapter 1 for a description of sensor ranges.

Sensors are calibrated in response to the Calibrate button, after both the Unit of Measure and the Calibration Value are entered.

Enter the unit of measure that is appropriate for the Cyclops 7 sensor mounted on the logger.

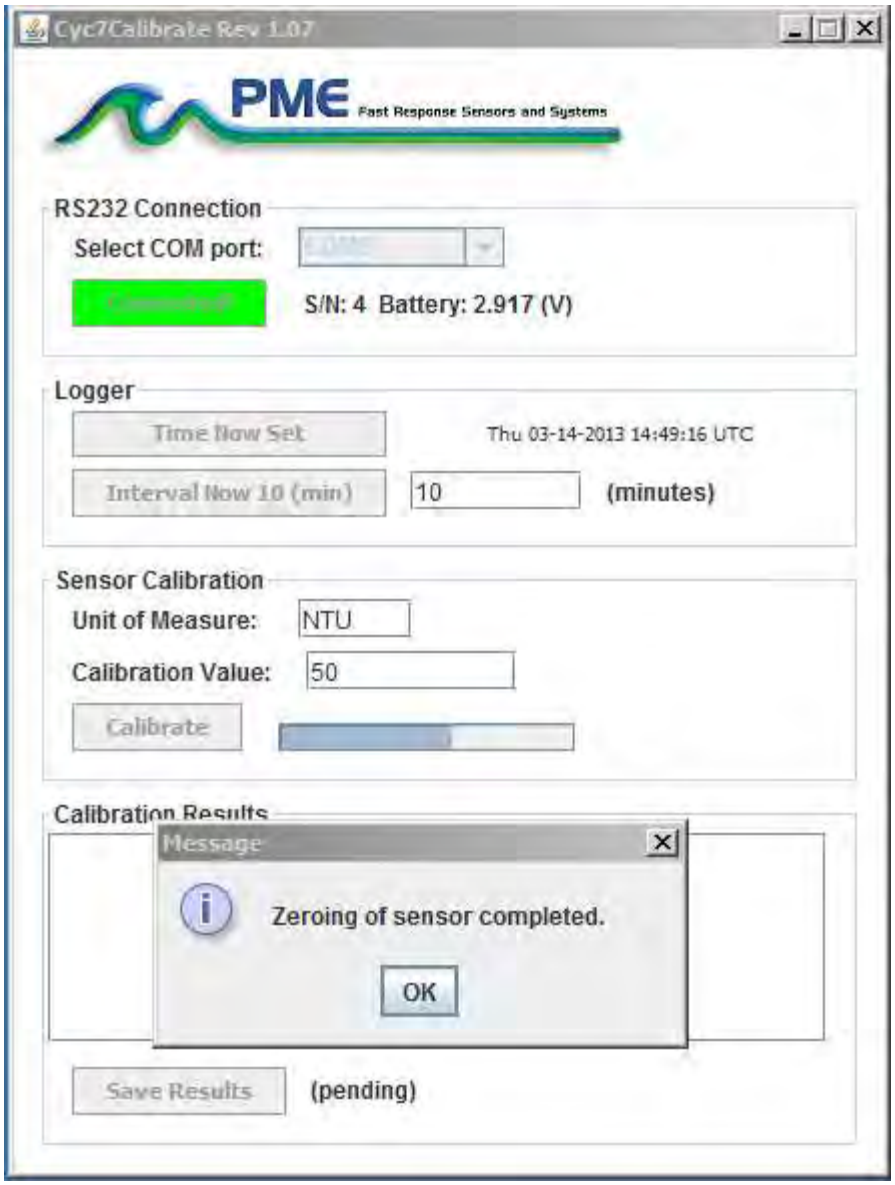
Enter the calibration value for the solution.

Click on the Calibrate button. The adjacent scroll bar shows how far the program has progress through the calibration procedure.

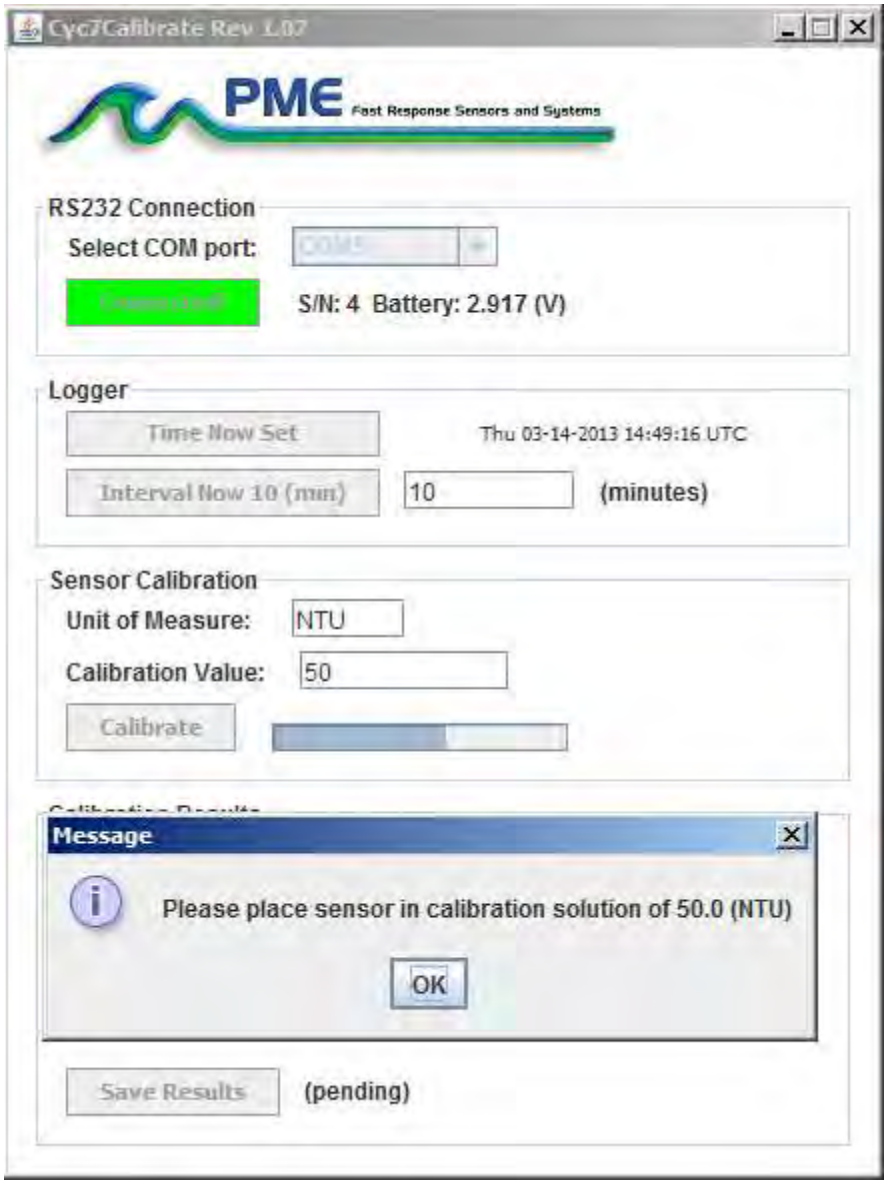


A dialog window appears instructing you to place the sensor in the zero solution. This will most likely simply be clear water contained in a bucket. Whatever the solution, the sensor after calibration will report 0 when returned to this solution. Click OK when the sensor is suitably positioned.

At this time the software reads information from the sensor, selecting all three ranges of the sensor sensitivity.



When this is completed a Zeroing of sensor completed dialog appears. Click OK.

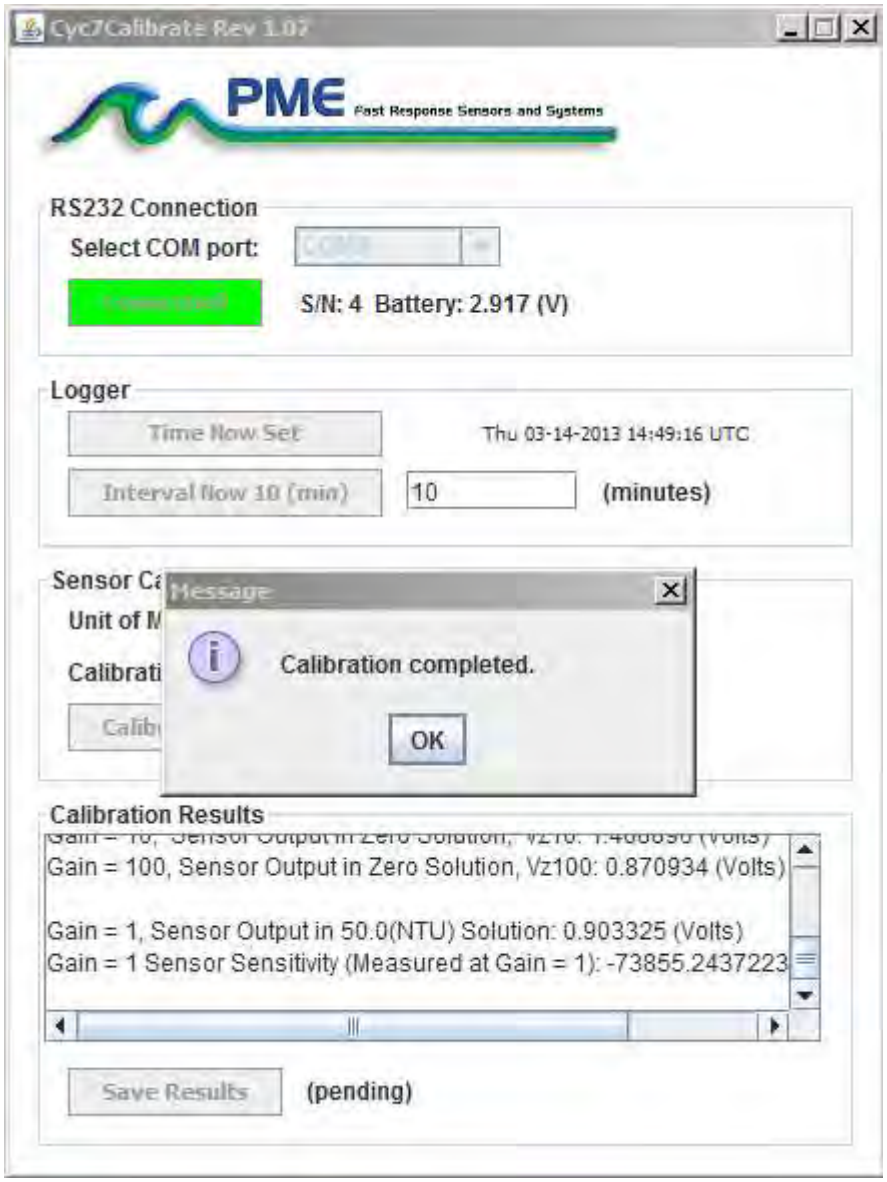


A “Please place sensor in calibration solution of <Calibration Value> (<Unit of Measure>)” dialog appears. In the screen shot above the value of 50.0 (NTU) is displayed. This information is taken from the Unit of Measure and Calibration Value text boxes and will be whatever is entered in the boxes.

Place the sensor in the calibration solution. Whatever the solution, the sensor after calibration will report the calibration value (50 NTU in the above example) when returned to this solution.

Click OK. At this time the software reads information from the sensor, selecting the best sensitivity range.

When this is completed a “Calibration completed” dialog window appears along with the actual calibration results.



Click OK. You may now save the results on disk by clicking the Save Results. Note that the calibration has been installed in the sensor and the sensor is calibrated no matter if the results are saved on disk or not.

If you choose to save the results a file save dialog appears. You must create a name for the calibration file, including the appropriate suffix. The .txt suffix is suggested since software saves a text file.

You may read the saved file later using a text file editor.

A note about Turner solid state secondary standards: These standards are not supplied with any calibration value, so they are not at first useful for calibration. However, once the sensor is calibrated the solid state secondary standard can be placed onto the sensor and adjusted so that the sensed value is some arbitrary value.

Please refer to Turner's documentation concerning the Solid Secondary Standard that is supplied with the standard or via the internet:

Install the standard as described. The logger's sensor guard must be unscrewed and removed for this procedure.

Operationally, adjustment of a standard is not well implemented in the logger software. Step 2 of theUse of the Solid Secondary Standard for in vivo Chlorophyll Applications on page 1 of this document assumes that the sensor output can be viewed in real time. However this output can only be logged by the Cyclops-7 Logger. A short recording of the measurement must be made, and then the record reviewed, to determine the sensed value. The process must be repeated by trials to adjust the standard as described in the document.

Chapter 3: Cyclops-7 Logger

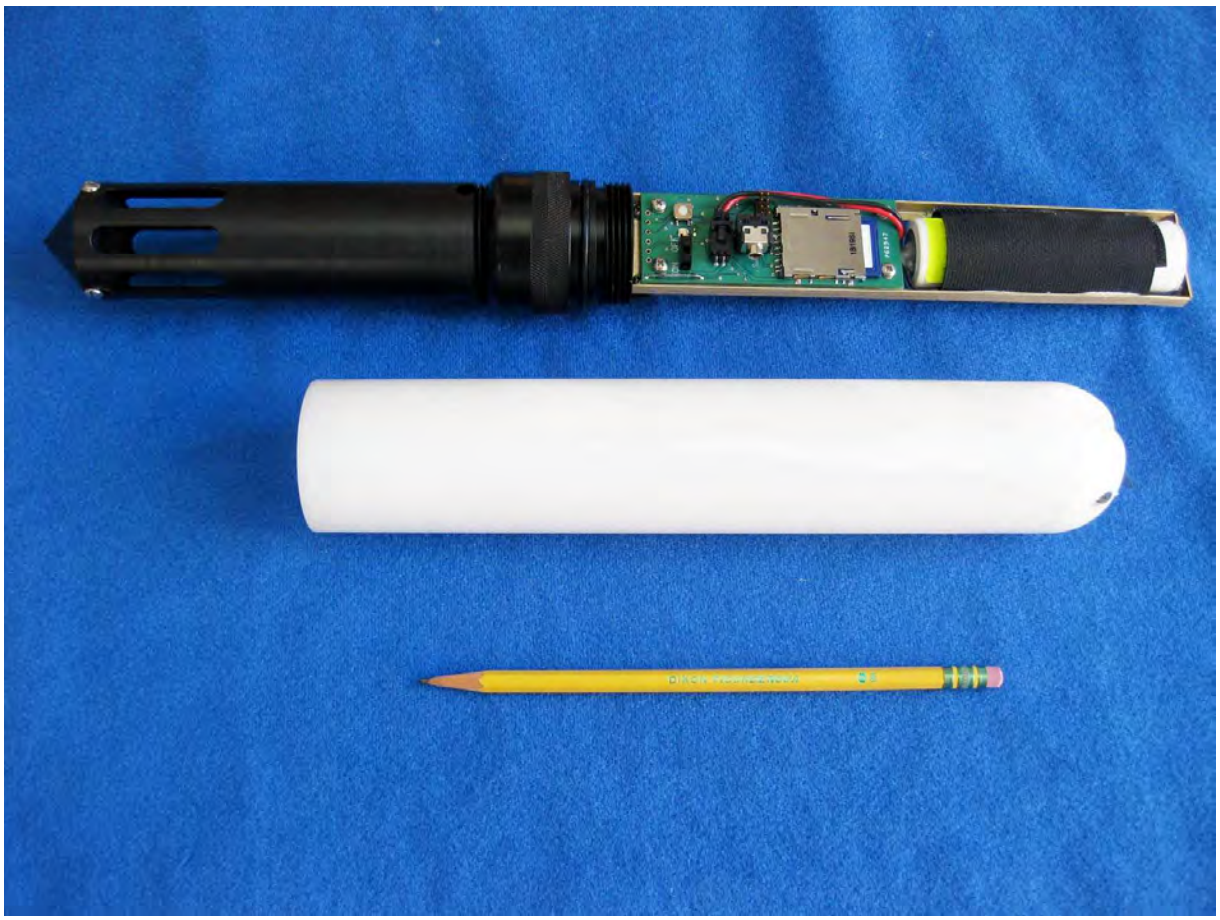
3.1 Overview

All of the Cyclops-7 Logger measurements pass from the sensors onto the SD card it contains. Measurements may flow from the logger to host computer by removing the SD card and copying the contents. Customers will be required to open the logger each time measurements are obtained. This chapter describes the logger internal features.

3.2 Opening and Closing the Logger

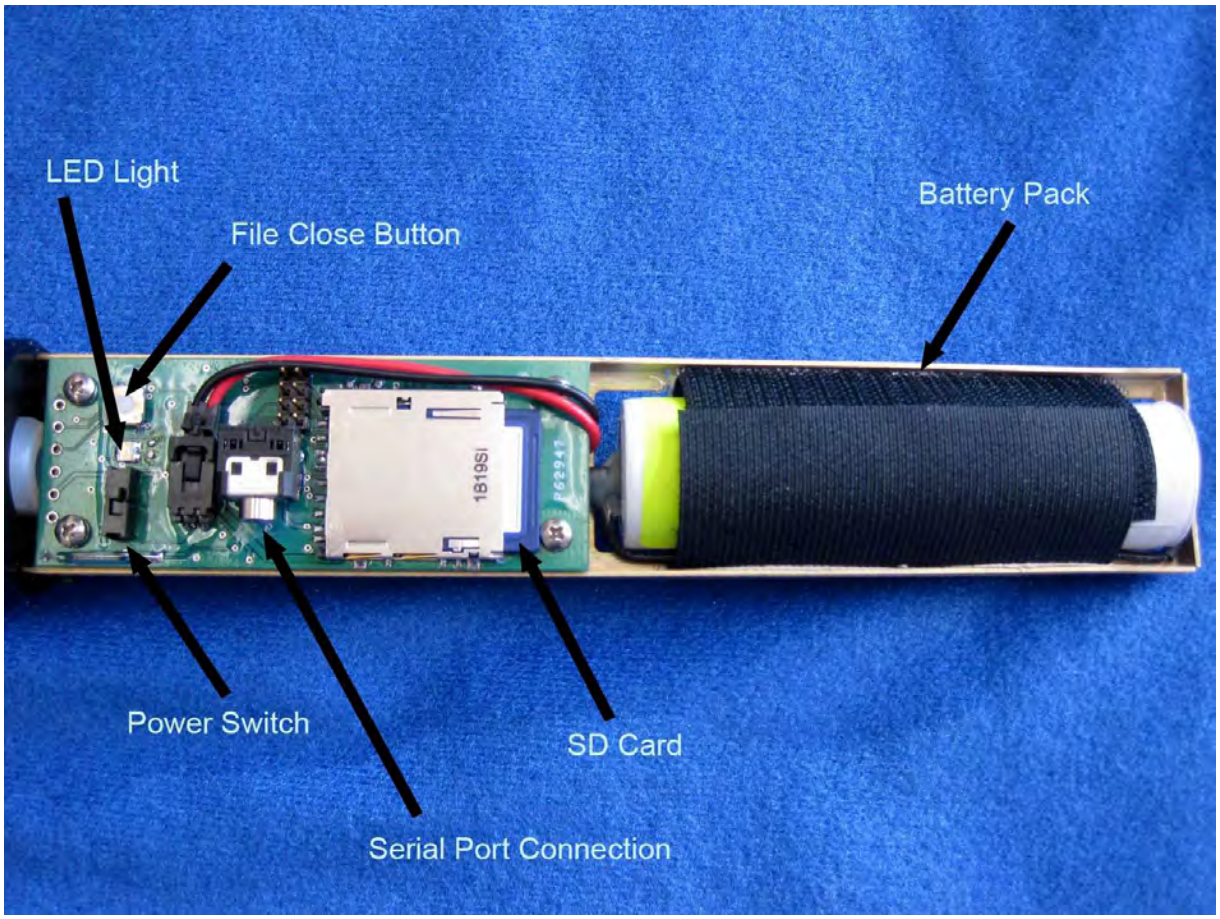
The logger circuitry is contained in a waterproof housing that must be opened. The housing is opened by unscrewing the white pressure housing from the black end cap. Turn the pressure housing counter clockwise relative to black end cap. Close by reversing this procedure after being sure that the o-ring is free from debris. Lube o-ring occasionally with grease intended for buna-n o-ring material.

The logger is much more difficult to open than to close. Screw the white logger housing onto the black cap until the housing touches the cap. No further tightening is necessary.



3.3 Electrical Connections and Controls

Removal of the cover reveals the logger connections and controls, shown below.



The **SD Card** contains data files and the calibration file. These are described elsewhere in this manual. Note that the battery pack and one screw must be removed to remove the SD card.

The **LED Light** is a yellow LED. This is used to indicate different features described elsewhere in this manual.

The **File Close Button** causes the program to save the current file and halt measurement logging. Press this button prior to switching power off. If you switch off without pressing this button nothing really bad happens but the last file that could contain up to 6 hours measurements will be forgotton.

The **Serial Port Connection** allows communication between the logger and an external computer. Communication parameters are 9600 baud with 8 bits, no parity, and one stop bit. The external computer must have a communication program such

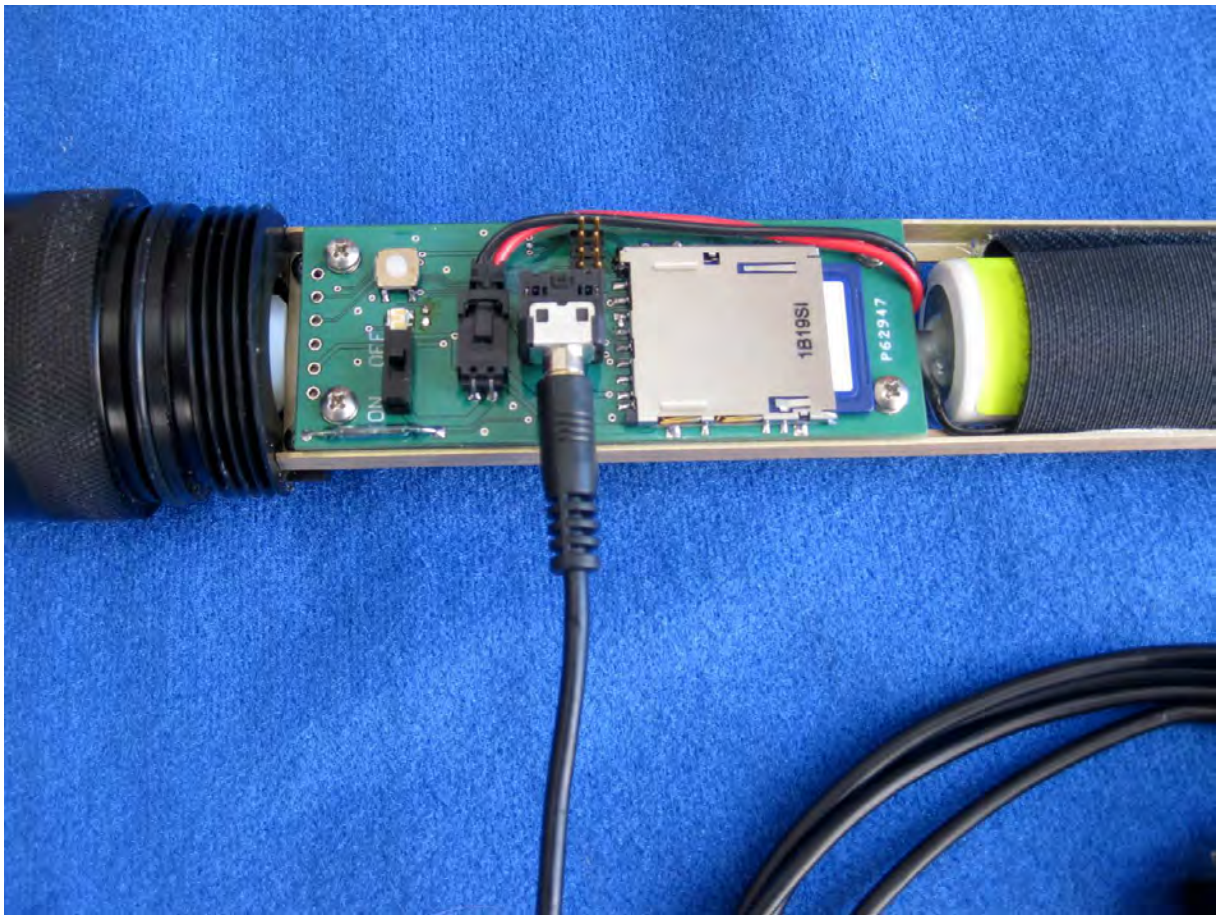
as Hyperterminal (for PC) or equivalent, a connecting cable, and must have a serial port or USB to serial adapter. The Cyc7Calibrate and Cyc7Service programs use this connection. Plug the connection cable supplied with the Cyclops-7 Logger into this connector. Plug opposite end to the host computer's COM port.

The **On/Off Switch** connects or disconnects battery power to the logger. In the 'Off' position the logger is completely without power except for the clock circuit. Note that 'On' and 'Off' positions are marked in white letters on the circuit board nearby the On/Off Switch.

The **Main Battery** provides main power to the Cyclops-7 Logger.

3.4 Connection to Serial Port

The Cyclops-7 Logger must be connected to a host computer to use the Cyc7Calibrate and Cyc7Service software. It can also communicate with a terminal program such as Hyperterminal.



Connect the Cyclops-7 Logger to a host computer by plugging the connection cable into the RS232 connection within the Cyclops-7 Logger. Connect the opposite end (9-pin D connector) to the host computer's serial port. On a PC desktop this is the COM port. Some computers may not implement a COM port in which case the serial

port must be emulated by using a USB to Serial converter. PME supplies a serial-to-USB converter in the Cyclops-7 Accessory Kit.

In addition to the physical connection, the host computer may run a terminal program such as Hyperterminal. Windows 2000 and XP ship with Hyperterminal located at programs|accessories|communication. Later Windows operating systems do not. The Cyclops-7 Logger communicates as shown in the table below. Appendix 1 shows how to set Hyperterminal for this protocol and gives other information about communications programs.

In general, Customers should not need to use software besides Cyc7Calibrate to communicate with the Cyclops-7 Logger.

Feature	Parameter
Baud Rate	9600 (bits/second)
Bits sent per byte	8 (bits)
Parity	none
Stop bits sent	1 (bit)
Flow control	none

3.5 File Close Button

The logger records individual measurements to the SD card file when the measurement is made. After each measurement the file remains open. If the power fails or is switched off while the file is open, then the file information is lost. Files are recorded 4 times daily so only as much as 6 hours of measurements are at risk. The user must inform the Cyclops-7 software that the power is about to be switched off by pressing the File Close button. The software will detect this action and close the presently open file. Thereafter the logger will halt its mission, flash its LED repeatedly.

There is no way to exit this loop except by turning the logger power off.

3.6 Battery Replacement

Carefully remove both “C” cells, noting the direction of the (+) terminals. These both are oriented towards the SD card and circuit. Insert new ‘C’ cells into the paper tube and re-install the pair into the battery holder. Take care not to break the glue connection between the holder and the aluminum chassis.

3.7 File Management

The Cyclops-7 Logger writes 4 data files daily onto the SD card. These are text files that contain the measured data. These files contain the serial number of the

Cyclops-7 Logger that wrote the file and also a time stamp for each measurement. The Cyclops-7 Plot software reads all these files and produces a CAT.TXT file that contains the original data plus extra information.

The recommended method of file management is the following:

1) Deploy the Cyclops-7 Logger for a period, and recover it.
2) Remove the SD card and place in a card reader on a host Windows computer.
3) Run Cyclops-7 Plot, selecting the DATA directory on the SD card. This creates the CAT.TXT file in the SD card DATA directory.
4) Create a folder on the host computer for this Cyclops-7 Logger deployment. Copy all files in the SD card DATA directory to this folder. Keep deployments of the same Cyclops-7 logger in separate folders. Keep files from separate Cyclops-7 sensors separated as well.
5) Delete all files in the SD card DATA directory.

File management may be handled in other ways, but in any event be sure that the SD card DATA folder is empty prior to beginning a deployment. If it is not empty nothing bad happens but unpredictable Cyclops-7 Logger operation may occur if the number of files becomes large, roughly over 1000 files.

3.8 SD Card

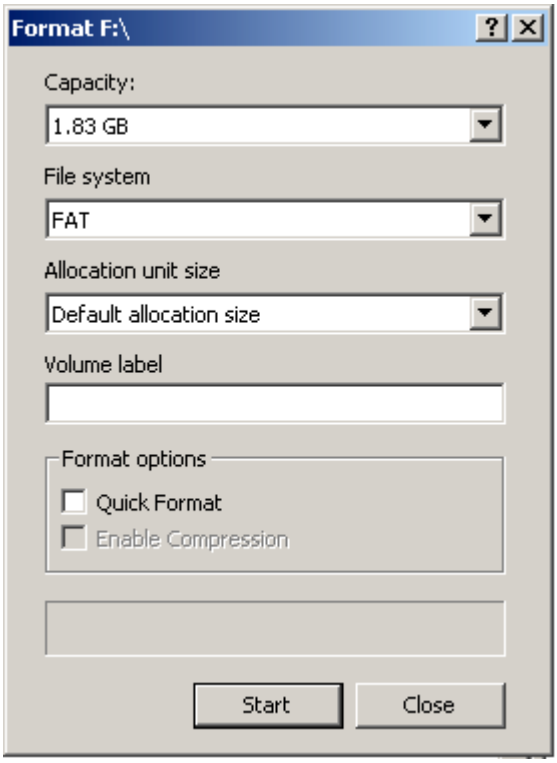
THE SD CARD IS NOT HOT-SWAPPABLE. POWER MUST BE SWITCHED OFF PRIOR TO INSERTING OR REMOVING THE SD CARD. IF THIS IS NOT DONE, DAMAGE TO THE SD CARD MAY RESULT.

Cyclops-7 is supplied with a 2 GB SD card. Alternates can be purchased and used with Cyclops-7. Use only SanDisk 2 GB SD cards. Cards manufactured by other manufacturers may work also but PME has tried SanDisk. In any event use only 2 GB capacity cards.

Format every card prior to using with Cyclops-7.

Format cards only on a PC computer running a Windows operating system. Other computers or operating systems may work but PME has tried only Windows.

When formatting, select FAT, not NTFS or FAT32. Do not provide a volume label nor select Quick Format. Here is the correctly set Windows 2000 Format dialog:



The SD card is retained by a small screw that must be removed prior to removing the SD card. If the retaining screw is lost, the SD card can be ejected from its socket if the Cyclops-7 Logger is dropped on its pressure housing end. The logger will be unable to log should this occur. If the retaining screw is lost the SD card can be taped in place using a bit of electrical tape.

3.9 Interchangeable Sensor Installation

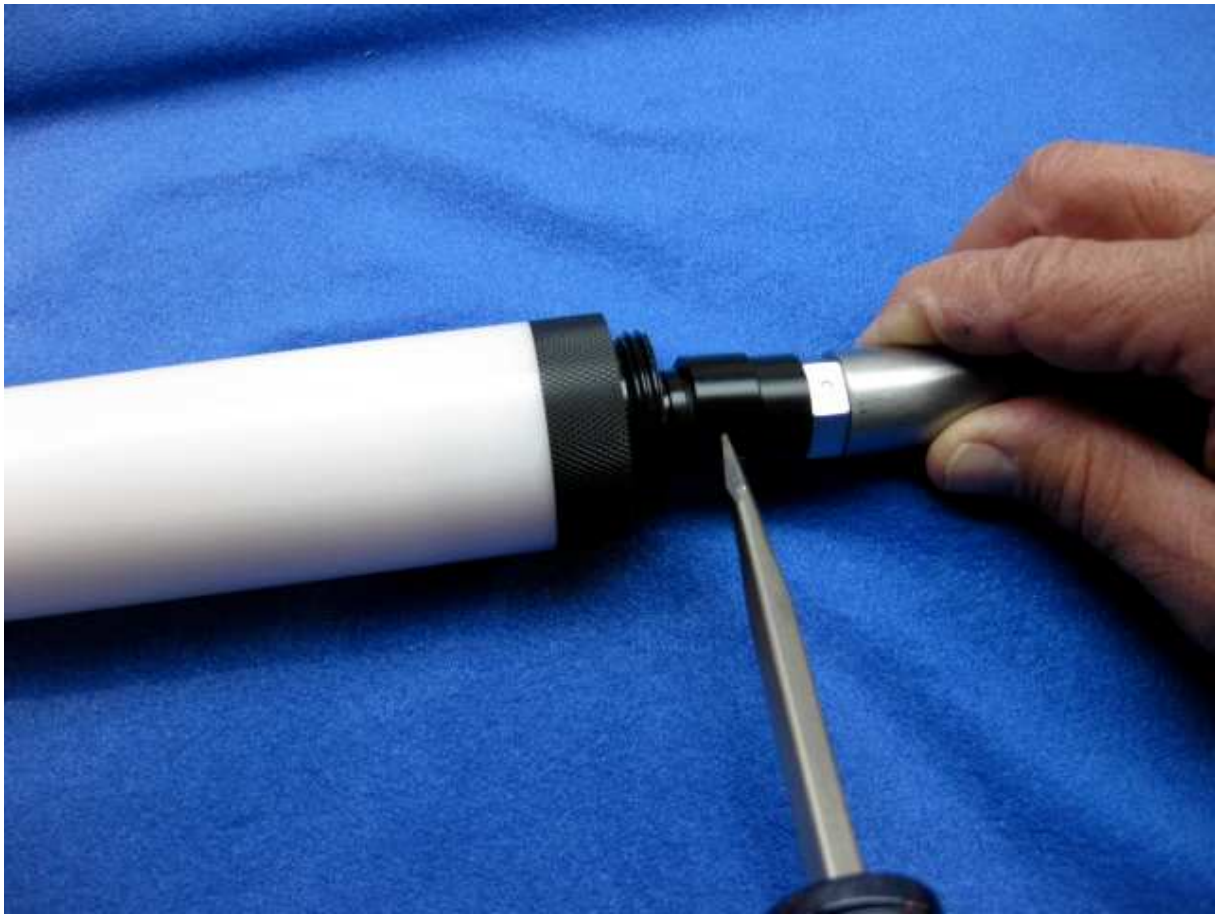
PME provides two types of Cyclops-7 loggers. Most of this document describes the version where the sensor is permanently mounted within the logger. This section describes the Interchangeable sensor. The other features described throughout this document are the same for both types of loggers.

Arrange the parts as shown in the picture below. Note that PME does not supply the sensor shown unless it is specially orderd.

The small circular black clip shown to the left of the C7 sensor will be found installed on the logger connector. These can be removed by gently opening the clip with a screw driver as shown in the picture below.

Place the clip (second piece left from sensor in picture above) onto the body (next to sensor in picture) and screw these onto the sensor connector threads.

Engage the sensor connector pins with the logger connector sockets. Gently spread the clip as shown below while pressing the sensor connector into the logger connector.



When the connector is fully mated remove the spreader. The clip should snap shut and have the same diameter as the body. This clip prevents the sensor from being unplugged during deployment.

Slide the sensor support (middle-left in first picture) over the sensor. Note this part has an internal o-ring that comes against the sensor. This is not a water-proof seal. It's purpose is to firmly secure the sensor within the support. Next screw the sensor guard (middle right in first picture) onto the sensor support. The completed assembly is shown in the picture below.

When exchanging the sensor, reverse the process steps given above.

The sensor connector is itself threaded into the logger end cap. This connector is tightened, but since the logger end cap is plastic there is a limit to how tightened this connector can be made. If the connector unscrews water can enter the logger and cause permanent damage. Be observant when installing sensors. When installed, the sensor should not be able to be rotated. Take care not to unscrew the sensor and watch the sensor when unscrewing the sensor support since the o-ring will apply a sight loosing rotation to the sensor. Should the sensor/connector become loose discontinue use of the logger and contact PME.

9.FL.PTSAP0

Spectra Colors Corporation
You'll Know Us By Our Colors

MATERIAL SAFETY DATA SHEET

prepared according to OSHA and 91/155/EEC guidelines

25 Rizzolo Road Kearny, NJ 07032 800 527-8588 (USA)
201 997-0606 (INT'L) fax- 201 997-0504 www.Spectracolors.com

Emergency Contact Numbers: (*CHEMTREC* – **800 424-9300** USA) (*CHEMTREC* **+1 703 527-3887** OUTSIDE USA)

Date issued: 4-mrt-11

SECTION 1 :CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name **SPECTRA TRACE SH-P**

Spectra Code # **9.FL.PTSAP0**

CAS No: **59572-10-0**
C.I. No: **None Known.**
C.I. Name: **FLUORESCENT**
Chemical Family: **1,3,6,8-PYRENE TETRA SULF AC S**

HMIS CODE: **4** – SEVERE HAZARD, **3** – SERIOUS HAZARD, **2** – MODERATE HAZARD, **1** – SLIGHT HAZARD, **0** – MINIMAL HAZARD
Personal Protection Code: (see section 8)

SECTION 2 : COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Name	% of Comp.	Cas No.	Colour Index No.	Color Index Name	EEC No.
None	None	None	None	None	None

SECTION 3 : HAZARDS IDENTIFICATION

Physical / Chemical Hazard: EYES: Flush with large amounts of water. SKIN: Shower with soap & water. INHALATION: Remove to fresh air. ALWAYS GET MEDICAL ATTENTION IF IRRITATION DEVELOPS. INGESTION: Get immediate medical attention.

Environmental Hazard: No Data Available
Human Health Hazard:

SECTION 4 : FIRST AID MEASURES

Symptoms: THIS PRODUCT IS NOT HAZARDOUS AS DEFINED BY HAZARDOUS COMMUNI- CATION STANDARD. HOWEVER, AS WITH ALL CHEMICAL; HANDLE WITH CARE AVOID EYE & SKIN CONTACT, AVOID INHALATION OF DUSTS OR VAPORS. WASH THOROUGHLY AFTER HANDLING. KEEP CONTAINERS CLOSED.
Eyes: Flush with plenty of cool water for at least15 minutes, holding eyelids apart for thorough irrigation. Get immediate medical attention.
Skin: Wash affected area thoroughly with soap and water. If any irritation develops, cosnult a Physician.
Ingestion: Remove to fresh air. If breathing is difficult, give oxygen and get immediate medical attention.
Inhalation: Induce vomiting – seek immediate medical attention.

SECTION 5 : FIRE FIGHTING MEASURES

Flash Point F(C): NORMALLY STABLE, NOT COMBUSTIBLE NOR FLAMMABLE.
Flammable Limits: NORMALLY STABLE, NOT COMBUSTIBLE NOR FLAMMABLE.
Extinguishing Media: WATER, DRY CHEMICAL,CARBON DIOXIDE,FOAM
Special protective Equipment: WEAR SELF-CONTAINED BREATHING APPARATUS.
Unusual Fire & Explosion Procedures: NONE EXPECTED. FIREFIGHTERS SHOULD BE EQUIPPED WITH SELF- CONTAINED BREATHING

P/N 998-0127

25 Rizzolo Road Kearny, NJ 07032 800 527-8588 (USA)
201 997-0606 (INT'L) fax- 201 997-0504 www.Spectracolors.com

Emergency Contact Numbers: (*CHEMTREC* – **800 424-9300** USA) (*CHEMTREC* **+1 703 527-3887** OUTSIDE USA)

Date issued: 4-mrt-11

APPARATUS TO GUARD AGAINST POTENTIALLY TOXIC AND IRRITATING FUMES. AVOID DUSTING. DUST CAN FORM EXPLOSIVE MIXTURES WITH AIR.

SECTION 6 : ACCIDENTAL RELEASE MEASURES

Personal Precautions:	Avoid any uncontrolled releasae of material.
Spills / Leaks:	Where spills are possible, a comphensive spill response plan should be developed and implemented. Steps to be taken if material is released or spilled are as follows: Utilize recommended protective clothing and equipment. Spills should be swept by using an absorbant dust control product and placed in containers. Spill area can be washed with water. Collect water for approved disposal. In the event of an uncontrolled release of this material, the user should determine if the release is reportable under applicable laws and regulations.
CERCLA:	NOT REGULATED.
RCRA status:	NOT REGULATED.
Section 302:	NOT REGULATED.
Section 313:	NOT REGULATED.
	THIS PRODUCT IS NOT HAZARDOUS AS DEFINED BY HAZARDOUS COMMUNI- CATION STANDARD. HOWEVER, AS WITH ALL CHEMICAL; HANDLE WITH CARE AVOID EYE & SKIN CONTACT, AVOID INHALATION OF DUSTS OR VAPORS. WASH THOROUGHLY AFTER HANDLING. KEEP CONTAINERS CLOSED.

SECTION 7 :HANDLING & STORAGE

Handling:	Handle with CARE. AVOID over exposure. Use NIOSH/OSHA APPROVED RESPIRATOR, WORK GLOVES and CLOTHING. WASH after handling. SENSITIVE INDIVIDUALS MAY EXPERIENCE RESPIRATORY ALLERGIES. MAY CAUSE SKIN IRRITATION. USE WITH LOCAL VENTILATION.
Storage:	
Storage Class:	FLUORESCENT

SECTION 8 :EXPOSURE CONTROLS / PERSONAL PROTECTION

Eyes:	Safety goggles or full face shield
Skin:	Plastic or rubber gloves
Body Protection:	Coveralls and non-leather soled work shoes.
Hygiene Practices:	Wash dye contaminted clothes and skin with mild soaps and detergents.

SECTION 9 : PHYSICAL AND CHEMICAL PROPERTIES

Appearance and Odor:	YELLOW POWDER / NO ODOR
Boiling Point:	0.00
Melting Point:	ND
Molecular Wt.:	NA
pH:	ND
Solubility in water:	Yes.
Bulk Density (gm /cc):	0.0000000
Specific Gravity :	0.00
Flash Point:	NORMALLY STABLE, NOT COMBUSTIBLE NOR FLAMMABLE.
Vapor Pressure :	NA
Vapor Density :	NA
Explosive Limit (lower) :	No exposure limits have been determined or found in existing published studies. It is suggested that this product be used in accordance with good industrial practices. HANDLE THIS PRODUCT WITH CARE. AVOID PERSONAL CONTACT
Explosive Limit (higher) :	No exposure limits have been determined or found in existing published studies. It is suggested that this product be used in accordance with good industrial practices. HANDLE THIS PRODUCT WITH CARE. AVOID PERSONAL CONTACT

SECTION 10 : STABILITY AND REACTIVITY

Chemical Stability:	
Conditions to Avoid:	OXIDIZING & REDUCING AGENTS MAY DESTROY COLOR.

Materials to Avoid:	OXIDIZING & REDUCING AGENTS MAY DESTROY COLOR.
Hazardous Decomposition Products:	CO, CO2, OXIDES OF NITROGEN AND OTHER POTENTIALLY TOXIC FUMES.

SECTION 11 : TOXICOLOGICAL INFORMATION

Oral(Animal):	NO DATA AVAILABLE.
Dermal (Animal):	NO DATA AVAILABLE.
Effects to eyes (Animal):	NO DATA AVAILABLE.
Skin irritation (Animal):	NO DATA AVAILABLE.

SECTION 12 : ECOLOGICAL INFORMATION

No Data Available

Fish toxicitiy:	NO DATA AVAILABLE.
Bacteria Toxicity:	
Biodegredation:	

SECTION 13 : DISPOSAL CONSIDERATION

Dispose of only in an approved land-fill area or by controlled incineration in accordance with local and State regulations.

Dispose Code Number:	
Contaminated Packaging:	Empty bags thoroughly. Carry out the proper recycling, re-usage or disposal. Please refer to the relevant EU regulations, in particular the guidelines/ decisions of the council regarding handling of wastes (e.g. 75/442/EEC, 91/689/EEC, 94/67/EC, 94/904/EC) as implemented in national regulations.

SECTION 14 : TRANSPORT INFORMATION

UN Number :

REGULATION	DESCRIPTION (proper shipping name)
DOT :	NONE
Land Transport / ADR/RID/GGVS/GGVE :	
Air Transport / IATA :	
Sea Transport / IMDG/GGVSee :	

SECTION 15 : REGULATORY INFORMATION

E C Classification	(67/548/EEC – 88/379/EEC)
TSCA Listed:	IN COMPLIANCE
DSL Listed:	
NDSL Listed:	
Label Name:	
R-phrases:	
S-phrases:	

SECTION 16 : OTHER INFORMATION

25 Rizzolo Road Kearny, NJ 07032 800 527-8588 (USA)
201 997-0606 (INT'L) fax- 201 997-0504 www.Spectracolors.com

Emergency Contact Numbers: (*CHEMTREC* – **800 424-9300** USA) (*CHEMTREC* **+1 703 527-3887** OUTSIDE USA)

Date issued: 4-mrt-11

The above Information is based on the present state of our knowledge of the product at the time of publication. It is given in good faith. No warranty is implied with respect to the quality or the specification of the product and the user must satisfy him self that the product is entirely suitable for his purposes