CYCLOPS-7 First Time Operation

Introduction

The following procedure will describe how to make measurements with the CYCLOPS-7 fluorometer/turbidimeter. For more complete information, please refer to the User's Manual.

Initial Connections

Attach the accessory connector/pigtail connector to the sensor, and connect the pigtail wires as shown in Figure 1. Do not connect or ground the Brown and Blue wires at this time – leaving them disconnected will set the sensor to the X1 gain range.

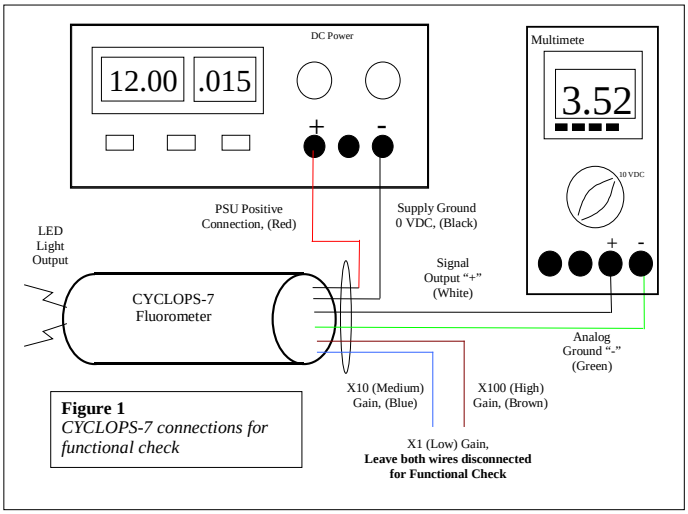

Figure 1
CYCLOPS-7 connections for functional check

Functional Test Validation

With the CYCLOPS-7 connected as shown in Fig. 1, make the following functional checks:

- The LED is on
- The multimeter reads >0 VDC
- Moving the light source close to your hand causes the output voltage to increase.

Choosing the Right Gain Setting

The gain setting refers to the sensitivity adjustment of the sensor. There are three gain settings; X1, X10 and X100. As the gain increases, the sensitivity increases and the measurement range decreases. All three gain settings can be used, however, you must determine which gain to use prior to deployment and have an integration cable made to activate a specific gain (see Appendix B). In other words, only one gain setting can be used at a time and if you want the ability to utilize all three gains with a multi-.parameter system, such as a CTD, you will need to purchase three separate integration cables.

In most instances the X10 gain will provide the appropriate sensitivity and range. If you are working in very low concentration applications (<2 µg/L chl *a* or, <5 ppb rhodamine WT), the X100 gain is recommended. If very high concentrations are expected (>40 µg/L chl *a* or >80 ppb rhodamine WT) the X1gain is recommended.

If you are uncertain of which gain setting to use you can take readings of a representative sample of water in the laboratory and determine which gain is the most appropriate.

Gain Switching Table

Gain X10 (Blue)	Gain X100 (Brown)	Gain	Chl Range (µg/L)	RWT Range (ppb)	TRB Range (NTU)
Not connected	Not connected	X1	0-500	0-1,000	0-3000
Connected to analog ground	Not connected	X10	0-50	0-100	0-1000
Not connected	Connected to analog ground	X100	0-5	0-10	0-100

**Gain switching table includes a subset of the available applications.*

Gain Determination Procedure:

1) For *in vivo* chlorophyll applications, take a natural sample of water from a sampling station where you plan to deploy the CYCLOPS-7. Applying good measurement practices, store it properly, and quickly transport it to a laboratory where you have the CYCLOPS-7 connected to a multimeter and DC power source. (see Figure 1)
2) Pour the water sample into to a clean glass beaker and submerge the optical end of the CYCLOPS-7 (See Sample Analysis below).
3) Activate the X10 gain setting (see Gain Switching Table above). If you believe the sample represents a typical condition, i.e. not a bloom or other abnormal event, obtain a signal from the sample that is significantly higher than a blank sample (DI 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-7.
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 even easier for dye tracing applications. Simply create the dye dilution of interest, and record what signal level it provides on the three gain settings.

Once the appropriate gain setting has been determined, order an integration cable for the particular gain. See Appendix D in the CYCLOPS-7 User's Manual for more information on Integration Cables.

Sample Analysis

When using the CYCLOPS-7 in the laboratory it is important to be aware of the following points:

1) When using the CYCLOPS-7 with discrete samples, allow at least 3" of clearance from the bottom of a sample container.
2) Ensure that there are no reflective or light colored surfaces under the sample containers. White or reflective surfaces will result in an elevated signal.
3) Check the optical surface of the sensor to ensure it is free from bubbles.

Recommended Measurement Practices

Linear Range and Quenching

The linear range is the concentration range in which the CYCLOPS-7 output is directly proportional to the concentration of the fluorophore. 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; the filters used; and the 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 3. At even higher concentrations, the signal will decrease even though the sample concentrations are continuing to increase. This effect is known as "signal quenching".

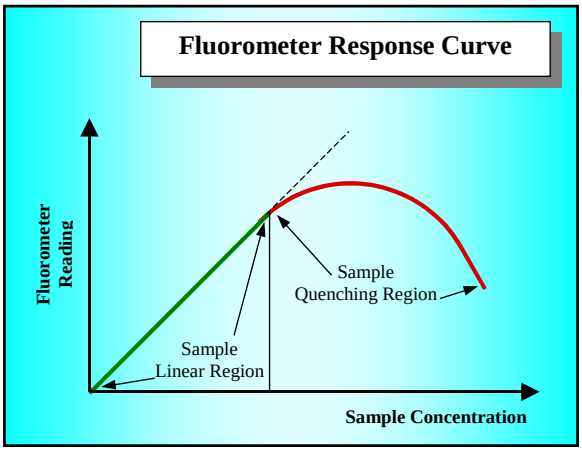

Figure 3.

Linearity may 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 a, please refer to the application section of Turner Designs' web site at the following URL:

http://www.turnerdesigns.com/t2/doc/tutorials/main.html

How to identify which fluorophore your Cyclops-7 is configured for:

"C" = Chlorophyll
"R" = Rhodamine WT
"F" = Fluorescein
"P" = Phycocyanin
"E" = Phycoerythrin
"U" = CDOM
"O" = Crude Oil
"B" = Optical Brighteners
"T" = Turbidity

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