Technical Note:

Cyclops-7 or 7F Calibration Using Liquid Dye Standards

Turner Designs liquid dye standards can be used to calibrate Cyclops instruments by converting voltage output to concentration estimates. We correlated the response from various dye standards with actual fluorophore concentrations for many of our applications so customers simply choose the appropriate standard for their application, if listed below, and calibrate their Cyclops instruments using the following instructions to obtain fluorophore concentration estimates.

Application (Channel)	Liquid Calibration Standard Concentration (ppb)	Part Number	Fluorophore Concentration	Fluorophore	NOTES
Chl *in vivo* (Blue)	RWT 400 ppb	6500-120	40 µg/L	CHL	
Phycocyanin (PC)	RWT 200 ppb	6500-020	260 ppb	PC	
Phycoerythrin (PE)	RWT 50 ppb	6500-020 (See NOTES)	500 ppb	PE	Dilute 6500-020 to 50 ppb (1 part dye to 3 parts deionized water) before use with Calibration Instructions 1.3 for PE units
Crude Oil	PTSA 100 ppb	10-608	275 ppm	Osberg Light Crude Oil	
CDOM	PTSA 400 ppb	10-609	125 ppb	Quinine Sulfate	
Other Recommended Standards:					
Turbidity	10 NTU 100 NTU 1000 NTU	8506 8507 8620	10 NTU 100 NTU 1000 NTU	Turbidity	AMCO Clear standards can be purchased through GFS Chemicals
Tryptophan	Sigma Aldrich Tryptophan Standard Weigh out 0.1g of tryptophan into 1L ultrapure water to make 100mg/L solution (100,000ppb). Then, 50mL of the 100mg/L is transferred to another 1L volumetric flask and made up with ultrapure water to get 5000ug/L (5000ppb)				
Refined Fuels	Fisher Scientific NDSA Standard 4500 ppb NDSA is equivalent to 1 pm BTEX				
Optical Brighteners	Sigma Aldrich Uvitex Dye				

1.0 Calibration Instructions

1.1 Material Required

You must have the following materials to proceed with Cyclops calibrations:

- Cyclops-7 or Cyclops-7F Fluorometer
- Darkened plastic container (min. vol. = 250 ml)
- Appropriate calibration standard for your instrument or application
- Deionized water
- Voltmeter or voltage measuring device
- 0.6 meter 6-pin pigtail cable (P/N 2100-750)
- 3-15 volt power supply
- Cyclops Cable Guide (P/N 998-2185)

1.2 Cyclops Setup

To properly set up the Cyclops for calibration, please follow the published technical note "Cyclops Cable Guide" located on the Turner Designs website (www.turnerdesigns.com) using the link: http://docs.turnerdesigns.com/t2/doc/instructions/998-2185.pdf . The Cable Guide provides instruction on how to connect your Cyclops to a power supply and voltmeter and a table that describes how to wire for various gain settings (100x, 10x, 1x).

1.3 How to Calibrate Cyclops

Once the Cyclops has been properly set up for the 100x gain:

1) Power the Cyclops using your power supply
2) Point the optical head at a white sheet of paper to ensure the LED is on
3) Fill your sample container ¾ full with deionized water (Note: Sample container should be dark; minimum container volume should be 500 ml)
4) Submerge the optical head ½ - 1 inch below the surface of your deionized water making sure bubbles are not trapped on the optical head
5) Record the voltage for the 100x gain
6) Remove the Cyclops from the sample and disconnect power
7) Rewire the Cyclops using the Cyclops Cable Guide to set the gain to 1x
8) Repeat steps 1, 2, & 4
9) Record the voltage for the 1x gain
10) Remove the Cyclops from the sample and disconnect power
11) Rewire the Cyclops using the Cyclops Cable Guide to set the gain to 10x
12) Repeat steps 1, 2, & 4
13) Record the voltage for the 10x gain
14) Remove the instrument from the deionized water
15) Discard the deionized water and dry the sample container
16) Fill your sample container ¾ full with the appropriate dye standard for your Cyclops
17) Submerge the optical head ½ - 1 inch below the surface of the dye standard in your sample container making sure bubbles are not trapped on the optical head
18) Record the voltage response from the dye standard for the 10x gain
19) Remove the Cyclops from the sample and disconnect power
20) Discard the sample from the sample container
21) Disconnect all cable connections

Your calibration is now complete!

IMPORTANT NOTE: All voltage values must be blank corrected with their respective gain blank values prior to converting voltage to concentration estimates.

Use the following equation to convert **Blank Corrected Voltage** to concentration estimates:

$$\text{Concentration of Fluorophore} = \frac{[(V_{100xSamBC}/100) + (V_{10xSamBC}/10) + (V_{1xSamBC}/1)] * (FC/V_{10xStdBC})}{10}$$

Where:

FC = Fluorophore concentration from Table 1 for your appropriate dye standard

$V_{10xStdBC}$ = Blank corrected voltage of dye standard; voltage in step 13 subtracted from voltage in step 18

$V_{100xSamBC}$ = Blank corrected voltage of sample in the 100x gain; if a different gain is used this value is zero

$V_{10xSamBC}$ = Blank corrected voltage of sample in the 10x gain; if a different gain is used this value is zero

$V_{1xSamBC}$ = Blank corrected voltage of sample in the 1x gain; if a different gain is used this value is zero