Digital

C-FLUOR

SUBMERSIBLE PROBES

User's Manual

Digital C-FLUOR Submersible Probe

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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 (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.

Introduction

2.2   Description

The Turner Designs Digital C-FLUOR Submersible Probe is an accurate single-channel detector that can be used for many different applications. Digital C-FLUOR can be integrated into multi-parameter systems from which it receives power allowing it to output digital ASCII data as concentration estimates for a fluorophore of interest.

Digital C-FLUOR Probes are factory calibrated and a probe-specific calibration certificate is included with each probe. The certificate contains information that states the probe's minimum level of detection and range of concentrations that can be measured for the specific application.

Digital C-FLUOR Probes are manufactured with a Titanium housing and connector, ideal for long-term deployments and able to withstand most corrosive environments. It is available without a connector for integration flexibility; see Section 2.2 for part numbers.

NOTE: Digital C-FLUOR Probes cannot be used with the C6 Multi-Sensor Platform, Cyclops Explorer or Databank Handheld Datalogger.

Inspection and Setup

2.1   Instrument Checklist

The Digital C-FLUOR Submersible Probe shipment package consists of:

- A Digital C-FLUOR Submersible Probe that is configured and factory calibrated for the specified fluorophore or material as noted by the Identification Letter stamped on the connector:

  - "C" = Chlorophyll
  - "R" = Rhodamine
  - "F" = Fluorescein
  - "P" = Phycocyanin
  - "E" = Phycoerythrin
  - "U" = CDOM / FDOM
  - "O" = Crude Oil
  - "B" = Optical Brighteners
  - "T" = Turbidity
  - "D" = Red Excitation Chlorophyll

- Calibration Certificate

- Quick Start Guide

2.2   Configurations

- C-FLUOR (Digital) P/N 2120-000 – "Identification Letter" – 232

- C-FLUOR Without Connector (Digital) P/N 2120-000 – "Identification Letter" – NC-232

Note: No end cap is supplied for the C-FLUOR Without Connector (Digital) – see Section 2.5. For end cap specifications, contact **support@turnerdesigns.com**

2.3   Optional Accessories

- Please refer to the C-FLUOR accessories on Turner Designs' website for more information.
- RS-232 Programming Kit P/N 2120-900 includes RS-232 Programming cable P/N 2120-160 and 12-volt power supply.
- Pigtail Cables with Locking Sleeve - see Appendix D for more information.
  - 0.6-meter Pigtail Cable with Locking Sleeve P/N 2100-750
  - 10-meter Pigtail Cable with Locking Sleeve P/N 2100-751
- Pigtail Cables longer than 10 meters will require RS422 converter.

Note: Pigtail Cables should NOT be used to tow instruments.

- Flowthrough Cap P/N 2100-600

- Shade Cap P/N 2100-701

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Note: We recommend use of the shade cap as it provides a fixed distance for sample measurement and minimizes effects from ambient light.

- Solid Secondary Standard (SSS) for *in vivo* Chlorophyll, Phycocyanin, Phycoerythrin, Rhodamine, Fluorescein P/N 2100-900

Note: The SSS can be used for both C-FLUOR and Cyclops for the applications specified above.

- Solid Secondary Standard (SSS) for UV - CDOM / FDOM, Optical Brighteners, and Crude Oil P/N 2100-904

Note: The UV SSS can be used for both C-FLUOR and Cyclops for the applications specified above, as well as Cyclops Refined Fuels and Tryptophan sensors.

Shade Cap   **Flow Cap**   **Solid Secondary Standard**

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2.4 Functional Test for Digital C-FLUOR with connector

> To perform a functional check on a Digital C-FLUOR Probe, connect the probe to your computer following the instructions below, using the RS-232 Programming Cable as shown in Figure 1:

Figure 1

Additional Equipment required for functional tests:

> RS-232 Programming Cable P/N 2120-160
> 12-volt power supply P/N 7000-941
> Computer with USB port

CAUTION

Note: Supply voltages greater than 15 VDC will damage the probe.

1) Insert the Programming Cable's USB plug into an available USB port on your computer and wait for the drivers to automatically install.
2) Download and install Digital C-FLUOR's Software and drivers from the included USB thumb drive or from www.turnerdesigns.com.
3) After software has successfully installed, double-click the software's icon which should have been automatically added to your desktop.
4) When software has opened, supply power to the instrument using the 12-volt power supply specified ensuring the power supply is plugged into an AC source.
5) Click "Communicate With C-FLUOR" and wait a few minutes for the software to detect the connected probe.
6) When connected, C-FLUOR Communication Status radio button will change from red to green.

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With the C-FLUOR connected to your computer and power supply, and communicating with the software, 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: This test does not work for Turbidity probes because they use infrared which is not visible.

2. Is there output?
    Click the "Get Datapoint" button; if a value is displayed in the box, then the instrument's output is working.

3. Does the output change?
    Move the light source closer to the piece of paper and again click the "Get Datapoint" button. If the output increases, then the instrument's detector is working.

2.5 Digital C-FLUOR with no connector

Digital C-FLUOR can be purchased without a 6-pin bulkhead connector or end cap. If the No Connector version is purchased the Digital C-FLUOR Probe will have bare wires as shown in the figure below. See Section 2.1 for identification letters.
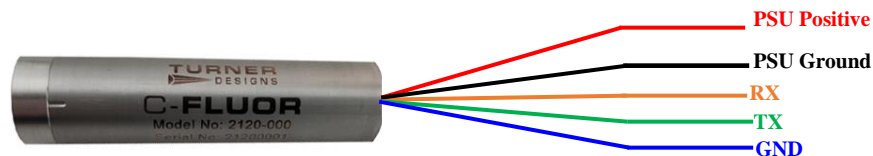
C-FLUOR Without Connector (Digital) P/N: 2120-000 - "Identification Letter" - NC-232

Use the wiring guide in Appendix C to wire the Digital C-FLUOR Probe for serial communication with your computer or controller. Use the command list in Appendix E to configure your Digital C-FLUOR probe for your data logger or third-party instrument that accepts an ASCII data string output.

Note: The Digital C-FLUOR Probe is factory calibrated; to re-calibrate the probe you must connect to a computer via serial connection and use Digital C-FLUOR Probe software. See Section 3.2 for Calibration.

Digital C-FLUOR Software & Functions

Software is used to configure Digital C-FLUOR Probes for digital integration and/or deployment. Digital C-FLUOR Probes do not store data internally, ASCII data strings are sent out via serial communication.

3.1 Setup

The Setup tab displays the probe's serial number and the probe-specific application; these values cannot be edited. There are two modes that can be selected, Polling and Data Streaming.
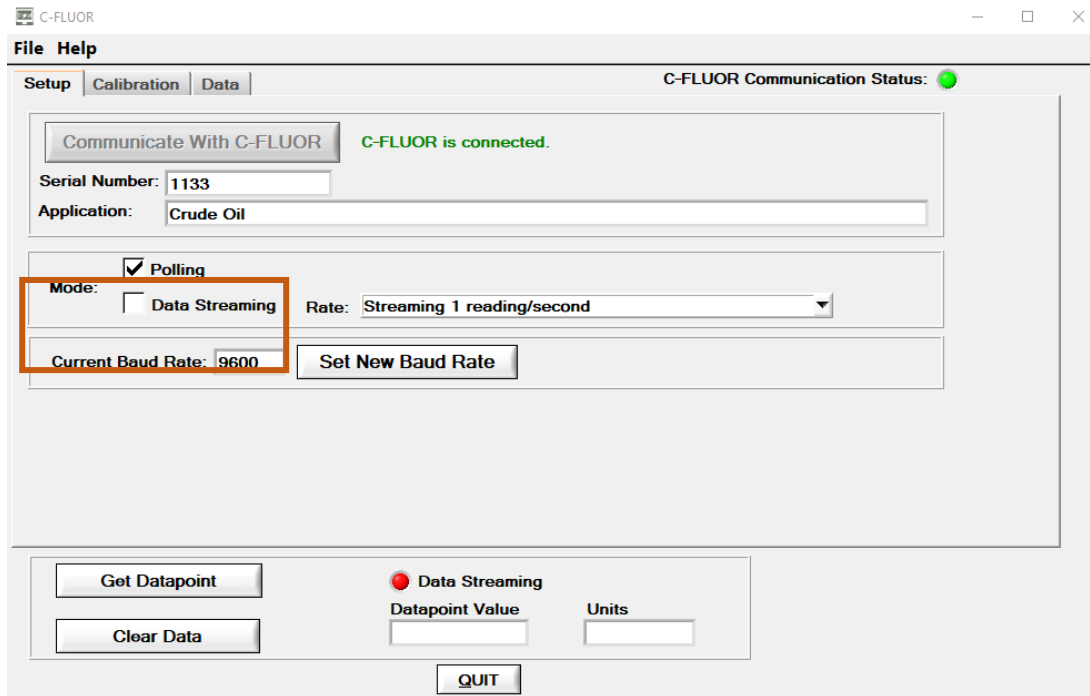
3.1.1 Polling Mode

Polling Mode is used when data storage or power is limited. Power is supplied to the probe and a command is used to trigger the probe to make a measurement. See Appendix E for command list. Every poll command will return an individual ASCII data string that contains a concentration value relative to the fluorescence detected. To activate polling mode, simply put a checkmark into the box next to the "Polling" function and select QUIT to exit the software. Once power is supplied to the probe, it will be ready to receive a poll command after 0.5 seconds.

3.1.2 Data Streaming Mode

Data streaming mode provides a continuous ASCII digital output string at selectable data rates. Rates can be accessed using the pull-down menu located next to the "Data Streaming" box. To activate Data Streaming mode, you must first choose a Rate and

then put a checkmark in the box next to the "Data Streaming" function. The Data Streaming radio button will change from red to flashing green indicating the unit is streaming data.

> *Note: Data rates faster than 1 reading per second will be updated at a rate of 1 reading per second in the Datapoint Value box highlighted below. To view the actual data rate users should run a terminal emulator such as HyperTerminal.*
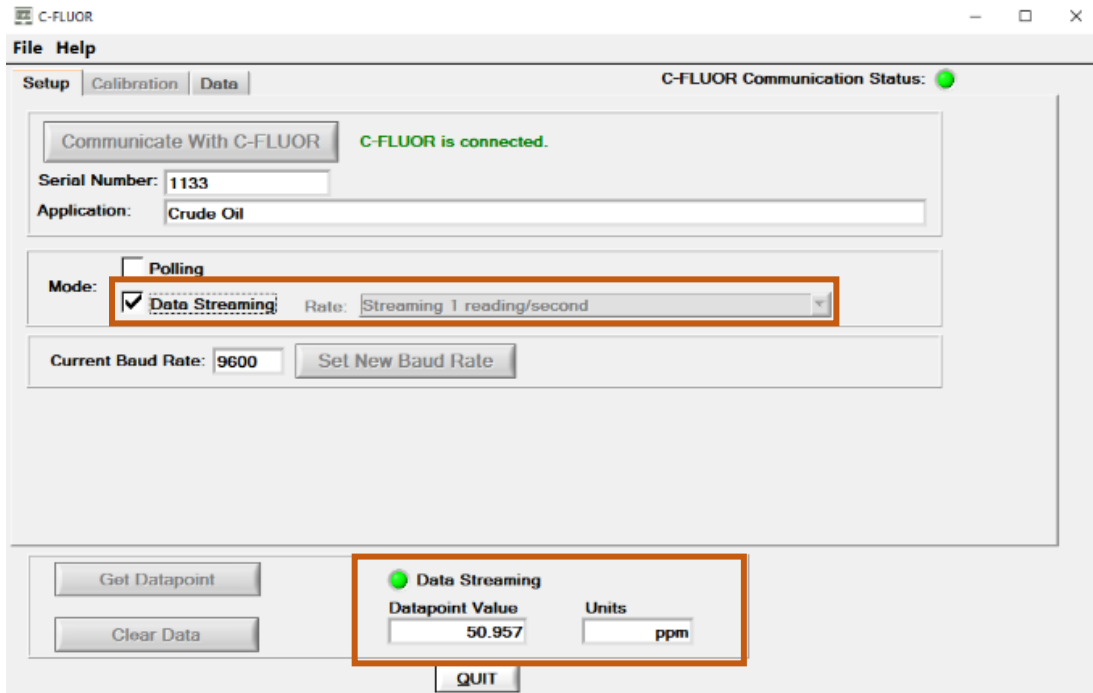
3.1.3 Setting a New Baud Rate

Users can change the Baud Rate by clicking the "Set New Baud Rate" box which will open a window giving the option to select any of five available baud rates. Place a checkmark in the box next to the desired baud rate and click "Set New Rate". The "Current Baud Rate" box will display the selected Baud Rate.
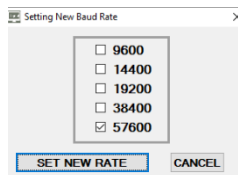
3.2 Calibration

The Digital C-FLUOR Probe is factory calibrated and the calibration values are stored in memory. The probe can be re-calibrated by users via software if site-specific calibrations are desired for increased accuracy. New calibration values will be stored into memory without overwriting or erasing factory calibration values. This allows users to restore factory calibration values if desired.

Note: Restoring factory calibration values will erase all customer calibration values.

To calibrate Digital C-FLUOR you'll need the following:
- PC with Digital C-FLUOR Software

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- RS-232 Programming Cable P/N 2120-160
- 12-Volt Power Supply P/N 7000-941
- Blank solution
- Standard solution of known concentration
- Blackened or dark 500 ml beaker/container

3.2.1 Calibrating the Digital C-FLUOR Probe

1) See section 2.4 Functional Test for Digital C-FLUOR with connector on how to connect to your computer.
2) Click the "Calibration" tab.
3) Enter the known concentration of your Standard Solution in the Concentration Value box. **Note: Only values greater than 1 are valid.**
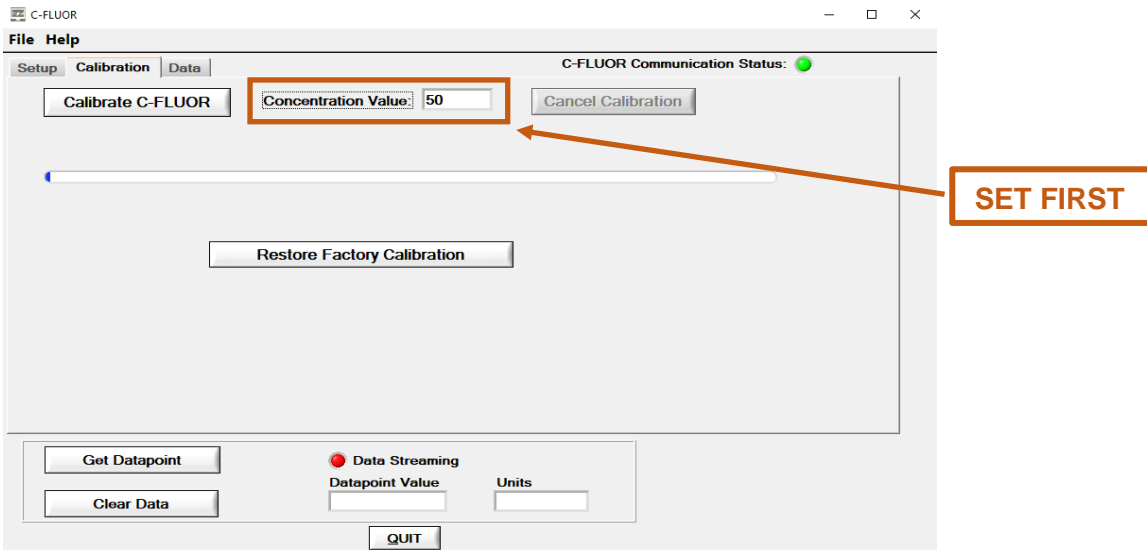
4) Fill your 500 ml beaker with blank solution.
5) Submerge the probe's optical head no more than an inch below the surface of the blank solution. See Appendix B for recommended lab practices.
6) Click the "Calibrate C-FLUOR" button, then click "OK".
7) Wait for the progress bar to complete.
8) When prompted to insert C-FLUOR into Calibration Solution, remove the probe from the blank solution.
9) Empty the blank solution from the beaker and wipe the beaker dry.
10) Fill your 500 ml beaker with standard solution.
11) Submerge the probes optical head no more than an inch below the surface of the standard solution. See Appendix B for recommended lab practices.
12) Click "OK".
13) Wait for the progress bar to complete.
14) Click "Yes" to save the new calibration.
15) Click "Get Datapoint" to read the standard solution with the newly calibrated probe; you should see the Concentration Value you entered displayed in the "Datapoint Value" box confirming the calibration was saved.

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3.2.2   Restoring Factory Calibration

To restore the factory calibration of your Digital C-FLUOR Probe, you'll need to connect your probe to a computer with Digital C-FLUOR software, communicate with your probe using the software and click on the Calibration tab. Then click "Restore Factory Calibration". You will be asked if you wish to continue, select "Yes" to restore or "No" to keep your custom calibration.

If factory calibration is restored, the software will display Factory Calibration was restored meaning your custom calibration was deleted and cannot be retrieved.

Note: Once customer calibrations are deleted, they cannot be retrieved. Please re-confirm the need to delete before choosing to restore to factory calibration.


Will be displayed after restoring factory calibration
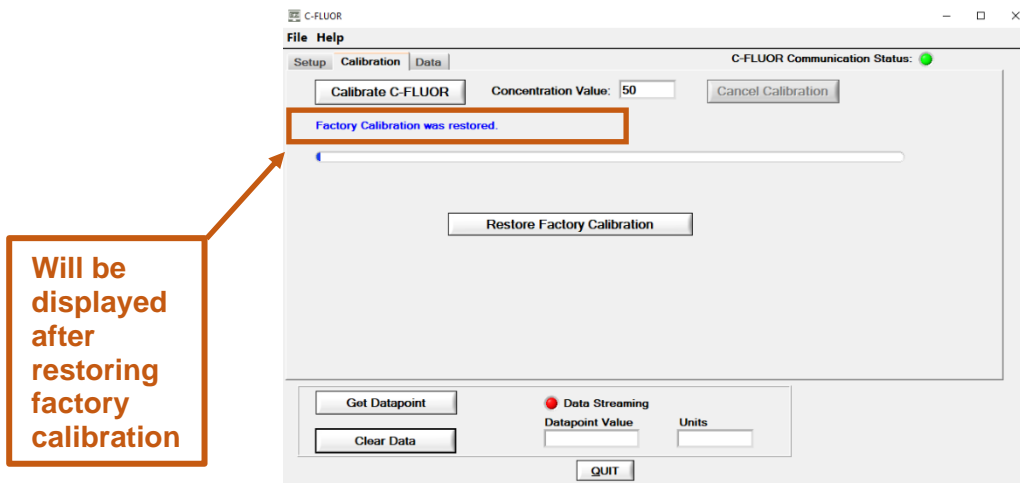
3.3 Data

The Data tab allows users to view data in tabular or waveform and to log data to a .csv file if desired. When the Data tab is clicked, values will begin scrolling in tabular format at a rate of 1 measurement per second as shown in the figure below **(Note: this rate cannot be changed for scrolling data).**

Digital C-FLUOR Submersible Probe
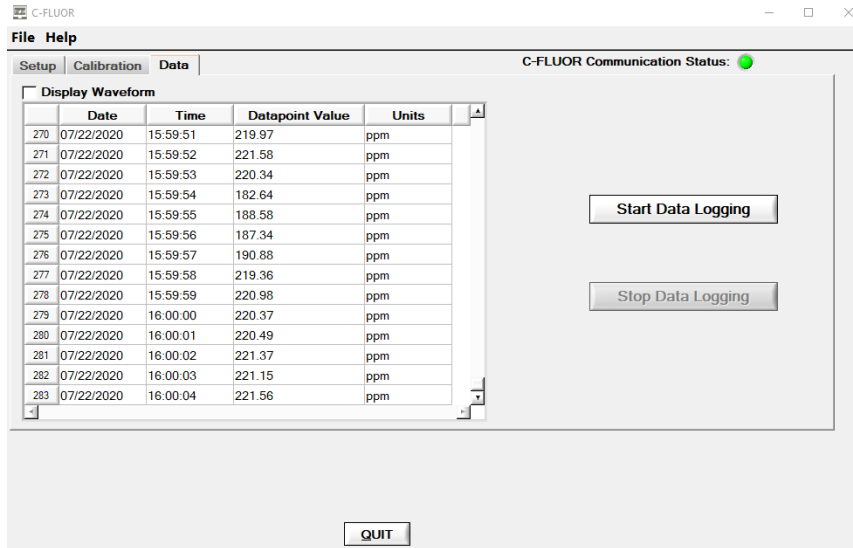
You can use the scroll bar to the right of the tabular data display to scroll through a 5 minute data window. Click on the Display Waveform box to enable graphical view and the display will change to a continuous plot with the same 5 minute data window as shown below,
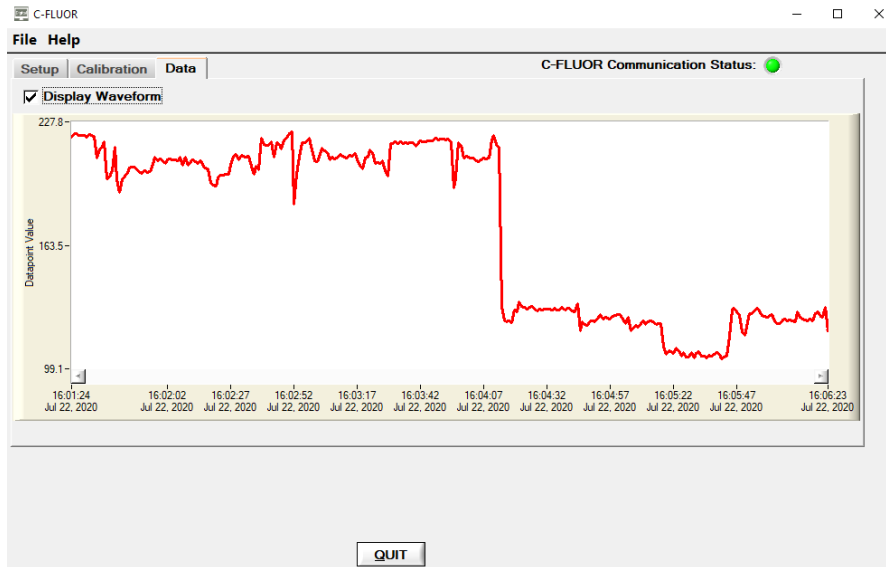

Click Display Waveform again to disable graphical view and return to tabular data where you can log data to a .csv file. When in the tabular data screen, click the Start Data Logging button and the following window will be displayed,

Digital C-FLUOR Submersible Probe
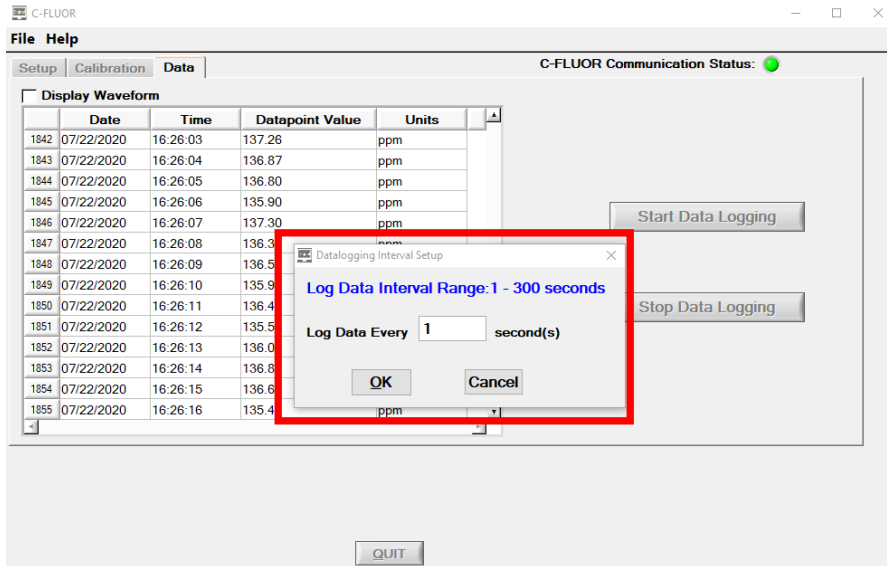
Enter a value between 1 and 300 seconds in the "Log Data Every" box and click OK. Navigate to a folder where you intend to save the data file, enter a filename and click Save. Data will continue to scroll at 1 measurement per second but will be logged at the sample interval that was entered. When data logging is enabled, the Start Data Logging button will be grayed out and a message will be displayed at the top of the window indicating the set logging interval and the filename data are being saved to as shown below,
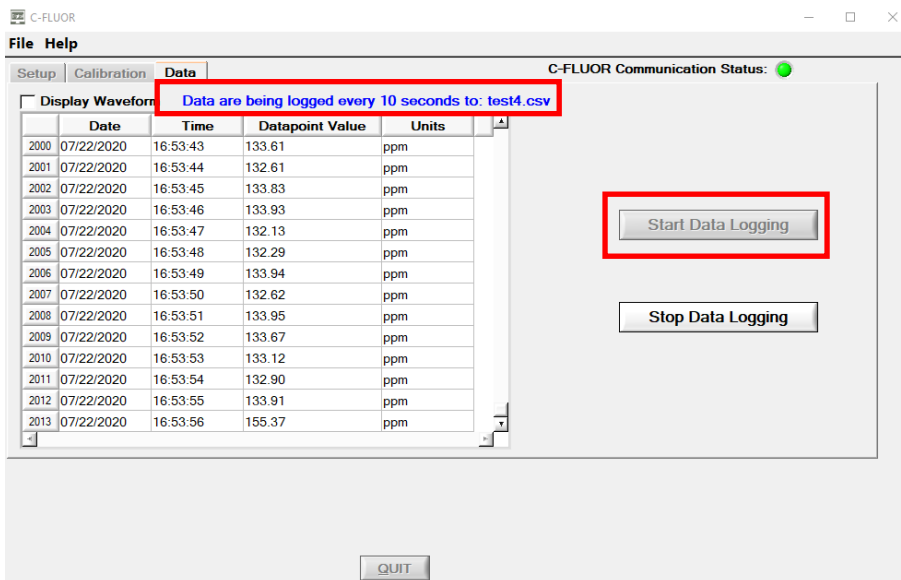
Maintenance

4.1 Maintenance

4.1.1 Rinsing

The C-FLUOR should be rinsed or soaked in fresh water following each deployment until it is completely clean again.

4.1.2 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.

4.1.3 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 water and dry with optical tissue to clean the window. Take care to leave instrument on stable surfaces to avoid any damage caused by accidental dropping.

Note: The C-FLUOR should NOT be used with any organic solvents (i.e., acetone, methanol) or strong acids and bases.

Warranty

5.1 Warranty Terms

Turner Designs warrants the C-FLUOR 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 incidental 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.

5.2 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.

5.3 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.
1995 N. 1st Street
San Jose, CA 95112
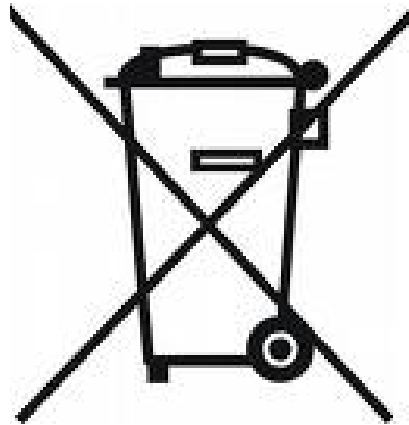
Digital C-FLUOR Submersible Probe

Appendix A: Specifications

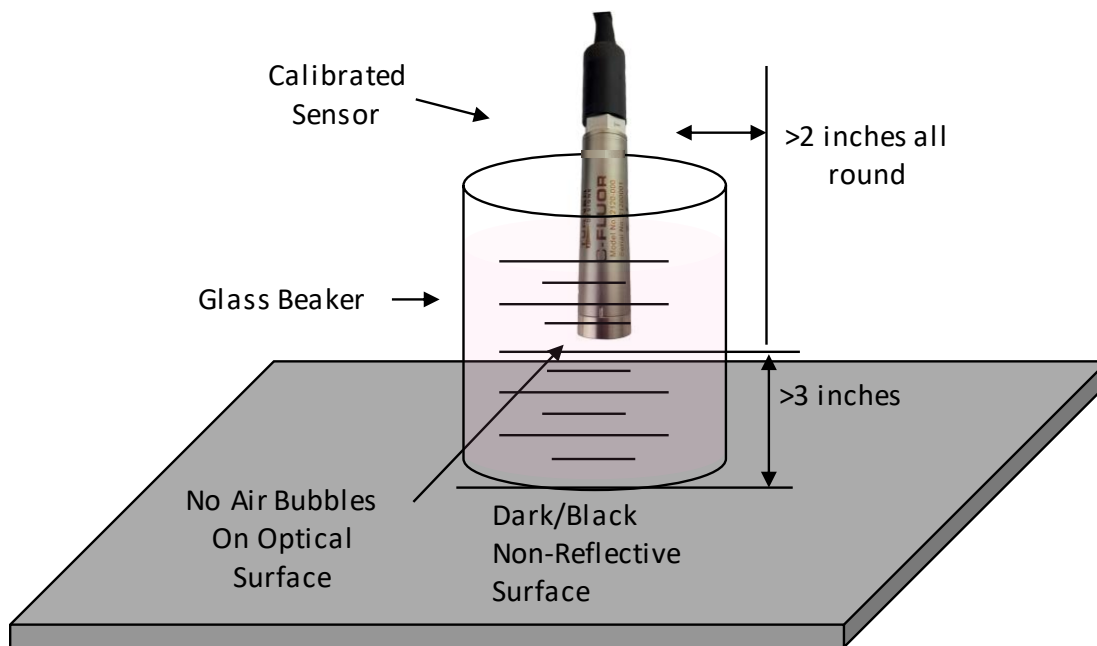| Parameter	Specification	
Full Range Linearity	0.99 R^2	
Power Draw @ 12V	CHL, RWT, PC, PE, F, CDOM/fDOM, Oil, & OB = 22mA Turbidity = 20mA Red Excitation CHL = 26mA	
Input Voltage	3 – 15 VDC	
Signal Output	ASCII Digital Data String (RS-232)	
Temperature Range	Ambient: 0 to 50 °C Water Temp: -2 - 50 °C	
Light Source	Light Emitting Diode	
Excitation Wavelength	Visible - CHL, RWT, PC, PE, F UV - CDOM/fDOM, Oil, OB IR - Turbidity	
Detector	Photodiode	
Detection Wavelengths	400 – 850 nm	
T99	< 0.6 seconds	
Housing Material	Titanium	
Dimensions	C-FLUOR L: 5.2 in., 13.24 cm D: 0.875 in., 2.23 cm	No Connector C-FLUOR L: 3.8 in., 9.68 cm D: 0.875 in., 2.23 cm
Depth Rating	2,000 meters	
Weight	3.3 oz (95 g)	

Appendix B: Recommended Lab 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 <u>non-fluorescent container</u> 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 <u>non-reflective black surface</u>.

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

4. Ensure that the probe is in the center of the container and has <u>more than 2 inches clearance</u> between the cirumference of the probe and the inside surface of the beaker.
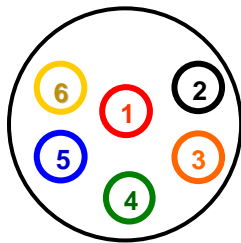
Appendix C: Wiring Guide

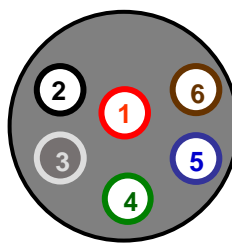| C-FLUOR Pins/Wires	Pin Number	Function	Connection
Red	1	Supply Voltage 3 – 15 VDC	PSU – Positive Connection
Black	2	Supply Ground, 0VDC	PSU – Ground Connection
Orange	3	Receive Data	RX
Green	4	Transmit Data	TX
Blue	5	Digital Ground	GND
Yellow	6	N/A	-

C-FLUOR Pins
and Wire Color

Pigtail Connector
and Wire Color
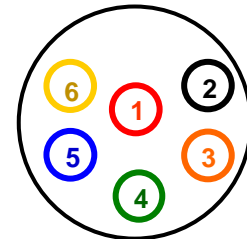
Note: Pin 6 is not used.

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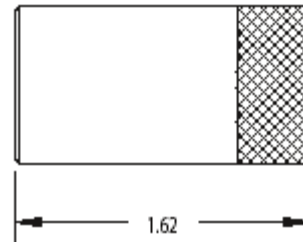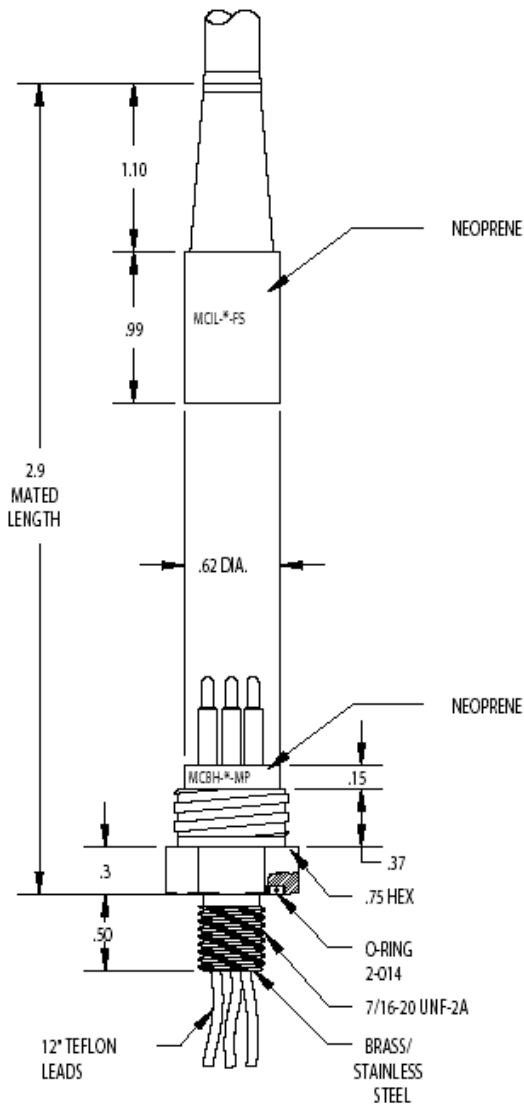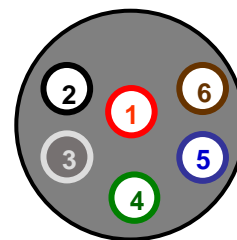
Female locking sleeve, (Impulse P/No. MCDLS-F)

C-FLUOR Pins and Wire Color

Pigtail Connector and Wire Color

Note: A maximum cable length of 30 feet can be used for digital data transfer from Digital C-FLUOR Probes to computers or data loggers. For long distance data transfer or communication, the digital RS232 signal should be converted to RS422.

Appendix E: Digital C-FLUOR Probe Command List

Digital C-FLUOR Probes can be programmed using commands via serial communication with terminal emulators such as Hyperterminal, TerraTerm, PuTTY, Procomm Plus, AlphaCom, etc or third-party communication systems. This is helpful for integrators as they don't need software for programming integrated probes. Use the following settings for serial connection:

Baud Rate: Use the rate that was displayed in the Digital C-FLUOR Software.
Data bits: 8
Parity: None
Stop bits: 1
Flow Control: None

Once connected, you can communicate using the list of commands below to setup, collect information, and program Digital C-FLUOR Probes:

Command	Name	Note
I!	Sensor Information	For Probe Information
C!	Calibration Information	For Calibration Values
Bxxxx!	Set Baud Rate	"xxxx" refers to baud rate (9600, 14400, 19200, 38400, 57600)
Sxx!	Streaming Output Rate	Puts probe into streaming mode Use table below to determine "xx"
P!	Polling Mode	Puts probe into polling mode
R!	Read Command	Only when in Polling mode
M!	Report the Current Mode	Returns S with rate or P

xx	Readings per	Seconds between
01	*Not Available*	
02	16	
03	8	
04	4	
05	2	
06	1	1 (factory default)
07		2
08		5
09		10
10		15
11		30
12		60
13		120
14		300
15		600
16		1800
17		3600