

FluoroSense™

User's Manual

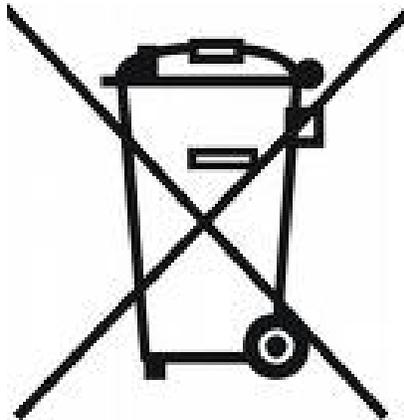


November 13, 2015
P/N: 998-2852
Revision B

TURNER DESIGNS
1995 N. 1st Street.
San Jose, CA 95112
Phone: (408) 749-0994
FAX: (408) 749-0998

Table of Contents

1	Introduction	
1.1	Description	4
1.2	Inspection and Setup	4
1.3	General Information, Precautions & Cleaning	4
2	Instrument Operation and Calibration	
2.1	Instrument Power Up	5
2.2	Sample Analysis	5
2.3	Calibration Procedure (only needed if FluoroSense fails calibration check)	5
3	Applications	
3.1	<i>In Vivo</i> Chlorophyll	6
4	Warranty	
4.1	Terms	7
4.2	Warranty Service	7
4.3	Out of Warranty Service	8
	Appendixes	
A	Specifications	10
B	Linear Range, Quenching and Temperature Considerations	11



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 FluoroSense is a lightweight, handheld fluorometer ideal for field use. Its small size makes it perfect for the user who needs quick measurements away from the laboratory.

1.2 Inspection and Setup

1.2.1 Inspection

Upon receiving your instrument, please inspect everything carefully and make sure all accessories are present. All shipments include:

- The FluoroSense
- The User's Manual and Quick Start Guide on USB Flash Drive
- Laminated Quick Start Guide
- 2 - AA batteries
- Shade Cap P/N 2850-500
- Wrist strap P/N 030-8500

1.2.2 Setup

Before the FluoroSense can be used, the supplied batteries must be installed.

1. On the back side of the instrument, remove the battery panel by loosening the screws and then gently remove the back panel.
2. Install the 2 - AA batteries and verify the batteries are positioned correctly.
3. Replace the battery panel and press it down into position.
4. Hold the battery panel down in place and gently tighten the screws until it is snug. Do not over tighten the screws.



1.3 General Information, Precautions and Cleaning

- **The FluoroSense should NOT come in contact with any organic solvents or strong acids and bases**
- Rinsing with fresh water and drying the instrument thoroughly with a non-abrasive cloth after use is recommended.
- Visual inspection of the optical face for fouling should be done on a regular basis.
- To inspect the optical face remove the cap:
- If there is any noticeable fouling, use a soft bristle brush or non-abrasive cloth and soapy water to clean the optical window. Rinse thoroughly.
- **Do not expose the FluoroSense to temperatures outside the specified range of 5 to 40 °C or damage may occur to the unit that will not be covered under warranty.**



2. Instrument Operation and Calibration

2.1 Instrument Power Up

To turn on the FluoroSense, press the power button.



2.2 Sample Analysis

1. Place the sensor in the sample with the cap fully submerged.
2. Shake gently to make sure all bubbles are purged from the cap.
3. Press the Read button.

2.3 Calibration Procedure

Note: FluoroSense ships calibrated. Only re-calibrate if unit does not read $100 \pm 3\%$ for the appropriate FluoroSense Standard Solution. Use P/N 2860-220 for *in vivo* Chlorophyll and P/N 2860-221 for *in vivo* Phycocyanin (PC).



- To calibrate, press and hold the Read button while unit is off.
- While holding the Read button, press and hold the Power button until 100 appears on the screen. Release both buttons.
- Place the sensor in the standard with the cap fully submerged, shake gently to make sure all bubbles are purged from the cap, and press the Read button.
- The display will flash “td” several times and then the unit will automatically turn off.

At this point the FluoroSense is calibrated. You can confirm the calibration by turning the unit on and pressing the read button while the unit is in the standard solution. Readings should be $100 \pm 3\%$.

3 Applications

3.1 *In Vivo* Chlorophyll

In vivo chlorophyll analysis is the fluorescence detection of chlorophyll in live algal cells, in water. This technique uses excitation light from the fluorometer to excite chlorophyll within algal cells causing them to fluoresce. The fluorescence is then detected and converted to an analog or digital value and can then be correlated to a known concentration.

In vivo fluorescence measurements are qualitative in nature. They can provide valuable information on the spatial and temporal distribution of algae, quickly and easily.

FluoroSense converts the *in vivo* fluorescence detected to chlorophyll concentration estimates reported in units of $\mu\text{g/L}$. The conversion factor was determined using green algae, *Tetraselmis sp.*

Data reported are semi-quantitative because environmental conditions, presence of interfering compounds, cellular physiology, morphology, and light history can influence the relationship between the *in vivo* fluorescence and the actual concentration of chlorophyll in algae.

For more details on chlorophyll analysis visit Turner Designs' website under [Applications](#).

3.2 *In vivo* PC

Phycocyanin (PC) is a pigment primarily found in cyanobacteria. It has fluorescence properties which allow for its detection and/or quantification. Similar to chlorophyll, we can detect PC *in vivo* as a qualitative measure providing valuable information on the spatial and temporal distribution of PC-containing algae and the phytoplankton population or community in an aquatic system. Researchers often use PC to CHL ratios to track changes or shifts in phytoplankton communities which may indicate mixing water masses or sharp changes in physical parameters such as salinity, temperature, suspended sediments, etc.

PC-containing algae are also often associated with harmful algae that contain toxic compounds such as *Microcystis aeruginosa*, a freshwater cyanobacteria. Detecting PC-containing algae in water systems can be a first step towards determining whether testing for toxins is required as a preventative measure to warn against potential harm from toxic algae.

PC FluoroSense converts *in vivo* fluorescence of PC detected to concentration estimates reported as $\mu\text{g/L}$ of PC. The conversion factor was determined using a known concentration of extracted PC in buffer solution, diluted in water. The actual concentration estimated by the FluoroSense is semi-quantitative at best as extracted PC has a different fluorescence yield from PC contained within live algal cells.

4 Warranty

4.1 Terms

Turner Designs warrants the FluoroSense 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 used 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.

4.2 Warranty Service

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

- 1 Write, email, or call the Turner Designs Technical Support department 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 the Technical Support Department.
- 3 If proper performance is not obtained you will be issued a Return Authorization number (RMA). 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.

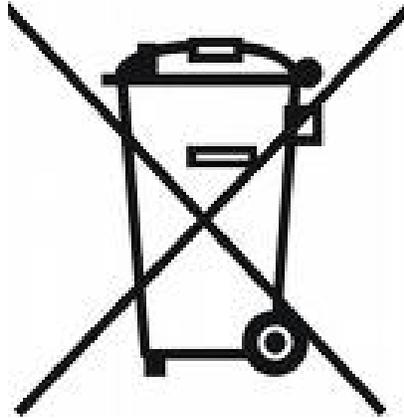
For customers outside of the contiguous continental United States who purchased equipment from one of our authorized distributors, contact the distributor. If you purchased directly, contact us. We will repair the instrument at no charge. Customer pays for shipping duties and documentation to Turner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

4.3 Out-of-Warranty Service

Follow steps for Warranty Service as listed above. If our Technical Support department 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
1995 N. 1st Street
San Jose, CA 95112



Appendix A: Specifications

FluoroSense	
Linear range	0-199 µg/L
Resolution	1 µg/L
Light source	LED
Detector	Photodiode
Calibration Type	Single point
Size	8.9" x 2" x 1.75"; 22.6 cm x 5.1 cm x 4.5 cm
Weight	4.3 oz; 120 g
Temperature	41-104°F (5-40°C)
Case	IP 67 standard; dustproof/waterproof
Power	2 AA batteries, standard or rechargeable
Auto Power Off	After 1 minute of inactivity
Temperature coefficient for <i>in vivo</i> chlorophyll	1.4%/ °C or .78%/ °F

Appendix B: Linear Range, Quenching and Temperature Considerations

Linear Range and Quenching

The linear range is the concentration range in which the readout of the FluoroSense is directly proportional to the concentration of the fluorophore in the sample. The linear range begins with the lowest detectable concentration and spans to an upper limit concentration that is dependent on the properties of the fluorescent material and the cuvette optical path length.

At concentrations above this upper limit, the fluorescence reading will not increase at a linear rate in comparison to the change in concentration. At concentrations 10 times higher than the upper limit, the readings will start to decrease even though the sample concentration is increasing.

This effect is known as "sample quenching" and is due to light absorption losses in the sample. See the Figure 1.

When you start to see visual color in the sample, this is an indicator that the sample may be above the upper limit of linearity. The linearity can be verified by diluting a sample 1:1 or another convenient dilution ratio. If the sample is within 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 original sample concentration was above the linear range.

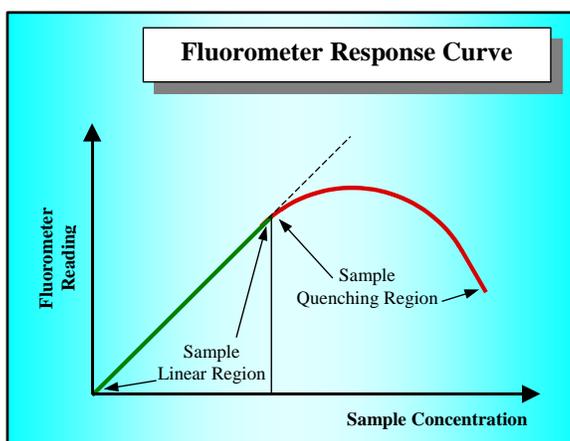


Figure 1. Linearity and Quenching Regions of Sample Response Curve

Temperature Considerations

Fluorescence is temperature sensitive. As the temperature of the sample increases, the fluorescence decreases. For best accuracy make sure your samples are at the same temperature as the calibration standard. If you have the ability to measure sample temperature, a temperature coefficient may be applied to your measurements, see Appendix A - Specifications table.