



Enviro-T2

In-Line Fluorometer



Version A

June 15, 2016

P/N 998-2823

TURNER DESIGNS

1995 N. 1st Street

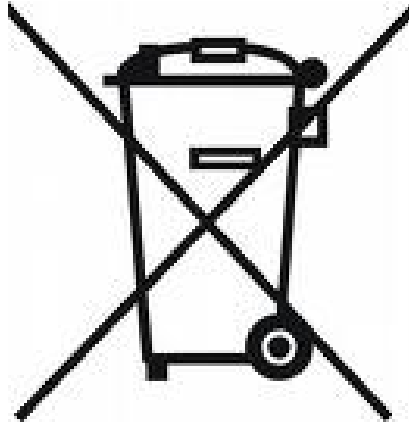
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WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT (WEEE) DIRECTIVE

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: 1-408-212-4041 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

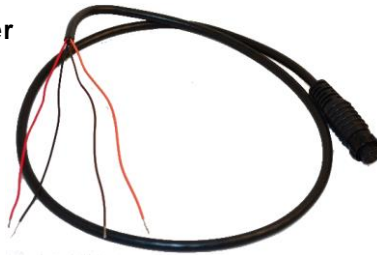
1.1 Description

Turner Designs' Enviro-T2 In-Line Fluorometer is an accurate, single-channel fluorometer that detects and measures algal fluorescence in water, providing a 4-20mA output signal proportional to the fluorescence detected. Built as an industrial grade instrument, the Enviro-T2 is a rugged, simple to use fluorometer that can be integrated with data collection systems used to monitor and control algal biomass levels in water. An LED light source at a certain wavelength is used to excite chlorophyll contained within algae, which fluoresce a different wavelength of light as a result. The intensity of the emitted light is proportional to the concentration of algae in the sample. Turner Designs' Enviro-T2 In-Line Fluorometer has a low maintenance design to provide trouble-free performance.

1.2 Inspection and Setup

The Enviro-T2 is factory calibrated to 0.03-100 µg/L.

Enviro-T2 In-line Fluorometer
with label specifying serial
number of unit



4-20mA cable P/N 021-2800
5foot long cable with 4 bare
leads Black, Red, Orange
and Brown



Threaded Connection Ring

1 in. (NPT) mounting tee
for flow through measurements.

2. Installation and Operation

2.1 Installation

Turner Designs' Enviro-T2 is rated for light industrial environments.

Do not install the Enviro-T2:

- In direct sunlight or near heat sources - operating temperature 0-50 °C.
- On vibrating walls or surfaces that affect the flow.
- Near devices that produce a strong electromagnetic field, such as large generators.

It is recommended that the Enviro-T2 be installed in such a way that the flow is directed upward to expel any trapped air bubbles or air trapped on the optical window will influence signal and cause erratic readings - see Section 3.0.

2.2 Tee Installation and Wiring

We recommend the following installation procedure for installing the Enviro-T2 onto the mounting tee provided for flow through applications:

1)



2) Connect the mounting tee in line with your flow and start flowing water.

3) Inspect for leaks.

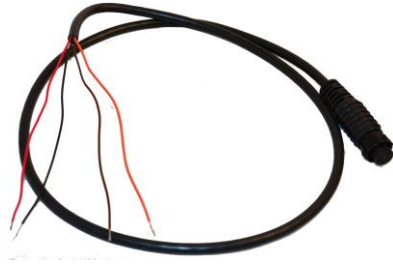
Note: In the event the Enviro-T2 must be removed for service, the mounting tee opening can be plugged with Plumbing Plug P/N 2820-520.



Plumbing Plug P/N 2820-520

Enviro-T2 In-Line Fluorometer

- 4) Connect the 4-20mA cable to the Enviro-T2.

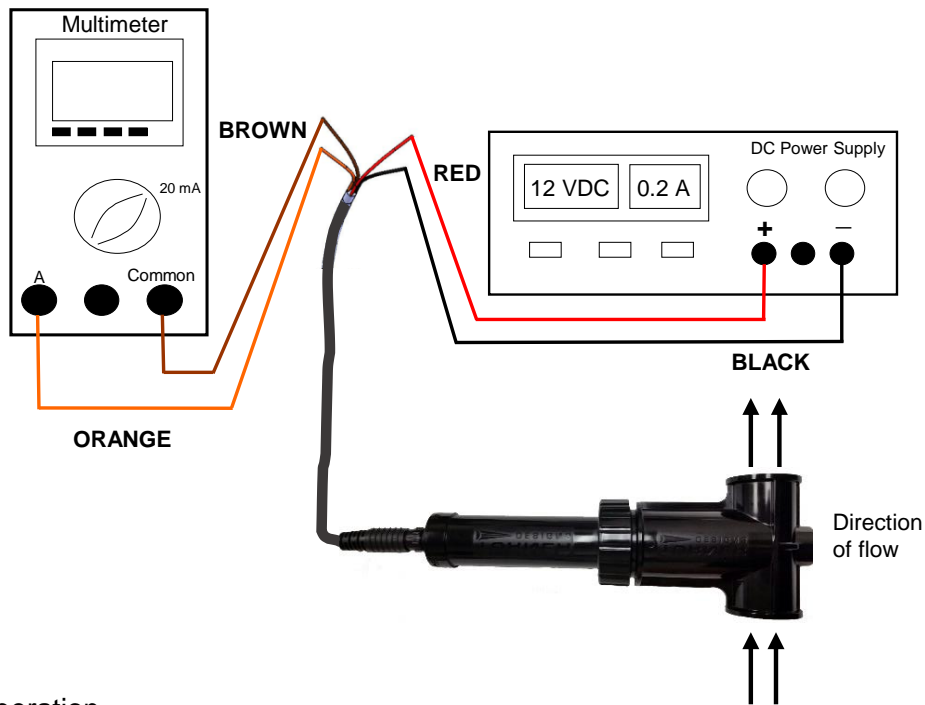


When connecting the Enviro-T2 to the cable, pay special attention to the orientation of the pins. Once the connection is made, slide the collar down and rotate the collar to secure.



- 5) Connect the Enviro-T2 In-Line Fluorometer to a power supply and digital multimeter for testing (as shown below) or to a datalogger.

Note: The power ground (Black Wire) and the 4-20 mA return (Brown Wire) are not common. These wires should not be connected to the same point. Do not allow the bare wires to touch each other or conductive surfaces. Use standard electrical connection and insulation materials. Failure to properly connect the Enviro-T2 may result in damaged equipment.



2.3 Operation

Turner Designs' Enviro-T2 uses a Light Emitting Diode (LED) at a specific wavelength to excite the fluorophore of interest in samples or source water. Upon excitation, the fluorophore emits a different wavelength of light (fluorescence) that will be detected by the fluorometer's photodiode.

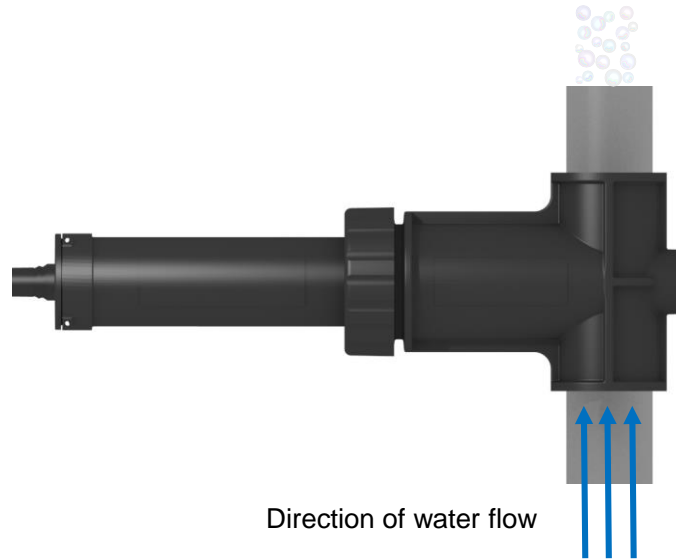
After power (8 - 30 VDC) is applied to the Enviro-T2 allow 5 seconds for the LED to stabilize. After 5 seconds measurements can be taken continuously as current output (4 - 20 mA).

3. Recommended Measurement Practices

3.1 Minimizing Variations in Signal

Turner Designs' Enviro-T2 has a flat surfaced optical window that might trap air bubbles when positioned vertically. For this reason we recommend:

- 1) Installing Enviro-T2 horizontally so that the mounting tee is in a vertical position.



- 2) That the flow direction is upward through the mounting tee.

This will ensure that any trapped air bubbles will be released and will not interfere with sample measurement.

3.2 Temperature Correction Coefficient

In vivo Chlorophyll

1.4% / °C Linear

See Appendix C for temperature correction of chlorophyll and equation.

3.3 Calculating Concentration Coefficients

You can find the coefficients required for calculating concentrations using the equation:

Equation 1: $y = mx + c$

Where:

y = the sample concentration,

m = the slope of your equation,

x = the sensor output in mA,

c = the x intercept (offset) when y = 0.

Enviro-T2 In-Line Fluorometer

Finding the slope of your equation using example data from Table 1:

Table 1.

Solution Measured	Concentration	Multimeter current output
Blank Solution	C_b (0 $\mu\text{g/L}$)	R_b (4 mA)
Std Solution P/N 2820-220	C_s (60 $\mu\text{g/L}$)	R_s (13 mA)

Equation 2: $m = [(C_s - C_b) / (R_s - R_b)]$
 $m = [(60 - 0) / (13 - 4)] = 60/9 = 6.67$

Finding the c constant using example data from Table 1, $y=0$ $\mu\text{g/L}$ for the blank:

Equation 3: $0 = [(m * R_b) + C]$
 $0 = [(6.67 * 4) + C]$
 $c = -26.68$

Substitute m and c in Equation 1 with end values from Equations 2 and 3:

Equation 4: $y = 6.67x + (-26.68)$

You can now calculate y ($\mu\text{g/L}$) concentrations simply by substituting sensor output (mA) values for x in Equation 4.

4. Maintenance and Warranty

The Enviro-T2 Fluorometer is designed for light industrial monitoring applications that require continuous measurements. It provides maximum performance and solid state reliability with minimal maintenance.

A maintenance check should be made once per month to ensure the optical window is free from any chemical or biological fouling. Frequency of maintenance checks are dependent on the fouling rate of the system being monitored. Systems that have a higher fouling rate might require more frequent maintenance checks.

4.1 Maintenance Check Using Standard Solutions

You may check if the unit is responding correctly simply by running standard solutions past the optical window.

Enviro-T2 Chlorophyll Standard Solution Blue Excitation P/N 2820-220 is available. Contact Sales@turnerdesigns.com.

Note: If you are using P/N 2820-220 the approximate concentration equivalent is 60 µg/L chlorophyll (*Tetraselmis sp.*). Refer to Section 3.3 on how to establish a concentration correlation to mA readings.

- 1) Using your Enviro-T2 Standard Solution, flow the solution past the optical window and record the reading.
- 2) If the reading varies by more than 5% of previous readings for the same solution, see Section 4.2 for visual inspection and cleaning.

Maintenance checks are important and will ensure the Enviro-T2 is continuing to provide maximum performance and measurement reliability.

4.2 Visual Inspection and Cleaning

To visually check if the optical window is fouled:

- 1) Remove the Enviro-T2 from the mounting tee.

Note: In the event the Enviro-T2 must be removed for service, the mounting tee opening can be plugged with Plumbing Plug P/N 2820-520.



Plumbing Plug P/N 2820-520

- 2) If there is any noticeable fouling, use a soft bristle brush or non-abrasive cloth material and soapy water to clean the optical window. Be sure to rinse thoroughly.

Enviro-T2 In-Line Fluorometer

- 3) If the fouled window is unable to be cleaned with soapy water and the soft bristle brush, make a 10% HCL solution and use that solution, in place of the soapy water, with the soft bristle brush to clean the window.

Note: Hydrochloric acid is a hazardous material and should only be handled by qualified personnel.

- 4) Once the optical window has been cleaned, re-install the mounting tee back onto the Enviro-T2.

Note: See Section 2.2 on how to properly install the mounting tee.

4.3 Warranty Terms

Turner Designs warrants the Enviro-T2 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.

4.4 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 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 customer pays for shipping duties and documentation

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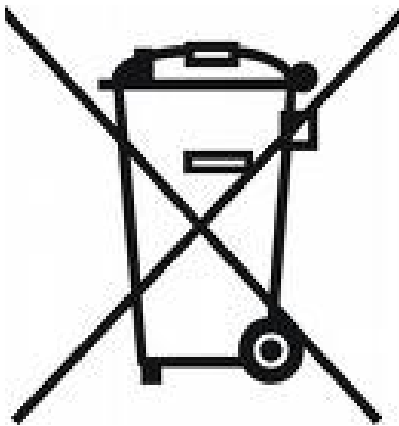
to Turner Designs. Turner Designs pays for return shipment (custom duties, taxes and fees are the responsibility of the customer).

4.5 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, Inc.
1995 N. 1st Street
San Jose, CA 95112



Equipment Specified as Electrical and Electronic Waste

Appendix A: Fluorometer and Mounting Tee Specifications

Parameter	Specification
Linearity (over dynamic range)	0.99 r ²
MDL for Chlorophyll	0.03 µg/L
Dynamic Range for Chlorophyll	0-100 µg/L
Power Draw	0.88 W @ 12 VDC (1.0 W max.)
Input Voltage	8 – 30 VDC
Signal Output	4 – 20 mA
Light Source	Light Emitting Diode
Detector	Photodiode
Warm up time	5 seconds
Dimensions	Length: 8.63 in. (21.9 cm) Diameter (housing): 1.30 in. (3.3 cm) Diameter (flange): 1.72 in. (4.4 cm)
Weight	4.4 oz. (125 g)
Material	PVC – Type I, Rigid injection-molded plastic

Mounting Tee Specifications

Parameter	Specification
Material	PVC – Type I, Rigid injection-molded plastic
Threading	1 inch (NPT)
Length	3.3 inches (8.4 cm)
Dynamic Pressure Rating	100 PSI

Appendix B: Wiring Guide

Wire Color	Function	Connection
Red	Supply Voltage 8 – 30 VDC	PSU – Positive Connection
Black	Supply Ground 0 VDC	PSU – Ground Connection
Orange	Signal out to data logger, “A”, 4 – 20 mA DC	Multimeter “A” Connection
Brown	Signal out to data logger, “Common”, 4 – 20 mA DC	Multimeter “Common” Connection

Appendix C: *In Vivo* Chlorophyll Measurements

Enviro-T2 In-Line Fluorometer P/N 2820-000-C is configured with chlorophyll optics to determine the relative abundance of algae in water samples. The instrument provides a 4 - 20 mA output signal proportional to the fluorescence from the sample or source water being measured. This signal can be recorded using any data collection system with the capability to read current (4-20 mA) output and can be used to estimate algal abundance.

In vivo chlorophyll measurements provide qualitative data. It is up to the user to convert these qualitative readings into quantitative data if actual concentration estimates are desired. Accuracy of concentration estimates is dependent on the correlation used to convert relative readings to concentrations.

NOTE: See the Maintenance Checks section 4.1 prior to enabling the Enviro-T2 In-Line Fluorometer for in-line measurements of your system's source water.

Temperature Correction

Temperature Considerations

Fluorescence is temperature dependent. The fluorescence signal from most fluorophores will decrease as sample temperature increases. However, fluorescence values can be corrected for temperature effects if the temperature correction coefficient of the fluorophore being measured is known. Section 3.2 lists the temperature correction coefficient for correcting temperature effects on chlorophyll fluorescence. The correction is linear so the following equation can be used to make the correction:

$$\text{Temperature Corrected Chlorophyll (ug/L)} = [(\text{Sample}_T - \text{Reference}_T) * (-0.014)] + (\text{Signal Measured})$$

Where,

Sample_T = Temperature of sample measured.

Reference_T = Reference Temperature; the temperature at the time of calibration.

Signal Measured = (mA output – 4mA)

Appendix D: Tee Modification

It is possible to modify the tee to add a clean-out plug directly opposite the Enviro-T2. This can be done by drilling and tapping the small boss shown in the picture to a 1/2" NPT thread.

