

**WALCHEM**

An Iwaki America Company

Fluorescent Sensors

# Turner Designs Little Dipper Fluorometer Instruction Manual

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## Information

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# 1.0 Introduction

Turner Designs' Little Dipper is an accurate, single-channel fluorometer designed to measure the concentration of your fluorophore of interest. The Little Dipper provides 4 - 20 mA output signal proportional to the concentration of the fluorophore in the sample or source water. In a representative application, the Little Dipper can be used with a data collection system to monitor and control the level of treatment chemicals in industrial applications. The sample water's fluorescence intensity is measured by passing the sample water, containing the fluorophore of interest, past the Little Dipper's optical window. An excitation light source illuminates the solution and excites the fluorophore in the solution which fluoresces at a different wavelength. The intensity of the emitted light is proportional to the concentration of the fluorophore in the sample of source water. Turner Designs' Little Dipper has a low maintenance design that will provide trouble-free performance.

Two sensors are available through Walchem. You can choose the PTSA sensor for a variety of applications including cooling towers. You can choose the Fluorescein sensor for a variety of applications including boilers.

## 2.0 Installation

### 2.1 Installation

Turner Designs' Little Dipper is rated for light industrial environments.

Do not install the Little Dipper:

- 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 Little Dipper be installed in such a way that the flow is directed upward to expel any trapped air bubbles as air trapped on the optical window will influence signal and cause erratic readings

### 2.2 Tee Installation

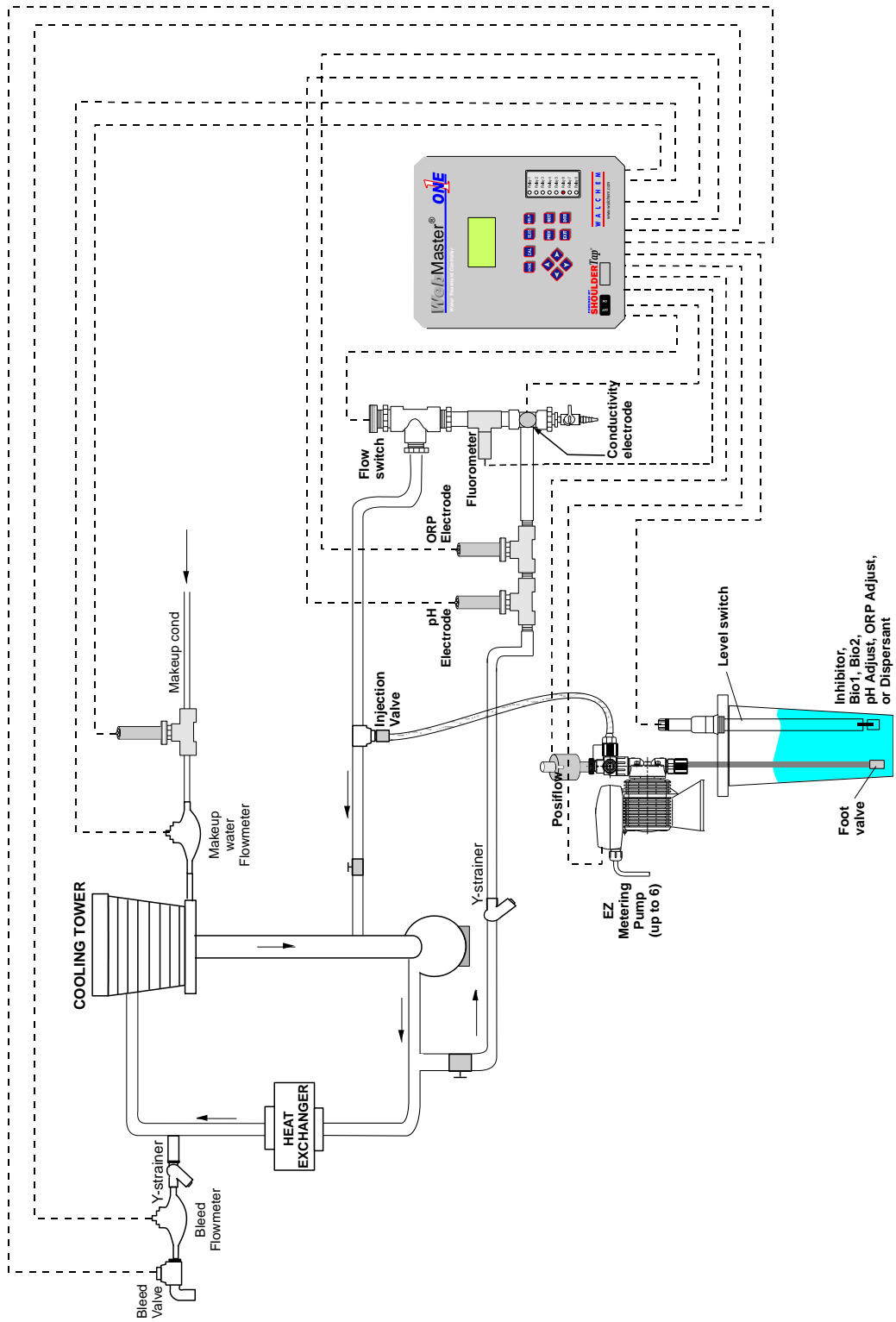
We recommend the following installation procedure for installing the Little Dipper onto the mounting tee provided for flow through applications.

Note: Only use the mounting tee provided when connecting the Little Dipper inline!

1. Wrap Teflon tape around the threaded male fitting which is bonded to the fluorometer's housing.  
Note: Turner Designs applies Teflon tape prior to shipping. For reapplications, do not wrap Teflon tape more than 3 – 4 full turns.
2. Turning clockwise, fully hand-tighten the Little Dipper to the mounting tee provided.
3. After the Little Dipper is fully hand tightened, use a wrench to make one more full clockwise turn.
4. Connect the mounting tee in line with your flow and start flowing water.
5. Inspect for leaks.
6. If a leak occurs, continue tightening ¼ inch at a time until the leaking stops.

Note: the base of the male fitting should not be flush with the mounting tee; the male fitting's threads should be visible after securing the connection using a wrench.

## Typical Installation – Cooling Tower



**Note: Sensors should be selected by the installer based on system requirements.**



## 2.3 Wiring

### Sensor to Isolator

The sensor is provided with an isolator connected to the short sensor cable. The sensor should be wired to the SENSOR terminal block of the isolator as follows:

ORN:	+
BRN:	-
RED:	PWR
BLK:	GND

Note: Sensors and Isolators with –C in the part number are supplied with prewired connectors.

### Isolator to Isolator Cable

The isolator is provided with a cable connected. The cable should be wired to the CONTROLLER terminal block of the isolator as follows:

ORN/WHT:	+
WHT/ORN:	-
BLU/WHT:	PWR
WHT/BLU:	GND

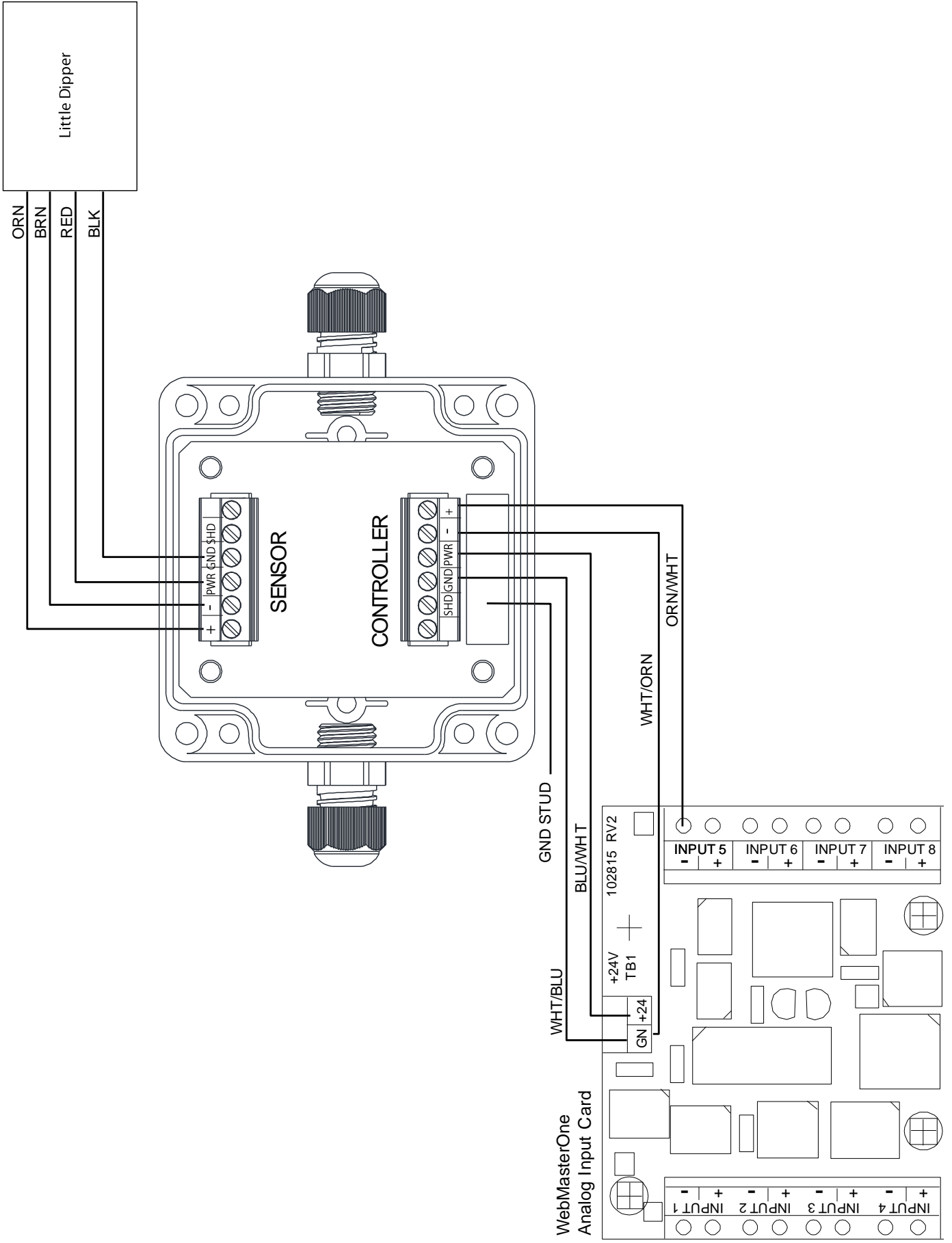
Note: Do not connect Shield drain in isolator.

### Isolator Cable to WebMaster

The isolator is provided with a 2-twisted pair, shielded, 24 AWG, 35 pF/foot capacitance cable. The wiring to the optional analog input card in the controller is as follows:

Shield Drain:	Earth Ground Stud
ORN/WHT:	IN-
WHT/ORN:	GND
BLU/WHT:	24 VDC
WHT/BLU:	GND

If the required cable length exceeds the 6 meters (20 feet) that is supplied, wire the fluorometer to a 190851 terminal box, then use a p/n 102535 cable to reach the instrument. The maximum cable length is 1220 meters (4000 feet).



### 3.0 Operation

Turner Designs' Little Dipper 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 Little Dipper allow 5 seconds for the LED to stabilize. After 5 seconds measurements can be taken continuously as current output (4 – 20 mA).

#### Programming the WebMaster

Refer to the detailed WebMaster instruction manual if necessary for information on how to connect to the controller via computer and program set points.

1. Go to the Analog Inputs 4-20 mA Inputs menu and assign the input where the Little Dipper is connected as a Generic type input.
2. Go to the Analog Inputs Generic menu and Enable Fluorometer Mode for the input where the Little Dipper is connected and click Submit.
3. Leave the 4 mA = and 20 mA = menus where they are. The 4 mA = should be set to 0 ppm. The 20 mA = setting will be automatically filled in after each 1 Point Calibration.

#### Calibration

The frequency of calibration is a function of many factors. These factors include:

1. The accuracy required by the application.
2. The value of the off-specification product versus the cost of calibration.
3. The coating or abrasive nature of the application.
4. The stability of the sensor and controller as a system.

The frequency of calibration is really determined by experience. At a new installation, calibration might initially be checked every day by comparing the controller reading to a handheld instrument or other manual analysis and logging the results. If the reading drifts off significantly in one direction you should consider calibrating. Resist the temptation to calibrate to correct for small errors that may be a result of normal variations in the test methods.

A calibration MUST be performed on initial installation, or after cleaning. A sensor installed in clean water can hold its calibration for several months.

#### Zero Calibration

1. Remove the sensor from the flow manifold and place it in a beaker of clean, fluorophore-free water. On system startup, if there is no fluorophore in the system water, the sensor may remain in the flow manifold.
2. Go to the Analog Inputs 4-20 mA Inputs menu of the controller. Refer to the controller instructions.
3. When the mA reading is stable, click on the button for Set 4 mA for the input where the Little Dipper is connected. Click OK when prompted to perform the calibration.
4. The controller will return a calibration pass or fail message:

Calibration Result	Message Shown
The mA reading at the time was within 2 mA of 4 mA.	Calibration Success!
The mA reading at the time was not within 2 mA of 4 mA.	Range Error!

5. Return the sensor to the flow manifold if necessary and check for leaks.

### One Point Process Calibration

1. Perform a handheld test or other manual analysis on the sample water.
2. Go to the Analog Inputs 4-20 mA Inputs menu of the controller. Refer to the controller instructions. Click on the 1 Pt Cal button for the input where the Little Dipper is connected.
3. Enter the New Value in ppb obtained using the handheld. If this is the first calibration at startup, also enter the Dye/Product Ratio, and then click Continue.
4. The controller will return a calibration pass or fail message:

Calibration Result	Message Shown
The user entered value is within range.	Calibration Success!
The input current is below 5 mA.	Cal Fail. Input below 5 mA.
The input current is above 21 mA.	Cal Fail. Input above 21 mA.

### One Point Calibration using Standard Solution

1. Remove the Little Dipper from the flow manifold and insert it into a calibration tee filled with calibration standard solution. If using a sensor with a connector, you may unplug the sensor from the isolator to avoid twisting the cable during removal, and to re-connect prior to calibrating.
2. Go to the Analog Inputs 4-20 mA Inputs menu of the controller. Refer to the controller instructions. Click on the 1 Pt Cal button for the input where the Little Dipper is connected.
3. Enter the concentration of the calibration standard solution in ppb under New Value. If this is the first calibration at startup, also enter the Dye/Product Ratio, and then click Continue.
4. The controller will return a calibration pass or fail message:

Calibration Result	Message Shown
The user entered value is within $\pm 50\%$ of the uncalibrated value.	Calibration Success!
The input current is below 5 mA.	Cal Fail. Input below 5 mA.
The input current is above 21 mA.	Cal Fail. Input above 21 mA.

## 4.0 Troubleshooting

### Calibration Fail Message

If the signal from the sensor is between 3.91 mA and 20.99 mA, yet you get a “Cal value out of limits” message:

Possible Causes	Corrective Actions
Optical window is dirty	Clean optical window as described in section 5.1
Calibration performed without a tee	Repeat the calibration with the sensor installed in a tee.
Problem with handheld instrument	Refer to the troubleshooting guide of the instrument used to measure the fluorophore.
Wiring incorrect	Check wiring against the wiring diagram. Ensure that each wire is stripped correctly and making contact with the terminal block.
Non-isolated signal	Ensure that the Little Dipper is connected to the controller through a signal isolator.
Faulty Sensor	Replace sensor.

### Sensor Error or Calibration Fail Message

If the signal from the sensor is outside the range of 3.90 to 21.00 mA, and you see either a Sensor Error status message, or Invalid ppm reading, or Cal Fail with either “Input below 4 mA” or “Input above 20 mA” message:

Possible Causes	Corrective Actions
Wiring incorrect	Check wiring against the wiring diagram. Ensure that each wire is stripped correctly and making contact with the terminal block.
Non-isolated signal	Ensure that the Little Dipper is connected to the controller through a signal isolator.
Faulty analog input card	Replace analog input card.
Faulty Sensor	Replace sensor.

### Reading is unstable

Possible Causes	Corrective Actions
Air bubbles in sample.	Find and repair any leaks in the sample manifold piping. Mount sensor tee vertically with flow going upwards.
Particles in sample.	Filter sample if necessary. Mount sensor tee vertically with flow going upwards.

## 5.0 Maintenance

The Little Dipper 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.

### 5.1 Visual Inspection and Cleaning

To visually check if the optical window has been fouled:

1. Remove the Little Dipper from the mounting tee.
2. If there is any noticeable fouling, use a soft bristle brush and soapy water to clean the optical window.
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 be handled only by qualified personnel)*
4. Once the optical window has been cleaned, re-install the mounting tee back onto the Little Dipper *(Note: see section 2.2 on how to properly install the mounting tee)*

## 6.0 Specifications

Fluorometer Specifications	
Parameter	Specification
Linearity (over dynamic range)	0.99 r <sup>2</sup>
Power draw	0.96 W @ 12 VDC (1.2 W max)
Input voltage	8 – 30 VDC
Signal Output	4 – 20 mA
Light Source	Light emitting diode
Detector	Photodiode
Warm-up time	5 seconds
Length	5.92 inch (15.04 cm)
Diameter (Housing)	1.05 inch (2.67 cm)
Diameter (Maximum)	1.54 inch (3.91 cm)
Weight	3.35 oz. (95 g)
Material	PVC – Type I, machined
Mounting Tee Specifications	
Parameter	Specification
Material	PVC – Type I, machined
Threading	1 inch NPTF
Length	3.44 inch (8.74 cm)
Dynamic Pressure Rating	100 PSI
Temperature Rating	140 °F (60 °C)
Fitting	Schedule 80