MiProbE Beta Installation Manual

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Introduction

The MiProbE Sentry is a remote aquatic monitoring system based on a proprietary microbial sensor technology. The MiProbE reports the microbial biofilm signal response to the environment surrounding the probe allowing real-time microbial response reporting to aerobic or anaerobic conditions. Real-time data is accessible via a cloud-based visualization and analytics platform provided by Groundswell Technology (Santa Barbara, CA).

This is a beta-test deployment of the MiProbE Sentry and real-time cloud monitoring dashboard. The MiProbE is a proprietary and patent-pending sensor technology developed out of the Department of Energy Small Business Innovative Research Grant program by Burge Environmental, Inc.

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1.0 Quick Installation

The MiProbE Sentry can be installed in either a Vertical Sensor Array configuration (Figure 1) or a Horizontal Sensor Array configuration (Figure 2).

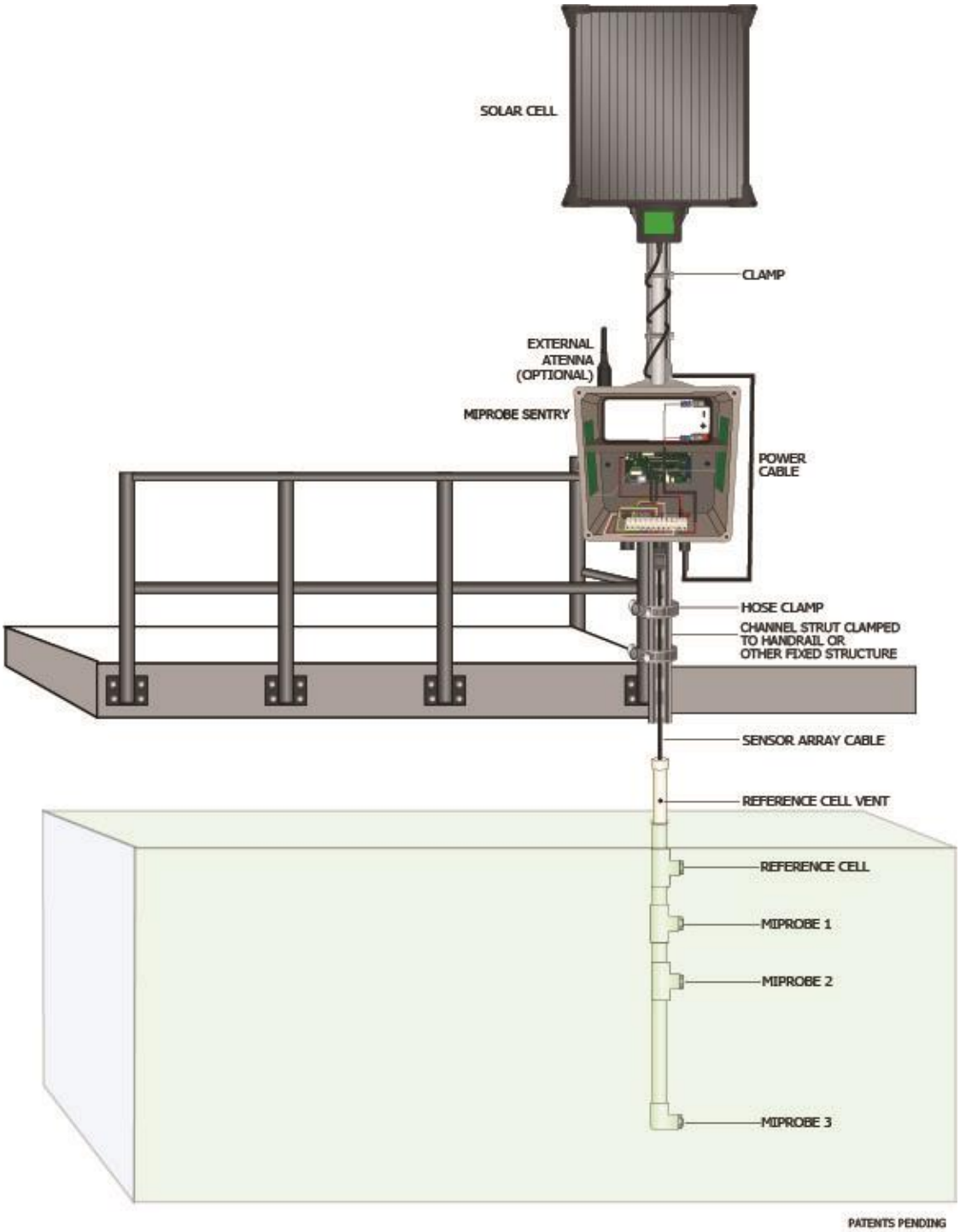


Figure 1 - Vertical Sensor Array Configuration

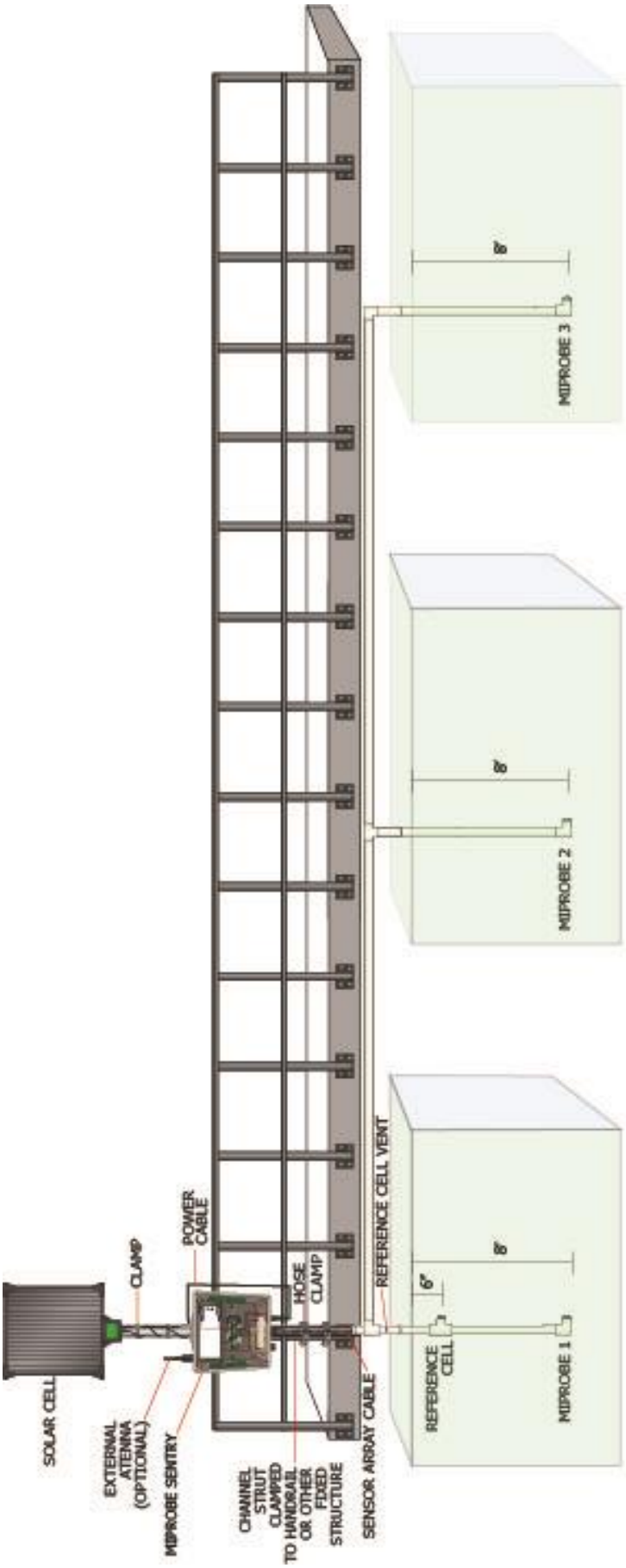
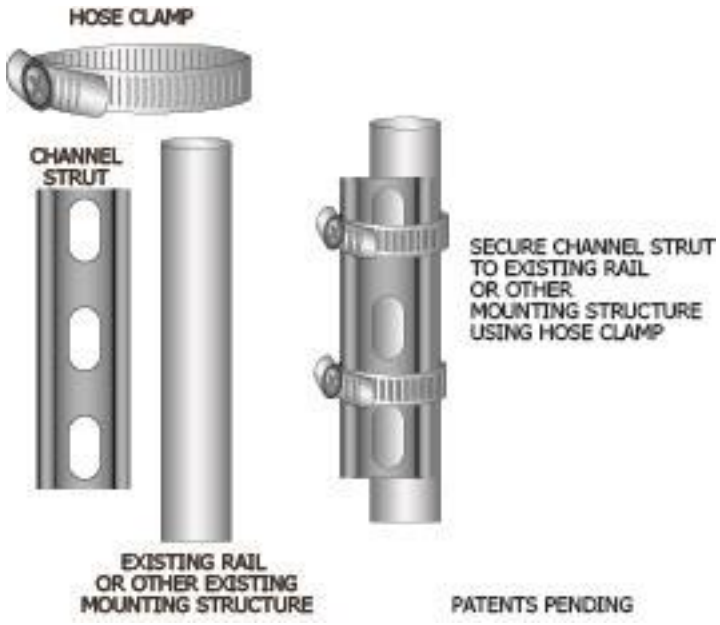


Figure 2 - Horizontal Sensor Array Configuration

1.1 Quick Installation Guide

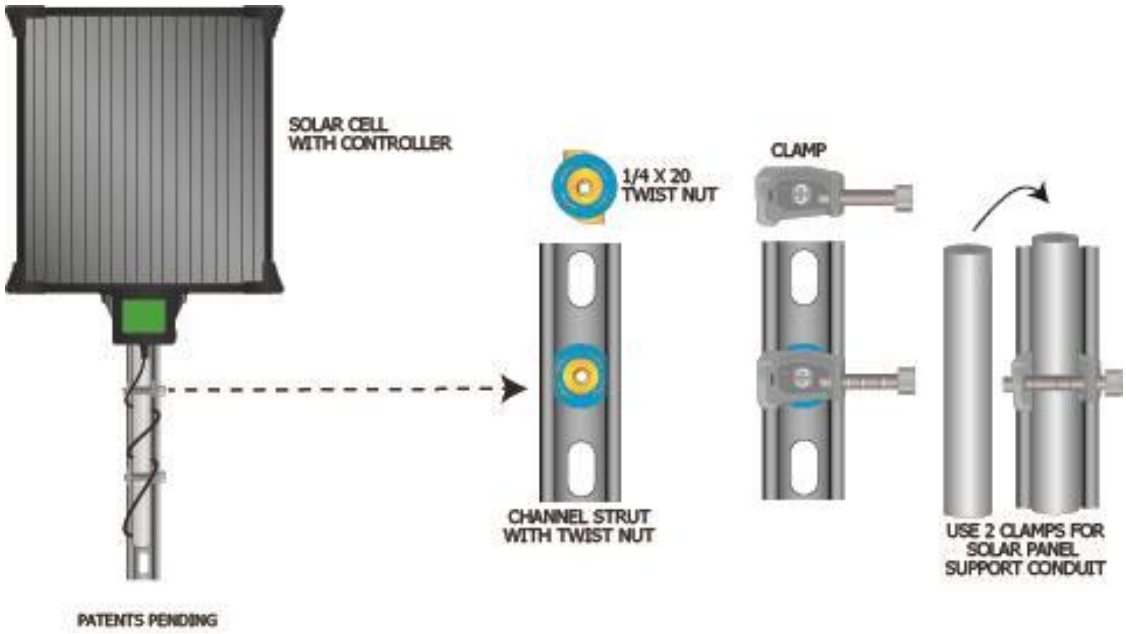
Step 1: Attach the Channel Strut to fixed infrastructure such as a handrail (Figure 3) or wall.

Figure 3 - Channel Strut Attachment



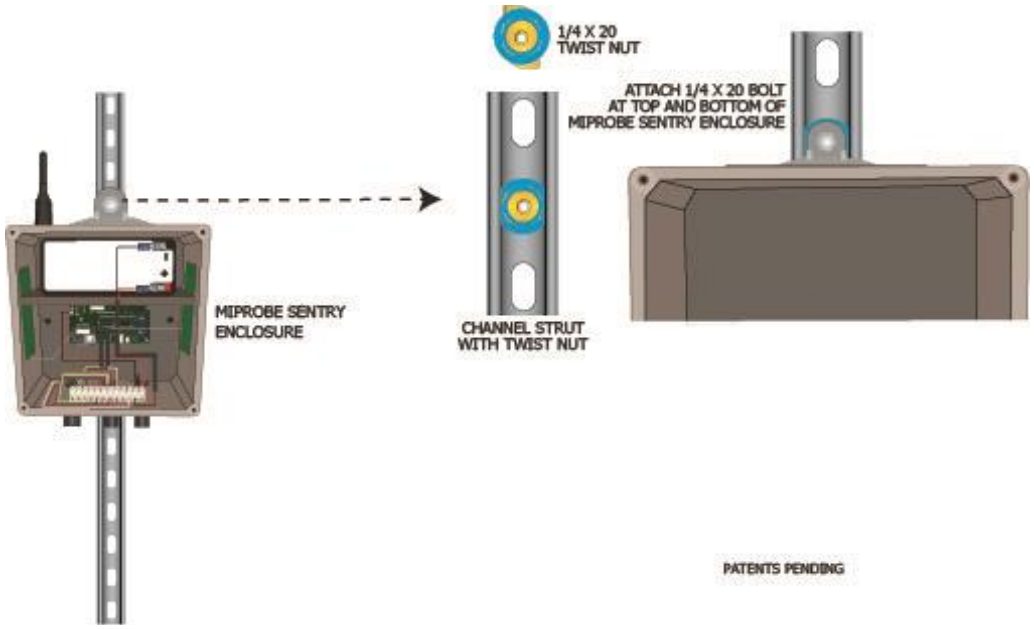
Step 2: Attach Power Module to structural conduit and clamp Power Module Assembly to Channel Strut (Figure 4).

Figure 4 - Power Module Assembly Attachment



Step 3: Bolt Sentry Enclosure to Channel Strut (Figure 5).

Figure 5 - Sentry Enclosure Attachment



Step 4: Attach Sensor Array with fixed or floating Reference Cell to fixed infrastructure. The Fixed (Figure 6) or Floating (Figure 7) Reference Cell must be installed below the water line.

Figure 6 - Fixed Reference Cell Vertical Sensor Array

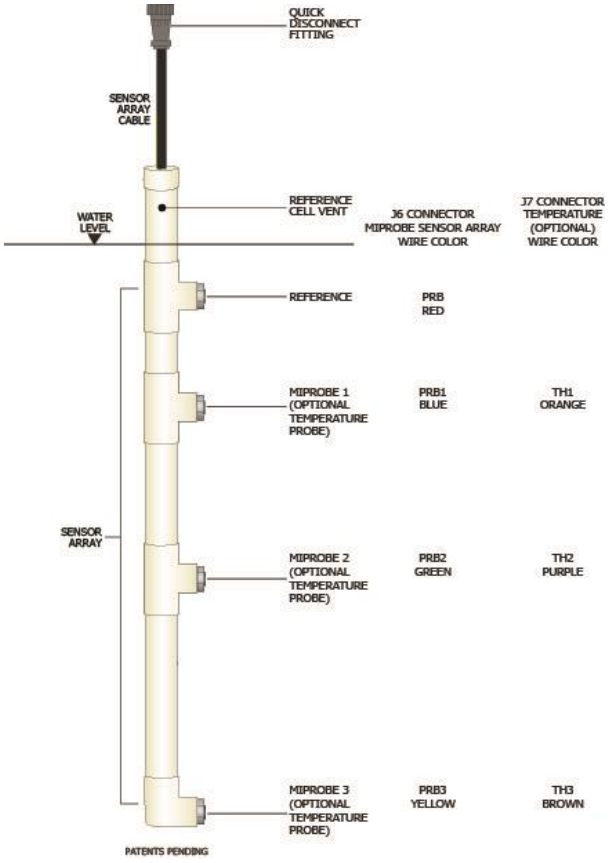
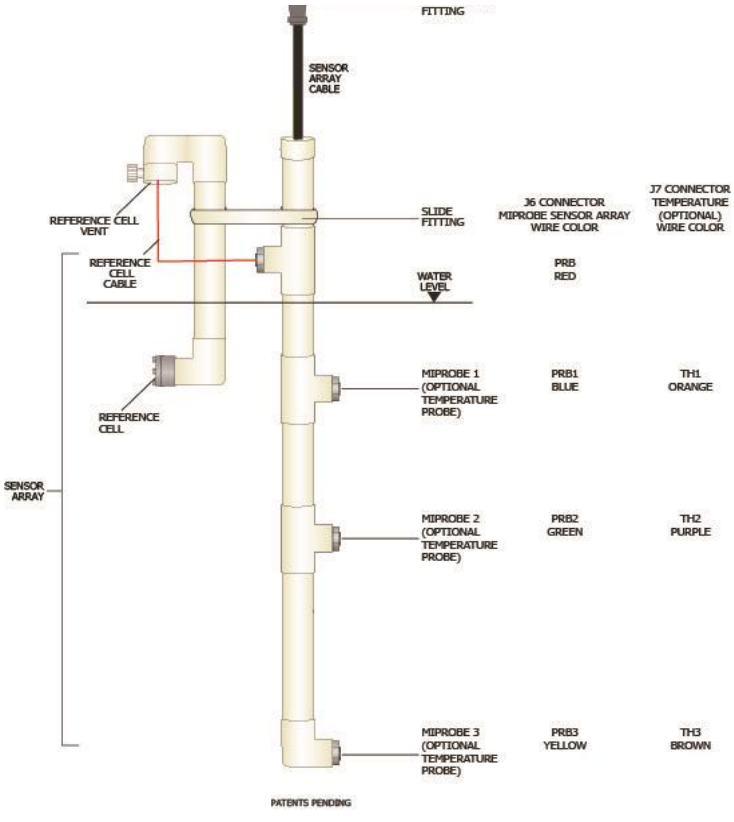


Figure 7 - Floating Reference Cell Vertical Sensor Array



Steps 5 through 7 (See Figure 8)

Step 5: Connect Sensor Array Signal Cable to Sentry Enclosure.

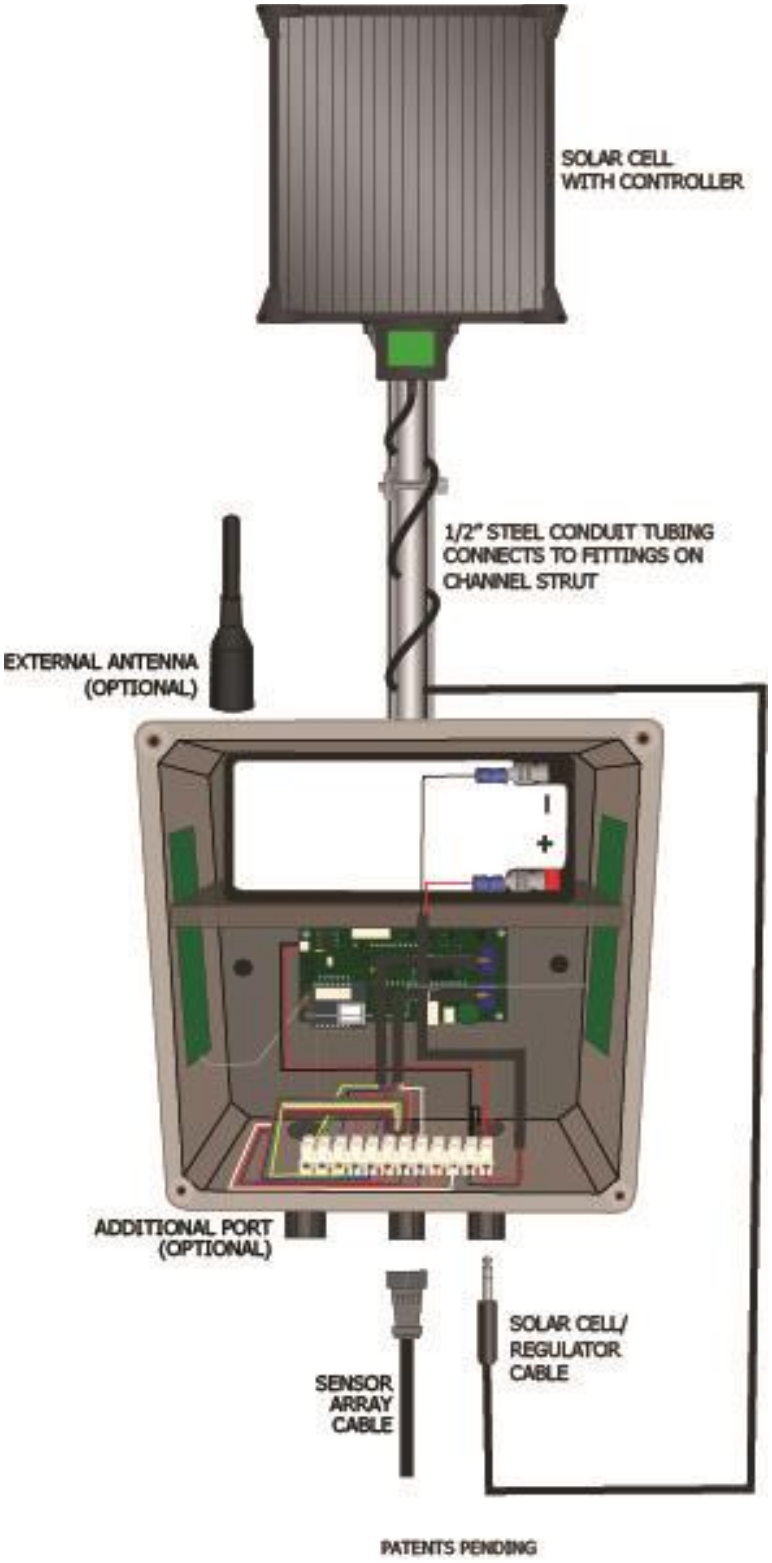
Step 5a: Connect Additional Port Sensor Cables (Optional).

Step 5b: Connect External Antenna (Optional).

Step 6: Connect Power Cable to Sentry Enclosure.

Step 7: Wait 30 seconds and press Manual Transmission Button (Optional).

Figure 8 - Sentry Enclosure Connection Diagram



2.0 MiProbE Sentry Components

2.1 MiProbE Sentry

The MiProbE Sentry low-power cellular enabled real-time monitoring system assembly includes the following:

- Sentry Enclosure
- Microbial Signal Processor (MSP) System Board
- Cellular Communications Module
- Solar Panel & Power Assembly
- Support Components
    - Terminal Block & Cabling
    - Internal or External Antenna
    - Internal Battery

2.1.1 Sentry Enclosure

The MiProbE Sentry Enclosure is an environmental enclosure to protect the MSP and other vital electronics components.

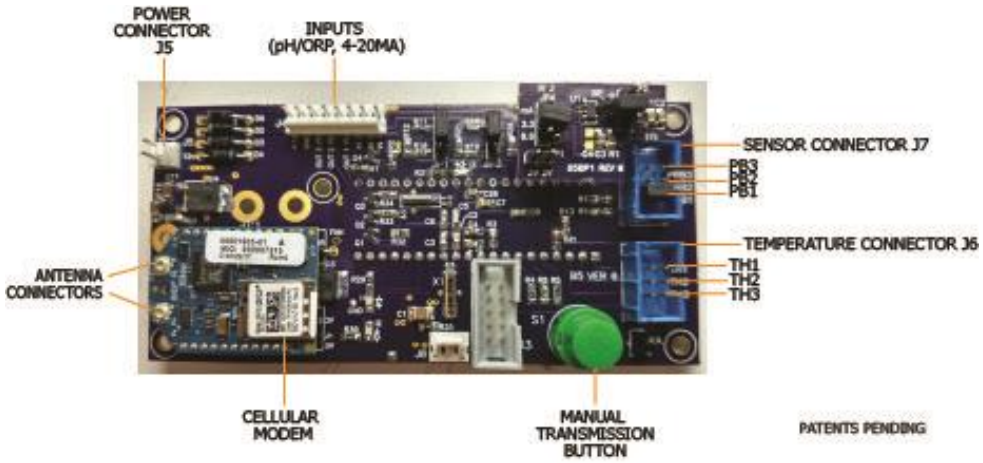
2.1.2 Microbial Signal Processor (MSP) System Board

The System Board (Figure 9) comes with a pre-installed MSP, Cellular Communications Module, and Solar Controller Module. The System Board has an optional Manual Transmission Button for confirming connectivity and troubleshooting.

Each System Board is pre-configured for the following:

- Real-time Sampling Interval
- Microbial Sensor Configuration
- Optional Sensor Configuration
    - Up to three Thermistors
    - Up to two 4-20 mA Sensors (e.g. Water Level, Turbidity, ORP, DO, pH, etc.)
- Cellular Connectivity (Verizon)

Figure 9 - Microbial Signal Processor System Board



2.1.3 Solar Panel & Power Assembly

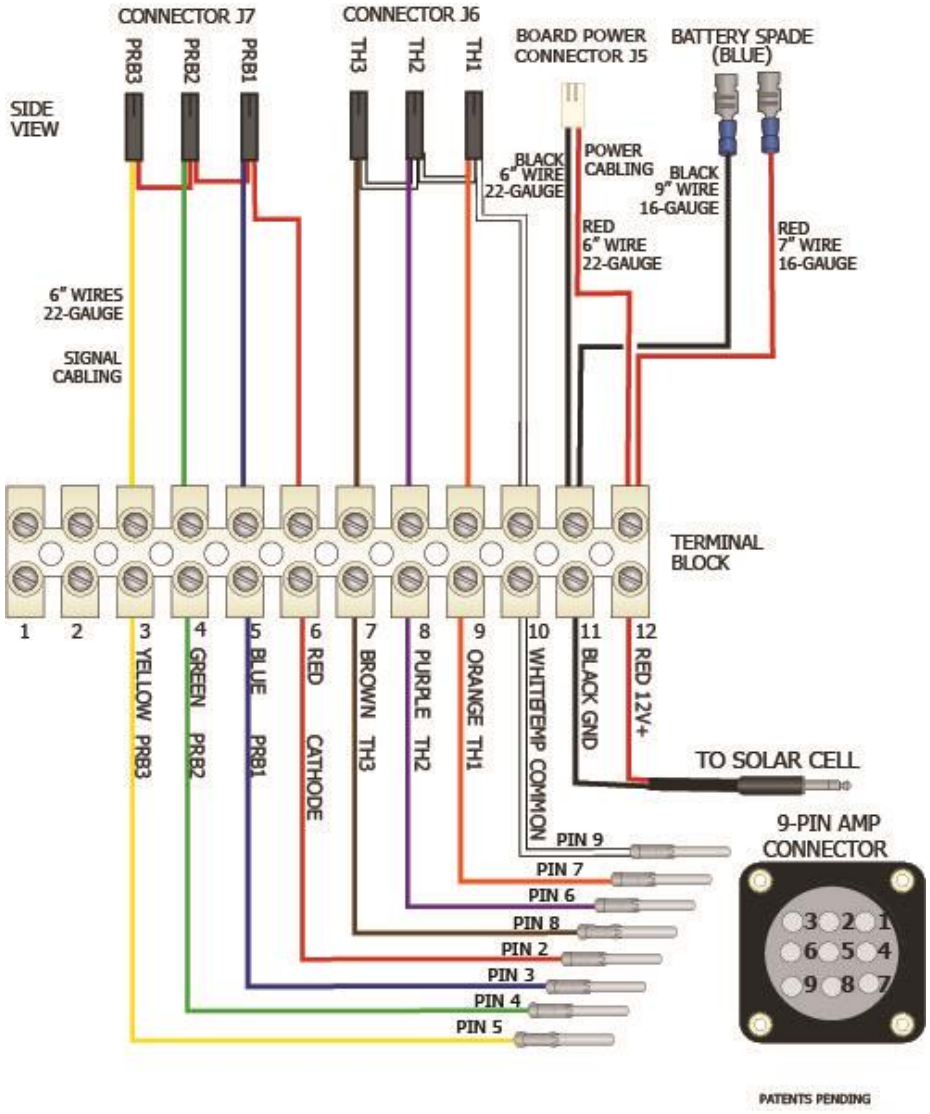
The default configuration includes a 5-watt Solar Panel attached to the Power Assembly for infrastructure-free deployment. The Solar Panel charges the internal battery for uninterrupted, continuous real-time monitoring.

2.1.4 Support Components

2.1.4.1 Terminal Block & Cabling

The Terminal Block is pre-wired for connection to the Microbial Signal Processor System Board and the Microbial Signal Cable (Figure 10).

Figure 10 - Terminal Block & Microbial Signal Cable Wiring Diagram



2.1.4.2 Internal or External Antenna

The MiProbE Sentry standard configuration includes an internal cellular antenna for connectivity to the Verizon 3G and 4G wireless networks. An optional SubMiniature version A (SMA) connector for high-gain external antennas is available for remote deployments with limited cellular coverage. The SMA connector port is located on the top of the Sentry Enclosure.

2.1.4.3 Internal Battery

Each MiProbE Sentry comes equipped with a heavy-duty 12 volt internal battery that can be powered by the standard configuration Solar Panel or an optional 12 volt transformer for dedicated power.

2.2 MiProbE Sentry Operating Specifications

MiProbE Sentry Operating Specifications:	
Power	0.06 watts (Typical)
	1.8 watts (Transmitting)
Dimensions	4" x 8" x 8" Controller Housing
Temperature	32° F - 149° F (Internal)
Humidity	1% - 99% Non-condensing
Sensor Configurations:	
MiProbE Sensors	Up to 3
Temperature	Up to 3
Optional 4-20mA Sensors	Up to 2
Optional Components:	
Solar Panel	12V 270mA Output
Lithium Ion Battery	12.8V 6.4Ahr
Groundswell Cloud Platform:	
Basic Internet Access and Web Browser	

2.3 MiProbE Sensor Arrays

Sensor Arrays come in either a vertical or horizontal configuration for either gradient or multi-vessel monitoring applications. Each Array will have 1 or more MiProbEs, a reference cell, and any optional sensors pre-installed.

2.3.1 Vertical Array Configuration

The vertical profile monitoring array is typically used for monitoring aerobic/anaerobic gradients in industrial vessels (Settling Basins, Aeration Ponds, etc.), and comes with two default configurations for fixed or variable water levels.

Design 1: Fixed Reference Cell Configuration
Design 2: Floating Reference Cell Configuration

2.3.2 Horizontal Array Configuration

The horizontal monitoring array is typically used for monitoring multiple vessels or ponds, ir in series to measure aerobic/anaerobic gradients across treatment vessels.

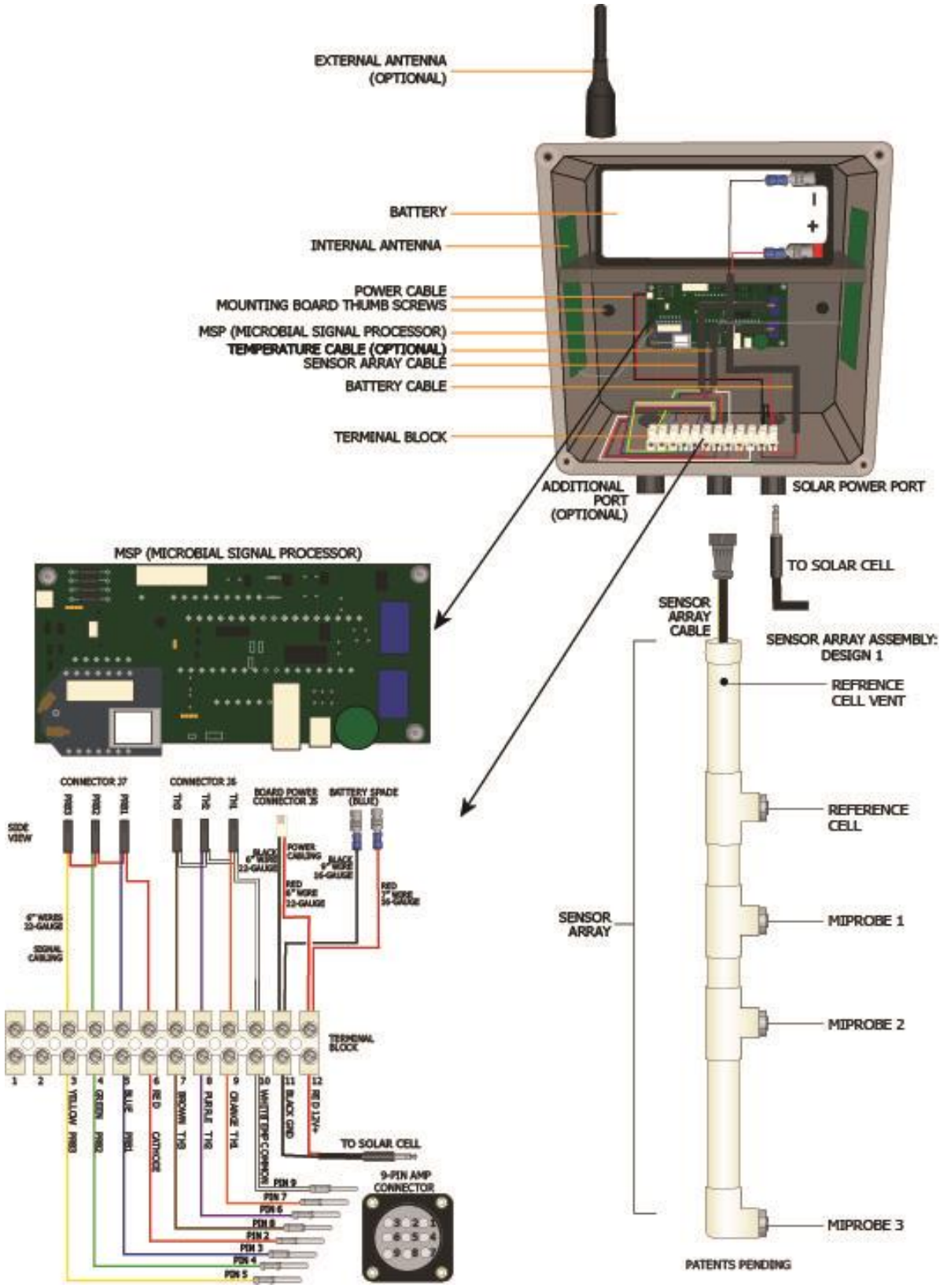
2.3.3 MiProbE Sensors, Reference Cell, and Signal Cable

Each set of MiProbE sensors and Reference Cell must be installed under the water-line of the installation vessel. A Microbial Signal Cable comes pre-wired as per the Sensor Wiring Color Code (See Table 1) to connect the Sensor Array to the Sentry Enclosure.

Table 1 - Sensor Wiring Color Code

Component	Sensor Assembly Location Height/Distance	Terminal Block Position	Signal Board, Pin #	Wire Color
Reference Cell		6		Red
MiProbE 1	Bottom/farthest	3	J7 PRB3	Yellow
MiProbE 2	Middle/Middle	4	J7 PRB2	Green
MiProbE 3	Top/Closest	5	J7 PRB1	Blue
Temperature 1 (optional)	Bottom/farthest	7	J6 TH3	Brown
Temperature 2 (optional)	Middle/middle	8	J6 TH2	Purple
Temperature 3 (optional)	Top/closest	9	J6 TH1	Orange
Temperature Common (optional)	Common	10	J	White
Power: +12 volts		12	J5 +	Red
Power: Common		11	J5 -	Black

Figure 11 - Detailed MiProbE Sentry Sensor Wiring Diagram



3.0 Groundswell Monitoring Dashboard

The MiProbE Sentry comes pre-configured for data acquisition through the Groundswell Technology online Dashboard. Login to the dashboard at http://www.groundswelltech.com/. Please contact Burge Environmental for login details at contact@burgenv.com.

Figure 6 - Groundswell Technology Real-Time Monitoring Dashboard