



Manta+ Water Quality Probes User Guide

June 22, 2026

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This User Guide covers Solinst Eureka's Manta+, Trimeter, *EasyProbes* and Manta2 models.
For simplicity the term "Manta" is used collectively for all models.



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1.0 Learning the Manta in 30 Minutes

1.1 Your Manta Probe



Figure 1-1 Your Manta Probe Assembly

1. The Manta Multiprobe is configured with your choice of sensors, and with or without a battery pack.
2. The Underwater Cable connects the Manta to a Data Display (Windows PC, third-party datalogger, telemetry device or, using the mantaMobile Bluetooth® device with a tablet or smartphone).

Note: See the [Using MantaLink™ App with mantaMobile™ User Guide](#) for instructions on programming, collecting data and calibrating your Manta probe using the app and your smart device.

Note: The Manta comes standard with the Data Cable and USB Adapter, Underwater Cables are sold separately. However, Vented Cables are included with Probes that have a vented depth sensor.

3. The Storage/Calibration Cup protects the sensors when the Manta is not in use (**keep a few drops of tap water in the S/C Cup when the Manta is not being used**). And with the lid removed, it holds your calibration solutions. During calibration, flip the lid over to use as a stopper when rinsing/shaking.
4. The Solinst Eureka Flash Drive contains the software for connecting your Manta to your Windows PC or other Data Display, plus a digital copy of this User Guide, several instructional videos, and several technical notes.
5. The Data Cable lets you communicate conveniently with your Manta when an Underwater Cable is not needed, for instance, during Calibration.

Note: Do not use the USB Adapter with anything but a USB port and a Manta.

6. The USB Adapter connects between your Data Cable (or Underwater Cable) and a USB port on your Windows PC or laptop. The USB Adapter can also connect an external power supply to your Manta if USB power is not adequate (particularly with long Underwater Cables or large number of sensors).

Note: Trimeters and EasyProbes do not come standard with the Data Cable and USB Adapter.

7. The Maintenance Kit contains all the tools and maintenance items needed to keep your Manta in top shape.
8. The Weighted Sensor Guard replaces the Storage/Calibration Cup to protect the sensors during deployment, and to help the Manta sink.

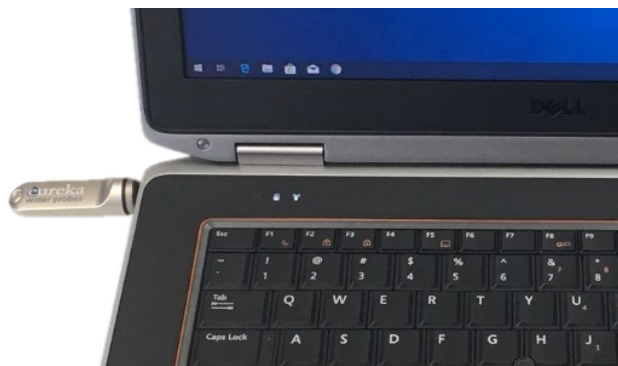
Note: EasyProbes come standard with a soft carrying case.

1.2 Connect Your Manta

Please follow the steps below to install Manta Control Software on your PC.

1. Plug the Solinst Eureka Flash Drive into one of your PC's USB ports.

Figure 1-2 Plugging Flash Drive into USB Port



2. When the dialog box shown below opens, click Install Manta Software to upload the Manta Control Software and the USB Driver software onto your PC. Depending on which version of Windows you are using, you might have to answer questions about your intention to load new software on your PC. Once that is through, you'll be returned to the same screen that you started with, meaning that your Manta Control software and USB Driver are installed. Click the X in the upper right corner of the dialog box to close the installation process.

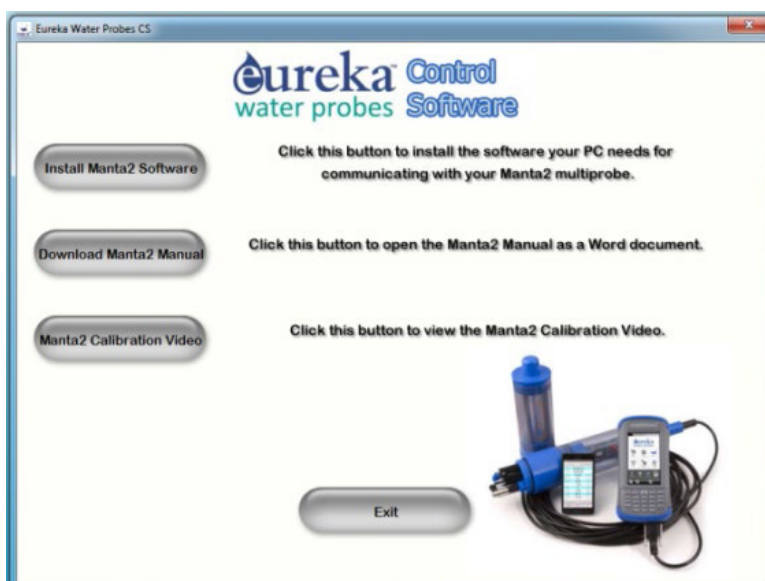
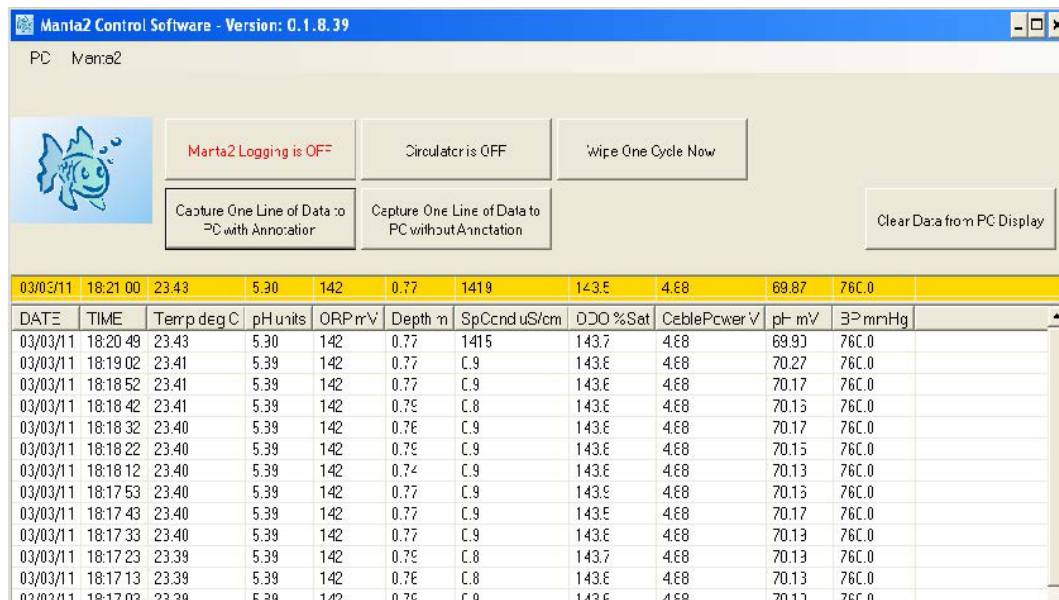


Figure 1-3 Manta Control Software Installation Window

This software installation process should take only a few minutes. Please contact Solinst Eureka if you have any issues.

Note: You can download the Manta+ Water Quality Probes User Guide and various videos and technical documents that are stored on the Solinst Eureka Flash Drive.

3. If Windows did not create a shortcut to the Manta Control Software on your Desktop, and you would like one, click the Start button in the lower left of your screen, click All Programs, click the Eureka folder, right-click “Manta 2 Control Software”, and drag it to your desktop.
4. Now connect your Manta to the USB Adapter using either a Manta Data Cable or Underwater Cable. Click the Solinst Eureka “fish” icon to connect your PC and Manta. The Home Page will appear, showing the Manta’s real-time data and various menu options. You can close the program by clicking the X in the upper right corner.



DATE	TIME	Temp deg C	pH units	ORP mV	Depth m	SpCond uS/cm	DO %Sat	Cable Power V	pH mV	SP mmHg
03/03/11	18:21:00	23.43	5.30	142	0.77	1419	143.5	4.88	69.87	760.0
03/03/11	18:20:49	23.43	5.30	142	0.77	1415	143.7	4.88	69.93	760.0
03/03/11	18:19:02	23.41	5.39	142	0.77	0.9	143.8	4.88	70.27	760.0
03/03/11	18:18:52	23.41	5.39	142	0.77	0.9	143.8	4.88	70.17	760.0
03/03/11	18:18:42	23.41	5.39	142	0.79	0.8	143.8	4.88	70.13	760.0
03/03/11	18:18:32	23.40	5.39	142	0.78	0.9	143.8	4.88	70.17	760.0
03/03/11	18:18:22	23.40	5.39	142	0.79	0.9	143.8	4.88	70.15	760.0
03/03/11	18:18:12	23.40	5.39	142	0.74	0.9	143.8	4.88	70.13	760.0
03/03/11	18:17:53	23.40	5.39	142	0.77	0.9	143.9	4.88	70.13	760.0
03/03/11	18:17:43	23.40	5.39	142	0.77	0.9	143.8	4.88	70.17	760.0
03/03/11	18:17:33	23.40	5.39	142	0.77	0.9	143.8	4.88	70.13	760.0
03/03/11	18:17:23	23.39	5.39	142	0.79	0.8	143.7	4.88	70.13	760.0
03/03/11	18:17:13	23.39	5.39	142	0.78	0.8	143.8	4.88	70.13	760.0
03/03/11	18:17:03	23.39	5.39	142	0.78	0.9	143.8	4.88	70.13	760.0

Figure 1-4 Manta Control Software Home Page

If your Manta does not connect with your PC, it may be that your organization’s network firewall prevented the installation of the USB driver. Consult your IT department if you do not see the Prolific USB driver listed in your device-driver menu (which is usually found in Settings after clicking the Start button in the lower-left screen).

1.3 A Short Exercise

Here is a quick exercise to show how easy the Manta is to use. We will connect the instrument to a PC, calibrate conductivity, and check the Calibration Log for the conductivity calibration information.

1. Connect your Manta to your PC with the USB Adapter and either a Data Cable or Underwater Cable.

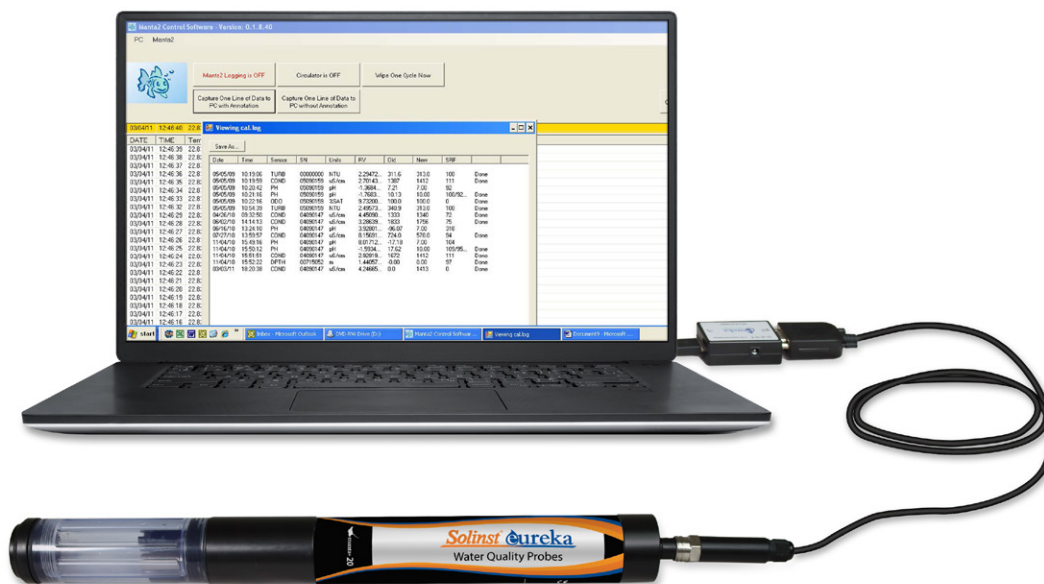


Figure 1-6 Manta Connected to a PC

2. Click the Solinst Eureka icon to launch the Manta Control Software. Once open, you will see the Home Page and the data being sent from your Manta.
3. Fill the Storage/Calibration Cup with tap water or conductivity standard and wait for the conductivity reading to stabilize.
4. Click the Manta pull-down menu on the Home Page and click Calibrate, and then click SpCond on the next screen.
5. Type in the approximate conductivity of your tap water or the value of your conductivity standard and click OK.
6. Click on OK in the next screen to finalize the calibration and be returned to the Home Page.
7. Click the Manta pull-down menu on the Home Page then click Cal Log on the next screen. At the bottom of the list are the details of the calibration that you just did.
8. Click on OK to return to the Home Page.

2.0 Manta Probe Basics

Solinst Eureka is the only major multiprobe manufacturer that provides a three-year warranty that covers all sensors, including pH and DO.

2.1 Deployment Specifications

The Manta can be used in natural water up to 50 degrees C and to 200 meters deep, except for those using ISEs, which are rated to 10 meters deep, and TDG sensors and low-range Depth, which should go no deeper than 25 meters.

2.2 Manta Control Software Flow Chart

See Section 3 Manta Control Software Map.

2.3 Four Basic Manta Probe Applications

1. **Manual Data Collection**, also known as profiling, surveying, site-to-site measurements, etc., means the user is present at the monitoring site and uses a Data Display to observe measurements. This allows the user to make data-driven decisions in the field in real time and to visit multiple monitoring sites in a single day. The Data Display can be a laptop, or almost any tablet or smartphone. The user records measurements either with pen and paper or, preferably, using Manta's Snapshot or Automatic Snapshot features. You might "snapshot" a series of measurements in one or more lakes or streams during the day, and then download the data to your desktop PC later.
2. **Unattended Logging** means that the user has set the multiprobe to Logging mode, deployed it in the proper location in the water, and then left the site. The Manta can run for weeks at a time with cable-supplied power or an optional Manta integral battery pack. You can, for instance, set the instrument to take a set of readings every half-hour, anchor it in an estuary, and return after two weeks to retrieve the instrument and download the data to a PC, laptop, or smart device.
3. **Telemetry Relay** means that the user has connected the multiprobe to a telemetry device, deployed the Manta in the proper location in the water, and then left the site. A cable connects the multiprobe to the telemetry system. The telemetry device uses satellite or cellular communication to periodically report the multiprobe's collected data to the user's office PC or to a proprietary web page. In many telemetry systems, the user can also contact the multiprobe and request transmission of the most recent data. Telemetry Relay allows the user to collect data for extended periods without being present at the monitoring site and to access that data remotely at any time. Telemetry helps determine when a field trip for multiprobe calibration or maintenance is necessary. Telemetry is also ideal in locations for which access is dangerous or expensive.
4. **On-Line Monitoring**, also known as process-control monitoring, means that the multiprobe is connected to a PLC, SCADA system, or similar system. An example is monitoring the input to a water-treatment plant for salinity or chlorophyll. On-Line Monitoring enables users to make water-quality-based decisions in real time. The Manta is particularly effective in this application when multiple parameters are used in the control loop.

2.4 Underwater Cables

The later Manta Underwater Cables have a marine-style connector (left), while the early Manta Underwater Cables had an audio-style connector (right).



Marine-Style Connector (new)

Audio-Style Connector (old)

Figure 2-1 Manta Underwater Cable Connectors

Vented Underwater Cables (VUC), which are used with the optional Vented Level sensor, have a small tube within the VUC to connect the sensor to the surface of the water so that changes in barometric pressure do not affect level readings. That vent tube is connected to a desiccant pack at the top of the VUC to prevent water from condensing inside the vent tube. Later VUCs are fixed to the Manta and cannot be removed.

2.5 LED Light Definitions

The Manta has three light-emitting diodes (LEDs), mounted on the circuit board visible through the instrument housing, to help you understand what's happening, and to provide information when troubleshooting a failure.

The green light blinks every second when receiving adequate operating voltage via the cable; it does not blink when the Manta operates under its own battery power.

The red light blinks five times upon power-up when Logging is enabled.

The amber light blinks when the Manta is receiving RS-232 communications from an external device (such as a PC or datalogger).

A sequence of red and amber LED flashes tell you the voltage of your battery pack if you have activated Logging. When you first power-up your Manta, the red LED will blink five times to indicate that Logging is activated and to indicate the first 5 volts of battery power, and then one amber blink for each volt, and one red blink for each half volt.

For example, five reds, five ambers, and a red means $5 + 5 + 0.5 = 10.5$ battery volts.

2.6 USB Converters

Solinst Eureka's USB Converter converts your Manta's data stream to a USB port. Newer models have a power port on the side that you can use to power the Manta when USB power is insufficient, or to protect your laptop's battery. The connector is pretty standard for power supplies, so that you can plug in many third-party power supplies—but do not use a power supply that provides over 14V DC.

Note: If you are using a power supply that plugs into the wall, please use a GFI-equipped circuit.

2.7 Accessories

Solinst Eureka provides a number of accessories for the Manta, including carrying cases, anti-fouling kits, SDI-12 and MODBUS converter cables, data displays, telemetry systems, cable reels, etc. Please See the Manta Probes Accessories Data Sheet for more details.

2.8 Flow Cells

If it is more convenient to bring the water to the Manta than the Manta to the water, for instance, when monitoring a groundwater well, you can screw a Flow Cell onto the Manta as you would normally screw on a sensor guard.

Note: Be sure to limit the pressure in your sample lines to 15 psi so that you don't damage the flow cell.



Figure 2-2 Flow Cell

2.9 Routine Maintenance

Clean your instrument periodically with warm soapy water. Liquid dish washing soap is fine. Do not use abrasives. Do not use acetone. Do not clean with gasoline, kerosene, or industrial cleaners. Mild household cleaners work well. Clean sensor stems with a soft brush.

Rinse well with tap water, and store sensors with tap water in the storage cup.

Replace any o-rings with visible cracks. Keep o-rings greased with silicon grease (found in your Maintenance Kit). Always remove batteries and clean your Manta prior to storing it for prolonged periods.



Figure 2-3 Cleaning Your Manta Probe

3.0 Manta Control Software

Note: See the Using MantaLink™ App with mantaMobile™ (Bluetooth device) User Guide for instructions on programming, collecting data and calibrating your Manta probe using the app and your smart device.

3.1 Manta Control Software Map

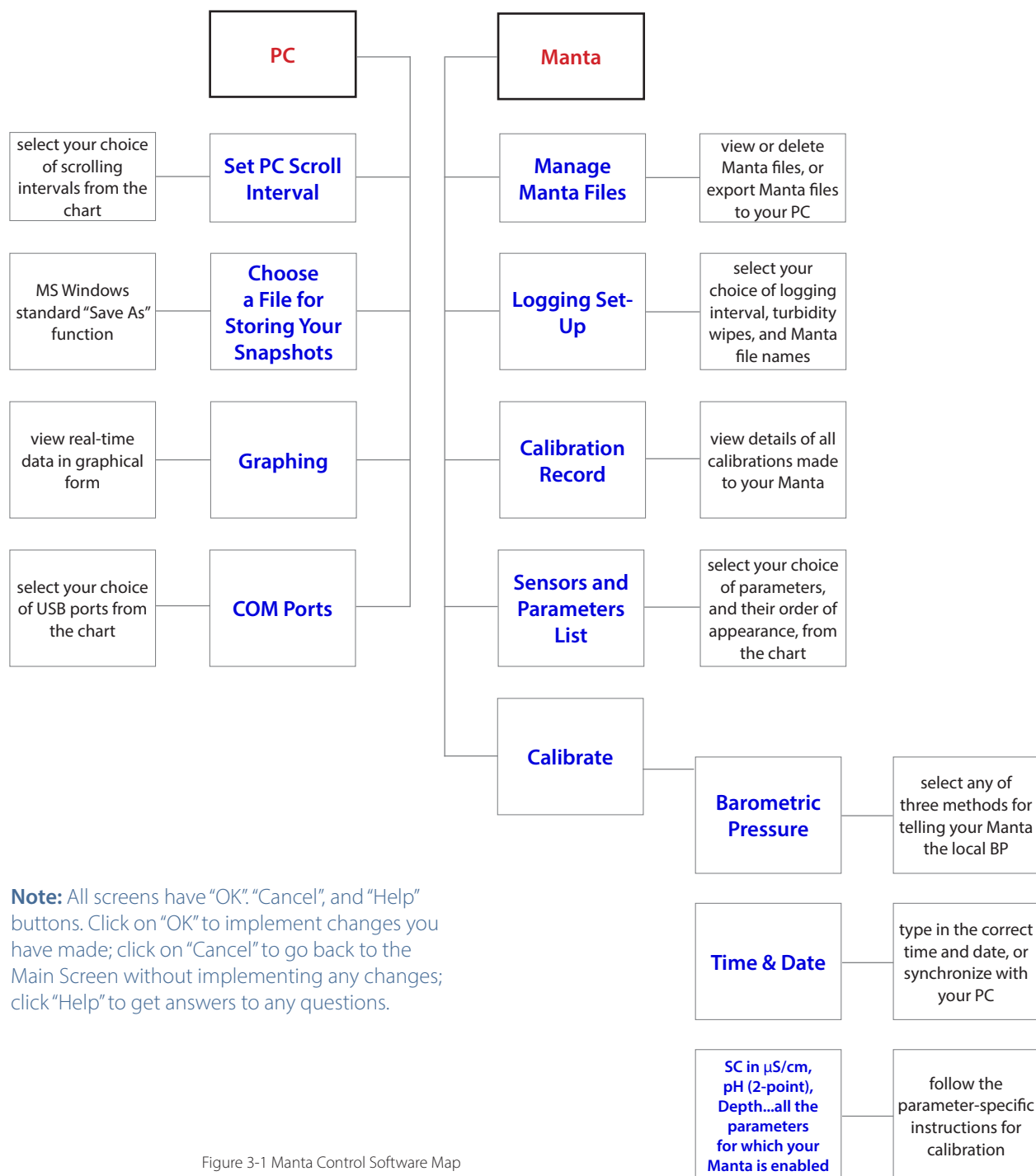


Figure 3-1 Manta Control Software Map

3.2 Home Page

You can access all of the functions of the Manta Control Software from the Home Page. The Home Page functions are:

- PC and Manta pull-down menus, which provide multiple options
- Hot Buttons that provide short-cuts to important and often-used functions
- The most recent line of data from your Manta highlighted in yellow
- Continuously updating real-time data from your Manta
- Connection, Snapshot, Logging and data file information tabulated at the bottom of the screen

The screenshot shows the Manta2 Control Software interface. Annotations point to various features:

- Top Left:** Two pull-down menus (PC and Manta2) are circled. Annotation: "These two buttons are pull-down menus."
- Top Center:** Six buttons are circled: "Manta2 Logging is OFF", "Circulator is OFF", "Wipe One Cycle Now", "Capture One Line of Data to PC with Annotation", "Capture One Line of Data to PC without Annotation", and "Clear Data from PC Display". Annotation: "These six buttons are 'hot buttons' — short-cuts to important and often-used functions."
- Table:** A table displays real-time data. The bottom line is highlighted in yellow. Annotation: "The line of data highlighted in yellow is the most recent line of data sent from the Manta."
- Bottom:** A status bar shows connection and logging information. Annotation: "The bottom line of the screen tabulates information you may find useful."
- Real-time Data:** A red arrow points to the continuously updating data. Annotation: "This area is continuously updating real-time data from your Manta."

DATE	TIME	Temp deg C	pH units	ORP mV	Depth m	SpCond uS/cm	DO %Sat	CablePower V	pH mV	BP mmHg
03/03/11	18:21:00	23.43	5.90	142	0.77	1419	143.5	4.88	69.87	760.0
03/03/11	18:20:49	23.43	5.90	142	0.77	1415	143.7	4.88	69.90	760.0
03/03/11	18:19:02	23.41	5.89	142	0.77	0.9	143.8	4.88	70.27	760.0
03/03/11	18:18:52	23.41	5.89	142	0.77	0.9	143.6	4.88	70.17	760.0
03/03/11	18:18:42	23.41	5.89	142	0.79	0.8	143.8	4.88	70.16	760.0
03/03/11	18:18:32	23.40	5.89	142	0.76	0.9	143.8	4.88	70.17	760.0
03/03/11	18:18:22	23.40	5.89	142	0.79	0.9	143.8	4.88	70.15	760.0
03/03/11	18:18:12	23.40	5.89	142	0.74	0.9	143.8	4.88	70.13	760.0
03/03/11	18:17:53	23.40	5.89	142	0.77	0.9	143.9	4.88	70.16	760.0
03/03/11	18:17:43	23.40	5.89	142	0.77	0.9	143.5	4.88	70.17	760.0
03/03/11	18:17:33	23.40	5.89	142	0.77	0.9	143.8	4.88	70.19	760.0
03/03/11	18:17:23	23.39	5.89	142	0.79	0.8	143.7	4.88	70.19	760.0
03/03/11	18:17:13	23.39	5.89	142	0.76	0.8	143.8	4.88	70.13	760.0
03/03/11	18:17:03	23.39	5.89	142	0.79	0.9	143.6	4.88	70.10	760.0
03/03/11	18:16:53	23.39	5.88	142	0.77	0.9	143.8	4.88	70.93	760.0
03/03/11	18:16:43	23.39	5.89	142	0.74	0.9	144.0	4.88	69.86	760.0
03/03/11	18:16:32	23.39	5.89	142	0.80	0.8	144.1	4.88	70.14	760.0
03/03/11	18:16:14	23.38	5.89	142	0.78	0.9	143.8	4.88	70.06	760.0
03/03/11	18:16:04	23.38	5.90	142	0.74	0.8	143.7	4.88	70.04	760.0
03/03/11	18:15:33	23.37	5.89	142	0.74	0.9	144.0	4.88	70.16	760.0
03/03/11	18:15:23	23.37	5.89	142	0.79	0.9	143.7	4.88	70.07	760.0
03/03/11	18:15:13	23.37	5.90	142	0.79	0.9	143.8	4.88	70.04	760.0
03/03/11	18:14:58	23.37	5.89	142	0.76	0.9	143.8	4.88	70.05	760.0
03/03/11	18:14:48	23.37	5.90	142	0.76	0.8	143.8	4.88	70.02	760.0
03/03/11	18:14:38	23.37	5.89	142	0.74	0.9	143.8	4.88	70.11	760.0
03/03/11	18:14:28	23.37	5.89	142	0.76	0.9	143.9	4.88	70.23	760.0
03/03/11	18:14:18	23.36	5.89	142	0.74	0.9	143.9	4.88	70.07	760.0
03/03/11	18:14:08	23.36	5.90	142	0.77	0.9	143.9	4.88	70.01	760.0
03/03/11	18:13:58	23.36	5.90	142	0.73	0.9	143.8	4.88	69.95	760.0
03/03/11	18:13:48	23.36	5.90	142	0.79	0.9	143.8	4.88	69.94	760.0
03/03/11	18:13:38	23.36	5.90	142	0.79	0.9	143.9	4.88	69.95	760.0
03/03/11	18:13:28	23.35	5.90	142	0.73	0.9	143.8	4.88	69.97	760.0
03/03/11	18:13:18	23.35	5.90	142	0.76	0.9	143.9	4.88	70.03	760.0

Connected on COM3 | Snapshot C:\Documents and Settings\Steve\My Documents\snapshot.csv | Log Interval: 1 min | Log File: DEFAULT.LCG

Figure 3-2 Manta Control Home Screen Map

3.3 Hot Buttons

If this button says "ON", click on it to turn Manta logging off. If this button says "OFF", click on it to turn Manta logging on.

Click this button to toggle your circulator, if any, on and off.

Click this button to start one wipe cycle for your turbidity sensor, if any.

The screenshot shows the Manta2 Control Software interface. At the top, there are three hot buttons: "Manta2 Logging is OFF", "Circulator is OFF", and "Wipe One Cycle Now". Below these are two more buttons: "Capture One Line of Data to PC with Annotation" and "Capture One Line of Data to PC without Annotation". A "Clear Data from PC Display" button is located on the right. The main area displays a table of water quality data. The top row of the table is highlighted in yellow, representing the most recent data. Red arrows point from the explanatory text boxes to the corresponding buttons in the software interface.

DATE	TIME	Temp deg C	pH units	ORP mV	Depth m	SpCon uS/cm	ODO %Sat	CablePower V	pH mV	BP mmHg
03/03/11	18:21:00	23.43	5.90	142	0.77	1419	143.5	4.88	69.97	760.0
03/03/11	18:20:49	23.43	5.90	142	0.77	1415	143.7	4.88	69.90	760.0
03/03/11	18:19:02	23.41	5.89	142	0.77	0.9	143.8	4.88	70.27	760.0
03/03/11	18:18:52	23.41	5.89	142	0.77	0.9	143.6	4.88	70.17	760.0
03/03/11	18:18:42	23.41	5.89	142	0.79	0.8	143.8	4.88	70.16	760.0
03/03/11	18:18:32	23.40	5.89	142	0.76	0.9	143.8	4.88	70.17	760.0
03/03/11	18:18:22	23.40	5.89	142	0.79	0.9	143.8	4.88	70.15	760.0
03/03/11	18:18:12	23.40	5.89	142	0.74	0.9	143.8	4.88	70.13	760.0
03/03/11	18:17:53	23.40	5.89	142	0.77	0.9	143.9	4.88	70.16	760.0
03/03/11	18:17:43	23.40	5.89	142	0.77	0.9	143.5	4.88	70.17	760.0
03/03/11	18:17:33	23.40	5.89	142	0.77	0.9	143.8	4.88	70.19	760.0
03/03/11	18:17:23	23.39	5.89	142	0.79	0.8	143.7	4.88	70.19	760.0
03/03/11	18:17:13	23.39	5.89	142	0.76	0.8	143.8	4.88	70.13	760.0
03/03/11	18:17:03	23.39	5.89	142	0.79	0.9	143.6	4.88	70.10	760.0
03/03/11	18:16:53	23.39	5.88	142	0.77	0.9	143.8	4.88	70.93	760.0
03/03/11	18:16:43	23.39	5.89	142	0.74	0.9	144.0	4.88	69.86	760.0
03/03/11	18:16:32	23.39	5.89	142	0.80	0.8	144.1	4.88	70.14	760.0
03/03/11	18:16:14	23.38	5.89	142	0.78	0.9	143.8	4.88	70.06	760.0
03/03/11	18:16:04	23.38	5.90	142	0.74	0.8	143.7	4.88	70.04	760.0
03/03/11	18:15:53	23.37	5.89	142	0.74	0.9	144.0	4.88	70.16	760.0
03/03/11	18:15:23	23.37	5.89	142	0.79	0.9	143.7	4.88	70.07	760.0
03/03/11	18:15:13	23.37	5.90	142	0.79	0.9	143.8	4.88	70.04	760.0
03/03/11	18:14:58	23.37	5.89	142	0.76	0.9	143.8	4.88	70.05	760.0
03/03/11	18:14:48	23.37	5.90	142	0.76	0.8	143.8	4.88	70.02	760.0
03/03/11	18:14:38	23.37	5.89	142	0.74	0.9	143.8	4.88	70.11	760.0
03/03/11	18:14:28	23.37	5.89	142	0.76	0.9	143.9	4.88	70.23	760.0
03/03/11	18:14:18	23.36	5.89	142	0.74	0.9	143.9	4.88	70.07	760.0
03/03/11	18:14:08	23.36	5.90	142	0.77	0.9	143.9	4.88	70.01	760.0
03/03/11	18:13:58	23.36	5.90	142	0.73	0.9	143.8	4.88	69.95	760.0
03/03/11	18:13:48	23.36	5.90	142	0.79	0.9	143.8	4.88	69.94	760.0
03/03/11	18:13:38	23.36	5.90	142	0.79	0.9	143.9	4.88	69.95	760.0
03/03/11	18:13:28	23.35	5.90	142	0.79	0.9	143.8	4.88	69.97	760.0
03/03/11	18:13:18	23.35	5.90	142	0.76	0.9	143.9	4.88	70.03	760.0

When you click on this button, a comment screen appears where you can type a note. Then one frame of data is sent to your Snapshot file (along with the comment you typed in the box). The comment is called an annotation.

Click this button to send one frame of data to your Snapshot file without an annotation.

Click this button to clear the data area.

Figure 3-3 Manta Control Home Screen Hot Buttons Map

“Hot Buttons” are the square buttons at the top of the Home Screen; when clicked, they perform an important function without leaving the Home Screen. Hot Buttons are:

1. Click the **“Manta logging is OFF”** (or, “Manta logging is ON”) hot button to enable or disable the Manta’s Logging function. Clicking the hot button toggles the Logging on and off. Generally, Logging should be off – turn Logging to ON only when you’re preparing for unattended deployment.
2. Click the **“Wipe one cycle now”** hot button to activate one cycle of the turbidity sensor’s wiper. If your Manta does not have turbidity, you can still click this button, but nothing will happen.
3. Click the **“Capture One Line of Data to PC without Annotation”** hot button to save the most recent line of data (as shown in the yellow band on the Home Page) in your Snapshot file.

4. Click the **“Capture One Line of Data to PC with Annotation”** hot button to save the most recent line of data (as shown in the yellow band on the Home Page) to your Snapshot file, along with a brief note appended to the data. Type that note in the annotation box. The note will be saved, along with the data, in your Snapshot file.
5. Click the **“Clear Data from PC Screen”** hot button to remove the data you see on the screen and start over with only the most recent data. Clicking this button does not close the program.

3.4 PC Pull-Down Menu

When you click on the PC pull-down menu, you get six options to choose from:

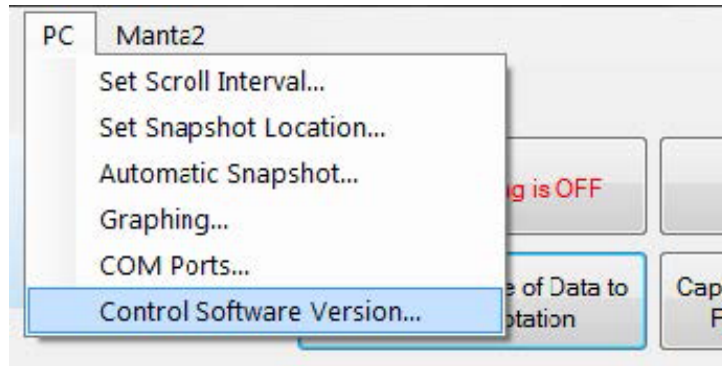


Figure 3-4 Manta Control Software PC Pull-Down Menu

1. Click “**Set Scroll Interval**” to change the time that lines of data on your Data Display screen are updated. You can click on a specific scroll interval or type in your own.
2. Click “**Set Snapshot Location**” to specify the location your Snapshots will be filed in. This calls up the standard “Save As” (or equivalent) function of your Data Display’s operating system. A “Snapshot” is what happens when you choose to log, or store, one line of data. For example, that line can be representative stabilized readings at 10 meters in a particular lake, or any other line of data you find important.

Note: Notice that the active Snapshot File location is listed on the bottom line of the Home Page.

3. Click “**Automatic Snapshot**” to log data automatically and quickly, for example, to catch a transient situation or if you are rapidly profiling a column of water. The data are stored in the Snapshot file as determined by “Set Snapshot Location”. In Automatic Snapshot, data are logged at the same interval as they are displayed on your Data Display screen when you’re not in Automatic Snapshot. For instance, if you have set your PC scroll interval to 10 seconds, Automatic Snapshot will record data at 10-second intervals.
4. Click “**Graphing**” to see your Manta real-time data in graphical form. The graph view is helpful for watching sensor stability when profiling. For example, Dissolved Oxygen readings are temperature and salinity corrected, so when the probe goes through water with thermal or saline stratification, it is important to wait for stable readings before recording a Snapshot.
5. Click “**COM Ports**” to change the USB port that your Manta Control Software uses to talk to your Manta. Typically, the Manta Control Software scans all active USB ports until it finds a Manta device to communicate with. However, you might have more than one Manta connected to your PC at a time. For example, if you are calibrating several Mantas at the same time, or are using your PC to monitor several Mantas at the same time (like in a fish hatchery with multiple tanks). In that case, you can click COM Ports to view the list of all the COM ports that your PC is aware of and select an alternative COM port corresponding to the Manta.
6. Clicking “**Control Software Version**” displays the software version that your Data Display is using to communicate with your Manta.

3.5 Manta Pull-Down Menu

When you click on the “Manta” pull-down menu, you get eight buttons to choose from:

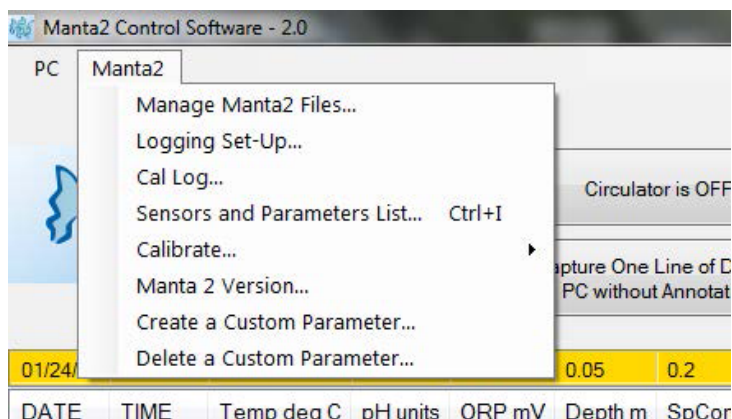


Figure 3-5 Manta Control Software Manta Pull-Down Menu

3.5.1 Manage Manta Files

Click on “**Manage Manta Files**” to see the names of all the data files stored in your Manta. Click on the file you would like to work with. Using the buttons on the screen, you can view that file on your Data Display, Delete that file, or Export it to your Data Display (via the Save As function standard to Windows). You may highlight multiple files to select for export.

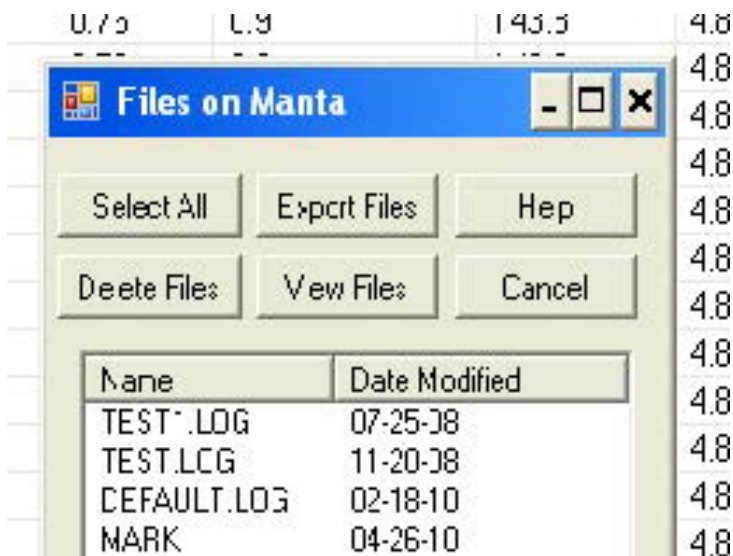


Figure 3-6 Manage Manta Files

3.5.2 Logging Setup

All Mantas include data memory and software that automatically logs (stores) a line of data. The “**Logging Setup**” screen lets you change the instructions the Manta will follow when Logging. Click on your preferred Logging interval. You can elect to append any new data to a file that already exists in the Manta by clicking “Browse Manta”, then selecting a file and clicking “OK”, or create a new Manta logging file by typing the new file name under “Log File Name”. If you need to log in seconds, select the “optional box” and write an “s” next to the value: Example: 5s would be every 5 seconds.

For your convenience, the active logging file name is displayed in the bottom line of the Home Page.

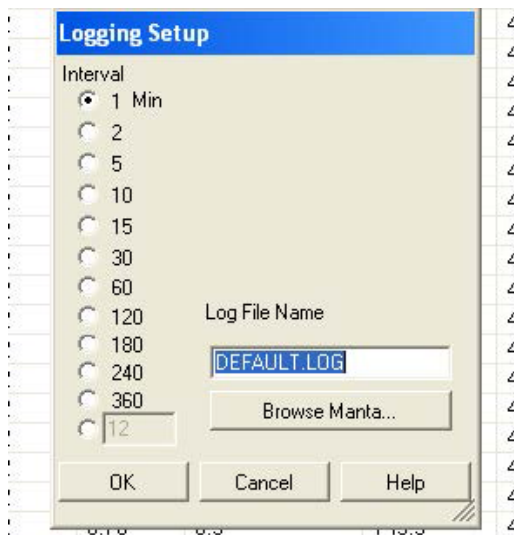


Figure 3-7 Logging Setup

3.5.3 Calibration Log

Click on the “**Cal Log**” button to view the calibration record. This is a lifetime, permanent record of all calibration changes for your Manta.

Viewing cal.log										
Save As...										
Date	Time	Sensor	SN	Units	RV	Old	New	SRF		
05/05/09	10:19:06	TURB	00000000	NTU	2.29472...	311.6	313.0	100	Done	
05/05/09	10:19:59	COND	05090159	uS/cm	2.70143...	1387	1412	111	Done	
05/05/09	10:20:42	PH	05090159	pH	-1.3684...	7.21	7.00	92		
05/05/09	10:21:16	PH	05090159	pH	-1.7683...	10.13	10.00	100/92...	Done	
05/05/09	10:22:16	ODO	05090159	%SAT	9.73200...	100.0	100.0	0	Done	
05/05/09	10:54:39	TURB	05090159	NTU	2.49573...	340.9	313.0	100	Done	
04/26/10	09:32:50	COND	04090147	uS/cm	4.45090...	1333	1340	72	Done	
06/02/10	14:14:13	COND	04090147	uS/cm	3.28639...	1833	1756	75	Done	
06/16/10	13:24:10	PH	04090147	pH	3.92801...	-96.07	7.00	318		
07/27/10	13:59:57	COND	04090147	uS/cm	8.15691...	724.0	578.0	94	Done	
11/04/10	15:49:16	PH	04090147	pH	8.01712...	-17.18	7.00	104		
11/04/10	15:50:12	PH	04090147	pH	-1.5934...	17.62	10.00	109/95...	Done	
11/04/10	15:51:51	COND	04090147	uS/cm	2.92919...	1672	1412	111	Done	
11/04/10	15:52:22	DPTH	00715052	m	1.44057...	-0.00	0.00	97	Done	
03/03/11	18:20:38	COND	04090147	uS/cm	4.24665...	0.0	1413	0	Done	

Figure 3-8 Calibration Log

3.5.4 Sensors and Parameters List

Enable the parameters listed by clicking the box (to the left of the parameter name) to produce a check mark. Clicking on a box with a check mark removes it and disables that parameter.

Note that if you enable a parameter but don't have a sensor for that parameter, inaccurate data will display.

The order of the enabled parameters in this list is the order in which the parameters will appear in your Data Display Home Page, the order in which they will appear in Logging files, and the order in which they will appear in Snapshot files. You can change the parameter order by clicking on (i.e. highlighting) the parameter name and then moving the highlighted name up or down by clicking on the up- and down-arrows at the bottom of the screen.

Par...	Sensor	Last Cal.	SRF	Fw/V...	Port No.	Serial #
☒	T... TEMP	2007010*	100.00	VER...	03	00000...
☒	p... pH	2007010*	108.02	VER...	04:0	04090...
☒	O... ORP	2007010*	100.00	VER...	04:1	04090...
☒	D... DPTH	2007010*	98.00	VER...	11	00715...
☒	S... COND	2007010*	0.07	VER...	02	04090...
☒	O... ODO	2007010*	100.00	VER...	07	04090...
☒	C... none					
☒	p... pH	2007010*	108.02	VER...	04:0	04090...
☒	B... none					
☐	T... TEMP	2007010*	100.00	VER...	03	00000...
☐	D... DPTH	2007010*	98.00	VER...	11	00715...
☐	S... COND	2007010*	0.07	VER...	02	04090...

Figure 3-9 Sensor and Parameters List

3.5.5 Calibrate

Click on the “**Calibrate**” button in the Manta pull-down menu to get a screen listing all the parameters that can be calibrated in a Manta. Click on the parameter you wish to calibrate to see its Calibrate screen. This screen has calibration instructions for the specific parameter and shows the current reading for that parameter.

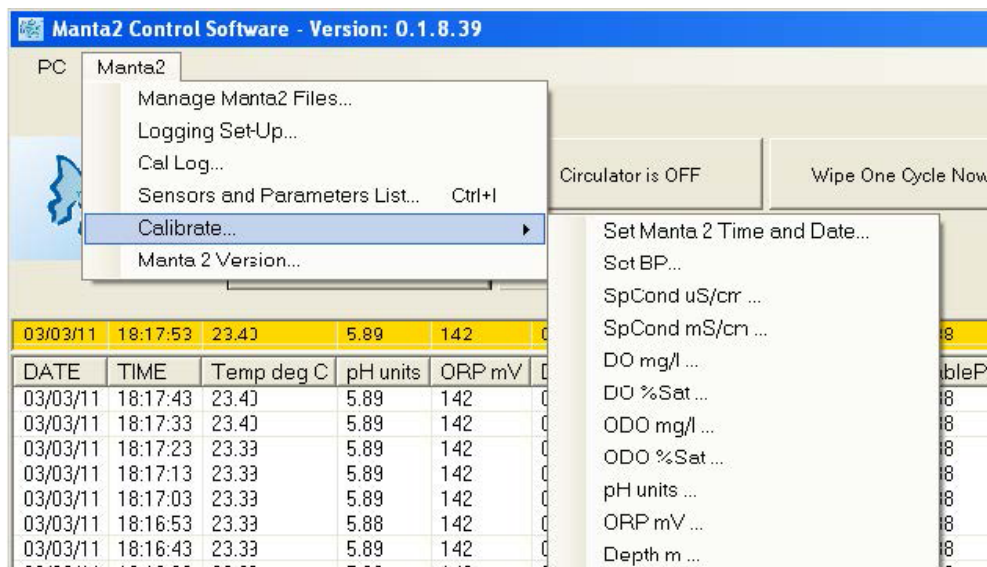


Figure 3-10 Calibrate

If your calibration requires a calibration standard, type your calibration standard value where it says “enter calibration value”. When the parameter reading has stabilized in the calibration solution, click on the OK button. If your calibration has an acceptable **SRF (Sensor Response Factor)**, an indication of the sensor condition, the calibration will be accepted and you will be returned to the Home Page. If you click on “OK”, the calibration will be accepted despite a deviant SRF, and you will be returned to the Home Page. If you click on “Cancel”, you’ll go back to the Calibrate screen.

How do I know if I need to calibrate?

Frequent calibration will give you better data. The more meticulous you are with calibration, the better data you will gather. If you are uncertain whether you need to calibrate, check your sensors against a known sample. If the reading is within the accuracy specification and/or your accuracy expectations, there is no need to calibrate. Experience and your program’s accuracy expectations will help determine calibration frequency for the various sensors. If, for instance, your reservoir discharge is hovering near the regulatory minimum for dissolved oxygen, you should pay special attention to DO calibration frequency and technique. On the other hand, if a conductivity accuracy of +/- 10% is OK, you needn’t calibrate conductivity very often.

3.5.6 Manta Version

Click this button to see the version number for the software that your Manta uses.

3.5.7 Create a Custom Parameter

If you have identified a relationship between conductivity and total dissolved solids (TDS) specific to your waters, or if you have an algorithm that relates water level to flow for a particular site, the Manta allows you to create new parameters. For example, you could name these parameters “My TDS” and “Site 4b Flow.” These custom parameters will appear on your Home Page and in your logged data alongside standard measurements like temperature and pH. To create a custom parameter, click on the Manta pull-down menu, and click on “**Create Custom Parameter**”. Follow the instructions to name your new parameter, specify the units that you wish the new parameter reported in (e.g. mg/l for TDS), and tell the Manta how to calculate your new parameter (using mathematical operators as you would in Excel). Please note that only basic operators can be used (such as + - * /).

Note: Enclose the entire expression in parentheses. After creating or deleting a parameter, restart your PC.

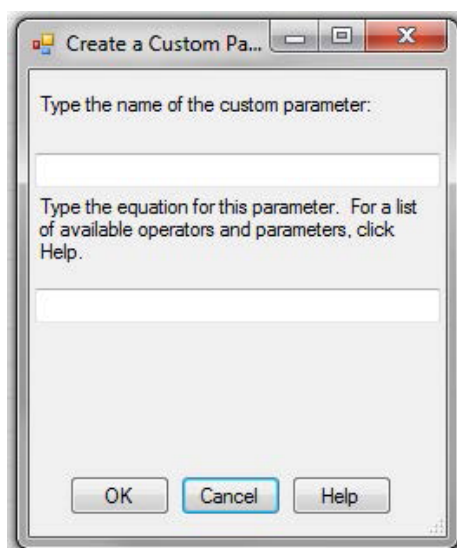


Figure 3-11 Create a Custom Parameter

3.5.8 Delete a Custom Parameter

To delete a custom parameter, click on the Manta pull-down menu and click on **“Delete Custom Parameter”** and follow the instructions provided in the software.

4.0 Sensors and Calibrations

4.1 Sensors vs. Parameters

A sensor is a basic element, like a thermistor or a pH glass electrode. Each sensor has one or more parameters. For example, we use a thermistor to measure both Temperature °F and Temperature °C — one sensor with two parameters. A conductivity sensor can be read as Specific Conductance $\mu\text{S}/\text{cm}$, Specific Conductance mS/cm , Total Dissolved Solids mg/l , and Salinity (PSU) — one sensor with four parameters.

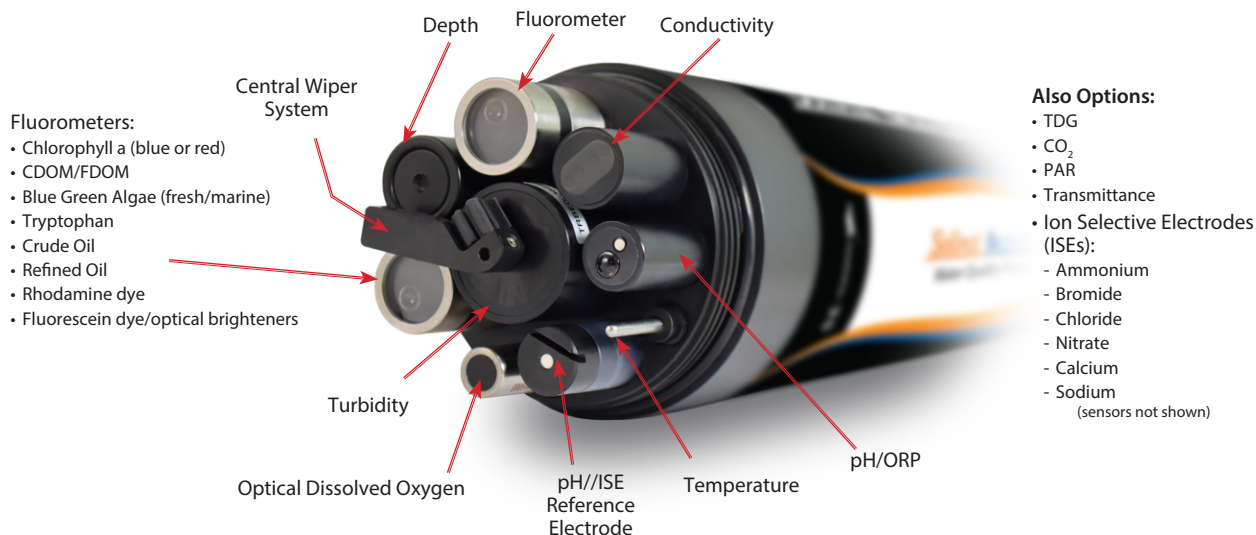


Figure 4-1 Manta+ Sensor Options (Manta+F35 shown with nose cone removed)

Note: Only Manta+F35 and F30 Models have depth sensors that take up one sensor port. Solinst Eureka's depth sensors are usually inside the instrument, with a small pressure port that can be seen on the outside of the Manta bottom cap. See Section 4.12 Depth and Vented Depth (Stage).

4.2 Basics of Parameter Calibrations

The Manta does not estimate parameter values, so it is necessary to calibrate it periodically. To do this, you simply need to inform the instrument of what it should read in a calibration solution, using a known correct parameter value. Below is the general procedure; instructions for specific parameters will follow:

1. Clean the sensor and perform any necessary sensor-specific maintenance.
2. Select a calibration standard whose value is close to the values you expect to see in the field. For best results, use fresh calibration solutions, and discard once they have been used.
3. Rinse sensors thoroughly (more than once may be required) with DI (deionized) water, especially if you have been using other calibration solutions. Pour the water into the calibration cup, position the "stopper" side of the lid on top and shake the Manta vigorously to remove traces of old calibration solutions — repeat if necessary.
4. Rinse the sensors twice with a small quantity of your calibration standard. Discard the used calibration standard.
5. Immerse the sensor in the calibration standard. This is usually accomplished by pouring the standard into the Manta's calibration cup once it has been screwed onto the Manta housing. Secure your Manta with the sensors pointing up and fill the calibration cup with your calibration standard. Make sure the standard covers the sensor entirely, and that it also covers the thermistor for those parameters that are temperature-compensated. For turbidity sensors and other fluorometers fill the cup to at least 1-1/2 inches above the sensor's lens surface.

6. Select the parameter to be calibrated by clicking on the Manta pull-down menu in the Home Page, clicking Calibrate, then the parameter you wish to calibrate. Next, enter the calibration value and press Enter. Wait for the reading to stabilize, and then press Enter again to initiate the calibration. The Manta will display the resulting Sensor Response Factor (SRF). You can then press Y to accept the calibration, N to back up one step, or Exit to leave the sensor uncalibrated.

4.3 Choosing Calibration Standards

For best results, choose a calibration standard whose value is close to what you expect to see in the field. For example, calibrate with a 1413 $\mu\text{S}/\text{cm}$ Specific Conductance standard if you expect to see Specific Conductance readings between 500 and 1000 $\mu\text{S}/\text{cm}$ in the field. Calibrating with a sea water standard or a very low standard would not be appropriate in that case. Similarly, if your waters tend toward the acidic, calibrate with a 4-buffer instead of a 10-buffer.

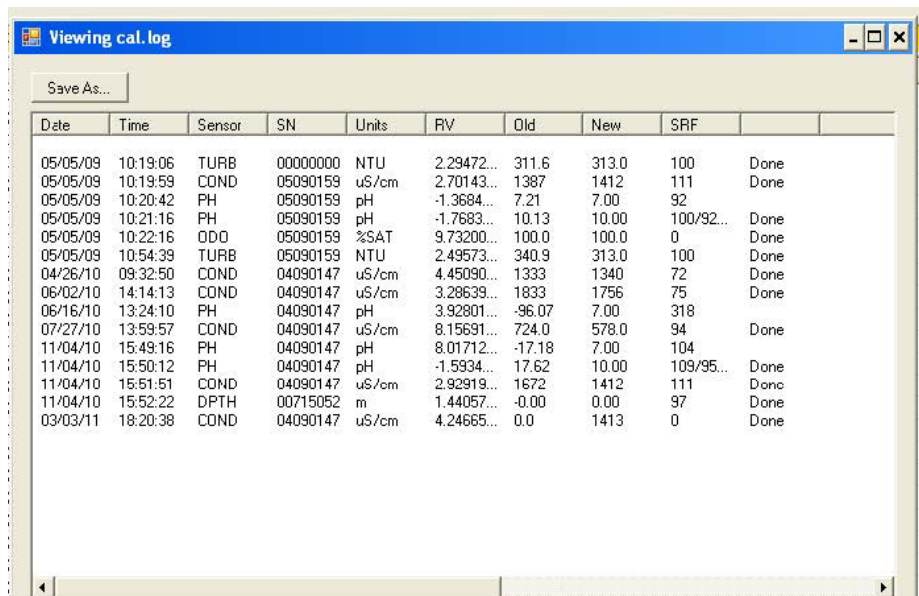
If you are moving your multiprobe across wide ranges of water conditions, you may wish to recalibrate to match the new situations. For instance, if you are measuring a clear lake during the morning and a high-sediment stream in the afternoon, you might consider recalibrating at noon with a high-range turbidity standard.

The table below shows common calibration practices.

Sensor	Standard Method of Calibration	Calibration Standards	Comments
Temperature	never requires calibrating	N/A	
pH	2 or 3 points	pH 4, pH 7, pH 10	pH7, pH 10 most common
ORP	1 point	ORP Standard 200 mV	
Conductivity	1 point	CD Standard, 0.5 Molar, 58670 Micro S CD Standard, 0.1 Molar, 12856 Micro S CD Standard, 0.01 Molar, 1412 Micro S CD Standard, 0.001 Molar, 147 Micro S	brackish/saltwater borderline brackish typical freshwater very pure fresh/glacial
Reference Electrode	calibration not required	N/A	replace pH electrolyte solution at routine calibration
Depth	adjust for barometric pressure	N/A	recalibrate at deployment site for best accuracy
Turbidity	2 points	0 NTU, 10 NTU, 100 NTU, 400 NTU 600 and 1000 NTU available by special order	calibrate bracketing expected value
HDO (Optical DO)	calibrate at 100% saturated water	DI water -shake vigorously to oxygenate	set barometric pressure before calibrating, recalibrate at deployment site for best accuracy
Chlorophyll	2 points	liquid dye or Chlorophyll standard	calibrate to zero and calibration standard
Rhodamine	2 points	rhodamine dye standard	calibrate to zero and calibration standard
Blue Green Algae	2 points	lab sample or dye standard	calibrate to zero and calibration standard
Ammonium (NH ₄ ⁺)	2 points	Low 4.63 mg/l; High 46.3 mg/l	calibrate to Low and High Values
Nitrate (NO ₃ ⁺)	2 points	Low 4.62 mg/l; High 46.2 mg/l	calibrate to Low and High Values
Chloride (CL ⁻)	2 points	Conductivity Standard 147 Micro S Conductivity Standard 1412 Micro S	enter 34.3 during calibration for low enter 319.3 mg/L for high

4.4 Calibration Record (“Cal Log”)

Every Manta has a dedicated data file called CAL.LOG. The CAL.LOG records every calibration that your instrument has accepted. This file contains the calibration time and date, the parameter being calibrated, the accepted readings before and after calibration, the SRF, and a few other details. If you wished to know, for instance, the last time that Conductivity was calibrated, the Calibration Record would tell you when the most recent Conductivity calibration was accepted, the value of the calibration standard, and the instrument’s reading in the standard before the calibration was made (to tell you exactly how much the instrument was changed during calibration). This data cannot be altered within the Manta.



Date	Time	Sensor	SN	Units	RV	Old	New	SRF	
05/05/09	10:19:06	TURB	00000000	NTU	2.29472...	311.6	313.0	100	Done
05/05/09	10:19:59	COND	05090159	uS/cm	2.70143...	1387	1412	111	Done
05/05/09	10:20:42	PH	05090159	pH	-1.3684...	7.21	7.00	92	
05/05/09	10:21:16	PH	05090159	pH	-1.7683...	10.13	10.00	100/92...	Done
05/05/09	10:22:16	ODO	05090159	%SAT	9.73200...	100.0	100.0	0	Done
05/05/09	10:54:39	TURB	05090159	NTU	2.49573...	340.9	313.0	100	Done
04/26/10	09:32:50	COND	04090147	uS/cm	4.45090...	1333	1340	72	Done
06/02/10	14:14:13	COND	04090147	uS/cm	3.28639...	1833	1756	75	Done
06/16/10	13:24:10	PH	04090147	pH	3.92801...	-96.07	7.00	318	
07/27/10	13:59:57	COND	04090147	uS/cm	8.15691...	724.0	578.0	94	Done
11/04/10	15:49:16	PH	04090147	pH	8.01712...	-17.18	7.00	104	
11/04/10	15:50:12	PH	04090147	pH	-1.5934...	17.62	10.00	109/95...	Done
11/04/10	15:51:51	COND	04090147	uS/cm	2.92919...	1672	1412	111	Done
11/04/10	15:52:22	DPTH	00715052	m	1.44057...	-0.00	0.00	97	Done
03/03/11	18:20:38	COND	04090147	uS/cm	4.24665...	0.0	1413	0	Done

Figure 4-2 Viewing the Cal Log

4.5 Sensor Response Factor (SRF)

Also included in the Calibration Record is each calibration’s Sensor Response Factor (SRF). Suppose that a typical Conductivity sensor reports 100 μ A in a 1413 μ S/cm standard. If your Conductivity sensor reports 100 μ A in that same calibration solution, then your SRF is 100% (some parameters, such as pH, have a more complex SRF calculation, but the effect is the same). If your response is 80 μ A, your SRF would be 80%. When you press the OK button to accept a calibration, the Manta automatically accepts your calibration if the SRF is between 60% and 140%. If the SRF falls outside that range, you will be cautioned to check your standard value, make sure the sensor is clean, make sure the reading has stabilized, etc. But you can elect to accept any SRF.

4.6 Temperature Sensor

The Temperature sensor is an electrical resistor (thermistor) whose resistance changes predictably with temperature. The sensor is protected by a stainless-steel tube. Thermistors are very stable with time, and so do not require calibration.



Figure 4-3 Temperature Sensor

4.7 Dissolved Oxygen Sensor

The optical dissolved-oxygen sensor comprises a blue-light source, a sensing surface, and a red-light receiver. The sensing surface is an oxygen-active compound stabilized in an oxygen-permeable polymer, usually silicone. When the sensing surface is exposed to water (or air), oxygen diffuses into the sensing surface according to the amount (partial pressure) of oxygen in the water. The oxygen-active compound fluoresces – that is, it absorbs energy in the form of blue light and then emits energy as red light. In each measurement cycle, the blue light is first turned on, and then turned off. The red-light receiver measures the time it takes, after the blue light is turned off, for the fluorescence to die off. This value is proportional to dissolved oxygen.

The sensor output is corrected for the temperature and salinity of the water.

Solinst Eureka is an advocate of the “air-saturated water” calibration method – different from the “water-saturated air” calibration commonly used in the past. Here are the steps to air-saturated water calibration:

1. Make sure your instrument’s Barometric Pressure setting is accurate (see Section 4.18 Set Barometric Pressure and Set Time and Date).
2. Put a half-liter of tap water in a liter jar, put on the lid and shake the jar vigorously for one minute. Take the lid off the jar and let the water stand for about five minutes to let the air bubbles float out.
3. Screw your calibration cup onto the Manta housing. With the sensors pointed upward, fill the calibration cup until your aerated water covers the DO cap by a centimeter or so.
4. Wait a few minutes for the temperature to equilibrate.
5. Follow the Manta Control Software calibration instructions – remember that you are calibrating % sat, not mg/l, so select % sat from the list.



Figure 4-4 Dissolved Oxygen Sensor

Optical DO Sensitivity to Fouling

Several years ago, it was believed that optical dissolved oxygen (DO) sensors were immune to fouling. However, this is only partially accurate.

For instance, when an optical DO sensor is placed in a river downstream of a rendering plant or oil extraction site, it may become coated with substances such as grease or oil. Unless that coating is impermeable to oxygen, your sensor will still give accurate readings (though it may be slow to respond to changes in oxygen). That’s because the coating is not oxygen-active, i.e. it doesn’t produce or consume oxygen.

On the other hand, if your sensor picks up an oxygen-active coating, for instance of photosynthetic algae. The algae’s respiration can cause the sensor to report exaggerated swings in diurnal oxygen pressure because the algae have their own micro-environment of oxygen pressure – and the optical DO sensor thinks that the oxygen pressure immediately adjacent its membrane is representative of the broader aquatic environment.

The manufacturers of optical-DO sensors recommend that you not calibrate the zero-DO point. However, we support zero-DO calibration in the Manta software, and think it's a good idea to check your sensor's zero from time to time in either of three ways:

1. Dissolve a few grams of sodium sulfite and a pinch of cobalt chloride in a half-liter of tap water. You can buy this solution ready-to-use, but be careful not to aerate the solution by pouring it numerous times.
2. Prepare zero-oxygen water by bubbling nitrogen through water. Use bottled gas and an aquarium-type airstone. (If you're using a high-pressure gas bottle, please use a two-stage regulator to prevent unnecessary excitement.) After bubbling the gas through about a liter of water for about 10 minutes, you should have a good zero.
3. The simplest way to check zero response is with nitrogen gas. Wrap the sensor-end of your Manta with a plastic bag, and feed nitrogen gas into the bag. Make sure there is another hole at the opposite end of the bag for the air to escape, otherwise you won't get a good zero. (If you're using a high-pressure gas bottle, please use a two-stage regulator.)

Optical dissolved-oxygen sensor maintenance is little more than occasionally cleaning the sensing surface (the black material; about a centimeter diameter) with a cloth and soapy water.

Optical dissolved-oxygen sensors usually have very low drift rates (compared to the old Clark sensors), so practice will show you how often to calibrate your optical sensor. You might also find that one or other of the calibration points does not require calibration every time you set the other point.

The Solinst Eureka HDO requires periodic replacement of its sensor tip, typically every five years. If your Sensor Reference Frequency (SRF) indicates values below 100% or if you observe fluctuations in the sensor's readings—characterized by erratic or jumpy data—it is advisable to replace the tip. This can be accomplished by unscrewing the existing tip and securely attaching a new one. After replacement, recalibrate.

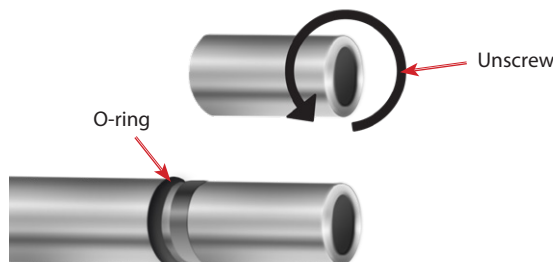


Figure 4-5 Dissolved Oxygen Sensor Tip Replacement

4.8 Conductivity Sensor

The Solinst Eureka employs a four-electrode method for measuring water conductivity. This system features two pairs of graphite electrodes arranged in a stable geometry, which are discreetly integrated into the design of the conductivity sensor, resembling two bull's eyes positioned within the sensor's slot.

Note: The Manta+F35 uses a different conductivity sensor that is flush with the instrument.



Figure 4-6 Manta+ Conductivity Sensor and F35 Conductivity Sensor

A constant voltage is applied to one of each electrode pair, and the amount of current required to maintain that voltage is measured. As the conductivity of the water increases, the current increases.

The zero point for the sensor is set electronically, so you need only set the “slope” point:

1. Fill the calibration cup with your conductivity standard to cover the conductivity sensor. Tap gently on the cup to make sure there aren't bubbles trapped in the conductivity sensor.
2. Follow the Manta Control Software's calibration instructions.

The Manta normally reports Specific Conductance – that's Conductivity standardized to 25°C. Your reading is thus the conductivity of your water if that water were heated or cooled to exactly 25°C. Conductivity has several other forms, Total Dissolved Solids (TDS) and Salinity. You can't calibrate TDS or salinity directly because they are calculated from Conductivity. You can, however, “calibrate” TDS with a TDS standard by adjusting the conductivity calibration point up or down until the TDS standard produces the desired TDS reading. The same is true for Salinity if you're using a standard qualified on the Practical Salinity Scale (PSS). “Enable” TDS and/or Salinity by checking the box next to those parameters in the “Sensors and Parameters” section.

4.9 pH Sensor

pH is measured as the voltage drop across the glass membrane of a pH electrode. A reference electrode is used to complete the voltage-measuring circuit. The pH glass is specially formulated to absorb water so that ions (particularly H⁺ and OH⁻) in the water are attracted to the glass to offset the ionic constituency of the pH electrode's internal electrolyte. As a result, there is a charge separation across the glass, and that's the voltage we measure. pH readings are automatically compensated for temperature.

pH electrode maintenance is nothing more than occasionally cleaning the glass surface with a soft cloth and soapy water. Do not use anything abrasive. The really important part of pH maintenance is refilling the reference electrode (see Section 4.10 Reference Electrode). It is also very important to add a bit of tap water to the storage cup when placing the Manta in storage, to prevent the pH bulb from drying out. If left completely dry for long periods, the pH bulb could become damaged.

You can choose a two- or three-point pH calibration. The two-point calibration, a seven buffer and a second buffer whose value is near that of the waters you intend to monitor, is recommended. If you are measuring in waters whose pH might range above and below seven, you can increase your accuracy slightly by choosing a three-point calibration (the third buffer should be on the other side of seven). pH calibration is simple:

1. Rinse your sensors several times with the pH buffer you'll use for calibration.
2. Fill the calibration cup with enough buffer to cover both the pH and reference electrodes.
3. Follow the Manta Control Software calibration instructions.
4. Repeat steps 1, 2, and 3 in succession for the 2nd and 3rd points. You will need to start over if you skip a step.



Figure 4-7 Manta+ pH Sensor and F35 pH Sensor

Note: The Manta+F35 uses a different pH sensor that is flush with the instrument.

4.10 Reference Electrode

The key to reliable pH, ORP, and ISE measurements is a well-maintained reference electrode. Recall that a reference electrode is required to complete voltage measurement for pH readings.

Reference electrode maintenance is simple:

1. Remove the reference cap by unscrewing it from the reference sleeve and pour out old reference electrolyte fluid. We recommend using a penny or short screwdriver to remove the cap taking care not to slip and cause damage to the pH bulb.
2. Fill the sleeve completely with fresh pH reference electrolyte (KCl saturated with silver chloride). Tap the Manta a few times to dislodge any bubbles.



Figure 4-8 Reference Electrode Maintenance

3. Screw the reference cap back on to the sleeve. As you screw the sleeve into place, air and excess electrolyte is forced out of the sleeve through the reference electrode junction (the white, porous circle at the end of the sleeve). This not only purges bubbles from the electrolyte, but also cleans any residue out of the junction. If you do not observe droplets of electrolyte purging through the porous circle it is likely clogged, and you may need a new reference cap.

Integral/Combination Reference Electrode Comparison

Some manufacturers may claim that their integral or combination reference electrode is superior. This is not true. First, combination electrodes typically require replacement approximately every year at a cost of around \$300, and you must install them yourself. Second, combination electrodes usually employ “gelled” electrolyte, and are therefore inclined to calibrate easily in standard pH buffers but measure poorly in low conductivity waters (like < 200umhos). In contrast, the Solinst Eureka reference electrode presents a more economical and user-friendly solution. Maintenance involves a simple replenishment of the electrolyte every month or two, at minimal cost. Furthermore, its “free-flowing” junction design ensures reliable performance even in low-conductivity environments.

4.11 ORP Sensor

ORP is measured as the voltage drop across the platinum membrane of an ORP electrode. The actual ORP sensor is the 1 mm silver-coloured dot that can be seen when looking down at the pH sensor – if your Manta has ORP. A reference electrode is used to complete the voltage-measuring circuit. Because platinum does not react with ions in the water, it won’t give or take any electrons from those ions unless they are very persuasive. The potential (voltage) created by this refusal is what you’re actually measuring as ORP.

ORP electrode maintenance includes occasional cleaning the platinum surface with a soft cloth and soapy water. If the platinum is discoloured, you can polish the ORP electrode with very light abrasive, like 900-grit wet-and-dry sandpaper (please be careful not to polish the pH glass bulb). The important part of ORP maintenance is refilling the reference electrode (see Section 4.10 Reference Electrode).



Figure 4-9 ORP Sensor

ORP uses a one-point calibration:

1. Rinse your sensors several times with the ORP standard you'll use for calibration.
2. Fill the calibration cup with enough ORP standard to cover both the ORP and reference electrodes.
3. Follow the Manta Control Software calibration instructions after selecting ORP_mV to calibrate.

4.12 Depth and Vented Depth (Stage)

Depth is measured by a strain-gauge transducer as hydrostatic water pressure. The deeper you go in the water, the higher the pressure.

Solinst Eureka's depth sensors are usually inside the instrument, with a small pressure port that can be seen on the outside of the Manta bottom cap. They require no regular maintenance, but you might check occasionally to make sure the pressure port is not clogged. If it is, use something soft, like a toothpick, to clear the port of obstruction.

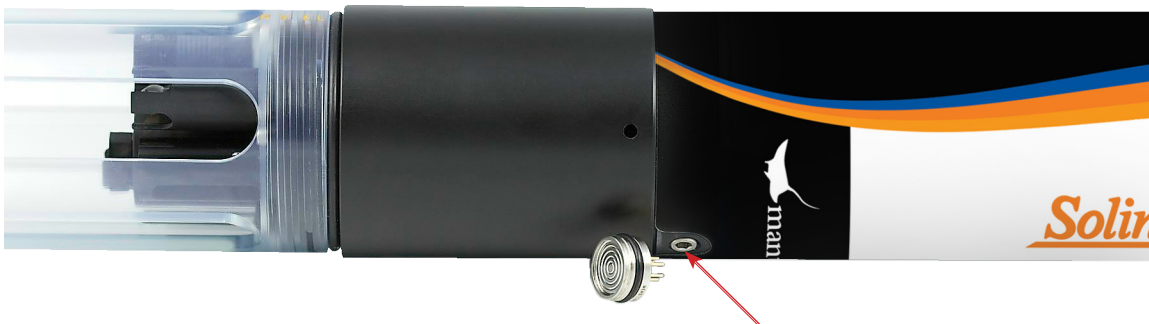


Figure 4-10 Pressure Transducer and Pressure Port Location

Depth calibration is simply “zeroing” the sensor in air, where one assumes the depth to be zero:

1. Make sure the Manta is not submerged.
2. Follow the Manta Control Software's calibration instructions.

The Depth sensor cannot distinguish between water pressure and the air pressure over that water (i.e. barometric pressure). After you have zeroed the sensor, any change in barometric pressure will be measured as a change in water pressure. Water on Earth is considerably heavier than air, so the error introduced by barometric pressure changes is small.

However, there is the option of Vented Depth, or Stage. Vented Depth uses the same transducer as does Depth, except that there is a tiny hole in the back of the transducer. If you have a vented cable (a cable that has a tube running through it), atmospheric pressure is sensed by the transducer via the little hole. Changes in barometric pressure will not affect the depth reading.

Vented-Depth cables have a desiccant-filled housing at their surface end. The desiccant keeps water from condensing in the vent tube by letting vapor escape through a small Gortex patch. Keep that housing clean and replace the desiccants every year or so.

4.13 Turbidity

Turbidity is measured as the fraction of an infrared light beam that is scattered at 90° to that beam. More particles in the water mean more of that light is scattered, so the Turbidity reading is higher. Any material that accumulates on the optical surfaces of the Turbidity sensor is indistinguishable from material in the water, so most Turbidity sensors have wipers to clean the window(s).



Figure 4-11 Turbidity Sensor with Wiper

Turbidity sensors require no regular maintenance, but it is recommended to occasionally make sure the optical window (i.e. the little glass port on the front of the sensor) has not been damaged.

Turbidity uses a two-point calibration; one point is zero turbidity and the other point should be a standard approximating the turbidity of the water you intend to monitor.

Make sure you use enough calibration standard to cover the sensor's "optical volume" – imagine a tennis ball stuck on the end of the sensor; make sure there are no objects in the volume represented by that ball.

For the zero calibration:

1. Make sure the Turbidity sensor is fully immersed (i.e. at least 1½" of solution over the sensor) in zero-turbidity standard and has an unobstructed optical path. It is fine to use distilled or DI water in lieu of zero-turbidity standard.
2. Follow the Manta Control Software's calibration instructions.

For the other calibration point:

1. Rinse your sensors several times with the standard you'll use for calibration.
2. Make sure the Turbidity sensor is fully immersed (i.e. at least 1-1/2 inches of solution over the sensor) in the standard and has an unobstructed optical path.
3. Follow the Manta Control Software's calibration instructions.

A clean wiper means better measurements. If the wiper pad has deteriorated or is clogged with debris from your water (algae, silt, etc.), you should change it. For best results, you might consider changing the wiper pad prior to each long-term deployment.

To change the wiper pad:

1. Make sure you have the 1.5 mm hex key and a new pad for the wiper. Loosen the small set screw on the wiper arm.
2. Remove the wiper pad from the wiper arm and replace the pad.
3. Place a new wiper arm on the motor shaft so that the set screw faces the flat spot on the motor shaft.

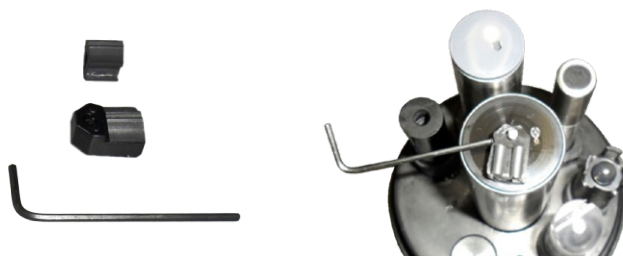


Figure 4-12 Changing the Wiper Pad

4. Gently press the wiper pad against the face of the probe until the pad is compressed to roughly three quarters of its original thickness. It is important that the wiper arm does not make contact with the probe face – only the pad should be in contact. A gap of 0.5 mm between the wiper arm and the probe face is typical when a new pad has been installed. Another way of setting the pad gap is to place the pad such that you can slide a small piece of paper under the pad, but snug enough that the pad will hold the paper.
5. Tighten the set screw against the flat edge of the wiper shaft for best adhesion.

Note: Do not over-tighten the set screw on the little rotating arm that holds the wiper pad; that will strip the threads. Don't rotate the wiper arm manually; that will strip the gears.

If fluorometers or ISE sensors are installed in your Manta, your turbidity sensor may be equipped at the factory with an extended brush arm. If you find that the brush is bio-fouled, the wiper arm may need to be replaced for best results. A dirty wiper brush can potentially scratch sensing surfaces and will not do a proper job of keeping the sensors clean.

Use the first Allen wrench from your wiper kit to remove the standard turbidity sensor wiper. Use the other Allen wrench to install the Solinst Eureka brush arm. Notice that the Allen set screw seats on the flat side of the wiper motor shaft.



Figure 4-13 Changing the Extended Brush Arm

4.14 Fluorometers

Solinst Eureka's chlorophyll, rhodamine, blue-green algae, CDOM, fluorescein, optical brightener, tryptophan, PTSA, refined oil and crude oil sensors are fluorometric sensors, with each tuned to slightly different wavelengths.



Figure 4-14 Fluorometer

Fluorescence occurs when a molecule absorbs light at one wavelength and then emits that energy at a different wavelength. More molecules of analyte produce a higher level of that different-wavelength light. Fluorometric sensors emit light at a certain wavelength, and look for a very specific, different wavelength in return. The magnitude of the return light is relatable to the amount of analyte present.

Note that there are two types of blue-green algae sensors — fresh-water and marine.

Note that CDOM, or Coloured Dissolved Organic Matter, is also known as fDOM (fluorescent Dissolved Organic Matter), chromophoric dissolved organic matter, yellow substance, and gelbstoff.

Note that there are many different types of crude oil, and each has a relatively unique fluorescence response.

The maintenance procedure is similar for all fluorometers:

Cleaning the sensor – Rinse the chlorophyll sensor in fresh water following each deployment, ideally until it is completely clean again. Do not let the chlorophyll sensor come in contact with any organic solvents, such as acetone and methanol, or strong acids and bases.

Cleaning the optics – Visually inspect the optical window after each deployment following a soaking in fresh water. Use optical tissue to clean the window with soapy water, if needed.

4.15 Ion-Selective Electrodes (ISEs)

ISEs are traditionally used in the laboratory at a constant, moderate temperature, with ionic strength adjusters added to each sample so that the sample and calibration solution have roughly the same ionic strength. ISEs can provide valuable information in the field, for instance in watching short-term trends, but their stability and accuracy are not nearly as reliable as those for DO, conductivity, turbidity, etc. For field use, Solinst Eureka makes several theoretical and empirical corrections to elicit the best possible field performance.

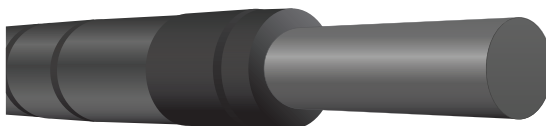


Figure 4-15 Ion-Selective Electrode

ISEs operate much like a pH electrode except that the pH glass is replaced by a membrane that is selective for the analyte of interest (ammonium, chloride, nitrate). The electrode's filling solution contains a salt of the analyte, and the difference between that salt's concentration and the analyte concentration in your water produces a charge separation. That charge separation is measured, relative to the reference electrode, as a voltage that changes predictably with changes in the analyte concentration in the water adjacent the membrane.

It's best not to let your ISE dry out, so place a small amount of tap water in the storage cup to ensure 100% humidity. The sensing elements (tips) for Ammonium, Nitrate, Calcium, Chloride, and Bromide ISEs are user-replaceable and can be changed in the field by unscrewing the existing tip from the sensor body and installing a new tip. Typical tip life is approximately 6 to 12 months, depending on application, water chemistry, maintenance practices, and storage conditions.

Note: When screwing in a new ISE tip, you will need to press down against an o-ring with some force to make sure the threads line up properly before tightening it.



Figure 4-16 Replacing ISE Sensing Tips

Sodium, Fluoride, and Potassium ISEs are complete sensor assemblies and do not utilize replaceable sensing tips. When replacement is required, the entire sensor must be replaced in the same manner as a pH sensor. Typical service life for these sensors is approximately 12 to 24 months, depending on application, water chemistry, maintenance practices, and storage conditions.

Note: A pH sensor replacement video is available on our YouTube channel. The same procedure can be followed for Na, F, and K ISE replacements if you are comfortable performing it yourself. Alternatively, the sonde can be returned to Solinst Eureka for the ISE replacement.

Each sensor body is programmed for a specific ISE; the ISE is identified by a series of rings or dots. One ring or dot means the sensor body is programmed for a Chloride ISE; two mean Calcium, three mean Nitrate, four mean Ammonium, five mean Bromide, and six mean Sodium.

Note: To avoid damaging the ISE sensor tip, limit the submersion of replaceable-tip ISEs to about 10 meters. If you need to go deeper than that with the other sensors, you can use a plug for the ISE electrode.

Note that the Ammonium ISE senses ammonium, but at pH values higher than about 8 the ammonium (NH_4^+) is mostly converted into ammonia gas (NH_3). Solinst Eureka's software uses the pH, Conductivity, and Temperature of the sample water to calculate Ammonia (as mg/L-N). You can also display Total Ammonia; the sum of Ammonia and Ammonium.

Note that Ammonium and Nitrate ISEs suffer interference from positive ions, especially potassium and sodium, and Sodium ISEs suffer interference from positive ions, especially potassium and ammonium. The Chloride ISE does not normally suffer from interfering ions.

Note that Solinst Eureka's Sodium ISE has a plastic membrane with a wider pH range (pH 3–10) and less pH interference than traditional sodium ISEs made with glass membranes. This sensor is specified to have a 10-second response time and a range of 0.05–2,300 mg/L Na^+ .

Note that the Sodium ISE has a slow response to changes in temperature and may take many minutes to reach a final reading when the temperature changes significantly. If your Manta is equipped with more than one ISE, use care when replacing tips so that you don't put a tip on the wrong sensor (for example, putting a Nitrate tip on a Sodium sensor).

ISE calibration is more complex than calibrations for most other sensors, but we've made it as simple as possible in "Ion Selective Electrodes: Activity vs Concentration". This document can be found on the Solinst Eureka Flash Drive and the Solinst website under Solinst Eureka Support Documents.

4.16 Total Dissolved Gas (TDG)

The TDG sensor is a pressure transducer (the same one used for the 10-meter depth sensor) attached to a “membrane”. This membrane is a long piece of thin-wall, silicone tubing whose job is matching gas partial pressures inside the tube with those of the surrounding water. The sum of those partial pressures is measured by the transducer, and that’s the TDG of the water.



Figure 4-17 Total Dissolved Gas Sensor

Aside from keeping the membrane as clean as possible without tearing the tubing, the TDG sensor requires no maintenance. When the membrane is torn or is just too dirty, the membrane assembly must be replaced. Simply unscrew the old membrane and screw on a new membrane. Screw it on finger-tight, plus 1/4 turn.

Silicone rubber is chosen for the membrane material because gases pass through silicone readily. This means that response time for silicone is much faster than if the membrane were, say, Teflon. However, if the membrane is soaked in water for more than a few hours, the silicone absorbs just enough water to slow the gas transfer considerably. This is not usually a problem for unattended monitoring applications (the TDG doesn’t change very quickly anyway) but can be annoying if you are doing daily spot-checks. In that case, it’s best to dry out the membrane between stations by using only a few drops of water in the storage cup instead of a few ounces.

4.17 Photosynthetically Active Radiation

The PAR (photosynthetically active radiation) sensor measures the amount of light available to biota for photosynthesis. It’s units of measurement are micro-moles of photons per square meter per second, or photon $\mu\text{moles}/\text{m}^2$ second. This is also referred to as micro-Einsteins per square meter per second.

The sensor looks like a light bulb and receives light from all directions except the “blind spot” at its base. Solinst Eureka mounts the PAR sensor a few inches away from the multiprobe, facing away from the multiprobe, so that the multiprobe is in the blind spot.

PAR sensors are supplied with a dummy plug so that you can use the Manta without the PAR sensor attached.

PAR measurement is accessed for display through the menu structure just like all other sensors. The PAR sensor is calibrated at the LI-COR factory, and cannot be calibrated by the user. LI-COR recommends that the sensor be returned to the factory every couple of years to be re-calibrated.



Figure 4-18 PAR Sensor

PAR sensors are not attached to the multiprobe when shipped from Solinst Eureka; there is a dummy plug in the PAR port. To attach the PAR sensor, simply unscrew the dummy plug's locking sleeve (it's the same type locking sleeve used for Solinst Eureka cables) and pull the dummy plug out of the port. Slide the locking sleeve onto the non-light-bulb end of the PAR sensor and push the PAR sensor into the port as you tighten the locking sleeve. This may take a little bit of practice, as the locking sleeve's off-center hole has to shift slightly to center of the PAR sensor and its port.

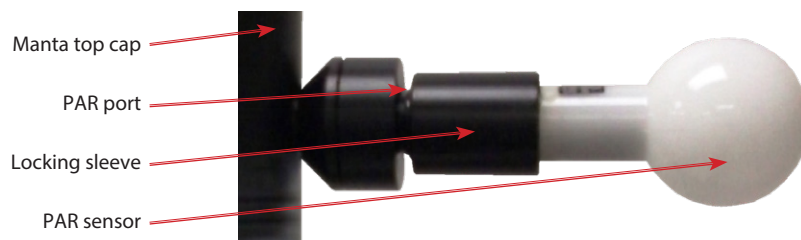


Figure 4-19 PAR Sensor Components

There is no need to tighten the locking sleeve more than finger-tight.

Reverse the process to remove the PAR sensor if you wish to make calibration easier, or for cleaning, or for storage if you want extra protection for the PAR sensor. Simply unscrew the locking sleeve, pull the sensor away from the multiprobe, re-install the dummy plug, and re-install the locking sleeve. The dummy plug seals the PAR port, so you can submerge the multiprobe without the PAR sensor attached.

The PAR sensor is made of acrylic plastic for optical reasons. Acrylic is somewhat brittle, so care should be taken while handling the sensor. It's also rather soft, so clean the sensor only with soapy water and a soft, wet cloth.

A copy of LI-COR's PAR instruction manual is included with the PAR sensor.

4.18 Set Barometric Pressure and Set Time and Date

You need to set the local Barometric Pressure (BP) when using an Optical Dissolved Oxygen sensor. To set this, click on the Set Barometric Pressure button in the Calibrate menu. You can set the BP by typing the correct value (in mm Hg) in the first box of the Set Barometric Pressure screen. Or, you can set the approximate BP by typing your altitude (in feet) in the second box. Notice that if you type in BP, altitude is automatically calculated, and vice-versa. The third method for setting BP, is getting it from your Manta (if your Manta is equipped with an un-vented depth sensor). If you choose this method, remove the calibration cup from the Manta and make sure the depth sensor is exposed to air, then click Get BP. The correct values will automatically appear in the BP and altitude boxes. You can check the BP you are already using by clicking Check BP.

Click on the Set Time and Date button to see the Manta's internal time and date. If you wish to change any of those values, just type the new value in the appropriate box or click the box at the bottom of the screen to synchronize the Manta time and date with that of the device you're using to read the Manta.

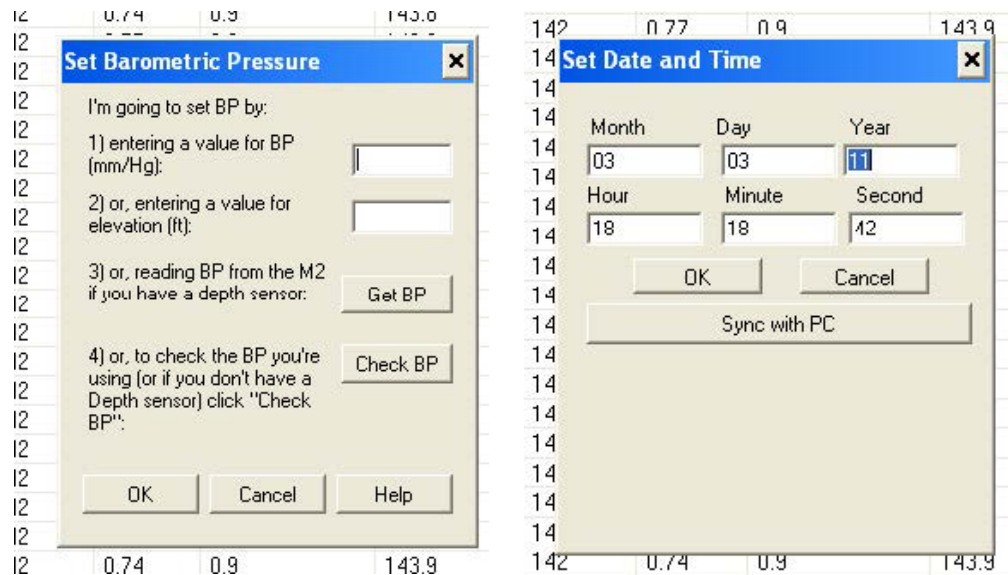


Figure 4-20 Setting Barometric Pressure and Date and Time

5.0 Data Logging

Batteries loaded backwards (reversed polarity) can damage an internal battery pack and may cause pressure to build up inside the battery pack. So please pay careful attention to the polarity markers found on all Solinst Eureka battery packs.

5.1 Difference Between “Logging” and “Snapshot”

“Logging” always refers to unattended data capture and storage in the Manta. “Snapshot” refers to the manual capture of data into your Data Display (PC or small-screen device).

5.2 Manta Logging Technique

Some manufacturers may require you to enter long strings of digits to specify the start time, start date, end time, end date, and logging interval. Manual entry can easily cause errors. The Manta requires only that you click one Hot Button, install batteries, and (for Manta 35 and 40 models) flip the internal battery-pack switch to “ON”. Once this is done, the red LED will blink five times to confirm that Logging is activated, and the green LED will blink briefly to confirm that the Manta is receiving adequate voltage to start Logging.

Another user-friendly feature of the Manta Logging is time uniformity. For instance, if your logging interval is 15 minutes and you turn Logging on at five minutes past 10 AM, your first data will be logged at exactly 10:15, and then every 15 minutes thereafter. Suppose your logging interval is one hour, and you turn Logging on at five minutes past 10 AM. In that case, your first data will be logged exactly at 11 AM, and then every hour thereafter. Your data is cleaner, and it’s easier to match times when merging data logs.

5.3 Sensor Warm-Up

Your Manta knows the warm-up times required for all the sensors you have enabled. It figures out exactly when to turn the various sensors on so that a frame of data can be taken exactly at the correct time. For instance, the HDO Dissolved Oxygen sensor takes 20 seconds to warm up and the turbidity sensor takes 25 seconds to warm up. So, the Manta turns on the DO sensor 20 seconds, and the turbidity sensor 25 seconds, ahead of the time data is required. This minimizes power consumption.

5.4 Logging Runs, Logging File Management, Logging Interval

These Manta logging functions are software-driven and explained in Section 3.5.2 Logging Setup.

5.5 Activating Manta Logging

To initiate Logging, you must activate Logging by clicking the “Manta2 Logging is OFF” Hot Button so that it changes to “Manta2 Logging is ON”.

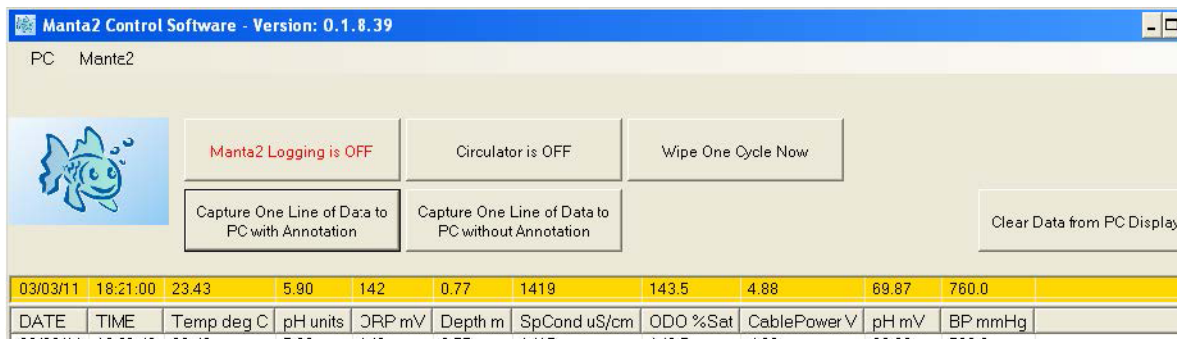


Figure 5-1 Turning Manta Logging ON and OFF

Then, to start Logging for Trimeter and Manta 20 and 25 models with Internal Battery Packs, simply load the batteries. For convenience, you can take a Data Display to the field and activate Logging right before you place the Manta in the water. Don't forget to activate Logging.

Note: the Manta 30 uses an External Battery Pack.

To start Logging for Manta 35 and 40 models with Internal Battery Packs, load batteries, and when you get to the field, turn the IBP switch on the top cap to “ON”. Don't forget to activate Logging.

To start Logging for all Mantas (20, 25, 30, 35, 40) with an External Battery Pack, simply connect the battery pack after you have activated Logging.

The blinking green LED indicates that you have sufficient voltage to begin logging, and the blinking red LED indicates that Logging is enabled.

5.6 Battery Pack Power or Cable Power

Most users log data using an Internal Battery Pack (IBP) or External Battery Pack (EBP). But you can also log using power from a secondary power source (such as a solar-recharged storage battery located above the water surface) via the Underwater Cable. If you have an IBP or EBP and a secondary power source attached, the Manta will use power coming from the secondary power source as long as its voltage is sufficient. If the Manta cannot find adequate voltage in the Underwater Cable, it will use the IBP or EBP.

This scheme preserves your Manta batteries when possible. Other manufacturers use the power source with the highest voltage, meaning that your Manta batteries may be consumed quickly.

More information can be found in “Manta Logging with an Uninterrupted Power Supply and Manta Power Options”.

5.7 Logging with an Internal Battery Pack

Most Mantas may be ordered with an optional Internal Battery Pack (IBP), a watertight housing with a cassette for batteries that is permanently fixed to the Manta. Most IBP's are used for logging, but they can also be used to power the Manta while it is connected to a Data Display.

5.7.1 Start Manta20/25/Trimeters Logging

1. Replace all batteries at the same time and use the same brand of battery.
2. Clean all moisture, dirt, grit and any other debris off the Manta, as you are going to expose sealing surfaces as you change the batteries.



Figure 5-2 Manta 20/25/Trimeter Internal Battery Housing

3. Grasp the clear battery sleeve that covers the battery housing and unscrew it until it detaches from the IBP body.
4. Remove the spent batteries and install the new ones carefully following the polarity diagram. If you have activated Logging in the Software, then your Manta will be Logging. De-activate Logging if you don't want to be Logging now.
5. Clean all moisture, dirt, grit and any other debris off the exposed O-ring surfaces and the inside of the battery sleeve. Add a small amount of silicone grease to the O-rings and to the inside of the battery sleeve where the O-rings will seat.
6. Carefully screw the battery sleeve back into place. You don't have to tighten it closely to the IBP body; finger-tight is fine.
7. If not done already, click activate Manta Logging by clicking the "Manta2 Logging is OFF" Hot Button so that it changes to "Manta Logging is ON".
8. Look for the red LED to blink five times to confirm that Logging is activated, and the green LED blink briefly to confirm that the Manta is receiving adequate voltage to start Logging.

5.7.2 Start Manta 35 and 40 Models Logging

1. Replace all batteries at the same time and use the same brand of battery.
2. Clean all moisture, dirt, grit and any other debris off the Manta, as you are going to expose sealing surfaces as you change the batteries.



Figure 5-3 Manta 35/40 Internal Battery Housing

3. Unscrew the eye-bolt until you are able to completely remove the battery plug.
4. Remove the spent batteries and install six C-cell batteries carefully following the polarity diagram.
5. Clean all moisture, dirt, grit and any other debris off the exposed O-ring surfaces and the inside of the battery tubes. Add a small amount of silicone grease to the O-rings and to the inside of the battery tubes where the O-rings will seat.
6. Re-attach the battery plug by turning the eye-bolt. You don't have to tighten it closely to the Manta; finger-tight is fine.
7. If not done already, click activate Manta Logging by clicking the "Manta2 Logging is OFF" Hot Button so that it changes to "Manta Logging is ON".
8. When you are ready to deploy the Manta, turn the battery switch to "ON". (And turn the switch back to "OFF" when you retrieve the Manta).
9. Look for the red LED to blink five times to confirm that Logging is activated, and the green LED blink briefly to confirm that the Manta is receiving adequate voltage to start Logging.
10. Your Manta is now logging and will continue logging until you turn the battery switch to its "OFF" position, or your batteries are depleted.

5.8 Logging with an External Battery Pack

5.8.1 The External Battery Pack

All Manta models (except the Manta 35 and 40 models with Internal Battery Packs) can utilize the optional External Battery Pack (EBP) (part number 403032), a watertight housing, with rechargeable Li-ion batteries, that can be removed from the Manta. EBPs are used for logging, but they can also be used to power the Manta while it is connected to a Data Display if the Data Display cannot provide sufficient power.

The EBP simply screws onto the end of the Manta multiprobe where you also connect the Underwater Cable (or Data Cable). The EBP is installed immediately before a Logging deployment, and later removed so your Manta can upload data to a Data Display or be calibrated.



Figure 5-4 External Battery Pack

5.8.2 Charging the EBP and Activating Logging

1. Recharge the EBP as required. Charging accessories are available from Solinst Eureka.
2. Clean all moisture, dirt, grit and any other debris off the Manta, as you are going to expose sealing surfaces as you charge the battery pack.
3. If not done already, click activate Manta Logging by clicking the “Manta2 Logging is OFF” Hot Button so that it changes to “Manta Logging is ON”.
4. Look for the red LED to blink five times to confirm that Logging is activated, and the green LED blink briefly to confirm that the Manta is receiving adequate voltage to start Logging.

5.8.3 Installing and Removing the EBP

1. Remove the marine connector protector or, if a cable is attached to your Manta, remove the cable.
2. Clean the connectors on the EBP and Manta and add a little silicone grease to each.
3. Find the connecting prong on the EBP and the hole in the top of the Manta and line them up. Line up the slots in the EBP locking sleeve with the screws around the top of the Manta.
4. Line up the connector pins with the sockets in the EBP and slowly push them together.

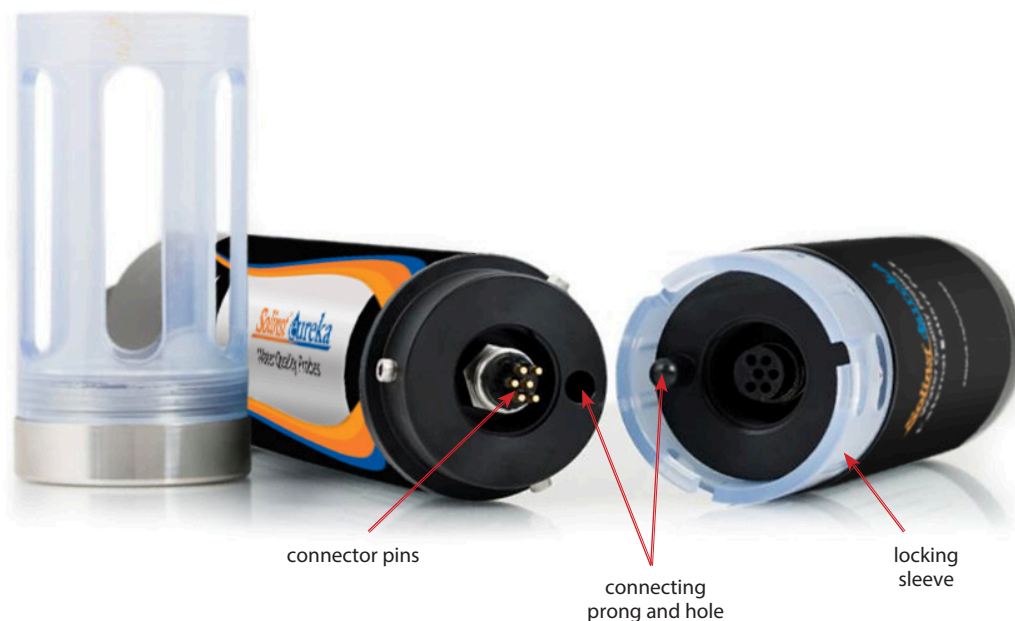


Figure 5-5 External Battery Pack Connection

5. Grasping only the Manta and EBP locking sleeve, turn the EBP locking sleeve so that it locks into place securely.
6. Tighten the EBP locking sleeve firmly, but not so tightly that you will have difficulty removing it later.



Figure 5-6 External Battery Pack Connected

7. If not done already, click activate Manta Logging by clicking the “Manta2 Logging is OFF” Hot Button so that it changes to “Manta Logging is ON”.
8. Look for the red LED to blink five times to confirm that Logging is activated, and the green LED blink briefly to confirm that the Manta is receiving adequate voltage to start Logging.
9. Your Manta is now Logging, and will continue Logging until you remove the EBP, or your batteries are depleted.
10. To remove the EBP, grasp the Manta with one hand and the EBP locking sleeve with the other, and unscrew the EBP locking sleeve. Pull the Manta and EBP apart.

Note: Twist only the EBP locking sleeve.

5.9 Batteries and Battery Life

When the batteries in a Manta battery pack are spent, logging simply ceases. It may begin again after a few hours if your batteries recover sufficiently during that time.

There are so many different combinations of sensors, water temperature, Logging Intervals, types of batteries, etc. that estimation of battery life may not be accurate. We recommend that you run the Manta in the field to see how long the batteries will last in your specific application.

For Internal Battery Packs, we recommend using the highest quality alkaline batteries available, such as Duracell Copper Tops. Rechargeable batteries can be used, but their battery life is typically only half that of non-rechargeable batteries.

We strongly recommend that you do not use lithium batteries in any Internal Battery Pack. Lithium batteries don't like water and may cause a dangerous build-up of pressure if they get wet during a deployment. That pressure can damage the instrument and/or you.

It's a good idea to remove the batteries from the Manta Internal Battery Pack if the Manta is not going to be used for a long period of time. This helps prevent battery leakage.

5.10 Logging Redundantly with Telemetry

If you wish to add redundancy to your data collection, you can connect a Manta to a third-party data logger, telemetry device, etc. to store data in the Manta (using its standard Logging function) and in the third-party device (according to its manufacturer's instructions).

Since you will be using an Underwater Cable, you can run power to the Manta from a surface power supply to provide power to Mantas – you don't need a Manta battery pack.

Or, the surface power supply can power Mantas with IBPs, thus saving your batteries for emergencies such as the failure of the surface power supply.

Either way, you will end up with data records in both the Manta and the third-party device.

More information can be found in "Manta Logging with an Uninterrupted Power Supply" and "Manta Power Options".

5.11 Controlling Sensor Fouling

Fouling cannot be eliminated altogether, but Solinst Eureka offers three effective options to minimize sensor fouling and maximize data quality.

1. Solinst Eureka's unique Copper Gauze Antifoulant is a double-wall sensor guard (below) envelops the sensors with copper gauze. Unlike copper screen, the copper gauze dissolves with time, killing or discouraging biota that would otherwise collect on the sensors. Available on all Mantas.

The copper-gauze method works better than copper screen or copper parts. Solid copper rapidly develops an oxide coating – growth may not occur on the copper part, but the copper will not protect the sensors. The copper gauze dissolves slowly, bathing the sensors in copper ions that discourage biological growth.

2. The Extended Turbidity Brush attaches to the turbidity sensor and cleans the measurement surfaces of several sensors, including the fluorometers (chlorophyll, blue-green algae, etc.) and the Dissolved Oxygen sensor. Available on Manta 30, 35, and 40 models with turbidity sensors.
3. Solinst Eureka's MiniCleaner is used for sensor brushing when the Manta does not have a turbidity sensor (and hence cannot have the Extended Turbidity Brush). It can be programmed for frequency of brush cycles and number of sweeps per cycle.



Figure 5-7 Antifouling Options

Note: Solinst Eureka also offers the Manta F35, which is essentially the Manta+35 fitted with a copper-filled, silicone "nose cone" that covers all of the exposed sensors except the critical measurement surfaces. A central wiper keeps those measurement surfaces clean.

5.12 Pipe Kit

For extra protection for your Manta during deployments in areas with boat traffic, flooding, debris in the waterway, etc., you can use a Pipe Kit. A Pipe Kit, which come in several diameters, is a PVC pipe with a locking, sealed cap on the top end and water-passage slots at the bottom end. An eye-bolt in the cap lets you tether the Pipe Kit if needed.



Figure 5-8 Pipe Kit

Because on a new Pipe Kit the cap is not glued to the slotted pipe, you can add more pipe (available at home-improvement centers) before fixing the cap in place.

6. Frequently Asked Questions

6.1 The Most Frequently Asked Questions

1. How does Solinst Eureka offer a three-year warranty that includes the turbidity, optical dissolved-oxygen, and pH sensors?

We looked at our repair records and realized that a three-year warranty will cost us a trivial amount of money. Other multiprobe manufacturers can't warranty their pH and DO sensors for more than one or two years.

2. Does Solinst Eureka develop anything?

In its continuing effort to make water quality monitoring easier, Solinst Eureka developed the first multiprobes with:

- 1) USB power capability
- 2) LED status indicators
- 3) standard memory and logging functions
- 4) a permanent calibration log
- 5) snapshot and automatic snapshot functions
- 6) custom-parameter feature
- 7) optical DO caps that never need replacement
- 8) turbidity-mimicking software
- 9) PDA-based data display
- 10) Bluetooth connectivity
- 11) cell phone as a data display
- 12) a digital user guide
- 13) smart sensors that were actually smart
- 14) fool-proof logging activation
- 15) a full, three-year warranty
- 16) a cell-phone-based telemetry system

6.2 Sensors

1. How do I know which sensor is which?

Please see Section 4.1– Sensors vs. Parameters.

2. How do I know when I need to maintain sensors?

Judgment gained from observing your field conditions and data requirements tells you when to maintain sensors. If you are logging data over long periods, the time when you collect your data from the Manta is a good time for maintenance and calibration. (Section 2.9 – Routine Maintenance).

3. Why is it important to check SC reading in air? What should it be?

A well-dried SC sensor should produce a zero reading in air. This lets you know that a one-point calibration is adequate.

4. Can I see the slope calculation for pH?

You can by looking at the mV readings in your calibration log. But there's no need to do that with your Solinst Eureka multiprobe because the reference electrode seldom needs replacement. You need only monitor pH slope for those manufacturer's whose reference electrodes are always moving toward the failure that requires replacement of the pH/reference sensor.

5. What is the range of millivolts for each pH solution?

Unlike other multiprobe manufacturers that require frequent replacement of the pH/reference electrode, with a Manta you do not need to worry about mVs. Just refill your reference electrode every two months or so.

6. How do I get the barometric pressure reading for the DO calibration? Do I need to check it to a certified Barometer?

You can enter an exact BP from, say, your lab barometer (don't use the weather station's BP – it's corrected to sea level). Or, you can enter your elevation and the Manta will estimate your BP. Or, if your Manta has a Depth sensor, the Manta can use it to measure BP. (Section 4.18 – Set Barometric Pressure and Set Date and Time).

7. Will my Manta also report TDS and/or Salinity?

Yes; please see Section 4.8 – Conductivity Sensor.

8. How often should I change the pH electrolyte?

Electrolyte usually lasts two months or more. But if you are logging data, or monitoring in very low Conductivity waters, change your electrolyte each time before you recalibrate pH to be safe. You may learn a better rule of thumb as you review your data. (Section 4.10 – Reference Electrode).

9. How long will my DO cap last?

DO caps last five years or more. You can see the condition of your cap when you calibrate DO. (Section 4.7 – Dissolved Oxygen Sensor).

10. How often should I change my turbidity wipers?

Wipers usually last for years, but you should change yours if it gets stiff or has nicks in it. (Section 4.13 – Turbidity).

11. Can I customize the Manta with different configurations of sensors?

We can fit up to 12 sensors in just about any combination you need. (Section 4.1 – Sensors vs. Parameters).

12. Can I replace the sensors myself, or do I have to ship the Manta back to Solinst Eureka?

Solinst Eureka sensors seldom need replacement – that's why they have a three-year warranty instead of the one-year warranty offered for other sensors. But if you have a problem, Manta sensors are easy to replace. Contact Solinst Eureka for assistance.

13. Why can your turbidity read negative?

We let the Turbidity reading go negative to indicate a problem with the Turbidity Low calibration. If, for instance, you calibrate at zero with water that is actually 5 NTU, then any sample less than 5 NTU will read negative. Recalibrating would be in order. Some manufacturers “clip” their Turbidity readings at zero to avoid this question, but that’s misleading and throwing away perfectly good information. (Section 4.13 – Turbidity).

14. How long do ISE tips last?

The usual rule is six weeks, but you may get more or less than that. Change tips often to be safe, but you may learn a better rule of thumb as you review your data. (Section 4.15 – Ion-Selective Electrodes).

6.3 Calibration and Maintenance**1. How do I know when I need to calibrate my sensors?**

The simple answer is that frequent calibration will give you better data. The more meticulous you are with calibration, the better data you will gather. If you are uncertain whether you need to calibrate, check your sensors against a known sample. If the reading is within the accuracy specification and/or your accuracy expectations, there is no need to calibrate.

Experience and your program’s accuracy expectations will help determine calibration frequency for the various sensors. If, for instance, your reservoir discharge is hovering near the regulatory minimum for dissolved oxygen, you should pay special attention to DO calibration frequency and technique. On the other hand, if a conductivity accuracy of +/- 10% is OK, you needn’t calibrate conductivity very often. (Section 4.2 – Basics of Parameter Calibrations).

2. How often should you calibrate your multiprobe?

That depends on a number of factors, including the nature of the waters being monitored and your expectations for accuracy. We suggest that you start by calibrating once per week and shorten or lengthen that interval as the data suggest. (Section 4.2 – Basics of Parameter Calibrations).

3. How do I choose calibration standards?

For best results, choose a calibration standard whose value is close to what you expect to see in the field. For example, calibrate with a 1413 μS Specific Conductance standard if you expect to see Specific Conductances between 500 and 1000 μS in the field. Don’t calibrate with a sea water standard. And if your waters tend toward the acidic, calibrate with a 4-buffer instead of a 10-buffer.

If you are moving your multiprobe across wide ranges of water conditions, you may wish to recalibrate to match the new situations. For instance, if you are measuring a clear lake during the morning and a high-sediment stream in the afternoon, you might consider recalibrating at noon with a high-range turbidity standard. (Section 4.3 – Choosing Calibration Standards).

4. What is an SRF?

Suppose that a typical Conductivity sensor reports 100 μA in a 1413 $\mu\text{S}/\text{cm}$ standard. If your particular Conductivity sensor reports 100 μA in that same calibration solution, then your SRF is 100% (some parameters, such as pH, have a more complex SRF calculation, but the effect is the same). If your response is 80 μA , your SRF would be 80%. When you click the OK button to accept a calibration, the Manta automatically accepts your calibration if the SRF is between 60% and 140%. If the SRF falls outside that range, you will be cautioned to check your standard value, make sure the sensor is clean, make sure the reading has stabilized, etc. But you can elect to accept any SRF.

Each sensor calibration’s Sensor Response Factor (SRF) is automatically logged into the Cal Record with the details of that calibration. (Section 4.5 – Sensor Response Factor).

5. Do I Have to Calibrate Temperature?

No; the Temperature sensor is so stable that it needs no calibration. (Section 4.6 – Temperature Sensor).

6. What is the Basic Calibration Procedure?

The Manta never guesses parameter values, so you have to calibrate it from time to time by simply telling the instrument what it should read in a known calibration situation. The general procedure is shown below. (Section 4.2 – Basics of Parameter Calibrations).

- 1) Clean the sensor and perform any necessary sensor-specific maintenance.
- 2) Select a calibration standard whose value is close to the values you expect to see in the field.
- 3) Rinse sensors thoroughly (more than once may be required) with DI (deionized) water, especially if you have been using other calibration solutions. Shake the Manta so the DI can vigorously remove traces of old calibration solutions and cleaning agents – repeat if necessary.
- 4) Rinse the sensors twice with a small quantity of your calibration standard. Discard the used calibration standard because it is probably contaminated with DI water.
- 5) Immerse the sensor in the calibration standard. This is usually accomplished by securing your Manta with the sensors pointing up, screwing the Cup onto the Manta, and filling the Cup with your calibration standard. Make sure the standard covers the sensor entirely, and that it also covers the thermistor for those parameters that are temperature-compensated.
- 6) Watch the parameter readings until they have stabilized.
- 7) Select the parameter to be calibrated by clicking on the Calibrations button in the Manta Control Home Screen, then clicking on Calibrate, and then clicking on the parameter you wish to calibrate. For Parameters that have two calibration points, you will specify which you wish to calibrate (usually High or Low). Enter the calibration value and click on OK. The Manta will report the resulting Sensor Response Factor (SRF); then click on OK to accept the calibration or Quit to leave the sensor uncalibrated. (Section 4.5 – Sensor Response Factor).
- 8) Each sensor calibration's Sensor Response Factor (SRF) is automatically logged into the Cal Record with the details of that calibration.

7. Can I Use Cal Solutions More Than Once?

If your QC protocol requires fresh cal solutions for every calibration, then discard the once-used solutions. If not, then your sensitivity cost and accuracy will determine whether you can re-use cal solutions. If, for instance, you want your field conductivity readings to be within 1% of reading, then fresh conductivity cal solution, which is not very expensive, should be used for each calibration. If you are not too concerned about turbidity accuracy, then you can probably reuse your turbidity cal solution once or twice because it's pretty expensive. (Section 4.3 – Choosing Calibration Standards).

8. What standard should I use to calibrate SC? What type?

For any parameter, use a calibration standard that is near the highest reading you anticipate in the field. For instance, if your lake usually runs about 1000 $\mu\text{S}/\text{cm}$, then calibrate with the readily available 1413 $\mu\text{S}/\text{cm}$ KCl standard. Note that some sensors (not SC) have two calibration points; the second point should be set at a convenient low point, usually zero. (Section 4.3 – Choosing Calibration Standards).

9. What is the different between calibrating % sat or milligrams per liter for DO?

Percent saturation tells you how much oxygen you have compared to how much you would have if the water were saturated with oxygen. Milligrams per liter tells you just that: how many milligrams of oxygen are dissolved in one liter of water. For instance, if your Manta was reading 6.0 mg/l and the saturation tables told you that at that temperature, salinity, and barometric pressure the saturation value was 8.0 mg/l, then your % sat would be $6/8 = 75\%$. You can use either measurement, or both, but % sat is helpful during DO calibration because it should always be 100%. (Section 4.7 – Dissolved Oxygen Sensor).

10. What is the difference between the Amco Clear turbidly standard and StablCal?

Amoco Clear is made of polymer beads while StablCal is a formazin compound. Most people want their turbidity measurements referenced to formazin, and so use formazin or StablCal for calibrations. The polymer beads are cheaper and more stable, BUT you must know the equivalent formazin value for any polymer bead standard. You cannot rely on what's written on the polymer-bead label; you must check it with your own instrument after it has been calibrated with formazin or StablCal. (Section 4.13 – Turbidity).

11. How do I cal BG algae?

There are several ways to calibrate fluorometers. Please read “Calibrating Solinst Eureka’s Fluorometers”; this can be found on the Solinst web site or the Solinst Eureka Flash Drive.

12. What is a good SRF?

Generally, and SRF between 80 and 120 is good, and 60 to 140 is acceptable. If your SRF is outside those limits, you should check your standard value and the maintenance condition of your sensor. (Section 4.5 – Sensor Response Factor).

13. How often should I change the pH electrolyte?

To be safe, change your electrolyte every month or so. That's probably more than needed, but changing electrolyte takes only a minute and is inexpensive. (Section 4.10 – Reference Electrode).

14. Where do I buy calibration solutions for the various sensors?

You can buy most cal solutions from Solinst Eureka, lab supply companies, or most catalog houses (such as Cole Parmer). (Section 4.2 – Basics of Parameter Calibrations, Section 4.3).

6.4 Communication and Software**1. How does the Manta communicate (SDI-12, etc.)?**

Mantas use RS-232 as their native language, but Solinst Eureka provides converters for SDI-12 and MODBUS if you prefer. (“Manta Comm Protocol”, “Manta SDI-12 Adapter”, and “MODBUS Communications” on the Solinst web site)

2. What com port should I use?

Most people should never have to worry about choosing a COM port; just let the PC do the work. (Section 3.4 – PC Pull-Down Menu).

3. Is the coloured top line an average of the values or the latest readings?

No; the data in the coloured band is the most recent line of data obtained from your Manta. (Section 3.2 – Home Page).

6.5 Deployment and Applications

1. How long can I expect my batteries to last?

Battery life is difficult to predict because it varies with Logging Interval, quality of batteries, number and type of sensors, and water temperature. Battery life is best determined by experimenting with your specific Manta in your specific applications. (Section 5.9 – Batteries and Battery Life).

2. For my battery pack, when looking at the battery voltage in the log file, at what point will the Manta stop logging?

The Manta can show the voltage provided via the cable and the voltage provided by an Internal Battery Pack. The voltage provided by an External Battery Pack is shown as cable voltage. There is no fixed cut-off point, but any time the battery pack or cable voltage drops below about 5 VDC, the voltage may not be adequate for the Manta to boot properly. (Section 5.9 – Batteries and Battery Life).

3. How do I deploy my sonde when there is no bail hook? Is it OK to hang by the cable? How much weight will the cable hold?

When properly attached, the Manta Underwater Cable can support well over 50 pounds without using a Bail Kit. You can hang the Manta by the Underwater Cable if the load is not likely to exceed 50 pounds. (Section 2.4 – Underwater Cables).

4. How do I attach the underwater cable to the sonde?

Please see Section 2.4 – Underwater Cables.

5. What anti-fouling products to you offer?

We offer three anti-fouling aids, including the uniquely effective copper-gauze method. (Section 5.11 – Controlling Sensor Fouling).

6. Can I use re-chargeable or Lithium batteries in the Internal Battery Pack?

We strongly discourage use of lithium batteries in enclosed housings if there is any chance the batteries could get wet – such as in the IBP or EBP. (Section 5.9 – Batteries and Battery Life).

7. Why is it important to check water temperature in a range of temperatures in the lab before deployment? How often?

It's not really that important; the Manta design has been checked many times to make sure it accounts for water temperature everywhere necessary, such as when calculating DO saturation. However, it might be instructive to check the performance of your Manta in cold water if you often operate in cold waters.

6.6 General FAQs

1. What do the LEDs mean?

Please see Section 2.5 – LED Light Definitions.

2. Is your sonde approved by the EPA, USGS, or has it been tested at ACT (Alliance for Coastal Technologies)?

Yes, and you can see the test reports, including “ACT’s Performance Verification Statement for the Eureka Manta2 pH Sensor (2015)”, “Evaluation of the Eureka Manta2 Water-Quality Multiprobe Sonde (USGS, 2017)”, and “Eureka Outperforms the Competition”, on the Solinst web site.

3. Can I add sensors to my Manta?

The Manta can handle as many as 12 sensors. If you have fewer than 12 and wish to add one or more sensors, we can do it.

4. What is the history of Solinst Eureka?

Solinst Eureka was formed as Eureka Environmental Engineering in 2002. Eureka's staff, mostly former Hydrolab and YSI employees with over 100 man-years experience in all areas of the multiprobe industry, produced the Manta1 Water-Quality Multiprobe and the Amphibian1 Data Display in 2003.

The Manta1 sported such industry firsts as direct connection to USB ports, unbreakable cable connections, transparent multiprobe housing, LED's for easy operation and troubleshooting, and software easily understood by regular people. The Amphibian1 was the industry's first PDA-based data display.

The Manta2, the first multiprobe in the world with "smart" sensors that were actually smart, was introduced in 2008. It was even more reliable and easy to use than the Manta1 and has been accepted by the most discerning field practitioners around the world.

Eureka was acquired by Measurement Specialties, Inc. in 2011 in the usual belief that multiple synergies would make everyone happy. But the multiprobe market just doesn't work well in a large, corporate framework, so partners from Europe, Asia, and America purchased the "old Eureka" in 2014. They resumed business seamlessly as Eureka Water Probes.

The Manta+ takes all the field-proven qualities of the Manta2, adds a user-interface with a dozen new features that is still easy to use, and adds a three-year warranty and marine-type connectors.

Eureka was acquired by Solinst Canada Ltd. in February 2025, becoming Solinst Eureka LLC.

5. Why do you build the Manta the way you do?

Unlike the products of other manufacturers, the Manta uses the same basic electronic and mechanical components regardless of how many sensors you order. Most importantly, we have a "No-Cramming Rule" that prevents stuffing too many sensors into an artificially small instrument diameter. We know that small instruments are desirable, but cramming sensors together results in sensors whose performance, reliability, reparability, and/or maintenance ease is compromised. We choose the best sensors available on the world market for your needs and build the Manta around them.

When you ordered your Manta, one of the Solinst Eureka product specialists determined the optimum housing diameter for the sensors you selected. The Manta sizes (outside diameters) are 2 inches (actually 1.95), 2.5 inches (2.45), 3 inches (2.95), 3.5 inches (3.50), 4 inches (4.00), and occasionally even 4.5 inches (4.50).

Anytime you wish to add or subtract sensors, we can use all of your Manta's circuit boards and sensors in a larger or smaller housing. Cost is minimized, and you still have a conventional Manta instead of having to change to a different instrument model.

We know that stuff - bad stuff - happens in the field, so we designed the Manta so you don't need a factory expert for troubleshooting if something goes wrong. If the multiprobe turns on and reads any of its parameters correctly, then the basic communication circuitry is OK - if not, you need a new CPU board. If the multiprobe reads temperature, but not, say, conductivity, then you need a new conductivity sensor. You call Solinst Eureka, we send you the replacement component, and you install it yourself in a few minutes. There's no labor charge, and only one day of down-time. It really is that easy.

And, of course, the Manta continues Solinst Eureka's tradition of user software that is extremely user-friendly.

