Manta 2™

Water Quality Multiprobe Manual

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Eureka Environmental Engineering
2113 Wells Branch Parkway, Suite 4400
Austin, TX 78728
Tel: 512-302-4333
Fax: 512-251-6842

sales@eurekaenvironmental.com
support@eurekaenvironmental.com
www.eurekaenvironmental.com

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QS Learning the Manta 2 in 30 Minutes

I'm the last to blame you if you are determined to read as little of this manual as possible. So, if you have any experience with multiprobes – you know what a cable looks like and you know what a pH buffer is – you can get by just fine reading only A1 – A3. The rest of you should at least skim the sections on software and sensors.

I tried to make this manual at least half as long as those of other multiprobes on the market just so you'd feel like you're getting your money's worth. But I couldn't do it – the Manta 2 is just too easy to use. We did that on purpose.

However, if you have any questions about the Manta 2, multiprobes in general, water chemistry, Longhorn baseball schedule, etc., please call Eureka at 512-302-4333 x? We'll drop what we're doing and talk to you until *you're* trying to figure out a polite way to get off the phone.

QS1 Loading the Manta 2 Software on Your PC – 5 Minutes

1) Find the Eureka Install Disc that was delivered with your Manta 2.

2) Stick the disc into your PC's CD-ROM drive tray and close the tray.

3) Verify, in a few minutes, that your PC desktop has a new icon called Manta 2 Control Software.

4) The Manta 2 software will start automatically, but you're going to click on Close because you've got to load your USB to Serial Driver now.

QS2 Installing the USB to Serial Driver

1) Plug the USB to Serial Adapter (it's the blue thing with the USB connector on a one-foot cable) into any USB port on your PC.

2) Your Windows system will give you the "Welcome to New Hardware Found" box. Click the little circle beside "Install the software automatically" and click on Next.

3) Your PC will find the USB to Serial Driver software on the Eureka Install Disc and load it automatically after you click on "Continue Anyway" when you see the box that says that the software has not been verified to be Microsoft compatible.

4) Then you'll see the box that says your hardware (meaning the USB to Serial Adapter) is successfully installed and ready for use.

QS3 Connecting the Manta 2 to Your PC – 5 Minutes

1) Connect the USB Adapter to any USB port on your PC.

2) Connect your Manta 2 Cable to the USB adapter.

3) Connect the Manta 2 to the Cable.

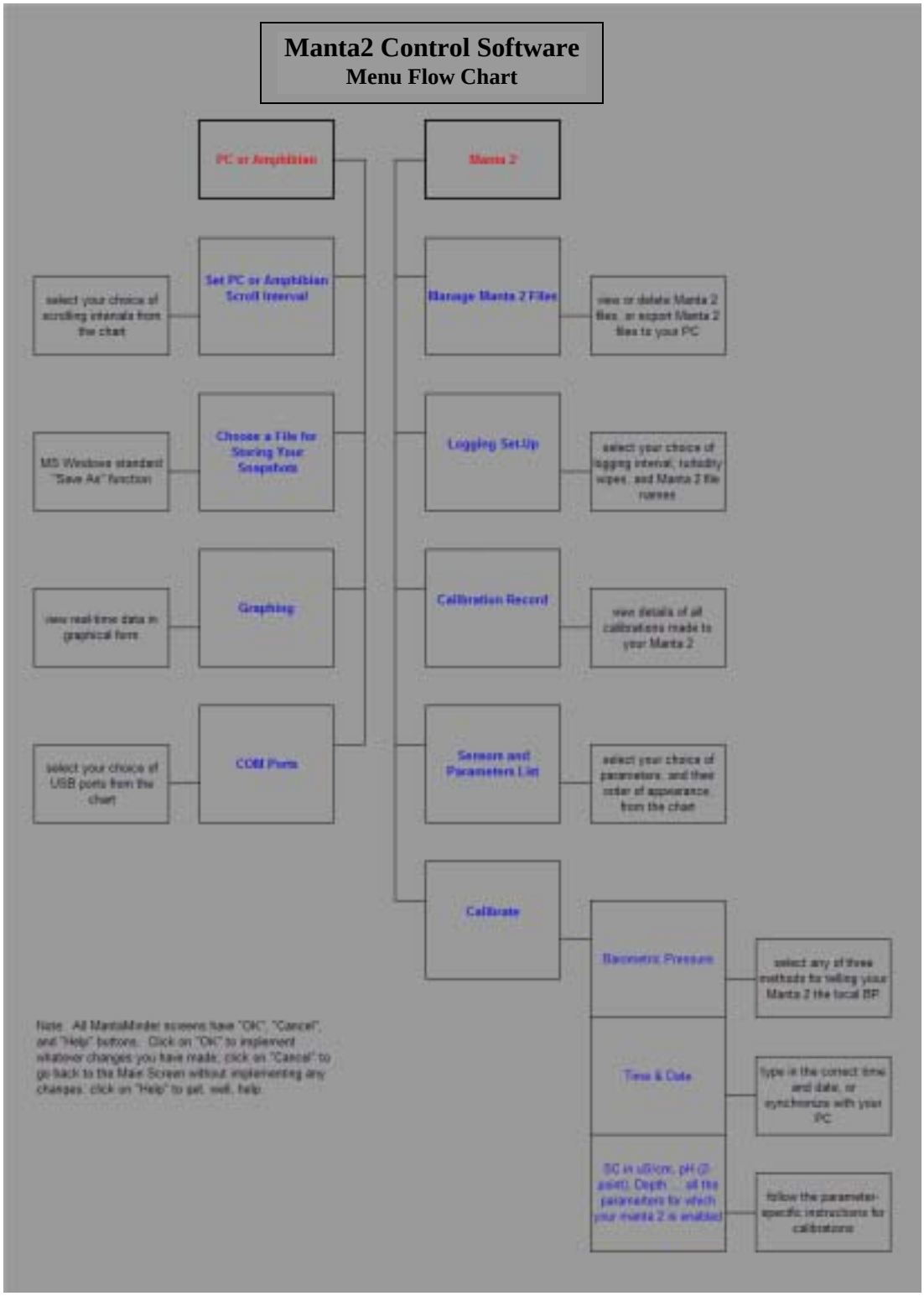
4) Click on the new Eureka icon.

5) Wait a few seconds while the PC and Manta 2 automatically find each other, and then you'll see the user interface Main Screen and rolling data from your Manta 2.

QS4 Tinkering with the Software – 20 Minutes

You can tinker around with the software until you see how to calibrate sensors, activate logging, etc. You can't break anything because every software step (i.e. every screen) has a "Cancel" button that takes you back to the Main Screen without changing anything.

Note that the Main Screen has six "hot" buttons that give you short-cuts to various routine tasks, like turning Manta 2 logging on and off, or clearing the data screen. But it's in the "pull-down" menus – "PC or Amphibian" and "Manta 2" – that you'll find most of the serious operating functions. Below is the flow chart for the menus.



A Overview

A1 Eureka Environmental

Eureka Environmental was formed in 2002 to take advantage of the market leaders' inattention to product development and customer service. Eureka's staff, with over 100 man-years experience in all areas of the multiprobe industry, produced the Amphibian Multiprobe Data Display and the Manta 1 Water-Quality Multiprobe in 2003. The Manta sported such industry firsts as direct connection to USB ports, unbreakable cable connections, the transparent multiprobe housing, and on-board LED's for easy troubleshooting. The Amphibian was the industry's first PDA-based data display.

With over 1000 instruments in the field, Eureka has joined the ranks of manufacturers whose instruments are accepted by the most discerning field practitioners.

A2 What is new about the Manta 2?

The Manta 2 takes the Manta 1's utility a step further by associating most of each sensor's circuitry with the sensor instead of elsewhere in the basic multiprobe. For instance, the circuitry that operates a conductivity sensor is normally built into the one or two large circuit boards dominating the center section of a multiprobe. In the Manta 2, however, most of the conductivity circuitry is built into the conductivity sensor itself. This architecture solves two of the most pernicious problems that have faced multiprobe users for decades.

First, you don't have to buy stuff you don't need. The base price of virtually all pre-Manta 2 multiprobes includes the circuitry needed to measure six or eight parameters. The Manta 2 base price includes only basic communication circuitry. If you want to measure pH, the price of the pH sensor and its circuitry are added to the Manta 2 base price. If you don't want pH, you don't pay for the sensor or its circuitry. This system also makes adding additional sensors to a multiprobe a snap.

Second, you will never have to suffer the downtime and cost of returning a Manta 2 to the factory for repair. Troubleshooting works like this: 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 communications board. If the multiprobe reads temperature, but not, say, conductivity, then you need a new conductivity sensor. You call Eureka, we send you a new conductivity sensor by FedEx, 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 2 continues Eureka's tradition of user software that is so easy that most customers rarely read this instruction manual. Who knows, you may be the only customer ever to read these words.

A3 Example Systems and Applications

The Manta 2 multiprobe, which can be used in any natural water up to 50 degrees C and 200 meters depth, has three basic applications. First, it can be used manually to gather data if you have a cable and an Amphibian or notebook PC. You might take a series of measurements in one or more lakes or streams during the day, and then download any saved data to your desktop PC that evening.

Second, it can run unattended for weeks at a time with a battery pack. You might set the instrument to take a set of readings every half-hour, anchor it in an estuary, and return two weeks later to retrieve the instrument and download the data.

Third, the Manta 2 can connect to a data telemetry system. You might deploy the instrument in a location for which access is dangerous or expensive. A data logger, battery, and modem would take data from the multiprobe and transmit the data to a Website of your choosing.

A4 Manta 2 System Components

Clockwise from the top: Manta 2 and its underwater cable, storage/calibration cup, maintenance kit, software disc and data cable, USB adapter, weighted sensor guard.

1) The Manta 2 system comprises these basic parts:

2) Manta Multiprobe – each unit is custom configured with your choice of sensors, and with or without a battery pack.

3) Underwater Cable – The underwater cable connects the Manta 2 to a PC, Amphibian Data Display, or telemetry device when the Manta 2 is underwater.

4) Storage/Calibration Cup – With the black lid screwed on, the storage/calibration cup should contain a few ounces of tap water to keep the sensors moist. (Some units are shipped with separate storage cups and calibration cups; the storage cup does not have a removable bottom.) Do not overfill, and do not allow the water to freeze. Do no store in anything other than tap water. With the black lid removed, the storage/calibration cup is used to hold calibration standards when calibrating the sensors.

5) Maintenance Kit – This kit contains spare DO membranes and DO electrolyte (if you ordered a Clark dissolved oxygen sensor), reference electrode filling solution (if you ordered pH), the logging on/off switch if the Manta 2 has an internal battery pack, and o-ring grease (please use this liberally, especially on the o-rings of the underwater cable connector and on/off switch if so equipped.).

6) Manta Desktop Software – allows you to connect the Manta directly to your PC through the USB port. You can view data, setup logging files, and calibrate your instrument. Also contains the USB to Serial Driver – The Manta connects directly to a USB port on your PC.

This software allows your PC to recognize the Manta. The original driver disc is included with your Manta, but has also been copied onto the Manta Installation Disc "2".

7) USB Cable – Use this cable to connect the Manta to your computer via a USB port. Do not use the USB adapter cable with anything but your PC and a Manta 2. In the USB world, this is considered abuse. You will make it soooo angry that it will refuse to work and no amount of pleading will help.

8) Weighted Sensor Guard – Replace the storage/calibration cup with the weighted sensor guard just before using your Manta 2 in the field.

A5 Manta 2 Different Sizes

Unlike the products of lesser manufacturers, the Manta 2 uses the same basic components regardless of how many sensors you order. All the circuit boards are the same, and all the sensors are the same. Most importantly, we have a No-Cramming Rule that prevents our stuffing too many sensors into an artificially small instrument diameter. Doing so usually results in sensors whose performance, reliability, and repair or maintenance ease is compromised.

So, when you ordered your Manta 2, one of the product specialists figures out the optimum housing diameter for the sensors you selected. The Manta 2 sizes (outside diameters) are 2 inches (actually 1.95), 2.5 inches (2.45), 3 inches (2.95), 3.5 inches (3.50), and 4 inches (4.00).

Anytime you wish to add or subtract sensors, we can use all of your Manta 2's circuit boards and sensors in a larger or smaller housing. You don't have to change from one model instrument to another.

All Manta 2's are the same height: 16 inches including the weighted sensor guard and cable locking sleeve.

A6 Connecting the Manta 2 to a PC

You're not going to believe how easy it is to communicate with your Manta 2 and make it jump through all its hoops:

1) Put the CD with the fish logo in your PC's CD tray. The Manta 2's operating software will automatically load on your PC in a few minutes, and you will see a new fish icon called Manta 2 Control Software on your PC desktop.

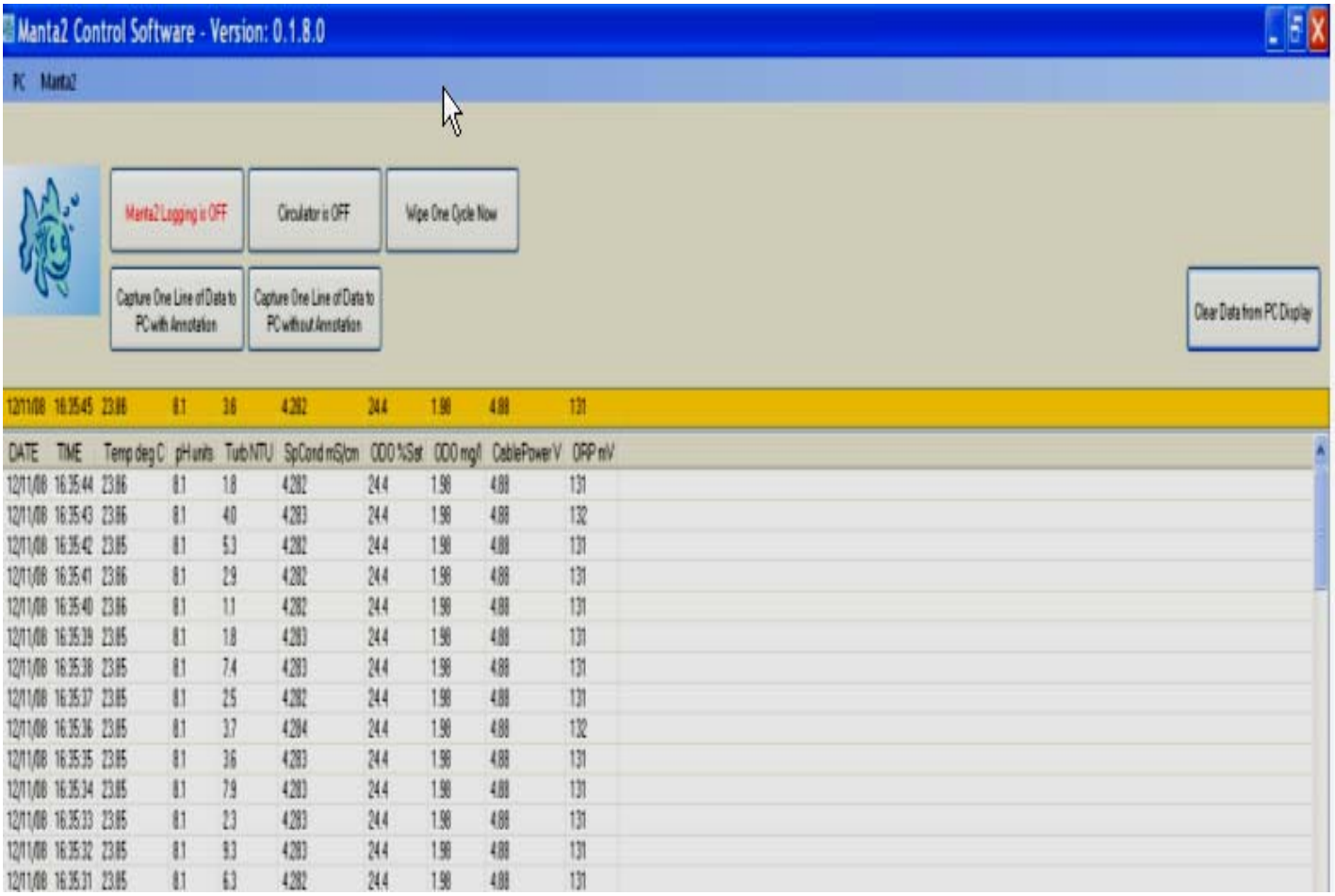
2) Plug the Manta 2's USB adapter into any USB port on your PC.

3) Connect the cable between the Manta 2 and the USB adapter.

4) Click on your desktop's fish icon.

5) Marvel at how quickly the Manta 2 software boots, automatically finds the correct PC communication port, and starts reeling off data from your Manta 2.

The first screen you see - the one with the rolling, real-time data - is called the Main Screen, which you can read more about in Section B.



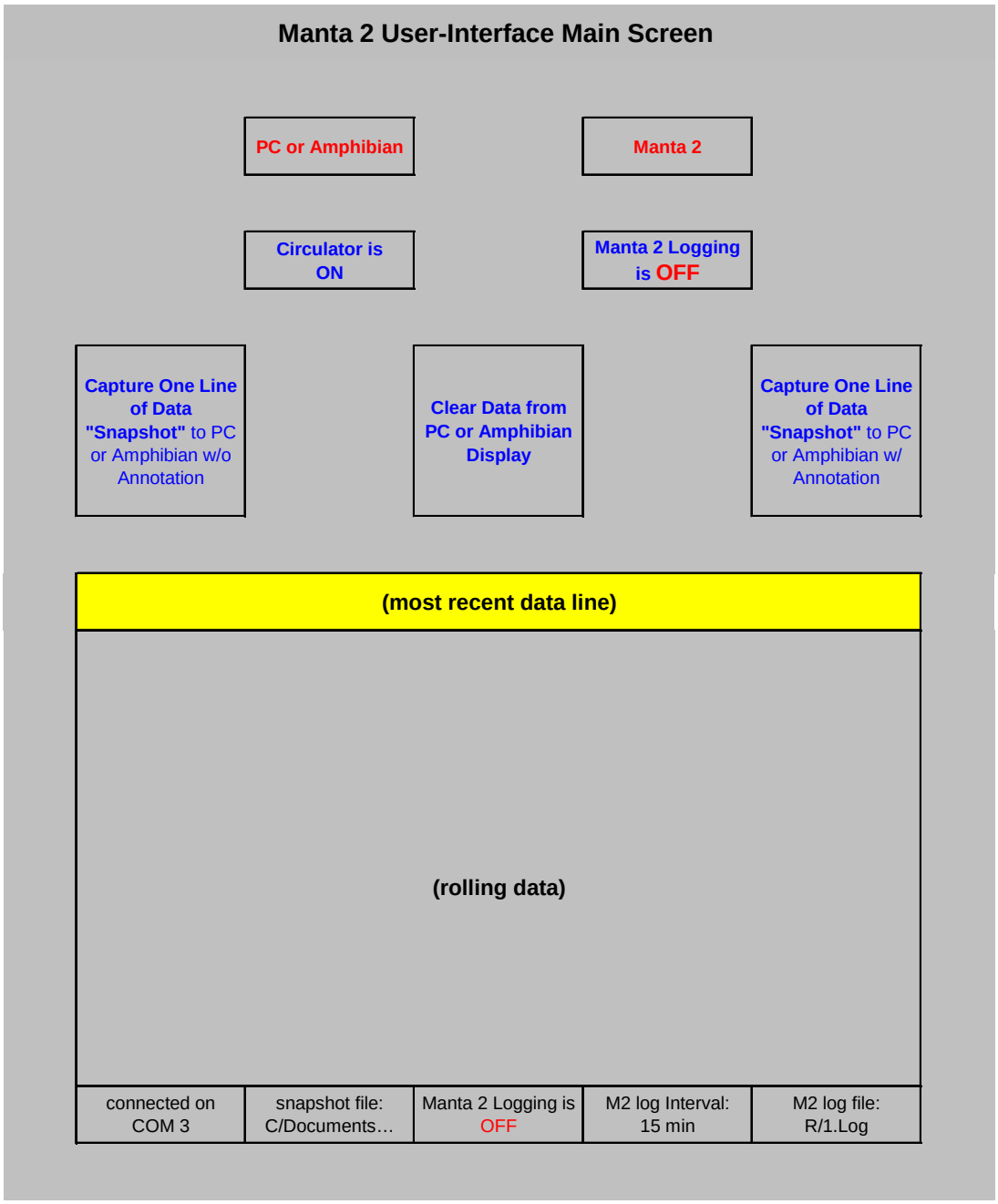
B Manta 2 Control User Interface

B1 Connecting the Manta 2 to a PC

If you're reading B1, we know you didn't read A1 and A2. Go back and do that.

B2 Main Screen

We call the Manta 2 Control Software's main screen the "Main Screen" because it's the screen that first appears when you click on the Eureka desktop icon, and because you can access all the Manta 2 Control Software functions from this screen. The MS functions are:



These two buttons are pull-down menus.

These five buttons are "hot buttons" – short-cuts to important and often-used functions.

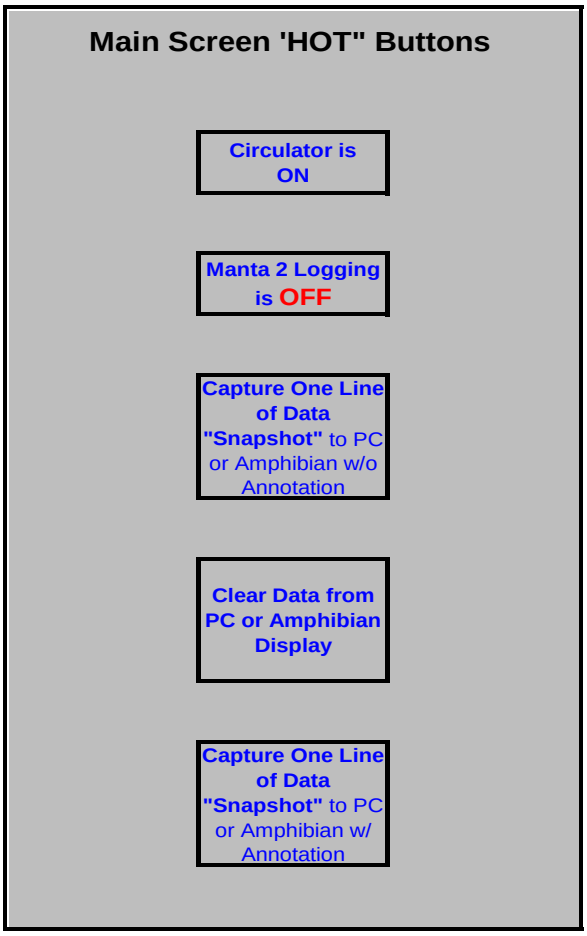
The line of data highlighted in yellow is the most recent line of data sent from the Manta 2.

This area is continuously updating, real-time data from your Manta 2.

This area tabulates some of the information you might find handy.

B3 Hot Buttons

"Hot Buttons" are the little squares you can click on to do something important without leaving the Main Screen. The Hot Button functions are:



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

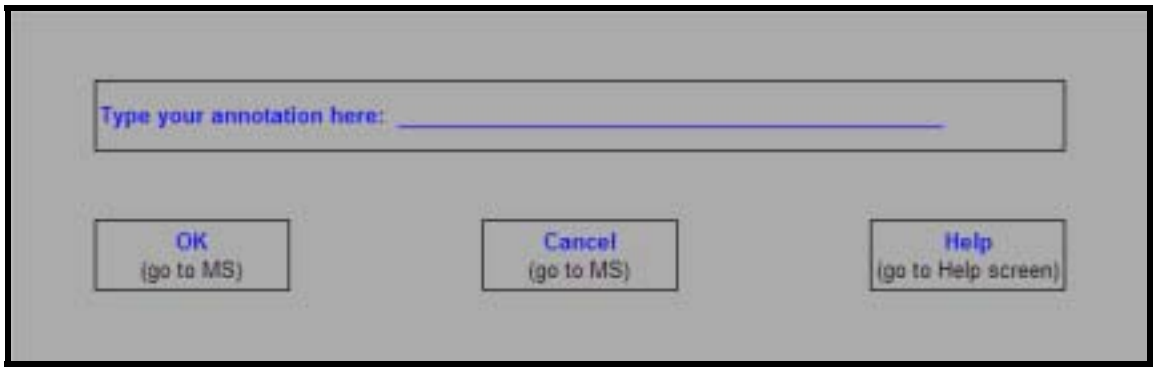
If this button says "ON", click on it to turn Manta 2 logging off .
If this button says "OFF", click on it to turn Manta 2 logging on.

Click on this button to send one frame of data to your PC or Amphibian Snapshot file.

Click on this button to clear the data area.

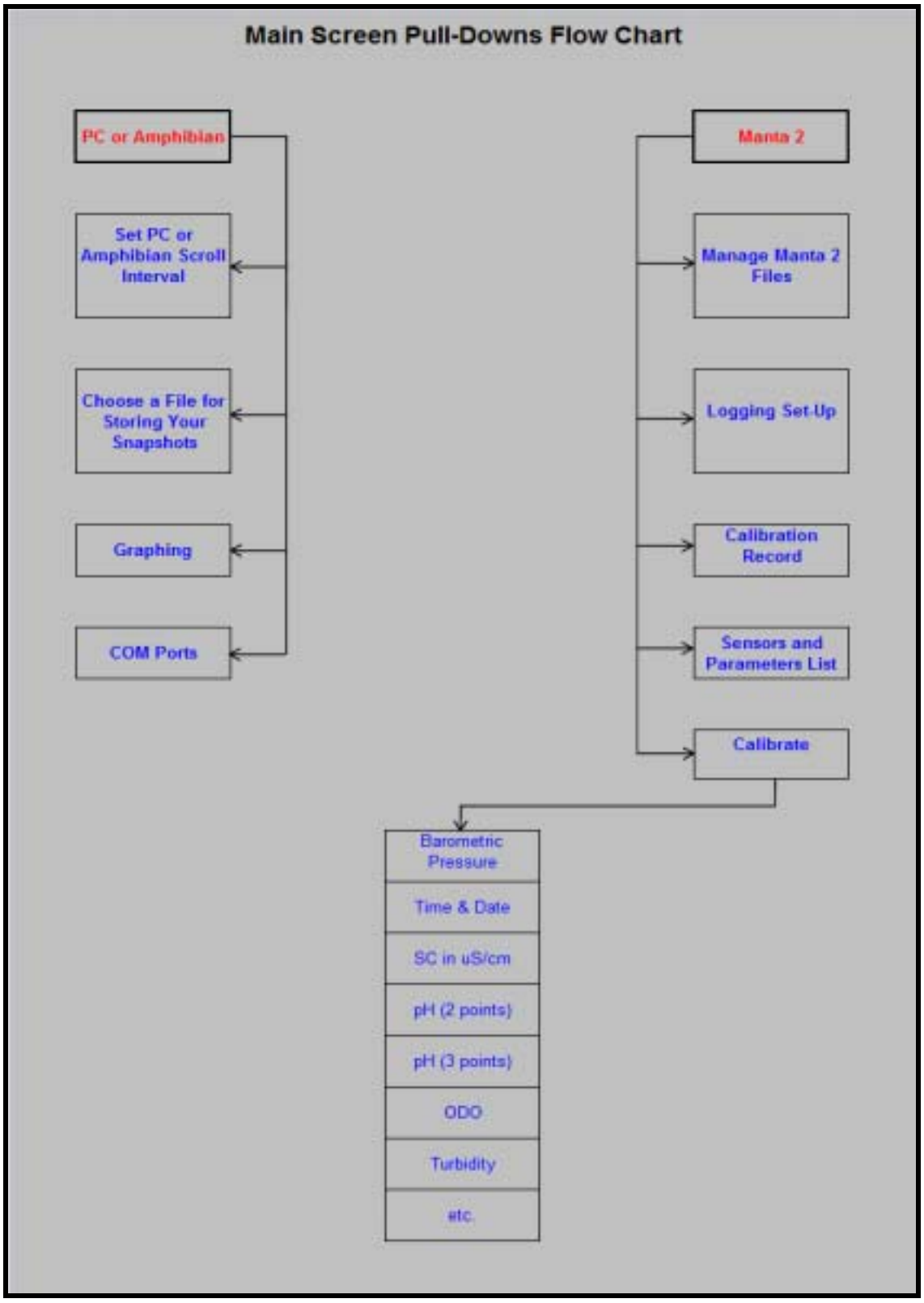
When you click on this button, a comment screen appears (see below), and then one frame of data is sent to your PC or Amphibian Snapshot file (along with the comment you typed in the box).

If you click on "Capture w/Annotation" Hot Button, this box appears so you can type in any comments you wish saved with the most recent line of data:



B4 Menus

Menus are the little squares that you can click on to see all of the things you can do to either the PC or Amphibian functions or Manta 2 functions:

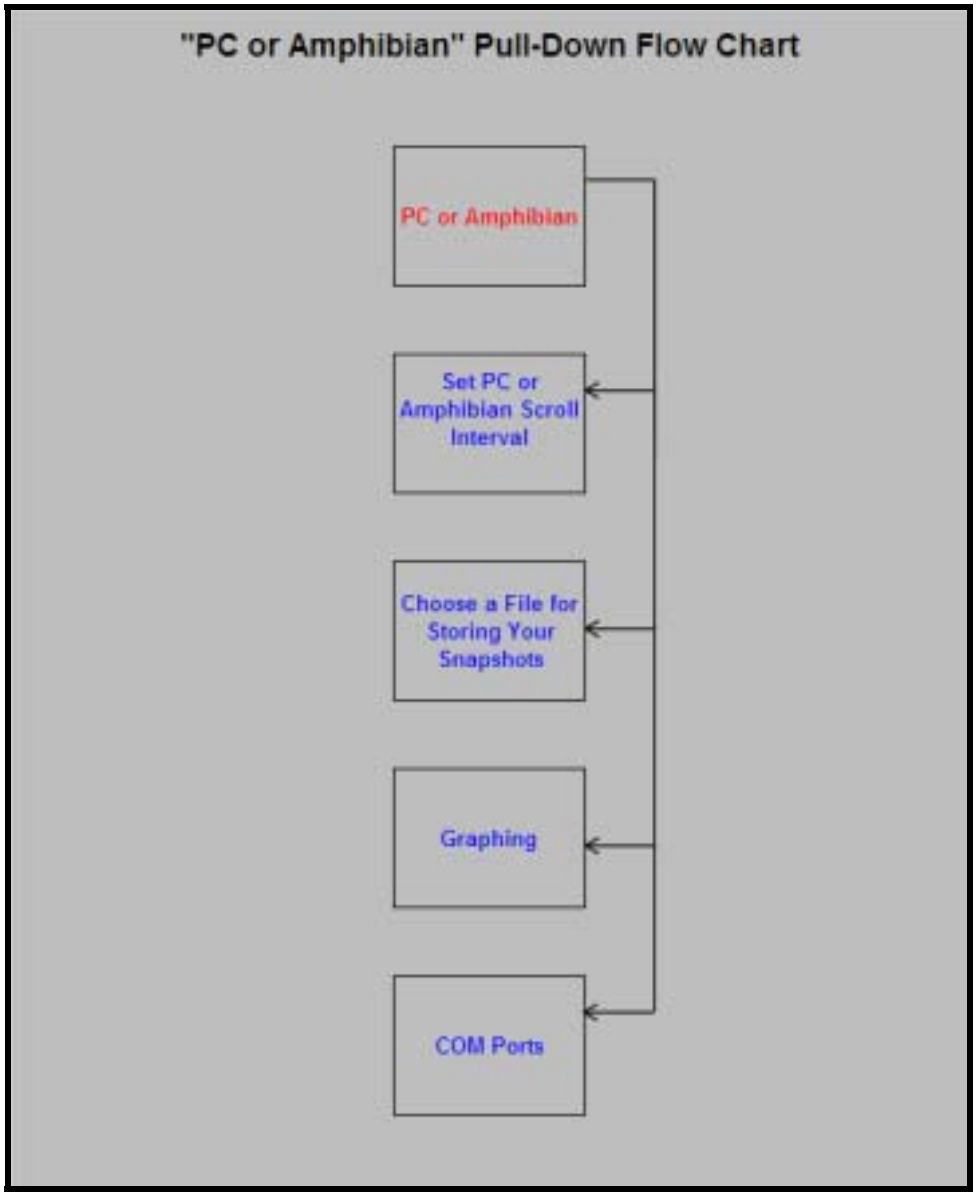


The two Menus are explained further in Sections C and D.

C User Interface Software – “PC or Amphibian” Menu

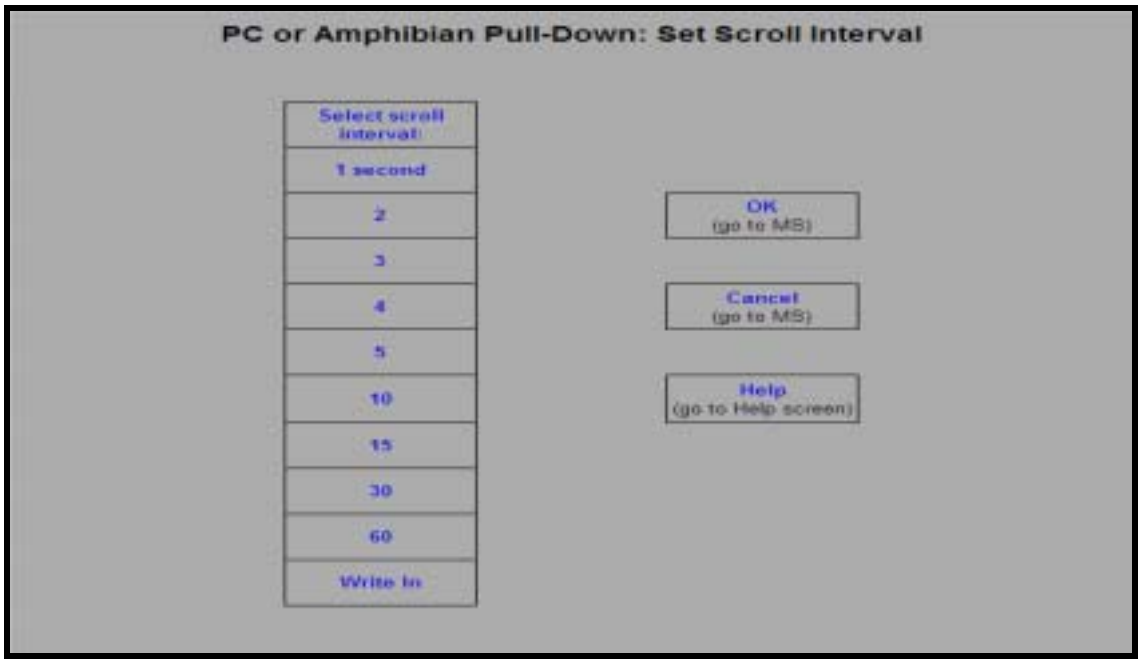
C1 “PC or Amphibian” Flow Chart

When you click on the “PC or Amphibian” menu, you can click on your choice of:



C2 Set PC or Amphibian Scroll Interval

Click on “PC or Amphibian Scroll Interval” if you wish to change the time for which lines of data on your screen are updated. You can click on a specific scroll interval, or write in your own:



C4 Choose a File for Storing Your Snapshots

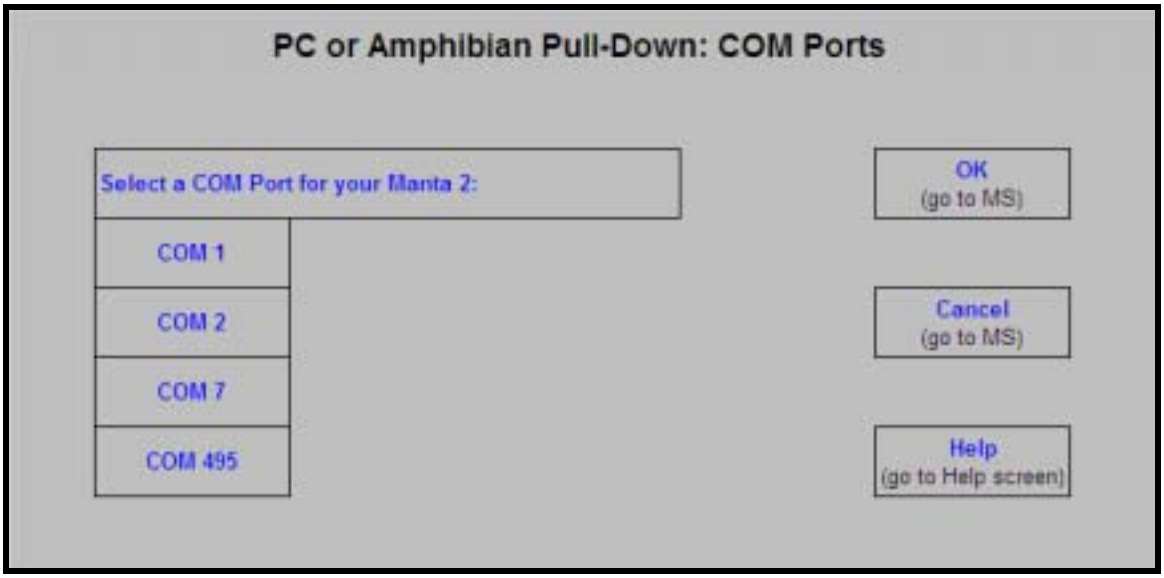
Click on “Choose a File for Storing Your Snapshots” if you wish to change the file in which your chosen lines of data (“snapshots”) are filed. This calls up the standard “Save As” function of your PC’s Windows operating system. Follow the instructions just as if you were saving a new Excel document.

C5 Graphing

Click on graphing to see your M2 data in graphical form.

C6 COM Ports

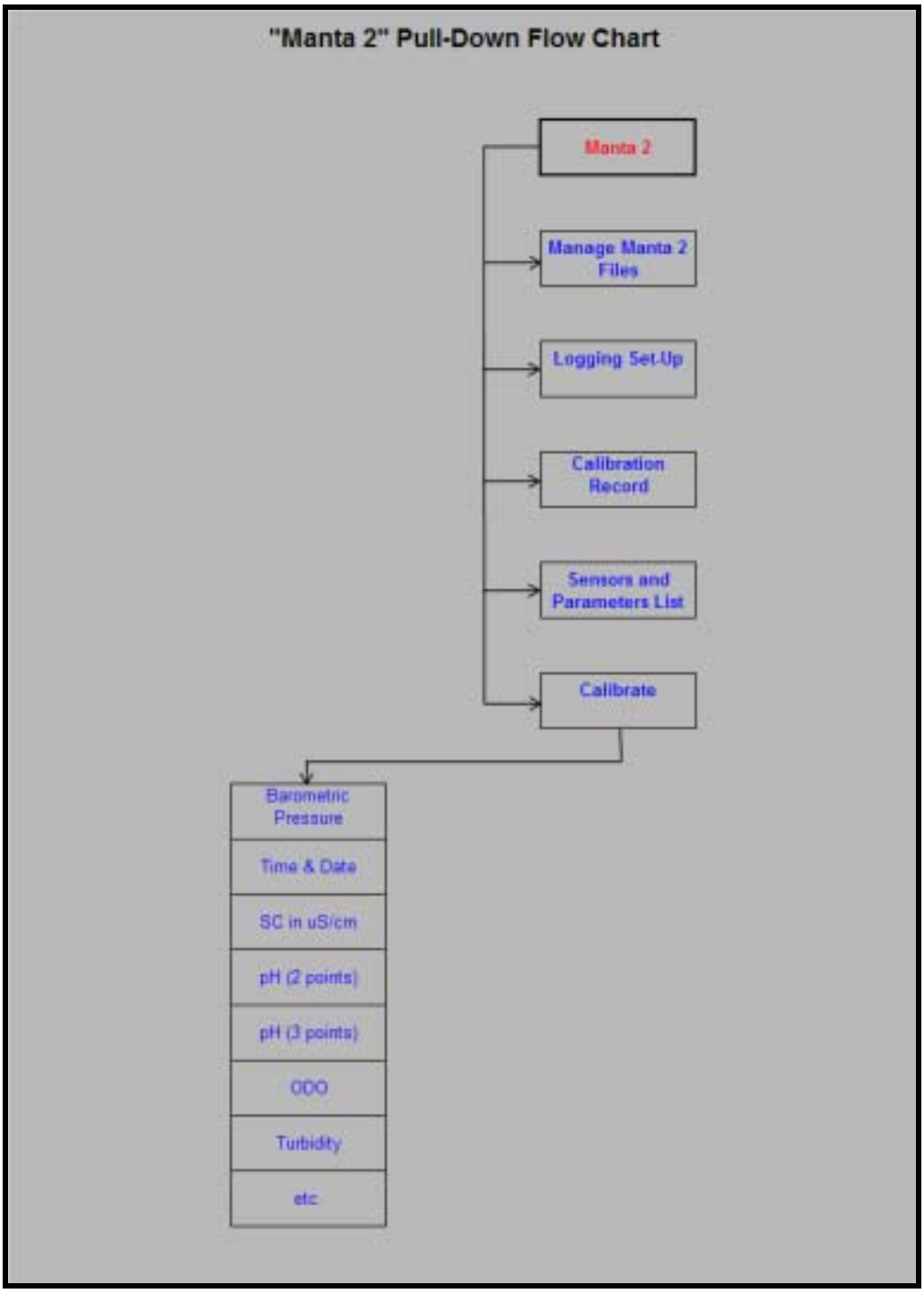
Click on “COM Ports” if you wish to change the USB port that your Manta 2 Control Software uses to talk to your Manta 2. Because the Manta 2 Control Software searches all active USB ports until it finds a Manta 2 to talk to, you may wish to tell the Manta 2 Control Software to look at another port if you have more than one Manta 2 connected to your PC at one time. This might be valuable if you are calibrating several Manta 2’s at the same time, or are using your PC to monitor several Manta 2’s at the same time (for instance in a fish hatchery with multiple tanks).



D User Interface Software – “Manta 2” Pull-Down Menu

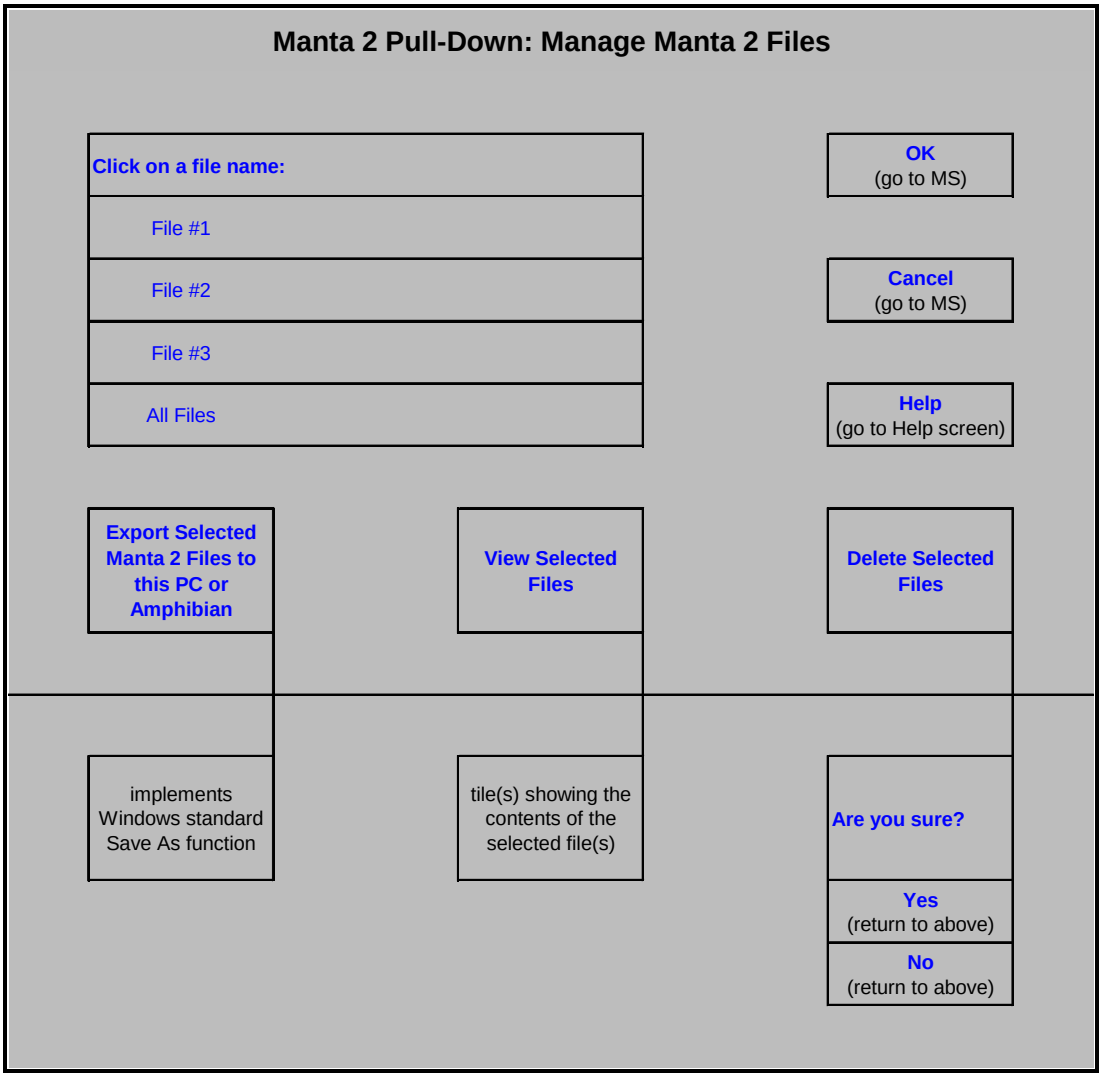
D1 “Manta 2” Flow Chart

When you click on the “Manta 2” menu, you can click on your choice of:



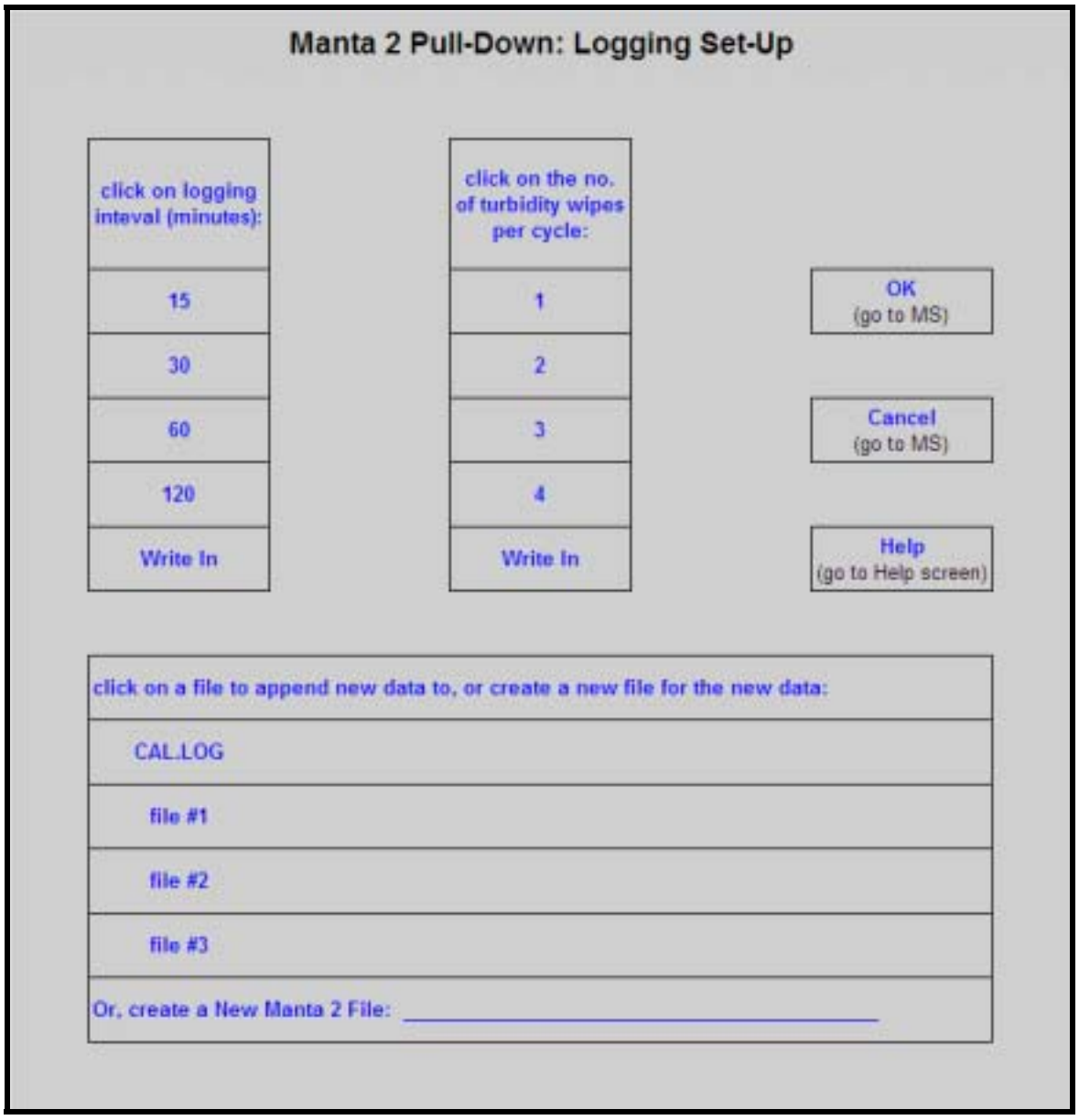
D2 Manage Manta 2 Files

This screen shows you all the files that are stored in your Manta 2. Highlight the file(s) you're interested in by clicking on it. You can then view that file on your PC screen, delete that file, or export it to your PC (via the Save As function standard to Windows).



D3 Logging Set-Up

This screen lets you change any or all of the instructions the Manta 2 will follow when logging (i.e. periodically saving data to its memory). You can click on your preferred logging interval (or write in another logging interval) and/or click on the number of wipe cycles your turbidity sensor (on most models, but only if you have a turbidity sensor). will make before taking data. You can also elect to append any new data to an existing file by clicking on that file name, or you can create a new Manta 2 logging file.



D4 Calibration Record

The Calibration Record is a permanent record of all calibration changes for your Manta 2. Please see E3 for more information.

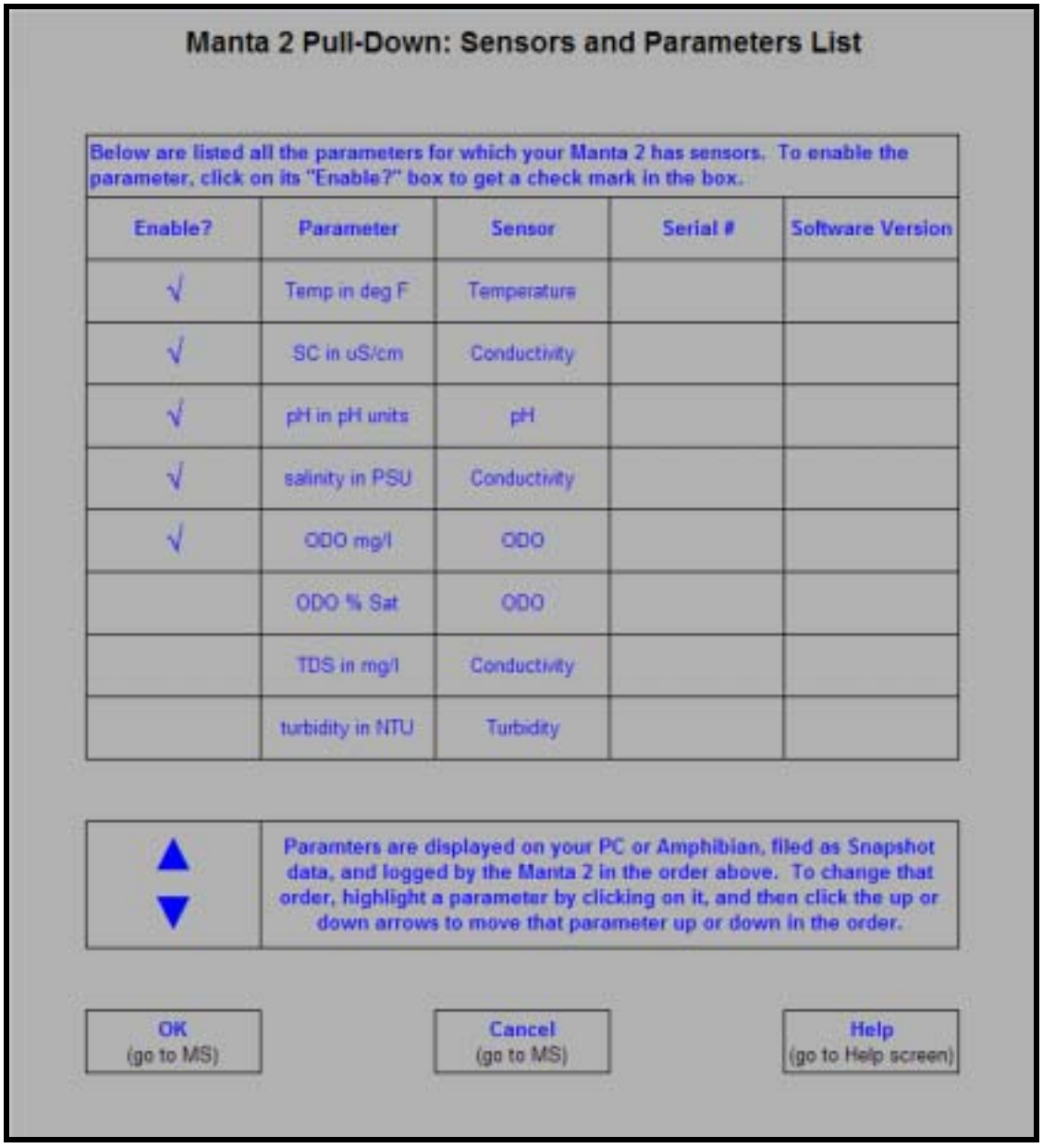
Manta 2 Pull-Down: Calibration Record

Parameter	Sensor	Serial No.	Rdg Before	Rdg After	SRF	Comments
Temp in deg F						
SC in uS/cm						
pH 7						
pH < 6						
pH > 8						
salinity in PSU						
ODO zero						
ODO span % Sat						
ODO span mg/l						
TDS in mg/l						
turbidity zero						
turbidity span						

D5 Sensors and Parameters List

A sensor is a basic sensing element, like a thermistor. A parameter is a type of data derived from that sensor, like degrees Fahrenheit and degrees Centigrade. This screen lists all the parameters supported by the Manta 2, and you enable these parameters by clicking in the box (to the left of the parameter name) to produce the check mark. Clicking on a box with a check mark removes the check mark and disables that parameter. Note that if you enable a parameter but don't have a sensor for that parameter, it would be a huge coincidence if the data were accurate.

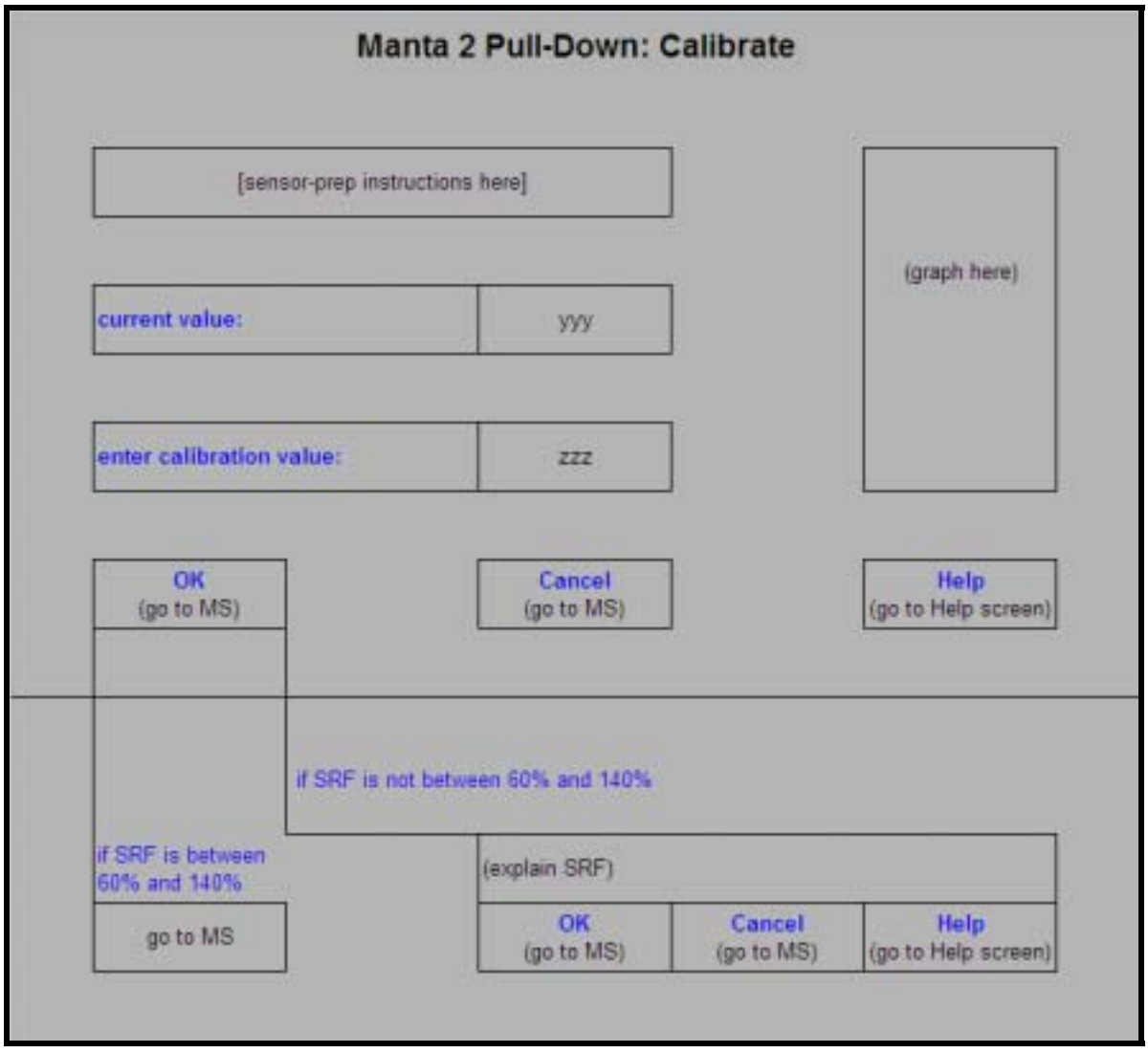
The order of the enabled parameters in this list is the order in which the parameters will appear in your PC or Amphibian Main Screen, the order in which they will appear in logging files, and the order in which they will appear in Snapshot files. You can change the parameter order by clicking on it (i.e. highlighting it) and then moving it up or down by clicking on the up- and down-arrows at the bottom of the screen.



D6a Calibrate

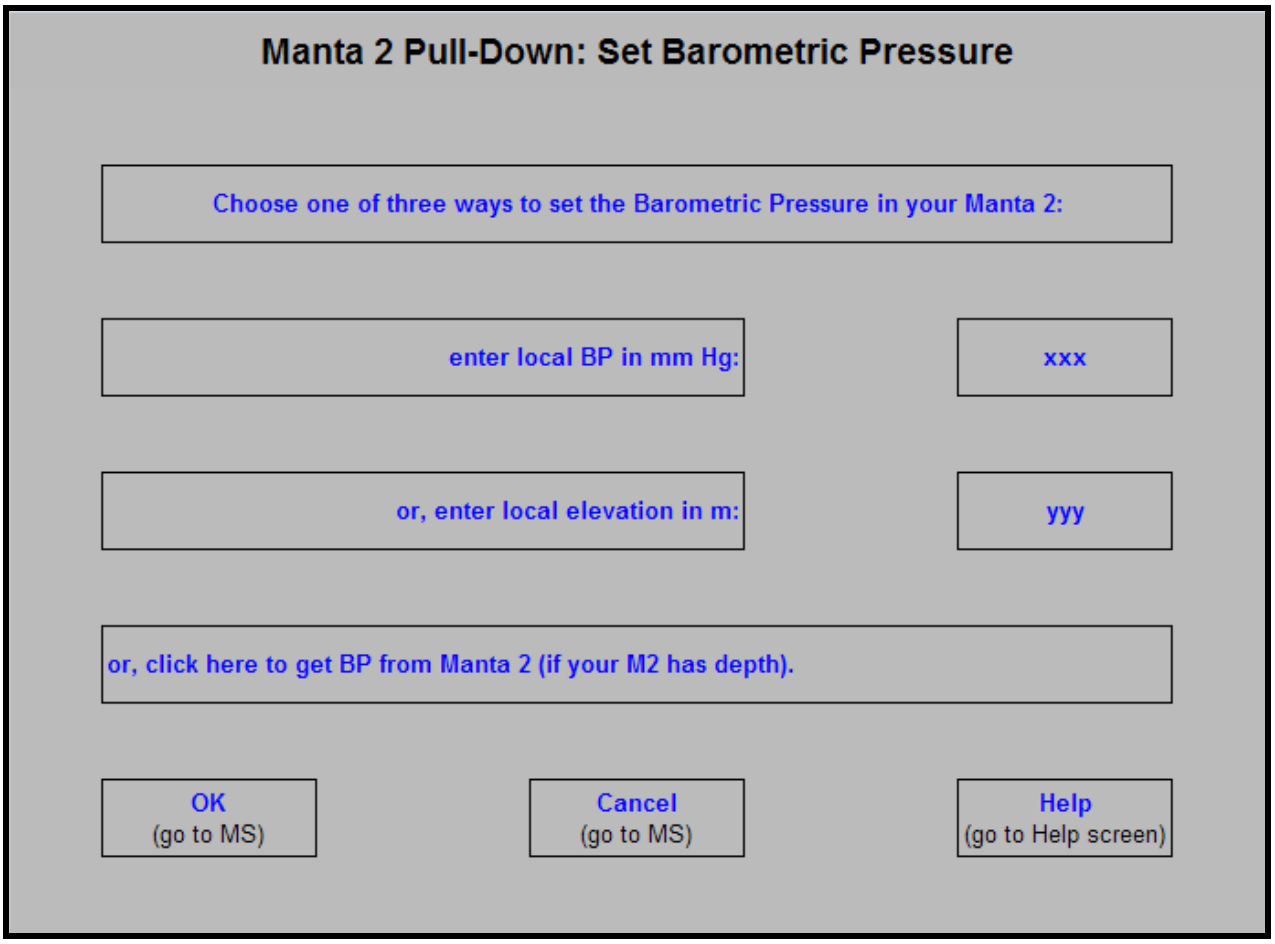
Clicking on Calibrate in the Manta 2 Menu gives you a pop-up screen listing all the parameters that can be calibrated in a Manta 2. Clicking on the parameter you wish to calibrate gives you the Calibrate screen. This screen has calibration instructions for the specific parameter, the current reading for that parameter, and a box for you to type in the value of your calibration standard.

When the parameter reading has stabilized in the calibration solution, click on the OK button. If your calibration has an acceptable SRF (please see Section E4), the calibration will be accepted and you will be returned to the Main Screen. If the SRF is not acceptable, a box will pop up and caution you about the feasibility of your calibration. You have the option of calibrating despite a deviant SRF (click on "OK", in which case you will be returned to the main Screen), or you can go back to the calibrate screen and check your instructions, calibration value, etc. (click on "Cancel").



D6b Set Barometric Pressure

Your Manta 2 needs to know the local Barometric Pressure (BP) if you have a Clark or Optical Dissolved Oxygen sensor. You can set the BP by typing the correct value (in mm Hg) in the first box of the Set BP screen. You can also 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 asking your Manta 2 the value (if your Manta 2 is equipped with an un-vented depth sensor). If you choose this method, the correct values will automatically appear in the BP and altitude boxes.



D6c Set Time and Date

This screen shows you the Manta 2's opinion on 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 2 time and date with those of your PC or Amphibian.

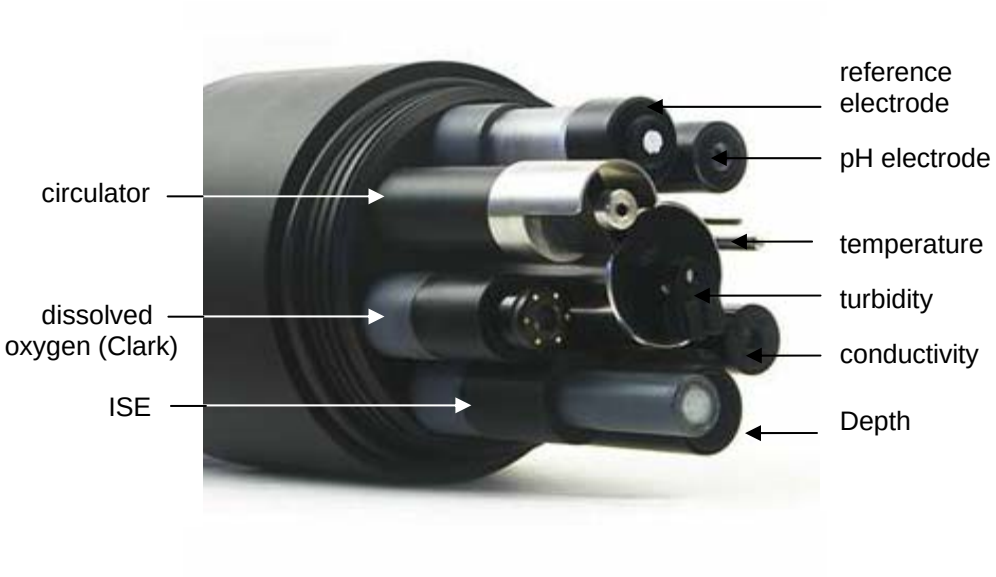
E Sensors and Calibrations

How do I know if I need to calibrate?

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.

If you replace the DO membrane or pH reference, you need to recalibrate regardless.



E1 The Difference between Sensors and Parameters

A sensor is a basic element, like a thermistor or a pH glass electrode. Each sensor has one or more parameters. For instance, we use a thermistor to measure both Temperature °F and Temperature °C – that's one sensor with two parameters. A conductivity sensor can be read as Specific Conductance µS/cm, Specific Conductance mS/cm, Total Dissolved Solids mg/l, and Salinity (PSS) – that's one sensor with four parameters.

E2 Basics of Parameter Calibrations

Calibration is simply telling the instrument what it should be reading by checking it with a calibration solution of known value. Here's the general procedure:

1) Clean the sensor and perform any necessary sensor-specific maintenance.
2) Select a calibration standard whose value is similar to the values 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. 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 to calibrate other parameters. Shake the transmitter 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 with the Manta 2's calibration cup. 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.
6) Select the parameter to be calibrated from the menu in the Manta 2 Control Software user-interface software. First, enter the cal value and press enter; when the reading has stabilized, press enter to calibrate. The Manta 2 will report the resulting Sensor Response Factor (SRF); then press Y to accept the calibration, N to back up one step, or Exit to leave the sensor uncalibrated.
7) You're done.

How do I choose my calibration standards?

For best results, choose a calibration standard whose value is close to what you expect to see in the field. For example, if you are monitoring in fresh water, calibrate with a low conductivity solution – not a seawater standard. 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 should consider recalibrating at noon with a high-turbidity standard.

E3 Calibration Record ("Cal Log")

Every Manta 2 has a dedicated data file called CAL.LOG. The CAL.LOG remembers every calibration that your instrument has accepted. In this Calibration Record are the time and date of the calibration, the parameter calibrated, the reading before the calibration was accepted, and the reading after the calibrations was accepted. 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 2.

E4 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 µA in a 1413 µS/cm standard. If your 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 press the OK button to accept a calibration, the Manta 2 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.

E5 Temperature

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.

E6 Dissolved Oxygen, Clark Sensor

The Clark-type dissolved-oxygen sensor comprises a gold cathode and silver anode immersed in a potassium-chloride electrolyte; the electrolyte is retained by a thin, oxygen-permeable membrane. If a voltage of roughly 0.8 V is imposed between the cathode and anode, any oxygen gas at the cathode is ionized, giving up electrons in the process. Those electrons are an electrical current through the electrolyte, between the cathode and anode, the magnitude of which is related to the amount of oxygen present in the air or water outside the membrane. The sensor output is corrected for the temperature characteristics of the membrane, and for the temperature characteristics of oxygen saturation in water.

Because the Clark sensor consumes oxygen, you must usually have a circulator to prevent oxygen starvation at the outer surface of the membrane.

The Clark sensor has performed will in the field for decades, but is slowly being replaced by optical dissolved-oxygen sensors. The latter have little calibration drift in the field, are not flow-sensitive (no circulator needed), and do not require the occasional membrane changes that annoy Clark sensor users.

Clark sensor maintenance is little more than replacing the membrane after cleaning the sensor and refilling its electrolyte. There should be no bubbles in the electrolyte, and the membrane should be taut with no wrinkles or holes. Eureka's unique pop on membrane cap virtually eliminates wrinkles, but care must be taken during the process:

1) Remove the DO membrane cap and discard the old membrane by pulling up on the cap.

2) Empty the old electrolyte solution and refill with a fresh supply. Take care to not introduce any air bubbles. Fill the cell as full as possible, creating a large droplet on the surface.

3) Select a membrane, handling only on the corners. Gently place the membrane on top of the dissolved oxygen electrolyte, taking care to prevent air bubbles from being trapped underneath. If there is an air bubble, remove the membrane, top off with more DO electrolyte, and replace the membrane. Place the DO membrane cap over the DO cell. Make sure the o-ring inside the cap is at the top. This o-ring will grab the membrane and stretch it uniformly.

4) Trim any excess membrane material with a pair of scissors.
5) Inspect the membrane for air bubbles or wrinkles. If any exist, go back to step one.
6) Do not leave it exposed to air for long periods. Place a few teaspoons of water in the storage cup and secure to the sonde.

It is best to let a freshly prepared DO sensor age for 24 hours before it is calibrated, as the sensitivity of the sensor decreases by two or three percent or more during the first 24 hours, with most of the decrease occurring during the first 12 hours. This is caused by a reduction in membrane permeability, due partly to a relaxation of stresses in the membrane and partly to the response of the membrane material to exposure to water. After about 24 hours, the sensor becomes stable.

It is perfectly all right to use a freshly prepared probe immediately, however the probe should be calibrated once after allowing the membrane to relax for approximately four (4) hours..

Here are the steps to water-saturated air calibration:

1) Make sure your circulator is turned off.
2) Fill your calibration cup up to the level of the DO membrane with tap water, DI water, your conductivity standard, or a pH standard.
3) With a paper towel, make certain the membrane is dry and free of water droplets.
4) Place the cal cup cover upside down over the calibration cup.
5) Make sure your instrument's Barometric Pressure setting is accurate.
6) Wait a few minutes for the air to become fully saturated and the temperature to equilibrate.
7) Follow the Manta 2 Control Software's calibration instructions.

A number of customers are moving away from the time-honored water-saturated air calibration to the air-saturated water calibration. Here are the steps to water-saturated air calibration:

1) Put a half-liter of tap water in a liter jar and shake the jar vigorously for one minute. Take the lid off the jar (assuming you put one on in the first place) and let the water stand for about five minutes to let the air bubbles float out.
2) Make sure your circulator is turned off.
3) Fill your calibration cup until your aerated water covers the DO membrane by a centimeter or so.
4) Make sure your instrument's Barometric Pressure setting is accurate.
5) Wait a few minutes for the temperature to equilibrate.
6) Follow the Manta 2 Control Software calibration instructions.

E7 Dissolved Oxygen, Optical Sensor

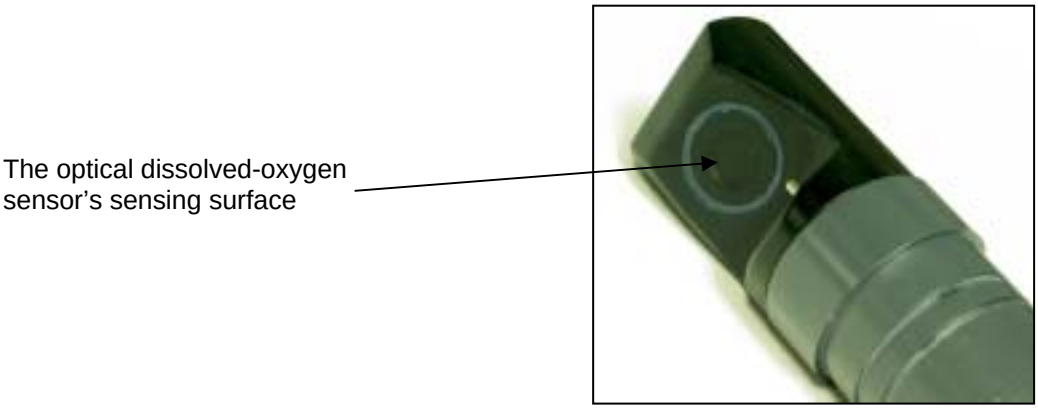
The optical dissolved-oxygen sensor comprises a blue light source, a sensing surface, and a red light receiver. The sensing surface is an oxygen-active compound stabilized in an oxygen-permeable polymer, usually silicone. The oxygen-active compound fluoresces – that is, it absorbs energy in the form of blue light and then emits energy as red light. The red-light receiver measures the amount of red light emitted as a result of the blue light's energy. However, this fluorescence is quenched by oxygen – that is, the emission of red light is reduced if oxygen molecules are present to interfere with the oxygen-active compound.

As the oxygen presence grows, the red light emitted falls. When the sensing surface is exposed to water (or air, for that matter), oxygen diffuses into the sensing surface according to the amount (partial pressure) of oxygen in the water. Thus, the amount of red light received by the sensor is directly relatable to the amount of oxygen in the water.

The sensor output is corrected for the temperature characteristics of the membrane, and for the temperature characteristics of oxygen saturation in water.

Despite its considerably higher cost, the optical sensor is becoming favored over the Clark sensor because the optical sensors have little calibration drift in the field, are not flow-sensitive (no circulator needed), and do not require the occasional membrane changes that annoy Clark sensor users.

Optical dissolved-oxygen sensor maintenance is nothing more than occasionally cleaning the sensing surface (the red material; about a centimeter diameter) with a soft cloth and soapy water.



Where the Clark sensor requires only one calibration point, the optical dissolved oxygen sensor requires two: one at zero dissolved oxygen, and one at the saturation point. To set the sensor's zero point:

1) Prepare a zero-oxygen solution by dissolving a few grams of sodium sulfite and a pinch of cobalt chloride in a half-liter of tap water.
2) Fill your calibration cup until your aerated water covers the sensor by a centimeter or so.
3) Make sure your instrument's Barometric Pressure setting is accurate.
4) Wait a few minutes for the temperature to equilibrate.
5) Follow the Manta 2 Control Software calibration instructions.

If you think the sodium-sulfite method is shaky and yesterday's news, you can rig a plastic bag to cover the empty calibration cup and run a little nitrogen (or helium or argon) gas into the bag so as to immerse the sensor in pure nitrogen. Then follow the Manta 2 Control Software's calibration instructions. If you're using a high-pressure gas bottle, please use a two-stage regulator to prevent excitement.

To set the sensor's saturation point:

1) Put a half-liter of tap water in a liter jar and shake the jar vigorously for one minute. Take the lid off the jar (assuming you put one on in the first place) and let the water stand for about five minutes to let the air bubbles float out.
2) Fill your calibration cup until your aerated water covers the DO sensor by a centimeter or so.
3) Make sure your instrument's Barometric Pressure setting is accurate.
4) Wait a few minutes for the temperature to equilibrate.
5) Follow the Manta 2 Control Software calibration instructions.

Optical dissolved-oxygen sensors usually have very low drift rates compared to 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, usually the saturation point, does not require calibration every time you set the other point.

E8 Conductivity

Eureka uses the four-electrode method for determining water conductivity. Two pairs of graphite electrodes are situated in a stable geometry (you can barely see the electrodes; they look like two bull's eyes inside the slot on the 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 only have to set one 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 2 Control Software's calibration instructions.

The Manta 2 actually reports Specific Conductance – that's Conductivity standardized to 25°C. Your reading is 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 until the TDS standard produces the desired TDS reading. The same is true for Salinity. or Salinity with a standard qualified on the Practical Salinity Scale (PSS).

E9 pH

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. The important part of pH maintenance is refilling the reference electrode (see E10).

You can choose a one, 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 2 Control Software calibration instructions.
4) Repeat steps 1, 2, and 3 if you choose to calibrate with one or two more standards.

E10 Reference Electrode

The key to reliable pH measurement (and reliable ORP and ISE measurements as well) 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 discard old reference electrolyte.
2) Fill the sleeve completely with fresh pH reference electrolyte (KCl saturated with silver chloride). Be careful not to introduce any air bubbles.
3) With the sensors facing up, screw the reference cap back on to the sleeve. Air should be purged through the Teflon junction when replacement is done.

As you screw the sleeve into place, the 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 nasty stuff out of the junction.

[Other manufacturers will tell you that their integral reference electrode is better. It's not, because every year you have to buy a new one for about $300 and install the whole thing yourself. Better to spend a few pennies every month or two refilling the Eureka-style reference electrode. This is not to mention the better stability you get out of the refillable reference electrode in low-conductivity waters.]

E11 Oxidation-Reduction Potential (ORP)

ORP is measured as the voltage drop across the platinum membrane of an ORP electrode. 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 no matter how much they beg. The potential (voltage) created by this refusal is what you're actually measuring as ORP.

ORP electrode maintenance is nothing more than occasionally cleaning the platinum surface with a soft cloth and soapy water. You can use a very light abrasive, like 900-grit wet-and-dry sandpaper, if the platinum is discolored. The important part of ORP maintenance is refilling the reference electrode (see E10).

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 standard to cover both the ORP and reference electrodes.
3) Follow the Manta 2 Control Software calibration instructions.

E12 Depth and Vented Depth

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

Depth sensors require no regular maintenance, but you might check occasionally to make sure the pressure port (i.e. hole in the front of the sensor) is not clogged. If it is, don't poke it with a bent paper clip; call the factory for instructions.

Depth calibration is nothing more than "zeroing" the sensor in air, where one assumes the depth to be zero:

1) Make sure the multiprobe is not in the water or in the storage cup as this will cause an offset.
2) Expose the sensors to air.
3) Follow the Manta 2 Control Software's calibration instructions.

Notice that 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. Fortunately, water is considerably heavier than air, so the error introduced by barometric pressure changes is small.

If that's not good enough for you, there's always Vented Depth. Vented Depth uses the same transducer as does Depth, except that there's a tiny hole in the back of the transducer. If you have a vented cable (a cable that has a tube running through it), then atmospheric pressure is sensed by the transducer via the little hole. Any change 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. Keep that housing clean, and replace the desiccants every year or so.

E13 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 the light is scattered and 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; that's why most Turbidity sensors have little wipers to clean the window(s).

Turbidity sensors require no regular maintenance, but you might check occasionally to make sure the optical window (i.e. the little glass port on the front of the sensor) has not been damaged by overzealous wiping.

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. Care must be taken during calibration to ensure that external effects are kept to a minimum and that enough calibration standard to cover the sensor's "optical volume" - imagine tennis ball stuck on the end of the sensor; make sure there are no objects in the volume represented by that ball. One common method is keeping calibration solutions in one-liter, dark, wide-neck bottles with a non-reflective finish (such as Nalgene® 2106 bottles in amber). For the zero calibration:

1) Make sure the Turbidity sensor is fully immersed (i.e. at least an inch of solution over the sensor) in zero-turbidity standard and has an unobstructed optical path.
2) Follow the Manta 2 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 an inch of solution over the sensor) in the standard and has an unobstructed optical path.
3) Follow the Manta 2 Control Software's calibration instructions.

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

Please do not over-tighten the set screw (that'll strip the threads) or rotate the wiper arm manually (that'll strip the gears).

1) Loosen the small set screw on the wiper with the 1.5mm hex key provided.
2) Remove the wiper from the wiper shaft.
3) Place a new wiper on the shaft so that the set screw faces the flat spot on the wiper shaft
4) Gently press the wiper against the face of the probe until the foam pad is compressed to roughly three quarters of its original thickness. It is important that the wiper arm body does not make contact with the probe face – only the pad should be in contact. A gap of 0.5mm between the wiper body and the probe face is typical when a new pad has been installed.
5) Tighten the set screw.

Eureka recommends the polymer-bead calibration solutions, as they are stable and safe. You can use formazin standards, but these are not as stable, require stirring and are a suspected carcinogen.

E14 Chlorophyll, Rhodamine, and Blue-Green Algae

Eureka's chlorophyll, rhodamine, and blue-green algae sensors are fluorometric sensors, with each tuned to the slightly different wavelengths. 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.

Maintenance and calibration are sensor-specific; please follow the instructions provided by Eureka's sensor vendor.

E15a Ion-Selective Electrodes (ISEs) – Ammonium (NH_4+)

Eureka's Ammonium ion-selective electrode operates much like a pH probe except the pH glass is replaced by a membrane that is magically selective for the ammonium ion. The electrode's filling solution contains an ammonium salt, and the difference between that electrode's ammonium concentration and the ammonium 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 ammonium concentration in the water adjacent the membrane.

Ion-selective electrodes actually respond to ion activity, which is lower than the ion concentration in high-conductivity waters (because all the other ions "shield" the ion of interest). Eureka uses the conductivity of the sample water to estimate its ionic strength, and then uses the composition of average river water to convert activity to concentration.

The Eureka ammonium sensor directly detects Ammonium ions. At higher pH (the pK_a for Ammonium-Ammonia is 9.3) Ammonium is converted into ammonia gas (NH_3). Eureka's software uses the pH, Conductivity, and Temperature of the sample water to calculate Ammonia (as mg/L-N) and Ammonia (as mg/L-N). You can also display Total Ammonia; the sum of Ammonia and Ammonium. It is common to use concentration units of mg/L-N (i.e., concentration of total nitrogen present as ammonia or ammonium), since using this unit eliminates errors in Total Ammonia when a pH change causes a shift in the equilibrium between Ammonium and Ammonia.

Ammonium electrodes suffer interference from positive ions, especially potassium and sodium. For instance, 1000 mg/L of sodium ions or 10 mg/L of potassium ions will cause at least a 1 mg/L-N increase in the Ammonium reading. In fresh water, potassium is the primary interference, raising Ammonium values by 0.1-0.2 mg/L-N in average 200 µS river water. In brackish or marine waters, sodium can become the primary interference because of its high concentration; sea water reads up to 12 mg/l-N Ammonium even if there is no Ammonium present.

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.

Ammonium requires a two-point calibration; we recommend calibration solutions of 4.63 mg/l – N and 46.3 mg/l – N. The response of the Ammonium electrode is affected by temperature. While Eureka uses generalized methods for temperature corrections, it's best to calibrate near the temperature of your water. Here's the procedure:

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

E15b Ion-Selective Electrodes (ISEs) – Nitrate (NO_3+)

The Nitrate ISE operates as does the Ammonium ISE (see F16a) except that its membrane is selective for, you guessed it, Nitrate ions.

Eureka's Nitrate ion-selective electrode operates much like a pH probe except the pH glass is replaced by a membrane that is magically selective for the nitrate ion. The electrode's filling solution contains a nitrate salt, and the difference between that electrode's nitrate concentration and the nitrate 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 nitrate concentration in the water adjacent the membrane.

It is virtually impossible to predict the behavior of a Nitrate ISE over wide ranges of temperature and conductivity, so you are strongly advised to calibrate the ISE at a temperature near that of the water you intend to monitor.

Nitrate electrodes suffer interference from positive ions, especially potassium and sodium. For instance, 1000 mg/L of sodium ions or 10 mg/L of potassium ions will cause at least a 1 mg/L-N increase in the Nitrate reading. In fresh water, potassium is the primary interference, raising Nitrate values by 0.1-0.2 mg/L-N in average 200 µS river water. In brackish or marine waters, sodium can become the primary interference because of its high concentration; sea water reads up to 12 mg/l-N Nitrate even if there is no Nitrate present.

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.

Nitrate requires a two-point calibration:

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

Again, you should calibrate with temperature of your standard as near as possible to the temperature of the water you intend to monitor.

E16 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.

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.

F The Manta 2

F1 Manta 2 Components

Please see the illustration in Section A1.

F2 What the LED lights mean?

Most Eureka multiprobes have small lights (LED's) to tell you things about your multiprobe. If so equipped, the Manta 2 has three LED's mounted on the circuit board visible through the instrument housing:

Current functionality:

1) Green – Flashes once upon power-up.

2) Red – The red LED blinks briefly whenever RS-232 communication is received by the Manta 2.

3) Yellow - The yellow LED blinks once every two seconds to indicate that the Manta 2 has adequate operating voltage.

To be implemented after December 2008:

1) Green - The green LED blinks once every two seconds to indicate that the Manta 2 has adequate operating voltage.

2) Yellow – The yellow LED blinks briefly whenever RS-232 communication is received by the Manta 2.

3) Red – The red LED blinks every 2 seconds for 10 seconds upon each power up if logging is enabled.

Have you ever turned on a multiprobe from one of those other manufacturers, only to find it didn't work? And that you had no clue why it didn't work? You'll never have that problem with the Eureka Manta 2 because the LED's tell you what you need to know.

F3 Applications: Profiling (Spot-Checking), Logging, and Telemetry

There are three basic applications for the Manta 2. Perhaps most common is profiling (spot checking), in which the Manta 2 is used with an operator present to gather data over a short time period. Data display options include the Amphibian and a PC or PDA.

Manta 2's are often used for unattended logging, in which the Manta 2 uses a battery pack or other power source to periodically record data over a long time period. No operator need be present.

Increasingly popular is telemetry, in which the Manta 2 uses a solar-charged battery to periodically transmit logged data to a secure Internet site. The Manta 2's internal logger can be used as a data back-up, and a Manta 2 battery pack can be used as a power back-up. This method has the advantage of maximizing deployment times (i.e. minimizing labor costs) because the user can watch his data over the Internet to determine when maintenance is required.

F4 Cables

Eureka cables have a special lower termination in which the cable wires can move around when the cabled is stressed one way or another. This means that the chance of breaking a cable through normal use is very small. Generally, just make sure the cable is kept clean and that you don't run it over the side of the boat without a gentle radius for the cable. And make sure to use the cable's locking sleeve (or locking plate for the internal-battery-pack-equipped models).

Eureka cables are unique in the market because their lower termination does not fatigue solder joints when you stress the cable. As of this manual's date, Eureka has had no lower-termination wire failures in the field. None.

F5 Operating the Manta 2 with Eureka's Amphibian

First, read the Amphibian manual.

Second, connect the Amphibian to your Manta 2 cable's 9-pin connector.

Three, you're done as the Amphibian uses the same type of program as is used on the PC.

G Logging

G1 The Difference between "Logging" and "Snapshot"

"Logging" always refers to unattended data capture and storage in the Manta 2. "Snapshot" refers to the manual capture and storage of data in your PC or Amphibian.

G2 Why We Do Logging the Way We Do

Other Manufacturers require you type in long strings of digits to specify start time, start date, end time, end date, logging interval, and who knows what else. One wrong digit and you might get no data. After you activate Manta 2 logging via the PC or Amphibian, however, the Manta 2 has a simple logging-activation mechanism. For the 2-, 2.5-, and 3-inch Manta 2's, all you have to do is attach the external battery pack. For the 3.5- and 4-inch Manta 2's, all you have to do is flip the ON/OFF switch to ON. In both cases, in most Manta 2 models, the LED indicator lights will confirm that logging is enabled, the logging interval value, and that sufficient voltage remains in the batteries. The Manta 2 method is faster, simpler, and virtually foolproof.

Another user-friendly feature of the Manta 2 is synchronization of logging times. For instance, if your logging interval is 15 minutes and you turn the logger on at five minutes past 10 AM, your first data will be logged at exactly 10:15, and then every 15 minutes thereafter. If your logging interval is one hour and you turn on the logger at five minutes past 10 AM, your first data will be logged exactly at exactly 11 AM, and then every hour thereafter. In addition to making the data log cleaner, this makes it easier to match times if you wish to merge data logs.

G3 Activating Manta 2 Logging

Before you go to the field to deploy your Manta 2 for unattended logging, always turn logging "ON" using the logging hot button on your PC or Amphibian Manta 2 Control Software. When you get to the field, all you have to do is connect the external battery pack or, for internal battery packs, flip the battery-pack switch to "ON". Logging will start and continue until you disconnect external power or flip the battery-pack switch to "OFF".

G4 Logging Interval

Logging interval, the time between logging runs in your Manta 2, is set with the "Set Logging Interval" menu under the "Manta 2" pull-down menu in the Manta 2 Control Software. Once you specify an interval, you never have to do it again unless you wish to use a different interval.

G5 Sensor Warm-Up

Your Mantra 2 knows the warm-up times required for all the sensors you have enabled. Then 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 Clark Dissolved Oxygen sensor takes two minutes to warm up and the turbidity sensor takes 10 seconds to warm up. So the Manta 2 turns on the DO sensor two minutes, and the turbidity sensor 10 seconds, ahead of the time data is required. This minimizes power consumption, and you don't have to do anything.

G6 Internal Battery Packs

The 3.5- and 4-inch Manta 2's use the optional Manta 2 Internal Battery Pack (IBP): a watertight (to 200 meters) housing with a cassette for six "C" batteries, on/off switch for the logging function, and a data port. The data port lets you connect your MBP-equipped Manta to a PC for dumping logged data, or for calibrating the Manta sensors.

The Manta 2 has been specifically designed with a clear housing to allow for visual inspection of the electronics as well as to insure the batteries are correctly installed. Also, the IBP has a simple on/off switch so that you don't have to type endless strings of digits into a computer in hopes that the logger will somehow start logging when you get to the field.

One you have activated the Manta 2 logging (by clicking on the logging button on the Manta 2 Control Software's main page) all you have to do to start logging is turn the battery pack on:

1) Remove the two thumb screws that hold the battery switch in place (it's the half-circle plate that also holds the cable in place (some models have an on/off switch; see picture below).

2) Turn the battery switch over to the side that says "ON" and put it back into place – that turns the IBP on.

3) Put the thumb screws back in place (finger-tight is sufficient).

4) When you turn the IBP on, make sure that the amber LED blinks every five seconds (on most models) – it's your assurance that the IBP has sufficient voltage to power the logging function.

5) Also when you turn the IBP on, make sure the red LED blinks every 2 seconds for 10 seconds upon each power up (on most models) – it's your assurance that Manta 2 logging is enabled.

Your Manta 2 is now logging, and will continue logging until you turn the battery switch to its "OFF" side (or turn the battery switch to the "I" side) , or your batteries are depleted.

Those with other brand instruments have also likely been disappointed by logging runs that quit too early – for instance, if a storm event or broken truck has prevented scheduled data dumps. The Manta logger, on the other hand, only stops logging when you rotate the switch from "ON" to "OFF" – again, no programming is required.

To replace batteries in the Internal Battery pack:

1) Replace all batteries at the same time, and use the same brand of battery.

2) Clean all dirt and stuff off the Manta, because you are going to expose sealing surfaces as you change the batteries.

3) Unscrew the large eye-bolt in the center of the IBP; that lifts the top cap to expose the batteries.

4) Pull the top cap completely away from the IBP (below), and clean any contaminants from the top cap and o-rings.

4) Remove the spent batteries, and install the new ones following the polarity label on the IBP.

5) Replace the top cap by screwing the eye-bolt back into the place where you found it. Note that the top cap can only fit one way because the black indexing stud (above) must fit into the hole in the underside of the top cap. Finger-tight is sufficient for the eye-bolt.

If your Manta 2 is not going to be used for a few weeks or longer, remove the batteries to prevent their leaking all over the inside of the IBP. Put your Manta 2 into a clean plastic bag to protect any exposed seals.

Note: Store at room temperature.

G7 External Battery Packs

The 2-, 2.5-, and 3-inch Manta 2's use the optional Manta 2 External Battery Pack (EBP): a watertight (to 200 meters) housing with a cassette for five or ten "AA" batteries and a data port. Remove the EBP to connect your Manta to a PC for dumping logged data, or for calibrating the Manta sensors.

The EBP simply screws into the Manta multiprobe where normally you would find the cable and its locking sleeve.

One you have activated the Manta 2 logging (by clicking on the logging button on the Manta 2 Control Software's main page) all you have to do to start logging is connect battery pack to the Manta 2 top cap:

1) If a cable is attached to your Manta 2, remove the locking sleeve and then the cable.

2) Make sure all the o-rings and inner surfaces are clean and covered with a light film of silicone grease.

3) Twist the EBP onto the same threads formerly occupied by the locking sleeve – finger-tight is sufficient.

4) Make sure that the amber LED blinks every five seconds – it's your assurance that the EBP has sufficient voltage to power the logging function.

5) Make sure the red LED blinks every 2 seconds for 10 seconds upon each power up – it's your assurance that Manta 2 logging is enabled.

Your Manta 2 is now logging, and will continue logging until you remove the EBP, or your batteries are depleted.

Bad news: Batteries don't last forever. Good news: You can buy 10 "AA" batteries at Sam's or Costco for about $2, and confidently install them in the EBP in about two minutes. All you need are the new batteries and a paper towel. When you change the batteries, please:

1) Replace all batteries at the same time, and use the same brand of battery.

2) Clean all dirt and stuff off the EBP, because you are going to expose sealing surfaces as you change the batteries.

3) Grab the EBP bottom cap (the black plastic cap just below the clear housing) and unscrew the housing by twisting it counter-clockwise. Don't take the housing all the way off; just open it wide enough to replace the batteries,

4) Remove the spent batteries, and install the new ones following the polarity labels.

5) Twist the housing back onto the EBP bottom cap – finger-tight is sufficient.

If your EBP is not going to be used for a few weeks or longer, remove the batteries to prevent their leaking all over the inside of the EBP. Put the EBP into a clean plastic bag to protect any exposed seals.

Note: Store at room temperature.

G8 Am I using Battery Pack power or Cable power?

If you have an Internal Battery Pack but are operating the Manta 2 with a cable attached, the Manta 2 will use power coming in through the cable as long as its voltage is sufficient. Otherwise, it'll be using battery power.

G9 Logging Redundantly with Telemetry

Some of you will connect an IBP-equipped Manta 2 to a cable-supplied battery, such as that in a telemetry system. Again, if you have an Internal Battery Pack but are operating the Manta 2 with a cable attached, the Manta 2 will use power coming in through the cable as long as its voltage is sufficient. Otherwise, it'll be using battery power.

G10 Dumping Data from the Manta 2

Connect the Manta2 to your PC or laptop.

1) Clean all contaminants from the Manta and MBP before dumping data – this helps protect the seals (the o-ring type, not barking type).

2) Remove the on-off lever by loosening the thumbscrew and pulling the lever straight out.

3) Connect the newly exposed Manta connector to the USB port on your PC with the supplied cable. Use the USB adapter that came with your Manta.

4) Connect the download cable to your Manta, and then to the USB port on your PC.

5) Launch the Manta 2 Control Software by double-clicking on the Eureka icon on your desktop. Click on Manage M2 Files, and then on Export Data, to upload data to save onto your PC.

6) When you have finished uploading data, unplug the cable from the MBP; reinstall the data-port knob so that it is held in place by the thumbscrew. Tighten the thumbscrew finger-tight.

G11 Routine Maintenance

Clean your instrument periodically with warm soapy water. Liquid dishwashing 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.

H Everything Else

H1 Troubleshooting

The Manta 2's "distributed function" architecture means that all components have roughly the same cost and roughly the same responsibilities. For instance, replacing the main circuit board (CPU) will not cost you $1000 or more, as it would for most multiprobes, because it has fewer parts. As a result, it's easy for you to isolate problems to a component that is easy to replace, and won't cost you big bills. Absent problems with cables or your PC, you can quickly determine if the problem is the CPU or one of the sensors.

Suppose your conductivity reading is suspicious (always reads zero, no reading at all, obviously wrong, etc.). Here's your checklist for isolating the problem:

1) Are there any obvious problems, like water leaks, damage to the sensor, etc.?
2) Are you certain of the value of your calibration standard or field sample?

If those questions do not solve the problem, then you can safely deduce that the conductivity sensor must be repaired or replaced.

Suppose your Manta 2 would not communicate with your PC. Here's your checklist for isolating the problem:

1) Are you sure that your PC is working correctly? If you have another Manta 2, will it connect to the PC? If you have another PC, will it connect to the Manta 2?
2) Are you sure your Manta 2 software is correctly loaded in your PC? If you have another Manta 2, will it connect to your PC?
3) Does the Manta 2's amber LED (most models) indicate that you have sufficient voltage to operate? If not, is your cable connected and free from damage? If you have another cable, will it connect your Manta 2?

If those questions do not solve the problem, then you can safely deduce that the Manta 2's CPU board (the board you can see through the housing) must be repaired or replaced.

Once you have made the diagnosis, please call or e-mail Eureka – a new part can be delivered to you in a day or two, and after a few minutes work, your manta 2 will be back in action.

H2 Opening the Manta 2

If you must replace the CPU board or one of the sensors, you must open the Manta 2's housing:

1) You will need a 3/16" Allen wrench, silicone grease, medium-sized flat-blade screwdriver, small Phillips screwdriver, mild soap and soft brush, and paper towels.

2) If your Manta or battery pack has any dirt, algae, or other contamination on it, use the brush and soapy water to clean all the external surfaces. Also, notice that the o-ring seals appear as two narrow black lines of consistent width (below). That indicates a good seal.

3) Remove the two Allen-head cap screws from the Manta's top cap. Grasp the Manta in both hands and use your thumbs to press the top cap out of the housing. If you can't easily remove the top cap by pushing it with your thumbs, then gently pry the top cap loose with the screwdriver. Pull the top cap completely away from the Manta, and clean any contaminants from the top cap and o-rings. Store the cable and top cap in a clean plastic bag. If the circuit board came out when you removed the top cap, you'd be in really big trouble and facing a huge repair bill if you had one of the lesser multiprobe brands. But with Eureka's Manta, all you have to do is pick up the circuit board by its edges and push it back into the connectors at the bottom of the Manta housing.

4) Examine the o-rings and the top of the Manta housing. Remove all contaminants, if any, from the o-rings and the sealing area. If you wiped away the existing grease during cleaning, apply a liberal amount of silicone grease to the o-rings and the housing.
5) Line up the screw holes in the Manta housing with the threaded holes in the top cap and use the two Allen screws to fix the top cap in the Manta. You may have to twist the Manta housing to get the screw holes to line up – it's OK, it's made to twist.
6) Examine the o-ring seals to ensure that the two narrow black lines, consistent in width, are present as they were just before you removed the when the top cap.

H3 Performance Specifications

Parameter	Range	Accuracy	Resolution
Temperature	-5°C - 50°C	± 0.1°C	0.01°C
Polargraphic (Clark) DO			
Dissolved Oxygen (mg/L)	0 - 50 mg/L	± 0.2 mg/L ≤ 20 mg/L ± 0.6 mg/L > 20 mg/L	0.01 mg/L
Dissolved Oxygen (% Sat)	0 - 200% 200 - 500%	± 2.4% ± 7.2%	0.1
Optical DO			
Dissolved Oxygen (mg/L)	0 - 25 mg/L	1% of reading or 0.02 mg/l, whichever is greater	0.01 mg/L
Dissolved Oxygen (% Sat)	0 - 200%		0.1
Conductivity (SC)	0 - 100 mS/cm	1% reading ± 1 count	
Salinity	0 - 70 PSU (PPT)	± 1% of reading or 0.1 PSU, whichever is greater	4 digits
TDS	0 - 65 g/L	Calculated from Conductivity	
Turbidity Optical 90° Nephelometric Mechanical Wiper	0 - 3000 NTU	0-100 < 1% of reading 100-400 < 3% of reading over 400 < 5% of reading	0.1
pH	0 - 14 units	± 0.2 units	0.01 units
ORP	-999 - 999 mV	± 20 mV	1 mV
Depth	Varies	± 0.1% Full Scale	0.01 m
Level	0 - 10 meter	0.003 meters	0.001
Ammonium	0 - 100 mg/L Nitrogen	± 10% of reading or 2 mg/L whichever is greater	0.1 mg/L - N
Nitrate	0 - 100 mg/L Nitrogen	± 10% of reading or 2 mg/L whichever is greater	4 digits
Chloride	0.5 - 18,000 mg/L	± 10% of reading or 2 mg/L whichever is greater	4 digits
TDG	400 - 1400 mm/Hg	± 0.5 mm/Hg	0.1 mm/Hg
Chlorophyll a	0.03 - 50 µg/L	± 3%	0.01 µg/L
Rhodamine	0.04 to 1000 ppb	± 3%	0.01 ppb
Blue Green Algae	100 - 200,000 cells/mL	± 3%	20 cells/mL

Performance specifications are affected by calibration and maintenance. For best results, clean and calibrate your instrument on a periodic basis.
Calibrate near sample conditions for best results.
See the sections in this quick start guide on calibration and maintenance for more information.

H4 Warranty

Service and Limited 2-Year Warranty

THIS WARRANTY IS EXPRESSLY MADE BY EUREKA ENVIRONMENTAL ENGINEERING CORPORATION (EUREKA) AND ACCEPTED BY PURCHASER IN LIEU OF ALL OTHER WARRANTIES, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHETHER WRITTEN OR ORAL, EXPRESS OR IMPLIED, OR STATUTORY. EUREKA DOES NOT ASSUME ANY OTHER LIABILITIES IN CONNECTION WITH ANY PRODUCT.

WHAT IS COVERED

This warranty statement applies to the Manta Multiprobe. All new Eureka Mantas are warranted by Eureka against defects in materials and workmanship for two years from date of invoice. Our obligation to repair or to replace products, including dissolved oxygen sensors, does not apply to those that have been consumed through normal use.

WHAT IS NOT COVERED

This warranty does not apply to products or parts thereof which may be used or connected to Eureka equipment but which are not manufactured by Eureka. This warranty specifically excludes batteries of any type and all other items, such as calibration solutions, which carry shelf lives. This warranty does not apply to products or parts thereof which have been altered or repaired outside of a Eureka factory or other authorized service center, or products damaged by improper installation or application, or subjected to misused, abuse, neglect or accident.

WHAT WE WILL DO

During the warranty period, we will repair or, at our option, replace at no charge a product that proves to be defective provided that you return the product, shipping prepaid, to Eureka. Eureka's liability and obligations in connection with any defects in materials and workmanship are expressly limited to repair or replacement, and your sole and exclusive remedy in the event of such defects shall be repair or replacement.

Eureka's obligations under this warranty are conditional upon it receiving prompt written notice of claimed defects within the warranty period and its obligations are expressly limited to repair or replacement as stated above.

WHAT WILL WE NOT DO

Eureka shall not be liable for any contingent, incidental, or consequential damage or expense incurred by you or others due to partial or complete inoperability of its products for any reason whatsoever or due to any inaccurate information generated by its products. Eureka's obligations and your remedies are limited as described above.

Products are sold on the basis of specifications applicable at the time of sale. Eureka shall have no obligation to modify or update products once sold.

WARRANTY AND SERVICE INFORMATION

If you have any questions concerning this warranty, please contact Eureka by telephone, fax, letter, or e-mail, at:

Eureka Environmental Engineering
2113 Wells Branch Parkway
Suite 4400
Austin, TX 78728

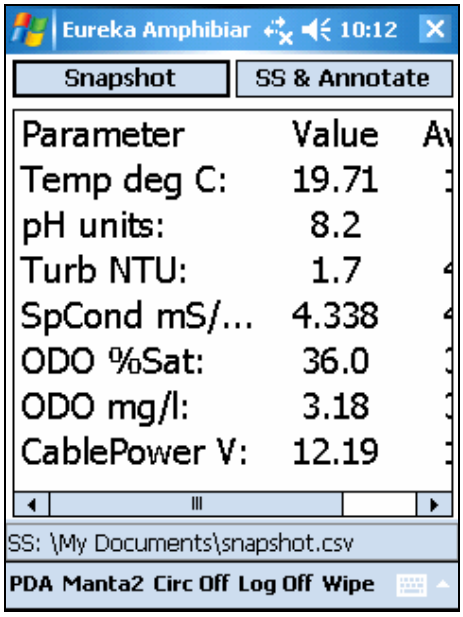
Telephone: 512-302-4333
Fax: 512-251-6842
e-mail: support@eurekaenvironmental.com

Should you be advised by Eureka to return an item, a returned materials authorization number (RMA Number) will be issued. The RMA number must be shown on the Service Memorandum, the address label of each shipping carton, and any correspondence related to the equipment returned for repair.

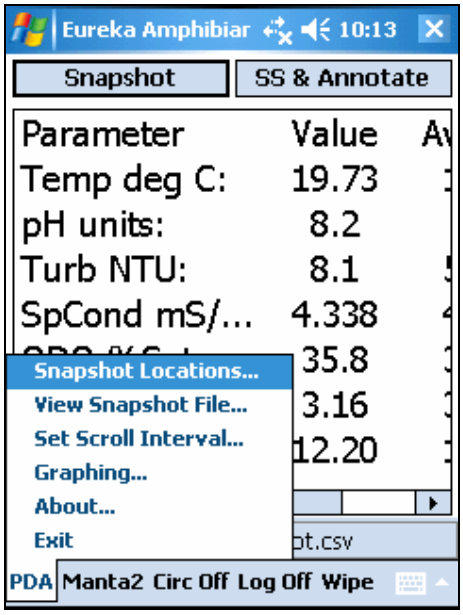
Please carefully pack your equipment in its original shipping case (or other protective package) to avoid in-transit damage.

Such damage is not covered by warranty, so we suggest that you insure the shipment. We also recommend that the entire instrument, including the battery pack and charger (when applicable), be returned unless a particular faulty component has been clearly isolated. Send the instrument and a complete Service Memorandum to Eureka, using the address shown on the Service Memorandum. **Whether or not the unit is under warranty, it is your responsibility to pay shipping charges for delivery to Eureka.**

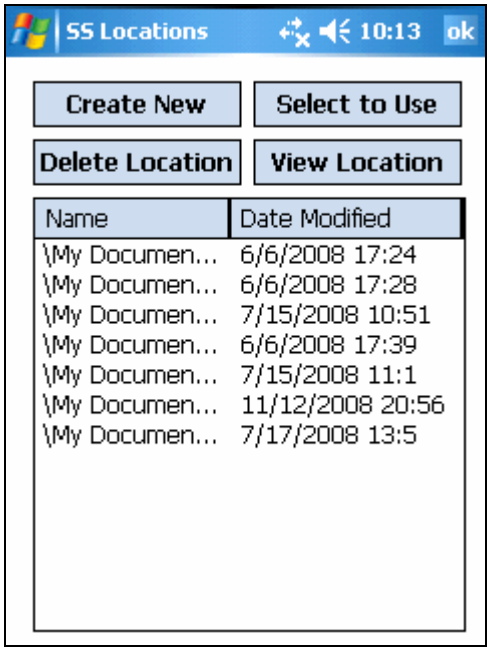
I Amphibian 2 Addendum (screen shots)



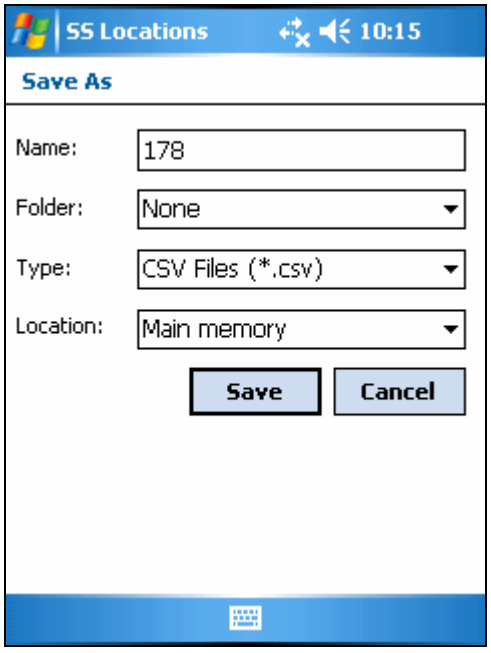
Main Screen



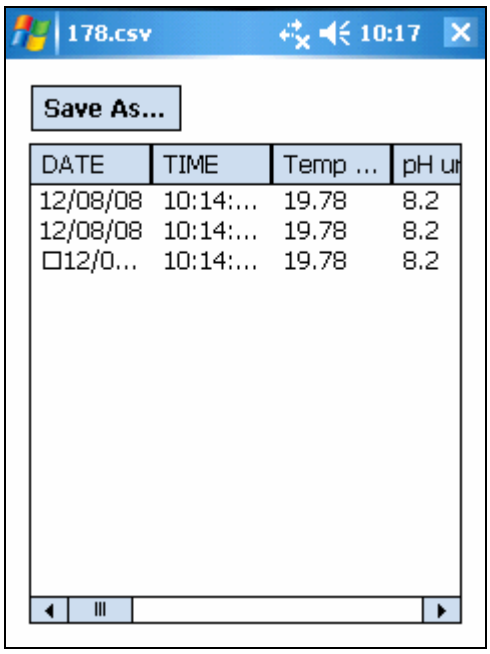
PDA Menu



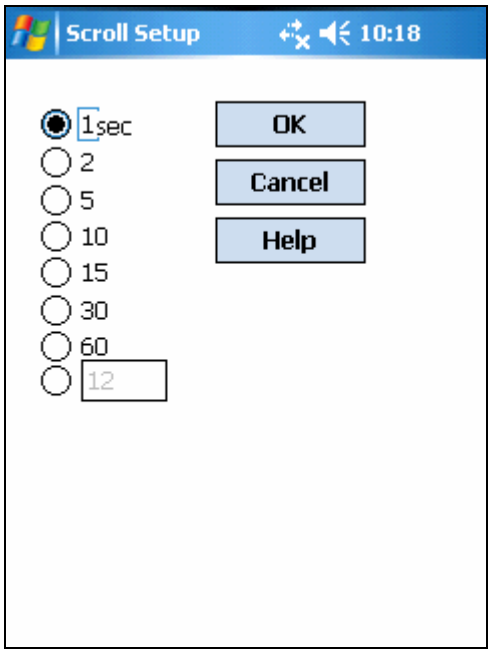
Snapshot Files



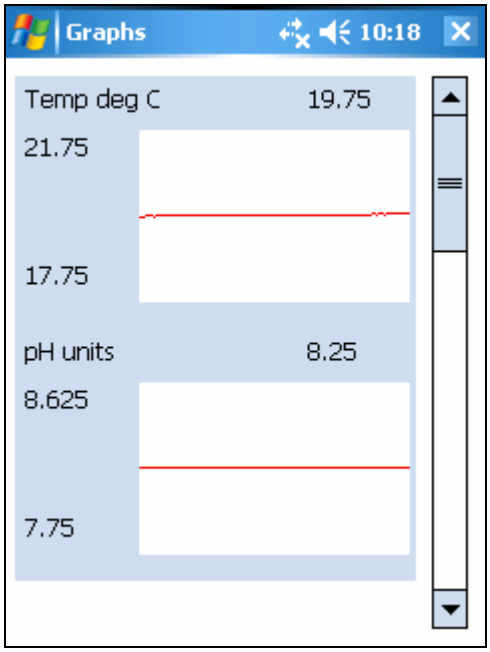
Create New Snapshot File



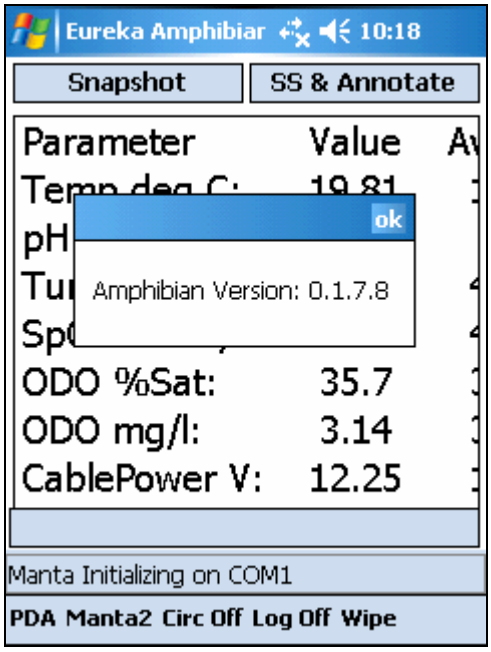
View Snapshot File Contents



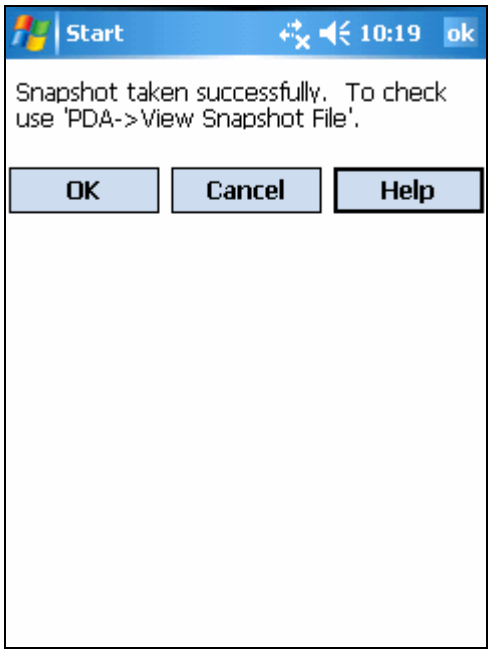
Set Scroll Interval



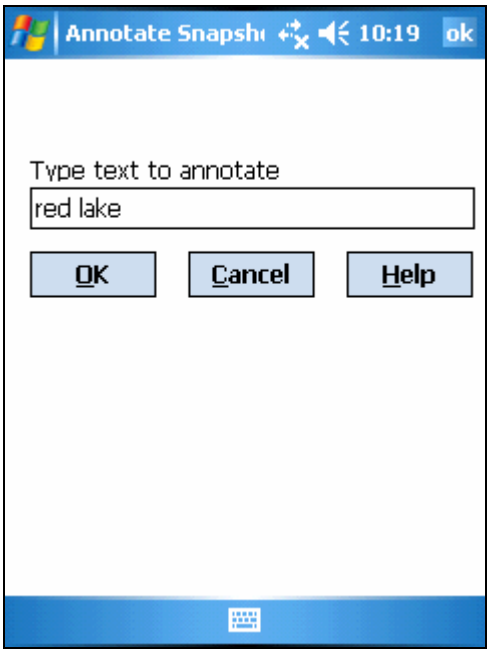
Graphs turned on



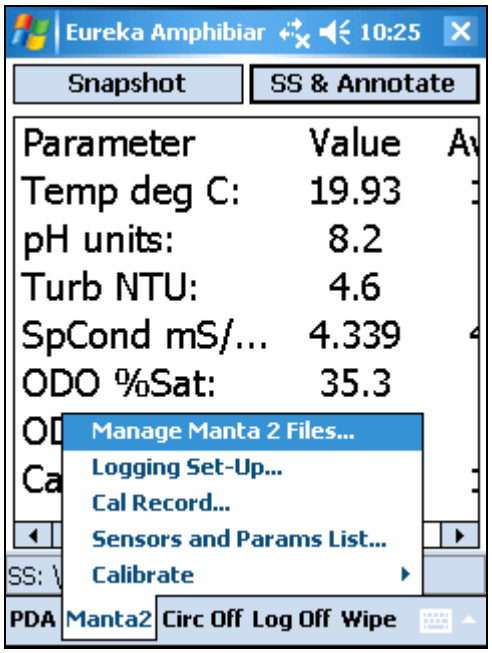
About Menu shows Amphibian Software Version



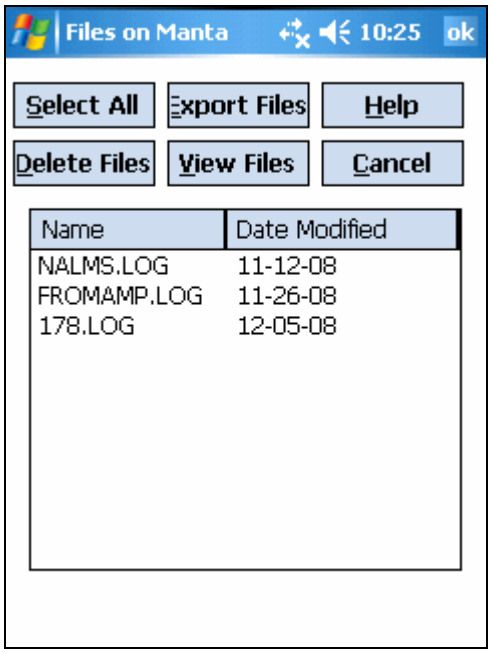
Message appears for 2 seconds after Snapshot is taken.



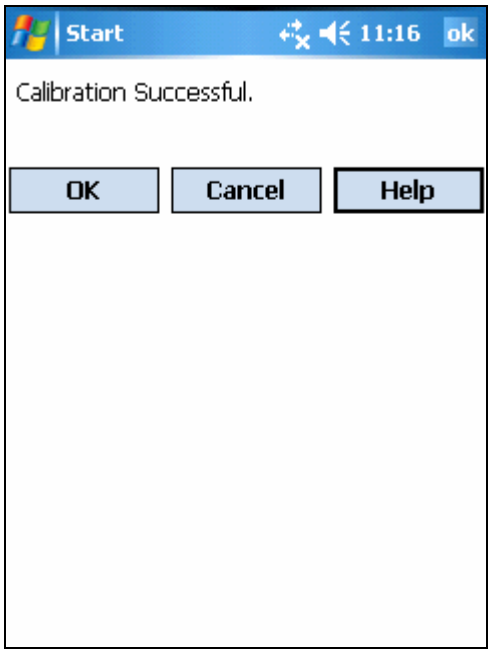
Window appears after Snapshot and annotate button pressed



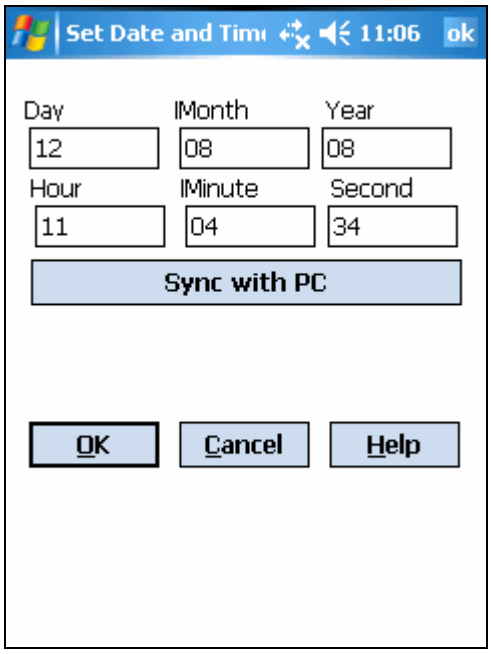
Manta2 Menu



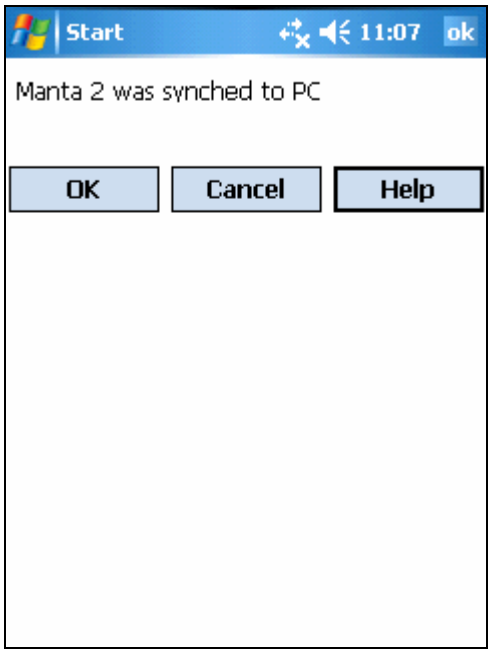
Manage Manta2 files menu. These log files are located on the Manta2



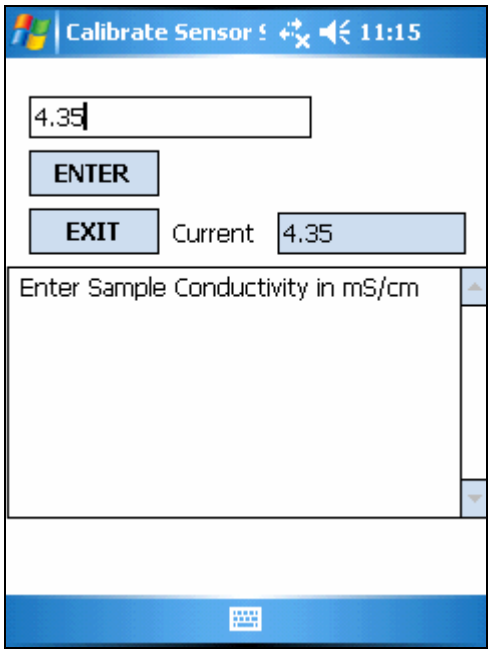
Manta2, Calibrate, SpCond us/cm menu after Sensor Response Factor Y to accept for 2 seconds then returns to Main screen.



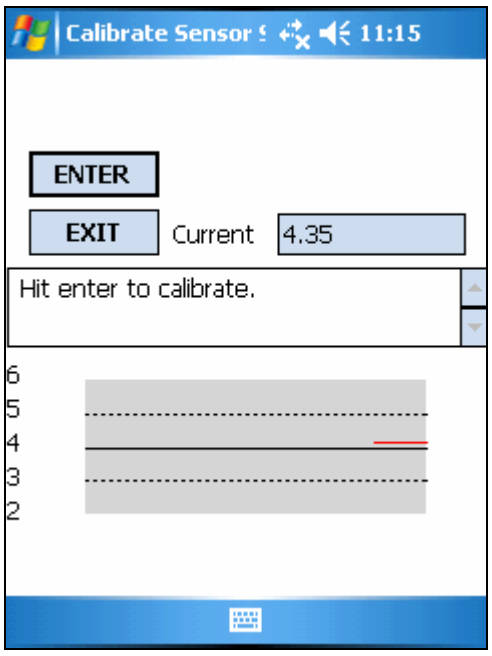
Manta2, Calibrate, set Date and Time Menu



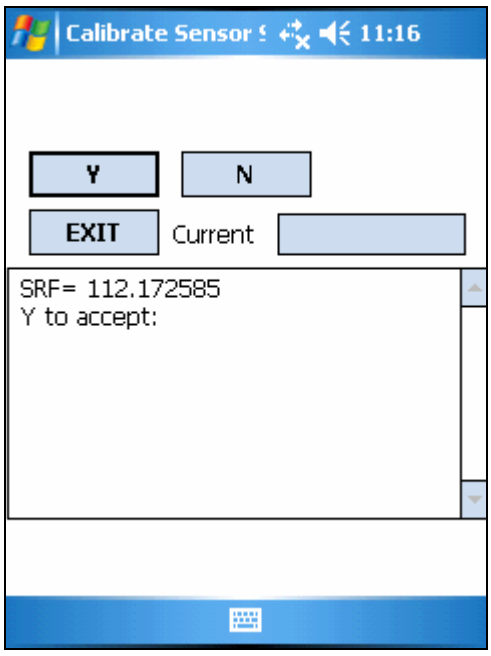
Manta2 Date and Time synched to PocketPc Date and Time.



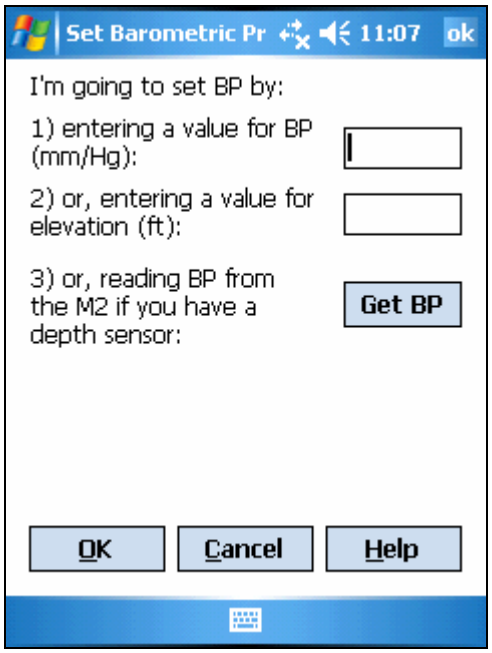
Manta2, Calibrate, SpCond us/cm menu



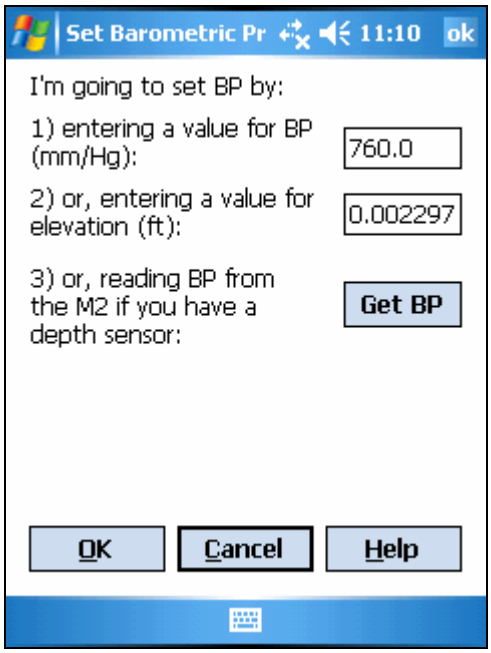
Manta2, Calibrate, SpCond us/cm menu after standard value was entered



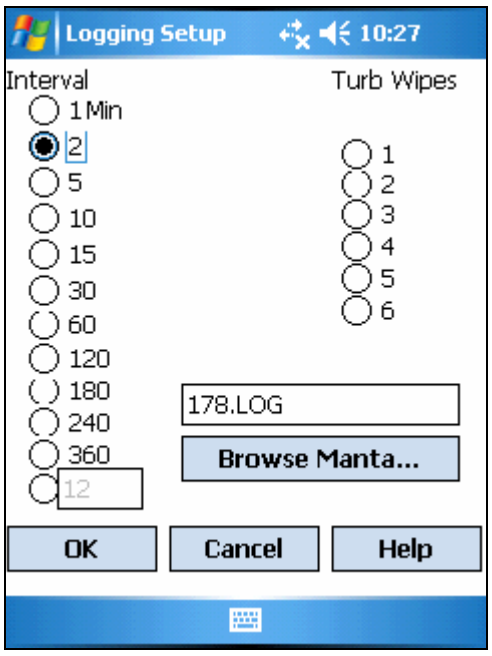
Sensor Response Factor



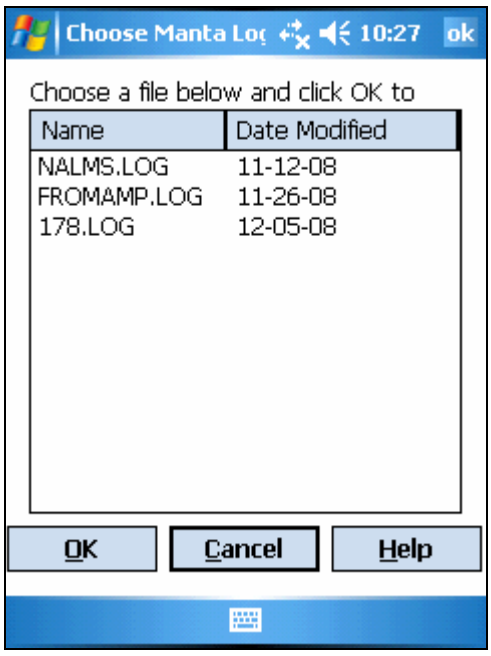
Manta2, Calibrate, Set BP menu



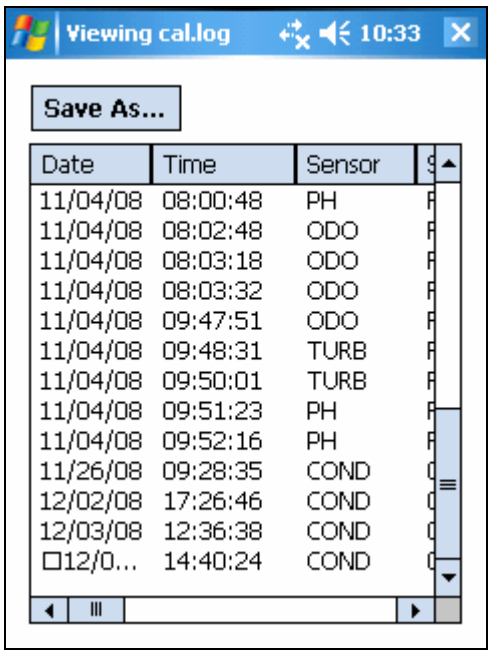
Manta2, Calibrate, Set BP menu



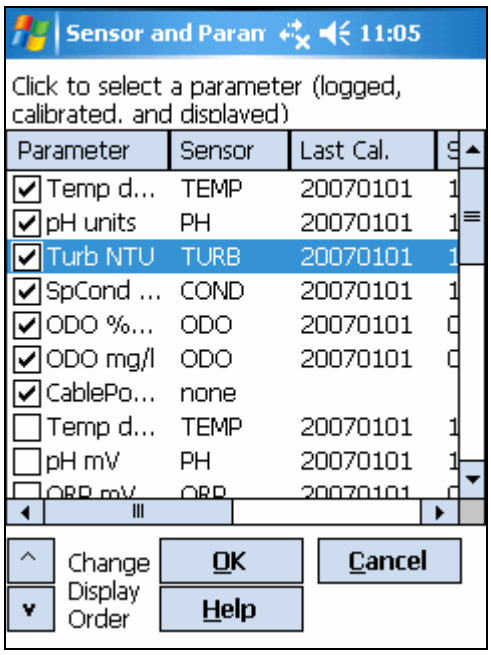
Manta2 Logging Setup menu



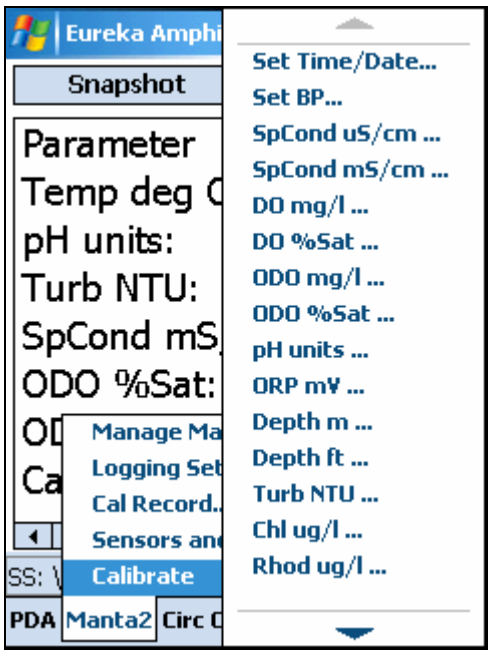
Manta2 Logging Setup Browse Manta menu



Manta2, Cal Record menu



Manta2 Sensors and Parameters List menu



Manta2, Calibrate menu