Operation Manual

MicroPurge® Flow Cell
MP25 & MP2T

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Dexter, MI 48103

A Graco Company
GRACO

Safety Warnings

Wear appropriate Personal Protective Equipment (PPE) including safety glasses when working with the QED MP25 or MP25T.

Intended for use with groundwater wells and common sampling pump systems with flow control capability.

MicroPurge Application
tinyurl.com/y3d5vbnq

MP25 & MP25T Manual
tinyurl.com/yxaanba8

MP25 & MP25T Quick Calibration Guide
tinyurl.com/y3nmsvef

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6. Flow Cup
7. Maintenance Kit
8. Sensor Guard
9. PTFE Thread Tape 1/4”
10. MP25 Flow Cell Adaptor
11. Assorted Fittings for flow cell connections to sampling pump tubing

1.2 Calibration Stands

There are two different calibrations stands that are available depending on what type of case the MP25 or MP25T was delivered in. Picture below are the two different types of cases.

MP25/MP25T Royal Case PN: 41922

MP25/MP25T Pelican Case PN: 41719

Use Part Number 41918 Calibration Stand with the Royal model case

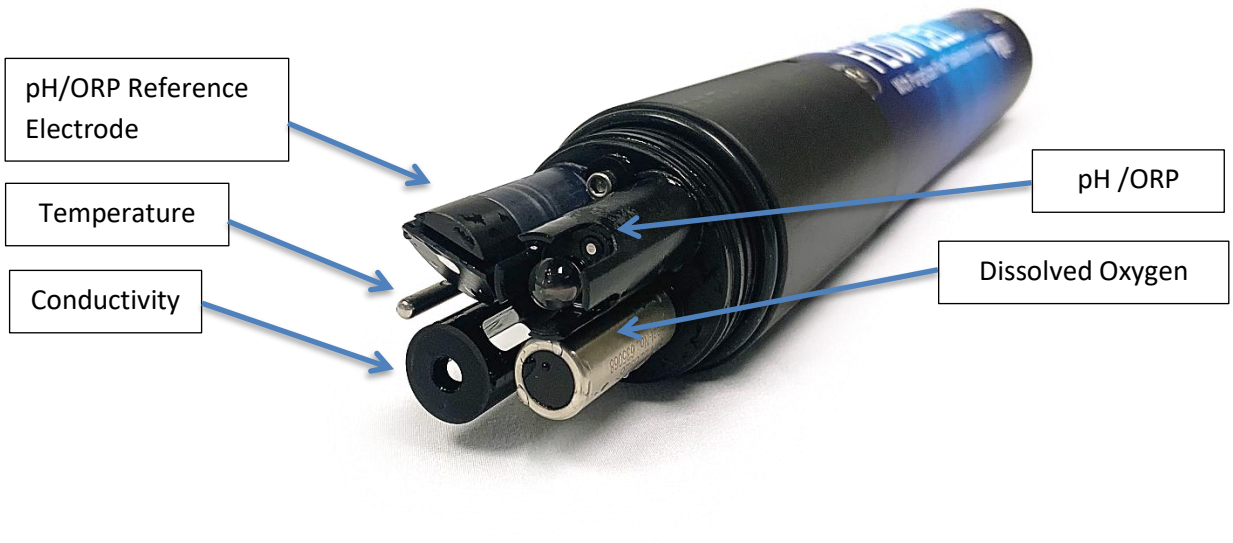
Use Part Number 41780 Calibration Stand with the Pelican model case

2. MP25 and MP25T Sonde

2.1 MP25 and MP25T Sensor/Parameter List

1. Temperature (°C)
2. Temperature (°F)
3. pH (units)
4. pH (mV)
5. Specific Conductivity (µS/cm)
6. Specific Conductivity (mS/cm)
7. ORP (mV)
8. TDS (mg/L)
9. HDO (%Sat)
10. HDO (mg/L)
11. Salinity (PSS)
12. Turbidity (NTU) *[MP25T Only]*

2.2 MP25 Sensors



2.3 MP25T Sensors

2.4 MP25 and MP25T Flow Cell Setup

2.4.1 Steps to connect the Flow Cell to the MP25 or MP25T

1. Remove storage cup from sonde
2. Attach flow cell adaptor to end of sonde (Only needed for MP25, MP25T has integral bayonet pins on the sonde bottom cap.)

3. Insert sonde/adaptor into flow cell and push into bayonets slots, then turn sonde clockwise to lock.

4. Determine necessary flow cell inlet connection fittings based on pump discharge tubing type and size.
5. Connect the included flow cell flexible tubing from pump to flow cell and then from flow cell discharge to purge water collection bucket.

   NOTE: The flow cell is designed to be used in either a horizontal or vertical position. Any gas bubbles in the flow stream are vented out of the cell and away from the sensors weather vertical or horizontal. The flow cell and sonde setup can be used while resting in the case as shown in the photo below as a convenient work platform or will stand or rest on any flat surface. Horizontal use is preferred to avoid possible damage if the standing sonde were to fall over.

2.5 LED Indicators

Both the MP25 and MP25T have three LED indicators mounted to the internal circuit board, to provide troubleshooting information to the user. The LEDs can be seen through the gap in the label, in the same window as the serial number when the sonde is connected to the application.

Green LED: Blinks every one second to indicate adequate voltage from the Bluetooth Battery Pack.

Amber LED: Blinks once when the system is receiving RS-232 communication and blinks twice when the PurgeScan Logging is activated.

Red LED: Blinks five times at power-up when logging is enabled.

2.6 Cleaning and Storage

Clean your instrument periodically with warm soapy water. Clean sensor stems with a soft brush. Laboratory-grade liquid detergent is preferred, but liquid dishwashing soap is fine. Do not use abrasives. Do not use solvents such acetone. Do not clean with gasoline, kerosene, or industrial cleaners. Rinse sensors free of soap with tap water and store the sensors in tap water (see below).

Replace any o-rings with visible cracks. Keep o-rings greased with silicon grease (found in your Maintenance Kit).

When storing the MP25 or MP25T, fill the storage cup provided with 1-2 oz. of tap or bottled drinking water and install the storage cup on the sonde. **NOTE: DO NOT use purified water such as, distilled, deionized or reverse osmosis water for storage,** as this will deplete the pH sensor and reference electrode and could result in premature replacement.

3. MicroPurge® Application Software

3.1 Installing the MicroPurge® App

The MicroPurge® App is a free to download app that can be found at www.qedenv.com, under the products tab for the MP25/MP25T. Below are the steps to take to install the app onto your Android Device.

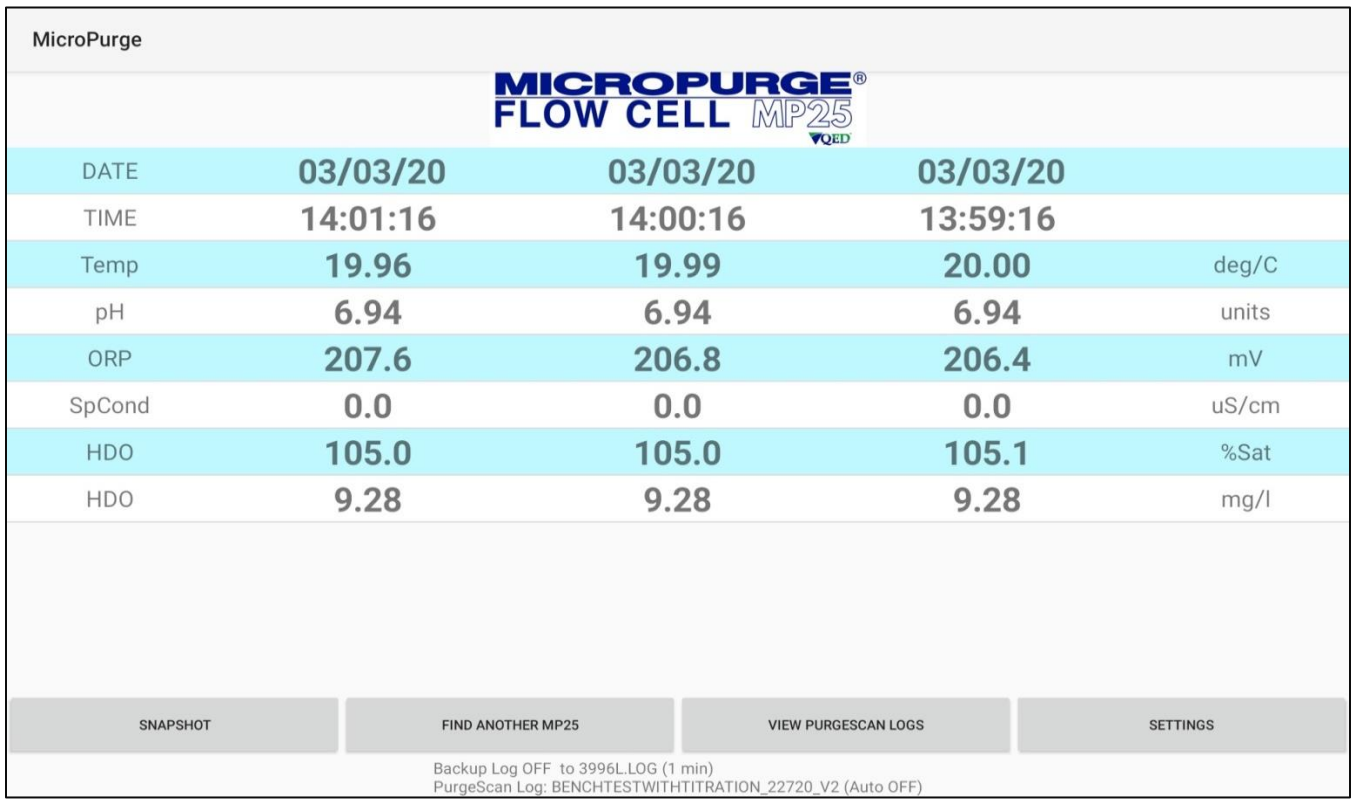
3.2 Connecting your MP25 or MP25T for the first time

The MP25 and MP25T are Bluetooth capable devices so the user can wirelessly display and log their data. Below is how the user will connect their MP25 or MP25T to their Android tablet or phone.

1. Connect the 3m waterproof cable to the top of the sonde.
2. Connect the nine pin RS-232 connector to the Bluetooth Battery Pack.
3. Press the Black Power Button next to the RS-232 connector on the Bluetooth Battery Pack.
4. Open the MicroPurge Application, after opening the app will automatically start searching for all Bluetooth Devices in the area. This can be filtered out, see section 3.7.2.
5. Select the Bluetooth Device that will be labeled with the same Bluetooth ID that is located on the bottom of the Bluetooth Battery Pack. If the MP25 or MP25T does not initially show up, press the *Find Another MP25* button and the app will refresh the list of devices.
6. Once selected the app will auto direct to the Bluetooth settings on the device. Select the corresponding device and if prompted for a password, enter 1234.
7. Return to the MicroPurge Application, and wait until the application initializes and brings up the local Bluetooth devices.
8. Select the corresponding device, the app will automatically start scrolling data from the device. At this point the MP25 or MP25T is connected, the device however is NOT logging data. To see how to set up the PurgeScan Logging, see section 3.4.

3.3 Home Screen

After successfully connecting your MP25 or MP25T to your Android Device, you will see a default list of parameters and data scrolling across the screen. The device is NOT logging data at this point, see section 3.4 to set up the PurgeScan Logging feature. Below is a description of each of the four buttons you will see on the bottom of the Home Screen. NOTE: The column on the left is the most current set of readings. The scroll interval (the time between live readings) can be set. It's easiest to use the same interval for the Tablet Scroll Interval as you use for the PurgeScan Logging Interval to avoid confusion, but this isn't required.



3.3.1 Snapshot

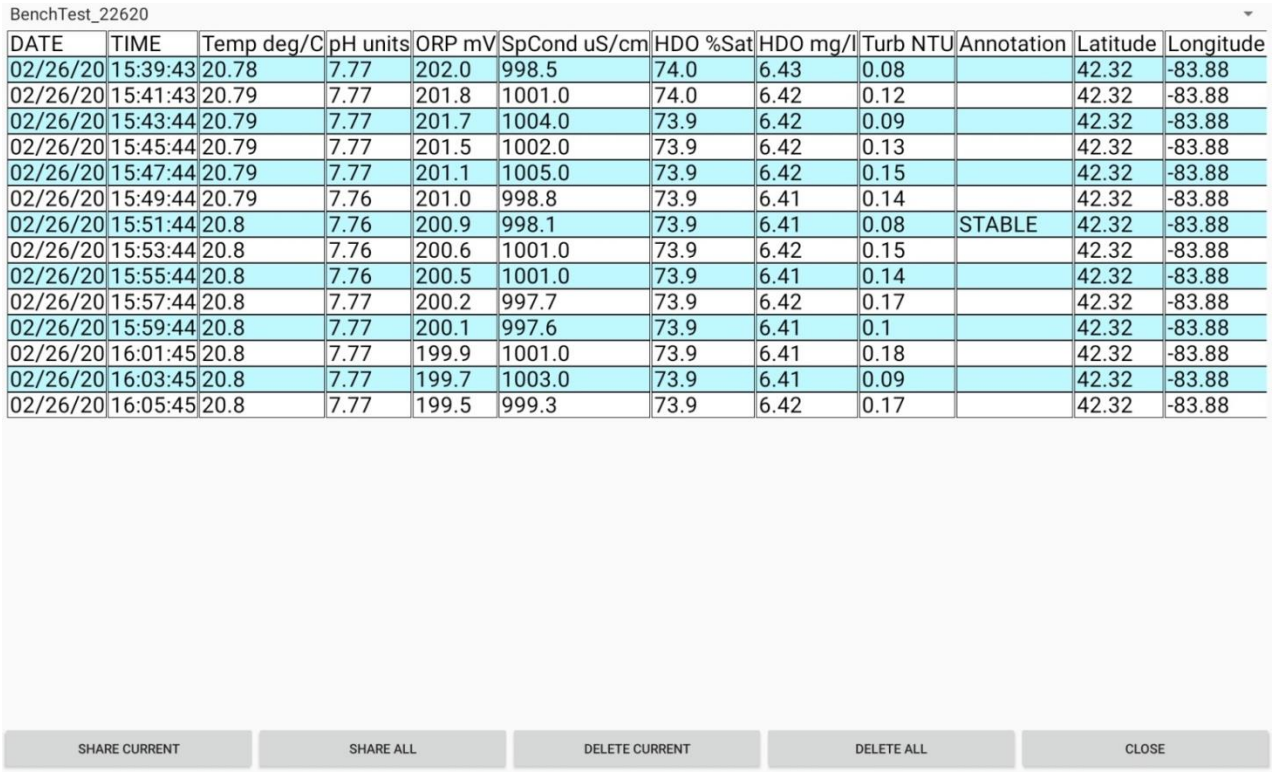
The Snapshot feature will take a single data reading of the parameters that are currently on the screen. To view the saved Snapshots, in the file explorer of the users tablet notated with MicroPurge, after selecting that there will be a folder named PurgeScan Logs. Under that folder the saved snapshots will be appended to the most recent PurgeScan log created. In the Annotation column will be the Note the user has entered into the Enter Note option.

3.3.2 Find another MP25

If this button is pressed after an MP25 or MP25T is connected it will disconnect the current device. This button can also be pressed if a user is trying to connect to an MP25 or MP25T and the device doesn't show up on the list of Bluetooth devices.

3.3.3 View PurgeScan Logs

This button will bring up a dialog box allowing the user to view or download any PurgeScan Logs that have been taken with the device. The *PurgeScan* Logs button located in the PurgeScan Menu is also another way to view the save log files. In the upper left corner is the name of the log file, when pressed a list of other logs will appear and can be viewed. These files will be downloaded onto the selected File Save Location, see Section 3.7.6 on how to set the save location.


BenchTest_22620

DATE	TIME	Temp deg/C	pH units	ORP mV	SpCond uS/cm	HDO %Sat	HDO mg/l	Turb NTU	Annotation	Latitude	Longitude
02/26/20	15:39:43	20.78	7.77	202.0	998.5	74.0	6.43	0.08		42.32	-83.88
02/26/20	15:41:43	20.79	7.77	201.8	1001.0	74.0	6.42	0.12		42.32	-83.88
02/26/20	15:43:44	20.79	7.77	201.7	1004.0	73.9	6.42	0.09		42.32	-83.88
02/26/20	15:45:44	20.79	7.77	201.5	1002.0	73.9	6.42	0.13		42.32	-83.88
02/26/20	15:47:44	20.79	7.77	201.1	1005.0	73.9	6.42	0.15		42.32	-83.88
02/26/20	15:49:44	20.79	7.76	201.0	998.8	73.9	6.41	0.14		42.32	-83.88
02/26/20	15:51:44	20.8	7.76	200.9	998.1	73.9	6.41	0.08	STABLE	42.32	-83.88
02/26/20	15:53:44	20.8	7.76	200.6	1001.0	73.9	6.42	0.15		42.32	-83.88
02/26/20	15:55:44	20.8	7.76	200.5	1001.0	73.9	6.41	0.14		42.32	-83.88
02/26/20	15:57:44	20.8	7.77	200.2	997.7	73.9	6.42	0.17		42.32	-83.88
02/26/20	15:59:44	20.8	7.77	200.1	997.6	73.9	6.41	0.1		42.32	-83.88
02/26/20	16:01:45	20.8	7.77	199.9	1001.0	73.9	6.41	0.18		42.32	-83.88
02/26/20	16:03:45	20.8	7.77	199.7	1003.0	73.9	6.41	0.09		42.32	-83.88
02/26/20	16:05:45	20.8	7.77	199.5	999.3	73.9	6.42	0.17		42.32	-83.88

3.3.4 Settings

In the settings menu the user can control the PurgeScan Logging and Logs, Calibration of the sensors, Backup Logs and app driven device settings.

3.4 Calibration and Calibration Logs

3.4.1 Calibration

Calibration of the sensors on the sonde is recommended each time the user goes out to sample for the day. The calibration function on the sonde is located in the menu under Settings > MicroPurge Sonde > Calibrate. The table below lists the parameters that can be calibrated on the MP25 and MP25T and the commonly used methods and standards.

Setting up the MicroPurge sonde for calibration

The MP25 and MP25T sondes are equipped with a storage cup that doubles as the calibration cup. The bottom cap of the cup can be unscrewed and the sonde inverted for calibration. The cap can also be inverted and used as a temporary lid for calibration of parameters such as DO % saturation in saturated air or water. The QED flow cell kit includes a unique calibration stand that slips over the edge of the carrying case and holds the inverted sonde as shown in the photo below.

Selecting Calibration Standards

For best results, choose a calibration standard whose value is close to what you expect to see in the water you're measuring. For example, calibrate with a 1413 µS/cm Specific Conductance standard if you expect to see Specific Conductance readings between 500 and 1500 µS/cm in the field. Similarly, if your waters tend toward being acidic (below 7) rather than basic (above 7), calibrate with a 4-buffer instead of a 10-buffer in addition to the 7-buffer base calibration.

Sensor	Standard Method of Calibration	Available Calibration Solutions	Comments
Temperature	Never requires calibration	N/A	
pH / pH Reference	2 or 3 points	pH 4, pH 7, pH 10	pH 7, pH 10 most common
ORP	1 Point	ORP Standard Solution, such as ZoBell's or Light's solution	ORP standards can range from 200 – 475 mV, any will work
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 water typical freshwater very pure fresh/glacial water
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	calibrate near expected value
HDO (Optical DO)	calibrate at 100% saturated water	DI water -shake vigorously to oxygenate	set BP before calibrating, recalibrate at deployment site for best accuracy

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.

Dissolved Oxygen (DO)

The optical dissolved-oxygen sensor uses fluorescence combined with a membrane cap made of an oxygen active compound to measure oxygen. When the sensing surface is exposed to water or air, oxygen diffuses into the sensing surface according to the amount of oxygen in the water. The sensor output is corrected for the temperature and salinity of the water.

The DO sensor can be calibrated for 100% saturation using either air-saturated water or water –saturated air.

Method 1 – Air-saturated water

1. Make sure that the barometric pressure setting is accurate (See Section X.XX)
2. Using a small jar or bottle with a lid, fill the container about halfway with tap water, cap it and shake vigorously for about a minute, then remove the cap/lid and let the water stand for about five minutes to allow air bubbles to float out.
3. With the sonde inverted and calibration cup attached, fill the cup until the water covers the DO sensor by about ½" (1 CM) or so.
4. Wait 1-2 minutes for the temperature to equilibrate
5. Follow the calibration instructions for dissolved oxygen percent saturation (HDO % Sat).

Method 2 – Water saturated air

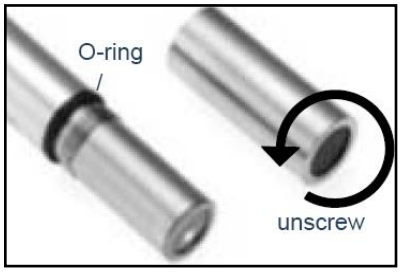
1. With the sonde inverted and calibration cup attached, rinse the cup with tap water and then empty
2. Place the storage cup cap upside down (threaded end up) on top of the calibration cup
3. Let the sonde stand in the calibration stand for 1-2 minutes for the temperature to equilibrate
4. Follow the calibration instructions for dissolved oxygen percent saturation (HDO % Sat).

The optical DO sensor in the MP25/MP25T system can be calibrated for zero oxygen as well as saturation. To calibrate the zero point, follow the same steps as above for air saturated water DO using one of the three following methods:

Method 1 – use a commercially prepared DO zero calibration solution or find instructions on preparation of a sodium sulfite and cobalt chloride solution for zero oxygen calibration..

Method 2 – prepare zero oxygen water by bubbling nitrogen through water using a compressed nitrogen gas source at low pressure and an aquarium air diffuser stone in a bottle of tap water for about 10 minutes.

Method 3 – Set up the MicroPurge with the flow cell and pass low-pressure nitrogen gas through the cell .



Optical dissolved-oxygen sensor maintenance is no more than occasionally cleaning the sensing surface on the tip (the black material; about a centimeter diameter) with a small soft cloth and soapy water. The tip has a very long service life but must be replaced periodically, usually about once every four years. If your SRF reports less than 100% or if you notice that the sensor's readings are getting noisy (i.e. jumpy), then it's probably time to change the tip by unscrewing the old tip and replacing it with a new tip and calibrating.

Conductivity/Specific Conductance (SpC)

The MicroPurge MP25 system uses the four-electrode method to determine water electrical conductivity. Two pairs of graphite electrodes are situated in a stable geometry. 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 MP25 reports conductivity as Specific Conductance (conductivity standardized to 25°C). The conductivity sensor is also used to calculate Total Dissolved Solids (TDS) and Salinity from the conductivity value.

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

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 MP25 software calibration instructions.

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.

You can choose a two- or three-point pH calibration. The two-point calibration is most common, using a pH 7 buffer and a pH 4 buffer if expected values are below 7 or pH 10 buffer if expected values are above 7. If you are measuring in waters whose pH might range both 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). To calibrate pH:

1. Rinse your sensors at least twice 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 MP25 Control Software calibration instructions.
4. Repeat steps 1, 2, and 3 if you choose to calibrate with one or two more standards.

pH electrode maintenance is minimal and only requires occasional cleaning of the glass bulb surface with a soft cloth or soft cotton swab and soapy water. Do not use anything abrasive. The really important part of pH maintenance is refilling the reference electrode.

pH/ORP Reference Electrode

The key to reliable pH, ORP, and ISE measurements is a well-maintained reference electrode. The MP25 system uses a serviceable reference electrode with a replaceable electrolyte and reference junction. This combination greatly extends the life of the pH/ORP probe as compared to probes that use integral reference electrodes with gelled electrolyte. The free-flowing junction design also responds better in low conductivity waters.

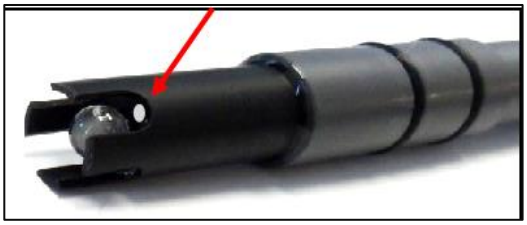
Reference electrode maintenance is as follows:

1. Remove the reference cap by unscrewing it from the reference sleeve using a coin edge and discard the old reference electrolyte.
2. Fill the sleeve completely with fresh pH reference electrolyte (KCl saturated with silver chloride). Tap the body of the MP25 sonde a few times to dislodge any bubbles.

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 displaces any lodged particles or biological growth out of the junction.

Oxidation-Reduction Potential (ORP)

ORP is measured as the voltage drop across the platinum membrane of an ORP electrode. The ORP sensor on the MP25 system is the 1 mm silver-colored dot you can see when looking down at the pH sensor. The pH/ORP reference electrode is used to complete the voltage-measuring circuit.

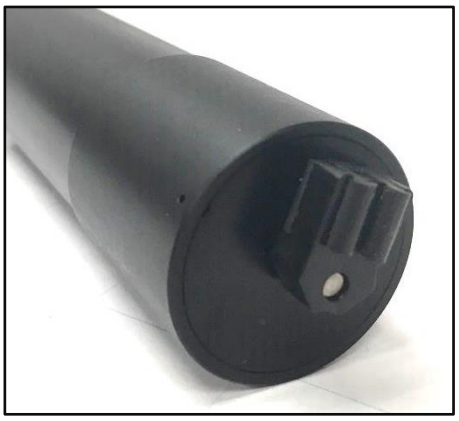


ORP electrode maintenance is also minimal, only occasional cleaning the platinum surface with a soft cloth or soft cotton swab and soapy water. If the platinum is discolored, you can polish the ORP electrode with very light abrasive, like 900-grit wet-and-dry sandpaper or a pencil eraser. You must be careful not to scratch or polish the pH glass bulb.

ORP uses a one-point calibration as follows:

1. Rinse your sensors at least twice with the ORP standard you'll use for calibration.
2. Fill the calibration cup with enough ORP standard solution to cover both the ORP and reference electrodes.
3. Follow the MP25 calibration instructions in the prompts after selecting ORP_mV to calibrate.

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 such as solids and gas bubbles is indistinguishable from particles suspended in the water, so most turbidity sensors have wipers to clean the optical window (the small glass port on the end of the sensor).

Turbidity sensors require no regular maintenance, but you should check occasionally to make sure the optical window has not been scratched or damaged by cleaning or accidental contact.

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. Zero calibration can be performed using a commercial turbidity standard of 0 NTU or with distilled or deionized water. Note that distilled or DI water can vary in clarity up to about 0.5 – 1.0 NTU, so using it as a 0 NTU standard could affect accuracy of very low turbidity readings.

Make sure you use enough calibration standard solution to cover the sensor's "optical volume" – generally, filling to near the top of the calibration cup when installed on the inverted sonde is sufficient. For the zero calibration:

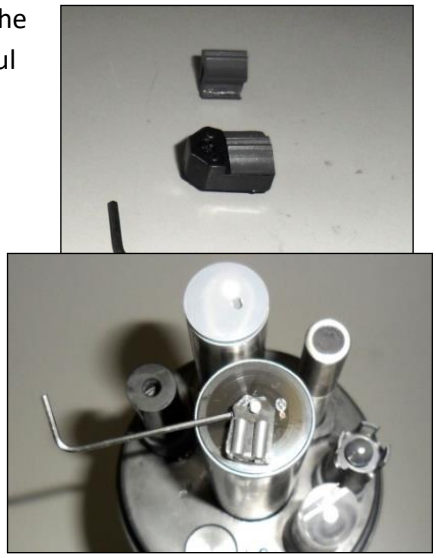
1. Make sure the turbidity sensor is fully immersed (i.e. at least 1 ½ inches of solution over the sensor) in zero-turbidity standard and has an unobstructed optical path.
2. Follow the MP252 Control Software's calibration instructions.

For the second calibration point:

3. Rinse your sensors several times with the standard you'll use for calibration.
4. Make sure the turbidity sensor is fully immersed (i.e. at least 1 ½ inches of solution over the sensor) in the standard and has an unobstructed optical path.
5. Follow the MP25 software's calibration instructions.

A clean, smooth wiper means better measurements. If the wiper pad shows signs of deterioration, it can be replaced. To change the wiper pad:

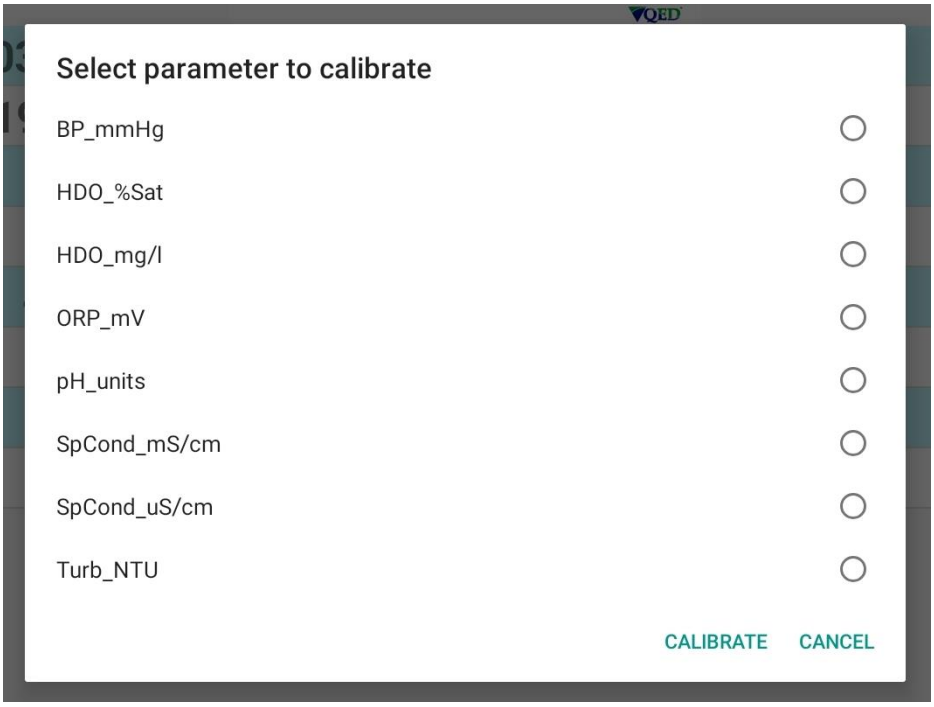
1. Using the 1.5mm hex key that comes with the new wiper pad, loosen the small set screw on the wiper arm and gently remove the arm. Be careful not to rotate the wiper arm as this can damage the internal gears.
2. Remove the wiper pad from the wiper arm and replace the pad.
3. Place the wiper arm on the motor shaft so that the set screw faces the flat spot on the motor shaft.
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. An easy way of setting the pad gap is to slide a small piece of paper under the pad and then gently push down until the wiper is just snug enough that the pad will hold the paper.



5. Tighten the set screw gently until snug. IT IS VERY IMPORTANT that you don't overtighten this screw to avoid stripping the threads, which would require replacement of the entire turbidity sensor.
6. **NEVER rotate the wiper arm manually!** This will strip the gears inside the wiper mechanism, which would require replacement of the entire turbidity sensor.

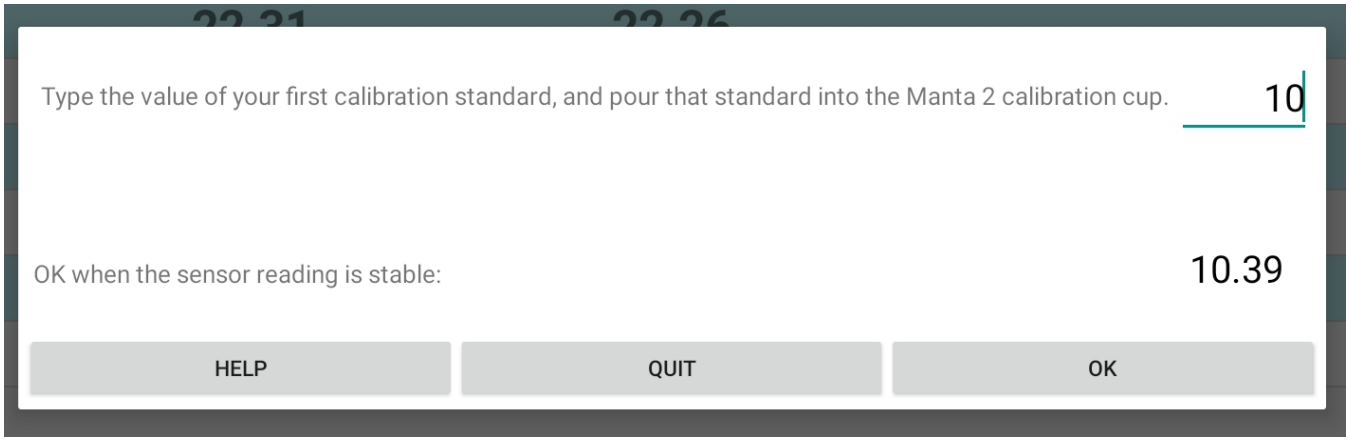
Select Parameter to Calibrate

When beginning the calibration process, a dialog box will appear prompting the user to choose which parameter to calibrate. After selecting press calibrate to open the next dialog box.



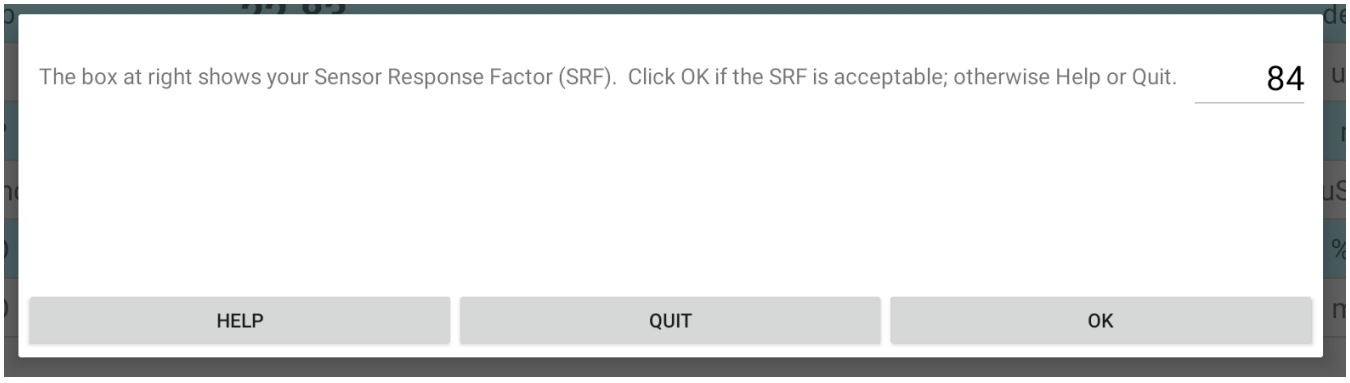
Entering calibration data

1. Enter Calibration Standard into the text field and hit done on the keypad.
2. Pour Calibration Standard into storage/calibration cup until sensors are fully submerged.
3. Wait for the value to appear on lower right corner of dialog box. This typically takes about one minute but could take slightly longer.
4. Hit OK
5. After this point the application will bring up another dialog box to calibrate to a second standard if applicable (e.g., pH or turbidity). Follow the same steps above for the second standard. After successful calibration of second standard the application will prompt for an optional third standard calibration for pH; this is not necessary but is recommended for a more accurate data representation.



Sensor Response Factor (SRF)

The Sensor Response Factor is created based off the calibration that was executed. This will tell the user how near or far each individual sensor is out of specification, and may need possible replacement if number is far enough out of specification. When you press the OK button to accept a calibration, the MP25 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. You can elect to accept any SRF value and continue with calibration.

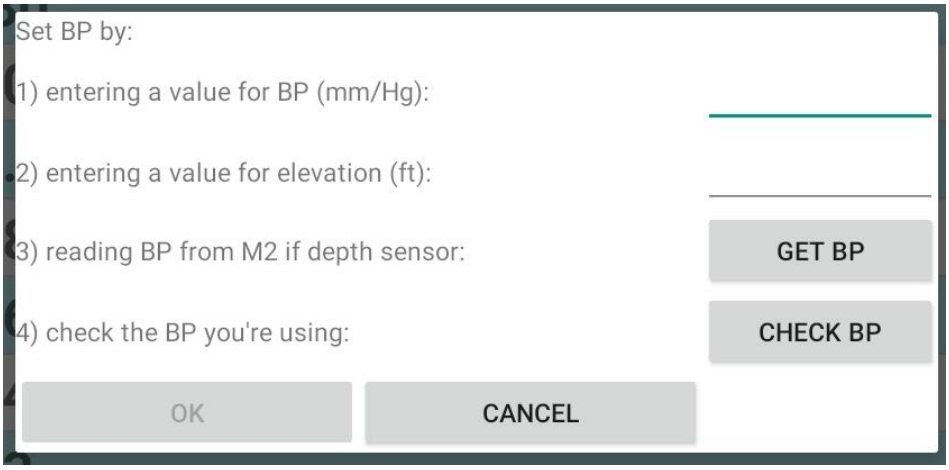


Calibrating barometric pressure for Dissolved Oxygen (DO)

There are two ways to calibrate the Barometric Pressure (BP) on the MP25 or MP25T. NOTE: The MP25 and MP25T sondes do not have depth sensors installed so the *Get BP* or *Check BP* buttons will not operate.

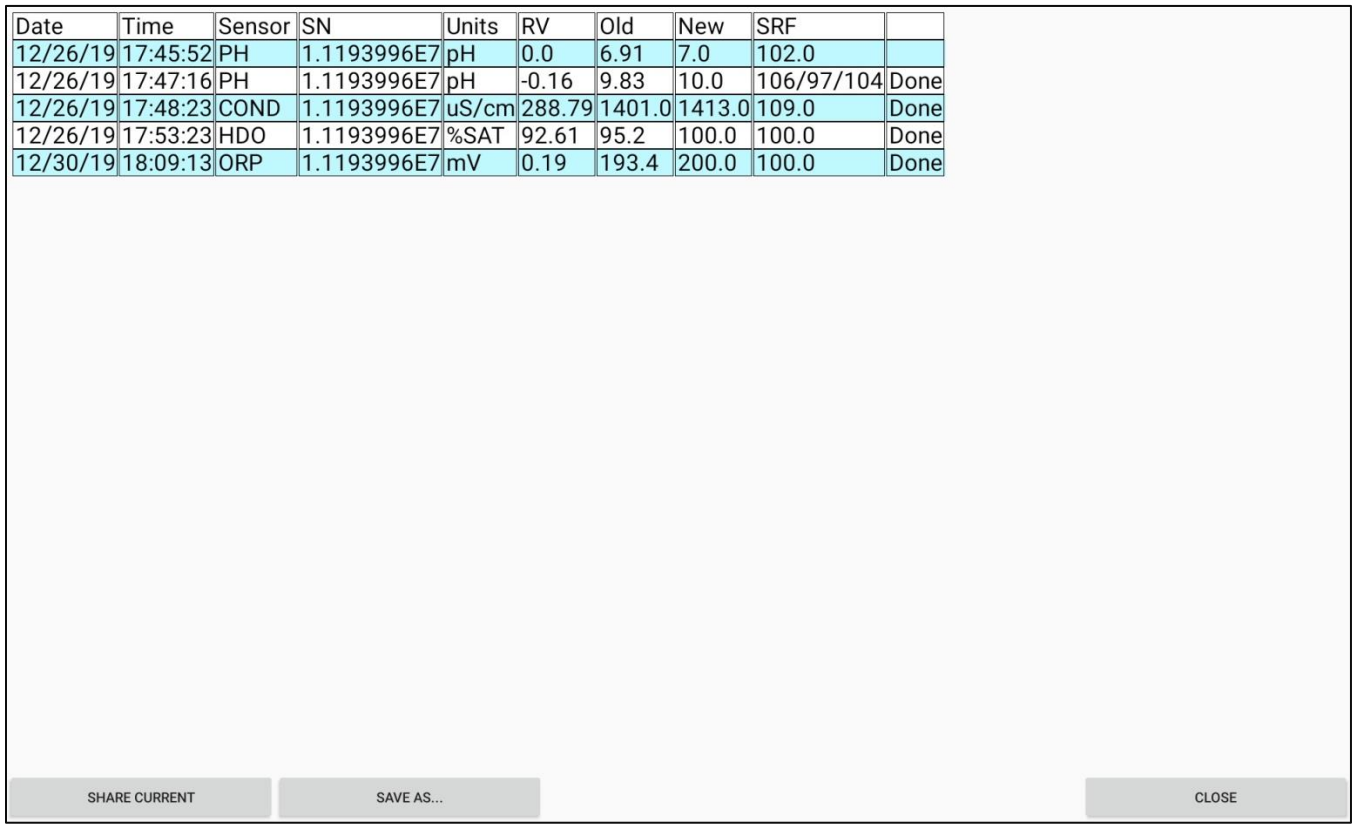
Method 1: Set the BP by typing in the correct pressure, if known, into the first test box. If entered the elevation will be automatically estimated and shown in the second box. If you know the elevation at your location, the calculated value in the second box should correlate with that elevation.

Method 2: The BP can be estimated by entering the altitude into the second text box. If entered the BP will automatically be estimated and shown in the first box.



3.4.2 Calibration Logs

Every MP25 sonde has a dedicated data file called CAL.LOG. The CAL.LOG will show all calibrations completed on the sonde during its lifetime. In this file are the time and date of the calibration, the parameter calibrated, the reading before the calibration was accepted, the reading after the calibration was accepted, the SRF, and a few other details. These logs can be downloaded and saved onto the tablet of the user for documentation.



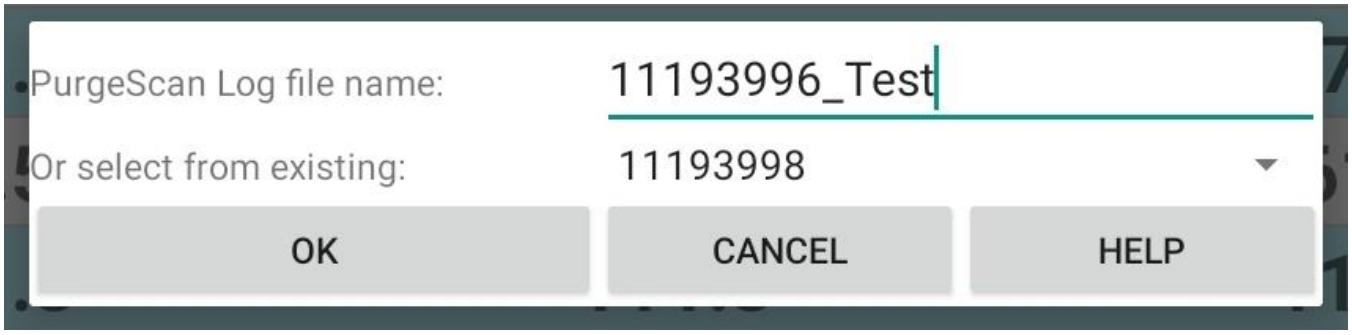
Date	Time	Sensor	SN	Units	RV	Old	New	SRF	
12/26/19	17:45:52	PH	1.1193996E7	pH	0.0	6.91	7.0	102.0	
12/26/19	17:47:16	PH	1.1193996E7	pH	-0.16	9.83	10.0	106/97/104	Done
12/26/19	17:48:23	COND	1.1193996E7	uS/cm	288.79	1401.0	1413.0	109.0	Done
12/26/19	17:53:23	HDO	1.1193996E7	%SAT	92.61	95.2	100.0	100.0	Done
12/30/19	18:09:13	ORP	1.1193996E7	mV	0.19	193.4	200.0	100.0	Done

3.5 PurgeScan® Logging and Setup

3.5.1 PurgeScan Logging Setup and Interval

PurgeScan Logging File Name

To set up the PurgeScan log, the user will go to the PurgeScan Menu, under the Settings menu. After menu has been accessed a dialog box will appear prompting to name the new logging file. It is common to use the Well ID and Date, but the file can be named anything seen fit. An example name will appear in the field; the user can delete this and add the Well ID. There is also the option to select from existing file names, where the user can select previous log files to appended new data to the file.



3.5.2 PurgeScan Logs

PurgeScan logs are the logs where the data and parameters set by the user are saved to.

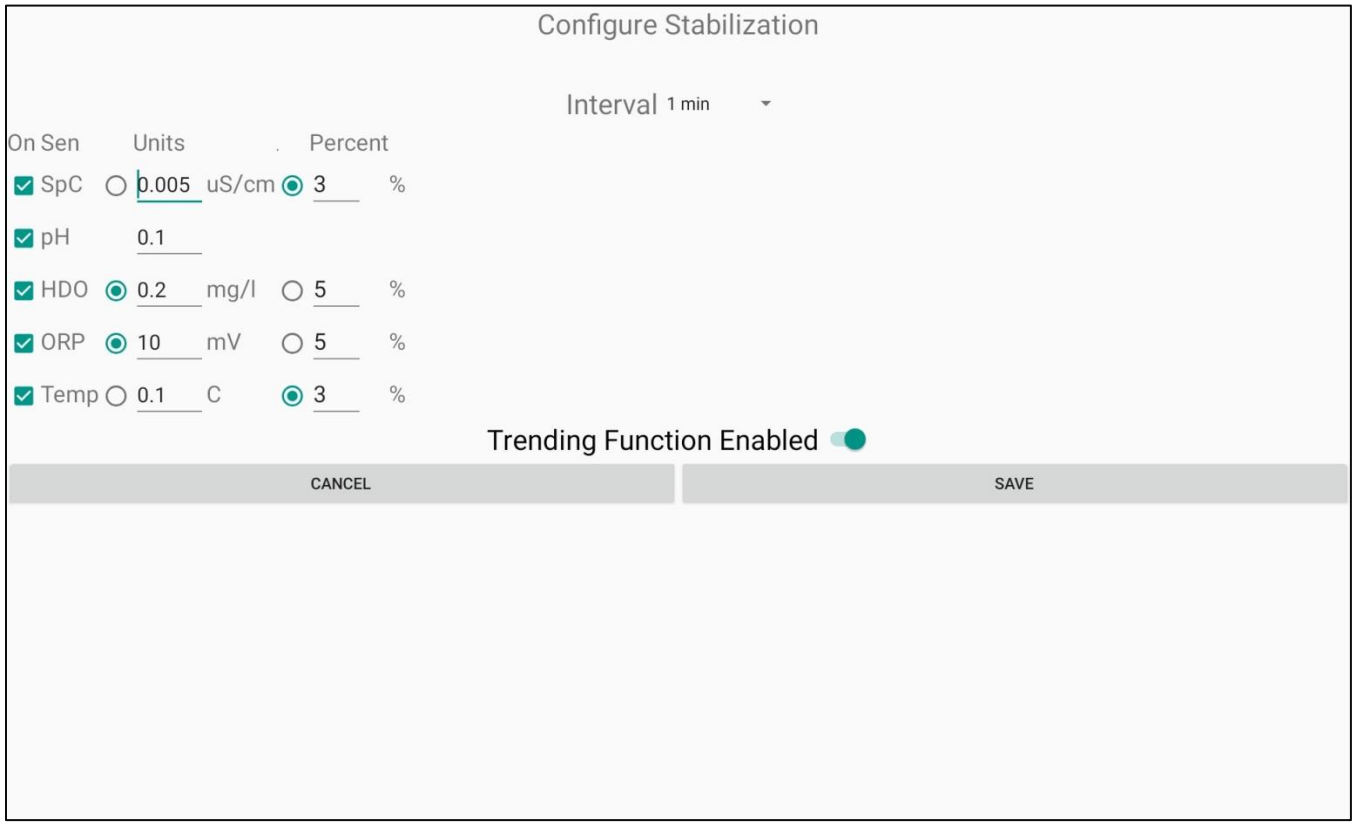
3.5.3 Sensors and Parameters

Enable the desired parameters from the list shown by clicking the box to produce the check mark. Clicking on a box with a check mark removes the check mark and disables that parameter. Only select parameters for sensors that are installed. If a parameter is selected and the MP25 or MP25T does not have that sensor installed, the data will not be accurate.

Measured parameters are Temperature, pH, Oxidation-reduction Potential (ORP), Specific Conductance (SpC), and Dissolved Oxygen (DO) for the MP25. The MP25T adds turbidity measurement. Calculated parameters are Total Dissolved Solids (TDS), Salinity and DO percent saturation (% Sat). Where a parameter can be displayed in more than one range of units (e.g, Specific Conductance in microsiemens/centimeter (µS/cm) or millisiemens/centimeter (mS/cm), select the desired range.

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. The user can change the parameter order by clicking on 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.

3.5.4 Configure Stabilization Criteria



Selecting Stabilization Parameters

Select parameters for purging stabilization based on your site work plan or groundwater sampling & analysis plan (GWSAP or SAP) and considering any regulatory guidance or requirements. Each parameter can be selected individually. If the parameter is not displayed on the screen make sure it is enabled for measurement (See section 3.5.3), as only the parameters that are selected for measurement can be used for stabilization. If the parameter is shown on this screen but is not selected for stabilization, it will be displayed on the main screen but will not be taken into account for stabilization.

Choosing Stabilization Criteria Range

The PurgeScan stabilization function indicates when the selected purging parameters have stabilized based on a comparison of the current measured values with the two previous logged values, with all three values falling within the range selected for each parameter (the stabilization criteria). The selection buttons next to each parameter allow the user to either stabilize based on either a unit of measure or a percentage of the measured. This can be different for each parameter but each parameter can only have one selection of either units or percentage. The units or percentage that the user sets is generally based on the site specific work plan, groundwater sampling & analysis plan (GWSAP or SAP) and considering any regulatory guidance or requirements. When all of the selected parameters fall within the selected stabilization criteria, the system will show “Stabilization Achieved” in green text in the status bar at the bottom of the main screen. The logged file will also be annotated with the word “Stable” in the comments section.

Trending Function

At the bottom of the screen there is a toggle switch allow the user to either turn ON or OFF the trending function. This optional function can be used to identify readings that are trending upward or downward to avoid “false” or early indication of stabilization. If the values are trending and changing by 50% or more of the stabilization criteria chosen, this function will prevent the software from indicating “Stabilization Achieved” even though the reading values fall within the stabilization criteria selected. When trending stops and the values fall within the desired stabilization range, the software will indicate stabilization on the screen and the PurgeScan log will be annotated.

PurgeScan Logging Interval

The interval between logged readings can be user selected. This option is located at the top of the screen notated *Interval*, with a drop down menu where the user can choose different preset times from 1-10 minutes in 1 minute increments.

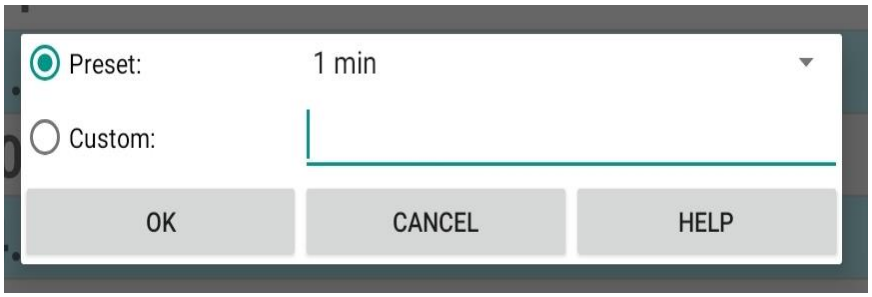
3.6 Backup Logs

The Backup Logs are saved onto the sonde as a backup to the PurgeScan logs. This is in the case of the tablet or PC being compromised and the user not being able to retrieve the logged data.

3.7 Other Operations

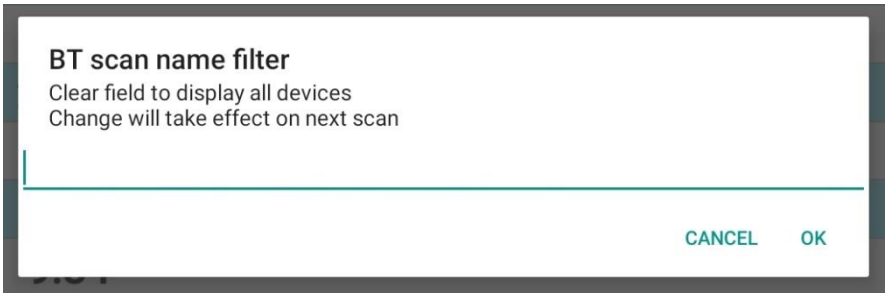
3.7.1Tablet Scroll Interval

This setting controls the scrolling interval of the data the user sees across the screen of the device. This does NOT control the PurgeScan Logging interval, which can be found in Section 3.4.



3.7.2 Bluetooth Scan Filter

This setting the user can filter out unnecessary Bluetooth devices under the *Find Another MP25* Menu. This will make connecting to the MP25 or MP25T more convenient.

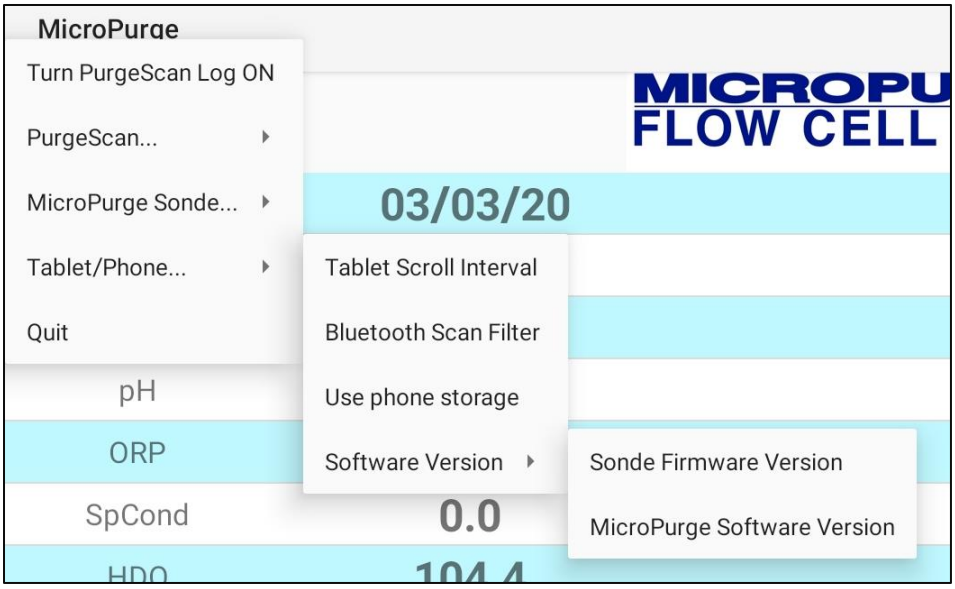


3.7.3 Save GPS Location

This feature will allow the user to save the physical GPS location of the tablet being used. It is recommended that when using this feature, the user is nearby the water sample location. The Latitude and Longitude will be appended to the PurgeScan log file currently in use.

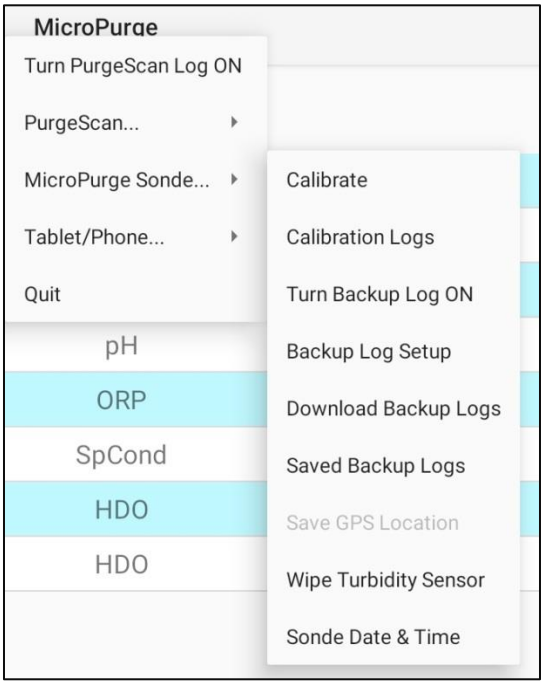
3.7.4 Software Version

This button when pressed, will allow the user to view either the current Sonde firmware version or the current MircroPurge application software version.



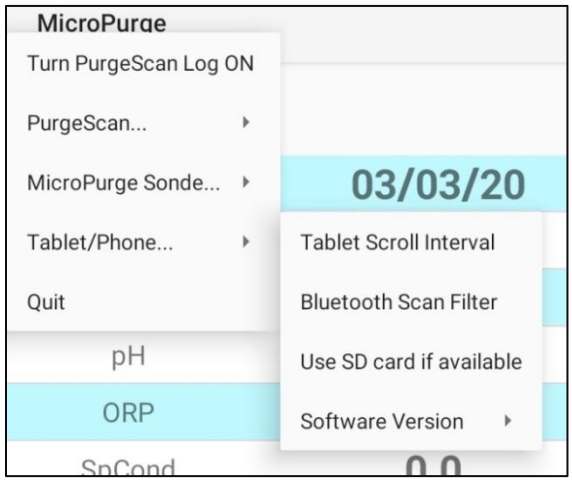
3.7.5 Wipe Turbidity Sensor

When taking turbidity measurements or using the PurgeScan stabilization function on the MP25T system, if you notice that turbidity values are rising significantly but the water in the flow cell does not appear to be increasing in turbidity, bubbles forming from dissolved gases in the groundwater may be interfering with the sensor. When this button is pressed, the wiper located on the end of the sensor will complete one “Wipe Cycle” to clean the optical sensor surface of any debris or bubbles that can cause falsely high turbidity readings. Note that if this button is pressed when connected to an MP25, nothing will happen.

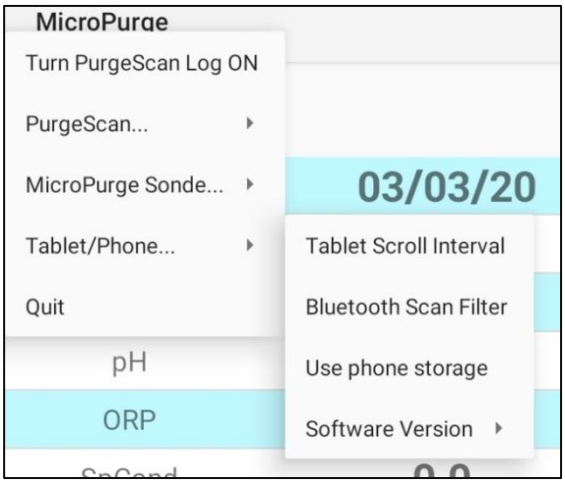


3.7.6 Selecting a storage location for PurgeScan Log Files

When saving the PurgeScan Logs, the user has the choice to save the files to either the internal memory of the tablet, or onto an SD if installed in the device. Under the *Tablet/Phone* menu the button will show either *Use Phone Storage* or *Use SD card if available*, the selection that is currently shown when the *Tablet/Phone* menu is open, is where the logs will be saved.



OR



4. Technical Notes

4.1 Dissolved Oxygen

4.1.1 Oxygen Solubility in Water

The function used to calculate oxygen solubility is based on the oxygen solubility vs. temperature data from Table 4500-O found in the 19th Edition of Standard Methods for the Examination of Water and Wastewater

4.1.2 Salinity Correction of DO mg/L

The function used to calculate oxygen solubility is based on the oxygen solubility vs. chlorinity data from Table 4500-O found in the 19th Edition of Standard Methods for the Examination of Water and Wastewater.

Note: DO %Saturation is not a function of solubility, and has no salinity or temperature correction.

4.1.3 Barometric Pressure of Functions

Local barometric pressure, BP, in mmHg can be estimated using: BP = 760- 2.5(A/100) where 'A' is the local altitude above sea level in feet. If using the local weather bureau BP, remember these numbers are corrected to sea level. To calculate the uncorrected atmospheric pressure BP', use the following function:

BP' =BP-2.5(A/l00)

4.2 Specific Conductance, Salinity, and TDS

4.2.1 Specific Conductance Temperature Correction

Temperature correction of conductivity to produce specific conductance is based on the temperature correction formulas and factors of Table 3 in ISO 7888-1985 Water Quality Determination of Electrical Conductivity. This temperature correction is normalized to 25C Because total dissolved solids (TDS) is calculated from the specific conductance reading, it also has the above correction.

4.2.2 Salinity Calculation

The method used to calculate salinity from conductivity is found in 2520B the 19th Edition of Standard Methods for the Examination of Water and Wastewater. This method is also commonly referred to at the Practical Salinity Scale or UNESCO method. This method uses conductivity, not specific conductance, and includes its own temperature correction normalized to 15C.

4.2.3 Total Disolved Salts (TDS) Calculation

TDS is calculated from specific conductance as: TDS = C x Scale Factor where TDS is total dissolved solids in g/L, C is specific conductance in mS/cm, and Scale Factor is a user defined. The default scale factor is 0.64 from Water Chemistry, by Snoeyink and Jenkins.

4.3 CE Testing and Certification

The MP25 System has been tested and complies with CE requirements in effect at time of manufacture. A copy of the MP25's current Certificate of Compliance is available on request.

4.4 Turbidity

QED's MP25T is compliant with GLI method 2 EPA approved method, and ISO 7027:1999(E). GLI Method 2 is recognized by EPAas an approved method in Section 141.74 of the Federal register Vol. 59 No. 232 (December 5, 1994). Reprints of both the GLI Method 2 documentation and the Federal Register reference are available on request. The MPs0DT's turbidity software, and Quick-Cal Cubes™ were developed as a joint venture between Hydrolab Corporation and GLI International, Inc. and are protected by U.S. Patents #5,059,811 and #5,140,168. Other patents pending.

5. Troubleshooting

1. The Bluetooth and Auxiliary Battery Box will not turn on.
    a. Connect the Auxiliary Battery charger provided in the kit to the nine pin RS-232 port of the Bluetooth and Auxiliary Battery box, then plug into a 110V outlet and allow to charge.
2. The tablet will not show readings.
    a. Try to reconnect the sonde. Turn off, then turn back on the Bluetooth Auxiliary Battery Box and re-open the MicroPurge app to reconnect the sonde to the application.
3. Measurements seem wrong.
    a. Recalibrate the sensors.
4. PurgeScan Stabilization not signaled as expected.
    a. Stabilization criteria may be too stringent.

b. Trending function is turned on, which can extend the time required to achieve stabilization.

5. The parameter the user wants is not on the Stabilization Criteria Screen.
    a. Under the Sensors & Parameters list the desired parameter needs to be selected.
6. The parameter the user wants is not on the main screen.
    a. The parameter may not be selected in the Stabilization Criteria screen.

6. Warranty

Q.E.D. ENVIRONMENTAL SYSTEMS, INC. ("QED") warrants to the original purchaser ("Purchaser") of its groundwater sampling products ("Products") that the products shall be free of defects in materials and workmanship on the date of sale, subject to the limitations below. Any failure of the products to conform to this warranty will be remedied by QED in the manner provided herein.

This warranty shall be limited to the duration and the conditions set forth below. Warranty duration is calculated from the original date of purchase.

1. Dedicated-Use System Products – Ten (10) year warranty on dedicated bladder pumps with PTFE (Teflon®) bladders equipped with original equipment inlet screens and used in periodic, non-continuous groundwater sampling (up to 52 samples events per year.) Five (5) year warranty on dedicated bladder pumps using Teflon-free proprietary polymer bladders. All other components, equipment and accessories are warranted for one (1) year except as stated below.

2. Portable Systems and Controls - Sample Pro portable-use pumps, MicroPurge Controllers and Water Level and Drawdown Meters are warranted for one (1) year. Hose reel and caps are warranted for ninety (90) days. Tubing used in a Portable System is covered by a ninety (90) day material and workmanship warranty. There will be no warranty for application on tubing when used as part of a Portable System.

3. Separately Sold Parts, Spare Parts Kits and Repairs - Separately sold parts and spare parts kits are warranted for ninety (90) days. Repairs performed by QED are warranted for ninety (90) days from date of repair or for the remaining term of the original warranty, whichever is longer.

4. Flow Cell Systems – The Sonde, OEM Handheld Display and Sensors are warranted for three years from date of purchase. Aftermarket handheld displays (e.g., ruggedized tablet devices) are covered by the aftermarket device standard limited warranty. This warranty does not apply to batteries of any type or any other items that carry shelf lives (i.e. calibration solutions). Also the warranty does not cover products damaged by improper installation, or application, misuse, abuse, neglect or accident. NOTE: THE FLOW CELL SYSTEMS WARRANTY EXCLUDES COVERAGE OF COMPONENTS CONSUMED THROUGH NORMAL USE, SUCH AS REPLACEMENT OF REFERENCE ELECTRODE JUNCTION OR SOLUTION.

Purchaser's exclusive remedy for breach of said warranty shall be as follows:

If Purchaser notifies QED in writing within the applicable warranty period of a claimed defect in the Product and QED determines after inspecting the Product that the defect is covered by the warranty, QED will repair the Product without charge to Purchaser. If QED for any reason cannot repair a Product determined by QED to be

covered by this warranty within four (4) weeks after receipt of the defective Product, then QED's sole responsibility shall be, at its option, either to replace the defective Product with a comparable new unit at no charge to Purchaser or to refund the purchase price paid by Purchaser. QED's obligation to repair, replace or refund are conditioned upon the Purchaser's return of the claimed defective Product to QED, after receiving authorization to do so from QED. In no event shall claimed defective Products be returned to QED without its authorization. If the Product is determined not to be defective within the terms of this warranty, then all costs for repair, parts and labor that are authorized by Purchaser shall be borne by Purchaser.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ALL OTHER WARRANTIES, WHETHER EXPRESS, IMPLIED OR STATUTORY (INCLUDING BUT NOT LIMITED TO THE WARRANTY OF MERCHANTABILITY AND THE WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE), WHICH OTHER WARRANTIES ARE EXPRESSLY EXCLUDED HEREBY. QED neither assumes, nor authorizes any person to assume for it, any other obligation or liability in connection with the Products. Purchaser agrees that in no event will QED be liable for incidental, consequential or special damages (including but not limited to lost profits, lost sales, or injury to persons or property) and that Purchaser's sole remedy is the above warranty.

This warranty will be void in the event of unauthorized disassembly of component assemblies. This warranty will also be void if the defect in a Product results from abuse; operating, installing or maintaining the Product in a manner other than in accordance with QED's written recommendations; uses or applications other than the intended use or application, as indicated in the manual; or exposure to chemical or physical environment beyond the designated limits of materials and construction. This warranty does not cover, and QED shall not be liable for general wear and tear, or any malfunction, damage or wear caused by faulty installation, misapplication, abrasion, corrosion, inadequate or improper maintenance, negligence, accident, tampering, substitution of non-QED component parts, or the selection of improper material or product configuration for Purchaser's application. Nor shall QED be liable for malfunction, damage or wear caused by the incompatibility of QED equipment with structures, accessories, equipment or materials not supplied by QED, or the improper design, manufacture, installation, operation or maintenance of structures, accessories, equipment or materials not supplied by QED. QED shall be released from all obligations under all warranties if any Product covered hereby is repaired or modified by persons other than QED's service personnel unless such repair by others is made with the written consent of QED.

RESPONSIBILITY OF THE PURCHASER

Purchaser is responsible for notifying QED of the defect, malfunction, or other manner in which the terms of this warranty are believed to be breached. In the event of a warranty claim, Purchaser must contact the Customer Service Department of QED and:

1. Identify the product involved (by model or serial number or other sufficient description that will allow QED to determine which product is claimed defective);
2. Specify where, when, and from whom the Product was purchased;
3. Describe the nature of the defect or malfunction; and

4. Send the malfunctioning component, after authorization by QED, to:

QED Environmental Systems, Inc.
2355 Bishop Circle West
Dexter, MI 48130
Toll Free North America: (800) 624-2026
Company Main: (734) 995-2547
Fax: (734) 995-1170
Web: www.qedenv.com
Email: info@qedenv.com

QED Environmental Systems Inc.
2355 Bishop Circle West
Dexter, MI 48103
1 (800) 624 – 2026
info@qedenv.com

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