
AQUASEND[™] BEACON

USER'S MANUAL



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WARRANTY

LIMITED WARRANTY

Precision Measurement Engineering, Inc. (“PME”) warrants the following products to be, as of the time of shipment, free from defects in materials or workmanship under normal use and conditions for the period indicated below corresponding to the product. The warranty period commences on the original date of purchase of the product.

Product	Warranty Period
Aquasend Beacon	1 year
miniDOT Logger	1 year
miniDOT Clear Logger	1 year
miniWIPER	1 year
miniPAR Logger (Logger only)	1 year
Cyclops-7 Logger (Logger only)	1 year
C-FLUOR Logger (Logger only)	1 year
T-Chain	1 year
MSCTI (excludes CT/C-sensors)	1 year
C-Sense Logger (Logger only)	1 year

For valid warranty claims made and covered defects existing during the applicable warranty period, PME will, at PME’s option, repair, replace (with the same or then most similar product) or repurchase (at purchaser’s original purchase price), the defective product. This warranty extends solely to the original end-user purchaser of the product. PME’s entire liability and the sole and exclusive remedy for product defects is limited to such repair, replacement or repurchase in accordance with this warranty. **This warranty is provided in lieu of all other warranties express or implied, including, but not limited to warranties of fitness for a particular purpose and warranties of merchantability.** No agent, representative, or other third party has any authority to waive or alter this warranty in any way on behalf of PME.

Warranty Exclusions

The warranty does not apply in any of the following circumstances:

- l) The product has been altered or modified without PME’s written authorization,

- II) the product has not been installed, operated, repaired, or maintained in accordance with PME's instructions, including, where applicable, use of proper grounding to an earth ground source,
- III) the product has been subjected to abnormal physical, thermal, electrical, or other stress, internal liquid contact, or misuse, neglect, or accident,
- IV) the product failure occurs as a result of any cause not attributable to PME,
- V) the product is installed with ancillary devices such as flow sensors, rain switches, or solar panels that are not listed as compatible with the product,
- VI) the product is installed in a non-PME specified enclosure or with other incompatible equipment,
- VII) to address cosmetic issues such as scratches or surface discoloration,
- VIII) operation of the product in conditions other than that for which the product was designed,
- IX) the product has been damaged due to events or conditions such as caused by lightning strikes, power surges, unconditioned power supplies, floods, earthquakes, hurricane, tornados, vermin such as ants or slugs or intentional damage, or
- X) products provided by PME, but manufactured by a third-party company, which products are subject to the applicable warranty extended by their manufacturer, if any.

There are no warranties that extend beyond the above limited warranty. In no event is PME responsible or liable to purchaser or otherwise for any indirect, incidental, special, exemplary, or consequential damages, including, but not limited to, lost profits, loss of data, loss of use, business interruption, loss of good will, or cost of procuring substitute products, arising out of or in relation to the product, even if advised of the possibility of such damages or losses. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Warranty Claim Procedures

A warranty claim must be initiated within the applicable warranty period by first contacting PME at info@pme.com to obtain an RMA number. The purchaser is responsible for proper packaging and return shipment of the product to PME (including shipping expense and any related duties or other costs). The issued RMA number and purchaser's contact information must be included with the returned product. PME is NOT liable for loss or damage of the product in return transit and recommends that the product be insured for its full replacement value.

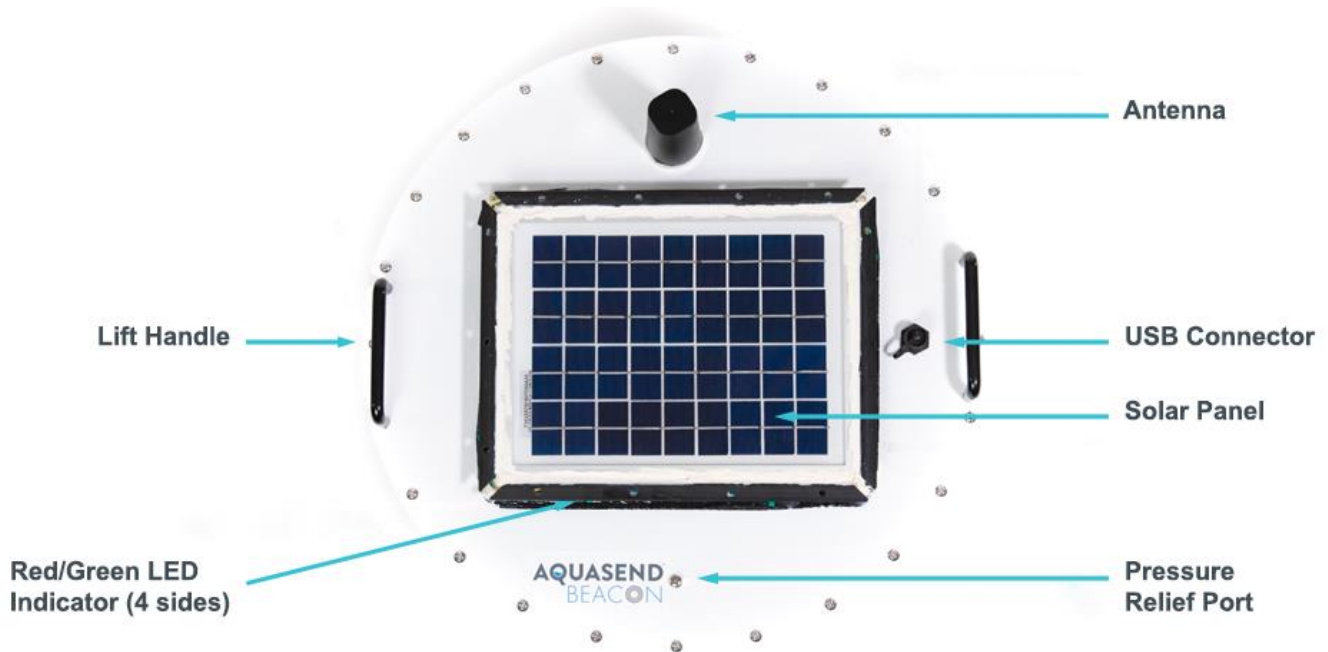
All warranty claims are subject to PME's testing and examination of the product to determine if the warranty claim is valid. PME may also require additional documentation or information from the purchaser to evaluate the warranty claim. Products repaired or replaced under a valid warranty claim will be shipped back to the original purchaser (or its designated distributor) at PME's expense. If the warranty claim is found to be not valid for any reason, as determined by PME in its sole discretion, PME will notify the purchaser at the contact information provided by the purchaser.

CHAPTER 1: INTRODUCTION

Thank you for choosing the Aquasend Beacon® for your real-time water monitoring needs! Aquasend® takes 30 years of research-driven water quality monitoring innovation and focuses it in one place. Your aqua farm. We recognize your goal of helping to feed a growing world and are proud to help you realize it. Once the installation of your Aquasend Beacon System is complete, you will be able to monitor your farm more reliably, allowing you to increase yields, your bottom line, and provide more food to all.

This Aquasend Beacon Operator's Manual provides information on basic components, gateway initialization, operation, unpacking, installation, and more. Make sure to read this manual in its entirety prior to operating the Aquasend Beacon.

1.1 AQUASEND BEACON COMPONENTS



1.2 GATEWAY INITIALIZATION



The Aquasend Beacon requires one of two types of Gateways: a DIGI ConnectPort X2 Gateway that is designed to plug onto the customer's local area network, or a DIGI ConnectPort X4 which is designed to connect to the public internet using cellular technology. Customers that require Verizon as their cellular provider will also get a DIGI WR11XT Transport modem device. This will be plugged into the DIGI ConnectPort X2.

For either of the Gateways, place the Gateway at some dry location having AC power and, in the case of the X2, access to the LAN.

X2: Follow steps 1 and 2 of the Quick Start Guide instructions included with the X2 Gateway. Ignore Step 3. Configuration of the X2 with the Aquasend Beacon, as described in steps 4 and 5, has already been done by Aquasend. Once this setup is completed, call or email Aquasend. We will verify that the Gateway is connected.

X4: The X4 will not need the Ethernet cable as shown in step 3 in the Quick Start Guide. Also note that the SIM card is already installed in the X4 so skip step 2. Once powered, verify that there is light operation on the top of the Gateway and that good signal strength is shown. The X4 can take several minutes to connect to the network. Once this setup is completed, call or email Aquasend. We will verify that the Gateway is connected.

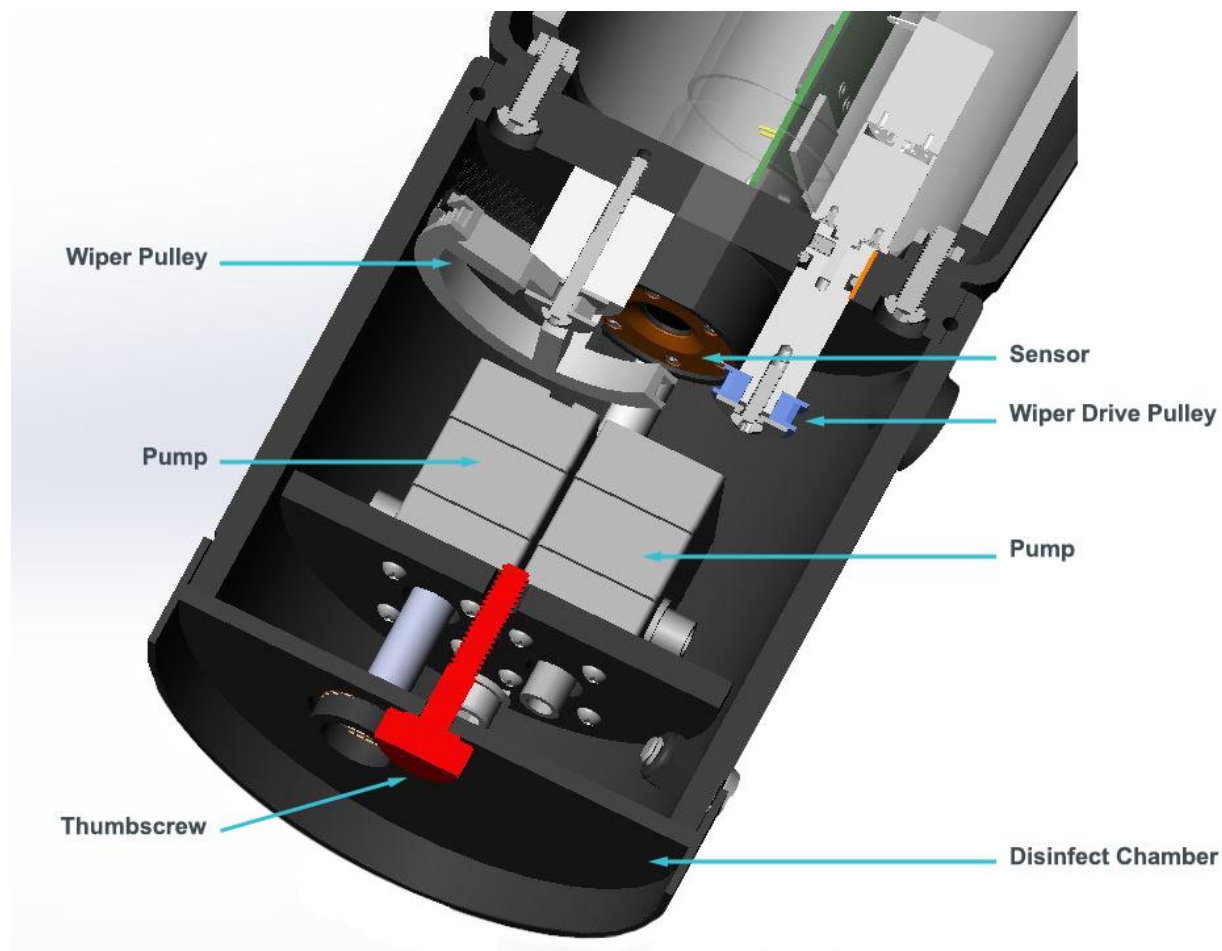
X2 WITH WR11XT: Follow the X2 setup but instead of plugging the Ethernet cable into a router, it will be plugged directly into the WR11XT. The WR11XT will already come with the SIM card installed. Plug in the two antennas and then power the unit with the A/C adapter provided. Make sure the WR11XT is located near a window or spot where there is good cellular signal. A picture of the setup is shown above. Once this setup is completed, call or email Aquasend. We will verify that the Gateway is connected.

CHAPTER 2: AQUASEND BEACON OPERATION

Aquasend Beacons consist of solar power, internal re-chargeable battery, oxygen/temperature sensor, radio, and a control circuit. Aquasend Beacons are programmed to send measurements on a regular schedule, normally a measurement every 10 minutes.

Aquasend Beacons are equipped with anti-fouling measures. These consist of a brush wiper intended to mechanically remove fouling organisms from the sensor. This is shown in the following drawing. The brush is mounted on the wiper pulley, which is driven by a belt (not shown) from the wiper drive pulley. Wipes can be programmed to occur less frequently than measurements.

A second anti-fouling method is implemented by a disinfect chamber and two pumps. One pump draws exterior, non-treated water into the sensed region while the other draws water from the disinfect chamber. These pumps are used in sequence, with the exterior water pumped in prior to sensing and disinfecting water thereafter.



The Aquasend Beacon is provided with red and green LED indicators mounted on each of the four sides of the solar panel. These give a visual indication of oxygen concentration based on the most recent measurement. Measurements will normally occur once every 10 minutes, but the Aquasend Beacon will indicate once each minute. A 3-flash of green indicates that the most recently measured oxygen concentration exceeds a pre-programmed alarm level. A 3-flash of red indicates that the oxygen concentration is below this level. A brief red flash immediately following either 3-flash indicates that the most recent telemetry attempt failed. No 4th flash occurs if telemetry was successful.

When the Aquasend Beacon is removed from the water, it will flash green due to the greater oxygen levels in the atmosphere. But for the first 10 minutes of operation after entering telemetry mode it may flash red since no oxygen measurement has yet been recorded. After this initial period the flash will be correct. The 4th (telemetry) flash will also occur and be red for at least the first 10 minutes and until a successful telemetry occurs.

The Aquasend Beacon will flash to indicate other events. The table below summarizes the potential Aquasend Beacon flashes:

2.1 DURING IDLE MODE

Event	Flash Pattern
1-minute interval battery state	1 X brief red flash if battery voltage is low. This is not emitted if battery voltage is critically low.
USB connect	1 X brief green
USB disconnect	1 X brief red
Enter telemetry mode by magnet trigger	2 X brief green
Enter bootstrap mode	10 X slow red followed by 5 X rapid green
Reboot after bootstrap or upon application of power	1 X green

2.2 DURING TELEMETRY MODE

Event	Flash Pattern
Exit telemetry mode by magnet trigger	2 X brief red
Exit telemetry mode by USB connect	2 X brief red, 1 X brief green

Event	Flash Pattern
1-minute interval oxygen state	3 X long green if last measurement of oxygen concentration is above alarm level. 3 X long red if last measurement of oxygen concentration is below alarm level
1-minute interval telemetry state	1 X brief red if last telemetry attempt failed.

Aquasend Beacons are equipped with a USB connection. When connected to a Windows PC, and after a brief time, the Aquasend Beacon will appear as a local drive in Windows Explorer. This drive will contain this operator's manual as well as software to control Aquasend Beacon operation and other software.

2.3 UNPACKING

- Remove upper packing material.
- Remove the Aquasend Beacon using carrying handles. Retain the box and packing materials for return of the Aquasend Beacon.



2.4 INSTALLATION SUMMARY

Aquasend will work with you to determine which Gateway is best for your farm based on location, internet access, and other variables. Once received, please locate this Gateway within radio range of the Aquasend Beacon. The location must provide AC power and protection from weather. Locate the Gateway as high above ground as possible and not within metal sheds. Locate by a window if possible. Radio range will depend on the location of Gateway, and line-of-sight impediments between the Aquasend Beacon and Gateway. Aquasend expects 1/2 mile or more of range between the Aquasend Beacon and Gateway. Initialize the Gateway (see Gateway Initialization section above).

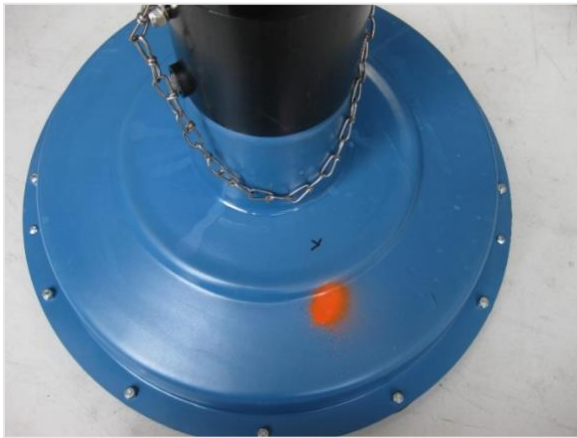
Before installing in water, fasten the pressure relief port screw. Leave the Aquasend Beacon in direct sunlight to charge the internal battery.

Please install the Aquasend Beacon in whatever tank, pond, or other circumstance that is to be monitored. The Aquasend Beacon is provided with a short length chain loop below the sensor end for this purpose. This should be attached to some neutrally buoyant anchor line (ex. rope). Start the measurement flow at this time (see below).

It is likely that installation will involve concurrent telephone conversations with Aquasend. Aquasend is able to 'see' the Gateway over the Internet once it is connected. Also, we can 'see' the Aquasend Beacon under special conditions that can be established at measurement time. Installation will probably include getting both the Gateway and Aquasend Beacon visible to Aquasend, with the Aquasend Beacon nearby the Gateway, but not in a tank, and then move the Aquasend Beacon to its desired location in tanks etc.

2.5 STARTING AND STOPPING MEASUREMENT FLOW

The Aquasend Beacon has two modes of operation: idle and telemetry of measurements. Transitions between these modes are signaled by bringing the magnet Aquasend supplies nearby the sensitive location, shown with a white sticker on the underside of the Aquasend Beacon.



If the Aquasend Beacon is idle the magnet will cause it to begin telemetering. The Aquasend Beacon will announce that it is entering telemetering mode by a brief flash of its green LED indicators. If the Aquasend Beacon is in telemetering mode, the magnet will cause it to stop telemetering and become idle. The Aquasend Beacon will announce this transition by a brief flash of its red LED indicators.

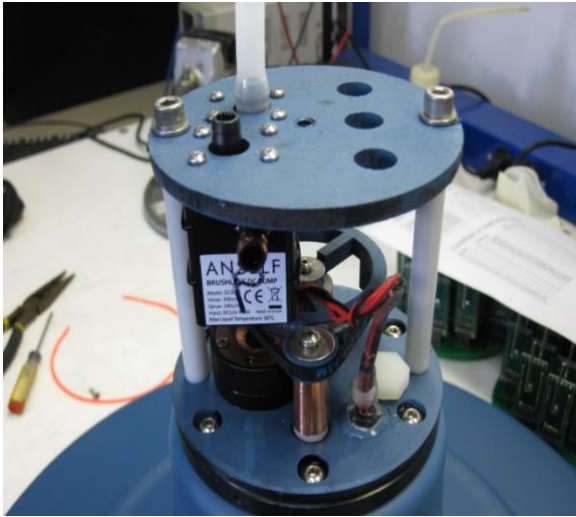
If the Aquasend Beacon does not flash its lights when the magnet is used, the battery is likely low, and the Aquasend Beacon should be put in direct sunlight to charge.

CHAPTER 3: SERVICING AND INSPECTING THE AQUASEND BEACON

Servicing the Aquasend Beacon will consist of replacing the chlorine tablet in the disinfect chamber every 1-2 months.

Tablet replacement is accomplished by flipping the Aquasend Beacon upside down and unscrewing the red thumbscrew at the bottom end of the Aquasend Beacon. The cap will come right off. This exposes the disinfect chamber. A chlorine tablet is placed in the chamber and the cap re-installed.

It is necessary to inspect the wiper monthly. This



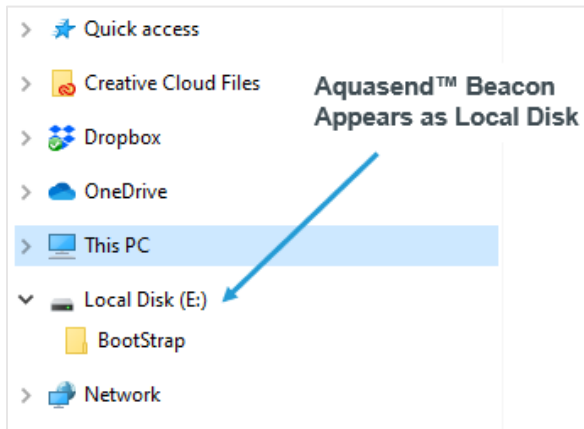
is accomplished by removing the cap and lifting off the sensor guard. This exposes the pumps, wiping mechanism, and sensor as pictured to the left.

Please note there are wires that connect the pumps to circuits within the Aquasend Beacon. These pass a waterproof seal but may be damaged by tensions or tugs. Please be gentle when exposing the interior.

At this time the sensor area can be cleaned, and the pumps flushed out with fresh water.

CHAPTER 4: OPERATION OF AQUASEND BEACON SOFTWARE

Various software programs are supplied with the Aquasend Beacon. These programs are located within the Aquasend Beacon. To access this software, remove the protective cap from the USB connector. Connect the USB cable supplied by Aquasend to the connector. Connect the opposite end of cable to a Windows computer. After about 30 seconds a new local drive will appear in the Windows Explorer tree. Please note that if the Aquasend Beacon is in telemetering mode the first USB connection may fail and an unplugging/re-plugging may be required. Also, connecting to USB causes the Aquasend Beacon to end telemetering and become idle.



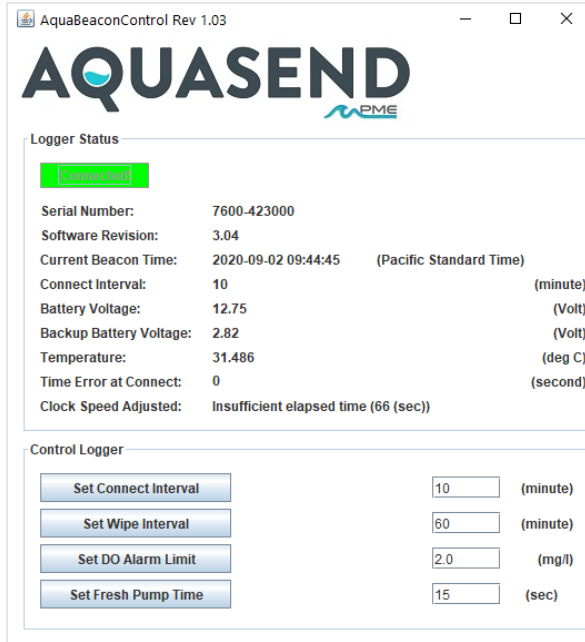
USB connection causes a brief green flash. Disconnection causes a brief red flash. If the Aquasend Beacon is telemetering when the connection occurs, red flashes show the end of telemetering and a green flash shows the start of USB connection.

In general, these programs are provided to allow Aquasend, with customer help, to control or modify the Aquasend Beacon's internal operations. Software operation requires that the Java Runtime Environment be installed on the Windows computer. This software can be downloaded from <https://java.com/en/download/> if not already present on the computer.

Aquasend may send special software separately from the Aquasend Beacon. This may be copied onto the Aquasend Beacon and used in the same way as existing software.

Most programs will only be useful to customers after specially instructed by Aquasend.

Name	Date modified	Type	Size
BootStrap	2/10/2020 11:37 AM	File folder	
AquaBeaconCircuitTest.jar	2/10/2020 11:05 AM	Executable Jar File	2,010 KB
AquaBeaconControl.jar	2/10/2020 9:59 AM	Executable Jar File	277 KB
AquaBeaconDisplayState.jar	2/10/2020 11:13 AM	Executable Jar File	262 KB
Manual.pdf	2/5/2020 4:40 PM	Foxit Reader PDF ...	554 KB

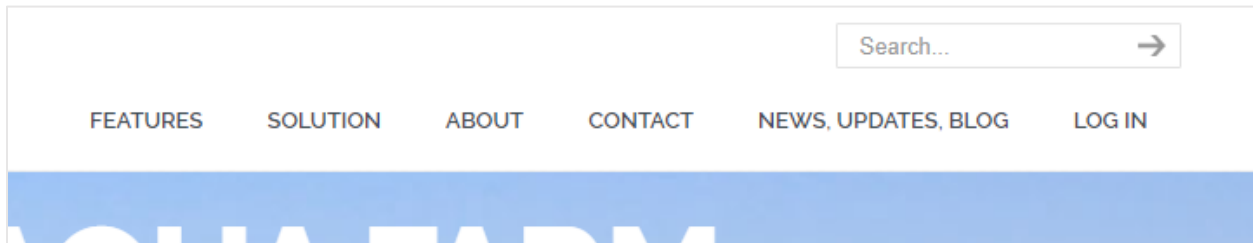


The screen shot on the left shows Aquasend Beacon’s AquaBeaconControl by way of example. Other programs are similar but display different information or give different abilities.

This Aquasend Beacon Buoy Control software allows the customer to select the connect interval, wipe interval, pump time, and alarm limit. The alarm limit is used within the Aquasend Beacon software to decide which LED indication to produce each minute. Green indications are produced for oxygen measurements above the limit; red is produced for concentrations below the limit. Software operation requires that the connection be established with the Aquasend Beacon.

CHAPTER 5: OPERATION OF INTERNET PORTAL SOFTWARE

Each farm will get an email from Aquasend to set up an account on the Aquasend Portal. Upon going to Aquasend.com, a login button can be found in the upper right section of the website.



Click on the “Log In” link to enter in the credentials.

Email Address
farmer@farm|com

Password
.....

Remember Me

Log In

You will now be logged into the Aquasend Portal and see your farm and Aquasend Beacon information displayed. You'll also notice there is now a Portal button at the top of the screen.

CHAPTER 6: MONITORING FEATURES

In addition to measurements of oxygen concentration and water temperature, the Aquasend Beacon also transmits monitoring information that allows Aquasend to determine how the Aquasend Beacon is operating. This information is transmitted each time oxygen concentration and water temperature are transmitted. At present this information is not available to customers at the Aquasend Portal but can be made available if requested.

- Oxygen measurement quality - this allows Aquasend to determine if the oxygen sensor is damaged or making an unusual measurement.
- Battery voltage, charge level, charge status, charging current, solar irradiation - these allow Aquasend to monitor the state of the solar panel and battery.
- Aquasend Beacon temperature - this allows Aquasend to determine the temperature in the Aquasend Beacon above water.
- Wipe time and wipe current - these allow Aquasend to determine if the wiper jams or if it is experiencing unusual loading.
- Pump current for both pumps - these allow Aquasend to determine if either pump is jammed.
- Tilt - this allows Aquasend to determine if the Aquasend Beacon is floating horizontally in the water.
- GPS Position - this allows Aquasend to determine where the Aquasend Beacon is located.

CHAPTER 7: CAUTIONS

This section contains a list of cautions:

- Do not lose the USB connector cover.
- Do not lose the pressure port screw with O-ring.
- Do not put the Aquasend Beacon into a wet location (tank or outdoors) without USB connector cover in place.
- Do not expose the Aquasend Beacon to freezing conditions.
- Do not use software to make settings without permission from Aquasend.
- Do not use lift handles for anchoring the Aquasend Beacon.
- Do not place the Gateway in an area where the elements can get to it.
- If the Aquasend Beacon is not being used, it should get direct sunlight weekly for a couple hours to charge its internal battery.