SailTimer Wind Instrument™

Owner's Manual

Wireless. Solar-powered.

SailTimer Inc.
www.SailTimerWind.com

Contents

1/3/2018

Quick Start

Your new Wind Instrument is the result of precision manufacturing for the axles and jewel bearings, and sophisticated electronics for the power management system and solar charging. It uses Bluetooth LE (Low Energy, also called Bluetooth 4 or Bluetooth Smart). It opens up some capabilities that have never been possible for sailors.

Many technical specifications, features and FAQs are provided on the web site www.SailTimerWind.com. The instruction sheet that comes in the box also has a useful summary of key points for getting started. This Owner's Manual provides some additional details and procedures to allow you to use and enjoy this state-of-the-art new device.

Your Wind Instrument is designed to be self-sufficient and provide its own power outdoors in the wind, ready to transmit for years to come. When you first remove the Wind Instrument from the box and are handling it until it is mounted, it is a good precaution to avoid laying it on a table with all of the weight on the wind cups. Lay the wind cups over the edge of a table to protect the jewel bearing inside.

The Design Thinking Behind Your New Anemometer

Your new Wind Instrument has so many innovative new features that a patent was filed to document the completely different approach that was taken with this product. Most masthead anemometers have had a horizontal arm. But that attracts large sea birds, which can cause damage. Why not give it a vertical orientation? We did. It is a nuisance to have to run wires down the mast and through the cabin liner to the helm, so why not make the anemometer completely wireless? We did; SailTimer Inc. made the first masthead anemometer that could transmit to smartphones and tablets, and this is the next generation. It is also awkward to have circuit boards and wiring running through an anemometer, since the wiring breaks and the circuit boards can get wet. So as another design innovation, we put the circuit board right inside the tail of the wind direction arrow.

Durable, Top-Quality Materials: Maybe you have noticed some parts on your boat that are stainless steel but still need to be polished to keep the rust off them. To avoid that problem with the Wind Instrument, the Mounting Rod is marine-grade stainless steel, which has increased resistance to corrosion. The accessories (L-Bracket, Track Slider and Extension Bar) are also marine-grade stainless steel. For the body of the Wind Instrument, we use a special low-friction, abrasion-resistant thermoplastic called acetal (polyoxymethylene) for the vertical cylinders. The other black metal parts are rigid 6061 aluminum, with the surface anodized to prevent chalking or corrosion. We also use a distinctive solid brass nose cone, and solid brass for other parts such as the threaded housing on the jewel bearings, since brass is non-corrosive.

Lock Nut on the Mounting Rod: This metric M6 nut tightens against the Spindle or base of the Wind Instrument. This helps to protect the threads on the base, so that they can't be turned past the bottom of the threads onto the rod itself. Also, if you turn the Mounting Rod all the way in without the lock nut, it could damage the jewel bearing inside. So it is important to always use the lock nut on the Mounting Rod.

The friction between the nut and the bottom housing stops it from coming unscrewed. Give the nut a gentle tug with a wrench or pliers to make it snug against the plastic, so they won't come unscrewed. You can still unscrew the Wind Instrument from the Mounting Rod by hand or with a pair of pliers quickly and easily, without needing to undo the Mounting Rod from the masthead.

If you want a quick release for the Mounting Rod, you can replace the lock nut with an M6 stainless steel wing-nut instead, for quick removal with no tools. We don't supply the Mounting Rod with a wing-nut because most users want it to be streamlined at the masthead. But for quick removal and portability, a wing-nut is very handy. Stainless steel is preferred to coated steel, because it is less susceptible to being magnetized (which would affect the compass in the tail section).

***To be extra sure that the Wind Instrument won't somehow work itself loose from the lock nut and unscrew off the Mounting Rod, there is an argument for adding thread adhesive or a dab of caulking to the Mounting Rod when the Spindle and lock nut are tightened into place. You should still be able to turn the spindle loose later, but that extra resistance in the threads may ensure that nothing unscrews itself with the constant motion on the boat and in the wind. Mounting is the customer's responsibility, and you don't want to lose your Wind Instrument overboard, if the lock nut worked itself loose.

The Electronics are Encapsulated in the Tail

The tail of the wind direction arrow has been encapsulated in UV-resistant plastic, because the electronics are actually all right in the tail. That way, the wind direction arrow knows which way it is pointing, with no calibration. This is a very advanced design that we have not seen before. The encapsulation is clear so that the sunlight can pass right through, to the solar panels inside. The material has been carefully tested to be as durable and scratch-resistant as possible. At the same time, we wanted it to have some flexibility

so that if the metal parts work against it, the material has the ability to flex rather than crack. We also use anodized aluminum on the metal parts with the encapsulation, because the encapsulation adheres better to anodized aluminum than to stainless steel.

That adhesion helps to avoid leaks. However, if you do ever notice any wearing or gaps around the 3 metal parts in the encapsulation in future years, a simple solution will be to put a drop of clear caulking around the gap. We don't anticipate that this should be necessary, but as we know, a good mariner is always on the look-out for wear & tear, and chafe.

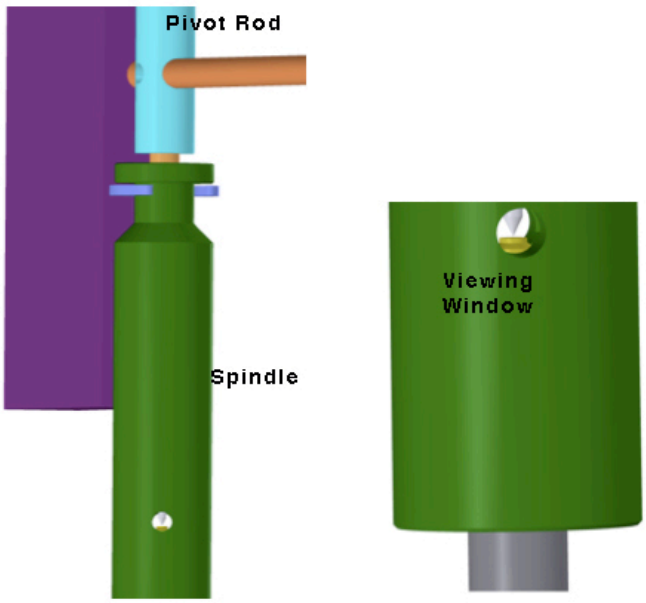
There is also a design innovation for how the spinning wind cups are measured for wind speed, when the electronics are all sealed inside the tail of the wind direction arrow. There is a tiny magnet on the bottom flange of the wind cups. Rather than the usual approach of running a wire from an axle sensor on the cups to a circuit board, we use a tiny magnet on the flange of the wind cup base. As it comes around, it reaches through the sealed plastic of the tail, and triggers a sensor inside. That lets your Wind Instrument be waterproof and submersible.

2-Jewel Mechanism

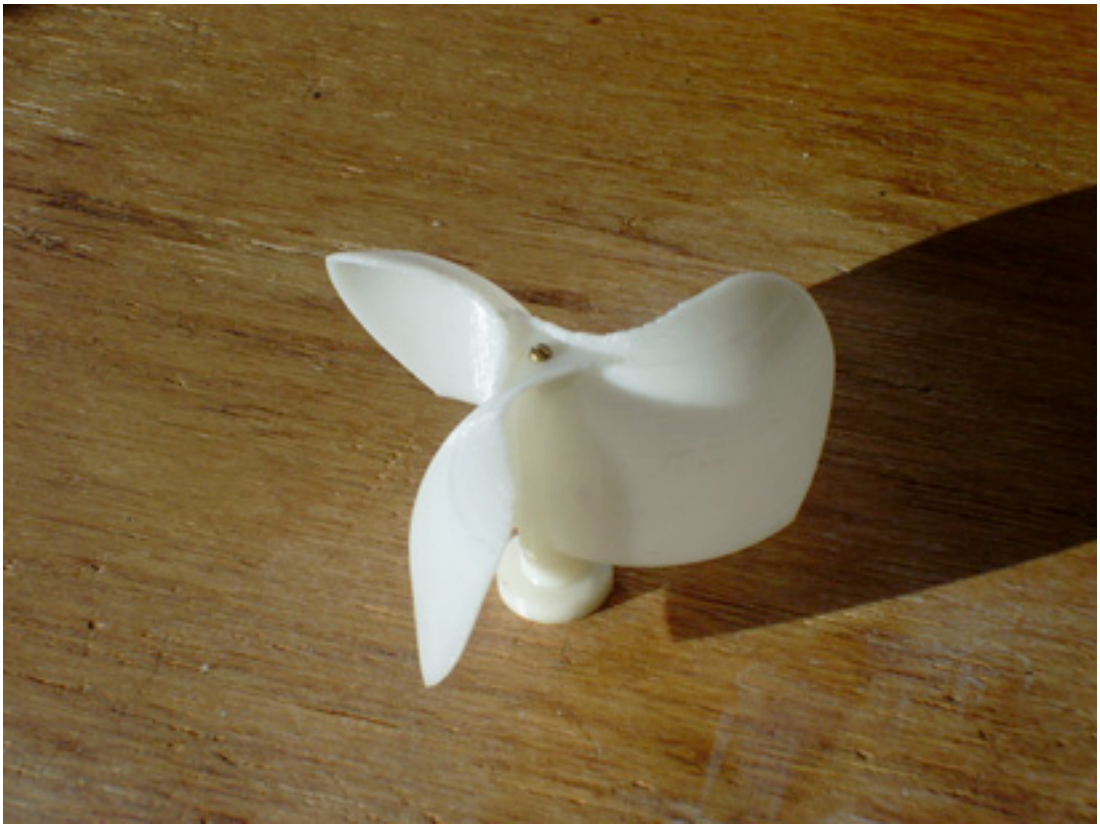
To provide rotation with virtually no friction, we use needle bearings with jewels, similar to those used in precision watch mechanisms. The peephole or viewing window in the Spindle or base of the Wind Instrument ensures that the Wind Direction Arrow is seated properly on the jewel.

Typical masthead anemometers use ball bearings packed in grease around an axle, all of which adds drag. But think of the point of a pin rotating on a surface harder than steel: no friction whatsoever. That is how the jewel bearings work in the Wind Instrument. Unlike electronic sensors (potentiometers) and axle bearings, jewels are also submersible, which is another advantage of this innovative new design.

The viewing window is shown in the picture below. It lets water drain if necessary, and allows you to adjust the spacing with a flat-blade jeweler's screwdriver, if an adjustment is needed in future. You can insert the jeweler's screwdriver into the Spindle from below to turn the jewel thread, which will adjust the spacing between the Spindle and the Pivot Rod above it. Similarly, you can turn the brass thread in the jewel in the top of the wind cups, to adjust their spacing above the Pivot Rod. These have all been pre-set at the factory, but can be adjusted in future if necessary.



Adjustable jewel bearing in top of wind cup blades:



Secure Transmissions

Only one device can pair with the Wind Instrument at a time, to minimize power consumption. However, you may be able to retransmit the wind data in the receiving unit. For example, the SailTimer™ app can retransmit wind data using wifi, as can the SailTimer Mini-Server™ accessory for the Wind Instrument.

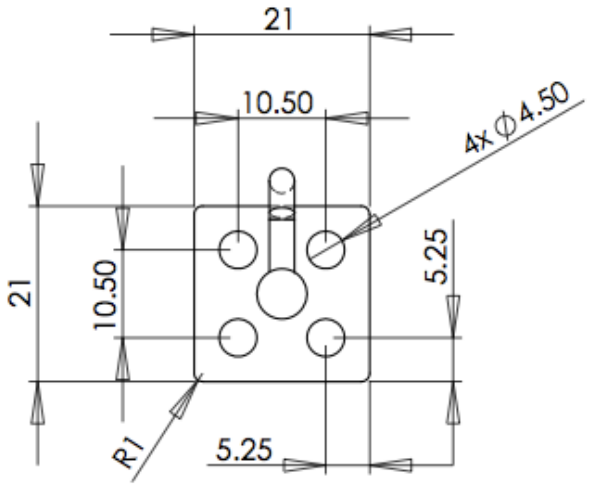
There are also security advantages to having only one user connect to the Wind Instrument, ensuring that someone else is not unintentionally receiving your wind data. They could not anyways, because the data transmitted from the masthead is encrypted.

When you get your Wind Instrument and first connect to it, you can rename serial number of the Bluetooth 4 connection, to make it easy to identify in future use. That way, you don't have any concern that you have connected to a different boat's Wind Instrument. (Which would not last long anyways, once they sailed away.) Bottom line: only you can connect to your Wind Instrument, with an encrypted, secure connection, and you cannot accidentally receive wind data from a neighboring boat.

Installation

The Wind Instrument can transmit up to 100 feet or more (30.5 m) with direct line of sight. It sends the strongest signal downward, since it is usually mounted up on a masthead or pole. You may also find that a tablet like an iPad can receive the signal more strongly when on the periphery of transmissions in certain orientations, like with the glass screen facing the Wind Instrument. When mounting the Wind Instrument, it helps to try to place it on the masthead in an optimal position. If it is in view of the helm, the cockpit or the cabin, the signal will be stronger than if it is trying to go through a metal mast. Metal seems to be the strongest obstruction, but with other materials like glass, fiberglass, wood or drywall, the Bluetooth 4 LE signal (and wifi) can typically pass through one or more walls. For optimal placement on the masthead, the goal is to keep the Wind Instrument in view as much as possible.

Mounting Pattern for Drilling Holes
The drill pattern for the holes in the foot of the Mounting Rod are shown below. The units are in millimeters. For example, the four holes are 4.5 mm in diameter to fit the fasteners that come with the foot plate (which is just 21 mm square).



Units in mm.

The fasteners provided are size #8-32 stainless steel; nuts & bolts are provided in this size, and also screws in case you can't access the underside of the masthead to put a nut on.

For the #8 screws, drilling holes in the soft metal of the masthead with a 9/64-inch drill bit will provide a very snug fit, so the screws won't come loose. The screws have a wide head on them, so no washers are needed.

A threaded machine bolt and nut may hold better than a screw (assuming your masthead is aluminum). So the strongest attachment may be the bolt and nuts that come with the product -- although sometimes it is hard to get at the under side for the nut.

It is also possible to tap 4 threads in this pattern into the masthead, and add lock washers. Tapping is a way to get the same holding power, without needing the nut underneath.

L-Bracket
If you don't have space on top of the masthead, the optional L-Bracket allows you to mount on a vertical surface like a wall or the side of the mast. It has the 4-hole pattern on the horizontal part of the L, for the foot of the anemometer to bolt on to. For side-mounting, there are 3 holes, also for a #8 screw (4.5 mm in diameter). The outer two are 1.25" (31.75 mm) from center to center, with the center hole in the middle between these.

If mounting onto the side of masthead, it is better to put screws into the vertical side of the solid aluminum masthead itself, not into the thin aluminum of the hollow mast. Trying to hold screws in the side of the hollow mast itself doesn't give much purchase because the aluminum is so thin. You may also be able to put long stainless steel bolts right through, to have a more secure attachment. Or if you have a space free at the top of a small boat mast, you may be able to use hose clamps to securely hold the L-bracket, rather than trying to use screws in the side of a hollow mast.

Stanchion Mount with Wing-Nut Hose Clamps
In the photo below, rather than being mounted on top of a masthead, it is mounted on a stanchion using a handy L-bracket accessory.

Use the L-bracket with the L upside down, which ensures that it can't slide out the bottom of the hose clamps. The L-bracket comes with special wing-nut hose clamps that can be tightened by hand without any tools.

Off-Season Removal
You can leave the Mounting Rod or the L-bracket in place all winter if you want. That may less wear on the screw holes, than taking the screws out every year. It is fast and easy to unscrew the lock nut below the black base (the Spindle) of the anemometer, and turn the black base (the spindle) off of the stainless steel Mounting Rod.

If you have the thin design of the 2016 or later Wind Instrument, it has the blue cap for the off-switch, so storing indoors for the off-season is recommended. The LED on the tail (below the CE logo) blinks every 4 seconds when Bluetooth is not connected. You'll see that you can make the blinking stop/start by putting the blue cap over the top edge of the tail, to activate the magnetic off-switch at the top of the circuit board. We use a magnetic off-switch so that there are no seams around a button that could leak. Be sure only to snap the blue cap in place on the top of the tail, but since it contains a magnet, keep it away from the rest of the tail electronics because of the digital compass there.

Depending on your location, it may be possible to leave 2016 and later Wind Instruments in place outside in the off-season, although below freezing the battery functions less effectively the colder it gets. This battery does work in an exceptionally wide range of outdoor temperatures. Flat batteries are not covered by warranty, so battery care is the user's responsibility. Temperatures below freezing may also cause the protective resin that encapsulates the tail section to contract slightly, which may cause some warping in the tail. The tail mostly goes back to normal when the weather warms up again. The tail is intentionally designed to be as thin and light as possible. So to avoid any long-term issues from flexing or warping (which is avoidable so not covered by warranty), if you have temperatures below freezing in the off-season we recommend storing your Wind Instrument indoors and using the off-switch.

If you have the 2015 model with no off-switch, it needs to be fed during the off-season (solar-charged). Since the battery is less effective if your temperatures are below freezing, bringing it in to warm temperatures and putting it in a window tilted up at the sun is the best way to ensure that the battery stays fully charged. If you monitor the battery level and you don't get extreme sub-zero temperatures in the winter, you may find that you can keep the 2015 version outdoors and maintain a charge (depending on local conditions). The 2015 version should not be stored in the dark with no solar charging, which will flatten and eventually damage the battery (and is not covered by the warranty). If you do temporarily flatten the battery with the 2015 version, note that the battery level displayed is not correct until the battery has been fully recharged to recalibrate again.

How to Install at the Masthead Without Lowering or Climbing the Mast

As described in the mounting options section of the web site, we have developed two procedures for raising your SailTimer Wind Instrument™ from deck level. Since this is really the beginning of wireless marine electronics, there has been little need to develop a system like this until now. But we get a lot of requests from customers who want to use our wireless anemometer on a boat that is already in the water, with the mast already up. So this gives you two convenient options for being able to use wind data right away.

Cantilever Method
You may have noticed the loop on the side of the Mounting Rod that came with your Wind Instrument. That is used with the Cantilever Method we have developed. This is the lowest-cost procedure.

Attach an extra pennant or foresail halyard to that metal loop on the Mounting Rod. Then add a thin line (e.g. 4-mm diameter) through 1 or 2 holes in the foot, as shown in the photo at right. It is amazingly simple: just raise the Wind Instrument with the halyard, then pull down on the thin line to swing the Wind Instrument upright like a cantilever.

Depending on the shackle or rope on the end of your halyard, you can usually make the Wind Instrument more vertical by tying around the Mounting Rod itself and through the loop. If you tie only to the loop (as with the shackle shown in the photo on the bottom of the previous page), the Wind Instrument tends to tilt out a bit. It is better to connect around the Mounting Rod shaft and through the loop, if possible.

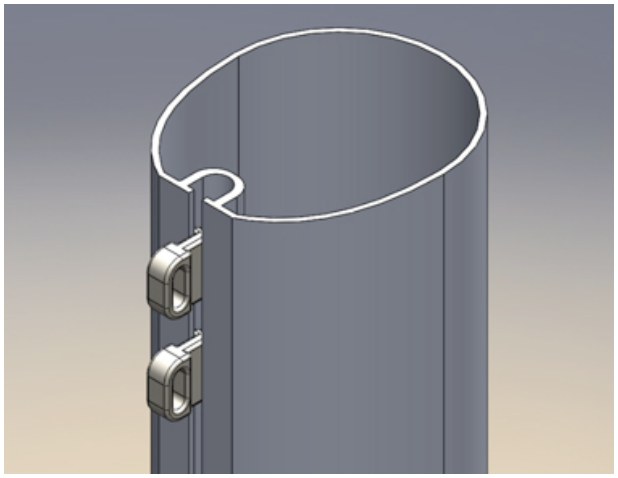
When lowering the Wind Instrument, its structure is designed to withstand strong wind forces. But it is a sensitive scientific instrument. So be cautious not to force it, if it gets hooked on something on the way down. It is held together vertically by the black C-shaped retaining clips. They are strong enough for the wind, but not as strong as you hauling on a halyard.

Pennant halyards are often found on a side deck, going up to a spreader. We don't recommend using the pennant halyard on a spreader, because the Wind Instrument would be blocked by the sails on some tacks. If you don't have a spare halyard going up to the masthead or want to try a different method, then it is best to use the Track Slider below.

SailTimer Track Slider™
Use this method if you don't have a spare halyard from a spinnaker or pennant, or if you need a more secure attachment. We hope that this procedure looks simple, but it actually took a lot of designing, prototyping, testing and refinement, since most mast tracks are unique.

The general approach is to raise the Track Slider up the mainsail mast track. Most mainsails have a rigid headboard on the top corner, and possibly also a few extra inches on the track above the mainsail. The Base Plate (photo at right) on the Track Slider is designed to sit flat against the mast, inside the mainsail halyard and the headboard on the top corner of the mainsail. The base plate itself only takes up 1 inch vertically at the top of the mast track. It has been tested with lots of different mast and sail types, although there may be rare examples where it won't fit (and can be returned for a refund).

The Base Plate is held in position by 2 slider cars in the mast track (which you provide, since there are different varieties on each different boat). A cable tie is provided that holds the slider cars in notches on the Base Plate. This holds the Base Plate in-between the two slider cars, straight and tight to the mast track.



Next, attach two shackles through the two larger holes in the Base Plate, as shown in the photo at right. Use shackles that fit whatever clip or knot you have on the end of your halyard. Connect both shackles to the mainsail halyard, as shown in the photo below. If you tie the halyard rope directly to the two shackles, be sure the rope cannot rub on the edge of the base plate. If you use a shackle as shown in the photo below, use a shackle as short as possible, to let the base plate get closer to the masthead.

With the mainsail halyard being used to raise the Track Slider, you'll need another pulley block for the mainsail. Attach this pulley block for the mainsail to a shackle that is either on the mainsail halyard shackle or above it on the halyard itself (e.g., on a knot in the rope above - or on the loop attaching the shackle to the mainsail halyard), being careful to avoid any chafing areas on the rope. Then put a new rope through this new block to serve as the new mainsail halyard, so that the top plate on the mainsail will come up and over the Base Plate.

We provide cable ties, and three pairs of lock nuts and bolts in the Track Slider package. However, we thought you would prefer to provide your own block (pulley), because we didn't know which size you would want. Mainsail blocks/pulleys tend to be expensive, so this gives you some control over what size and price you prefer. The same is true with the additional mainsail halyard rope that you'll need to provide.

With the rig set up, you can then pull your original mainsail halyard to raise the SailTimer Track Slider™ to the masthead. It can stay there until you get access to the masthead for more permanent attachment of the Mounting Rod to the masthead with nuts & bolts. You can then also raise/lower the mainsail, using the additional block and halyard that you added. The photo above shows how most mainsails have an area at the top that will pass right over the base plate at the top of the mast track.

Finally, once the Track Slider rig is raised to the top of the mast, you can use a thin rope to pull the Mounting Rod vertical once the masthead is cleared. Attach this thin line to the loop on the Mounting Rod as shown in the photo below, or to base of Mounting Rod. It should be diagonal across above Base Plate, so that when you pull on the thin line, it will straighten the Mounting Rod and Wind Instrument to vertical. The thin line can also be used to pull down the SailTimer Track Slider™ later.

Repair and Maintenance

Your Wind Instrument contains an extremely sensitive digital compass, so like all compasses it needs to be kept away from magnetic fields. As noted on the outside of the white box, you should not put it through the carry-on scanner at airport security. There is a magnet in the blue cap for the off-switch, so do not lay this on the tail section, or store them side-by-side. The blue cap should only be placed on the top edge of the tail, but never kept near the battery, which has a steel case that could be magnetized.

If you ever needed to disassemble the unit (e.g. to replace broken wind cups), this is easily done. There are instructions here for loosening the dome nut and set screw, to allow the tail to be pulled back: www.sailtimerwind.com/replacement.html. That moves the retaining clip away from the flange of the wind cups, so that you can lift the wind cups off. We would recommend not unthreading the brass nose cone, since it is firmly in place with adhesive, and you don't want it to work itself loose in future. If you do remove it, add adhesive on the threads when you turn it back on.

Generation 4 of the Wind Instrument started shipping in August 2016. It had the new AirGap Axle™ for better performance, less sound and less maintenance. An updated version of the AirGap Axle started to be used in mid-January 2017, which has extremely precise machining. It is quieter and is maintenance-free. For earlier models of the Wind Instrument, the AirGap axle can be added as an upgrade and is listed on the Accessories page of the web site.

If you have an earlier model and the wind cups are making sound when spinning, some maintenance may be needed if that becomes noticeable. Depending on where you have mounted the Wind Instrument, you may not hear a spinning sound over the wind noise. But lubricating the axle will eliminate all sound. It is best to remove and lubricate the wind cups using the instructions on the link above.

Power Management

The Wind Instrument is one of the first devices in the world of any kind that can transmit to smartphones and tablets powered only by solar panels. At SailTimer Inc. our engineers have done extensive R&D to make the power consumption in the Wind Instrument extremely frugal.

When using the SailTimer API™ or a mobile app, there are a few things that you may want to be aware of regarding battery levels. First, in the API on both iOS and Android there is a Disconnect button. If you are not using the Wind Instrument while on board (e.g., at night), or are leaving the boat, this allows you to disconnect until next time. Shutting off the Bluetooth transmissions preserves power in your iPad/ iPhone. Plus, when the Wind Instrument is not connected on Bluetooth, it uses up to 45% less power.

The 5th-generation Wind Instrument (which started shipping in June 2017) has a sophisticated battery charging system that monitors solar charging and power consumption. It allows you to check battery levels in the API at any time for an accurate reading. For filling up the battery, it will charge faster when turned off with the blue cap. However, the battery gauge circuitry is not getting power when turned off, so it resets to the factory level of 2 bars as if only partially full. Your Wind Instrument will need to be turned on and get a bit of charging out in the sun again, to start to display when it is full (4.2 volts). If you are charging it for 3 days, one strategy would be to charge it with the blue cap for the first two days, then let it run on the third day while topping up the battery, which will activate the battery gauge.

For the earlier 2016 version, it may be useful to understand how the battery-level indicator works. The Wind Instrument has a very advanced battery that is designed to provide constant voltage to the circuit board, even as it loses power. That makes it tricky to measure the battery level; the battery always appears full (until it is nearly empty). But we have tried to make the battery levels as informative for you as possible. When the solar panels are providing electricity, that will cause more bars to appear on the battery-level icon, and this may linger for 3-6 hours. But the next morning, before the sun is on the solar panels, you could get a better indicator of the actual energy store in the battery. Even if the battery icon shows 4/4 bars through the day in the sun, if it is lower at the end of the night, that is a more reliable indicator of the actual energy in the battery (and how effective your solar charging is, given your weather, latitude and season).

The 2015 version of the Wind Instrument (blue tail section) uses a different system for measuring battery levels. If the Wind Instrument is not functioning because the battery power is too low, it needs to be charged up to full again before the battery level readings are meaningful. That allows the 2015 version to calibrate the full range of voltages at all battery levels.

Recharging
When your Wind Instrument first arrives, the LFP lithium battery usually only has a partial charge because of UN/DOT and IATA manufacturing regulations. You'll be able to test and use it, but as noted on the instruction sheet in the box, it is best to fully charge the Wind Instrument before mounting on the masthead.

If the blue LED is not blinking (below the CE symbol), the battery is flat. Don't leave the battery flat for a long time or it could affect the battery chemistry. In normal operation, the unit is always on, because it needs to listen for your connection. But it is designed to generate far more power than it consumes, for continuous ongoing operation night and day. Do not throw away the blue cap for the magnetic off-switch. You may want to shut the unit off in future for testing, for storage, or for warranty service.

Recharging the battery takes far more power than normal operation of the device. So you'll need to lay it horizontally, tilted up at the sun (like in this photo). If convenient, turn it to follow the sun in morning and afternoon. Just lay it in a lawn chair for example, facing south east in the morning and south west in the

afternoon. Even in tropical latitudes horizontal charging works best, because the sun is overhead through mid-day and does not hit the solar panels directly if the unit is mounted vertically. The more directly the solar panels face the sun, the faster your charging will be. One or two sunny days like this will usually get it charged enough to turn on, and a third day to fully top up the battery. It will still charge on cloudy days, but not as fast. The charging is faster outside rather than through a window. Solar charging is also faster with the blue cap on the off-switch, because the unit is not consuming power then.

NMEA 0183 Sentences

NMEA 0183 is an open industry-standard format for data sent between marine electronics. The SailTimer Wind Instrument™ sends the wind speed and wind direction in NMEA 0183 format, as shown below. The SailTimer™ chartplotter app (and Charts Edition) can receive that data, and we also encourage third-party apps to receive the wind data too. It is also possible to send this data into the wiring for marine electronics, using the SailTimer Mini-Server™.

MWD Sentence
The format of the NMEA sentence that we use is: $WIMWD,148,T,166,M,1.2,N,0.6,M*--

The initial 2 letters after the $ are the talker-ID, with WI specifying that it is Weather Information. Then the MWD indicates that it is wind speed and direction. Note: MWV is a common sentence for wind *angle*, which we have used previously. However, this new version of the Wind Instrument has a built-in compass, measuring wind direction. It does not need to be calibrated to the bow of the boat; it knows which way it is pointing. Therefore we use the MWD sentence for wind direction, not wind angle.

All of the wind data in MWD is True wind (not Apparent or Relative). 148,T is the wind direction in True (non-magnetic) degrees. 166,M in the above example is the Magnetic wind direction.

1.2,N is the wind speed in knots, which is represented by N in the sentence. 0.6,M is the wind speed in meters per second. Finally, the 2 digits after the '*' is a checksum.

Proprietary STW Sentence
There is no NMEA 0183 sentence for Apparent wind speed and direction. When the specification was set up probably in the early 1990s, perhaps it did not seem possible that a compass could ever be built right in a masthead anemometer. So NMEA 0183 only includes sentences for apparent wind *angle*, not direction. But we don't want to convert from Apparent to True for the MWD sentence, send that data to an app, and then re-convert it back to Apparent. Doing the math twice makes the data less precise. Therefore, we added a proprietary sentence (initially only in the API in iOS, although the same logic is used in the Android API without this specific format). It is acceptable within the NMEA 0183 specification to use a proprietary sentence, if it begins with $P to indicate that it is proprietary, and then some characters to identify what it is. So iOS users will see the following data in the green text, and here is what it means:
$PSTW,116,T,133,M,0,N,0.0,M*03

$P - Proprietary sentence
STW - SailTimer Wind Instrument
116,T - Apparent Wind Direction (AWD) in True-North reference
133,M - Apparent Wind Direction (AWD) in Magnetic-North reference
0,N - Apparent Wind Speed in knots
0.0,M - Apparent Wind Speed in meters per second
*03 - Checksum

Bon voyage.