Analog Underground Locating

Prototek

Underground Locating Equipment

Ardy Analog Kit

During any use of this equipment, priority must be given to following national and local safety requirements. The equipment is not approved for use in areas where hazardous gases may be present.

Underground Analog Locating

Welcome to the Prototek locating family. Throughout this manual we will talk about the basics of analog locating. The same principals apply to both the Ardy and Ferris systems. Your skill at handling these tools and recognizing their strengths and weaknesses is what makes a locating job successful. So best to practice before arriving at the site.

Why do we call these "analog" tools?

Analog technology is relatively "old fashioned" but it remains solid and reliable as a result. Our analog locating tools use meters and speakers to guide you to the strongest signal. Many find the analog tools "friendlier" and more intuitive than digital tools. It's really a matter of preference. Once you master analog techniques, there is nothing you can't accomplish with Prototek's analog tools that a digital tool can do.

The following pages will take you through all the steps necessary to understand and use your equipment. We strongly recommend that you pay close attention to the section "Getting to Know your Tools", and come back to it whenever you have questions about the responses you are seeing on actual locating jobs.

This advice applies whether you're a rookie at underground locating or an "old pro". Prototek tools are extremely simple to use, and it's easy to outsmart yourself if you're used to more complicated equipment and procedures.

Prototek uses two frequencies with our analog equipment. The Ardy receiver paired with the ATP-12 use the 223 KiloHertz and the Ferris paired with the FTP-8 uses the industry standard 512 Hertz frequency.

Please note: These instructions should be considered guidelines. Every locating job presents unique challenges, and although most will yield to "textbook" procedures as described here, many will require a creative approach. We strongly advise that you familiarize yourself with the fundamentals of analog locating described in the "Getting to Know your Tools" section. Armed with this knowledge, you will be able to tackle most locating challenges.

Product Specifications

FR-1 I Ferris

AR-1 I Ardy

These analog locating receivers are solid, reliable and affordable. They are both well suited for locating sondes that emit either continuous or beeping tones.

The FR-1 operates at the industry standard frequency of 512 Hertz, which will penetrate cast iron as well as nonmetallic lines.

The AR-1 detects sondes transmitting at a Prototek proprietary frequency of 223 KiloHertz, and is ideal for septic tank locating and nonmetallic lines.

Easy to use controls and clear feedback from the meter and speaker guide the user to fast, accurate locates and support precise depth determination.

Specifications

Frequency ..... FR-1: 512 Hz, AR-1: 223 KHz
Power source ..... 6 AA Alkaline
Battery life .....30-40 hours
Controls .....On-Off/Sensitivity, Near/Far toggle switch, battery test button
Outputs.....Signal strength meter, speaker, headphones
Dimensions.....21” x 5” x 4”
Weight.....1.5 lbs. (0.7 kg)
Operating temperature..... -20 to +130oF (-29 to +54oC)
FTP-8.....512 Hz, continuous tone, 5 hours use time, cast-8ft, nonmetallic-12ft
ATP-12.....223 KHz, Beeping tone, 10 hours use time, 12ft nonmetallic only

FR-1| 512 Hz Frequency Receiver

The antenna is what picks up the signal from the transmitter. It will also point you in the right direction of the line.

The blue FTP-8, 512 Hertz flushable transmitters are a great companion with the FR-1 receiver.

Meter indicates the strength of the peak signal to the right and the null signal to the left.

The sensitivity knob is also used to turn the receiver on and off. It allows you to control the amount of signal you see on the meter and hear from the speaker.

The red button lets you test your battery strength. Press and hold down the button when the receiver is on. If the needle is in the green your batteries are good.

The near/far switch is to help you further control the amount of sensitivity. As you begin a locate you are furthest away. Position the toggle switch to far and as you hon in on the transmitter switch to near to lower the sensitivity.

The speaker allows you to hear the transmitters signal.

Headphone Jack can be used during a locate on a noisy site.

On the back side is the battery compartment. Slide the cover off and replace with 6 AA alkaline batteries.

AR-1| 223 KHz Frequency Receiver

The antenna is what picks up the signal from the transmitter. It will also point you in the right direction of the line.

The orange ATP-12, 223 KiloHertz flushable transmitter will only work with the Ardy(AR-1) receiver.

Meter indicates the strength of the peak signal to the right and the null signal to the left.

The sensitivity knob is also used to turn the receiver on and off. It allows you to control the amount of signal you see on the meter and hear from the speaker.

The red button lets you test your battery strength. Press and hold down the button when the receiver is on. If the needle is in the green your batteries are good.

The near/far switch is to help you further control the amount of sensitivity. As you begin a locate you are furthest away. Position the toggle switch to far and as you hon in on the transmitter switch to near to lower the sensitivity.

The speaker allows you to hear the transmitters signal.

Headphone Jack can be used during a locate on a noisy site.

On the back side is the battery compartment. Slide the cover off and replace with 6 AA alkaline batteries.

Getting to Know your Tools

The AR-1 “Ardy” and FR-1 “Ferris” receivers both help you locate transmitters(aka sondes) the same way, using a meter and sound to help guide you to peak signals and other specific locating landmarks. The major difference between the two is the frequency at which each operates - 223 kiloHertz for Ardy and 512 Hertz for Ferris. This in turn dictates what kind of material you can locate through; the Ardy equipment works only in nonmetallic environments (concrete, clay, PVC, etc.) while the Ferris will work in cast iron in addition to the nonmetallic environments. **Note:** *You must match the ATP-12 transmitters with Ardy receivers, and 512 Hertz transmitters with the Ferris - they are not interchangeable.*

A good battery is indicated by the needle being in the green area when the red button on the handle is pressed.

First let’s take a look at the meter. As with any signal strength meter, when the needle is at the far left it means little or no signal, and as it goes to the right it means the signal is stronger. But why is zero near the middle? It’s marked this way to encourage you to “ride” the sensitivity controls to keep the needle in the center of the range (between 0 and +4). That way you will be able to detect any change in the signal: *nulls* when the needle suddenly drops to the negative end, and stronger signals that will push the needle to the right. (Nulls are described in detail on the next few pages.)

Please note: If you’re using a “beeping” transmitter, such as an ATP-12, the meter will “bounce” with each beep. You will still be able to detect the difference between strong and weak signals by paying attention to the highest point the meter needle reaches on each bounce.

The best place to practice is above ground where you can see how the receiver responds to the location and position of the transmitter. Do your practicing outside where you have plenty of room to move around. Before you turn on the transmitter do a survey of the area for electrical interference. To do so turn on the receiver, switch to far and turn the sensitivity all the way up. Now walk around the area to see if there are any "hot spots". Keep a mental note of these "hot spots”. Now turn on a transmitter and toss it on the ground. Walk about 20 feet away and turn on the receiver. Set the switch to far and turn the sensitivity up all the way clockwise. You may hear some noise but the meter should sit at the far left with no distinct signal. For more details Check out "At the Jobsite”.

Now walk around randomly, holding the receiver level, at waist height, toward the general direction of the transmitter, slowly sweeping the receiver back and forth. As you point toward the direction of the transmitter, the signal will get louder and the meter will begin to rise. Try to maintain a meter reading in the center of the scale. Turn the sensitivity down as needed to keep it in this range as you get closer. When you're unable to keep the meter below full scale, flip the switch to "Near". Keep moving in the direction that makes the signal stronger.

When you have reached the point that the signal seems to be strongest, and any direction you move makes it weaker, mark that spot directly below the center of the antenna rod. Move to another place and seek this peak signal again and see if you always come back to the same spot. You should find yourself right over the transmitter each time. If you don't, keep practicing until you get consistent results.

I keep finding "dead" spots!

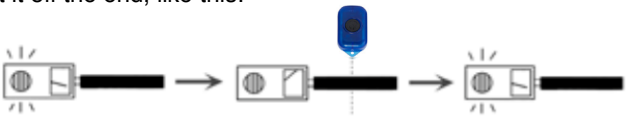
That's good news! And if you haven't noticed any "dead spots", let's go look for some. These dead spots are known as "nulls", and they are the key to accurate, precise locating.

As we find nulls, notice that they happen at very sharp and precise places, unlike "peak signals" which are much more generalized. Let's look at a clear demonstration of a "peak" and a "null".
Note: *Be sure to do all these tests with the receiver held level, at waist height.*

Hold the receiver directly above the transmitter, parallel to the long axis of the transmitter. The speaker is loud and the needle goes all the way to the right. This is called a peak signal.

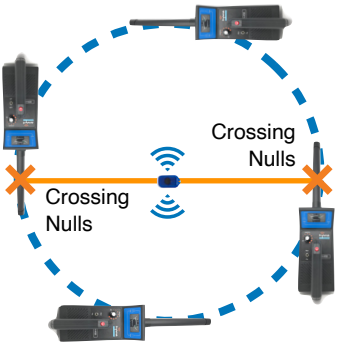
Now turn the receiver to be perpendicular to the transmitter. The signal suddenly drops to almost nothing. This is called a Null. Move the receiver around a little to see how sharp and precise this null point is and how dependent it is on being exactly perpendicular.

Now let us look at some other places to find Nulls. Back away from the transmitter and walk past it off the end, like this:



There was a null just as you crossed the axis of the transmitter, just like before! This is called a “crossing null” and it is a very good thing to know about. Walk around and see that the crossing null is detected any time you cross either end of the transmitter, no matter how far away you are as long as you are within range.

Now for the real beauty of crossing nulls. Walk in a 5 foot circle around the transmitter with the receiver rod held straight in front of you and notice that you get a crossing null at two points of the circle, directly across from each other and on a line that runs right through the center of the transmitter, parallel with its long dimension.



What’s so special about this? Well, imagine that you can’t see the transmitter, which is just like a real locating situation. In fact, have someone put the transmitter under a box or newspaper and orient it in a way you can’t see. Using the circle method, you can quickly determine which way the transmitter is lying. And in a real pipe, almost always that means that the pipe lies along that line, too. That can be very useful information when trying to locate in unknown lines, but it has even more usefulness for the next step in precision locating: determining depth.

Determining Depth Before you Dig

When locating a transmitter underground, you will do the front and back null determinations described below at ground level, *with the receiver at ground level*, and the calculated depth will then be the distance between the top of the ground to the transmitter, which is its true depth. In this exercise, you will hold the receiver level at waist height because the transmitter is actually on top of the ground.

When you have found the crossing nulls on your circle walk, mark them on the ground with something like a stick or a rock. A straight line drawn between these markers will run right through the middle of the transmitter. Step away a bit and begin walking the line slowly, from outside the circle toward the middle, again holding the receiver level at waist height.

Watch carefully, and you will find a null again a foot or two before you reach the center of the circle. Mark this spot as precisely as you can, by putting another marker directly below the center of the receiver's antenna rod, then continue to walk toward the center. At the center, you will encounter the peak signal when you are right over the transmitter. Mark this spot. Continue to walk the line, now away from the transmitter, until you encounter another null about the same distance away from the center as the first one was. Mark it also. You have just discovered the front and back nulls.

Measure this distance in inches then multiply by .7= depth in inches

Measure the distance between the front and back nulls in inches and multiply by 0.7. That is the depth of the transmitter in inches, directly below the peak signal mark, which is halfway between the front and back nulls. It's that simple!

For example, if you measured 50 inches between the front and back nulls, then the depth is calculated by multiplying **50 x 0.7 = 35** inches.

Now you may be saying, "That's not the depth! The transmitter is lying on top of the ground." OK, let me modify that. You have calculated the distance from the center of the transmitter to the center of the receiver rod, at the peak signal point. The "depth" you calculate in this exercise should be about the height of your belt above the ground. **Remember, when you're locating an actual transmitter underground, you will do these determinations with the receiver held at ground level.**

With what you have learned here, you will be able to go out and be successful at locating a transmitter you have sent underground without knowing in advance where it is. Be sure to read "At the Jobsite" for tips and tricks in the field. Happy locating!

At the Jobsite

Before starting any locating job, please perform the following.

Survey the area

Before turning on any transmitter, turn your receiver on, flip the switch to “Far”, and turn the sensitivity all the way up. Walk around the area where you will be locating and check for sources of noise or interference. Buried power lines, nearby computers and other electrical sources can all cause the receiver to respond as though there is a transmitter in the area. Mark any of these “hot spots” so you won’t be fooled by them when you’re locating.

Test your equipment

Turn on your transmitter and set it on the ground, then turn on the receiver and turn up the sensitivity. Be sure you are getting full range out of your equipment. For an Ardy receiver you should be able to walk 12 feet away from the ATP-12 flushable transmitter, with a Ferris receiver you should be able to walk 12 feet away from a FTP-8 flushable transmitter, 15 feet away from a FD-10 DuraSonde transmitter or 25 feet away from a FD-20 DuraSonde transmitter and get a signal on the meter (at maximum sensitivity). Anything far less than this requires fresh batteries and another run through this test. If this doesn’t solve it, there may be a problem with the transmitter or receiver (see the Troubleshooting section).

Using Flushable Transmitters

The flushable ATP-12 or FTP-8 transmitters are small enough to pass through 3 inch lines. You can free-flush them through the plumbing to the tank; when you open the tank, the bright flashing LED on the transmitter should be seen floating near the inlet baffle. Once retrieved, turn it off so you can use it on the next job.

How to turn a flushable transmitter on and off- Hold the button down until the LED lights up, then let go - the LED flashes and it's ready to use. Hold it down again until it lights up steady, then let go and it's off. When the LED turns red, you have one hour of battery life left. Be sure the LED is no longer flashing when you are done. An easy way to double check if the transmitter is off is to turn on your receiver and check for signal.

- Find the toilet you believe is closest to the tank.
- Flush the toilet. When the water develops a good vortex, toss in the transmitter.
- As it leaves the building, the signal will diminish. Go outside and "hone in" on the signal using the peak method. If the drain is not blocked the transmitter will go straight to the tank.
- Extra flushing may be needed if the tank is far from the toilet. You may need to partly fill a nearby bathtub, then empty it to get sufficient flow. If the building is locked, the transmitter can be flushed down a roof vent or exterior clean-out using a garden hose.

If the dig-up is to be done later, attach a fishing line or string to the eyelet so that the transmitter can be pulled back out of the line. You can also use this method to slow its voyage so the line can be traced. If there is a possibility that the tank is made of steel (which will completely block the signal from either of these transmitters), send it down the line with the fishing line attached. If you lose signal suddenly, it's a good sign that it's reached a steel tank. Pull back slowly on the line until you detect the signal again. This location will be the inlet point of the tank.

Flushable transmitters have a shelf life of about 1 year. If you store them in a cool place you will get maximum life out of them. An ATP-12 has 10 hours of use life, an FTP-8 has 5 hours of use life. If you keep track of how long they were ON at a job you can get many uses out of each one.

Sonde Locating

When using a camera sonde(transmitter) or a sonde with replaceable batteries on a push rod, your best locating success will involve moving the transmitter in small increments. Push it 5 to 10 feet, locate it using all the steps, then repeat this process until you have reached your final locate position. It can be easy to be fooled about the route of a line when you can't see it, and you can waste a lot of time retracing your steps if you lose track of the transmitter.

If you are locating a septic tank using a flushable transmitter, follow our flushing guidelines. If the tank is close to the building you should find it pretty quickly. If you suspect it is farther away, and its direction is uncertain, it can be helpful to tie a string or fishing line to the transmitter before flushing it, letting it go only 5 to 10 feet on each flush so you can follow it better.

Find the Peak Spot

Take the receiver in your hand and turn the sensitivity knob all the way up and flip the toggle switch to "Far". Hold the receiver parallel to the ground at waist height. Walk around the area you expect the transmitter to be in, moving the receiver in an arc, back and forth.

Listen to the strength of the signal and look at the right half of the meter. Try to maintain a meter reading in the middle of the scale (between 0 and peak 4). When it reaches full scale and you are unable to turn it down any further, flip the toggle switch to "Near". As you move closer to the transmitter, continue to maintain a meter reading in the middle of the scale. When you reach what seems to be the maximum signal, and every direction you move from there has a lower signal, you have reached the Peak Spot.

Mark this spot, then move off in another direction and repeat the locating procedure. Keep doing this until you always return to the same spot. You should be able to narrow this rough-in area to within a few inches.

If you're just locating a septic tank, and knowing its depth is not critical, you are ready to dig. The Peak Spot you have marked is directly above the transmitter, near the inlet baffle. Also be aware that if the transmitter is turning in the tank, it is virtually impossible to determine its depth.

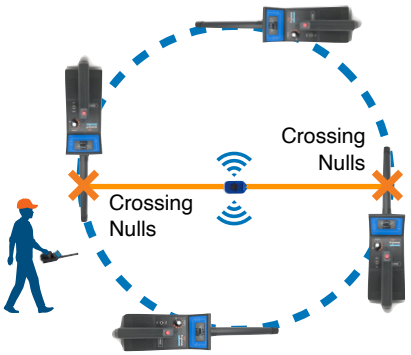
If you need to know the lay-of the line or the depth of the line, read on.

Determine the Lay of the Line

Before you can determine the depth of your transmitter, you must establish the lay of the line. This is an important step.

Walk 4 or 5 feet away from the Peak Spot you marked. Hold the receiver level *straight in front of you* at waist height, as before, but don't wave it back and forth, just hold it straight. Adjust the sensitivity so that the meter reads about the middle of the scale. Walk in a circle around the Peak Spot, keeping your inside shoulder pointing at the Peak Spot. This would be called a "pylon turn" if you were flying an airplane.

As you walk the circle slowly, watch the meter and listen to the sound. At two distinct points in the circle, the signal strength will suddenly drop, then come back up as you move further. These are "null" points. Take the time to precisely determine these points, and mark them (the point is directly below the center of the rod). You will find that they are directly across the circle from each other, and describe a line that passes right through the peak area.



You have just identified the two Crossing Nulls and the line between them indicates the lay of the line the transmitter is in. Technically, we can only be sure that this line is parallel to the axis of the transmitter, but it is usually safe to assume that the transmitter is parallel to the line at that point, and we will assume for the moment that the line is running straight through that point, along the line of the Crossing Nulls. If you are in the middle of pushing the transmitter 5 or 10 feet at a time and don't need to know the depth yet, it's time to push it another 5 or 10 feet, with a good general idea of which direction it is heading. If it takes a bend, you'll still have a good idea of where to look for it.

Determine the Precise Depth

When you have reached the final point of your transmitter's travel and have carefully established the Crossing Nulls and marked them, as above, you are ready to determine the depth. Walk away from the transmitter *along the line that goes through the Crossing Nulls*. Walk from the center out to the maximum range of the transmitter, with the sensitivity all the way up in the "far" position. When in doubt, walk further away. Hold the receiver level and straight in front of you, at waist height, heading toward the Peak Spot, and increase the sensitivity until you have a signal around center scale on the meter.

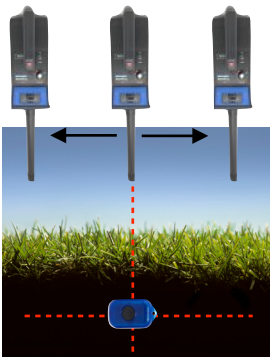
Bend down so that the receiver is close to and parallel to the ground, walk slowly toward the Peak Spot along the line between the Crossing Nulls. Adjust the sensitivity as you go so that the meter stays around center scale (switch between “Far” and “Near” positions as needed). At some point before you reach the Peak Spot, you will notice a sudden signal drop-off. This is called the “Front Null”, and you should mark it carefully. Confirm it by backing up a few feet and approaching the spot again.

Continue walking, with the receiver straight in front of you and close to the ground, toward the other Crossing Null marker. As you pass over the Peak Spot on your way there, you will encounter the peak signal. Keep moving in the same direction (adjusting the sensitivity to keep the meter needle in the center), and you will find another sudden signal drop-off. This is the “Back Null”, and it should be about the same distance from the Peak Spot as the Front Null was. Mark this spot also.

Now you can determine the depth. Simply measure the distance between the Front Null and Back Null and multiply by **0.7**. It’s that simple.
For example, if you measured 50 inches between the front and back nulls, then the depth is calculated by multiplying **50 x 0.7 = 35** inches.

To pinpoint the exact location of the transmitter, find the center null.

This is done by walking back along the line between the Front and Back Nulls, toward the Peak Spot, with the receiver rod *pointing straight down*. When you cross over the center signal drop-off, which is the Center Null. The transmitter is directly below this point.



Troubleshooting

Two things to always check before you start a locate, and again if you have trouble:

- Make sure the batteries in both your transmitter and receiver are fresh. If using flushable transmitter check to make sure the orange LED is flashing for the ATP-12 and blue LED for the FTP-8. If any doubt, throw them out! A weak transmitter battery reduces its range, weak batteries in a receiver can make it act off, as well as reducing the range. Corrosion on battery contacts will also cause problems. Do not store batteries in your receiver long term.

- Always test your transmitter and receiver above ground, for operation and range, before sending the transmitter down the line. *Every time.*

The signal from my transmitter suddenly disappeared. Now what?

Aside from checking batteries, determine whether it is possible that the pipe material changed at some point, or if you may have reached a steel tank. If you're using an Ardy system at 223 kHz, it will disappear when it goes inside any metal pipe. 512 Hz equipment will penetrate cast iron, but not steel, ductile iron or other metal.
A sudden loss of signal may also mean you have encountered a null, which is a normal part of locating. If the signal drop-off is at a particular spot, and the signal returns when you move a little ways away, then it is a null.

My transmitter and receiver seem to work but I can't get further than about 3 feet away before the signal dies.

A big reduction in range often means a broken antenna, on an Ardy or a Ferris receiver. It won't look broken, but even a hairline crack in the ferrite core inside the antenna tube can destroy its sensitivity. It's an easy inexpensive fix, but you will have to send it to us. A hard case is a good investment for preventing antenna damage.

My system doesn't seem to be working, but I don't know how to tell if the problem is the transmitter or the receiver.

One thing to try is a different transmitter (of the same type) with your receiver, or a different receiver with the transmitter, but this is often not an available option if you don't own a lot of equipment. Replace the batteries before you go further.
The ATP-12 transmitter can be tested by holding it near an AM radio tuned to a dead spot (no station) on the dial. If the transmitter is working, you'll hear its raspy "beep-beep" from the radio.
A receiver can be tested in a rudimentary way by turning it up and holding it near sources of electronic radiation - like a computer, a cell phone,
a dimmer switch. You should hear some noise. If it remains silent, the receiver should be sent in for repair.

The definitive test of a 512 Hertz (such as a Ferris) is to call Prototek and have us perform a phone test. We will play a 512 Hertz tone over the phone, which you hold up to the receiver's antenna. If the receiver is working, the signal strength shown on the receiver will be strong. Please note that this test cannot be done with a cell phone, it must be an indoor land-line phone. Sadly, there is no phone test possible for an Ardy receiver.

How Expensive is it to fix my receiver? Should I just buy a new one?

Receiver repairs are usually pretty straightforward, and it's very rare that a receiver is in such bad shape that it's not worth repairing. Give us a call and explain the issues you are experiencing. We can always give you an idea over the phone if it is worth sending in for repair. Send it to us and we'll let you know quickly what it needs, and you can decide then. See our repairs section page 17.

Tip: to prolong the life of your receiver, remove the batteries when not in use for extended periods of time and store in a dry environment.

Ferris Analog Kit

Warranty I Returns I Repairs

Warranty

We have designed our equipment to be durable and reliable, and all products are warranted for a period of one year* (from date of shipment) to be free from manufacturing defects. We will repair or replace, at our discretion, any product covered under this warranty. All repairs are to be performed by our technicians at our facility; any repairs attempted by other parties risk loss of warranty protection and/or increased repair costs.

We make every effort to ensure the quality of our products, but we can't control how they are used nor the conditions they are used under. For example, ground conditions, pipe conditions, your interpretation of instructions or any of dozens of other factors beyond our control. Therefore, we cannot be liable for any damage or loss incurred while using this equipment due to, but not limited to, false indications, equipment failure or misinterpretation of results.

Flushable transmitters are only to be flushed. Attaching them to any apparatus to help push it down the line will void any and all warranties. Once inside a pipe, we cannot control the use of transmitters on the job site, and will not warrant damage caused by conditions inside a pipe or other work area. Visit our website https://prototek.net/warranty-services/ for more details.

Returns

You have 30 calendar days to return and item from the date you received it. To be eligible for a return, the item must be unused and in the original packing it was received. For items not directly purchased from Prototek, you will need to contact the original vendor. We cannot refund you for an item that was not purchased directly from Prototek. Ship items back through UPS or FedEx. Do not ship through the post office. Please contact our sales team for help. Visit our website for more details. https://prototek.net/returns-refund-policy/

Refunds

Once the item is received and inspected for damage and use, we will notify you of your refund status. If your return is approved we will initiate a refund to your credit card or original method of payment . Please contact your card carrier for their refund policy. Visit our website for more details. https://prototek.net/returns-refund-policy/

Repairs

We do all repairs in house. Follow the steps below to send in your equipment for repair.

- Contact us at 800-541-9123 or submit a repair form on our website at https://prototek.net/repairs
- Please include a brief description of the issue and a good contact name and phone number.
- Package your equipment well. We are not responsible for damage that occurs during shipping.
- **Ship via UPS or FedEx only. Do not ship through the post office. They do not deliver to us.**
- Our repair shop is open Monday-Thursday.
- We will contact you within 24 hours of receiving your unit with an estimate.

Ship to:
Prototek Corp.
Attn: Repairs Dept.
19044-B Jensen Way NE
Poulsbo, WA 98370

During any use of this equipment, priority must be given to following national and local safety requirements. The equipment is not approved for use in areas where hazardous gases may be present.

Contact us:

Toll Free: 800-541-9123
Local: 360-779-1310
Hours: 7am-4pm PST Monday-Friday

Email: prototeksales@prototek.net

Shop Online: https://prototek.net

Fax: 360-779-1510

Mail: PO Box 1700
Ship: 19044-B Jensen Way NE
Poulsbo, WA 98370

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