DIGITAL UNDERGROUND LOCATING

HOW TO GET THE MOST OUT OF YOUR

Prototek

Underground Locating Equipment

DIGITAL LOCATING TOOLS FROM PROTOTEK

Prototek

Underground Locating Equipment

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If you cant find the answer in this manual, go to our web site:

www.prototek.net

or contact us:

(800) 541-9123
Fax (360) 779-1510

prototeksales@prototek.net

We Guarantee Common Sense

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. We feel confident that you will be successful in using them, but we can't control 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.

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.

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.

Having said all that, Prototek remains dedicated to your success in using our tools. We are always available by telephone during business hours (7:30 AM to 5:00 PM Pacific Time, M-F) to help you understand locating techniques and solve on-site problems. E-mail works, too, and be sure to check our web site under "How Locating Works". We are constantly innovating, and we welcome your ideas.

Welcome to Underground Locating

You have purchased some of the finest locating tools in the business, but they don't do magic. Your skill at handling these tools and recognition of their strengths and weaknesses is what makes a locating job successful. Before taking them out on their first job, make sure you understand how the system works.

What's so special about "digital" tools?
Digital technology combines modern radio circuitry with microprocessor control, allowing great versatility in the operation of an instrument. What this means to you is tools that make judgments from many sources of information and interact with you as the operator to help lead you to fast, easy and accurate locating.

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 are confused 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.

Please note: These instructions should be considered guidelines, not gospel. 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 digital locating as described in the section "Getting to Know Your Tools". Armed with this knowledge, you will be able to reason your way through most locating challenges.

We are available to help!

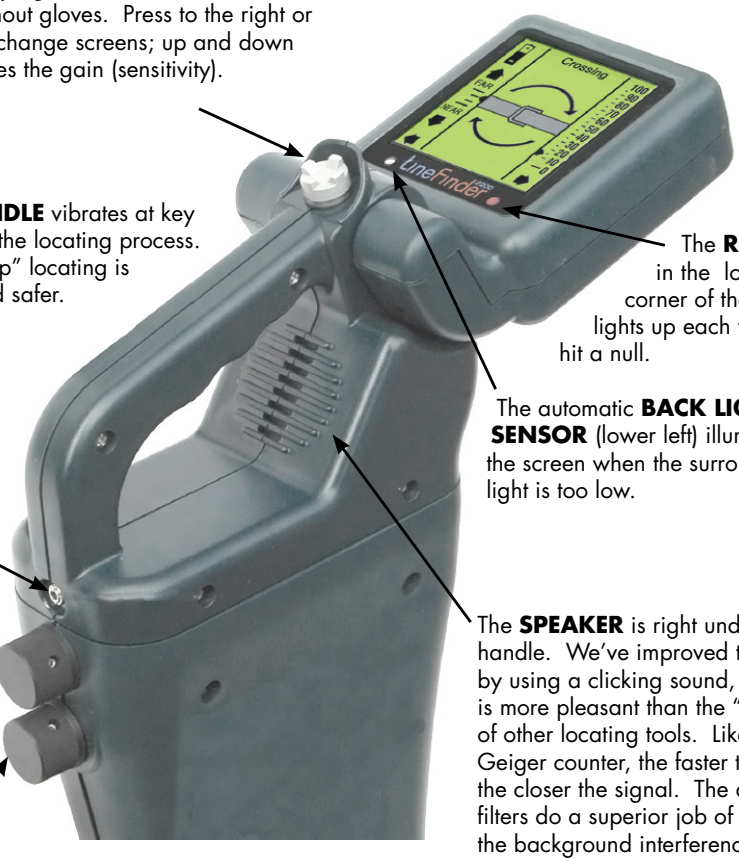
Don't hesitate to call us at **800-541-9123** if you get stuck.
www.prototek.net
prototeksales@prototek.net

Know your Digital Receiver

the **LF2000** and **LF2200**

LCD SCREEN
With each left or right click of the switch, the screen will show, in sequence, the steps you will need to complete the locate, whether you're using a sonde or a BuzzBox.

THUMB SWITCH
The comfortable rocker switch can be used by right-handers or lefties, with or without gloves. Press to the right or left to change screens; up and down changes the gain (sensitivity).



The **HANDLE** vibrates at key points of the locating process. "Heads up" locating is faster and safer.

The **RED LED** in the lower right corner of the screen lights up each time you hit a null.

The **PHONE JACK** accepts standard stereo headphones (1/8" plug) available from Prototek.

The automatic **BACK LIGHT SENSOR** (lower left) illuminates the screen when the surrounding light is too low.

The **SPEAKER** is right under the handle. We've improved the audio by using a clicking sound, which is more pleasant than the "squeal" of other locating tools. Like a Geiger counter, the faster the clicks, the closer the signal. The digital filters do a superior job of keeping the background interference to a minimum.

The **BATTERY COMPARTMENTS** hold a total of 6 "AA" alkaline cells, which will last 30-40 hours depending on the amount of LCD screen backlight usage.

The LCD screen's backlight will come on when the surrounding light is low. If you want to keep it on all the time, place your finger over the sensor (lower left of screen border) or put a piece of electrical tape over it. This will, however, drastically shorten the expected battery life. If you choose to tape over the sensor, make sure you turn the unit off when not in use.

Getting to Know your Tools

The LF2000 and LF2200 receivers both help you locate **sondes** (transmitters) the same way, using a series of screens that guide you through the steps necessary for an accurate locate. The LF2200 additionally does **line tracing**, where buried lines are energized by an external line exciter. Line tracing will be covered later in this document.

The best place to practice is above ground where you can see how the receiver responds to the location and position of the transmitter or line. You may be surprised at what you see. Better to be surprised when you have plenty of time to learn and nothing is at stake!

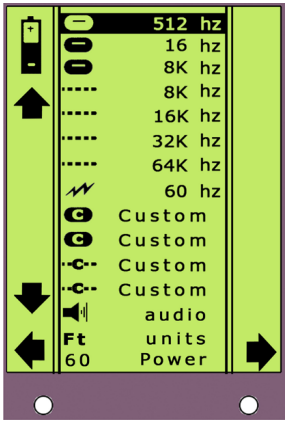
Do your practicing in a place where you have plenty of room to move around; inside in a large room, or outside on the ground.

Turn on the receiver by clicking the rocker switch in any direction and *hold it there for a second*. The friendly Prototek logo screen greets you, with our phone number, which you should not hesitate to call if you're having problems. The unit performs a brief self-test, checking circuit boards and signal processing. If you have problems, this information can be valuable to Prototek for troubleshooting. Notice the arrows - the one pointing down shows where to push to turn the unit OFF, the one pointing right indicates that a push on the right side of the switch will take you to the next screen.

You must return to this screen to turn the unit off

This next part only applies to the LF2200

The LF2000 doesn't have a menu because it only does one thing, so this next part doesn't apply to it. LF2000 users please skip to "Sonde Locating."

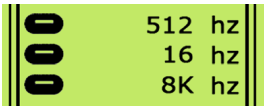


The menu shows you all of the choices you have for locating with the LF2200. The screen you see won't show all of these choices at the same time; it can only display 10 lines at a time. One of the menu choices will be highlighted (black bar), in this case the choice for locating a 512 Hz sonde. Pushing the thumb switch forward and back (up and down arrow directions) scrolls the highlight through each menu choice. The menu itself will scroll to reveal choices that are off the screen.

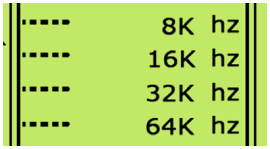
Pushing the button in the direction of the right arrow activates that choice, taking you to the next screen in most cases. A full description of each menu choice is on the next page.

The LF2200 Menu

Top to bottom, this is what each choice in the LF2200 menu offers you:



These are preset sonde frequencies that the LF2200 will locate. The frequency you select here must match the frequency of the sonde you are going to use.



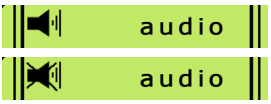
These are preset line tracing frequencies, for use in conjunction with a line exciter like the Prototek Blue BuzzBox. The frequency you select here must match the frequency that is set on your line exciter.

This is the selection for passively detecting the presence of underground power. This can be set to 50 or 60 Hz using the Power menu item (below) to match the frequency of power in your area.

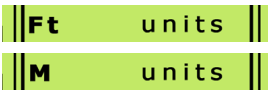
The LF2200 will "sniff" the frequency of any operating sonde, from 16 Hz to 100 kHz. Two custom frequencies can be set and saved.

The LF2200 will also "sniff" the frequency of any operating line exciter between 16 Hz and 100 kHz, and save two custom frequencies. **Details on how to use sniffing are on page 17.**

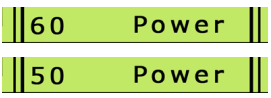
The bottom three menu items are "toggles", which means you can switch between two options by clicking the button to the right. Doing this only changes the item you are on, and leaves you in the menu.



When you select "audio" and click to the right, the speaker is turned off or on, toggling to the opposite of how it was set before. The upper picture here represents speaker "on", the lower is "off".



Toggle between displaying depth in Feet/inches or Meters/decimeters by pushing the button to the right.



Set this to match the frequency of power in your locality, so that the LF2200 can pick it up in Power mode. Whatever this is set to will be reflected in the Power menu item (above).

The last two items generally only need to be set once, to match your local conditions, and never touched again. In most cases, it will have been set to your locality already by Prototek.

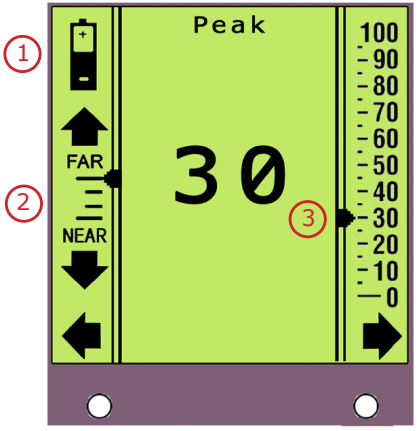
The **audio** setting can be modified at will whenever you desire. This setting was provided for those who find the clicking sound during a locate distracting, or disruptive to others in the area. The speaker is also turned off any time you have headphones plugged in; in that case only the operator who is using the headphones will hear the clicking (if audio is "on").

Sonde Locating

If you are using an LF2000, use a 512 Hz transmitter (sonde). If you have an LF2200, use a sonde that matches a frequency you can set on the Menu. Turn it on, toss it on the ground and walk away from it further than its range.

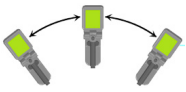
Step 1: The Peak Screen

Go ahead and push the switch to the right to get to the Peak Screen. You may hear some noise but the digital display should read under 10, and possibly say "signal too weak". Let's look at the features on this screen that are typical of all the locating screens.



The "30" in the middle in this example duplicates what is currently shown on the sliding scale, and is only seen on the Peak Screen.

- Battery symbol - shows battery strength, with all black meaning full. When the black level of the battery symbol gets near the bottom, it's time to replace them.
- "FAR"..."NEAR" with up and down arrows shows you the current sensitivity setting; FAR being the most sensitive and NEAR the least, with two intermediate settings. This setting can be manually controlled by pushing the switch away from you or toward you, as the arrows show.
- The sliding scale on the right side of the screen shows the current signal level, at the current sensitivity setting. It will never be higher than "99"; whenever it reaches this level, automatic circuitry will lower the sensitivity to the next setting.



Turn the sensitivity up to FAR, and walk around with the receiver held so that it hangs straight down. Turn to the left and right in a "sweeping" motion as you walk, keeping the receiver directly in front of you. You will hear the receiver click at a faster rate as you get closer to the transmitter, which will be accompanied by a higher number in the display. When the signal gets too strong for the current sensitivity setting, it will automatically be lowered. The clicking will slow down at this point, but will speed up again as you continue to approach the transmitter. You already know where the transmitter is, but try to approach this exercise as though you didn't.

Note that the receiver circuitry will automatically lower the sensitivity when the signal gets too strong, but it will not raise it when the signal gets weak. You would never be able to find your way if it did that! If you get too far away from the signal, raise the sensitivity with the rocker switch and start over.

When you have reached the point where any direction you move causes the signal to drop off, mark that spot. Move to another place and seek this peak signal again and see if you 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.

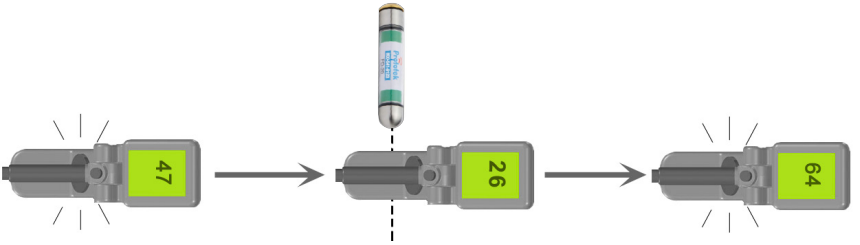
Recognizing "Nulls"

Depending on the orientation of the transmitter with respect to the receiver, you may encounter "dead spots" where the signal suddenly drops off. These are called "nulls", and rather than being an annoyance they actually provide the means for very precise locating. These nulls happen at very specific spots, and it's good to recognize these. So let's find a few nulls.

Hold the receiver directly above the transmitter, parallel to the long axis of the transmitter. The clicking is fast and the Peak screen indicates a strong signal. This is a peak signal.

Now turn the receiver to be perpendicular to the transmitter. The click slows way down and the Peak screen indicates almost no signal at all. This is 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.

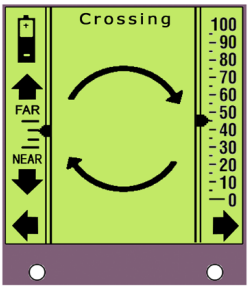
Now let's look at some other places to find nulls. Back away from the transmitter and walk past it off the end, like this:



There was a small but noticeable signal drop-off just as you crossed the axis of the transmitter. Our digital receivers have circuitry that compensates for nulls in Peak mode, so the effect is not as sharp as it was in the previous exercise. (You'll see it demonstrated more dramatically in the next step.) 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.

We've done all this in the Peak screen to show you where nulls are, but the Digital receivers will do the job of figuring out nulls and what they mean for you, depending on which locating step, or screen, you are on. Step away from the transmitter several feet and then push the switch to the right to go to the Crossing screen.

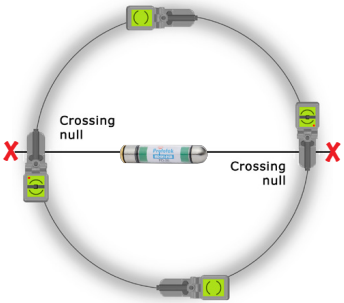
Step 2: The Crossing Screen *(do not skip this step!)*



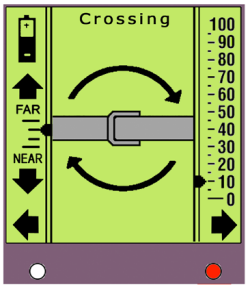
This screen represents the most overlooked step for locating with our Digital receivers. Many people figure that the Peak screen got them to the transmitter and they move straight to the Sonde screen to get the black sonde icon. And then they complain that the transmitter is not where it said it was! Learn what this screen has to tell you and you'll be right on the money every time.

Most of the time this screen is showing, it will look just like this, with a couple of curved arrows around a blank space. You'll hear the clicking go up and down, along with the sliding signal strength indicator, as you move around.

Using the Crossing screen, we are going to find the same nulls we just found with the Peak screen, but in an easier and more useful way. Walk in a 5-10 foot circle around the point you established from step 1 on the Peak screen. Hold the receiver right in front of you, letting it hang naturally. Walk slowly, and notice that the clicking slows down and the screen changes at two distinct points of the circle.



Notice that the pipe image appears and the red LED lights up at the two points where you cross the axis of the transmitter.
Mark these spots clearly

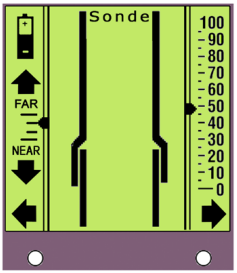


The handle vibrates whenever this image appears.

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 steps in precision locating: zeroing in on the exact location of the transmitter, and determining its depth.

Step 3: Zeroing In - Using the Sonde Screen

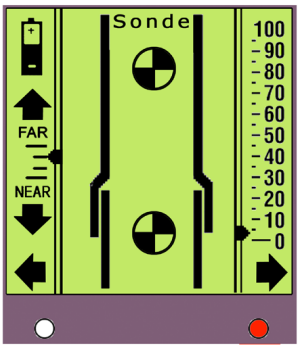
When you have found the crossing nulls on your circle walk, mark them on the ground with something like a stick, a rock, chalk or a paint marker. A straight line drawn between these markers will run right through the middle of the transmitter. Push the switch to the right once more to get to the Sonde screen.



Remember that the Crossing Nulls we just marked indicate the direction the transmitter is lying, and presumably a pipe it is in lies the same way. The Crossing screen showed an image of a pipe at right angles as we crossed it. Now we are going to walk *in line with* the "pipe". Notice that the Sonde Screen shows us a pipe in line with the way we walk with the receiver.

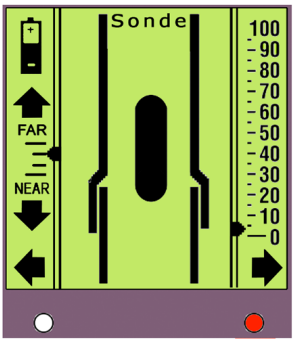
For this exercise, hold the receiver up so that the handle is in front of your chest (and you can still see the screen). We need to have a little distance between the bottom of the receiver and the transmitter as we approach it. (When the transmitter is actually underground, we'll do this step with thhe fooot of the receiver at ground level.)

Go to a point about 6 feet or so away from the location of the transmitter, on the line described by your Crossing Null markers. Bump the sensitivity up to "FAR" as a starting point; it will automatically reset itself as necessary. Start walking slowly along the line toward the transmitter.



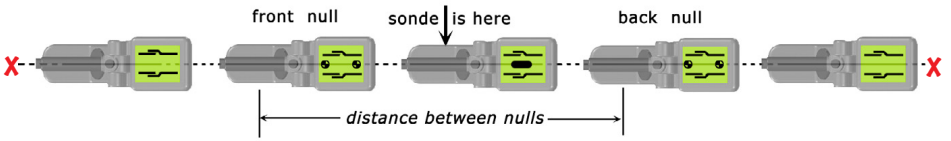
Indicates a front or back null

These images appear at very sharp points. The clicking will slow down and the red LED will light at the same time. The handle vibrates when the Sonde image appears (right).



Indicates the sonde is directly below

Watch carefully as you walk, and you should see both of these screens appear at different points as you approach the transmitter and walk beyond it.

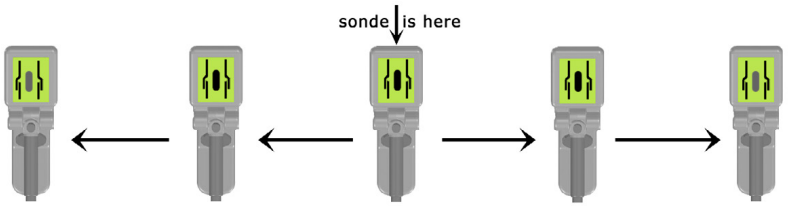


The appearance of the front and back nulls is a good sign that you are proceeding along the correct path (determined by the crossing nulls of the Crossing screen) but they aren't of particular interest just yet. The appearance of the sonde in the pipe image is just what you are looking for. That means you are directly over the transmitter (sonde) and you're ready to find out its depth.

Or does it ?

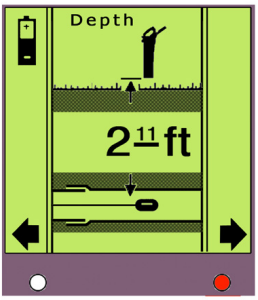
The appearance of the sonde in this screen is a reliable indication that you are directly over the sonde ***IF*** you have gotten to that point by following the line described by the crossing nulls using the Crossing screen. If you have skipped that step and just looked for the sonde image, you can be way off, and be very disappointed. Let's demonstrate why.

Go back to where the receiver is directly over the transmitter, and the sonde image is showing clearly in the screen. Now move the receiver to the right a foot, keeping it parallel to the transmitter. Move it another foot away. Now go back to the original point and move it to the left the same way. Surprised?



The sonde signal can show on the screen for many feet on either side of its actual location. *The only way you can be sure which of these spots is the actual location is to have first found the crossing nulls with the Crossing screen.* The exact location of the sonde is along the line through the crossing nulls.

Step 4: The Depth Screen



Now that you know for sure where to stand so that the sonde is directly below the receiver, it's time to determine its depth. Holding the receiver at chest height, click the rocker switch once more to the right with your thumb to get to the Depth screen. Hold the receiver still in this position; in just a second or two, the depth (i.e., the distance between the bottom of the receiver and the transmitter) will be displayed, and the red LED will light.

What if you had settled on one of the "ghost" sonde locations we discovered a minute ago, and tried to determine depth on it? Try it and see. The depth will appear to be considerably deeper than actual as you move to the right or left of the true sonde location. And, of course, it won't be down there when you dig. That's why it's so important to establish your crossing nulls on the Crossing screen before you proceed to the Sonde screen.

With what you have learned here, you should 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 practical considerations when doing actual field locating. Good luck!

Know Your Line Exciter

the **Blue BuzzBox**

The BuzzBox **enclosure** is made by Pelican™ of ultra high-impact structural foam resin. It's tough and weather-resistant.

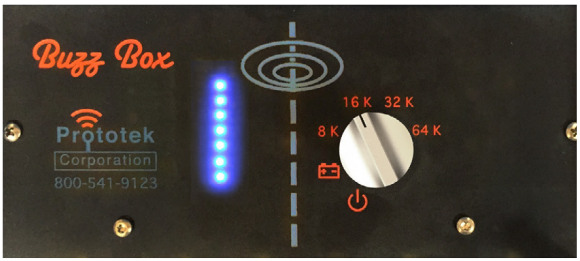
The **cables** are used for conductive locating. 6 feet long with strong clamps for secure connection.

Battery compartment holds 6 "C" cells, providing 4 watts of long-lasting power.

The 9-inch stainless steel **ground rod** ensures a solid ground connection. And it stores neatly in the box.

The **cable connector** jack is waterproof.

Eight **LEDs** indicate battery level (green) as well as signal or ground quality

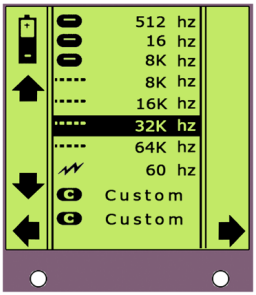


A choice of 4 **frequencies** to optimize your locating job.

The **track** up the center of the panel show you how to align your BuzzBox with the line for inductive locating.

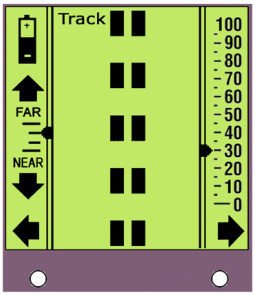
Line Tracing with the LF2200 and Blue BuzzBox

First turn on the Blue BuzzBox, by turning the frequency knob to one of the choices. At first, a few of the blue LEDs light, then finally all 8 are lit. This means that the BuzzBox signal is at full power. Don't plug in any cables at this point. Set the box on the ground and step away from it about 10 feet in the direction of the "tracks" on the panel.

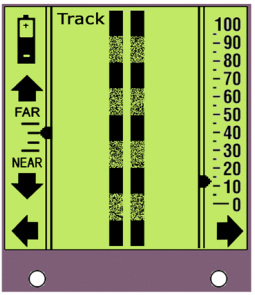


Turn the LF2200 on the usual way, go to the Index screen and select the frequency that corresponds to the frequency you set on the BuzzBox (in this example, 32 kHz). Click the thumb button to the right to get to the Track Screen.

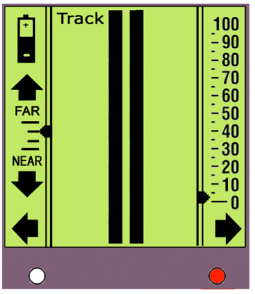
Stand in front of the BuzzBox about 6 feet away with the LF2200 hanging down in front of you, and sweep the LF2200 back and forth across the imaginary line extending out from the "track" lines on the BuzzBox, as shown. As you do this, you will see (and feel) the Track Screen change as you cross that line.



Off the line, no signal. Track gaps are clear.



Nearing the line, track begins to fill in



Right on the line, track solid black, red LED lights, and handle vibrates.

Walk along the line, sweeping the receiver as you go, and see how easy it is to follow the path of the signal "by feel" while keeping your eyes on your surroundings instead of having them glued to the instrument. It's important to sweep the receiver in an arc, as shown, instead of letting it swing back and forth like a pendulum, because it makes it much easier to detect a line that changes direction. This will be explained more fully later on.

So far, we've only "located" the BuzzBox by its signal through the air. Not exactly useful. But you have learned how the receiver responds in the presence of a signal generated by the BuzzBox, and it will respond the same way when you're searching for a line that it has energized.

Let's go outside (if you're not already) and practice a little closer to reality. Why outside? Most buildings are full of metal in one form or another, and metal can interfere with the quality of a locate. A concrete floor full of steel rebar is one of the worst places we could practice - the signal gets dissipated everywhere but where you think it should be. Plus, we'll need to work at least 20 feet away from the BuzzBox so we won't pick it up instead of the line.

We will need a metallic line to put our signal into. A sewer cable or metal fishtape will work, or even a plain old extension cord, as long as whatever you are using is at least 50 feet long. First we'll set up for Inductive locating.

Using the BuzzBox in Inductive Mode

This is the simplest connection of all. Just lay the BuzzBox on top of the cable, tape or cord, with the "tracks" right on top of and parallel to the line. In the picture above, the blue dashed line now represents the cable lying under the box. String the cable out in the yard and give it some bends like you might find in an actual line. Now walk the length and see how easy it is to follow by looking, listening and feeling. If you're sweeping your LF2200 in an arc, as shown, you will see how easy it is to detect when the line takes a bend and to keep following it. If you don't sweep it this way, it is too easy to walk right "off the end" and lose the signal when the line turns.

As you move further away from your BuzzBox signal source, turn up the sensitivity on the LF2200 by clicking the rocker switch forward, raising the sensitivity toward "FAR." The difference between signal and null is much more distinct when the signal is strong.

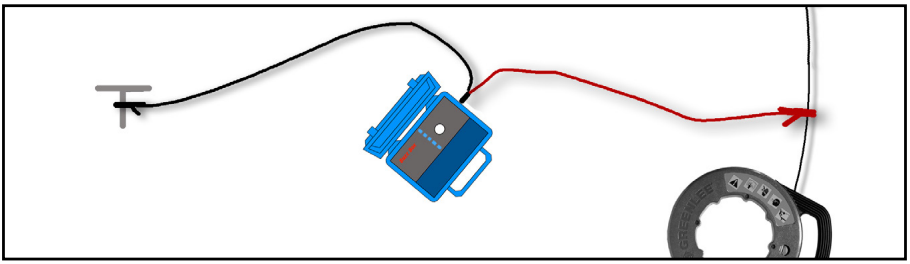
Note a key difference between sonde locating and line tracing: with a sonde you are approaching the signal source, so the signal keeps getting stronger and the sensitivity is automatically lowered; with line tracing you are moving away from the source, so the signal is getting weaker and you may need to raise the sensitivity manually as you go.

Walk all the way to the end of the line you have energized. Notice that the signal drops off and disappears shortly before you get to the end. This is a fact of life with line tracing, and you need to keep it in mind when you are concerned with exactly where a line ends. Also keep in mind that *this effect is more pronounced the deeper the line is* - that is, a deeper line of a given length

will appear to be somewhat "shorter" than a shallow line of the same length. You'll need to experiment to see how much you should compensate for this. *This effect will be noticed in both Inductive and Conductive modes.*

Using the BuzzBox in Conductive Mode

Plug the cable set into the jack on the side of the BuzzBox. Connect the red clamp to the line, that is, the cable or cord you are using for this exercise. It must make a good electrical connection, so clean off any rust or insulation that might compromise this (on an extension cord, just clamp it to the prongs on the male end of the cord). Shove the ground rod into the ground and connect the black clamp to it. The ground rod also needs to make a good electrical connection with the earth; deeper is better and wetter is better. You might want to pour a cup of water around your ground rod if the earth is very dry. The better your ground, the more blue LEDs will be lit. In practice, it is best to maximize the distance between the ground rod and where you attach to the "line", keeping it at a 90° angle to the run of the line.

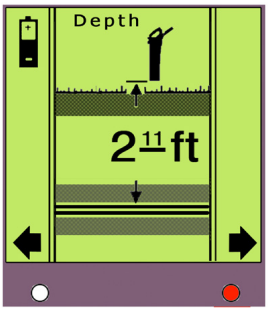


The technique for locating a line energized conductively is the same as for inductively, so go ahead and walk the line again to see how it works. In general, you will find that the signal is stronger and more distinct in the Conductive mode.

> ***For best results*** *in conductive mode, the far end of your test line (cable, extension cord, etc.) should also be grounded, in order to make the best electrical path back through the ground rod to the BuzzBox.*

Determining Depth

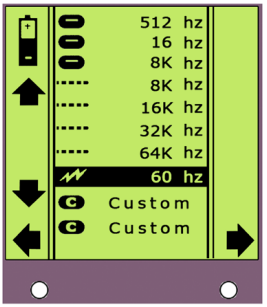
The LF2200 uses the same method to determine the depth of a line as it does for determining the depth of a sonde.



The screen looks much the same too. When you are directly over the line (indicated by solid tracks and vibrating handle), hold the LF2200 up by your chest, where you can still see the screen. We do this when practicing because the line is on top of the ground and we want to establish a distance we can measure. When doing actual tracing, you will set the foot of the LF2200 on the ground for this step. When ready, click the rocker switch to the right to get to the Depth Screen. In a second or two, the depth will be displayed in feet and inches or meters and decimeters, if you have set your defaults that way), and the red LED will light.

Power Mode

If you select the choice on the Menu screen with the symbol, you can locate in "Power" mode. This is also known as a "passive" locating mode, since you will be detecting a signal that already exists instead of one you are causing. The signal you are seeking is the one produced by an *energized* underground power line.



Be sure the Power frequency is set to what is used in your region (for North America it is 60 Hz). If this is set wrong, you won't detect power at all. This is set at the bottom of the Menu.

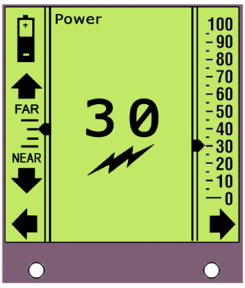
Note: *The fact that an underground power line is energized is not enough to guarantee you will be able to detect it.* It must be carrying a certain minimum electrical current before the electromagnetic field will be strong enough to detect. A main line supplying an entire neighborhood will certainly be detectable, but one serving a single house may not be unless a fairly large appliance like an electric clothes dryer or oven is operating.

For this reason your success at tracing power lines will generally be better if you use Inductive mode, with a BuzzBox, as described earlier. However, if you can't find one end of the line to set the BuzzBox next to, this method may be your only choice in determining whether there are buried electrical lines in the area. Once you have located the presence of buried power, try to trace it to a riser where you can energize it Inductively and perform a more accurate locate.

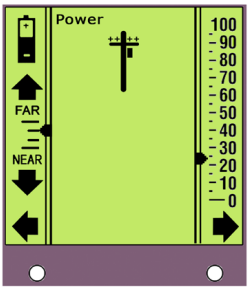
There are two different techniques for tracing electrical lines in Power mode; "Peak" power and "Null" power. We have provided both in order to help overcome limitations in passive line tracing that are caused by "field distortion" due to the presence of multiple buried power lines in the area.

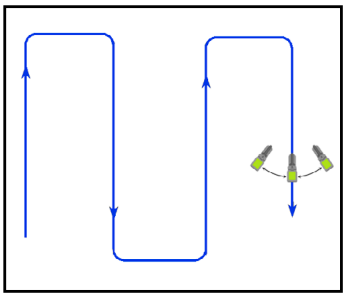
The "Peak" Power Screen

The first screen you see in Power mode is the Peak Power screen. Initially, use this screen to seek a "peak" signal from buried power lines just as you seek the peak signal from a sonde. It's a good mode to use when you don't have a good idea where power lines are running - it gets you "in the neighborhood."



Note the symbols that appear on the Peak screen. When a "zap" symbol is below the number, it shows that the source of signal is underground. Be alert for the "telephone pole" to appear on the screen - in this case the source of signal is overhead, which is not the signal you are looking for.

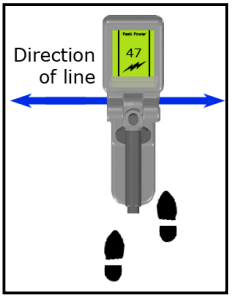




Practice detecting the presence of underground power by walking over the area of interest in a systematic grid pattern, watching the signal strength number and listening to the clicking getting faster as you near the line. *Remember to sweep the LF2200 in an arc while you walk, the same way you search for a sonde*, in order to cover the area with the LF2200 held at all possible angles.

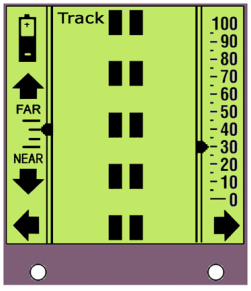
With the amount of ambient electrical energy that is typical of residential and commercial areas, you are very likely to see the screen flicker back and forth between the "overhead" and "underground" power indications. *Do not assume you have detected power unless the underground signal level shows a substantial increase over this background energy, and it is repeatable.*

In Peak mode, the LF2200 picks up the strongest signal as you cross the power line. When you think you have found the peak signal, confirm it by moving a little forward and a little back to be sure where the strongest signal is. Then rotate the LF2200 a little bit left and right to find the best signal, which indicates that your receiver is now directly perpendicular to the direction the line is running.

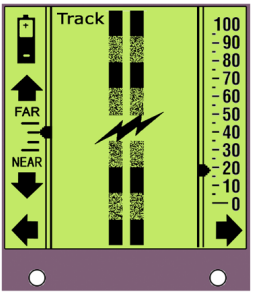


The "Null" Power screen

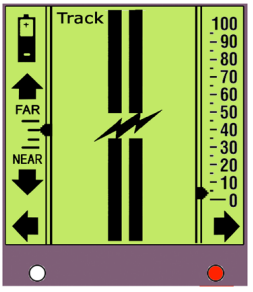
To track the power line, switch to the Track screen ("Null Power" mode) by clicking the thumb switch to the right. Notice that the "track" lines on the Power screen are just like the ones for active line tracing, in line with the way you walk. The handle will vibrate and the red LED will light when you are directly over the energized power line, just like with "active" line tracing described earlier.



Off the line, no signal. Track gaps are clear.



Nearing the line, track and "zap" begin to fill in



Right on the line, track solid black, red LED lights, handle vibrates

To practice in Power mode, find a place where underground power lines are known to run and try to ensure that there is sufficient load to produce a strong enough electric field to work with, using the guidelines described above. If you can detect the line at any point, you may be able to follow it for its entire length. Its signal will not "drop off" as you go further, since the entire line is the source of signal, not a BuzzBox at one end of it. However, be prepared for the signal to suddenly disappear if the load on the line is decreased.

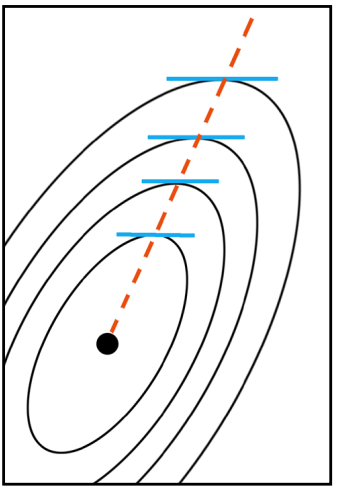
The LF2200 does not have a Depth screen for Power. As we have said, locating power using passive methods is at best an approximation, and the lack of accuracy extends to the determination of depth to the point that we don't want to mislead you by suggesting unwarranted precision. Use the Power features only for an initial survey of an area; use with your BuzzBox inductively for precision locating of power lines.

Recognizing and Dealing with Field Distortion

It is becoming increasingly rare to have only a single power line running underground in an area where you are going to be working. The presence of other power lines in the vicinity, or even other buried metallic material (such as pipes) can distort the apparent magnetic field around a power line and give misleading results if you are not prepared to expect it.

If the magnetic field produced around an energized power line is perfectly circular, as it would be in total isolation, the locations indicated by both Peak and Null modes would be the same, and they would be accurate. However, the presence of field distortion tends to make the Null mode indicate off to the side of the actual location.

This illustration shows the influence of a distorted field on Null mode. The lines of the magnetic field around the wire are not circular, and skew to one side. The blue horizontal lines in the figure show where a receiver in Null Power mode will indicate the location of the line. The deeper the line, the further off this reading will be. Fortunately, Peak Power mode is not particularly influenced by field distortion, and although it is less precise than Null mode, it will show the correct location regardless of depth. You can detect the presence of field distortion by raising the LF2200 a foot or two when you have located the line in Null mode. If the field is distorted, the location indication will appear to move right or left. If this is the case, establish the actual location using Peak mode and proceed to the Depth screen from that point.



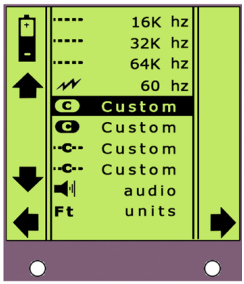
Be aware that "active" locating, using the LF2200 in conjunction with the Blue BuzzBox in Inductive mode, is not affected by field distortion and will always be more accurate.

With what you have learned here, you should be able to go out and be successful at tracing a line you can connect to inductively or conductively without knowing in advance where it is. Be sure to read "At the Jobsite" for practical considerations when doing actual field locating with this equipment. Good luck!

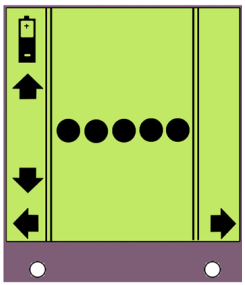
"Sniffing" Custom Frequencies

Although the LF2200 is preset to work with several standard sonde and line exciter frequencies, you are not restricted to working with only those frequencies. The LF2200 has no problem working with other frequencies that other manufacturers might provide, between 16 Hz and 100 kHz. The LF2200 can "sniff" the frequency of an operating sonde or line exciter, and set itself to work with that frequency.

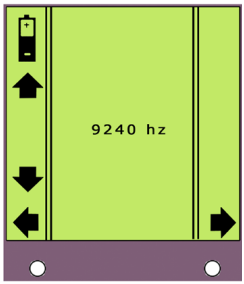
To sniff a sonde or line exciter, turn the sonde or line exciter on and place it on the ground. Set the LF2200 menu to either a "Custom" sonde (shown here) or "Custom" line, as appropriate. Set the foot of the LF2200 right over it, as close as you can get.

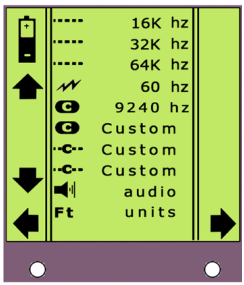


Press **and hold** the button *to the right* while the LF2200 is over the signal source.



While you hold the button to the right, you'll see a series of dots march across the screen (left) while your LF2200 is sniffing. You can let go when you see the dots. When it has detected the frequency, you will briefly see the frequency it sniffed (right).





Then it will automatically return to the menu screen, now with your new frequency shown in the menu (left). This setting will last forever, unless you sniff another sonde at this menu location, which will replace the old frequency with the new one. You can save two different sonde frequencies and two different line frequencies with the LF2200.

At the Jobsite

Before starting any locating job, please follow these simple steps. An ounce of preparation here can prevent a ton of embarrassment and lost time.

- **Survey the area** - before turning on any transmitter, turn your receiver on, set the frequency you are going to use, then go to the screen you will be using (Peak or Track) and set the sensitivity to "FAR". Walk around the area where you will be locating and check for any indications in the unit such as LED flash or handle vibration. Buried power lines, nearby computers, 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**

  For Sonde locating: Put the battery in your transmitter and throw it on the ground, then turn on the receiver (set to the same frequency as your transmitter) and turn up the sensitivity. Be sure you are getting full range out of your equipment. You should be able to walk 12 feet away from a -10 transmitter or 25 feet away from a -20 transmitter and get a signal above 15 at "FAR" sensitivity. Anything less than this requires fresh batteries and another run through this test. If you still don't get a correct response after changing batteries on both, there is likely a problem with either the transmitter or the receiver.

  For Line Tracing: Turn on the BuzzBox to the first (battery check) position and see that the LEDs are all green (red ones mean the batteries are nearly dead). Turn to one of the frequency positions and see that the LEDs are blue. Turn on the receiver, set it to the same frequency and go to the Track screen. Confirm that the receiver responds correctly to the signal from the BuzzBox at 10 feet away.

Use correct technique with your LF receiver:

- Let the receiver hang naturally straight down as you walk with it
- "Sweep" the receiver in an arc when you are looking for signal, while the receiver hangs straight down, don't "swing" it
- When you are looking for the crossing nulls, don't twist the receiver handle in your hand, just let it move with you as you walk in the circle
- Keep the foot of the receiver as close to the ground as possible. This is especially important when you are marking front and back nulls, as well as when you switch to Depth mode

Sonde Locating

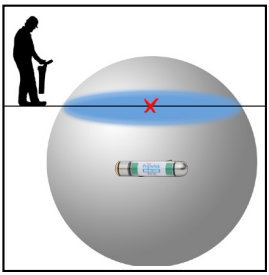
Select the right Transmitter

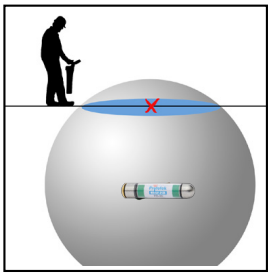
There are three main considerations when selecting a transmitter (or "sonde") to send into a line for a locating job:

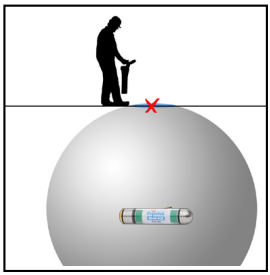
- choosing the frequency that will work best in the pipe your sonde will be in (which also must be compatible with your receiver). 16 Hz will work in just about anything, including steel and ductile iron; 512 Hz is for cast iron and nonmetallic; frequencies above 1 kHz are for nonmetallic only, but generally have the best range for their size.
- choosing the size and shape that suits the line size and delivery method
- choosing one with enough signal strength, or "range", to work at the maximum depth you expect to encounter.

In the illustrations below, the "ball" around the transmitter represents the maximum distance from the transmitter, in all directions, at which a signal can be detected by a receiver. This is its "range". The blue area, at ground level, shows how far you can be from the Peak Spot (red X) and detect enough signal to be able to home in on it. As you can see, as the depth of the transmitter approaches its maximum range, you have to be right on top of the transmitter to pick up any signal at all. When you have a choice, always choose the transmitter with the longest range for easiest locating.

Always test your transmitter before sending it underground!



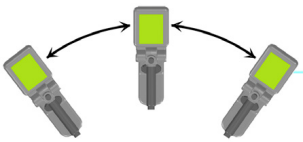




Your best locating success will involve moving the transmitter in small increments. Push it 5 to 10 feet, locate it using all the steps, then repeat this process until you have reached your final locate position. It's easy to be fooled about the route of a line when you can't see it, and you can waste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

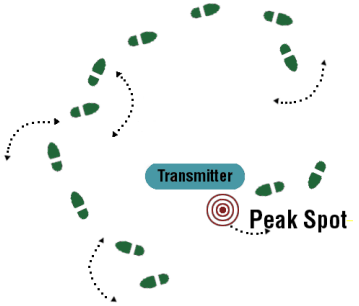
Step 1. Locate the Peak Signal

The first thing to do is to find the general area of the transmitter. Starting with the Peak screen, set the sensitivity to "FAR" by pushing the rocker switch away from you until the little pointer points to FAR on the left side of the screen.



Walk around the general area where you think the transmitter should be. Sweep the receiver slowly in a 3 foot arc, turning your body as you go.

Walk in the direction that the clicks get faster and the number in the center of the screen reaches its highest value. When you have reached a point where the clicking is fairly rapid and everywhere else you move makes the clicking slow down and the number in the screen get lower, you have found the "Peak Spot". Now repeat this procedure starting from a different place until you consistently come back to the same spot. Mark it with a rock or other marker.

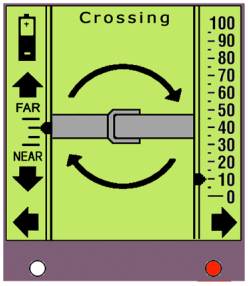


When the pointer is at "FAR", the receiver is at its most sensitive. Use this setting when you start your locate, because you are relatively "far" from the transmitter. As you get closer and the signal gets stronger, the receiver automatically reduces its sensitivity (moving toward "NEAR") while the signal strength numbers in the middle of the Peak screen start over at a smaller value, getting higher as you again move closer to the transmitter.

When the pointer reaches "NEAR", it means the receiver is at its least sensitive because it is picking up a strong signal. In all cases, your objective is to find the path that causes the numbers to increase within the current sensitivity setting, while also causing the sensitivity setting to move toward NEAR as you locate.

Step 2. Determine the Direction of the Line

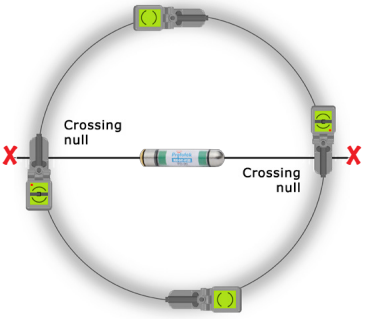
This step is very important - don't skip it!



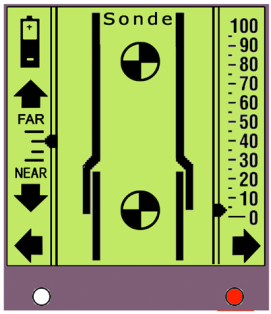
Crossing null image

Move about 5 feet away from the Peak Spot and switch to the Crossing screen by clicking once to the right. Increase the sensitivity until you have the strongest signal. Now walk in a 5 to 10 foot diameter circle, with the Peak Spot as the center of the circle, while you listen and watch the screen carefully. You will encounter a spot where the clicking slows down almost to a stop, the red LED at the lower right of the screen comes on, and the handle vibrates. At the same time you will see an image of the line appear on the screen, as seen here. Note that the way the pipe lies on the screen is the way the pipe lies in the ground beneath you. You may need to raise or lower the sensitivity to "fine tune" the image. This is a "Crossing Null". **Mark this spot** and continue your trip around the circle. You will find another "Crossing Null" on the opposite side of the circle from the first one. **Mark this spot also.**

A line drawn between these points will pass directly over the center of the transmitter, and is parallel to the transmitter. It also describes the lay of the line the transmitter is in. This is very valuable information, and sets the stage for determining the precise location and depth of the transmitter. Many people skip this step, thinking it unnecessary, but it is the key to successful locating. See "Getting to Know Your Tools" for more information.



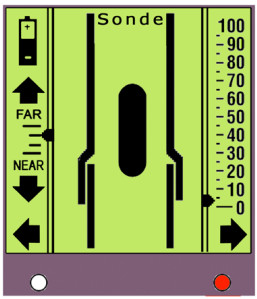
Step 3. Find the Exact Location of the Transmitter



Front or Back Null image

Switch to the Sonde screen with another click to the right ("sonde" is another word for transmitter). Walk about 10 feet away from the Peak Spot along the line described by the markers you placed on the two Crossing Nulls. Increase the sensitivity until you have the strongest signal. Walk slowly toward the Peak Spot, with the receiver held in front of you about an inch off the ground, while you listen and watch the screen carefully. You are first going to be looking for the "front null" that will be indicated by a slowing down of the clicking to almost nothing, lighting of the red LED, and appearance of the symbols shown here. Note: if the transmitter is deeper than about 15 feet, you may not see these nulls at this point. That's not important now; we will return to them later.

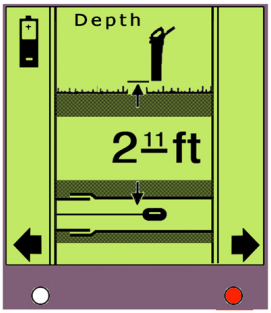
Continue walking along the line while you listen and watch the screen carefully. You will hear the clicking slow down, the red LED will light up again, and the handle will vibrate, but this time the screen will look like this. Turn up the sensitivity and move slowly back and forth along the line to make the sonde symbol as clear as possible. Mark this spot. The transmitter is directly below it ***IF*** you completed the previous steps using the Crossing screen. If you didn't, you cannot be certain of this location and should start over.



Sonde image

Place the bottom of the receiver squarely on the ground with the sonde image still solidly on the screen. If you have performed all of the preceding steps correctly, you are ready to determine depth.

Step 4. Determine the Depth



Click again to the right to get to the Depth screen and hold the receiver still. In a second or two, the red LED will glow steadily, indicating that the data acquisition is finished. The depth will be displayed in feet and inches (or meters and decimeters if your default units are set that way). This depth is accurate to 10% of the actual depth, meaning that for a depth reading of 12 feet (for example) the actual depth may be up to one foot deeper or shallower than indicated.

And now for the depth disclaimers

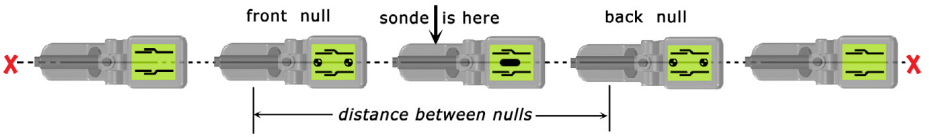
The best accuracy for depth determination will be found when the transmitter is no deeper than half of its maximum rated range. For example, use an FV-10 down to 5 or 6 feet in cast iron, 8 to 10 feet in non-metallic. That doesn't mean you can't use these transmitters down to their maximum rated depth, it just means that the digital receiver's automatic depth reading becomes less reliable at these depths.

Even though our digital receivers are fantastic instruments, there is a limit to how deep they are able to automatically determine the depth of a line or transmitter, even when you have a strong signal. At this writing, that limit is about 25 feet (8 meters). If your transmitter is deeper than this, the depth screen will read "OVER 25 Ft" (or "OVER 8 M", if you are set up for metric units).

All is not lost! Manual depth determination can often be accomplished in situations where automatic depth is unreliable, and it's always a good idea to confirm automatic depth using this method anyway.

Determining Depth the Old Fashioned Way

The front and back nulls you found earlier (using the Sonde screen) are your landmarks for determining depth manually. Revisit them by switching to the Sonde screen and walking about 20 feet away from the Peak Spot along the Crossing Null line you determined using the Crossing screen. Turn the sensitivity as high as it will go. Walk the Crossing Null line toward the Peak Spot, with the bottom of the receiver about an inch off the ground, while listening and watching carefully. Watch for the Front or Back Null image on the screen at the same time the clicking slows down and the red LED comes on.



The first one you reach is the Front Null, and you should mark it clearly. Continue on this line toward the Peak Spot, where you should again encounter reduced clicking, a red LED, a vibrating handle and the Sonde image on the screen. Continue walking in the same direction until you reach the Back Null and mark it as well. Measure the distance between the Front Null and Back Null and multiply by 0.7. This is the depth of the transmitter, right below the Sonde location.

> For example, if you measured 60 inches between the Front and Back Nulls, then the depth is **60 x 0.7 = 42** inches. Or, if you want to figure it in feet, multiply **5 x 0.7** and you get **3.5** feet, which is again 42 inches.

Warning: Even manual depth determination has its limits. If your transmitter is deeper than 80% of its rated depth, the signal will drop off before you will be able to detect the front and back nulls. In this case at least you know that the transmitter is at or below this depth.

Line and Power Tracing

1. Which Mode?

The first decision you must make when starting a line tracing job is whether to use Inductive or Conductive mode. Generally, the conditions you are working under will dictate. Here are some considerations.

Conductive mode *is always preferred if you have the choice*, but you must be able to make a direct, metallic connection to the line you wish to trace. This mode is typically used for underground metallic pipes, metallic cables pushed into pipes, tracer wires accompanying nonmetallic gas lines, etc.

- The signal will be stronger and will travel further than Inductive mode.
- There is less tendency for the signal you have injected into the line you are tracing to "bleed into" adjacent lines.

Do not use Conductive mode for energized power or telephone lines!

Inductive mode is used when you can't connect directly to the end of the line you wish to trace. This mode is typically used for power and telephone lines, and other metallic lines that you cannot gain direct access to.

- Maximum depth of an Inductive trace is about 6 feet.

2. Which Frequency?

The Blue BuzzBox and the LF2200 both can operate at any of 4 industry standard frequencies: 8 kHz, 16 kHz, 32 kHz and 64 kHz. The latter two frequencies are sometimes called "33 kHz" and "65 kHz" by other manufacturers, but they are the same frequencies. If you are using one of these Prototek tools with another manufacturer's equipment, the frequency choice will be dictated by which frequencies they have in common, but since the LF2200 can "sniff" just about any line exciter frequency, your choices are very broad when using it. When you have choices, the best frequency to use will be determined by your tracing conditions. Feel free to change frequencies as you work to find the one that gives you the best results (making sure that whichever you choose is set on both the BuzzBox and LF2200).

In general, lower frequencies will travel further and have less tendency to "bleed" into adjacent underground lines. Inductive locating usually responds best to the higher frequencies. However, remain open to trying different frequencies to see what works best in the locating conditions you encounter.

Application note: If you have access to a pipe for inserting a cable, your best locating method is to use a sonde on the end of the cable and locate using the sonde procedures. If finding the exact end point of a line is important, you can put a sonde on the end as well as using the Conductive procedures, allowing you to trace the line *and* pinpoint the end of the cable.

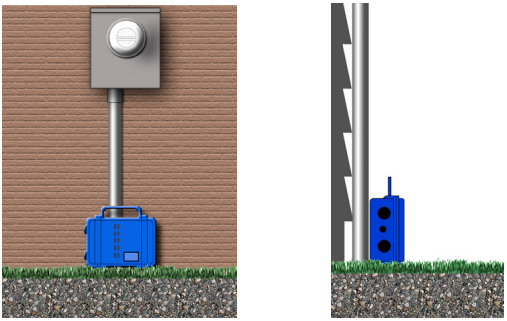
Setting Up for Line Tracing

You will need to have access to one end of the line you want to trace, so that you can excite it with your BuzzBox. For Conductive mode you must be able to make a direct metallic connection to the line, or a tracer that accompanies it. For Inductive locating, you only need to be able to get near the line where it is out of the ground. In many cases, a line can be inductively excited even when it is fully buried, if you know where it runs at that point.

Note: The metallic part of the line you wish to trace must be continuous - insulating couplers or gaps in the line will end the signal at that point. This applies to both Inductive and Conductive tracing.

For a **Conductive** locate, plug the cable connector into the BuzzBox and connect the Red clamp to the line or tracer wire. Connect the Black clamp to a good ground connection. This can be the ground rod that is supplied with the BuzzBox, or a cold water pipe or electrical service ground rod. If you are using the ground rod supplied with the BuzzBox, push it into the ground as far from the excited line as possible (the cables will allow 12 feet of separation) and at right angles to the excited line (that is, not off the end). The blue Ground Quality LEDs should have at least 4 lit to indicate an adequate ground connection. Wet the area around the ground rod or move it to another spot if necessary to improve the ground quality.

For **Inductive** mode, the aim is to place the BuzzBox as close as possible to the line you wish to induce signal into. It doesn't matter if the line is in metallic or nonmetallic conduit at this point; the signal will be induced into the wire inside the conduit. The other requirement is that the "tracks" on the BuzzBox label be parallel to the run of the line at that point.



How to set the BuzzBox for Inductive mode on a power line riser.
The signal will follow the line when it turns to run horizontally underground

When using the Inductive mode, avoid attempting to trace the line within 15 feet of the BuzzBox. The signal in this proximity to the Box can be very misleading, even absent, due to competition between the signal the Box is radiating into the air and the signal you are picking up from the line. This should not be as much of a problem in Conductive mode, as the BuzzBox itself does not radiate a signal in this mode.

When tracing a long line, the strength of the signal will diminish as you move further from the exciter, until it is no longer strong enough to complete the trace. This can be overcome by "leapfrogging". Select a point on the line that still has a clear signal and the direction of the line is well defined. Move back up the line (toward where you started) about 20 feet. Place the BuzzBox over this spot, with the "tracks" set parallel to the direction of the line, and use Inductive mode (regardless of the mode you originally used to get this far). Now continue the trace further along the line; you should find good signal for a good distance. If you run out of signal again, do another "leapfrog".

Power Line Tracing Considerations

You should plan to use the Power mode on the receiver only for initial survey of an area to detect the presence of underground power lines. Remember that this mode is only effective if there is considerable power being drawn through the underground lines; the signal from a light residential load probably can't be detected this way. Basically, if you detect a signal using Power mode you can be fairly confident there is underground power nearby, *but the lack of signal is no guarantee that underground power does not exist in the area*.

See the section titled "Power Mode" under **Getting to Know your Tools** for details on using Peak Power and Null Power screens for detecting and tracing underground power using passive techniques.

The best method to use for precise power line tracing is the Inductive mode, using the BuzzBox, as described earlier. Usually the higher frequencies (32 kHz and 64 kHz) work best for this. If you have indications from Power mode that there is underground power in the area, but can't find a conduit riser on a building or pole nearby to initiate an Inductive locate from, you may have success by using the following method: Determine as best you can the route of the underground power, set the BuzzBox to 32 kHz or 64 kHz and lay it on the ground so that the Tracks are parallel to this route, then use the LF2200 at the same frequency to trace the induced signal. If you can trace a clear and repeatable path this way (further than 15 feet from the BuzzBox), you can be reasonably sure you have located and traced an underground line. Whether this is a power line or some other underground metallic line is not certain, unless you can trace it to an identifiable source of power like a conduit riser.

Remember these things about using Power mode:

- The highest reading when using Peak Power screen will occur when the LF2200 is at *right angles* to the direction of the line, directly above it.
- When using the Null Power screen, the handle vibration and solid track lines also occur when the LF2200 is *in line with* the direction of the line. (Note that this is *not* the way the **LF2100** works on this screen.)
- Automatic depth readings is **not available** in Power mode.
- The presence of signal in Power mode is very dependent on the power being drawn through the buried line. Be prepared for the signal to suddenly disappear if the load on the line is decreased.
- Test for field distortion by lifting the LF2200 when you have located the line using the Null Power screen. If the apparent location moves to the right or left as you raise it, the field is distorted and you should use the Peak Power screen to establish the correct location of the line.

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 in doubt, throw them out! A weak transmitter battery reduces its range, while weak batteries in a receiver can make it act brain-damaged, as well as reducing the range.
* Always test your transmitter and receiver above ground, for operation and range, before sending the transmitter down the line. ***Every time.***

The transmitter isn't where my receiver said it was; it's several feet off to one side.

The most common source of errors in precise sonde locating is failure to follow all of the locating steps in the operating instructions. It's easy to think when you find a peak signal that your job is done. The LF Series receivers will show you a sonde image on the Sonde screen at many different places, but only one of them is the actual location of the sonde. Pay particular attention to the Crossing screen on the LF receiver, where you walk in a circle around the peak signal to locate the crossing nulls and from there mark a line through the sonde. If you haven't established that line, you can't accurately determine the location of the sonde or its depth.

The signal from my transmitter suddenly quit. I was following it fine, then it disappeared.

Aside from checking batteries, determine whether it is possible that the pipe material changed at some point, or you reached a steel tank. 512 Hz equipment will penetrate cast iron, but not steel, ductile iron or other metal. (Using a 16 Hz sonde with the LF2200 will overcome this problem.)

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.

Check our web site for updated troubleshooting information!

https://prototek.net/faq

and don't hesitate to call us with questions:

800-541-9123

"It's best to shoot trouble before it shoots you."

Product Specifications

BuzzBox

The **BuzzBox Line Exciter** is the companion to the LF2200 or any other line tracing receiver that operates at a compatible frequency. Enclosed in a tough, durable, weatherproof case. Supplied with a set of 6 foot cables with clamps and a 9 inch stainless steel ground rod. Operates in either Conductive or Inductive mode. "Tracks" on the front panel indicate proper orientation for Inductive setup. Operates at four industry standard frequencies, using six standard alkaline "C" cells.

Specifications

Operating Modes	Conductive and Inductive
Frequencies	8 kHz, 16 kHz, 32 kHz and 64 kHz
Power	4 watts maximum, uses 6 "C" alkaline cells, battery life approx. 10 hours continuous
Control	Rotary switch: "Off", battery check, 4 frequency selections
Indicators	8 LEDs indicating ground quality and battery level
Included accessories	Ground rod, cable set with 1/4" phone plug
Operating temperature	-20° to +130° F (-29° to +54° C)
Weight	4.8 lbs. (2.2 Kg)
Size	9-1/2" x 7-1/2" x 4-3/8"

LF2000

The **LF2000** is a powerful and durable receiver that is also remarkably easy to use. Locates any 512 Hz sonde in cast iron or non-metallic lines. Uses 6 off-the-shelf AA alkaline batteries. A clear clicking sound provides intuitive feedback on signal strength – the faster the click, the stronger the signal. Clear LCD screens (with automatic backlight compensation) guide you through the steps critical to locating with accurate position as well as precise depth. Handle vibration at key locating points enables fast, safe "heads-up" locating.

Specifications

Frequency	512 Hz
Output	LCD Screen: Peak locate, Crossing, Sonde, Depth
Automatic Depth detection	to 25 feet (7.6 M)
Controls	4-way thumb switch: Power, Gain, Screen select
Speaker output	Variable rate click
Power source	6 AA Alkaline
Battery life	30-40 hours*
Operating temperature	-20 to +130°F (-29 to +54°C)
Weight	6 lbs. (2.7 Kg)
Size	32" x 8" x 4-1/4"

* Battery life reduced with extensive backlight use

The **LF2200** adds line tracing capabilities to the already powerful features of the LF2000. Locates *any frequency* sonde or line exciter between 16 Hz and 100 kHz using our exclusive "sniffing" feature. Built-in support of 16 Hz (steel or ductile iron), 512 Hz (cast iron or nonmetallic) and 8 kHz (nonmetallic only) sondes. Traces underground metallic lines at four built-in industry standard frequencies using external line exciter. Passively locates underground power at 50/60 Hz. Clear LCD screens (with automatic backlight compensation) guide you through the steps critical to locating both sondes and lines with accurate position as well as precise depth. Locating is enhanced by handle vibration and LED feedback at key locating points, in addition to on-screen imagery. User selectable scaling in English or Metric units.

Specifications

Frequency	Sondes at 16 Hz, 512 Hz & 8 kHz Line tracing at 8, 16, 32 & 64 kHz 4 Custom "sniffable" settings Passive power tracing at 50/60 Hz
Output	LCD Screen: Menu, Peak locate, Crossing, Sonde, Track, Power, Depth
Automatic depth detection	to 25 feet (7.6M)
Controls	4-way thumb switch: Power, Gain, Screen select, Sniffing
Speaker output	Variable rate click, mutable
Power source	6 AA Alkaline
Battery life	30-40 hours*
Operating temperature	-20 to +130°F (-29 to +54°C)
Weight	6 lbs. (2.7 Kg)
Size	32" x 8" x 4-1/4"

* Battery life reduced with extensive backlight use

Operational Notes

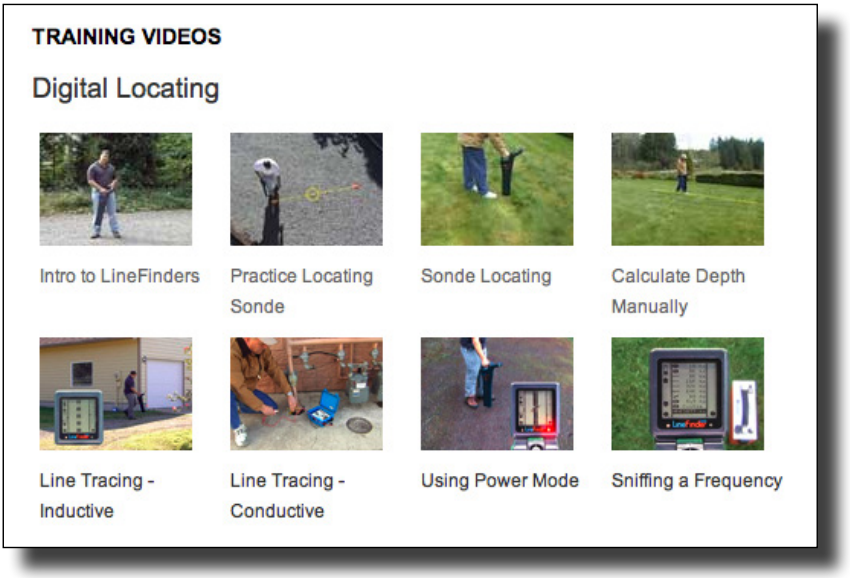
- All LineFinders are designed to shut off after four minutes of inactivity in order to save batteries. The timer is reset whenever you click the button in any direction. This effect can be annoying if you are concentrating on a precise locate on the Sonde screen, for example, and it shuts off in the middle because you haven't been pushing the button to change the sensitivity or go to another screen. It is a good practice to raise the sensitivity one click higher now and then during this process to keep your LineFinder "alive."
- On all LineFinders (LF2000, LF2100 and LF2200) the clicking gets faster as the signal gets stronger (nearer to the source). As you approach a null point, the clicking slows down to a near stop. *On the LF2200 only*, the clicking gets faster in line tracing mode when you are directly above the line (which is technically a null). This was done because we felt it was a more intuitive response when tracing lines.
- Only newer LF2200s include the Menu option of setting the Power frequency. Earlier models (and the LF2100) required Prototek to set the frequency. This user feature can be added to an existing LF2200 for those who need it.
- Newer LF2200s add an alternative Units setting "In" which will express Depth in *inches only* up to 15 feet (feet only beyond that). This setting is not otherwise documented here because its use is rare. This user feature can be added to an existing LF2200 for those who need it.
- Older LF2000s and all LF2100s use a db (decibel) scale for expressing sensitivity, rather than "NEAR..FAR". 0 db is the least sensitive (equivalent to "NEAR"), ranging up to 90 db as most sensitive (equivalent to "FAR"), in 5 db increments. Otherwise, the operation of all units in this regard is the same.
- The LF2100 (discontinued but still supported) offers sonde locating for only 16 Hz and 512 kHz, without the Sniffing feature. Line tracing frequencies are the same as the LF2200, as are all other locating procedures. The LF2100 is not upgradeable.

Your Notes

Training Videos for using

Prototek LineFinders

are available on our web site



https://prototek.net/training/

Prototek

Underground Locating Equipment