



# Lost and Found

## Electronic Locators Provide an Important Tool in Preventing Utility Strikes

By Nick Zubko

**W**henever you can't find something (popular disappearing acts like your keys, the remote control or maybe your cell phone), we all have the tendency to protest that the item isn't lost, per se. It's just "misplaced." You frantically retrace your steps and try to reenact the last time you saw it — all the while probably talking to yourself like a crazy person.

Inevitably, someone tries to help by asking you where you left it and you just about lose it yourself. Every once in a while you're successful, but usually the entire production is for naught. Months later you stumble across the item after you chalked it up as a loss and just bought another one (hopefully you had a spare set of keys lying around somewhere).

Unfortunately for utility contractors, buried utilities are held to a much different standard. These hidden service lines aren't really lost either, but at the same time we don't always know exactly where they are. And contractors today need to be absolutely certain before they can even think about digging. Because as more utilities take up residence in the underground community, the tougher it becomes to install a new one without hitting something.

That's why most contractors employ a variety of different methods to check, double-check and triple-check for existing utilities before cracking the surface of a new project. One method that's gained significant popularity in the last five to 10 years is the use of handheld, electronic locating devices.

Once a one-call center does its work, a contractor can take it a step further and verify the markings electronically before exposing the utilities for visual confirmation (in case you're counting, that's already three methods right there).

"It has taken a long time for the utility locator market to develop; even now it's still in the acceptance stages," says John Bieberdorf, product manager for Subsite Electronics, a division of the Charles Machine Works. "Back in the 1960s and even into the '70s, it was commonplace for contractors to cut through communication lines, for example, repair them and move on. But as lines have gotten more sophisticated — like multiple-bank telephone lines and fiber optics — utilities stopped tolerating it. When contractors started being charged with damages, it probably drove the market as much as anything."

## Finding a Market

Prior to the invention of the electronic locator, witching rods and probe rods were some of the more commonly used methods to find a buried utility. Electronic locating units first came about in the 1940s and '50s, using much of the same basic technology that is still used today. Essentially, the units utilized a transmitter to generate an electromagnetic field around the metallic structure and “detected” its magnetic field.

“The first electronic locators were most commonly a split box type, which is still being used today,” explains Dave Smith, area sales manager for Radiodetection Corp. “They were fairly effective in that they used an analog meter for signal intensity, a gain control and could determine the depth by triangulation. However, they were a little difficult to use in that the receiver had to be held close to the ground so the operator spent a lot of time bending over, which was tough on the back.”

Later variations used single or dual antennas to give an estimate of the depth of the line. Those systems took a signal that was being generated by an existing line and simply amplified it. But the problem was that you didn't always know where it was coming from. It wasn't directional, it was very prone to interference and it only worked as long as things were not congested.

Since then, the devices have improved exponentially. Accuracy has grown in huge increments. In addition to Radiodetection, many other companies have entered the fray, such as Metrotech Corp., Rycom Instruments and Schonstedt, in addition to equipment manufacturers like Subsite (Ditch Witch) and McLaughlin Mfg. Through them all, most locators still operate on many of the same basic principles.

“A transmitter is used to generate a magnetic on a metal conductor by means of an alternating current,” explains Dave Gasmovic, president and CEO of McLaughlin Mfg. “Power can be applied to the metallic conductor by directly connecting to the line (direct connection), using a clamp that encircles the line or induction, sending the transmitter over the line and letting the signal be broadcast through the earth onto the line.”

The line or pipe must be metallic and the system in most cases must be grounded. The better the conduct line is — and the better the system is grounded — the stronger the locate signal and further you will be able to go. Improvements to the interface have also made a huge difference. As modern displays have been introduced, they have been able to take fairly complicated information and make it easy to read and understand.

“Modern displays were an important invention, because with the early units all you had to work with was an audible signal,” Bieberdorf says. “When you walked over a line, the unit would give you a peak indication like an AM radio; it would get louder as it went over the line. Now the products do the same thing, but they do it graphically and in some instances give you an indication of whether it's a power line or another utility.”



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Improvements in electronics have improved signal stability and brought about features that include multiple frequencies, more output power, current direction, current measurement and signal processing. In addition, depth accuracy has improved due to signal stability. There are still many things that effect depth accuracy that are out of the control of the electronics themselves.

Early units were also big and heavy, cumbersome and awkward to use. Units today are lighter, more balanced and from an ergonomic standpoint, they are more comfortable to use. Miniaturization of electronics has helped manufacturers immensely, in addition to developments in polymer. The units are designed to be stronger and lighter weight material that can be molded and fashion into a specific shape to house the antennas and the other oddly shaped components of the units.

“Not only are the transmitters in these units much more powerful, applying more signal to the line,” says Gasmovic. “But they are also more durable. They have greater depth capabilities and multiple antennas to help with depth accuracy. Plus, the units are capable of using more transmitting frequencies, since different frequencies work better on different types of lines.”

## Uncovering the Options

A typical locating system consists of a transmitter, a receiver, ground stakes, direct connection leads and a coil clamp. There are a few different questions contractors need to ask themselves before they start browsing through their dealers. Most units display line location and depth on a large backlit LCD screen for optimal visibility.

“Locators can vary in both shape and size,” Smith explains. “Very simple units are a basic wand or box and the more sophisticated unit is a wand with a larger display that can show more information and a larger antenna area. The transmitters themselves are larger on the more powerful types and usually have a display.”

According to manufacturers, the style of the display should be chosen based on several factors, including what type of operator will typically be using the device and how often it will be used. With the variety of small details incorporated into locators today, these factors can weigh heavily into a buying decision.

“Think about how frequently you’re going to be using the unit,” Gasmovic suggests. “If infrequently or with multiple people, pick a unit that is more user-friendly. Some units have instructional decals right on the unit. This is a great “cheat sheet” for the operator. You should also consider how your crew will treat the unit. Most construction crews are rough on equipment. Pick an instrument that can take abuse without calibration or constant repair.”

Next, you need to select a unit that has power and frequencies suited to the appropriate type of service for which you’re going to be looking. Will it mostly be water, sewer, telephone, electric or gas? Or maybe a little bit of everything? Most units are categorized by the range and



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the number of frequencies available and can be broken down into three general categories.

“Low frequency is 3 kHz and lower, which is typically used when you want to detect lines over a long distance or in congested areas because it tends not to couple onto other lines as freely,” explains Bieberdorf. “Medium frequency is around 30 kHz is mostly a general purpose frequency, since it couples well and goes long distances. If you’re a contractor who only wants one frequency, the middle range is typically what you would choose.”

## Locating 101

### Five Helpful Hints Before You Start Digging

The guys at Subsite Electronics were kind enough to supply us with five quick tips on how to perform utility locates that are both easy and reliable. Pay attention, there may be a pop quiz later.

#### 1.) Setup

First, identify the best access point to the target line. When connecting directly to a line, remove common grounds and connections to other utility lines to prevent the signal from being placed on untargeted lines.

#### 2.) Power & Frequency Selection

On the transmitter, select the appropriate power and frequency setting to match the conditions of the particular locate. Use the lowest frequency required. Remember, the higher the frequency, the easier it is to couple to adjacent lines (but the signal will travel down the line a shorter distance). The lower the frequency, the harder it will be to couple to an adjacent line (but the signal will travel a longer distance).

#### 3.) Sweep

Set the receiver frequency to match the transmitter frequency. Conduct a 360-degree sweep around the access point that the transmitter is hooked to on the target line. This will help determine the direction of the line.

#### 4.) Trace the Line

The location of the target line can be identified by finding the location with the strongest signal response. Sweep the receiver perpendicular to the target line and walk the path. Retrace the path and mark it with the proper color paint or flags.

#### 5.) Expose the Line

Complete the process by exposing the line. Select the critical areas along the marked path of the line and excavate. This is the only recommended practice to verify exact depth and location.

High-frequency units (80 to 120 kHz) couple easily and work well with tracer wires. The signals don't travel very far, but they can broadcast and will couple fairly easily. Most manufacturers offer units with either a single frequency or various combinations, since some frequencies work better than others, travel longer or couple easier. But it really comes down to the fact that the different types of utilities you need to detect require different frequencies. Locators can also be divided by those that provide depth, and those that don't. If you want depth, it requires twice the number of antennas.

Ditch Witch's 910R, for example, comes standard with up to four frequencies and more can be added for a small fee. McLaughlin's Verifier G2 has four active frequencies and uses "smart" transmitter technology to simplify locating and ensure proper connection to the line to be identified.

"Your choice of frequency will depend on the type of line. The best way to isolate a line is by picking the lowest frequency you can so that it doesn't couple," Bieberdorf adds. "A lot of these systems are commonly grounded, which gives you a path to other facilities. If there are common grounds and you have that capability, you break them. Directly connecting the lines is the best. Obviously if it's a power line, you need people who are qualified to deal with them."



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## Seeing the Light

Electronic locators can be an important addition to any contractor's utility location program. However, manufacturers urge customers to use a variety of methods to confirm a line's location. Relying on One-Calls is of course the most common practices, but according to some experts, even they are not 100 percent accurate.

"There are some utilities in the ground that might not be located by the one-call," notes Bieberdorf. "In addition, a one-call only has a certain range at which they locate. They don't give you depth; they locate it on the ground plus or minus a couple of feet. So there are certain things that are missing from one call systems. You also need to be a member, and not all utilities are necessarily members."

Locators add an important tier of verification and expedite the process by being able to match up the marks made by the one-call center. Not only that, the process can also reduce the time needed to expose the line for visual verification (by potholing or vacuum excavation). The visual element is advocated by locator manufacturers across the board, because while locators can get you very close, they aren't completely accurate either.

"Any locator is subject to signal distortion from various sources of interference, so visual confirmation should always be performed," notes Gasmovic. "This needs to be done by non-destructive means. That can be a shovel on a water line, but that can be destructive to a fiber-optic cable. That is where vacuum excavation and potholing come in. This is a quick, non-destructive method to check line and depth of utility."

The biggest challenge is making sure that locating is done before digging begins, which is often one of the primary causes of damage to underground utilities. Then the challenge is training of all parties using locators, which is something manufacturers stress as much as anyone.

"There needs to be an emphasis on continuing to make locators easier to use and understandable along with an emphasis on training," notes Smith. "Technologies like global position systems (GPS) and ground penetrating radars (GPR) will continue to be used more in the mapping and locating of underground lines. Until recently, there has been relatively little demand for this capability."

As the underground infrastructure continues to mature, contractors will have a tougher time contending with the three-ring circus taking place under the ground. It will continue to be a challenge, but it simply means that damage prevention is more important than ever. And while there will be costs associated with correctly locating and exposing utilities, manufacturers agree that they will be well worth it.

"It may be paying a little more for the locate ticket or the excavation price to make sure the job is done correctly," Gasmovic says. "It may be taking the time to expose a line even if you're not getting paid or it may be legislating sensible digging laws — not just revenue generating laws in the way of fines. Reducing damages is achievable, but everyone needs to be willing to compromise."

**Nick Zubko** is associate editor of *Utility Contractor*.