VM-510FFL User Guide V1.3

1. Introduction

The VM-510FFL standalone A-frame is primarily a cable sheath fault finder. The fault must be in contact with the ground to be detectable. It can detect other conductors to ground faults such as pipeline coating defects or cable conductor to ground faults.

The VM-510FFL standalone A-frame requires a fault find signal be applied to the faulty conductor via a connected transmitter. There are two types of fault find signals:
- “FF” (3/6Hz fault find)
- “8kFF”

For the purposes of this manual the 8k FF signal is assumed. (Operationally they are very similar)

Compatible Transmitters:
- Loc-10Tx (type of fault find type dependant on model)
- Loc-5Tx (type of fault find type dependant on model)
- VM-550FF (8kFF)
- VM-560FF (8kFF)

2. Power Supply

The unit is powered from a choice of six AA alkaline cells or six AA NiMH cells. Change or recharge the cells when the indicator on the screen indicates empty.

Note that the rechargeable option is compatible with “off the shelf” NiMH cells. The cells must be charged outside the unit. Ensure the correct charger is used and adhere to the manufacturer’s instructions.

2.1. Accessing the Batteries

Lay the unit on the ground to avoid dropping the battery pack. Unscrew the battery cap on the units handle section. The battery holder can then be removed by gently pulling on the holder.

When inserting the battery pack ensure the correct orientation of the holder. The two contacts at the end of the battery pack should be at the bottom as shown in the adjacent graphic.

TIP
Replace all batteries. Do not mix new and old batteries or charged and uncharged batteries. This can lead to batteries being reverse charged and can cause damage, heat and even fire.

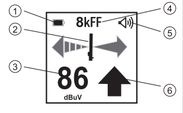
2.2. Powering from Rechargeable Batteries

The unit can be powered from NiMH batteries. It is important that the unit is configured to the correct batteries. To configure the unit press and hold the **Mode** button until the menu appears. Use the “**+**” and “**-**” buttons to scroll to “Batt”.

Use the **On/Off** button to toggle between the two options. Select NiMH. Exit the menu by a short press of the **Mode** button.

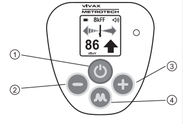
3. Default Locate Screen

A short press on the **On/Off** button will switch on the unit and the default Fault Locate screen will appear. The screen elements are listed below.



1	Battery Indicator
2	Left/Right of Cable Indicator
3	Fault Signal Level (dBuV)
4	Mode (Defaults to 8kFF)
5	Speaker Volume (Use the **On/Off** button to turn the unit on, change the volume levels from low, medium, to high, and turn the unit off)
6	Fault Direction Indicator

The unit is operated from four buttons as listed below:

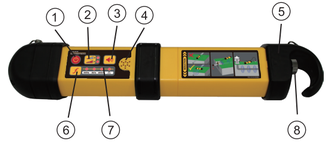


1	**On/Off** button. Short press on, long press off. Also short press to change volume.
2	“**-**” button. Decrease sensitivity or when in menu, will scroll up.
3	“**+**” button. Increase sensitivity or when in menu, will scroll down.
4	**Mode** button. Single press for depth, double press to change mode, long press for Menu.

4. Mini USB Connector

The USB connector is located on the underside of the electronics housing, next to the speaker grill. It is used for software updates.

5. Transmitter Operational Controls



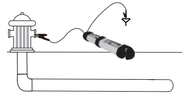
1	On/Off Button
2	Output Power Select and Indicator
3	Speaker Volume Select
4	Speaker
5	Battery Housing Cover
6	Frequency Select
7	Frequency Selected Indicators
8	Battery Cover Retaining Screws

Active Cable and Pipe Locating
Detecting a cable or pipe can be achieved by applying a locate tone to a cable or pipe from a transmitter. This is called active locating.
The locate tone can be applied by either:
- Direct Connection
- Signal Clamp Mode

Direct Connection Mode
This method involves making a direct connection to the cable or pipe.

WARNING
Do not attempt to make a connection to a live conductor. Only make a connection to de-energized or dead cables. It is possible to connect to the sheath of active cables but this should only be attempted by qualified and authorized personnel.

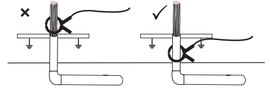
Method:
Plug the direct connection leads to the transmitter. Connect the red lead to the cable or pipe and the black one to a suitable ground. Ideally this should be a ground stake placed at right angles to the probable route of the target line. If it is not possible to use a ground stake, connect the black lead to a grounded structure such as the rim of a manhole cover or other buried metallic structure. Try to avoid fencing as this will create interference from the return signal travelling along the fence. A good connection will be indicated by a change in speaker tone. The larger the tone change the better the connection. If there is no tone change, re check the connections and if necessary clean the connection point with a wire brush and try again.



Select the desired frequency by pressing the “f” pushbutton. As a general rule the higher frequency will have a cleaner more stable reading and will jump insulation joints on pipes but has the disadvantage that it is more likely to jump to other utility nearby. The lower frequency is better for tracing a particular utility as it is more likely to keep to the utility line the transmitter is attached to. If in doubt, start with the lower frequency and switch to the higher one if it is not possible to detect a stable reading.

The same applies to setting the signal level. A short press on the output level pushbutton will alter the output from low to high. Always start with the low setting and switch to high if it is not possible to detect a stable reading on the receiver. Using the low setting will also prolong the battery life.

Signal Clamp Mode
1. Connect the signal clamp to the transmitter.
2. Place the clamp around the cable to be located. Ensure that clamping is done below the earthing point of the cable otherwise a signal will not be induced efficiently.
3. Make sure the two halves of the clamp close properly.



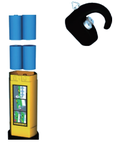
4. Switch on the transmitter and set to 8 kHz for optimum clamp performance. Follow the locating instructions as in “the Direct Connection Mode” section.

NOTE
Using the clamp does not require a ground connection from the transmitter. However, the signal quality will be better if there is a ground at both ends of the cable.

Transmitter Batteries
The transmitter is supplied with alkaline batteries. It can also be powered from a bespoke Li-ion battery pack.

Alkaline Batteries
A low battery is indicated by a flashing on/off LED. The transmitter requires four D type alkaline batteries. To replace the batteries unscrew the two retaining fasteners of the battery compartment. Remove the old batteries and replace all of them. Mixing good and discharged batteries may result in excessive heat or even fire.

Note the retaining screws should only be hand tight. Only use a screw driver to undo the screws. It is not necessary to use a screw driver to tighten them.



Charging the Transmitter Li-ion Batteries

Remove the battery pack by unscrewing the two fasteners of the battery compartment. Align the red dot on the charger with the dot on the charging socket, situated at the base of the battery, and connect together. Connect the charger to the mains and switch on. The charging LED on the charger will illuminate red until the batteries are charged. The LED will then turn green indicating a full charge.

WARNING
Only use the charger supplied. Using non-recommended charger may result in damage to the equipment or even fire and explosion.

6. Using the Standalone A-frame to Locate the Conductor

Use the Left/Right Guidance, signal strength, and audio tone to guide you toward the conductor. The needle on the Left/Right Guidance meter will move to the right and the tone will be steady if the conductor is to your right. The needle will move to the left and the tone will pulse if the conductor is to your left. The signal (or field) strength on the digital display (LCD) will rise as you approach the conductor. As you close in on the location of the conductor, the meter needle will move toward the center, the signal will peak and the tone will be silent. See graphic below.

7. Determining the Depth and Signal Current applied to a Conductor

To determine the depth/current of a conductor accurately, the VM-510FFL field strength must be strong enough to provide a stable meter reading. Keep in mind that depth and current measurements are affected by, overhead lines, adjacent conductors and abrupt changes in direction or depth.

1. First determine the location of the conductor using any of the methods described above.
2. Slowly rotate the A-frame to achieve the largest numeric value on the display. The A-frame is now on top of and in line with the conductor. Touch the spike tips to the ground keeping the A-frame vertical.
3. Single press and release the Mode Button on the handle of the A-frame. Within seconds, the digital display will show the signal current and depth of the conductor.

8. Using the Standalone A-frame to Fault Find

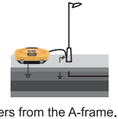
WARNING
Always be aware of the location of buried utilities (especially buried power lines) when pushing the spikes of the a-frame into the soil.
The spikes of the A-frame are sharp. Always handle carefully to avoid injury.

The standalone A-frame is used to detect ground faults on pipes and cables. In the case of pipes, the faults consist of coating defects. In the case of cables, faults are usually caused by insulation damage allowing the metallic sheath (or internal conductor) to become in contact with the ground.

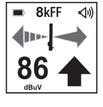
To detect a damaged section, the line should be isolated and have all ground bonding removed. This will ensure that the ground fault is not masked by deliberate bonding to ground. The A-frame cannot distinguish between these two situations.

After isolating the line, if available, use the resistance measuring function on the transmitter, or, if not, use a dedicated resistance measuring device to confirm that there is a fault to ground. The A-frame will typically detect faults up to 2 mega ohm (depending on the distance from transmitter, soil conditions, etc.).

Connect the transmitter to the target line using the red lead. A ground stake needs to be pushed into the ground and the black cable clipped to it. Try to place the ground stake as far as possible from the line to be evaluated. This ensures return currents do not distort the results. Switch on the transmitter and select either FF low or FF high. Use FF high if the line to be surveyed is long or the fault resistance is high. Make sure the receiver and transmitter are set for the same FF type.

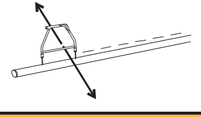


Remove the rubber spike covers from the A-frame.
Press the **On/Off** button to turn the unit on. The unit will automatically default to the A-frame screen.



Note that if the spikes are not in the ground or there is only a very small signal, the dB reading and arrow may not be visible. These are only shown when there is a valid fault find signal.
Use the left/right indicator to position yourself over the cable. The correct position is indicated by the bar being centralised on the display.

Note that if using the default FF screen as indicated above, there is no need to adjust the gain using the **"+"** and **"-"** buttons as the unit does this automatically for you.

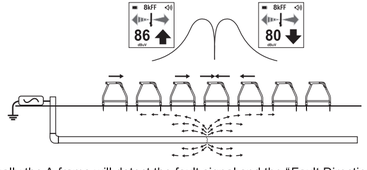


Also the speaker will emit a pulsed tone one side of the cable and a solid tone the other, so it is possible to locate without looking at the screen. If necessary, adjust the volume by using short presses on the **On/Off** button.

Hold the A-frame in line with the suspected route of the cable.

Walk along the route of the line placing the spikes of the A-frame in the ground (with the green leg pointing away from the transmitter connection point) every two or three paces. Allow a couple of seconds for the electronics to settle before moving off to the next position.

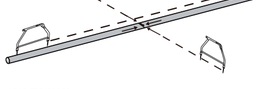
If starting near the transmitter, the arrow on the display will point away from the ground point. As the distance from the transmitter increases, the dBuV reading will reduce and eventually the arrow will fluctuate or disappear altogether. This is because the fault location is further along the line. Use the left/right indicator to ensure the A-frame is positioned over the line and continue placing the A-frame in the ground every two or three paces.



Eventually the A-frame will detect the fault signal and the "Fault Direction Indicator" arrow will point forwards.

Continue moving forwards, it may be worth reducing the distance between measurements points as the fault is neared. The dBuV reading will increase as the fault is neared. Maximum reading will be just before and just after the fault.

When over the fault, the dBuV reading will drop and the arrow will flip backwards indicating that the position of the fault has been passed. Carefully place the A-frame before and after the fault to pinpoint the position. Repeating this across the line direction will pinpoint the fault laterally. The fault will be at the point where the lateral fault is identified.

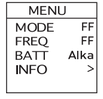


WARNING
Always disconnect or isolate target/faulty/suspected cables before connecting the transmitter to it. Never attach the transmitter to live cables.

TIP
If it is suspected that there is just one fault, insert the A-frame approximately one meter from the ground stake. Note the dBuV - this is approximately the maximum dBuV reading that will be measured over the fault.

9. Menu Settings

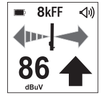
The standalone A-frame has a number of configurable features. These are accessed via the user menu.
To enter the User Menu press and hold the **Mode** button until the menu appears.



(Note, the menu is continually under development, so there may be discrepancies from what is shown.)
When in the Menu screen, the buttons have the following functions:
- **"+" and "–"** buttons navigate up and down the menu.
- **On/Off** button is used to change a selection.
- **Mode** button is used to enter or exit the menu screen.

Mode: This Menu section allows the user to change modes between FF, P/N, Peak or Null. Note that it is also possible to toggle through these options with a double press of the mode button when in a locate mode.

FF :-



This is the default screen and displays both the cable location and the direction to the fault.

P/N (Peak/Null) :-

This mode uses the null antenna to indicate the position of the cable on the Left/Right indicator. The numeric value indicates the peak value. In a non-distorted signal field the maximum peak indicator will coincide with the Left/Right indicator null position (i.e. the bar will be centralised). If they do not coincide the signal is distorted and the information should be treated with caution.

PEAK :-

This screen shows a peak level signal. The bar graph and numeric value are both indicating the maximum signal over the cable. The Peak signal is the most accurate signal and should be used to pinpoint the line of the cable if high accuracy is required.

The bar graph at the bottom of the display indicates the gain setting. The gain can be altered when in Peak or Null modes by pressing the "+" or "-" buttons.

NULL :-

The Null screen shows a minimum signal over the cable. Both the bar graph and numeric value indicate signal strength. The position of the cable is indicated by a minimum signal. This method gives a sharp null over the cable and is useful for tracing the approximate position while walking the route. Caution should be taken though as the null signal can be displaced to the side by a distorted signal.

9.1. "FREQ" Setting

Use the **"+"**, **"-"** buttons to move the cursor down to the "FREQ" position. Use the **On/Off** button to select either 8kFF or FF. 8kFF is the preferred fault find mode as it gives the best performance in most situations. However, the FF signal is used to be compatible with older type transmitters. Check which setting is used on the transmitter and select the setting on the A-frame to match.

9.2. "BATT" Setting

Use the **"+"**, **"-"** buttons to move the cursor down to the "BATT" position. Use the **On/Off** button to select either "ALKA" for alkaline batteries or "NiMH" if rechargeable batteries are used.

9.3. INFO

The INFO screen is used by service technicians to determine the software status and also some measured parameters. A screen similar to the one below will be displayed. U is battery output voltage. I is battery output current. T is A-frame handle inside temperature. BL is backlight voltage. The measurements (U, I, T, and BL) are updated every second. Short press **Mode** button to return to main screen.

INFO	
SW	v1.1221
U	8732mV
I	26.4mA
T	19C
BL	3316mV

TIP
Keeping the spikes of the A-frame clean will help it make good contact with the soil.

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