AALogic

Cable Fault Location System

User Manual
Version 1.0.4

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1 GENERAL DESCRIPTION

The ***AALogic*** Cable Fault Location System allows the user to locate the physical location of pair faults in aerial cable and shield faults in buried cable using the ST-101 tone transmitter; SR-101 sensitive receiver; and either a hand coil, lay-up stick, or A-frame.

The ST-101 is connected the cable pairs or the cable shield to send tone. Fault location is accomplished by measuring the signal received from the cable. Current flow through the fault requires a complete path for the current. The ST-101 provides the source voltage and the fault completes the path back to the source.

The technician checks the cable at points along the cable to determine if the tone is present and compares the tone with the last position. Depending on the fault type, the tone level will change indicating the location of the fault. The fault location can be confirmed by re-checking the signal levels before and after the suspected fault location.

2 WHAT IS INCLUDED

The Cable Fault Location System basic kit includes the following items:

- Rugged carry/storage case
- ST-101 Signal Transmitter
- SR-101 Receiver with carrying case
- Accessory bag
- ST-101 charger
- SR-101 charger
- Test cord with clips
- Differential hand coil
- Audio headset
- USB Drive with documentation

3 ADDITIONAL ACCESSORIES

Contact your local sales representative for these additional accessories.

- LUPA-25 — Layup Pole Assembly with differential pickup coil and extension cable for toning aerial cable while standing on the ground.
- DAP-125 — Differential Amplified Probe for picking up tone on cable pairs
- AFP-100 — A-Frame buried cable probe for buried fault location
- TXSTX-25 — 25 feet, extra-long test cord with clips for extending a coil connection.
- D105DC615 — Vehicle charging adapter for the SR-101 Receiver (not compatible with the ST-101 Transmitter)

4 TRAINING

This manual is written in a tutorial format. Users can learn to use the equipment by stepping through these instructions. This manual is available in PDF format on the included USB drive and from http://aalogic.com/products/snoopy/downloads .

Check www.AALogic.com for videos or contact your sales local representative for additional information and other ***AA*Logic** products.

5 SAFETY

⚠ The ST-101 can apply 200V of low current power to the line that can produce a shock to the user similar to ringer voltage.

Extreme caution must be exercised when using the LUPA-25 or hand coils on aerial cables to avoid contact with high voltage power lines.

All prescribed safety precautions and procedures must be observed while using the ST-101 and SR-101. Failure to do so can result in serious injury or death.

Caution should be used when foreign voltage is detected on a pair. The voltage may be a power source capable of injury to technicians and possible damage to equipment. Foreign voltage should be removed prior to locating for best results.

6 CARRY/STORAGE CASE

The Cable Fault Location System kit includes a rugged, waterproof storage case. The equipment should be stored in this case when it is not in use to avoid damage to or loss of any of the components.

7 ST-101 TRANSMITTER OVERVIEW

This manual applies to ST-101 firmware versions 2.28 and higher. The ST-101 main display and front panel controls are shown in the following example.

- The **PWR/CLR** on the lower left is used to exit any screen or to turn the unit off.
- Keys **[F1]**, **[F2]**, and **[F3]** are screen addressable keys. The key functions change as you select various options. On the Main screen, **[F1]** **AERIAL** starts the transmitter in the Aerial fault mode and **[F3]** **Buried** starts the Buried fault mode.
- The **FREQ** key allows for manual frequency selection from the transmit screen.
- The **LEVEL** key allows for manual voltage level setting from the transmit screen.
- The **CFG** key allows the user to set the **CONTRAST**, **BACKLIGHT**, and access the **HELP** options.
- The **12V** jack is used to charge the internal battery. Only use the supplied charger when charging the ST-101 to avoid damage to the unit.
- The **CHGR** lights above the example has a green light when the charger is connected. A red light is on when the battery is charging. The battery is fully charged when the red light goes out.
  Note: Both lights may appear white when the backlight is on and the charger is disconnected.

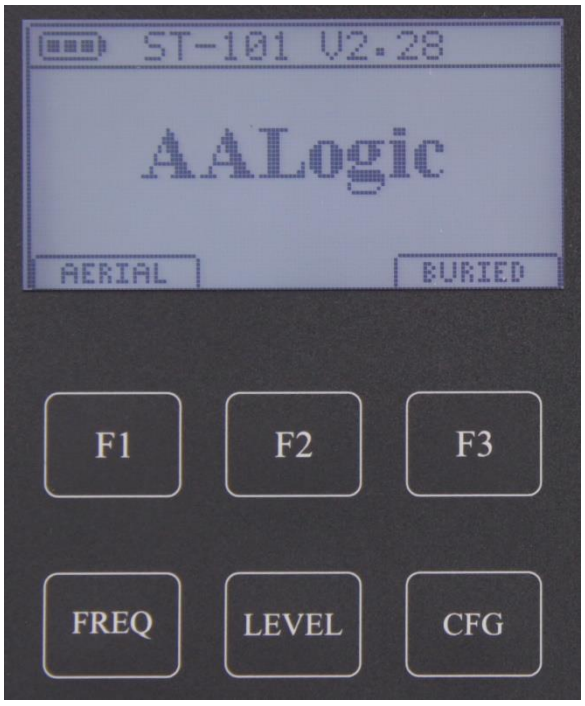
7.1 TEST CORD CONNECTION

The test cord is used to send tone on the faulted pair(s) or the cable shield.

Connect the test cord to the jack on the right side of the ST-101. Lift the jack cover and plug in the test cord.

7.2 DISPLAY

The main screen is shown in the following example.

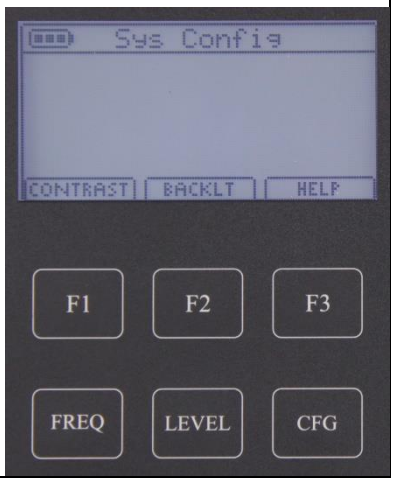


- The display backlight and contrast are adjustable by pressing the **CFG** key.
- A battery charge indicator is in the top left corner. Always check this indication before use. If only one segment is shown, charge the unit as soon as practical.

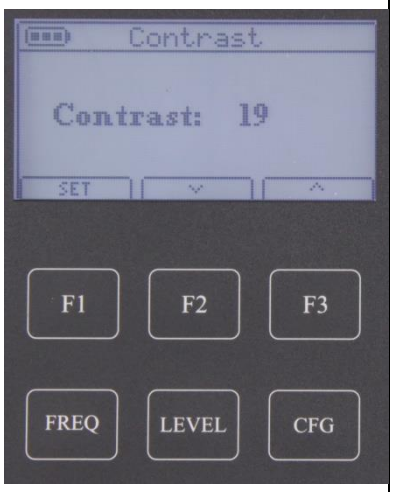
7.2.1 Adjusting Contrast and Backlight

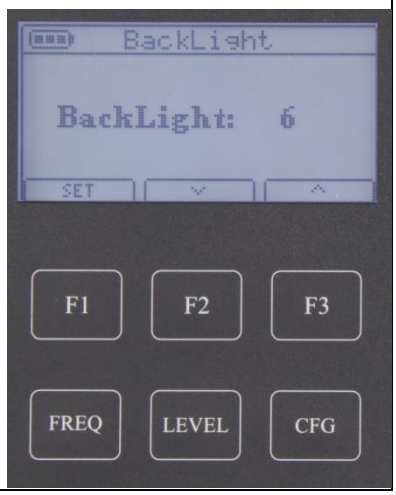
The contrast and backlight settings can be changed as follows:

1. Press the **[CFG]** key to display the Config screen.
   The contrast and backlight levels can both be adjusted. It may be easier to adjust the backlight to a comfortable level first and then adjust the contrast.



2. Press **[F1]** **CONTRAST** or **[F2]** **BACKLT** to select the setting to adjust.
   Use the **[F2]** ⇩ and **[F3]** ⇧ to adjust the setting and press **[F1]** **SET** to save and exit the **[CFG]** mode.





7.3 BEFORE EACH USE

7.3.1 Battery Charging

The ST-101 should be charged before each use. Use only the supplied power supply with the ST-101. AALogic recommends charging a minimum of four hours before the first use. In normal operation, the ST-101 should be fully charged after two to three hours depending on the current charge level.

The battery is approximately above 60% when all three segments are shown, 40% to 60% with two segments and less than 40% when only one segment is shown.

When the battery fails to operate the ST-101 for at least four hours between charges, the battery is becoming weak and should be replaced. Contact TechSupport@AALogic.com or your local sales representative.

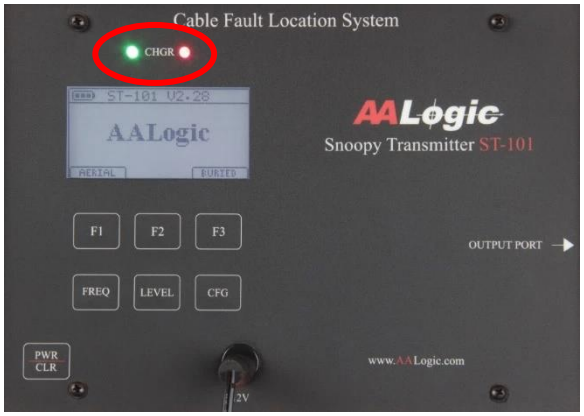
Plug the provided charger into an outlet and the other end into the charger jack located on the front of the ST-101.

Two indicator LEDs are provided above the screen. The green LED indicates the charger is connected and has power. The red LED indicates the battery is charging. The red LED is goes off when the battery is fully charged.

There is a battery charge indicator in the top-left corner of the display. This indicator has three segments. The battery is approximately above 60% when all three segments are shown, 40% to 60% with two segments and less than 40% when only one segment is shown.

The ST-101 should be charged as soon as practical when only one segment is shown.

There is no power off timeout on the ST-101.



7.3.2 Checking the Pair Cord

The pair cord should be checked periodically to ensure it is not damaged. If damage is suspected, short the clips and measure the resistance from the tip to the sleeve of the plug with a test set. The resistance should be 0 Ω.

8 SR-101 Receiver Overview

The SR-101 Receiver is a multipurpose, sensitive receiver used to monitor signals on cables. The SR-101 is compatible with the DHC-124 differential hand-coil, LUPA-25 Layup Pole sensors, A-frame probes and the DAP-125 differential amplified probe. Some third-party sensors may also be compatible.

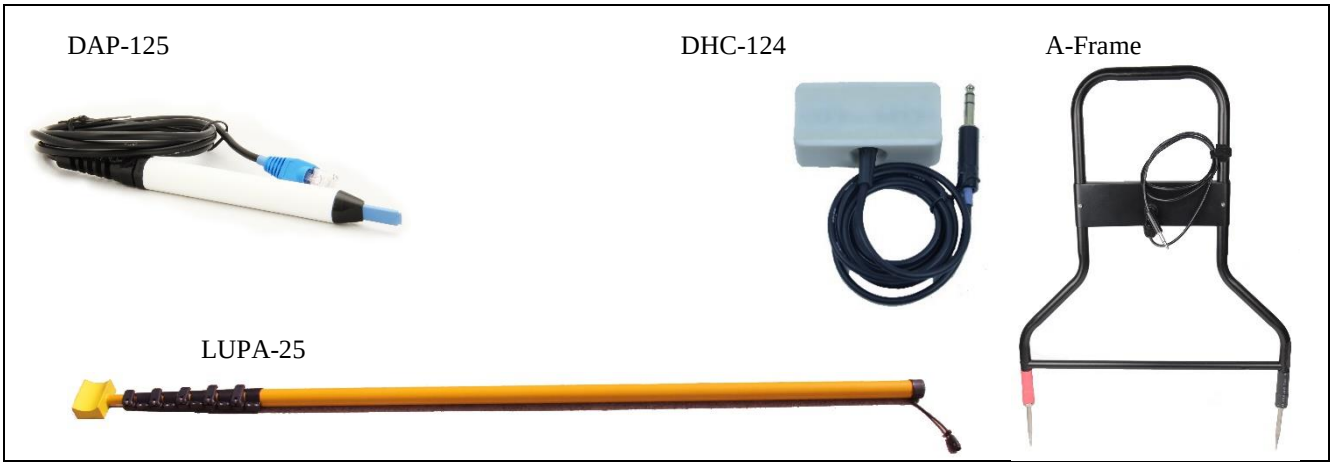
This manual applies to SR-101 firmware versions 4.31 and higher.

8.1 Carry Case

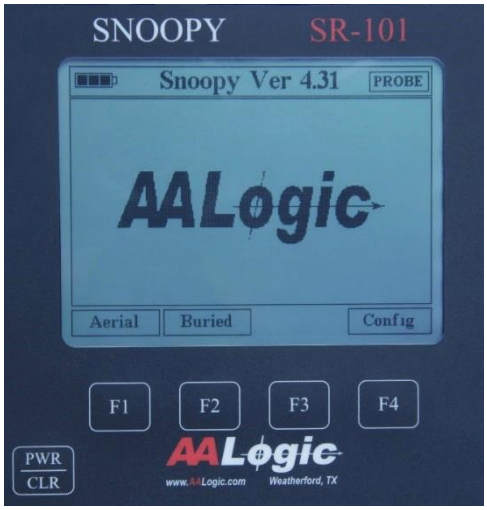
The included carry case may be adjusted for a comfortable carry height when worn around the neck. The case is designed to hang in a face up position when in use. The case can be easily removed and cleaned if needed.

8.2 PROBE/COIL SELECTION

At least one probe is necessary when using the SR-101. The DHC-124 hand coil is included in the basic Cable Fault Location System kit. The available LUPA-25 Layup Pole Coil can be used to tone aerial cables while standing on the ground. The DHC-124 is to pick up tone directly from the cable. An optional A-frame is required for locating buried faults.



8.3 MAIN DISPLAY



The SR-101 main display is shown.

- The PWR/CLR on the lower left is used to exit any screen and to turn the unit on/off.
- A battery indicator is in the top left corner. Always check this before use. If only one segment is indicated, charge the unit as soon as practical.
- The three modes are **Buried**, **Aerial**, and **Config**. Press the key below the label to select a mode.
- The display is transflective making it easy to read in bright light.
- Contrast and backlight options allow optimum display in a wide variety of operating conditions.

8.4 MODES

This is a brief description of each of the options on the main display. Detailed operation information is provided in the locating sections.

8.4.1 Buried

The buried mode is used to locate buried cable faults when used with an A-frame probe. Procedures are different for open shields vs. Earth faults. Both faults are described in this manual.

8.4.2 Aerial

The aerial mode allows the technician to locate resistive pair faults in aerial cables using the DHC-124 differential hand-coil, LUPA-25 layup pole assembly, or another compatible probe.

This mode can also be used to monitor 577Hz and 987Hz pair identification tone sent by AALogic or other manufacturer test sets using the DAP-125 differential amplified probe.

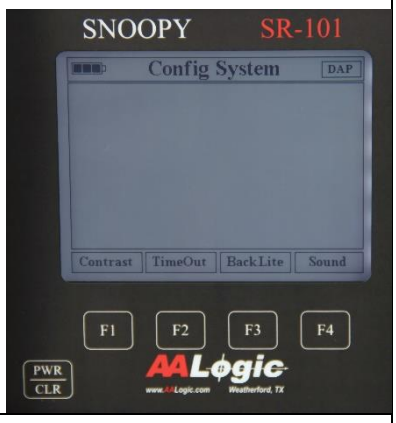
8.4.3 Configure

The Configure mode allows the setting of the Display Contrast, Time-out, Display Backlight, and the Sound mode.

8.4.3.1 Display Setup – Contrast and Backlite

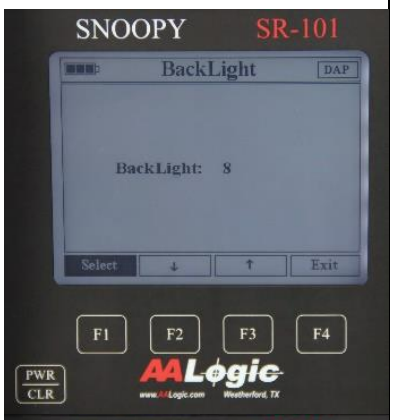
The contrast and backlight settings can be changed as follows:

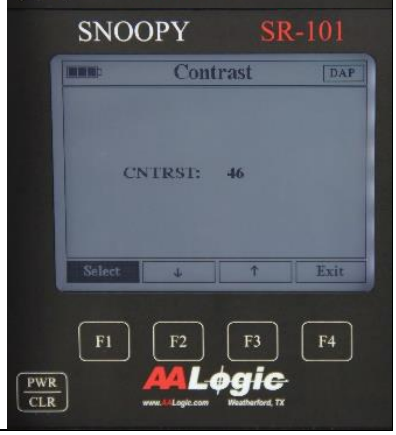
1. Press the **[F4]** **Config** key from the main screen to display the Config screen.



The Contrast and Backlight levels are both adjustable. It may be easier to increase the backlight to a comfortable level first and then adjust the contrast.

2. Press the **[F2]** ↓ and **[F3]** ↑keys to decrease or increase the values and press [F1] Select to save them. Pressing **[F4]** **Exit** returns to the main screen without saving any changes.

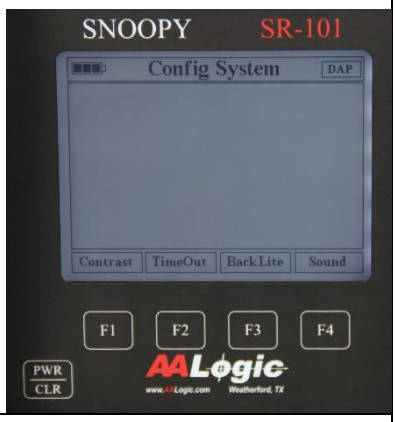




8.4.3.2 Timeout

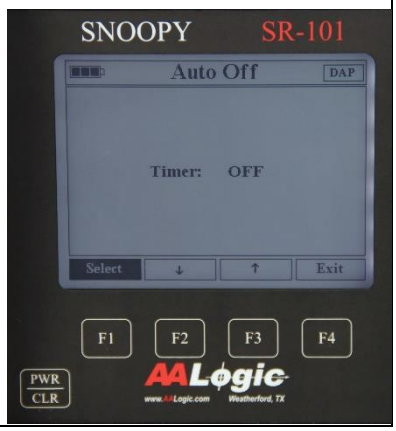
The timeout option allows the SR-101 to shut down after an idle period to conserve battery power. The timeout can be disabled for continuous operation.

1. Press the **[F4]** **Config** key from the main screen to display the Config screen. Then press **[F3]** **TimeOut**.



This timeout can be set in 15-minute increments from OFF to 45 minutes. As shown, the SR-101 remains on until the user turns it off with the **[PWR/CLR]** or the battery is exhausted.

2. Press the **[F2]** ↓ and **[F3]** ↑ keys to decrease or increase the value and press **[F1]** **Select** to save the setting. Pressing **[F4]** **Exit** returns to the main screen without saving any changes.

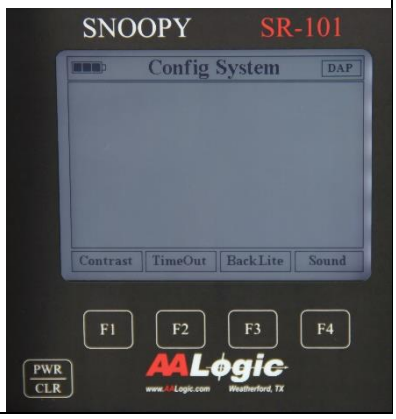


8.4.3.3 Sound and Speaker

The external speaker is located on the left side of the SR-101. This area should be protected from exposure to water. Inserting sharp objects into the holes will damage the speaker.

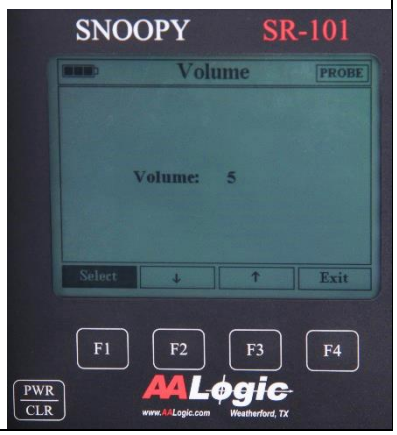
A volume control for the tone is provided on the tone monitoring screens. The volume of the keypresses is controlled through the Config screen as follows.

1. Press the **[F4]** **Config** key from the main screen to display the Config screen. Then press **[F4]** **Sound**.



The loudness of the keypress volume can be adjusted. Press **[F3]** **KPVolum**.

2. Press the **[F2]** ↓ and **[F3]** ↑keys to decrease or increase the folume and press **[F1]** **Select** to save them. Pressing **[F4]** **Exit** returns to the main screen without saving any changes.



8.5 CONNECTIONS

The right-side panel has the connections for the SR-101 as shown below. This area should be protected from exposure to water.

1. Probe jack for DHC-125 or another compatible probe.
2. Hand coil, layup pole, A-Frame, or third-party coil jack with Tip/Ring/Sleeve plug – three-wire.

3. Hand coil, layup pole, A-Frame, or third-party coil jack with tip/Sleeve plug – two-wire.

4. Earphone/headphones jack for the provided headphones or other compatible earphone/headphones.
5. Charger for the provided battery charge adapter.

8.6 BEFORE EACH USE

8.6.1 Battery Charging

The SR-101 should be charged before each use. Use only the supplied power supply. AALogic recommends charging a minimum of four hours before the first use. In normal operation, the SR-101 should be fully charged after two to three hours of continuous usage depending on the level of discharge.

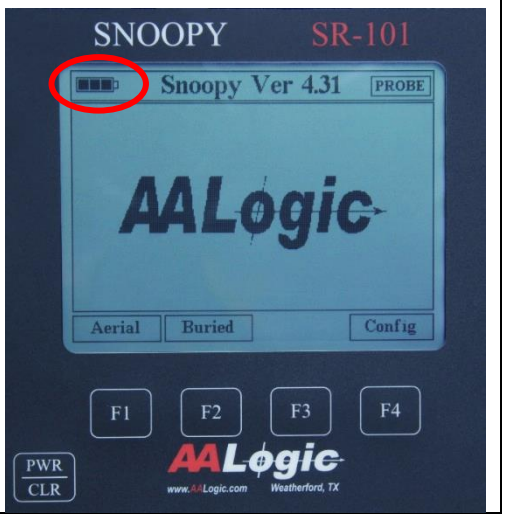
Plug the provided charger into an outlet and the other end into the charger jack located on the right side of the SR-101.

Two indicator LEDs are provided at the probe jack. The green LED indicates the charger is connected and has power. The red LED indicates the battery is charging. The red LED goes off when the battery is fully charged.

There is a battery charge indicator in the top-left corner of the display. This indicator has three segments. The battery is approximately above 60% when all three segments are shown, 40% to 60% with two segments and less than 40% when only one segment is shown.

The SR-101 should be charged as soon as practical when only one segment is shown. The SR-101 may be operated with the charger connected if practical.

To conserve battery power, the Timeout feature can be set to automatically turn the unit off. Refer to 8.4.3.2 above.



9 GROUNDING

Grounding is critical for proper operation of the outside plant. It also plays a significant role in the identification and measurement of faults as well as the location process. The ground should always be confirmed before use in fault location.

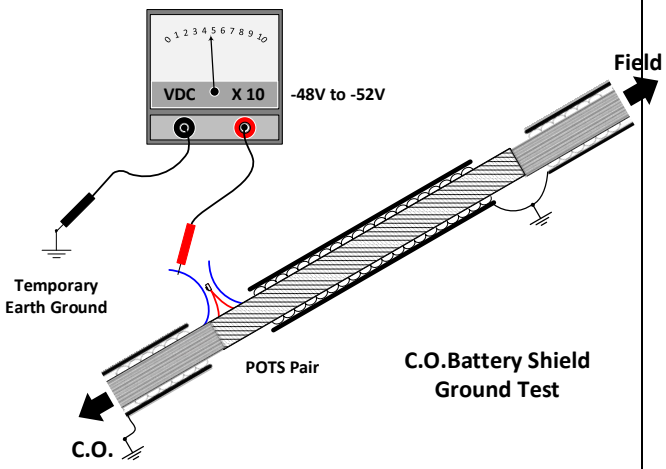
9.1 SHIELD GROUND

The shield ground may be compromised at any point along the cable. This may be due to failing or missing bonds, physical cable damage, or environmental damage such as lightning. The shield continuity should always be tested prior to use in any measurements or fault locating.

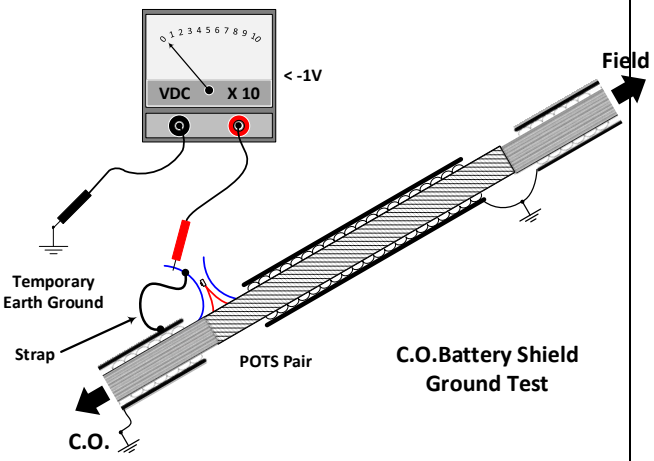
9.2 C.O. BATTERY TEST

A C.O. battery test (CBT) uses a POTS pair to verify that the shield ground condition. The test is used to ensure the shield is adequately grounded and has continuity for test measurements and toning and testing.

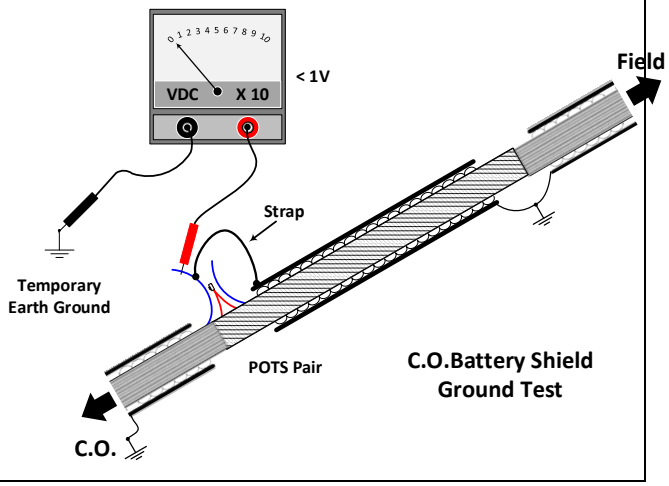
1. Locate a POTS pair in the cable.
2. Place a temporary ground. A screwdriver inserted into the ground is acceptable. A Multiple Grounded Neutral (MGN) may also be used for this test.
3. Remove the bonds and grounds at the access point. Leave other grounds and bonds in place.
4. Connect a test set, such as the D-105, in voltage mode, between the temporary ground and the ring of the pair.
5. The meter should indicate between -48V and -52V.
6. If no reading is obtained, recheck the connections to the temporary ground and the ring. If there still is no reading, change the temporary ground.



7. Connect a strap between the ring and the shield toward the C.O. The voltage reading should drop to less than -1V if the shield is good and there is a good ground.
8. If there is no change in the reading, verify that the strap is making good connection between the ring and the shield.
9. If there is only a partial or no drop in the voltage, the shield has a partial open, is completely open, or the bond(s) in that section of the shield is bad and not sufficient for fault location.



10. Repeat the test for the field side shield at the access point.
11. Additional measurements should be taken on any shields identified as defective.

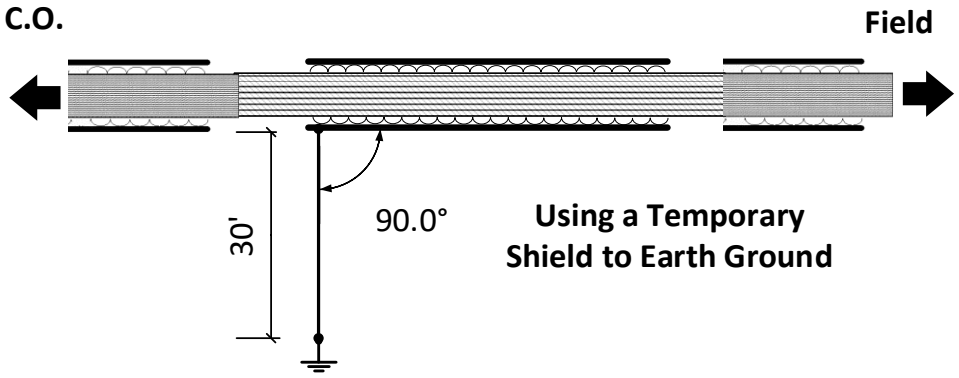


9.3 MULTI-GROUND NEUTRAL (MGN)

If the C.O. battery Test above indicates the shield grounds are not good, an MGN connection is the next best connection to use for sending tone when ground is required and for testing/estimating fault location.

9.4 TEMPORARY GROUND

A temporary ground may be used if other ground options are not available. The temporary ground should be placed at least 30 feet from the access point and at 90 degrees from the cable path to avoid tone coupling paths. The ground may be extended using horizontal jumper wire, drop wire, or equivalent.

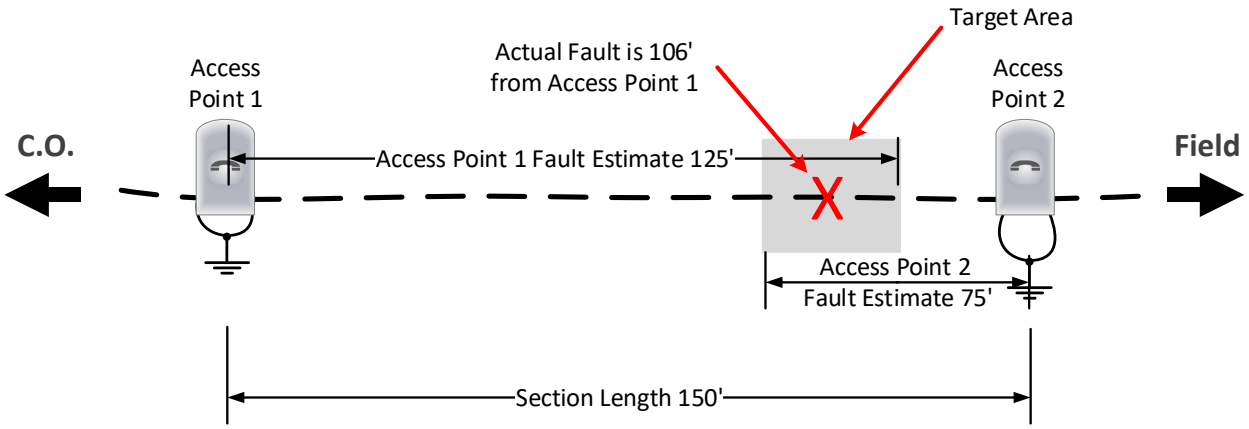


10 FAULT IDENTIFICATION AND LOCATION ESTIMATION

The technician must identify the type of fault before attempting location. Test equipment, such as the AALogic D-105 test set, may be used to identify various fault types according to local practice. Refer to the test equipment manuals for testing procedures.

The distance to the fault should also be *estimated* using test equipment. Resistance meter, capacitance meter, resistive fault location, and TDR may all be useful depending on the cable and type of fault. The estimate and the cable documentation are used to reduce the amount of cable that must be toned. The physical location and the location provided by test equipment and documentation may not match. Most faults are located at an access point. The remainder of the faults are typically located in mid-span.

During fault identification, testing and estimates should be conducted from both ends of the span. Bridge tap in the span will affect the test measurements and distance estimates and should be removed when possible.



Fault Estimate

Once the faulted wires or shield faults are identified and distance estimated, the transmitter can be connected. With multiple faults, it is recommended to use the fault with the lowest resistance then retest after the fault is located and corrected.

10.1 Types of Faults

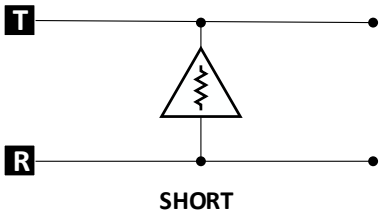
The Cable Fault Location System is designed to locate pair faults in aerial cables and shield faults in buried cables as follows:

10.2 Aerial Pair Faults

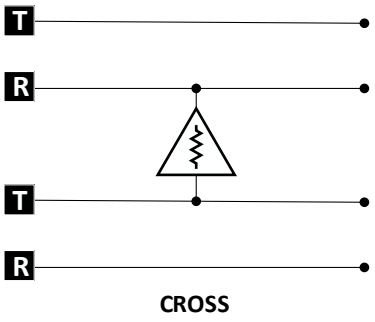
The following aerial resistive pair faults located and maximum resistance:

Note: The actual maximum resistance depends on many factors. In some instances, faults with much greater resistances than those listed may be located.

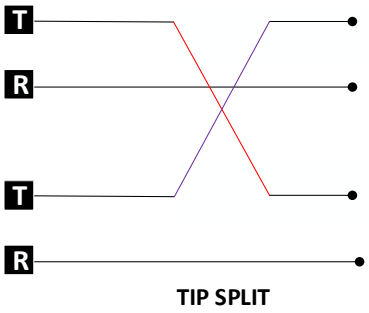
- **Short** Tip connected to Ring
  Maximum resistance: 50K



- **Cross** Tip or Ring of one pair is connected to the Tip or Ring of another pair
  Maximum resistance: 75K

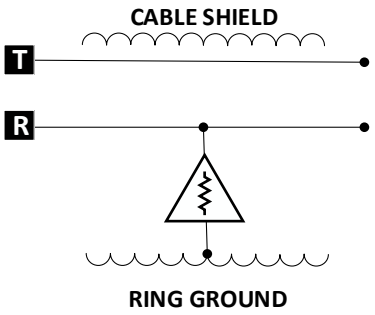


- **Split** Tip or Ring of one pair is split with the Tip or Ring of another pair
  Maximum resistance: < 1.6KΩ



- **Ground** Tip or Ring Connected to shield (grounded)
  Maximum resistance: 50K

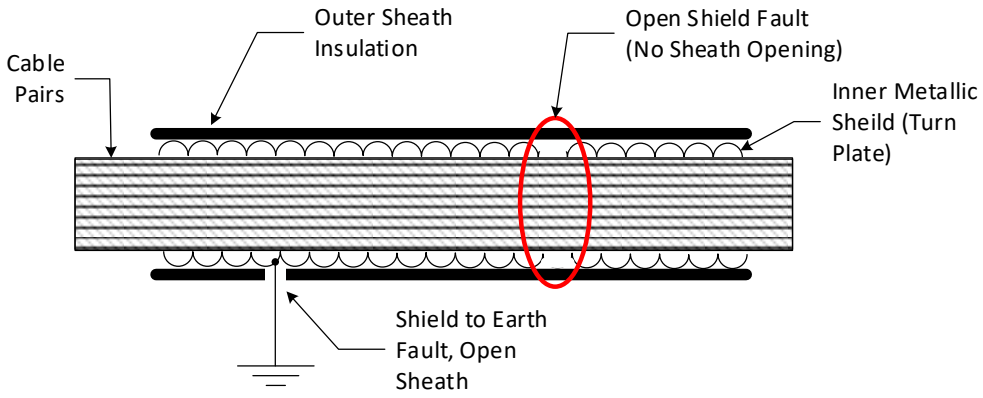
  Locating ground faults can be more difficult due to multiple ground signal return paths. It is recommended to locate shorts or crosses whenever possible. Otherwise it may be helpful to remove shield ground at the transmitter location, then connect the transmitter leads to the faulted wire and shield.



10.3 CABLE SHIELD FAULTS

The following cable shield faults may be located:

- Open Shield Partial or complete open in the shield in a span
- Shield to Earth Contact between the cable shield and Earth through the cable insulation.



Types of Cable Faults

11 SECTIONING

The CO and premise should be isolated from the fault section as close as practical on each side of the fault following standard. This improves the reliability of the fault indication and reduces the time needed to locate the fault.

The cable should be located and marked for buried faults. Skipping this step can result in false indications when probing.

Any premise equipment left on pairs or bridge taps may draw tone resulting in following tone to the wrong location

12 AERIAL PAIR FAULT LOCATION STEP-BY-STEP

The ST-101 includes a cord with pair clips. This cord is plugged into the jack on the right side. Only the pair cord supplied with the ST-101 should be used as shown in 7.1 above.

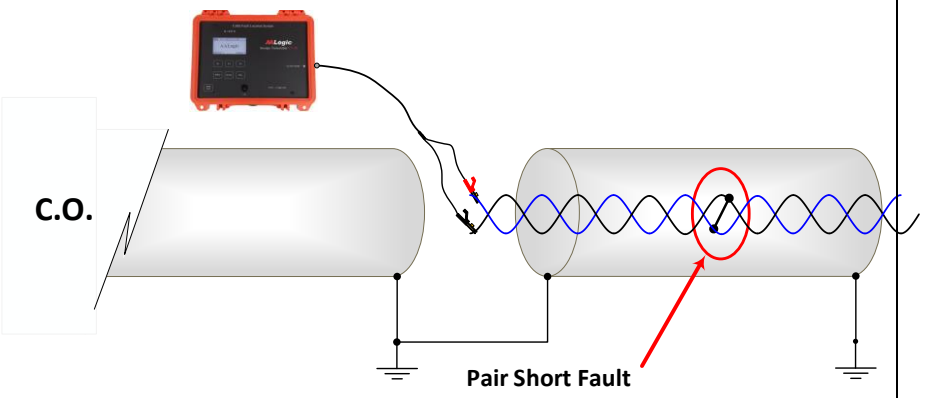
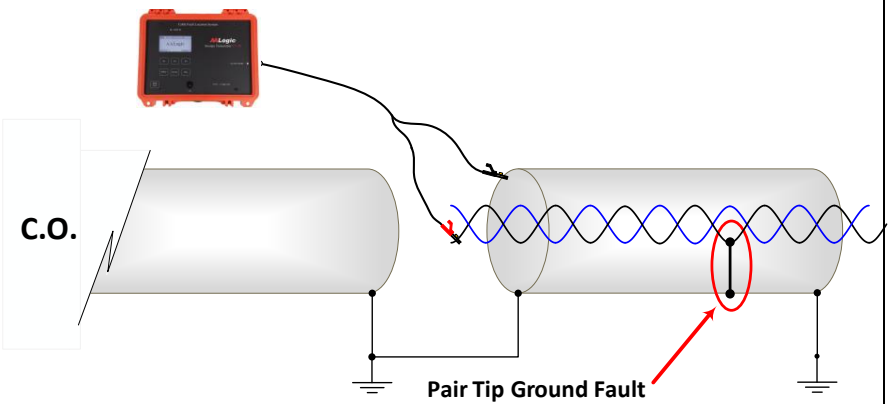
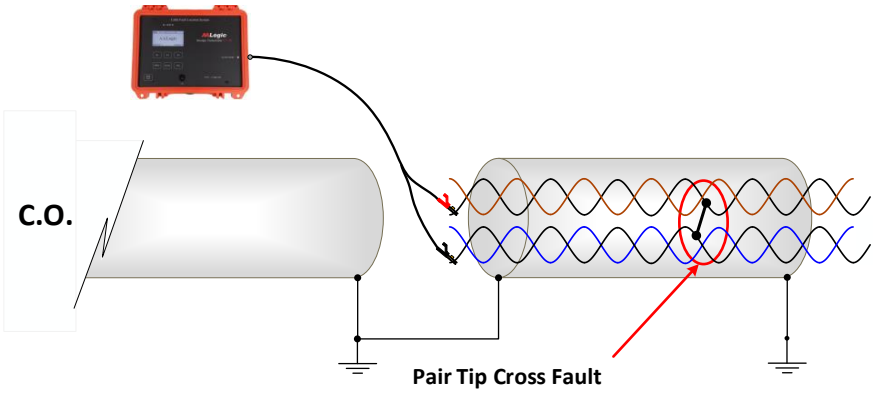
Pair fault location focuses on aerial cables due to the attenuation of the signal in buried faults.

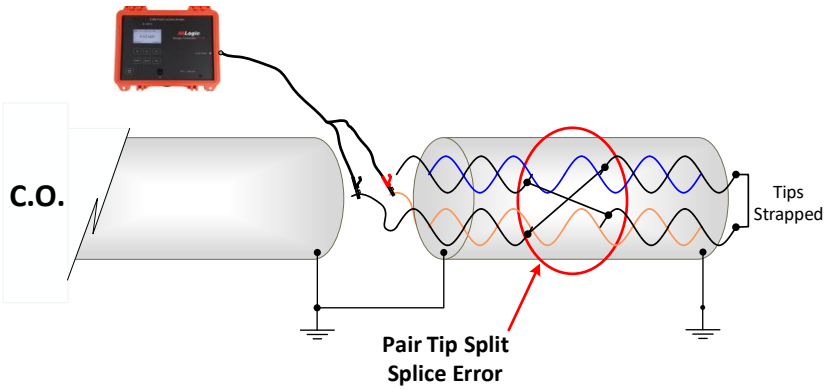
The SR-101 is used with the provided hand coil or using the optional Layup Pole. Although the SR-101 is compatible with some third-party coils, the DHC-124 hand coil or LUPA-25 Layup Pole coil is preferred.

12.1 ST-101 TRANSMITTER SETUP – AERIAL PAIR FAULTS

12.1.1 Fault Connections

Connect the ST-101 test cord black and red clips as follows:

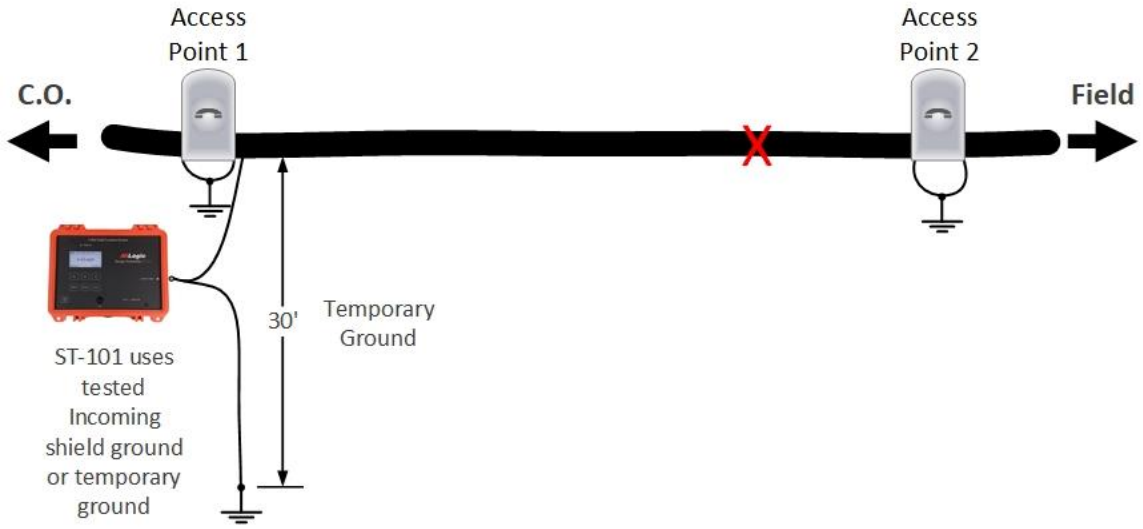
Fault	Description	Connections
Short	Black to Tip and Red to Ring	
Ground	Black to shield and Red to the grounded wire (See para. 10.1 above)	
Cross	Black to one of the crossed wires and Red to the other crossed wire.	

Fault	Description	Connections
Split	Black to Tip of the split pair and Red to the Ring of the same pair.	

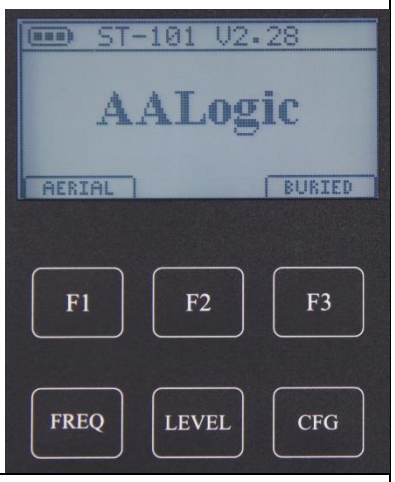
12.1.2 ST-101 Transmitter Operation – Aerial – Auto-Set

Follow these steps to setup the ST-101 for aerial fault location using **Auto-Set**.

1. Locate the ST-101 at a point that allows connection of the clips at the access point. It is recommended that he ST-101 be at least 10 feet, 90º from the access point when possible. A temporary ground should be 30’ and 90º from the access point if used.

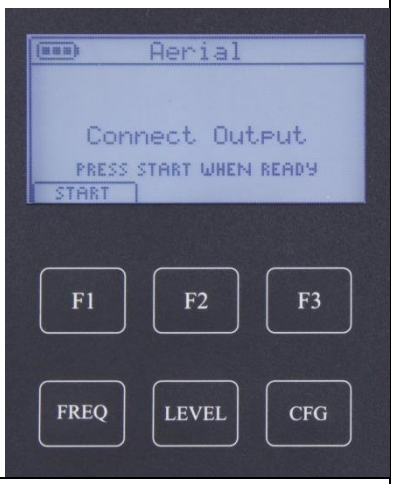


2. From the Main screen, press **[F1]** **AERIAL**.



3. The ST-101 prompts to "**Connect Output**". Connect the clips as described in 12.1.1 above and press **[F1]** **START**.

⚠ Note: When the ST-101 is sending tone, pressing **[CLR]** stops the ST-101 from sending tone to avoid shock.

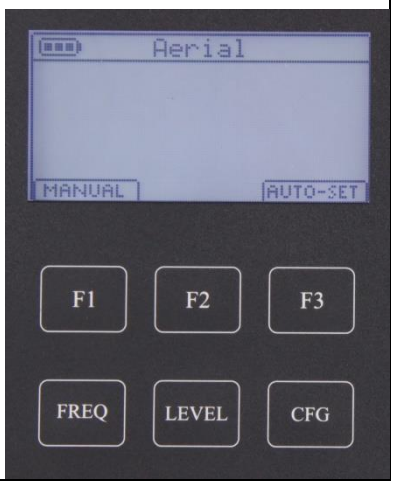


4. The ST-101 prompts to press **[F1]** **MANUAL** or **[F3]** **AUTO-SET** modes. Press **[F3]** **AUTO-SET**.

   The transmitter frequency and level can be set manually or using the Auto-Set function. The Auto-Set function searches for a voltage level and frequency combination for the connected fault. This combination should allow the user to obtain an acceptable tone reading with the SR-101 in most cases.

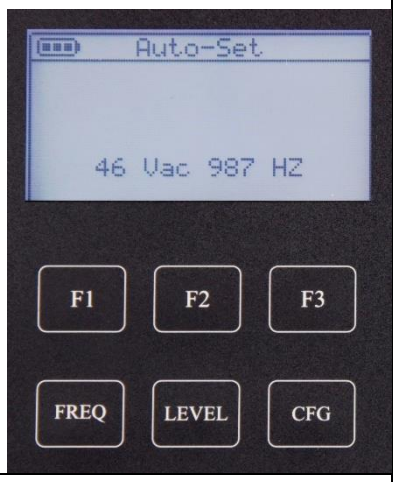
   The frequency and output level can be manually adjusted after the Auto-Set function is used.

   Refer to 12.1.3 below for information on using the **MANUAL** mode.



The **[F3]** **AUTO-SET** mode is the easiest way to start unless you want to use the last frequency or set a specific frequency. You can adjust the frequency and/or the level after the ST-101 begins transmitting.

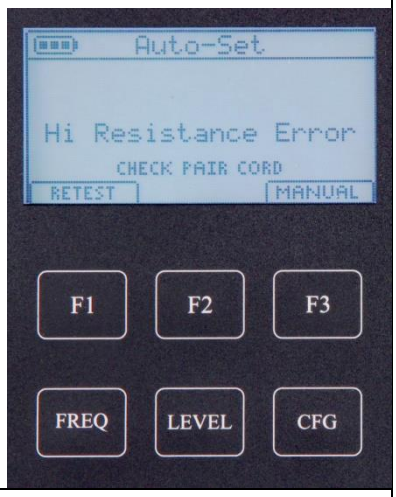
The display shows the voltages and frequencies as it scans.



5. **Hi Resistance Error** is displayed if there is less than a minimum amount of current through the clips for fault location. This message prompts to check the pair cord to ensure the clips are connected properly for the type of fault, refer to 12.1.1 above, then press **[F1]** **RETEST.**

   If the message repeats and you are positive the clips are connected correctly, the ST-101 cord may be damaged. This can be verified by connecting the clips together and measuring the resistance on the plug. The resistance should be 0Ω between the tip and the sleeve on the plug.

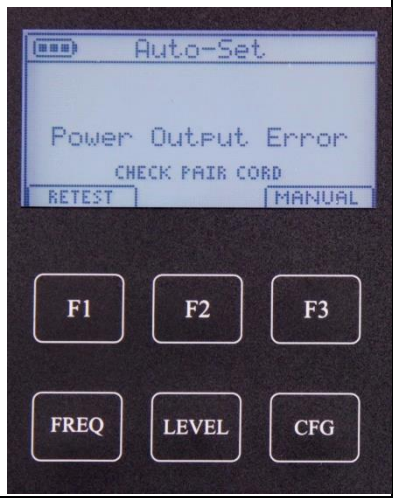
   If the ST-101 cord is not defective, press **[F3]** **MANUAL** and set the ST-101 manually.



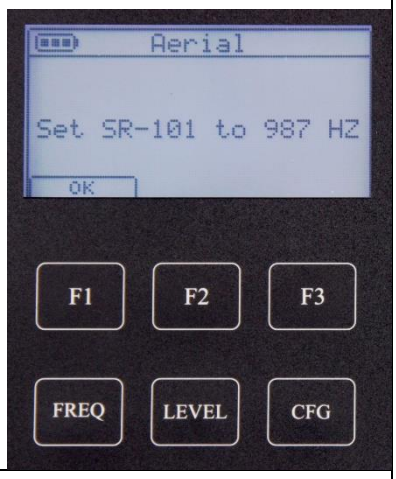
6. **Power Output Error** is displayed if the current through the clips exceeds the power limits of the ST-101. The message prompts to check the pair cord to ensure they are connected properly for the type of fault, refer to 12.1.1 above, then press **[F1]** **RETEST**.

   If the message repeats and you are positive the clips are connected correctly, the ST-101 cord may be damaged. This can be verified by ensuring the clips are separated and measuring the resistance on the plug. The reading should be open between the tip and the sleeve on the plug.

   If the ST-101 cord is not defective, press **[F3]** **MANUAL** and set the ST-101 manually.



7. **Set SR-101 to XXX Hz**. In the example, ST-101 has successfully determined a starting frequency of 987. Set the frequency on the SR-101 receiver. Press **[F1]** **OK** to continue and start sending tone.

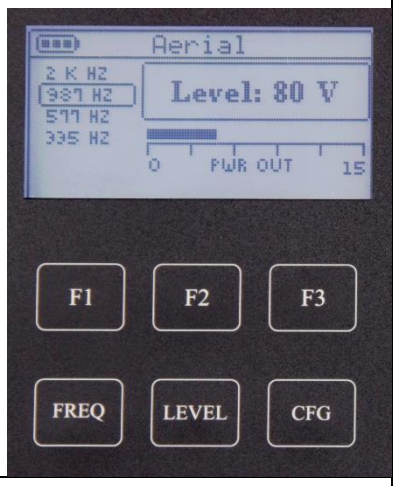


8. Transmit screen

   The ST-101 starts transmitting using the frequency and power level determined by the scan. Follow the SR-101 instructions in 12.1.4 below to ensure the signal is detected by monitoring the cable approximately 10 feet from the connection point.

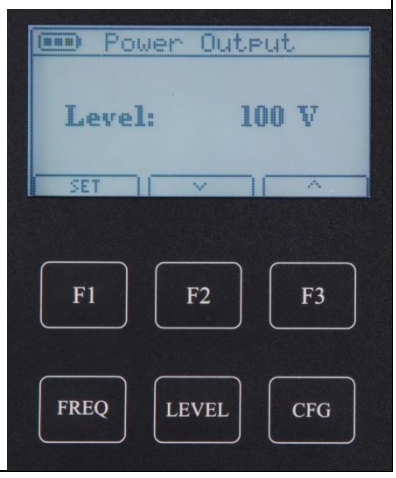
   In the example, the selected frequency is highlighted in the left column, 987 Hz, and the Level: 80 V is indicated. A bar graph indicates how much power is flowing in the fault. A power indication between the first and third marks is normally sufficient for fault locating.

   It is important to test the signal level using the SR-101 to ensure the level is adequate to avoid the need to return to the transmitter to adjust the level. The SR-101 should have a signal indication of 30% to 60% with a gain of not more than 3 or 4. Adjust the Level on the transmitter as needed to obtain this reading.



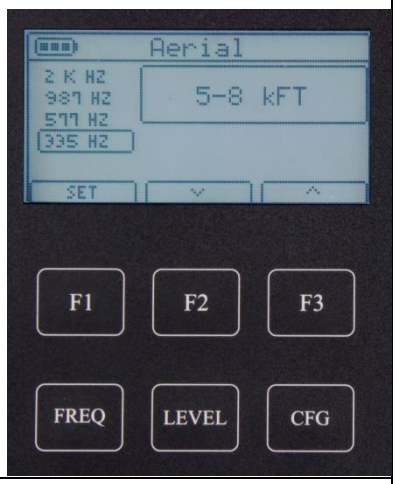
9. Output level is manually adjusted by pressing the **[LEVEL]** key. Use **[F2]** ↓ and **[F3]** ↑ to decrease or increase the voltage Level then press **[F1]** **SET**. The ST-101 returns to the transmit screen.

   NOTE: The ST-101 may reduce the voltage level, if needed, to protect internal circuits.



10. The frequency is manually adjusted by pressing the **[FREQ]** key. Use **[F2]** ↓ or **[F3]** ↑ to highlight the frequency then press **[F1]** **SET**. The ST-101 returns to the transmit screen. The screen also displays a suggested section length for each frequency.
    Always ensure **the ST-101 and SR-101 are using the same frequency.**
    The lowest frequency that provides a good signal indication on the cable at a point approximately 10 feet from the transmitter is usually preferred. However, using a higher frequency may be necessary if the tone cannot be heard well on the cable after increasing the output Level.

    Higher frequencies are sometimes easier to hear but may carry-by the fault more than lower frequencies. Lower frequencies are also preferred for longer cable sections. Lower frequencies are also preferred for longer cable sections.

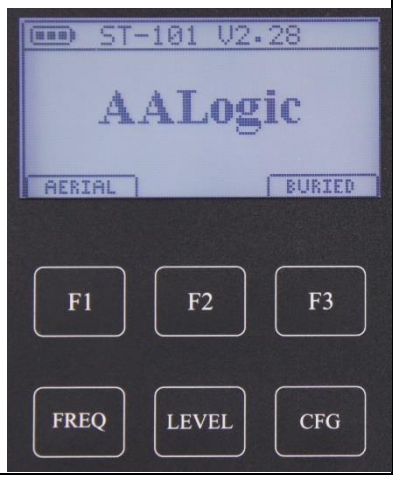


11. Press **CLR** on the main panel to stop transmitting and return to the main screen.

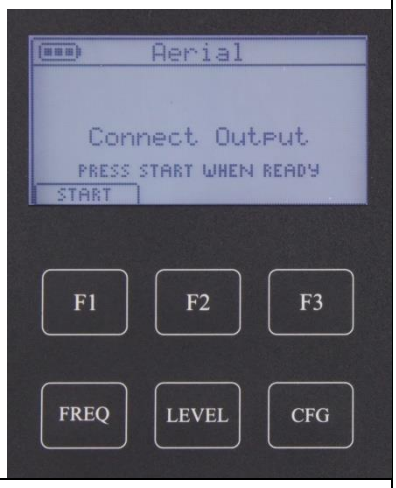
12.1.3 ST-101 Transmitter Operation – Aerial – Manual

Use these instructions to transmit a signal at a pre-set frequency.

1. From the Main screen, press **[F1]** **AERIAL**.

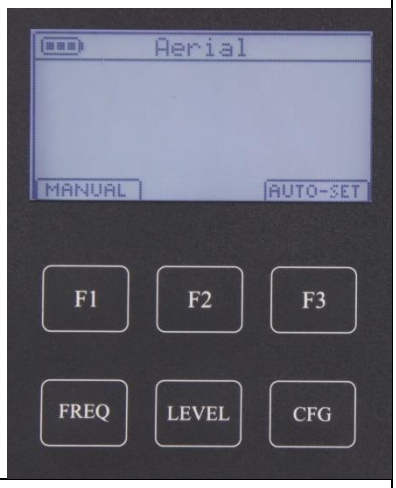


2. The ST-101 prompts to "**Connect Output**". Connect the clips as described in 12.1.1 above and press **[F1]** **START**.



3. The ST-101 prompts to press **[F1]** **MANUAL** or **[F3]** **AUTO-SET** modes. Press **[F1]** **MANUAL**.

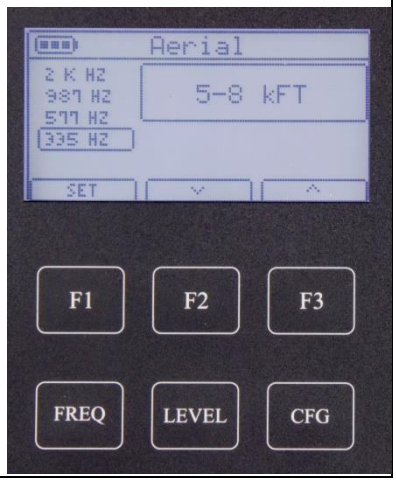
   Refer to 12.1.3 above for information on using the **AUTO-SET** mode.



4. The ST-101 prompts to select a frequency. Use **[F2]** ↓ or **[F3]** ↑ to highlight the desired frequency then press **[F1]** **SET**. The frequency last used in aerial mode is pre-selected. The screen includes a suggested section length for each frequency.

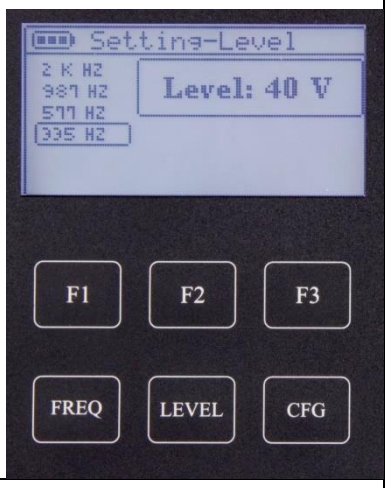
   The lowest frequency that provides a good signal indication on the cable at a point approximately 10 feet from the transmitter connection point is preferred. However, using a higher frequency may be necessary if the tone cannot be heard well on the cable after adjusting the output Level.

   Higher frequencies are sometimes easier to hear but may carry-by the fault more than lower frequencies. Lower frequencies are also preferred for longer cable sections. Lower frequencies are also preferred for longer cable sections.



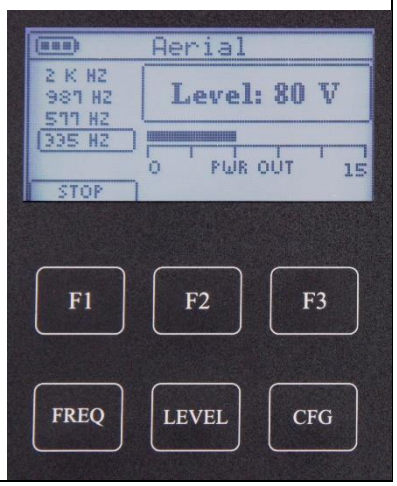
5. The ST-101 uses the selected frequency and gradually increases the voltage to obtain an initial Level. This level should be sufficient in most cases. The frequency and gain on the receiver must also be adjusted on the SR-101.

   NOTE: The ST-101 may reduce the voltage level, if needed, to protect internal circuits.



6. The ST-101 starts transmitting the signal at the frequency and level determined by the scan. Follow the instructions for the receiver to ensure the signal is detected by monitoring the cable.

   The remainder of the operation of the ST-101 is the same as the Auto-Set mode. Refer to step 8, 12.1.2 above.



12.1.4 SR-101 Receiver Aerial Pair Fault Operation

These instructions expect the ST-101 is properly connected to the fault and sending 335Hz tone.

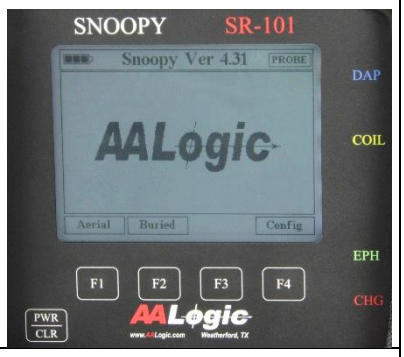
1. Prepare the SR-101 by connecting the DHC-124 hand coil or another appropriate sensor to the SR-101.

   Ensure the curved portion of the coil is centered on the cable for consistent results.

   Connect a headset or earphone to the jack on the right side if desired.

2. Turn on the SR-101 and select **[F3]** **Aerial** .

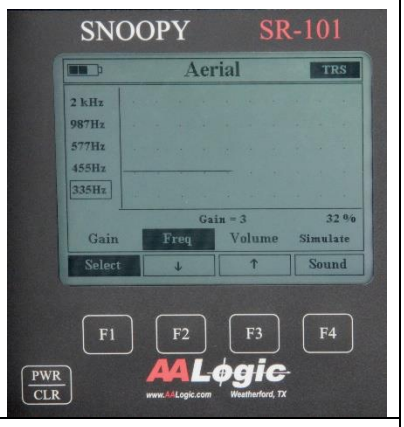
   The SR-101 shows the Aerial receive screen. The settings are the same as the last time the unit was used for Aerial fault location. This is for convenience when starting and stopping locating tasks on the same fault.



The SR-101 shows the Aerial receive screen. The settings are the same as the last time the unit was used for Aerial fault location. This is for convenience when starting and stopping locating tasks on the same fault.

3. Select the frequency matching the transmitter frequency. Press **[F1]** **Select** until Freq is highlighted. Change the frequency by using **[F2]** ↓ and **[F3]** ↑ to until the desired frequency is highlighted. 335Hz is highlighted in this example.

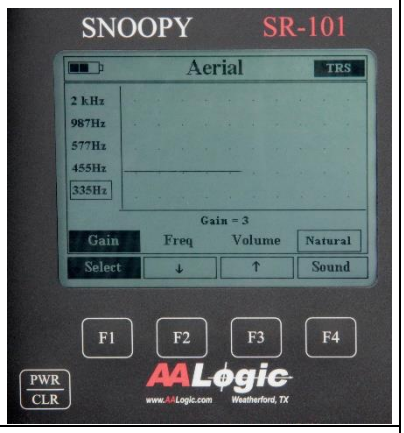
   There frequency change is immediate. Put the hand coil near the test cord or cable to hear the tone.



4. The sound mode can be changed by pressing **[F4]** **Sound** .

   The SR-101 has two sound options. Natural is the actual tone as picked up from the cable and Simulate is a computer-generated tone. The Simulate tone's advantage is there is no noise heard, just the simulated tone.

   The Natural tone has the advantage of allowing the user to hear the actual tone and the technician can use this when there is a lot of noise being picked up and/or the transmitted tone is weak.

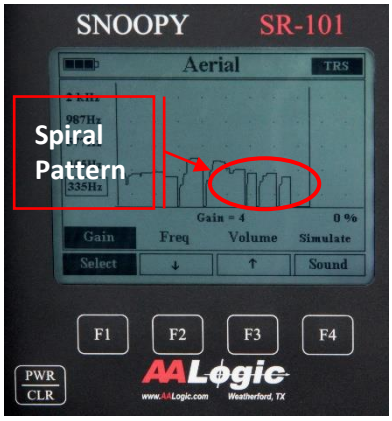


5. Place the probe on the cable and slowly move the coil about 3 feet along the cable and observe the spiral signal pattern. Adjust the Gain to obtain a graph signal that peaks between 30% and 60% with the coil on the highest signal peak.

   The pattern is highlighted in the example. This was taken by hand coiling a 6-pair cable with a 1.8 KΩ short on pair 5.

   a. Adjust the gain by using **[F1]** Select, if needed, to highlight Gain on the screen. Use **[F2]** ↓ and **[F3]** ↑ to decrease or increase the gain values. The recommended gain is a setting of 3 or 4 when initially testing the tone from the cable. The gain is set at 4 in the example.

   b. The volume from the speaker or headset can be adjusted by using **[F1]** Select, if needed, to highlight Volume on the



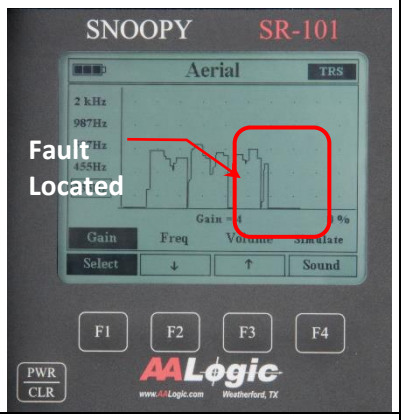
screen. Use **[F2]** ↓ and **[F3]** ↑ to decrease and increase the volume to the desired level.

Move to points on the cable closer to the fault and move the probe 3' back and forth along the cable while monitoring the screen graph and audible tone for changes in the peak signal strength.

A large change, up or down, in the average peak signal indicates the fault is between the present location and the previous location.

6. To verify the location when the fault is indicated, compare the peak signal before and after the identified location. The example shows the actual results of toning the 1.8 KΩ short on pair 5. The signal begins strong and shows the same pattern as in step 5. There is no signal after the short. The graph is the line at 0%.

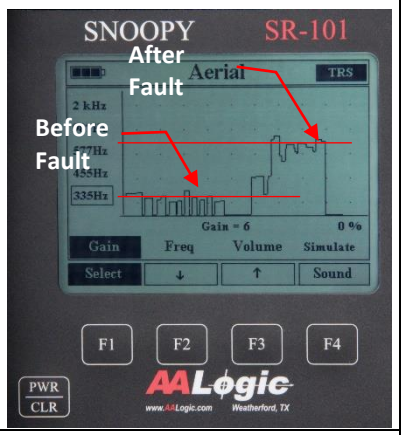
   The signal should **decrease** significantly for shorts, crosses, and grounds after the fault, depending on the resistance of the fault. The lower the resistance the greater the change.



7. The example shows the signal levels before and after a split fault. The hand coil is moved back and forth to determine the peak signal.

   The signal before the fault is weak and increases by 3 to 1 after the fault. After the fault, the tone is split between the two pairs making the signal significantly **stronger**.

   Refer to 12.1.1 above for transmitter connections.



Note: The cable pair and group are twisted inside the cable. This means the pair may be on the top, bottom, or middle as the probe is moved along the cable. It is normal for the signal indication to rise and fall wile monitoring the cable. The fault location is determined by higher average signal peaks before the fault than after the fault for shorts and crosses. The average peaks are higher after a split.

The average signal may also increase as a splice case is approached. This is due to the lack of sheath shielding at the case and the separation of the pair groups during splicing.

The position of the pair in the inbound cable may be different than the outbound cable due to the change in position of the pair in the two cables. Compare the average maximum signal before the splice and after the splice to confirm a fault location. The average maximum signal will also change when a cable size change is encountered.

12.1.5 Typical Fault Tone

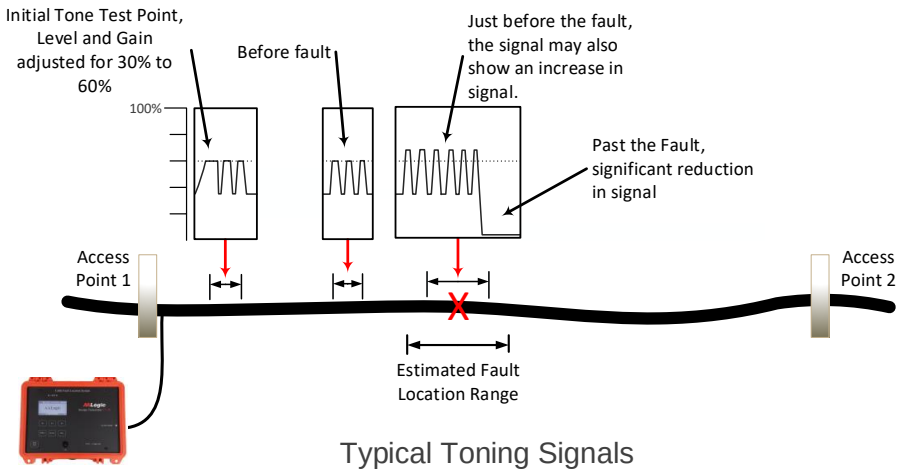
The following figures show the tone signal at points along the cable for various faults.

12.1.5.1 Short, Cross, and Ground

The illustration shows typical tone levels at three points along a cable with a short, cross, or ground pair fault.

The peaks in the patterns show where the faulted pair is closest to the hand coil position as it twists inside the cable. The coil is moved back and forth over the cable to identify the peak signal.

Past the fault, the tone peaks drop significantly or to 0 depending on the resistance of the fault.



Typical Toning Signals

Short, Cross, and Ground

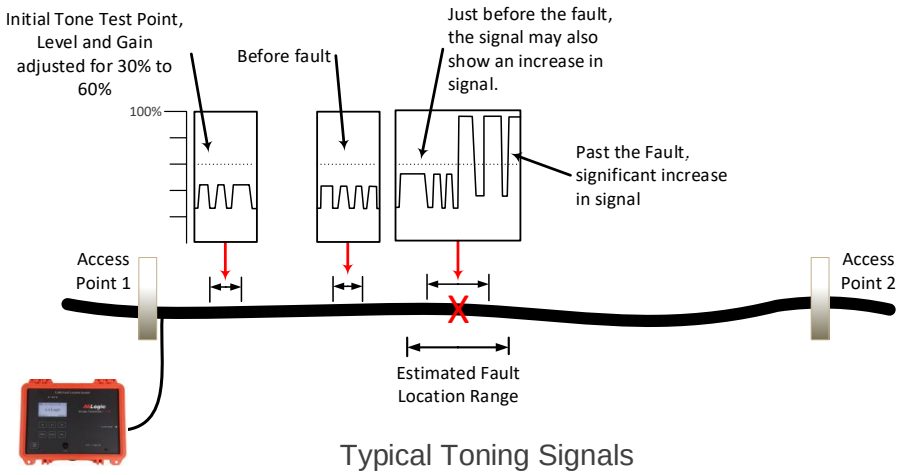
12.1.5.2 Split

The illustration shows typical tone levels at three points along a cable with a split pair fault.

The peaks in the patterns show where the faulted pair is closest to the hand coil position as it twists inside the cable. The coil is moved back and forth over the cable to identify the peak signal.

The tone before the fault is much lower than after the fault due to the twist in the pairs.

The split pairs are strapped at the far end as shown in 12.1.1 above.



Typical Toning Signals

Split

13 Buried Fault Location Step-By-Step

The ST-101 includes a cord with pair clips. This cord is plugged into the jack on the right side. Only the pair cord supplied with the ST-101 should be used.

The SR-101 is used with an A-frame probe and the provided hand coil. Although the SR-101 is compatible with some third-party coils, the DHC-124 hand coil is preferred.

13.1 MARKING THE CABLE PATH

Marking the cable path is an essential step when locating buried faults. Follow local practice when locating and marking the cable. Take note of depth changes as this affects the signal level and could lead to false location due to increases and decreases in the signal strength as the depth changes.

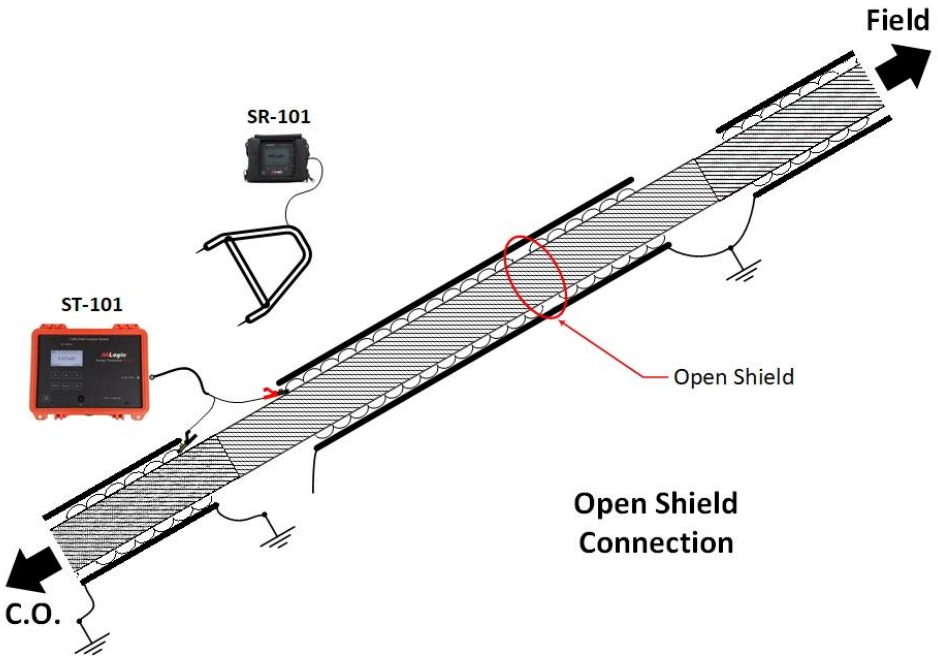
The signal strength will also change if the A-frame is not held at a consistent angle and distance relative to the cable path.

13.2 SHIELD FAULT CONNECTIONS

13.2.1 Open Shield

Open shield faults allow noise to enter the cable and cable pairs. The shield open may be a result of poor or missing bonds or corrosion of the cable shield itself. The clips are connected between the faulted shield and a tested ground connection with far end bonds in place. Preferred ground connections are:

a. Incoming shield
b. MGN
c. Temporary ground

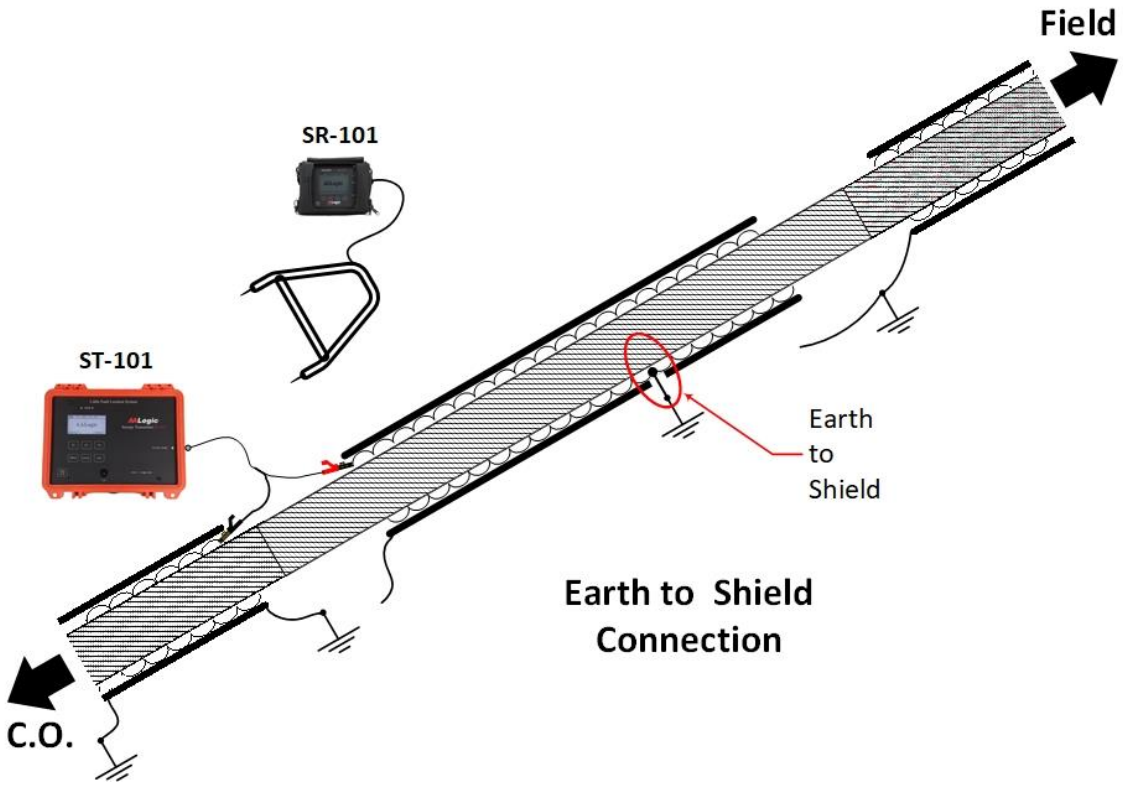


13.2.2 Earth to Shield

Earth faults are cause by damage to the outer sheath of the cable that is designed to prevent water from entering the cable. An opening in the sheath allows the inner shield to come in contact with the soil in buried

faults causing a shield-to-Earth fault. The clips are connected between the faulted shield and a tested ground connection with far end bonds removed. Preferred ground connections are:

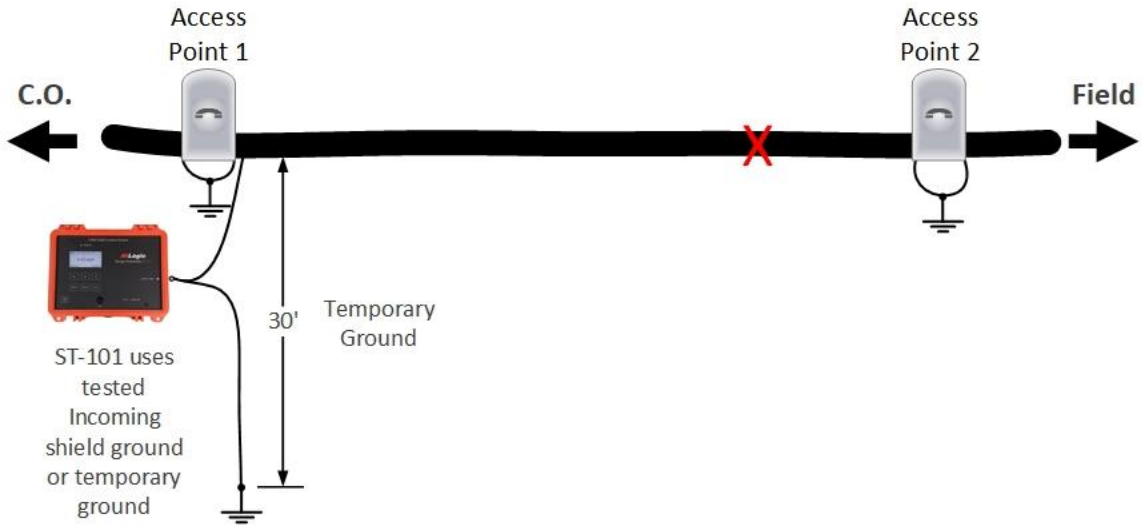
a. Incoming shield
b. MGN
c. Temporary ground



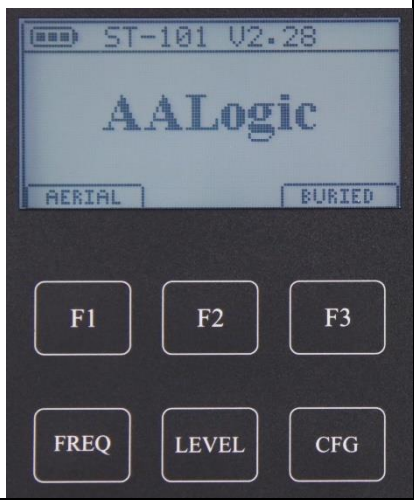
13.3 ST-101 TRANSMITTER OPERATION – BURIED – AUTO-SET

Follow these steps to setup the ST-101 for buried fault location.

1. Locate the ST-101 at a point that allows connection of the clips at the access point. It is recommended that he ST-101 be at least 10 feet, 90º from the access point when possible. A temporary ground should be 30’ and 90º from the access point if used.

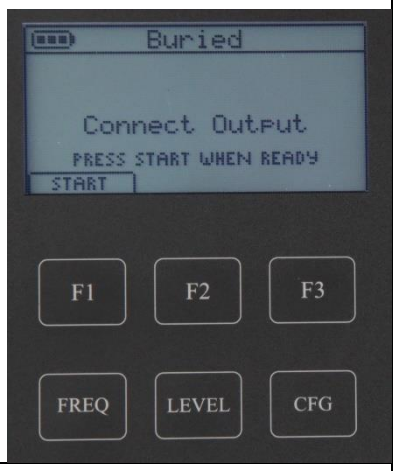


2. From the Main screen, press **[F3] BURIED**.



3. The ST-101 prompts to "**Connect Output**". Connect the clips as described in 13.2 above and press **[F1]** **START**.

⚠ Note: When the ST-101 is sending tone, pressing **[CLR]** stops the ST-101 from sending tone to avoid shock.

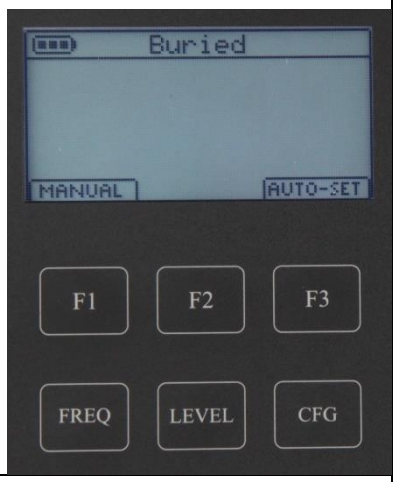


4. The ST-101 prompts to press **[F1]** **MANUAL** or **[F3]** **AUTO-SET** functions. Press **[F3]** **AUTO-SET**.

   The **AUTO-SET** function automatically adjusts the voltage Level using the last used frequency in **BURIED** mode. The **MANUAL** function allows changing or using the last frequency before applying voltage up to the last voltage level used in **BURIED** mode. The **MANUAL** function is preferred when restarting the ST-101 on the same fault.

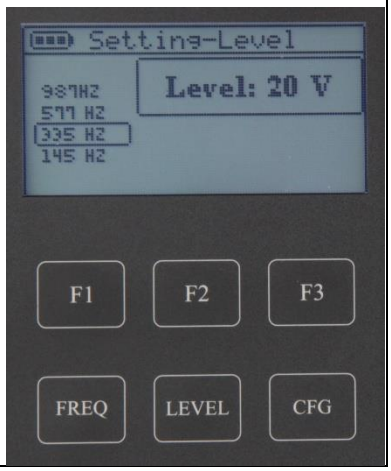
   The frequency and voltage level can be set manually after the ST-101 is in the transmit mode.

   Refer to 13.4 below for information on using the **MANUAL** mode.



The **AUTO-SET** mode is the easiest way to start unless you want to change the frequency. You can adjust the frequency and/or the level after the ST-101 begins transmitting.

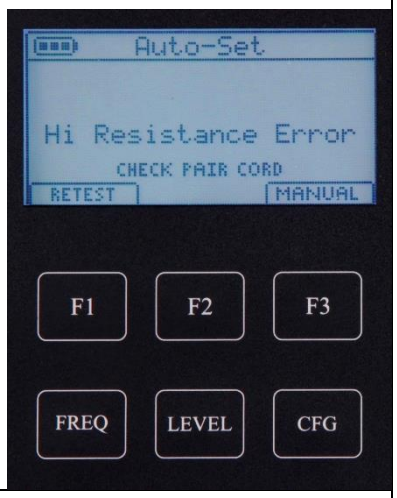
The example shows the selected frequency and the voltage Level as it steps up. The maximum voltage level the AUTO-SET function will use is 100V. Higher voltages can be set after the ST-101 begins transmitting.



5. **Hi Resistance Error** is displayed if there is less than a minimum amount of current through the clips for location. The message prompts to check the pair cord to ensure the clips are connected properly for the type of fault, refer to 12.1.1 above, then press **[F1] RETEST.**

   If the message repeats and you are positive the clips are connected correctly, the ST-101 cord may be damaged. This can be verified by connecting the clips together and measuring the resistance on the plug. There should be 0 **Ω** between the tip and the sleeve on the plug.

   If the ST-101 cord is not defective, press **[F3] MANUAL** and set the ST-101 manually.



6. **Power Output Error** is displayed if the current through the clips exceeds the power limits of the ST-101. The message prompts to check the pair cord to ensure they are connected properly for the type of fault, refer to 13.2 above, then press **[F1] RETEST**.

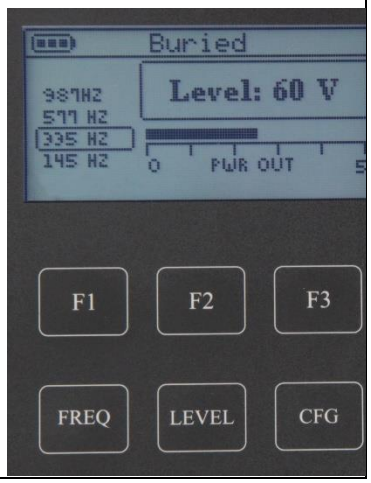
   If the message repeats and you are positive the clips are connected correctly, the ST-101 cord may be damaged. This can be verified by ensuring the clips are separated and measuring the resistance on the plug. The reading should be open between the tip and the sleeve on the plug.

   If the ST-101 cord is not defective, press **[F3] MANUAL** and set the ST-101 manually.

7. The ST-101 starts transmitting. Follow the SR-101 instructions below to ensure the signal is detected by monitoring the cable approximately 10 feet from the connection point.

   The screen shows the current settings of the ST-101. In the example, the selected frequency is highlighted on in the left column, 335 Hz, and the Level: 60 V. A bar graph indicates how much power is flowing in the fault. A current indication between the first and third marks is normally sufficient for fault locating.

   It is important to test the signal level using the SR-101 to ensure the level is adequate to avoid the need to return to the transmitter to adjust the level. Ideally, the SR-101 should have a signal indication of 30% to 60% with a gain of not more than 3 or 4. Adjust the Level on the transmitter as needed to obtain this reading.



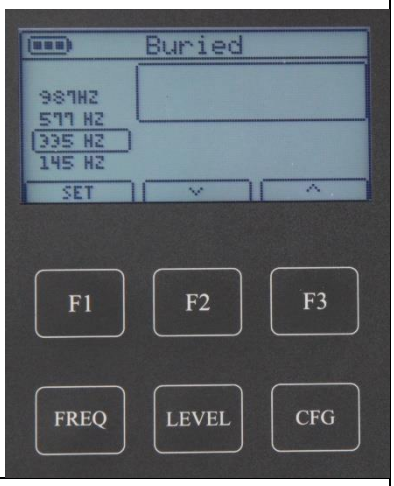
8. Voltage level is manually adjusted by pressing the **[LEVEL]** key. Use **[F2]** ↓ and **[F3]** ↑ to decrease or increase the voltage Level then press **[F1]** **SET**. The ST-101 returns to the transmit screen.

   NOTE: The ST-101 may reduce the voltage level, if needed, to protect internal circuits.

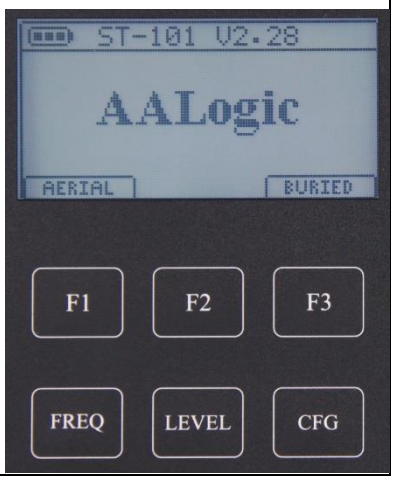
9. The frequency is manually adjusted by pressing the **[FREQ]** key. Use **[F2]** ↓ or **[F3]** ↑ to highlight the frequency then press **[F1]** **SET**. The ST-101 returns to the transmit screen.

   Always ensure the ST-101 and SR-101 are using the same frequency.

   The lowest frequency that provides a good signal indication at a point approximately 10 feet from the transmitter connection point is preferred. However, using a higher frequency may be necessary if the tone cannot be heard well after increasing the output Level.



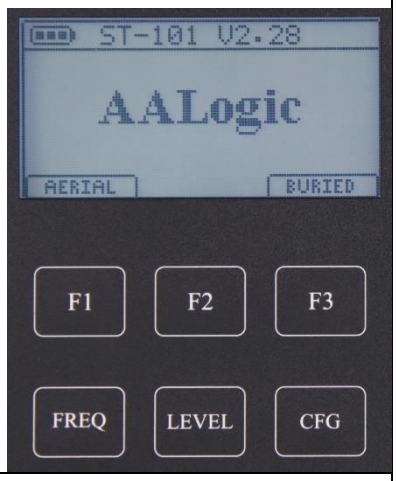
10. Press **CLR** to stop transmitting and return to the main screen.



13.4 ST-101 TRANSMITTER OPERATION – BURIED – MANUAL

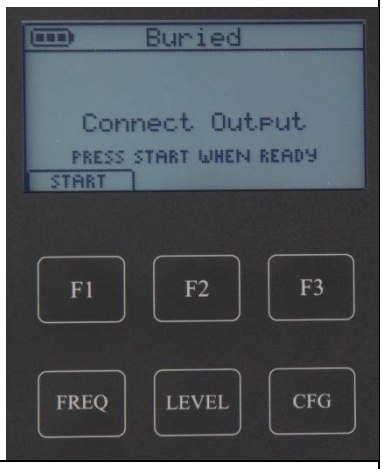
Use these instructions to transmit a signal at a pre-set frequency and the last voltage used in this mode.

1. From the Main screen, press **[F2]** **BURIED**.



2. The ST-101 prompts to "**Connect Output**". Connect the clips as described in 13.2 above and press **[F1]** **START**.

   ⚠ Note: When the ST-101 is sending tone, pressing **[CLR]** stops the ST-101 from sending tone to avoid shock.

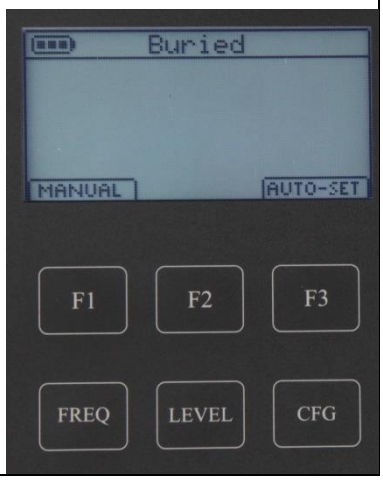


3. The ST-101 prompts to press **[F1]** **MANUAL** or **[F3]** **AUTO-SET** modes. Press **[F1]** **MANUAL**.

   The **AUTO-SET** function automatically adjusts the voltage Level using the last used frequency in **BURIED** mode. The **MANUAL** function allows changing or using the last frequency before applying voltage up to the last voltage level used in **BURIED** mode. The **MANUAL** function is preferred when restarting the ST-101 on the same fault.

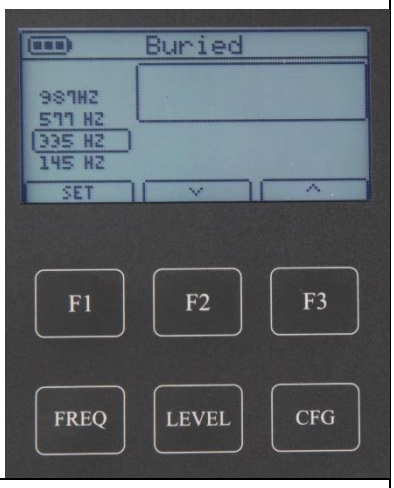
   The frequency and output level can be adjusted after the ST-101 is in the transmit mode.

   Refer to 13.3 above for information on using the **AUTO-SET** mode.

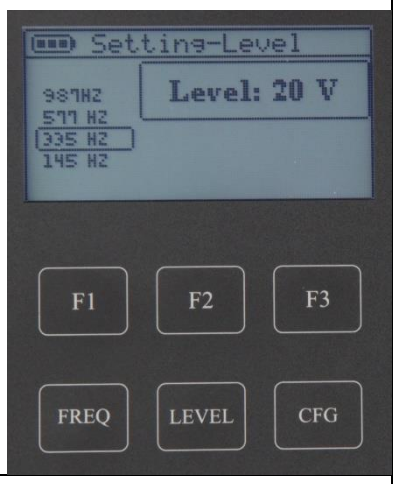


4. The last used frequency in buried mode is automatically selected in the list on the left. Use **[F2]** ↓ or **[F3]** ↑ to highlight the desired frequency then press **[F1]** **SET**. The ST-101 returns to the transmit screen.

   Ensure that the SR-101 is set to the same frequency.



5. The ST-101 slowly increases the voltage level using the selected frequency until the last level used in buried mode is reached or the power limit is reached.



The remainder of the operation of the ST-101 is the is the same as described for **AUTO-SET** mode.

Refer to 13.3 above, step 7 for information on using the **AUTO-SET** mode.

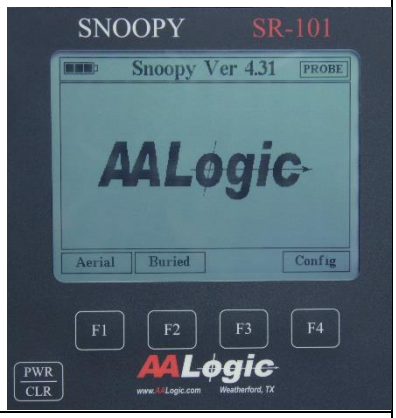
13.5 SR-101 RECEIVER BURIED FAULT OPERATION

These instructions expect the ST-101 is to the fault and sending 335Hz tone.

1. Prepare the SR-101 by connecting a compatible A-frame probe to the SR-101. Connect a headset or earphone to the jack on the right side if desired.

   The hand coil is also used to confirm the fault location directly on the cable once it is exposed.

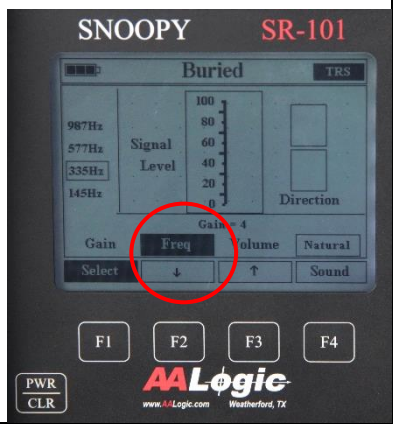
2. Turn on the SR-101 and select **[F2]** **BURIED** using the key from the main screen.



   The SR-101 shows the Buried receive screen. The settings are the same as the last time the unit was used for Buried fault location. This is for convenience when starting and stopping location tasks on the same fault.

3. Select the frequency matching the transmitter frequency if necessary. Press **[F1]** **Select** until Freq is highlighted. Change the frequency by using **[F2]** ↓ and **[F3]** ↑ to until the desired frequency is highlighted.

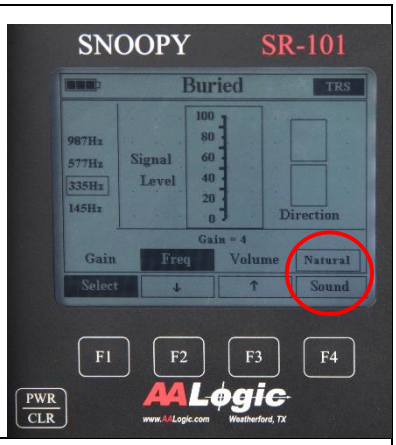
   335Hz is highlighted in this example. The frequency change is immediate and tone will be heard if the A-frame is near the cable path.



4. The sound mode can be changed by pressing **[F4] Sound**.

   The SR-101 has two sound options. Natural is the actual tone as picked up from the cable and Simulate is a computer-generated tone. The Simulate tone's advantage is there is no noise heard, just the tone.

   The Natural tone has the advantage of allowing the user to hear the actual tone and the technician can use this when there is a lot of noise being picked up to distinguish between the locate tone and other noise.

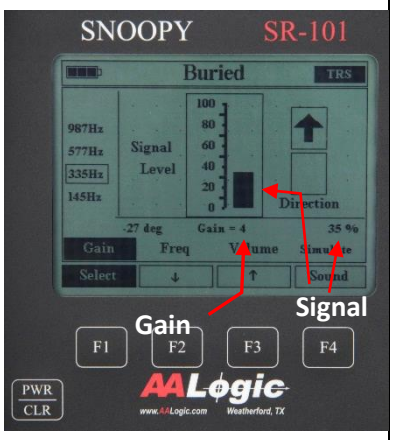


5. Insert the A-frame in the Earth approximately 1' from the previously marked cable path, refer to 13.6 below. Adjust the **Gain** to obtain a graph signal that peaks between 30% and 60%. The graph in the center shows the signal level. There is also a percentage shown below and right of the arrows.

   The Up and Down arrows can be used to check the location of the buried cable, refer to 13.6 below. They are also used when locating Earth to shield faults, refer to 13.7.2 below.

   a. Adjust the gain by using **[F1]** Select, if needed, to highlight Gain on the screen. Use **[F2]** ⇩ and **[F3]** ⇧ to decrease and increase the gain values. The recommended gain when initially testing the tone from the table is a setting of 3 or 4. The gain is set at 4 in the example.

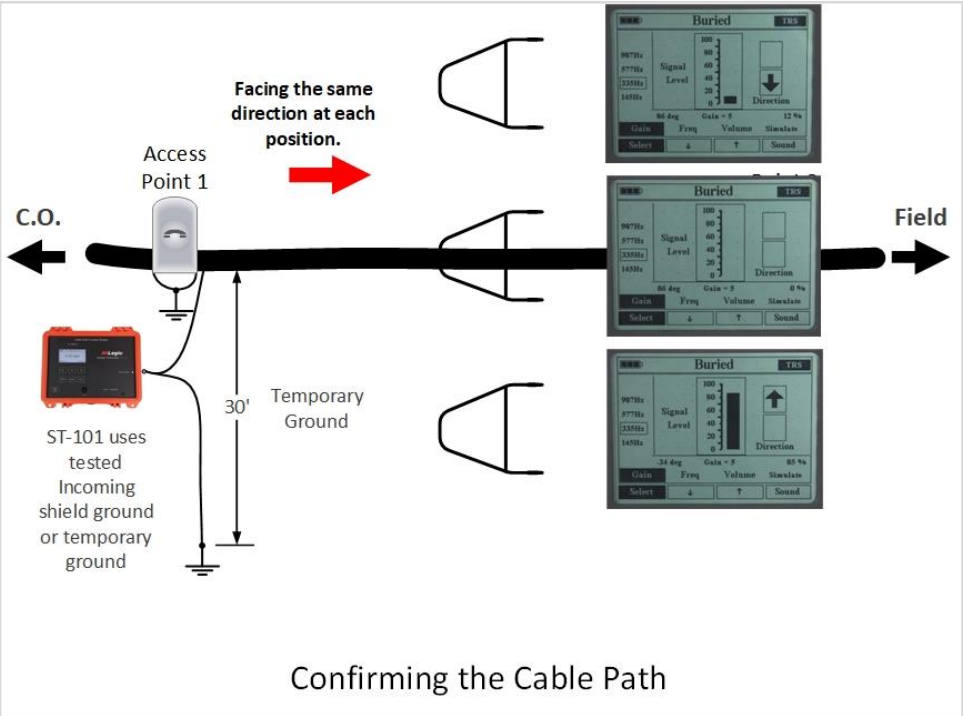
   b. The volume from the speaker or heard in the headset can be adjusted by using **[F1]** Select, if needed, to highlight Volume on the screen. Use **[F2]** ⇩ and **[F3]** ⇧ to decrease and increase the volume to the desired level from the speaker or headset.



13.6 CONFIRMING CABLE PATH LOCATION

The cable path location can be confirmed while locating buried faults.

1. Position the A-frame on either side of the path to monitor the tone.
2. If the arrow is not pointing toward the cable path, turn the A-frame around.
3. Probe toward the cable path with the A-frame.
4. The signal will decrease as you approach the path and NULL directly above the cable.
5. The signal will increase on the opposite side of the path and the arrow will reverse.



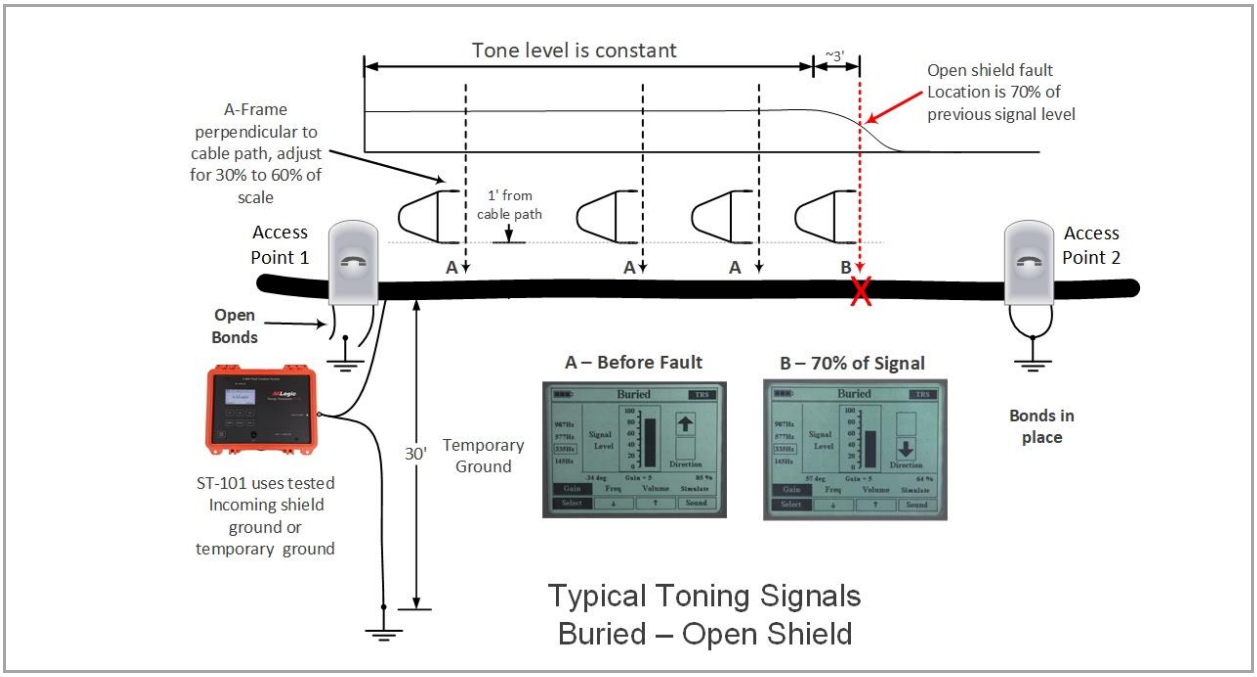
Confirming the Cable Path

13.7 TYPICAL FAULT TONE LEVELS

The following figures show the tone signal at points along the cable for open shield and shield to Earth faults.

13.7.1 Open Shield

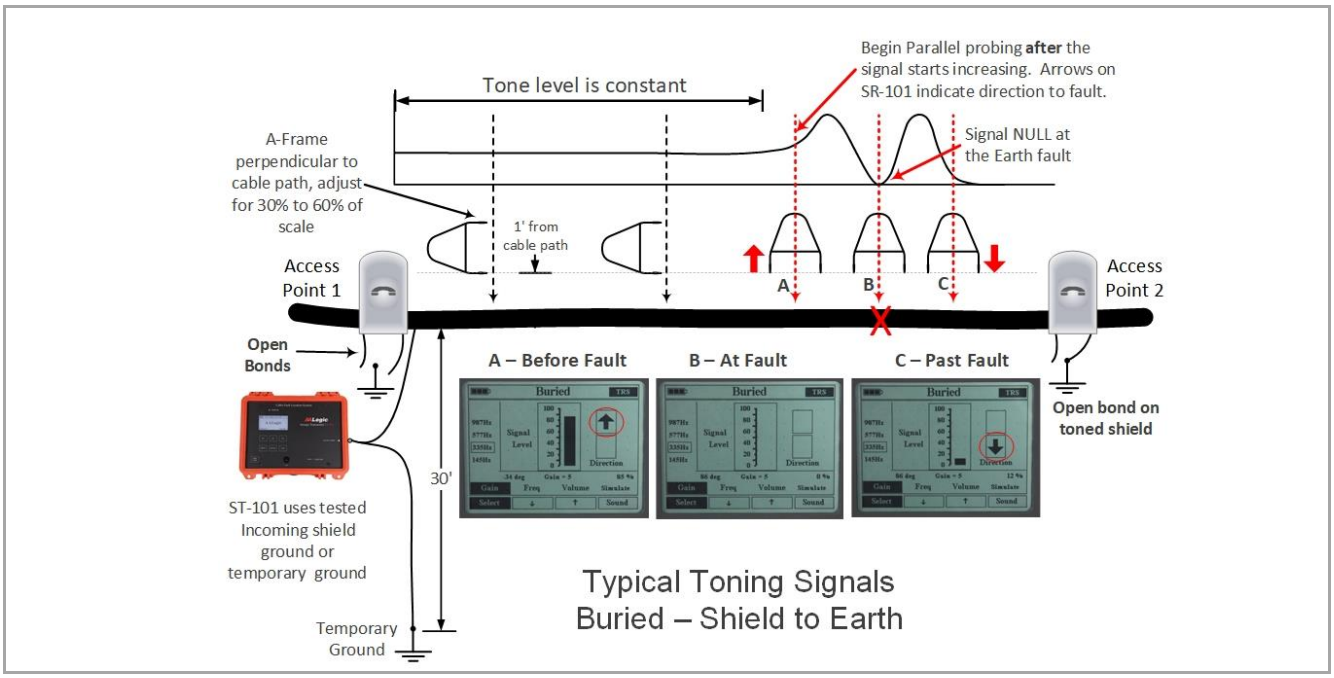
An open shield fault has a relatively constant tone as long as the cable is at the same relative depth and the technician is a consistent distance from the marked cable path.



13.7.2 Earth to Shield Faults

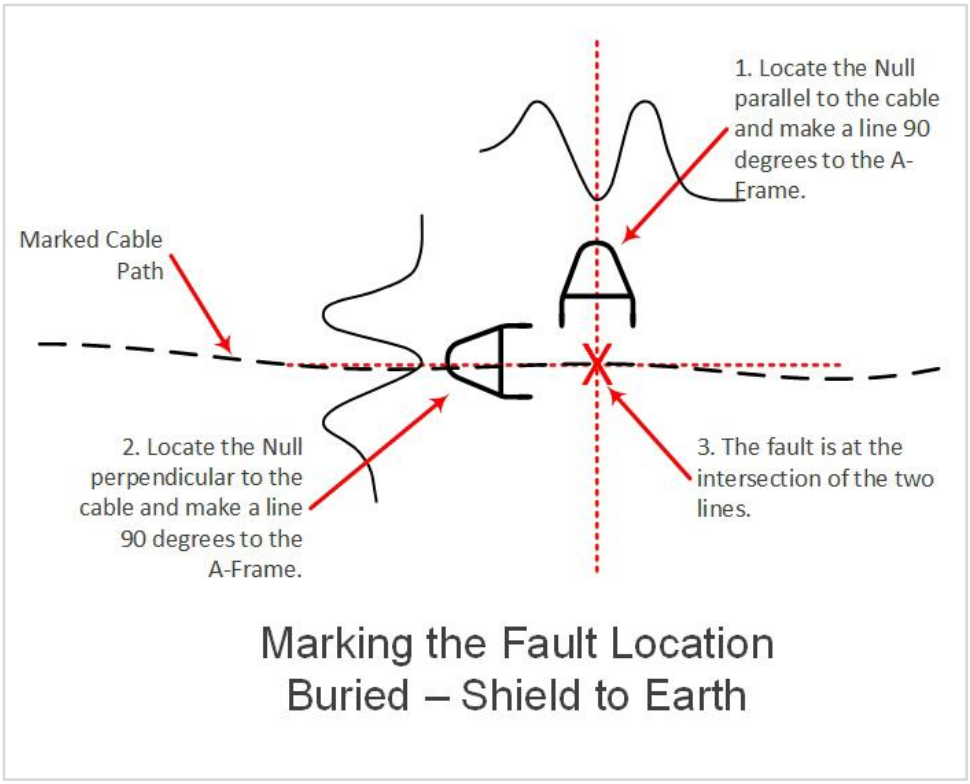
An Earth to shield has a relatively constant tone as long as the cable until the technician is close to the fault. The A-frame is oriented perpendicular to the cable path until a rise in the signal is detected. The a-frame is the oriented parallel to the cable. The technician continues to probe toward the fault. The signal will increase

significantly before the fault, NULL at the fault, and increases past the fault. The fault is 90º from and centered on the A-frame.



13.7.2.1 Marking the fault

The location of the buried fault can be accurately marked as shown.



14 SPECIFICATIONS

14.1 ST-101 TRANSMITTER SPECIFICATIONS

Display		
	Transflective	Sunlight Readable
	Backlight	LED
	Resolution	128 x 64
Power		
	Li-ion	6800 mAh
	Charger	12 Vdc @ 2A
	Operate Time	8 to 16 hours
	Charge Time	~4 Hrs
	Temperature	
	Charge	0 to 45c (32 to 113F)
	Operate	-20 to 60c (-4 to 158F)
	Storage	-20 to 60c (-4 to 158F)

14.2 SR-101 RECEIVER SPECIFICATIONS:

Gain		
	Receiver	≥ 90dB
	DHC-124 Hand coil and LUP-25	12dB
Display		
	Transflective	Sunlight Readable
	Backlight	LED
	Resolution	320 x 240
Power		
	Li-ion	2000 mAH
	Charger	6Vdc @ 1A
	Operate Time	8 to 16 hours
	Charge Time	~ 2 Hours
	Temperature	
	Charge	0 to 45c (32 to 113F)

Operate	-20 to 60c (-4 to 158F)
Storage	-20 to 60c (-4 to 158F)

14.3 FAULT LIMITS

Fault Limits are shown as a general guideline and may vary due to cable makeup or fault position within the cable and Earth conditions for buried faults.

Note: The actual maximum resistance depends on many factors. In some instances, faults with much greater resistances than those listed may be located.

Resistive Fault Range (Ω) (approximate)			
Fault Type	Cable Diameter		
	1”	2”	3”
Short	50K	30K	15K
Cross	75K	50K	25K

Shield Range (Ω) (approximate)	
Fault Type	
Open Shield	> 100
Shield to Earth	≥ 50K

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