SLIDES ONLY

NO SCRIPT PROVIDED

ASTRONICS TEST SYSTEMS

ATS-6100 Wire Fault Tester (WFT)

Trainers

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OPERATOR TRAINING

Safety


WARNING
Do not operate when an explosive atmosphere is suspected.
Acknowledge

What Is an ATS-6100 Wire Fault Tester (WFT)?

The WFT is a fully functional, handheld wire integrity tester used to evaluate the condition of wiring/cabling within an aircraft system.

Operational Modes

Self-Test Mode

- This mode of operation can be initiated on command. The Self-Test Mode is used to verify proper WFT prior to use.

SSTDR Static Mode

- The SSTDR Static mode provides a means of troubleshooting hard opens and shorts in the Wire.

SSTDR Intermittent Mode

- The SSTDR Inter mode looks for Wire intermittent opens and shorts, provided vibration can be induced.

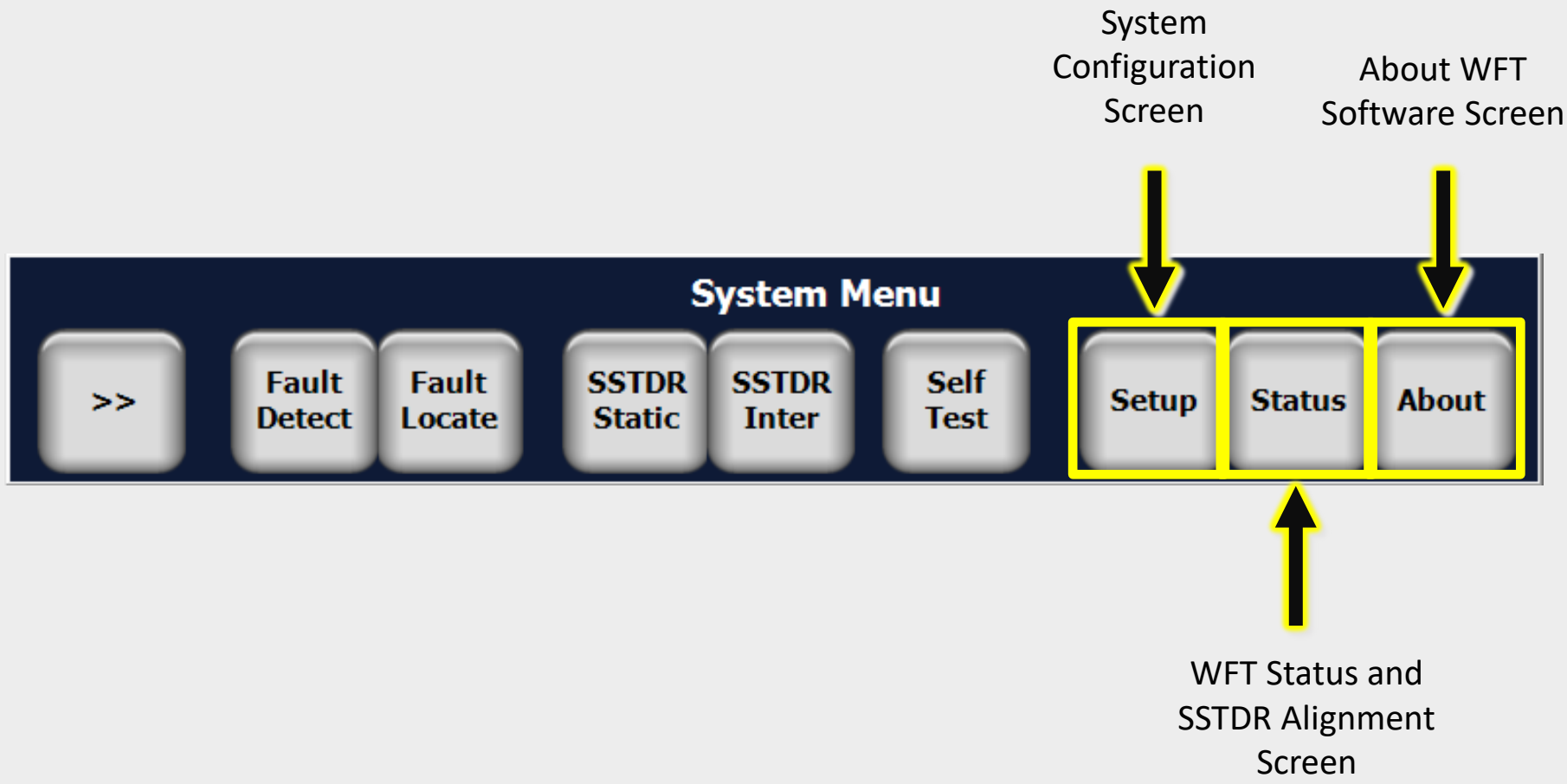
LEHV TDR Mode

- The WFT Unit functions as a Low Energy, High Voltage Time Domain Reflectometer in this mode of operation.

Aircraft Troubleshooting Scenario

1. The fault is reported to the qualified maintenance personnel.
2. Based on the fault reported, the user determines which wire paths are suspect.
3. The user disconnects wire runs from all ends of the wire path.
4. The SSTDR is used to look for static (hard opens/shorts) by disconnecting the cable and probing the suspect pins.
5. If no fault is found, proceed to LEHV.
   - SSTDR Intermittent mode may also be used if the cable can be put into vibration mechanically or by hand.
6. The LEHV is then used to charge the cable and detect any arc events.
7. When an arc event is detected, the WFT will automatically analyze the data and present the user with fault detection information and/or the distance to the fault.
8. If a fault occurs on a branched path, the user will need to perform the test at the other branched ends for proper fault isolation.

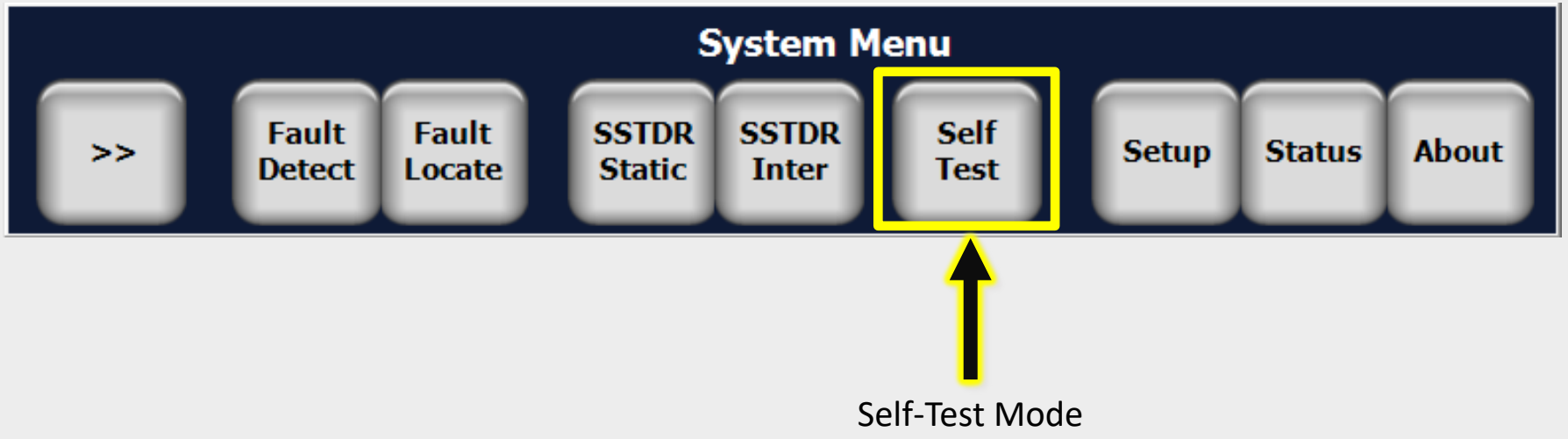
WFT System Menu



Self-Test Mode

Self-Test Mode

This mode of operation can be initiated on command. The Self-Test Mode is used to verify proper WFT calibration, prior to use, and as part of the Return-to-Service procedure to confirm that the device is ready for use after corrective maintenance is completed.

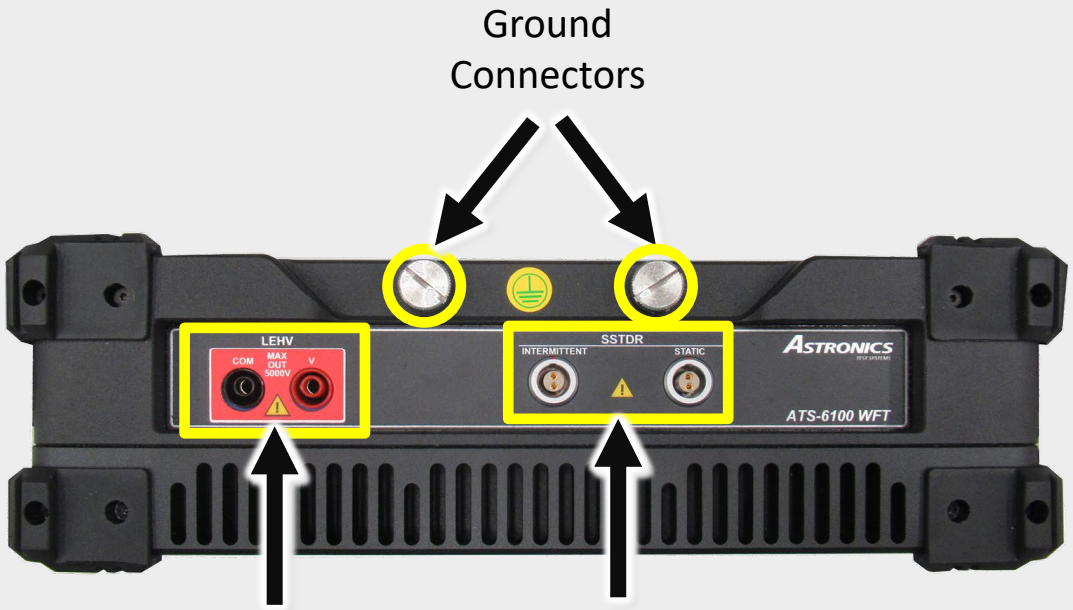


WFT Self-Test

- LEHV Adapter Cable (P/N 408796)
- SSTDR Adapter Cable (P/N 408795)
- Select Self-Test Tab
- Follow on-screen instructions
- Self-Test Pass - Unit is ready for use.
- Self-Test Fail - **Do not use**!

P/N 408724

WFT Connections



TOP VIEW

SIDE VIEW

Self-Test On-Screen Configuration

Enter values from labels affixed to cables and the Self-Test Adapter.

Exercise: Run Self-Test

Requires:

- ✓ Self-Test Adapter (P/N 408724)
- ✓ LEHV Adapter Cable (P/N 408796)
- ✓ SSTDR Adapter Cable (P/N 408795

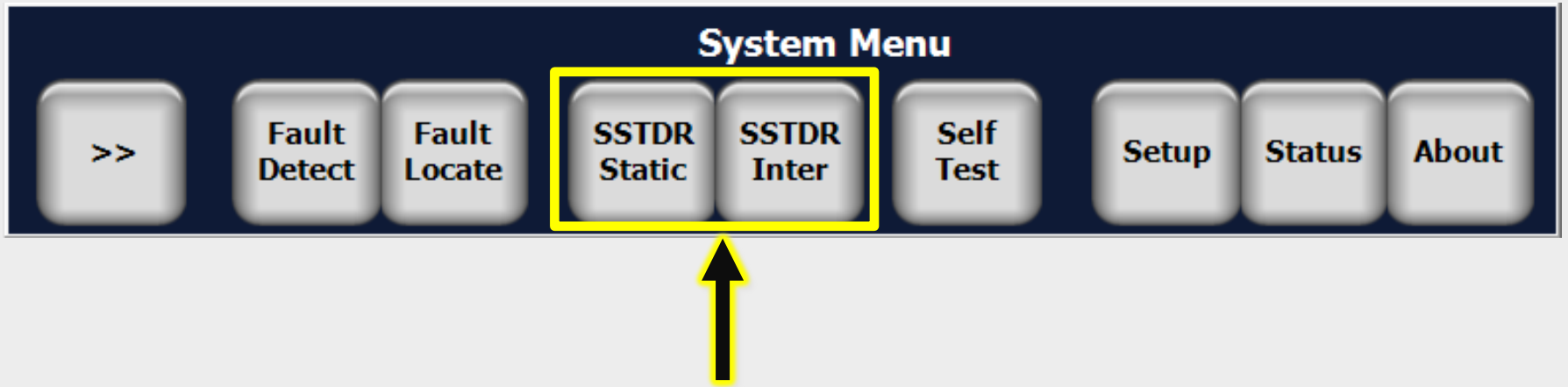
Actions:

1. Select Self Test Tab
2. Follow on screen instructions
   - ✓ If **SELF Test Pass** - Unit can be used
   - × If **SELF Test Fail -** Do not use!

Operational Modes

SSTDR Mode

- The WFT Unit functions as a Spread Spectrum Time Domain Reflectometer in this mode of operation.
- The WFT provides two different SSTDR modes of operation: SSTDR Static and SSTDR Inter (intermittent)



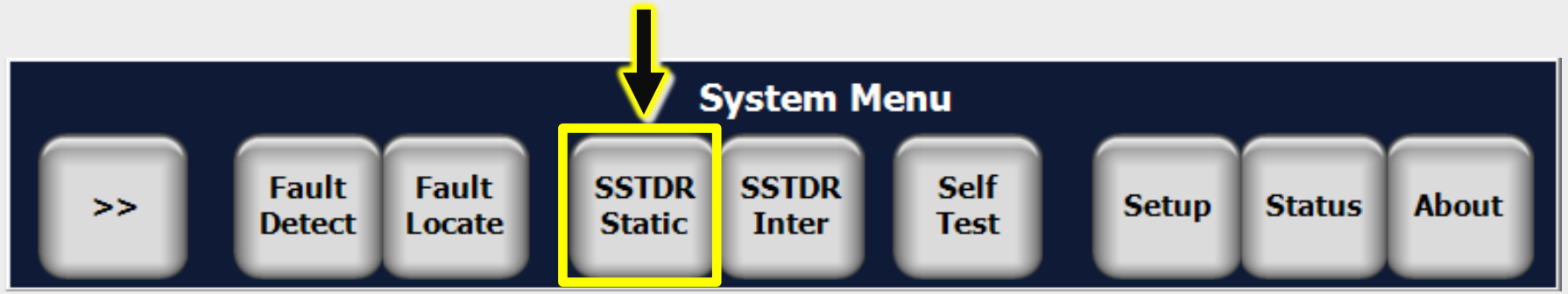
SSTDR Modes

Operational Modes

SSTDR Static Mode

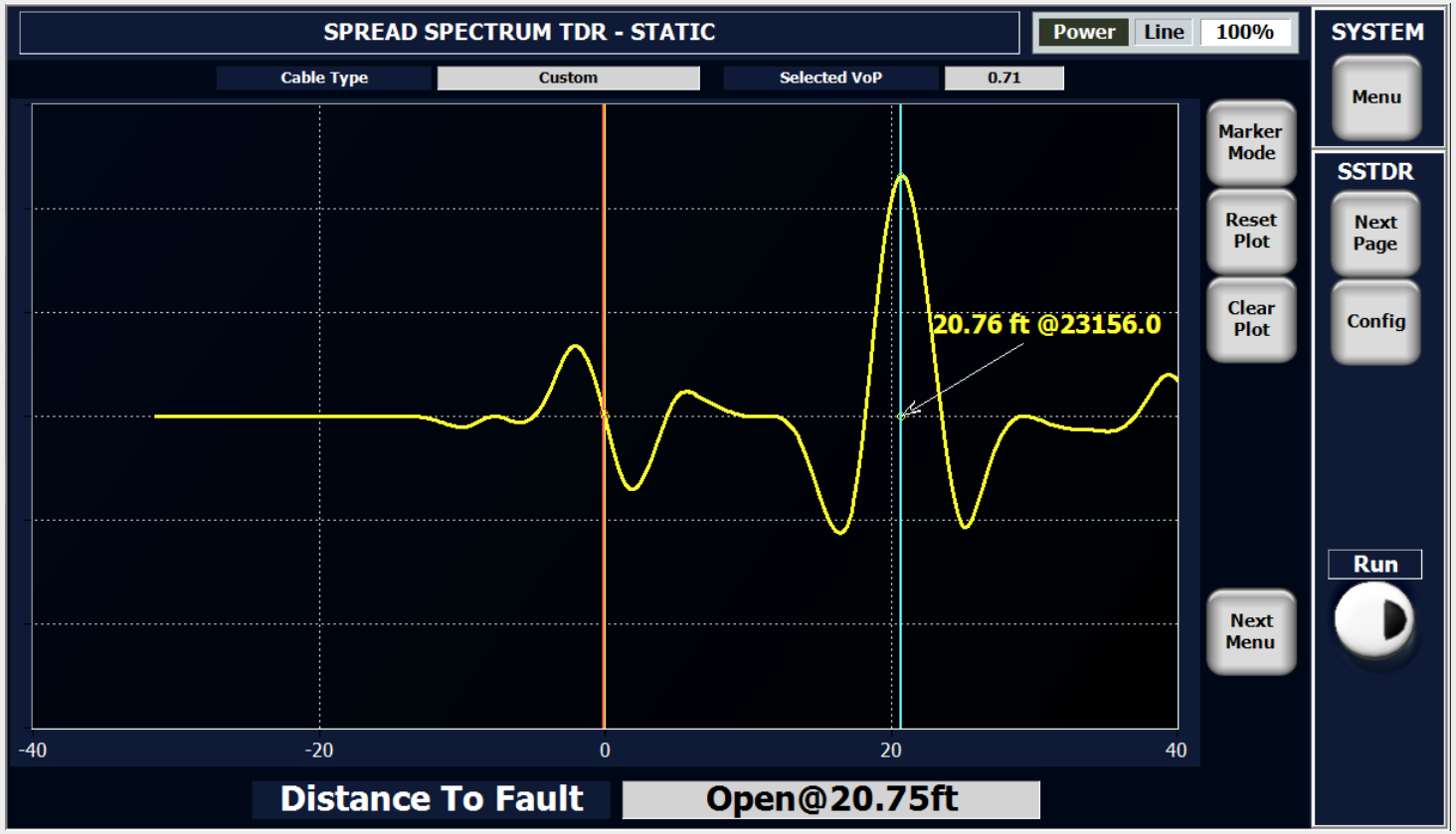
- The SSTDR Static option provides a means of troubleshooting hard opens and shorts in the Wire under test.

SSTDR
Static Mode

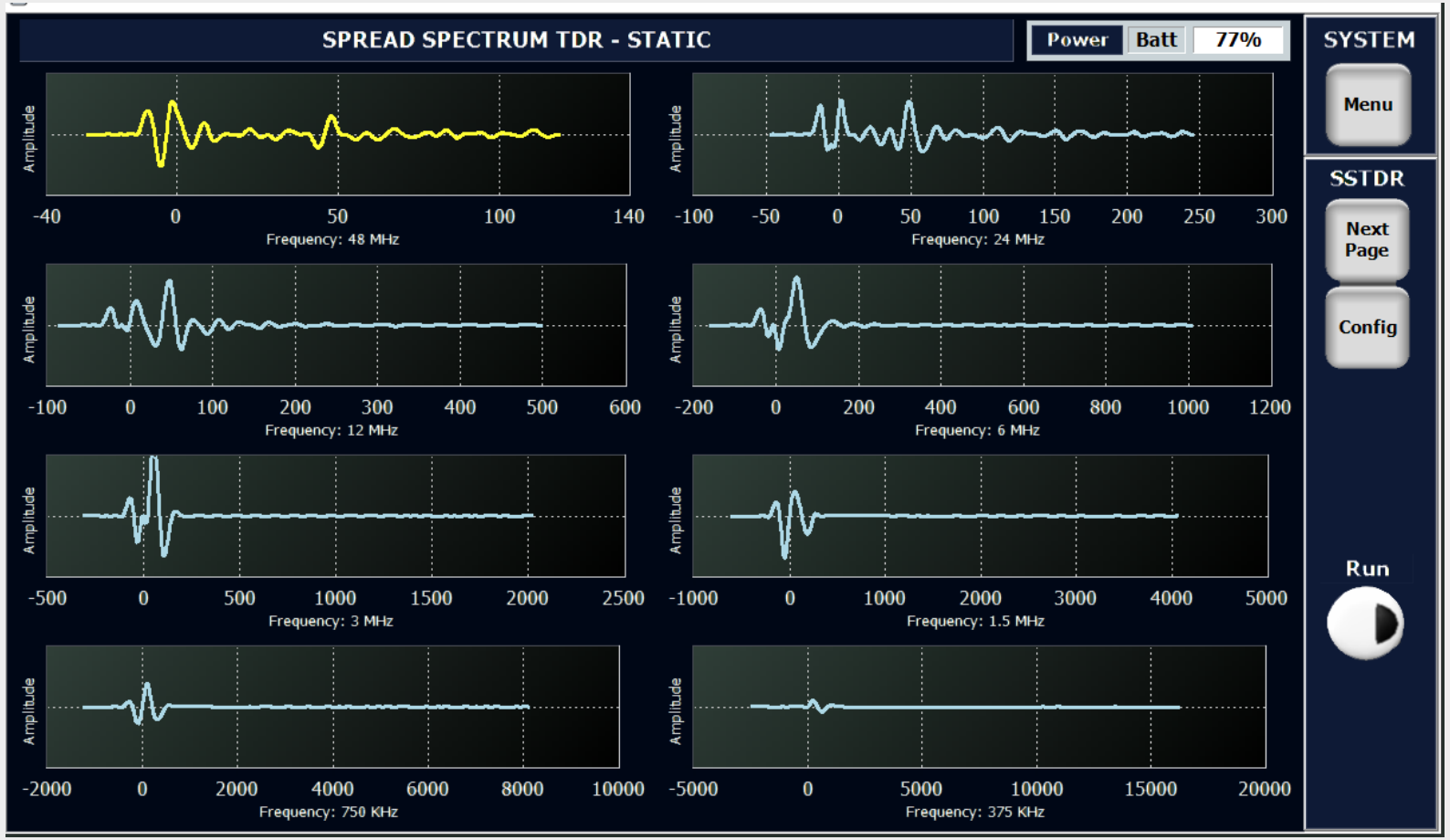


SSTDR STATIC Screen

Numeric and Graphic Results



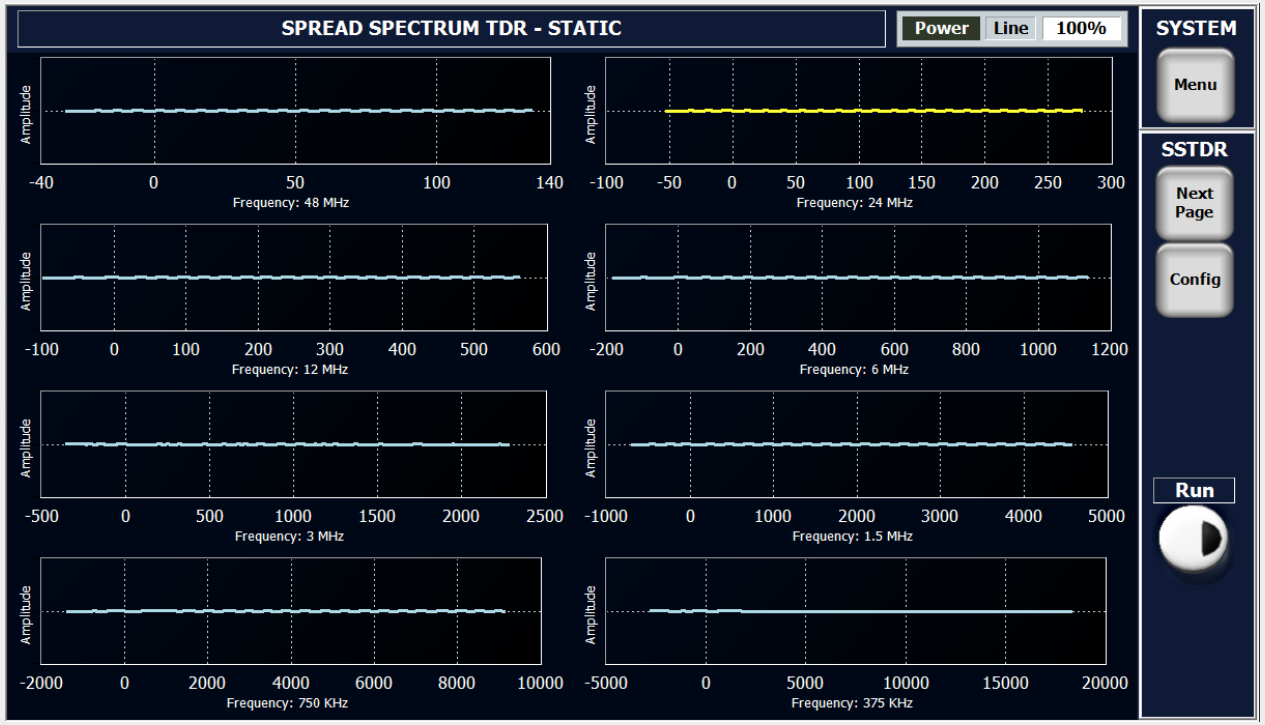
SSTDR 8-Graph Screen



Troubleshooting SSTDR Issues

Verify SSTDR Alignment

- If traces on the 8-graph page are not flat, re-run alignment.

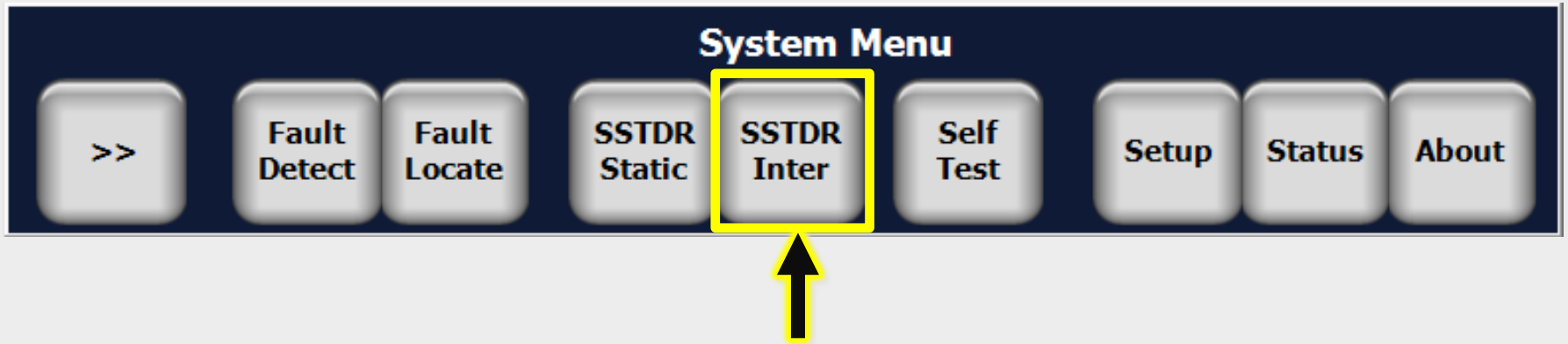


- Example of Flat Traces
- Small ripples are normal, as shown here

Operational Modes

SSTDR Intermittent Mode

- The SSTDR Inter option looks for intermittent opens and shorts in the Wire, provided vibration can be induced.
- These faults are isolated by disconnecting the cable(s) and probing the suspect pins.



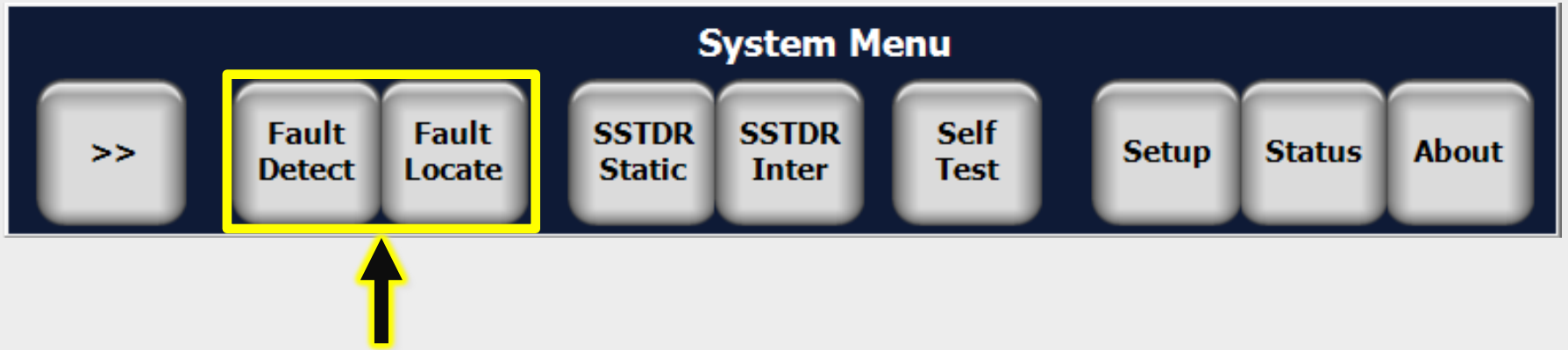
SSTDR Intermittent Mode

SSTDR INTERMITTENT Screen

Operational Modes

LEHV TDR Mode

The WFT Unit functions as a Low Energy, High Voltage Time Domain Reflectometer in this mode of operation.

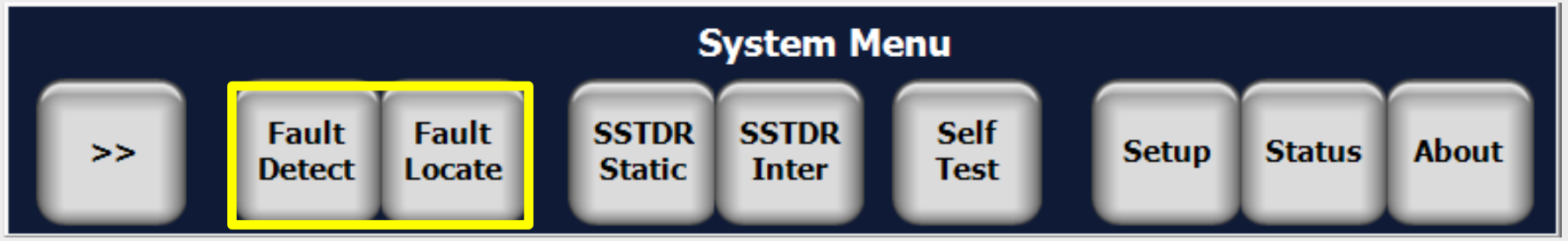


LEHV Modes

Low Energy High Voltage Time Domain Reflectometer (LEHV TDR)

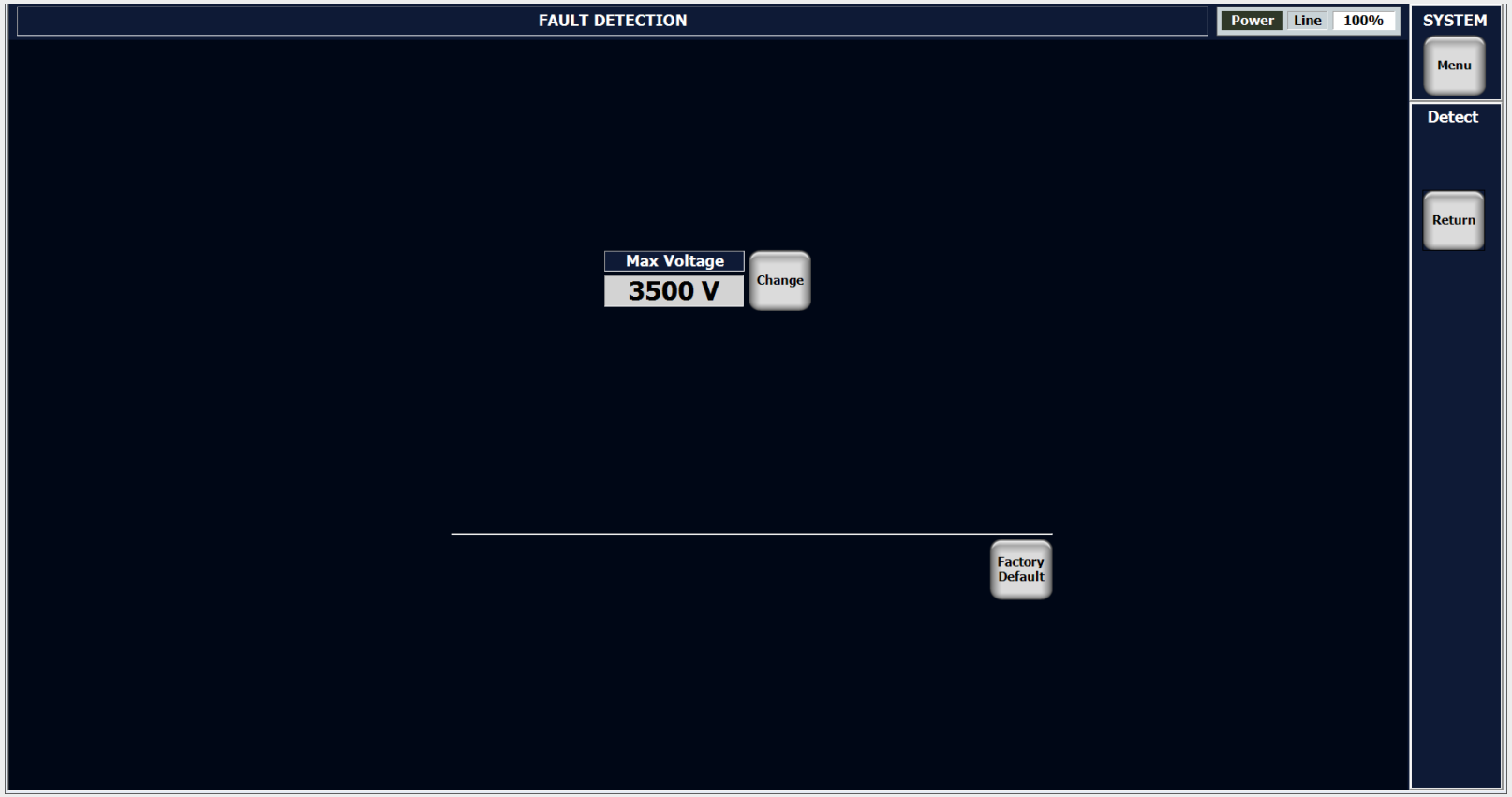
The WFT provides two different LEHV modes of operation: **Fault Detection** and **Fault Location**.

- The **Fault Detect** option provides a means of quickly and easily testing for Wire faults. The results are textually displayed as “Fault Detected” or “No Fault Detected” in the initial view and in graphic form on the next screen. Minimal setup is required.
- The **Fault Locate** option provides more detailed numeric and graphic distance to fault measurements/diagnostics, but typically requires more setup time to run the test.



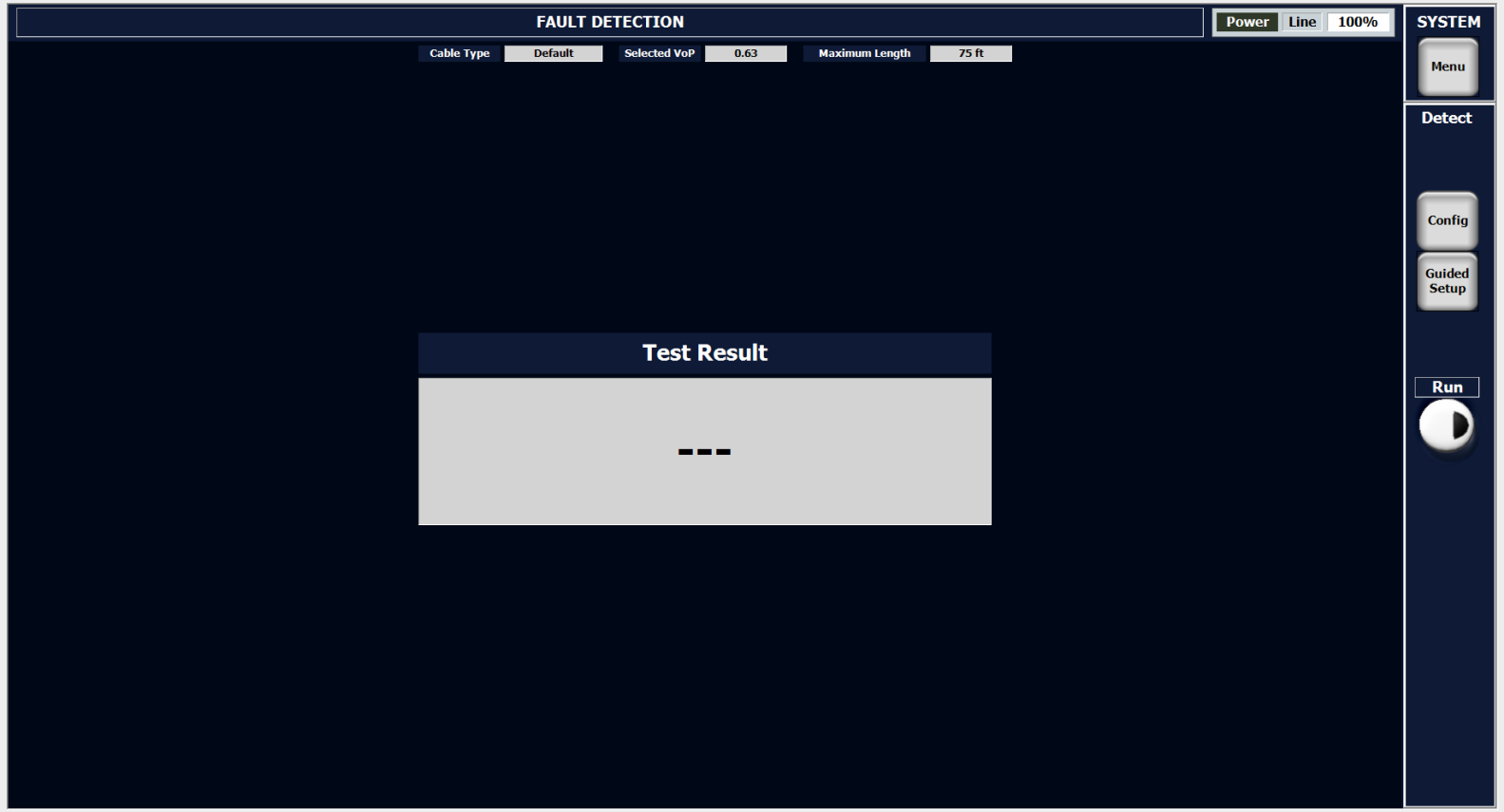
LEHV FAULT DETECTION Configure Screen

Only input is Max Voltage



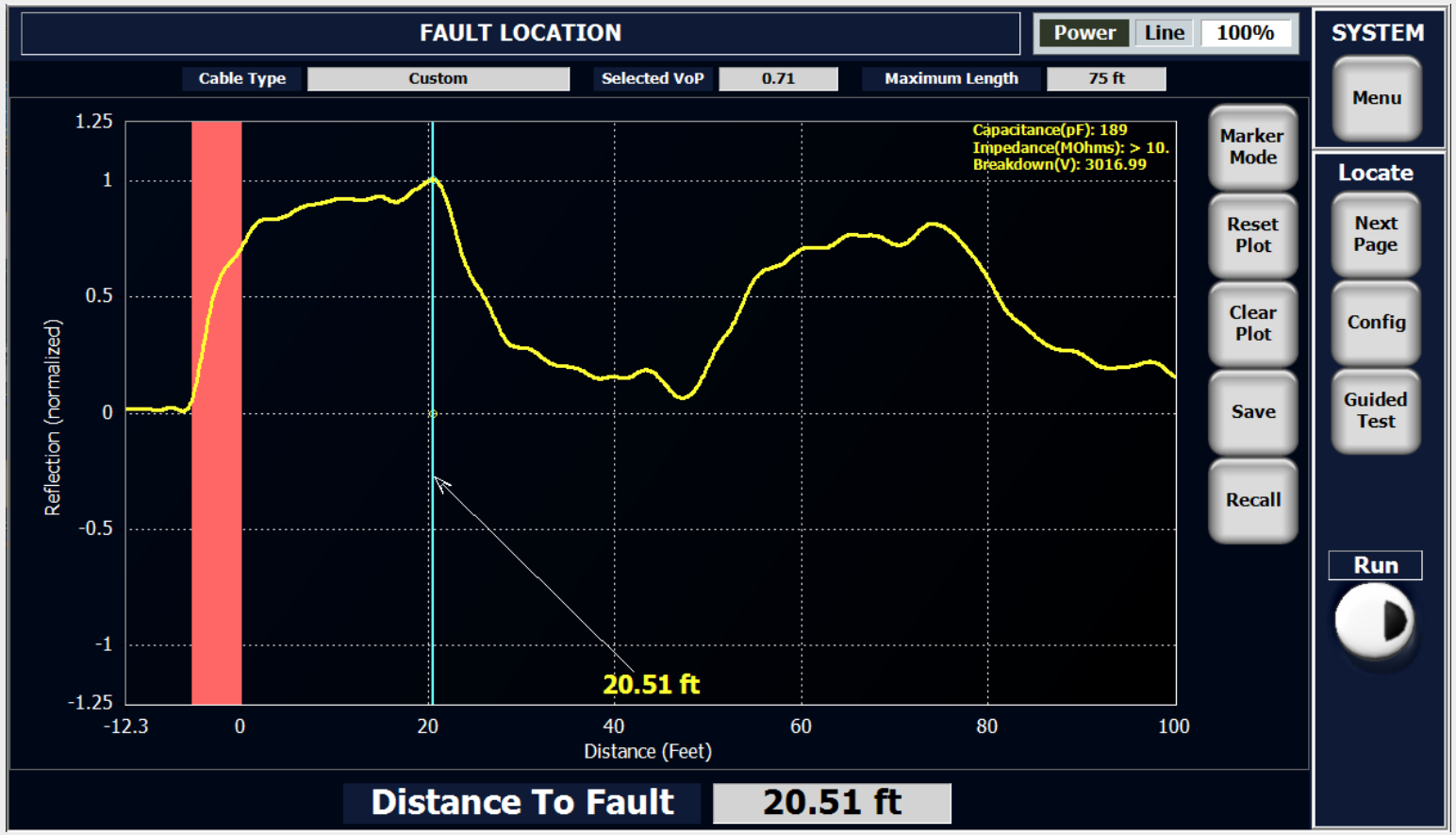
LEHV Basic Screen

Fault Detect and Fault Locate

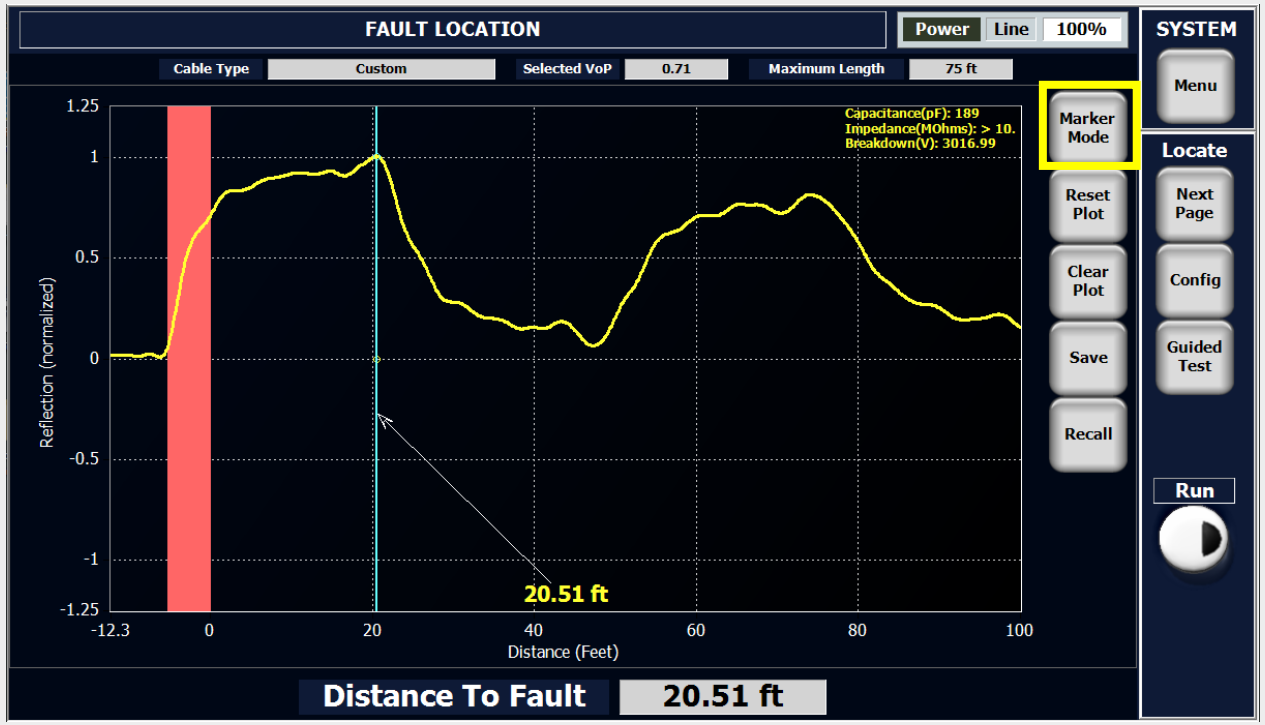


LEHV FAULT LOCATION Graph Screen

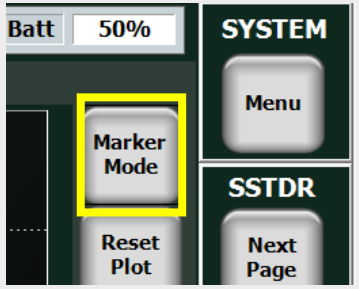
Numeric and Graphic Results



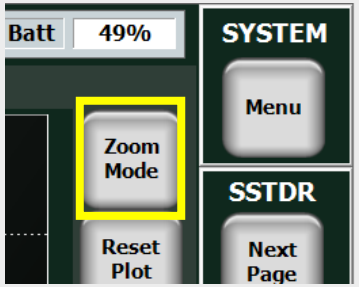
Graph Controls



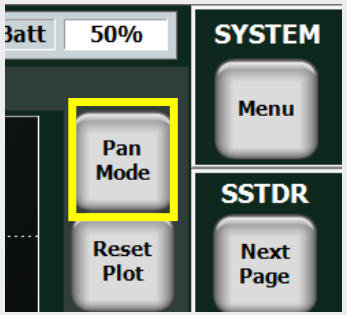
Marker Mode



Zoom Mode



Pan Mode



- Select the **Marker Mode** button to cycle the graph control mode between Pan Mode, Zoom Mode, and Marker Mode.

WFT User Aid

- LEHV Adapter cable selection
- Get VOP from cable of known length
- SSTDR waveform definition
- SSTDR Intermittent frequency selection
- Moving the graph cursor
- Recommendations for connections to the wires under test
- When in doubt use guided test setup

LEHV Adapter Cable Selection

To ensure proper test accuracy and to match the impedance and improve the signal, the adapter cable should be of similar wire type.

- Similar wire type
  - Twisted pair should be tested with a twisted pair adapter
  - Twisted/shielded should be tested with twisted/shielded adapter
  - Coax should be tested with a like impedance coax (50 ohms)

Velocity of Propagation (VOP)

Setting the Velocity of Propagation (VOP) is a **critica**l step for getting accuracy in measurements.

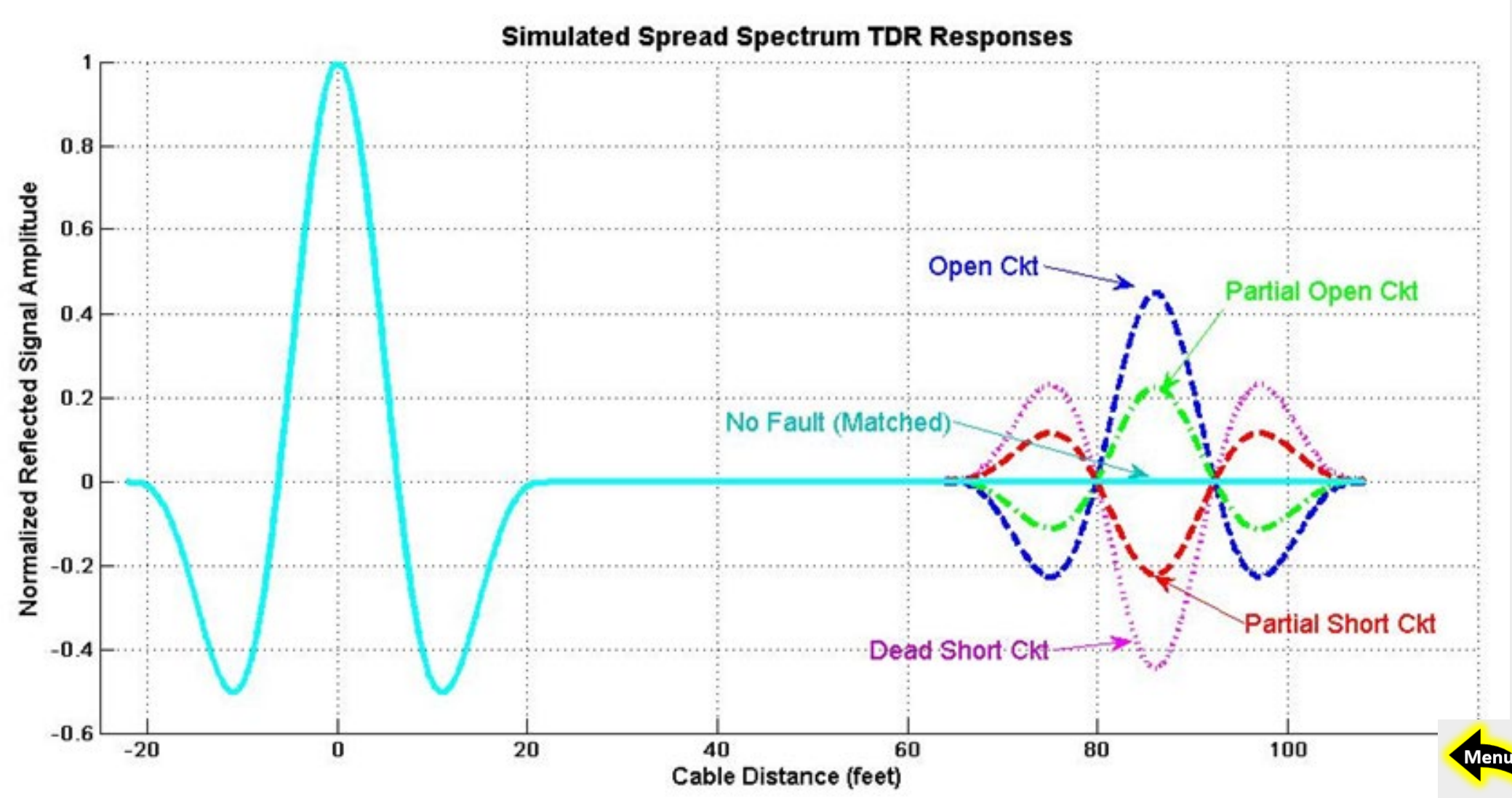
If you do not know the VOP you can measure it on a similar wire run of known length.

Exercise: Setting Velocity of Propagation (VOP)

Perform the following steps to set the Velocity of Propagation (VOP).

1. Power System on
2. Select Menu
3. Select SSTDR - Use Adapter Cable P/N 408795. (VOP is .74 , 6’ Cable)
4. Select Config Button
5. Select Mode from DTF to VOP
6. Input Known Cable length
7. Input VOP of Adapter cable(.74 and 6’)
8. Hit Return
9. Hook adapter to Position 1
10. Select Run - Should get VOP of .69 for Cable that is in the Breakout Box

SSTDR Waveform Definition



SSTDR Intermittent Frequency Selection

When using the intermittent SSTDR the following frequencies are recommended for the given length.

- If the results are inconclusive, try up or down one frequency
- For aircraft, the 48 MHz and the 24 MHz are typically the best fit.
- Select the various frequencies as follows:

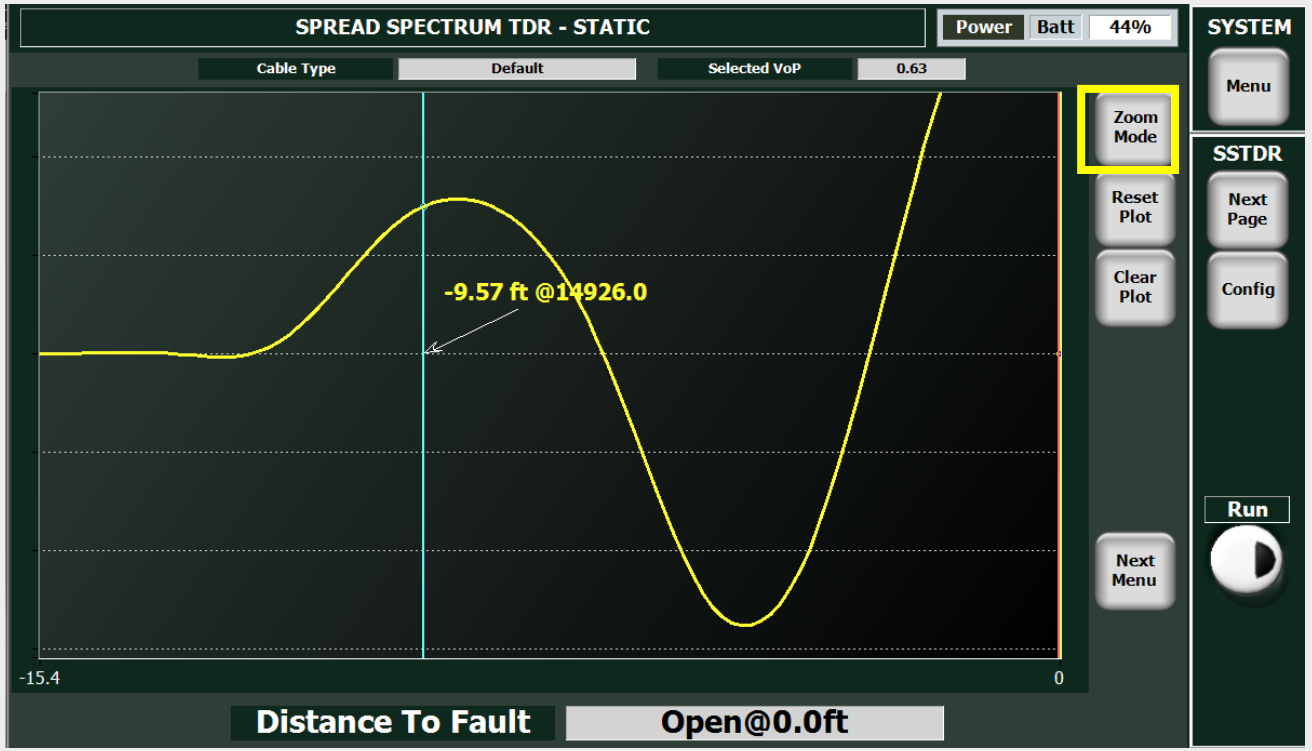
Freq: 48 MHz – < 40 ft
Freq: 24 MHz – 40 - 100 ft

} Typical Aircraft settings

Freq: 12 MHz – 100 - 250 ft
Freq: 6 MHz – 250 - 500 ft
Freq: 3 MHz – 500 - 1000 ft
Freq: 1.5 MHz – 1000 - 2000 ft
Freq: 750 kHz – 2000 - 4000 ft
Freq: 375 kHz – > 4000 ft

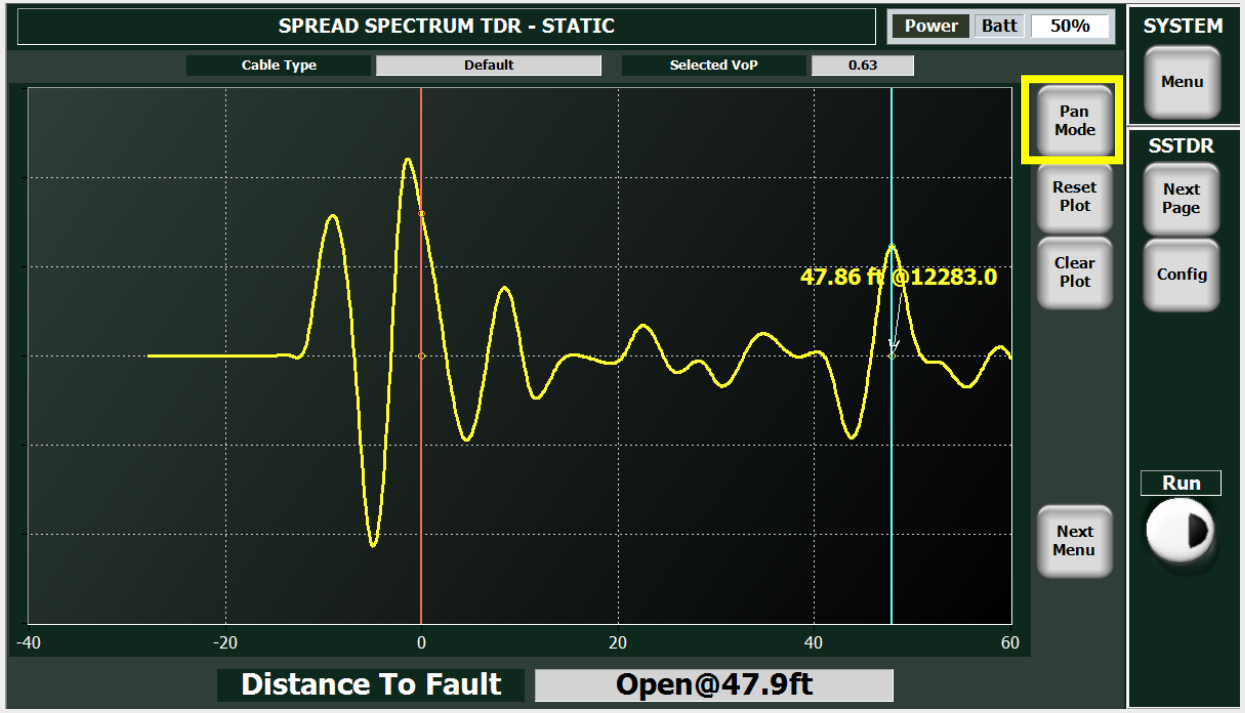
Moving/Zooming the Graph Cursor

- To zoom in on an area of the graph, click the **Marker Mode** button to change it to Zoom Mode
- Place the cursor on the graph and drag from upper left to lower right to select the zoom area
- To reset Zoom mode, select the **Reset Plot** button



Moving/Zooming the Graph Cursor

- To move the graph, click the **Marker Mode** button to change it to Pan Mode
  - Pan mode allows the graph to be moved horizontally on the display
- Click on the graph and drag the screen to pan the graph left or right



Recommendations for Connections to the Wires Under Test

- Keep the adapter wires close together
  - Open space between wires increases the impedance and can be detected causing incorrect distance to fault readings
- Straighten the adapter cable when in use
  - Loops create inductance that can be detected causing incorrect distance to fault readings
- When using the LEHV use similar wire type for the adapter
  - Twisted pair should be tested with a twisted pair adapter
  - Twisted/shielded should be tested with twisted/shielded adapter
  - 50 ohm coax should be tested with a like impedance coax (50 ohms)

Menu

When in Doubt

Use guided test function

ATS-6100 WFT Quick-Start Guide

1. Select SSTDR
    a. Mode to DTF
    b. Enter the VOP (for DTF mode) or cable length (for VOP mode) and adapter cable configuration data
    c. Connect the adapter cable
    d. Select Run
    e. Distance to fault should be detected
2. LEHV
    a. Select Menu
    b. Select Fault Detect or Fault Locate
    c. If Fault Locate is selected, enter the VOP and adapter cable configuration data
    d. Connect the adapter cable
    e. Select Run
    f. Will indicate either No Fault or the DTF

Troubleshooting Guide

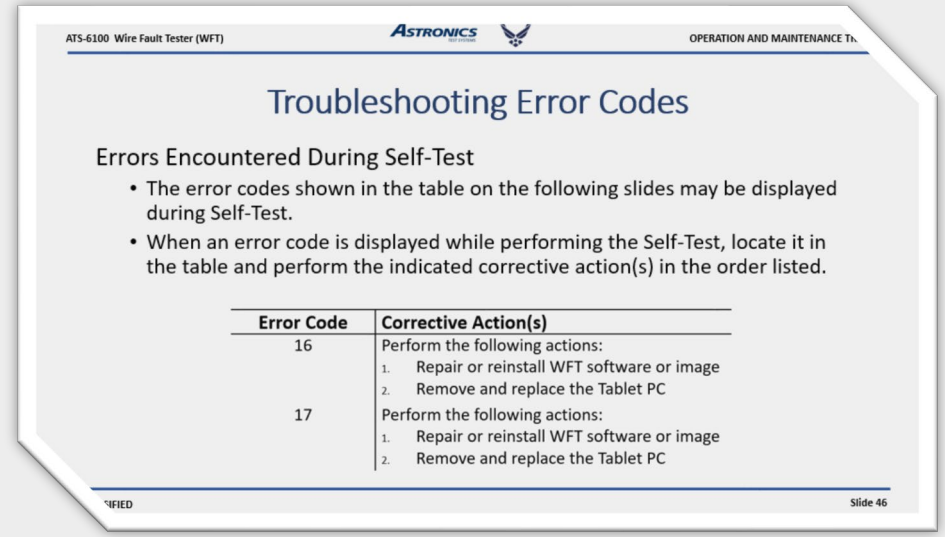
- Self-test failure
- High-density connectors
- SSTDR alignment verification
- Fault at the start of cable
- LEHV fault gap to be expected

Troubleshooting Self-Test Failure

If the self-test fails:

- Re-run self-test, paying close attention to the instructions and the data entered.
- If the unit fails repeatedly, tag the kit for repair.

For detailed information on Self-Test error codes, select the item below:

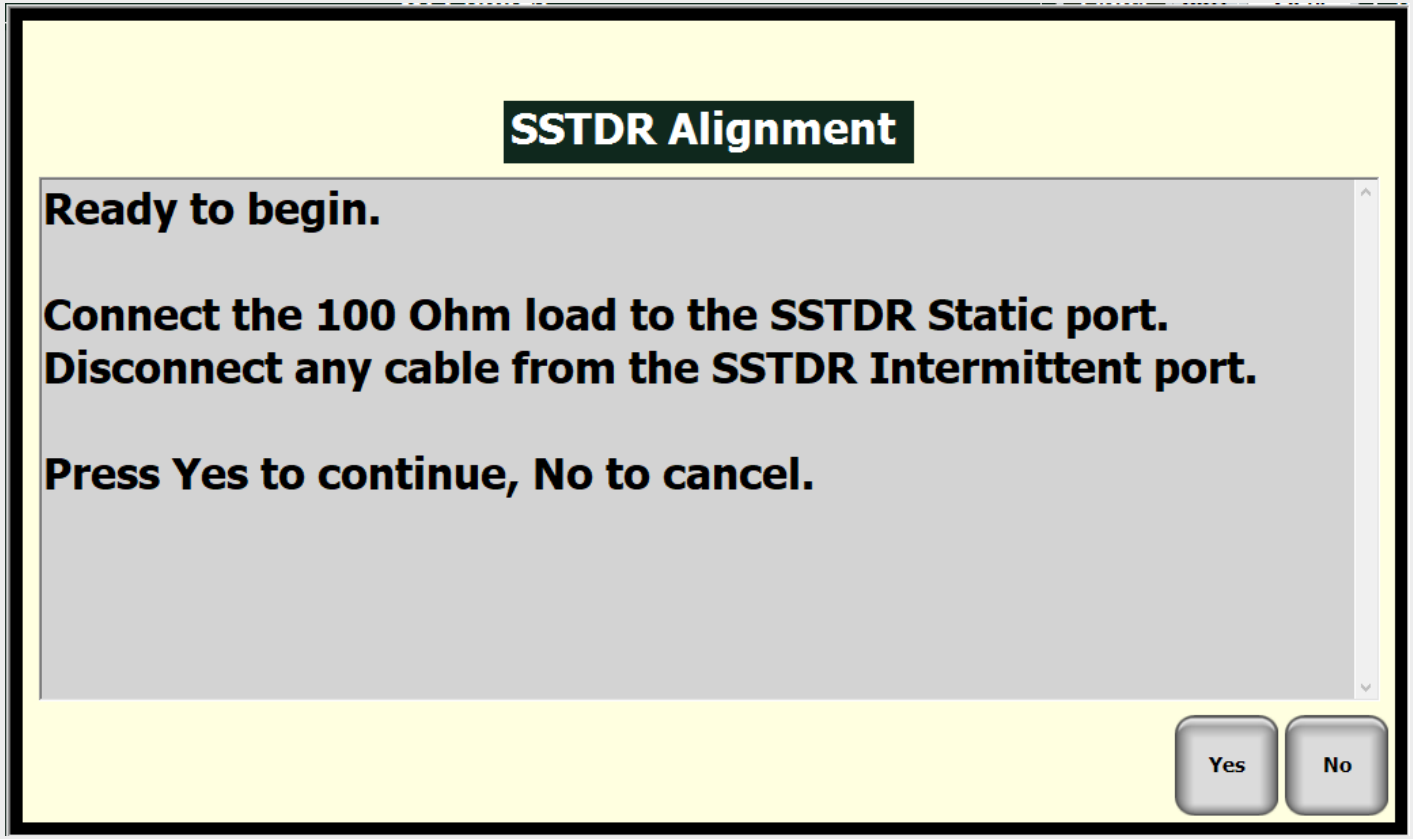


Menu

Troubleshooting High-Density Connectors

- When using LEHV and arcing is observed in the connector at the pins, lower the voltage to 2.5 kV. This would typically happen in connectors with high-density 22 awg pins.
- If this does not solve the problem, lower the voltage in 250 V increments until the arcing in the connector stops.
- Results will vary depending on contaminants in or on the connector insulator and the humidity.

SSTDR Alignment



Troubleshooting Fault at the Start of End of Cable

- Verify there is no arcing between pins at the connector ends
  - When using LEHV and arcing is observed in the connector at the pins, lower the voltage to 2.5 kV. This would typically happen in connectors with high-density 22 awg pins.
  - If this does not solve the problem, lower the voltage in 250 V increments until the arcing in the connector stops.
  - Results will vary depending on contaminants in or on the connector insulator and the humidity
- Test the cable from the opposite end to verify fault location

Troubleshooting LEHV Fault Gap to Be Expected

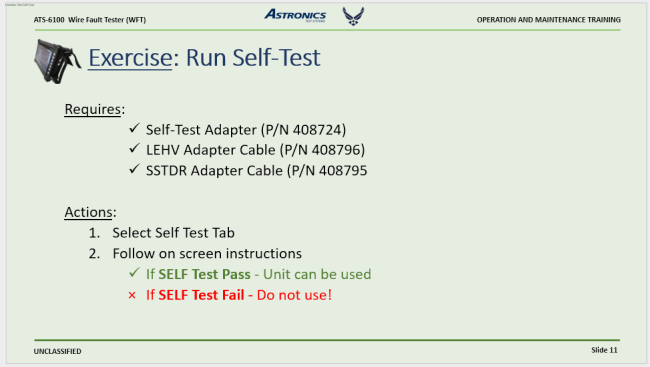
- A test voltage of 4.5 kV will detect defect gaps of approximately 0.080 in., close enough to cause problems if the wires vibrate, as in flight
- A test voltage of 800 V will detect defect gaps of approximately 0.010 in.
- Results will vary based on contamination and humidity

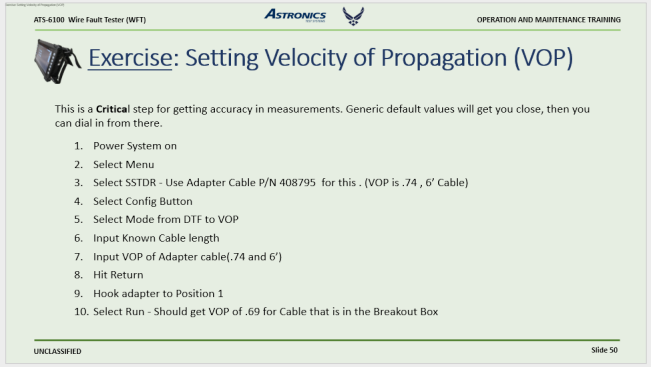
Hands-on Training

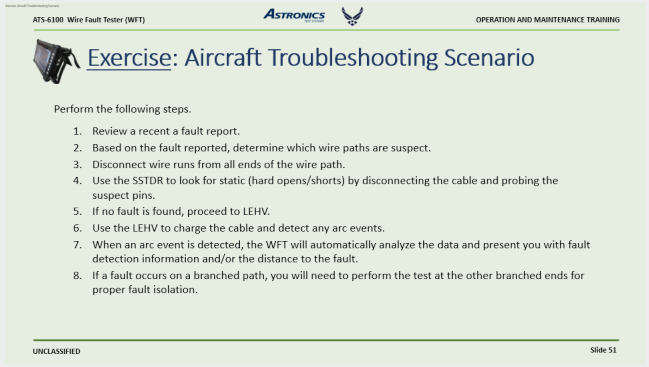
- SSTDR Alignment
- Find VOP
  - Twisted Pair Wire
  - Discrete Wires
- Find length of wire using SSTDR
  - Twisted Pair
  - RF Cable
  - Discrete Wires
- Use LEHV TDR
  - Detect Fault Mode
    - RF Cable
    - Twisted Pair
    - Discrete Wires
  - Fault Locate Mode
    - RF Cable
    - Twisted Pair
    - Discrete Wires
- Intermittent SSTDR Mode
  - Find Opens and Shorts using “Suitcase” Training Aid

Exercise Menu

Choose an Exercise







Congratulations

You have completed the Training.

Additional Information

The slides that follow contain optional information that may be of interest to some audiences.

Troubleshooting Error Codes

Errors Encountered During Self-Test

- The error codes shown in the table on the following slides may be displayed during Self-Test.
- When an error code is displayed while performing the Self-Test, locate it in the table and perform the indicated corrective action(s) in the order listed.

Error Code	Corrective Action(s)
16	Perform the following actions: 1. Repair or reinstall WFT software or image 2. Remove and replace the Tablet PC
17	Perform the following actions: 1. Repair or reinstall WFT software or image 2. Remove and replace the Tablet PC

Troubleshooting Error Codes

Error Code	Corrective Action(s)
16	Perform the following actions: 1. Repair or reinstall WFT software or image 2. Remove and replace the Tablet PC
17	Perform the following actions: 1. Repair or reinstall WFT software or image 2. Remove and replace the Tablet PC
18	Remove, replace, and retest Digitizer/SSTDR PCBA
19	Remove, replace, and retest LEHV PCBA
20	Remove and replace, in order: 1. Battery Interface PCBA 2. Portable I/O Expander PCBA 3. Battery Packs
21	Perform the following actions: 1. Repair or reinstall WFT software or image 2. Remove and replace the Tablet PC
22	Remove, replace, and retest LEHV PCBA
23	Remove, replace, and retest Digitizer/SSTDR PCBA

Troubleshooting Error Codes

Error Code	Corrective Action(s)
256	Remove, replace, and retest in order: 1. LEHV PCBA 2. Digitizer/SSTDR PCBA
512	Remove, replace, and retest Digitizer/SSTDR PCBA
768	Remove, replace, and retest in order: 1. LEHV PCBA 2. Digitizer/SSTDR PCBA
1024	Remove, replace, and retest Digitizer/SSTDR PCBA
1025	Remove, replace, and retest Digitizer/SSTDR PCBA
1026	Remove, replace, and retest Digitizer/SSTDR PCBA
1027	Remove, replace, and retest Digitizer/SSTDR PCBA
1280	Remove, replace, and retest Digitizer/SSTDR PCBA

Troubleshooting Error Codes

Error Code	Corrective Action(s)
1281	Remove, replace, and retest Digitizer/SSTDR PCBA
2560	Remove, replace, and retest LEHV PCBA
2561	Remove, replace, and retest in order: 1. LEHV PCBA 2. Digitizer/SSTDR PCBA
2562	Remove, replace, and retest LEHV PCBA
2563	Remove, replace, and retest in order: 1. LEHV PCBA 2. Digitizer/SSTDR PCBA
2564	Remove, replace, and retest LEHV PCBA
2565	Remove, replace, and retest in order: 1. LEHV PCBA 2. Digitizer/SSTDR PCBA
2566	Remove, replace, and retest in order: 1. LEHV PCBA 2. Digitizer/SSTDR PCBA

Exercise: Setting Velocity of Propagation (VOP)

This is a **Critica**l step for getting accuracy in measurements. Generic default values will get you close, then you can dial in from there.

1. Power System on
2. Select Menu
3. Select SSTDR - Use Adapter Cable P/N 408795 for this . (VOP is .74 , 6’ Cable)
4. Select Config Button
5. Select Mode from DTF to VOP
6. Input Known Cable length
7. Input VOP of Adapter cable(.74 and 6’)
8. Hit Return
9. Hook adapter to Position 1
10. Select Run - Should get VOP of .69 for Cable that is in the Breakout Box

Exercise: Aircraft Troubleshooting Scenario

Perform the following steps.

1. Review a recent a fault report.
2. Based on the fault reported, determine which wire paths are suspect.
3. Disconnect wire runs from all ends of the wire path.
4. Use the SSTDR to look for static (hard opens/shorts) by disconnecting the cable and probing the suspect pins.
5. If no fault is found, proceed to LEHV.
6. Use the LEHV to charge the cable and detect any arc events.
7. When an arc event is detected, the WFT will automatically analyze the data and present you with fault detection information and/or the distance to the fault.
8. If a fault occurs on a branched path, you will need to perform the test at the other branched ends for proper fault isolation.