Frequency Domain Reflectometer Feature

Introduction
The Frequency Domain Reflectometer (FDR) feature for the New DSP Family of Installation & Maintenance Meters provides a simple, convenient, and accurate tool for determining the distance to cable faults.

This feature works by sending a sweep into the cable and analyzing the complex reflected wave to determine the distance to various sources of reflection (opens, shorts, splitters, etc.). The reflecting events are indicated on an amplitude versus distance display, and markers are used to identify the distance to the source of the reflection, and the return loss at that point.

To access this feature, select the FDR icon from the Troubleshoot menu, as shown in the images below.

![180 DSP Troubleshoot Menu](image1)
![360 DSP Troubleshoot Menu](image2)
![720 DSP Troubleshoot Menu](image3)
![1G DSP Troubleshoot Menu](image4)
How to Verify Activation of the FDR Option on a 180 DSP or 360 DSP

The Frequency Domain Reflectometer (FDR) feature is included with all 720 DSP and 1G DSP meters and is an optional feature for the 180 DSP and 360 DSP. If the FDR Option is not activated on your device, you can purchase an activation code for this feature by calling Trilithic at 1-800-344-2412 or 317-895-3600.

There are two methods that can be used to verify whether the FDR Option has been activated on your 180 DSP or 360 DSP:

• Select the FDR icon from the Troubleshoot menu. If the option is activated, you will be able to access this feature. If the option is not activated, a warning window will appear as shown in the image to the right.

• Select the Information icon from the Setup menu as shown in the image to the right. Select the Option Information button from the Information screen to see if you have the FDR option as shown in the following images.
How Do I Use the FDR Feature?

The FDR feature allows you to find reflection points in a cable network. When you select the FDR feature, you first need to adjust the Velocity of Propagation (VoP) to match the cable under test and then start the signal source.

This signal travels the length of the cable under test and measures the reflections returned back to the meter. The meter then analyzes these reflections to determine the distance to the reflection source and the return loss at that point.

Adjusting the Velocity of Propagation

The Velocity of Propagation (VoP) can either be manually adjusted from 60.0 to 99.0 % in 0.1 % increments via the up/down arrow buttons or Virtual Keyboard. You can also automatically select one of the following 6 presets values from the Preset softkey:

- RG-59 Mini VoP – 83.0 %
- RG-59 VoP – 85.0%
- RG-6 VoP – 85.0 %
- RG-11 VoP – 85.0 %
- Semi-Rigid VoP – 87.0 %
- Hardline VoP – 87.0 %
What are My Maximum & Working Distances

The frequency step size of the FDR feature is fixed and results in a maximum distance equal to 1259.8 feet (384.0 meters) at a VoP of 100%. Use the following formula to calculate the working distance for the FDR feature based on the selected VoP:

\[
\text{Working Distance} = \text{Maximum Distance} \times \text{VoP}
\]

<table>
<thead>
<tr>
<th>Name</th>
<th>VoP</th>
<th>Working Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Feet</td>
</tr>
<tr>
<td>Minimum Value</td>
<td>60.0%</td>
<td>755.88</td>
</tr>
<tr>
<td>RG-59 Mini</td>
<td>83.0%</td>
<td>1045.63</td>
</tr>
<tr>
<td>RG-59</td>
<td>85.0%</td>
<td>1070.83</td>
</tr>
<tr>
<td>RG-6</td>
<td>85.0%</td>
<td>1070.83</td>
</tr>
<tr>
<td>RG-11</td>
<td>85.0%</td>
<td>1070.83</td>
</tr>
<tr>
<td>Semi-Rigid</td>
<td>87.0%</td>
<td>1096.02</td>
</tr>
<tr>
<td>Hardline</td>
<td>87.0%</td>
<td>1096.02</td>
</tr>
<tr>
<td>Maximum Value</td>
<td>99.0%</td>
<td>1247.20</td>
</tr>
</tbody>
</table>
Starting & Stopping the Measurement

The On and Off softkeys are used to enable and disable the source output from the meter.

When the source is deactivated, the measurement screen will appear empty, as shown in the image to the right. If you exit the FDR screen at any time, the source output will automatically be deactivated.

Select the On softkey to enable the source output. When the source is activated, the meter will scan for incoming signals, as shown here.

Once a reflection is found, the measurement screen will appear as shown in the image to the right.
Adjusting the Vertical (Amplitude) Scale

The vertical (amplitude) scale will always show the Reference Level (Ref) at the top of the graph. By default, each time the FDR feature is launched, the previous settings for the Reference Level are stored and used again. The vertical (amplitude) scale should be adjusted to a point where the maximum amplitude meets but does not exceed the top amplitude level shown on the screen for the minimum return loss that is detected.

You can use the up/down arrow buttons or Virtual Keyboard to adjust the vertical (amplitude) that is displayed on the screen from 0 to -80 dBRL in ±3 dBRL increments, respectively. The images shown below represent the same signal with two different settings for the Reference Level.

An improperly adjusted vertical scale of 0 dBRL is shown here, which results in a return trace with very little detail.

Here is a properly adjusted vertical scale of -12 dBRL, which results in a return trace with a much higher level of detail.
Adjusting the Horizontal (Distance) Scale

The horizontal (distance) scale will always show the minimum distance (location of the meter) on the far left side of the graph at the zero (0) distance mark. By default, each time the FDR feature is launched, the far right side of the graph is set to the full working distance, based on the selected VoP.

The horizontal (distance) scale should be adjusted to a point where the maximum distance meets or exceeds the distance to the farthest fault from the source that is detected.

You can also set the Start/Stop working distance using the Start and Stop fields at the bottom of the screen.

You can use the Zoom softkey to adjust the horizontal scale (distance) that is displayed on the screen. The Zoom pop-up menu options are Zoom In, Zoom Out, or Full.

When zooming in or out, the distance displayed at the far right side of the graph will either increase or decrease by 1/10th of the working distance, as shown here.
**Using Markers**

The position of the manual marker can be adjusted in 1 foot (0.5 meter) increments to determine the distance to any fault, as shown in the image to the right.

This marker is indicated on the graph by a vertical magenta line and its distance and loss values are displayed on the right side of screen, as shown here.

Additionally, automatic markers are used to display the distance and loss associated with up to three faults at a time. These automatic markers are indicated on the graph by the blue, yellow, and green dots, and their corresponding distance and loss values will be displayed on the right side of the screen.
An Example of How to Use the FDR Feature

For the following example, a test setup was constructed to match the schematic shown in the image to the right.

This schematic shows an unterminated splitter at 36 feet, with one port connected to 45 feet of unterminated coax.

The screen shown in the image to the right is clearly displaying two reflections along the path of the FDR with:

- **Reflection #1 at 36 feet**
  1. Signal goes down 36 feet of coax losing 6 dB
  2. Signal goes through a splitter losing 3.5 dB
  3. Reflection goes back through splitter losing 3.5 dB
  4. Reflection goes back through 36 feet of coax losing 6 dB
  5. Final result of -13.70 dBRL (dB Return Loss)

- **Reflection #2 at 81 feet**
  1. Signal goes down 36 feet of coax losing 6 dB
  2. Signal goes through a splitter losing 3.5 dB
  3. Signal goes down 45 feet of coax losing x dB
  4. Reflection goes back through 45 feet of coax losing 6 dB
  5. Reflection goes back through splitter losing 3.5 dB
  6. Reflection goes back through 36 feet of coax losing 6 dB
  7. Final result of -14.30 dBRL (dB Return Loss)
When you terminate the open end of the splitter, the reflection at 36 feet will no longer be displayed, as shown here.

When you add a 1.5 dB pad to the end of the 40 feet of unterminated coax, the reflection at 83 feet goes down by 3 dB (1.5 dB out and 1.5 dB back).