AERO SMART-R KIT V1.2

ET5X TABLET VERSION

User Manual version 3.8

Note

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Customer Support

For technical information and customer support, please contact your local distributor, send an email to support@win-ms.com or contact us by phone.

WiN MS Contact	Local Distributor Contact

Warranty

WiN MS warrants that this product will be free from defects in materials and workmanship for a period of one year from the date of shipment. If any such product proves defective during this warranty period, WiN MS, at its discretion, will repair or will provide a replacement in exchange of the defective product.

In order to obtain service under this warranty, please contact your local distributor or contact WiN MS directly. WiN MS must be notified before the expiration of the warranty period.

Calibration

Regular calibration of the product is essential to ensure optimal performance and accuracy. To maintain the highest level of precision, we recommend that you send the product back to WiN MS service center for calibration every 2 years. During this process, our expert technicians will thoroughly inspect and calibrate your product, ensuring its continued reliability. Regular calibration not only guarantees the longevity of your product but also ensures that it meets the required industry standards. Please refer to our website or contact our customer support team for further instructions on how to initiate the calibration process.

1. BEFORE YOU START

1.1. SAFETY INSTRUCTION

Before using the Aero Smart-R kit be sure to understand the following precautions:

- Do not apply heavy pressure on the Aero Smart-R kit;
- Do not place near fire or other sources of heat;
- Do not expose to rain, moisture or liquids;
- Do not use or store the Aero Smart-R kit in extreme weather conditions;
-  LOW VOLTAGE DIRECTIVE! WiN MS module must not be used on any live cables over 50V or that may present a risk to the operator.
-  WiN MS module injects continuously probe signals when performing a test. User must control that there is no risk for their proper signals to damage cable under test and / or equipment.
-  Only qualified personal should perform service procedures.
-  WiN MS module exchange data through a Class 1 Bluetooth connection. User has to comply with obligation and / or recommendation regarding his environment.
- The diagnosis system provided by WiN MS is used to help maintenance technicians in accelerating the maintenance process but cannot be used to qualify or not a harness. The system is not a mean to ensure that there is no fault, failure or dysfunction.

1.2. BATTERY PACK SAFETY

Please read the following carefully before using the VOLTCRAFT product. Incorrect use or incompatibility with your device may result in reduced battery performance or damage to your device.

Warning

1. Please charge this device every six month at least if it is not used for a long time;
2. Pull out the charging plug when the charging indicator lamp is on in order to avoid damaging the battery due to long-time charging;
3. Please use this device under 0 – 45 °C ambient environment and 20 – 70 % RH and avoid moisture, high temperature and fire source;
4. Please store the product in dry place and avoid moisture and corrosive materials;
5. Never clean this device with rough chemicals such as soap or cleaning agent;
6. Never dismantle, impact or put this device in fire or water;
7. Stop using this device if the battery is expanded, leaks or has odd smell.

Maintenance

- Store it where it is dry and away from moisture and corrosive articles.
- Do not try to disassemble the device
- Do not keep the device in an overheating or super cooling condition.
- Do not throw, hit or violently shake the device.
- Do not operate the power pack if it has been subjected to shock or damage.

For more information read the document: VOLTCRAFT PB-10-PD3.0 Material Safety Data Sheet.

1.3. DEFINITIONS AND SYMBOLS

Icons, symbols and terms used in the following document are defined in Table 1

Table 1: Definitions and Symbols

Symbol	***Definition***
DC	**D**irect **C**urrent
AC	**A**lternative **C**urrent
LED	**L**ight-**E**mitting **D**iode
LUT	**L**ine **U**nder **T**est
SC	**S**hort **C**ircuit
OC	**O**pen **C**ircuit
	Bluetooth
	Windows
	Warning / Caution
	Power Button
Digital-R	App installed on Aero Smart-R tablet to run permanent and/or intermittent fault tests.
MCTDR (**M**ulti-**C**arrier **T**ime **D**omain **R**eflectometry)	Designates the probe signal sent down the LUT so the reflected one can be analyzed. The defect is then characterized and located.
VF (**V**elocity **F**actor)	The velocity factor is the ratio between the speed of an electrical signal traveling through the cable and the speed of light in vacuum
Injection Point	This point represents the last matched connection between the module and the LUT

2. DISCOVERING THE AERO SMART-R KIT

The Aero Smart-R kit is a portable and autonomous system for helping a maintenance operator to locate a defect in a transmission line formed by at least two electrical conductors.

2.1. EQUIPMENT AND ACCESSORIES

The Aero Smart-R kit is delivered in a suitcase and the list of equipment and accessories are described below:

Table 2: Smart-R Kit main contents

	① The Windows Tablet
	② The Aero Smart-R module with Battery Pack
 	On the left: 5 V DC adapter for the battery pack On the right: 12 V DC adapter for the tablet
	12 V DC adapter with mini docking station
	③ BNC adapter kit (1 each) W1501 – SHORT W1502 – LONG
	④ Aero test leads (2 each) W27068→W27087 ⚠ Pairs must be twisted
	⑤ High voltage detector W1605

2.2. WIN MS MODULE AERO V1 OVERVIEW

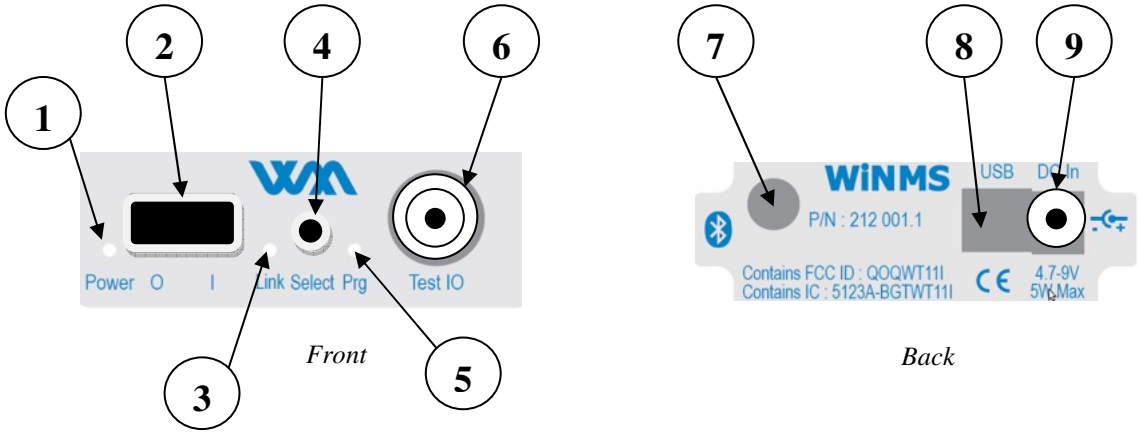


Figure 1: Module Aero v1 overview

Front

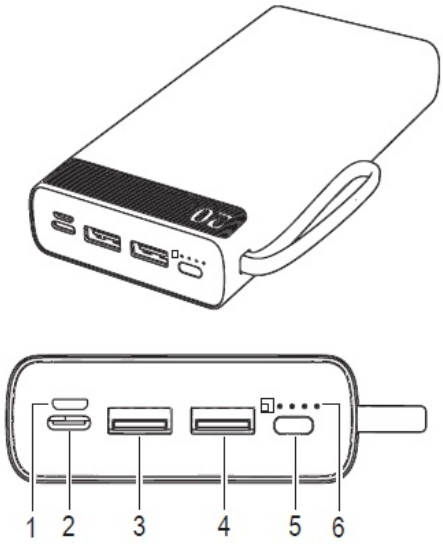
1. LED Power Indicator
2. Power Button
3. LED Link selection Indicator (ON: Bluetooth; OFF: USB)
4. Link Select Button
5. LED Program running Indicator
6. Main BNC output

Back

7. Bluetooth Antenna
8. USB connector
9. 4.7-9 V DC Input Connector

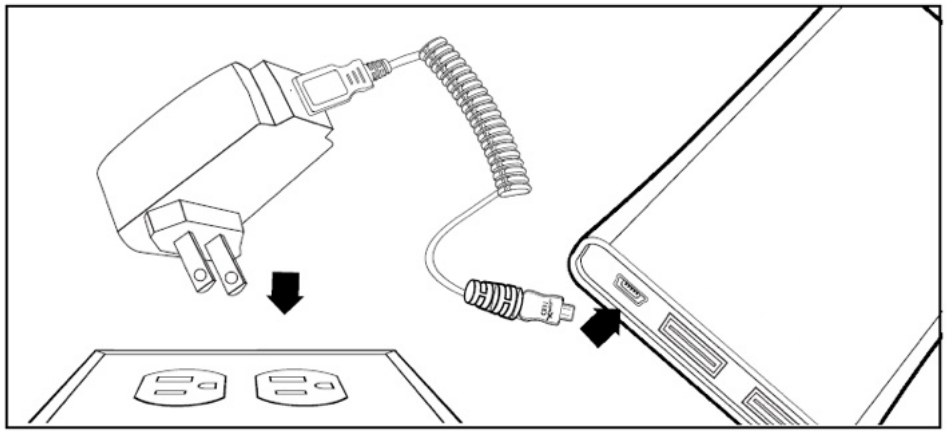
Figure 2: WiN MS Module Aero v1 with Battery

2.3. BATTERY PACK AND CHARGER OVERVIEW



1 Micro USB input
2 USB-C® input/output
3 USB-A output1 (fast charging)
4 USB-A output2 (fast charging)
5 Power button:
Press once to show the battery status.
Press twice to deactivate the output power.
6 LED battery status indicators

2.4. INSTALLING AND CHARGING THE BATTERY



Charging the power bank

1. Connect one end of the micro-USB cable to the power supply device (such as AC charger or PC USB) and the other end to IN port of the power bank to start charging. Normal charging would take only 4-5 hours.
2. Display the battery level: press the power key once to see the display of four battery level indicators, which is easy for you to control the power bank capacity.

It is not possible to use the system while the battery is charging.

For more information read the document: VOLTCRAFT PB-10-PD3.0 User Manual.

2.5. TURNING THE UNIT ON/OFF

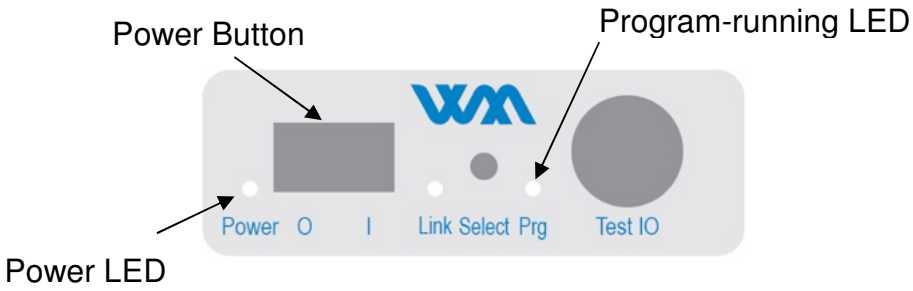


Figure 3: Turning the Unit ON/OFF

Turning the unit ON

- **First of all, ensure the Bluetooth Antenna is correctly tighten to the module**

- Check your battery pack connection between the battery and the module Aero and press the battery power button. The solid blue light should stay ON
- Press the Power Button ON (I)
- The Power Green LED stays ON
- Your unit is ready to use when Program LED stays ON

Turning the unit OFF

- Press the Power Button OFF (0)
- Battery pack will automatically switch OFF

Note: The WiN MS Module Aero V1 will remain ON and running until it is either powered down, or the battery is depleted.

2.6. USING THE WINDOWS TABLET

Turning Tablet ON

Press the Power (ON/OFF) to turn the unit ON.

The Tablet immediately boots.

Click Digital-R icon from the home screen

Feel free to move or create new shortcut icon at your convenience.

2.7. INSTALLING AND CHARGING THE TABLET BATTERY

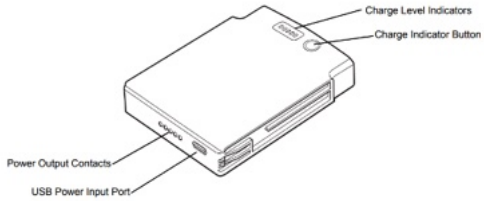
2.7.1. Internal tablet battery

Before using the ET5, charge the battery using the DC 12 V power charger and the tablet dock.

- Plug the DC 12 V power charger to the tablet dock
- Connect the ET5 tablet to the dock
- Plug the charger to a regular power outlet 110–230 V, 50–60 Hz

The Battery Charge LEDs blinks yellow indicating that the battery is charging. When the battery is fully charged (approximately six hours) the LEDs becomes solid green.

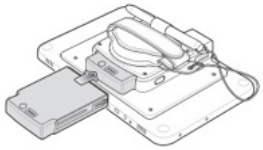
2.7.2. Power pack



- Remove the Power Pack from the expansion back
- Control the battery level by pressing the charge status button
- Charge the Power Pack using a suitable power source that supplies 5 VDC @ 2A. The Power Pack charges in less than five hours
- The Battery Charge LEDs blinks green while battery is charging. When the battery is fully charged (approximately six hours) the LEDs becomes solid green.

Charging the tablet, with the Power pack inside, will not charge the power pack.

- To install the Power Pack, press the two buttons to release the protective cover and insert the Power pack inside the bracket until you hear a click from both buttons.

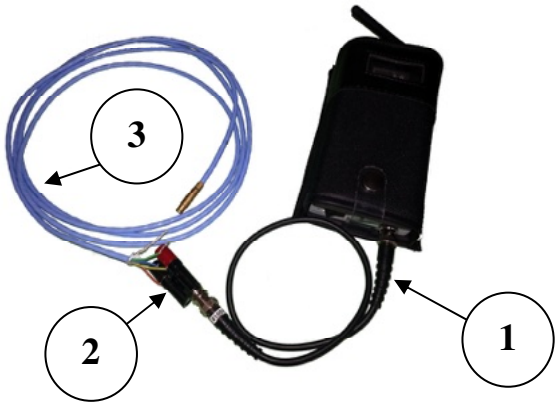


For more information, please refer to the document: ET5 Quick Start Guide by Zebra

3. USING THE AERO SMART-R KIT

3.1. HOW TO TEST A LINE?

3.1.1. Coupling walkthrough



1. Connect the BNC cable to the module on "Test IO" connector
2. Choose one of the BNC / Banana adapters and aero connectors if needed (see table below). This point is called "*injection point*".
3. Plug the LUT

Table 3: LUT connection – Typical examples

Configuration	Picture	Adapters architecture
Single wire above aircraft ground or airframe		• **BNC probe** (COAX CABLE BNC) • **BNC/Banana adapter** (COAX KIT 1) • **Banana transition** (ref. W24044/B) • **Alligator Clips** (ref. W26017/B)
Two wires (twisted or not) without connector		• **BNC probe** (COAX CABLE BNC) • **BNC/Banana adapter** (COAX KIT 1)
Two wires (twisted or not) with connector		• **BNC probe** (COAX CABLE BNC) • **BNC/Banana adapter** (COAX KIT 1) • **Aero wires** (ref. W27082)

Tips: You will get better coupling and performance if you twist the aero wires.

Important

When troubleshooting a single wire:

- It is preferable to identify another wire in the same bundle (another wire following the same route) and use the '2-wire' configuration in the cable library (*cf.* 3.2).
- In case there is no other wire in the same bundle or uncertainty about the routing of the second wire, then the single wire can be tested by connecting the other input/output to ground (using alligator clip and when needed the small black extension wire, see picture below).

In this situation:

- Location accuracy may be worse.
- High-gain mode can be useful to pre-locate the fault area (*cf.* 3.3.1.1).

3.1.1. Launching the Digital-R app

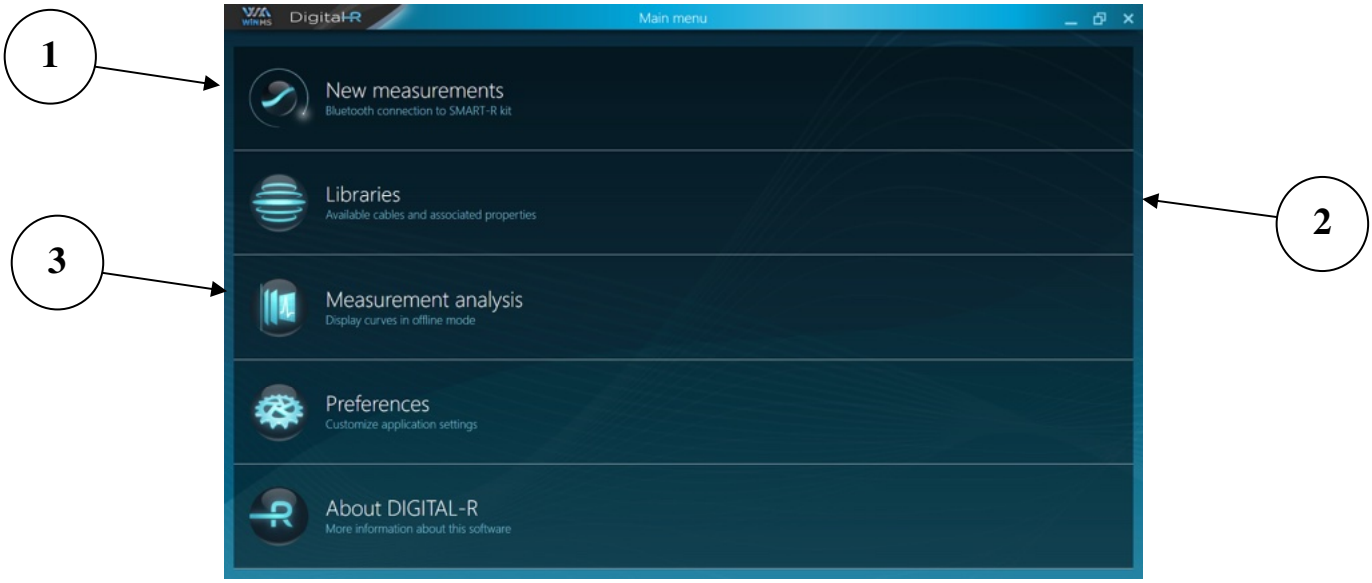


Figure 4: Digital-R Home Screen

The app is properly configured with the device, so settings shall remained unchanged. The main useful features from this screen are:

1. Starting a new campaign

   Please turn on Aero module before proceeding. The kind of fault to look for will also have to be selected (permanent or intermittent). This topic will be explained later on.

2. Managing the cables library

   This allows to select the type of cable the module is connected to and/or customize its physical properties to improve measurement accuracy. The built-in library is supposed to contain most of the widespread aero cables. Should you encounter an unknown type, do not hesitate to contact WiN MS support team to help you build a specific model.

3. Offline analysis

   In this mode, earlier-performed measures can be replayed without being connected to Aero module. This allows to plot exported data (this will be explained later on) and analyze them.

4. Preferences

   This menu allows the user to change Digital-R settings, such as Language, Units, friend device, software update, licence update, tool sensitivity, activate or deactivate help windows…

3.2. SELECTING THE APPROPRIATE CABLE TYPE

Please always keep in mind that WiN MS module does not directly measure a distance to a fault, but rather a time-of-flight to a fault. That is the reason why the more the cable characteristics are well-known, the better the accuracy.

When launching the 'Library' from the main menu, the screen should look like this:

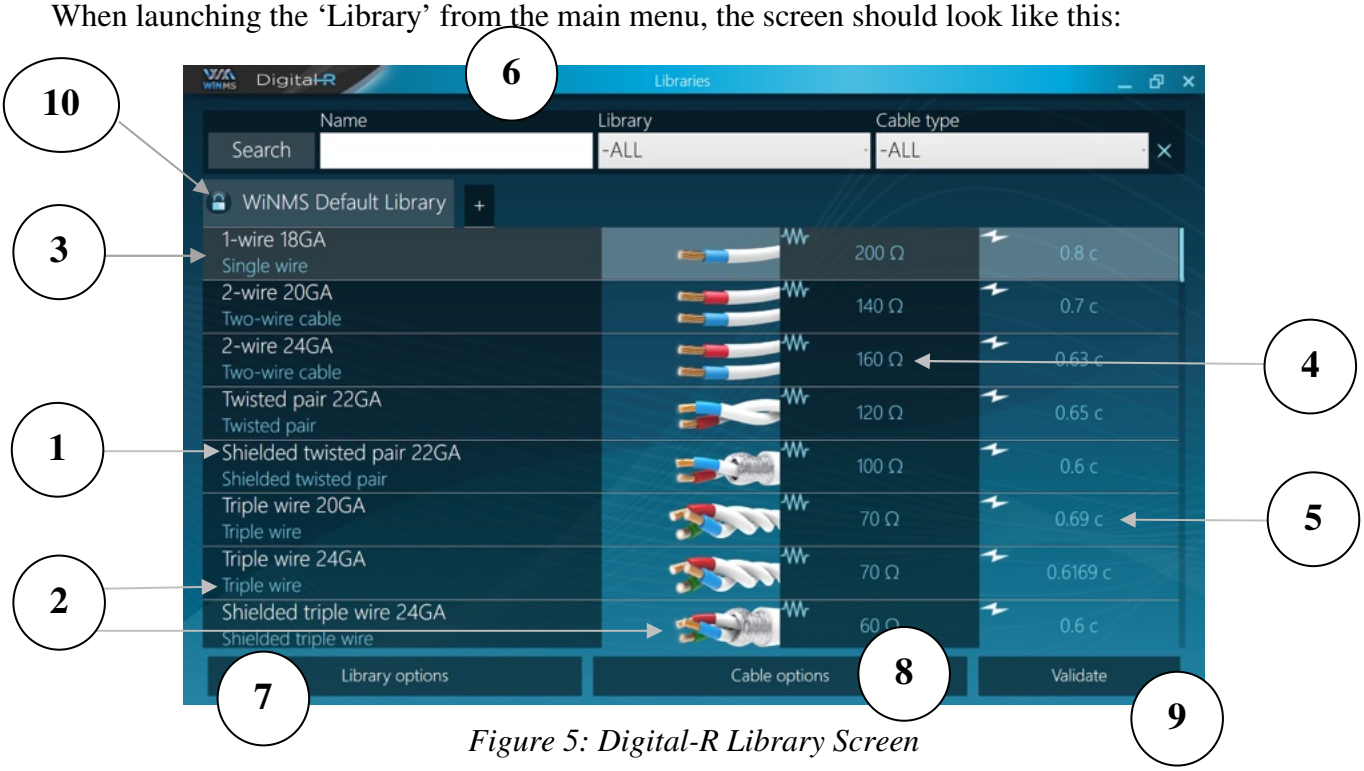


Figure 5: Digital-R Library Screen

All the available cables are listed here with the following properties:

1. Cable's name
2. Cable's type (empirical, lossless, twisted pair, coaxial, parallel pair or RLCG-based are supported)
3. Selected by default (on campaign startup)
4. Characteristic impedance
5. Velocity factor
6. Filter option (by name, by library or by cable type)
7. Library options are linked to current selected library (create new library, import a library from a file, export the library to a file, rename the library, duplicate the library, delete the library, set a password to a library, unlock a library with the password)
8. Cable options are linked to current selected cable (add a cable to an unlocked library, duplicate a cable to another library, edit the selected cable, delete the selected cable)
9. Validate the selected cable as the cable used for the measurement campaign
10. Locked library can not be modified

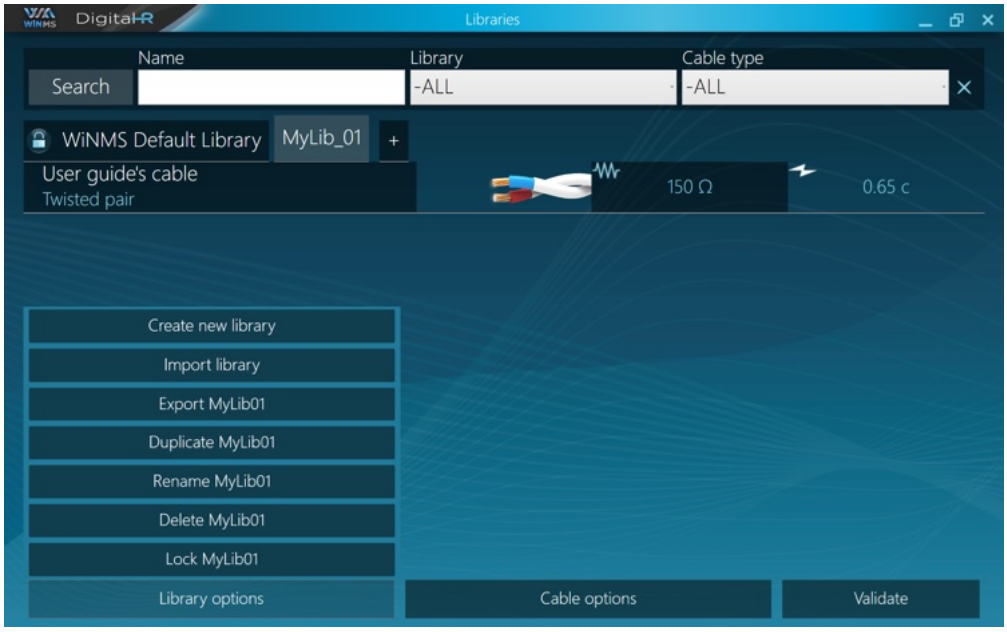


Figure 6 Library options

Figure 7 Cable options

Important

- Velocity directly impacts measurement accuracy
- Impedance is used to estimate coupling quality and peaks magnitude (*cf.* Expert Mode). If the LUT is well-matched to the Aero module, the app will ask for the probe length, as depicted below.

Figure 8 Set probe cable length

Probe length can either be entered manually or automatically detected. To use 'Auto' feature, the LUT has to be disconnected from the probe cable.

3.2.1. Physical models (empirical)

The empirical family contains two types: lossless and fully empirical.

3.2.1.1. Lossless

This is the simplest model, because only 2 parameters are required: the velocity and the impedance (if you do not know the impedance, please let the space blank).

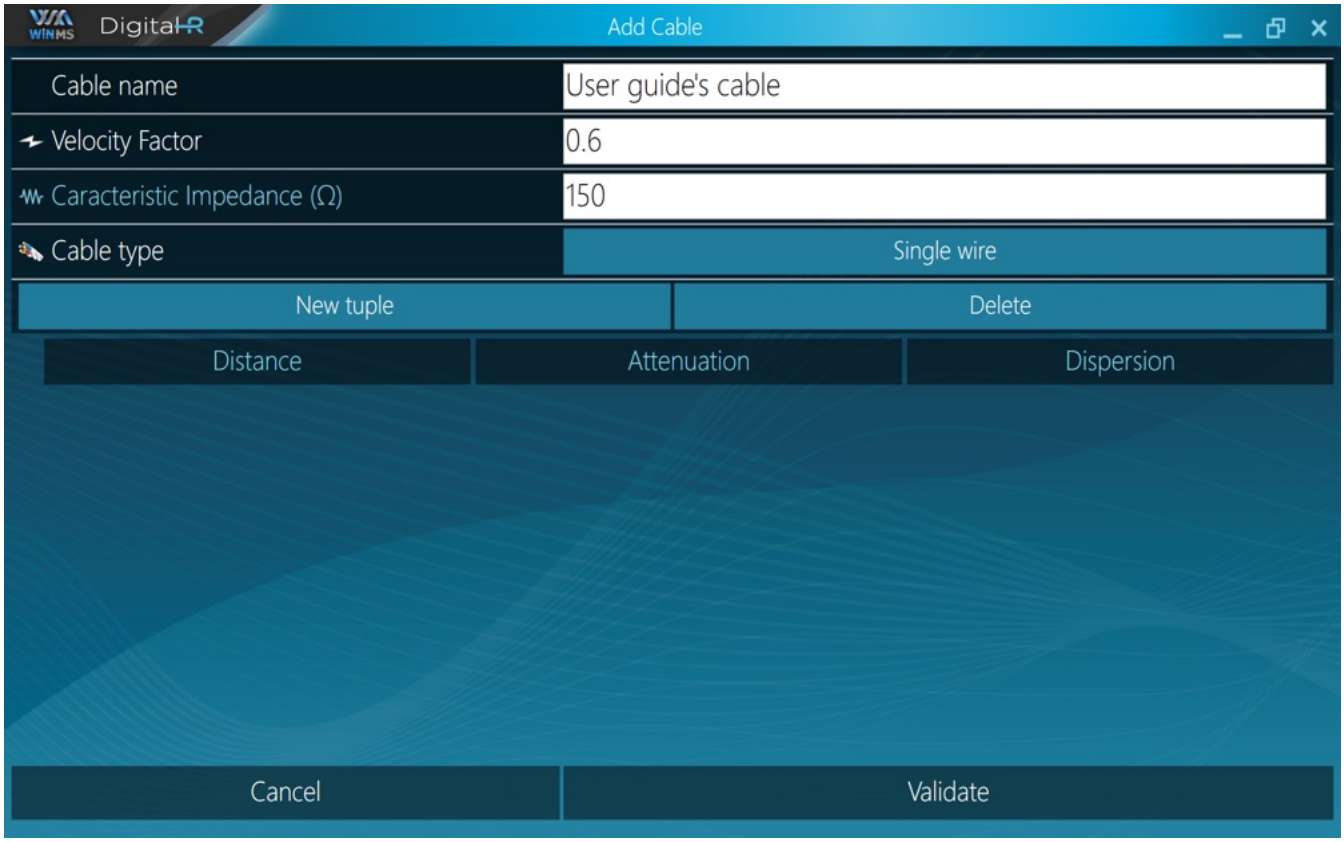


Figure 9: Digital-R Lossless Model

3.2.1.1. Fully empirical

This model is quite powerful because it allows the user to build a template of the real cable's response. It is possible to enter an unlimited number of (distance / magnitude) pairs, in order to fit as close as possible to the measurements.

Important

- Distance must be entered in meters
- Magnitude is a positive real number between 0 and 1. The value should **take into account impedance mismatch** with WiN MS module. Please contact support team for more information.
- Dispersion is an optional value in meters which can be left empty. This value is used to compensate the dispersion of the cable. Please contact support team for more information.

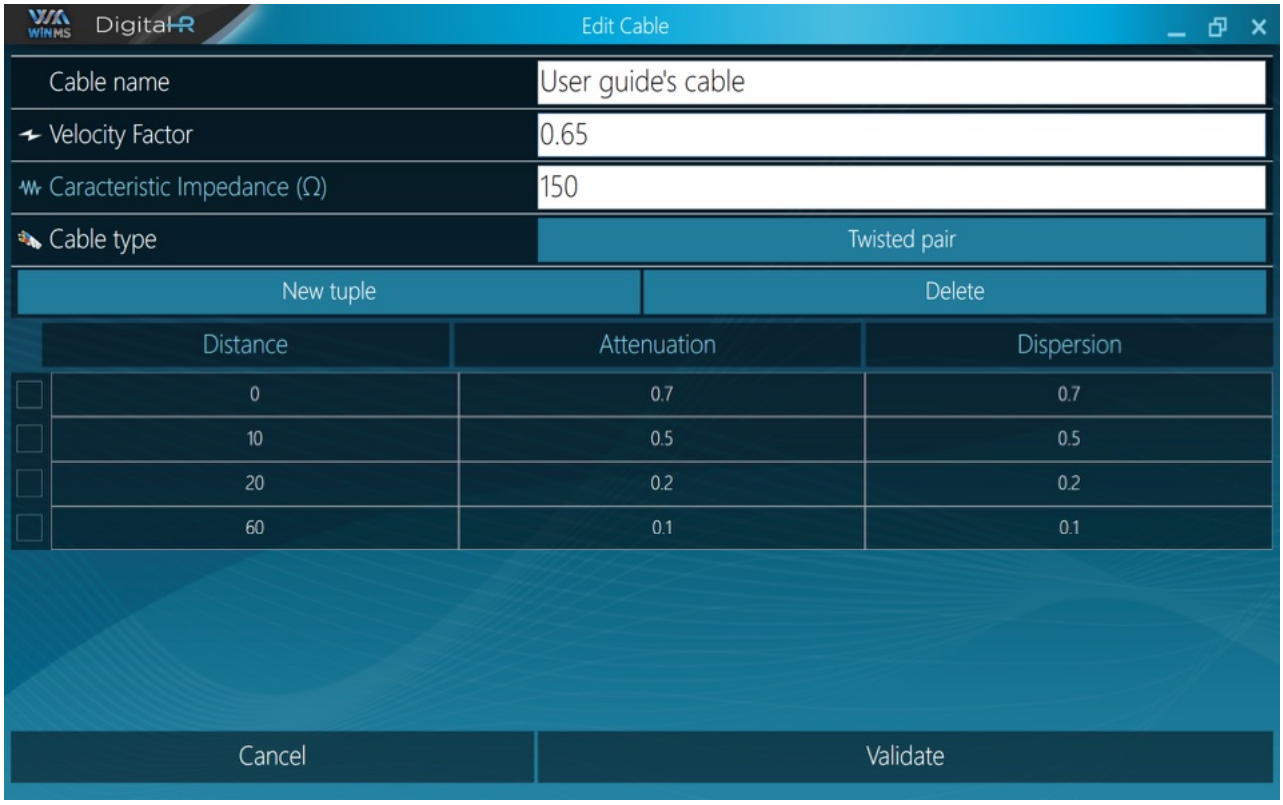
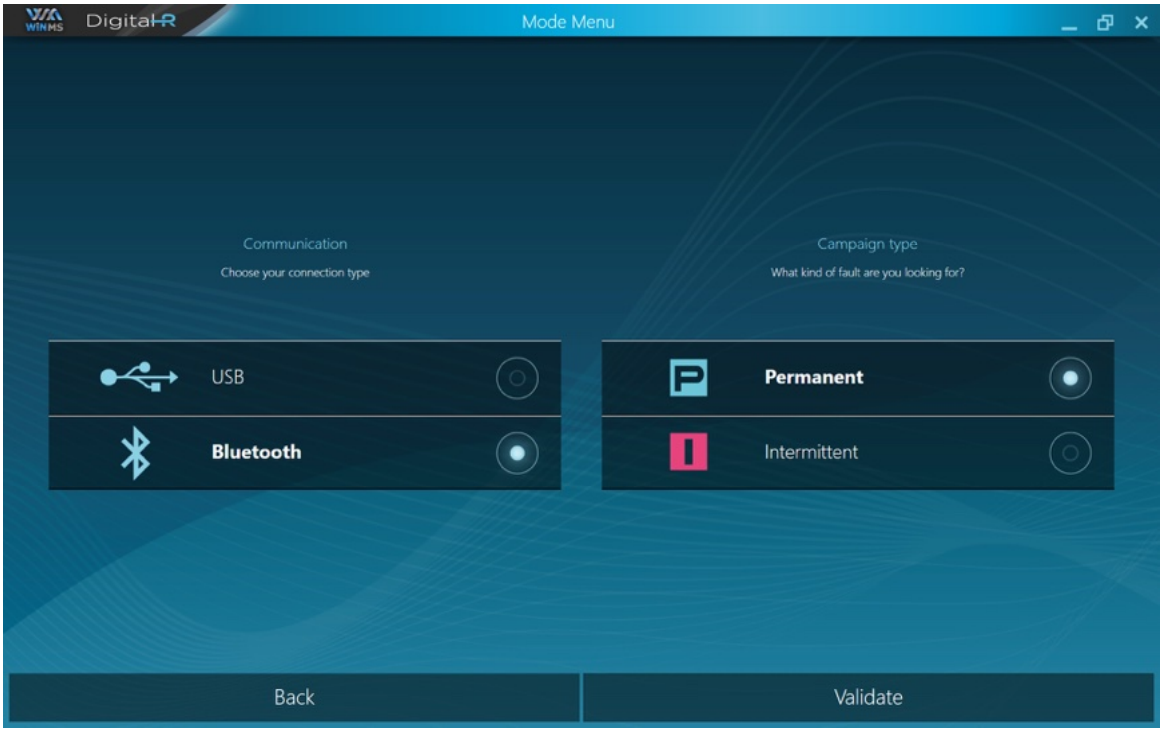


Figure 10: Digital-R Fully Empirical Model

3.3. PERMANENT FAULT DETECTION

The permanent campaign is designed to:

- Characterize and locate established faults
- Find the length of a cable
- Check the homogeneity of a transmission line



3.3.1. Standard mode

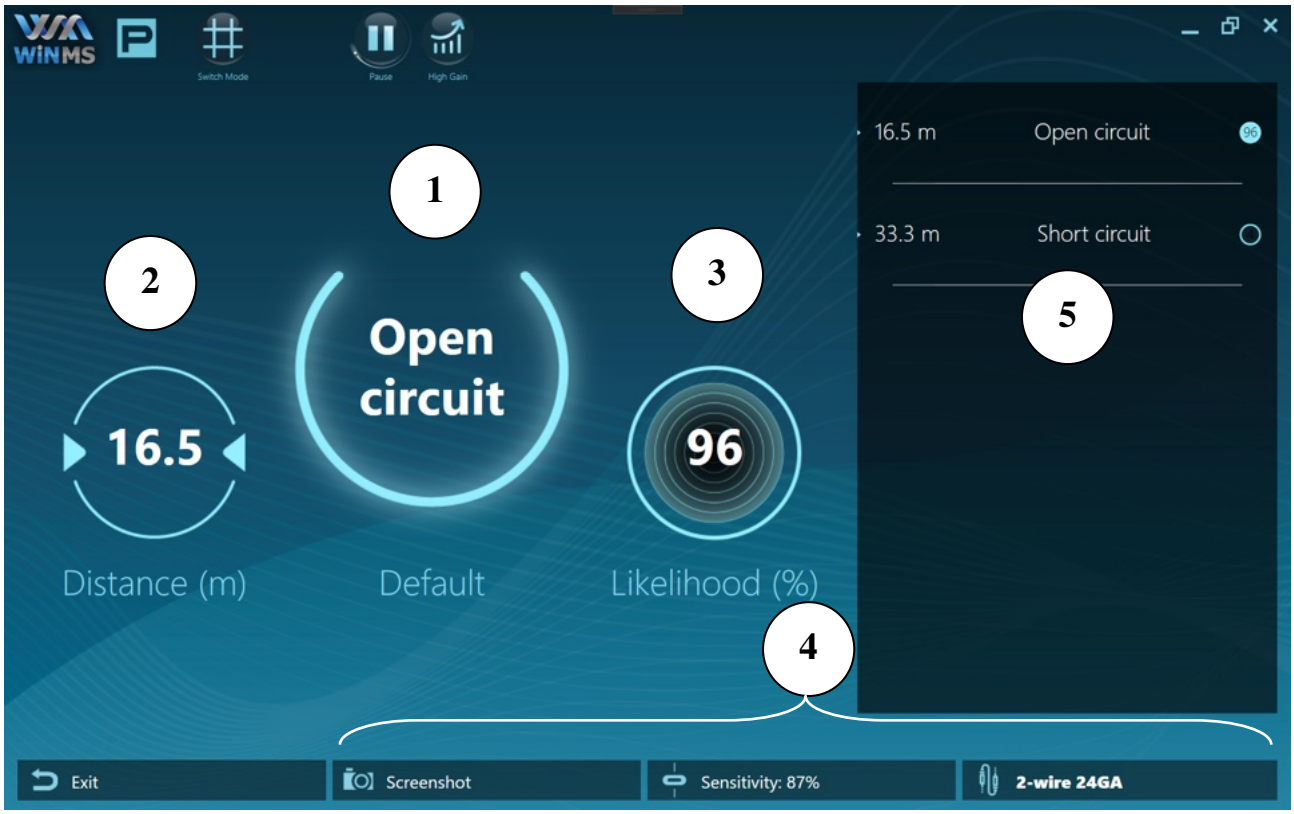


Figure 11: Digital-R Standard Screen

This screen contains a list of possible scenarios automatically computed by the software. They are displayed as a list and are sorted from the most likely (top) to the less likely (bottom).

1. The first result is also graphically represented in this banner
2. Detailed information about the fault: characterization (open / sort) and location.
3. Likelihood indicator: this value does not qualify the cable's health, but indicates how certain the displayed result is. The computation takes into account:
   - The magnitude of the signal at this point (the closer to the model's template, the greater the likelihood)
   - The measurement quality (the sparser the signal, the greater the likelihood)
   - The reflection's primacy (the closer the point to a submultiple of a previous one, the least the likelihood)
4. This can be called through the context menu button

   Several features can be found in this menu:
   - There is a direct access to the library to change the cable type without exiting the campaign
   - The sensitivity of the measure can be adjusted
     - increase if no result appears
     - decrease if too much results
   - A screenshot can be taken at any time and will be stored in the folder:
     `C:\Users\%user%\Documents\WiN-MS\DigitalR\Screenshots`
5. The right panel show all the results ordered by likelihood

3.3.1.1. High-gain Mode

On few exceptional cases, the reflected signal could be so weak that no fault is found, mainly due to long distance cable, or bad quality wire (especially single wire vs. ground case). In such a situation, the fault indicator displays: "Unknown".

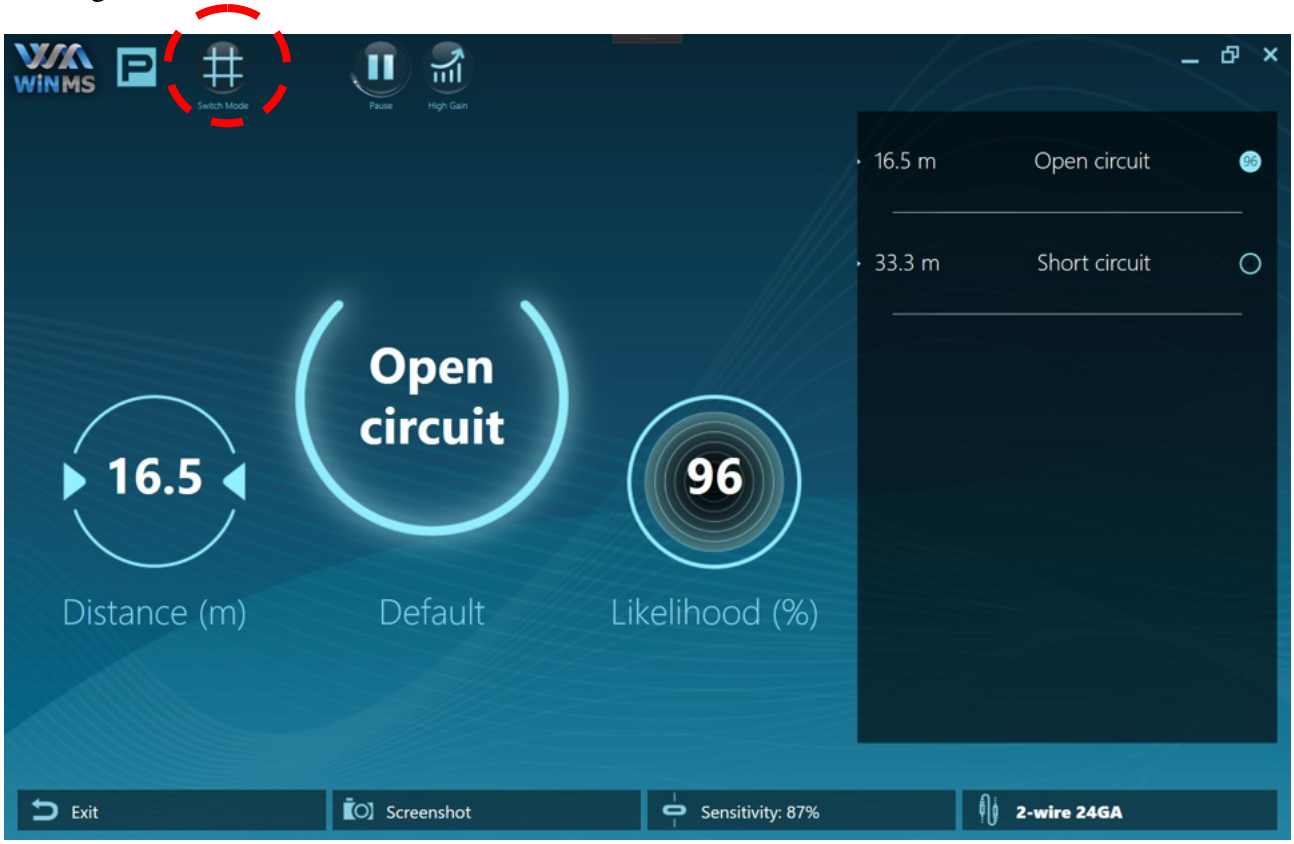
In order to increase signal's energy, there is a special "High Gain Mode", which enables fault finding even in extreme condition, by clicking on the button "High Gain".

Note: Enabling High Gain Mode decreases Distance-To-Fault accuracy.

Note: High Gain could be used either on Standard Mode or Expert Mode.

3.3.2. Expert mode

Sometimes a case may require to go much further into details in order to assert the correct diagnosis. To do so, expert mode becomes needed. In this mode, a full access to the curves will be given. Having a few theoretical knowledges about transmission lines and reflectometry is strongly recommended in order to better apprehend the measurement. Expert mode can be accessed by clicking 'Switch Mode' button:



The context menu also contains more features.

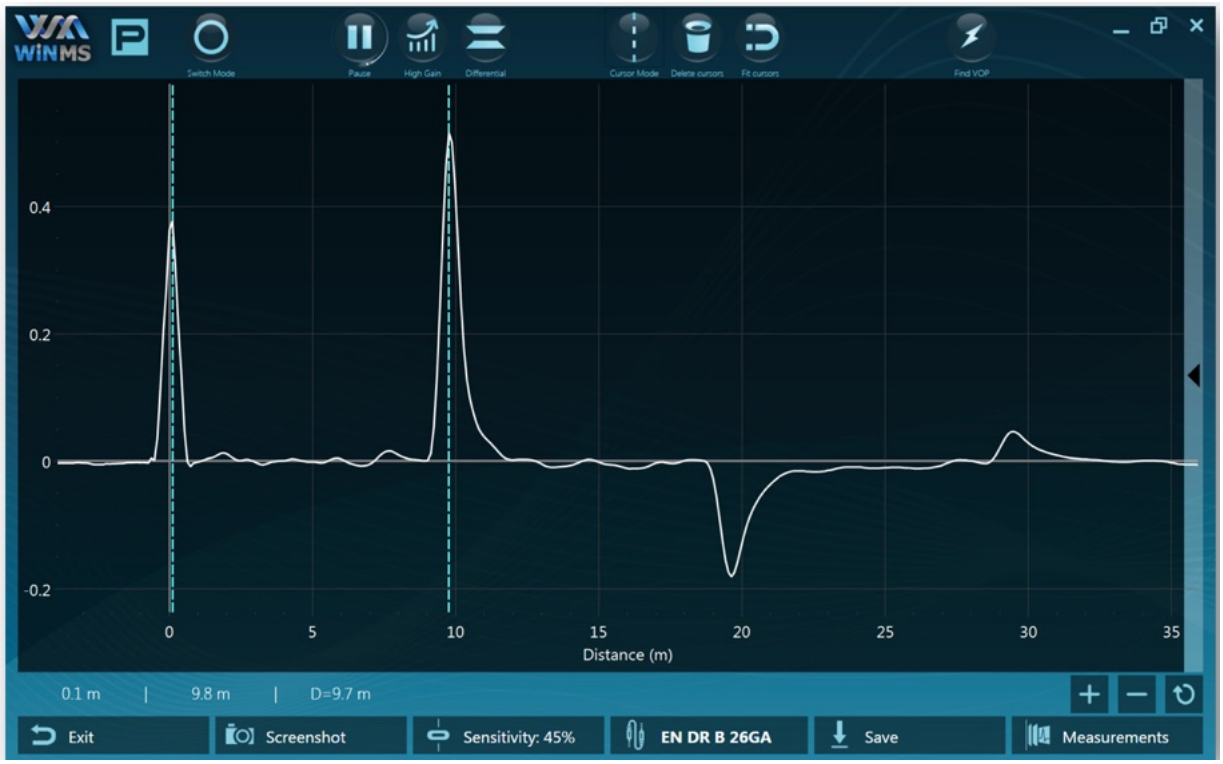


Figure 12: Digital-R Expert Screen

1. The result from the standard mode is recalled in this status bar.
2. Multiple relevant peaks can be seen on this curve:
    - The first one corresponds to the mismatch between the WiN MS module 50Ω output and the characteristic impedance of the LUT
    - The second seems to be a connector or a junction between 2 different cables
    - The third one is the open circuit at the end of both cables
    - The fourth one is a secondary echo (the signal which reached the end bounced back on the junction and traveled another time through the second cable)

3. Useful tools to optimize your analysis

Figure 13: Digital-R Icons of available Tools

These features are fully described and commented hereafter.

3.3.2.1. Zoom & Cursors

- Button ⑤ allows switching between zoom tool (default) and cursor tool.
  Zoom is available either through pinch (use your fingers) or classical + / – / 1:1 buttons

- Two cursors max. can be displayed at the same time. They can be touched and moved.
  To remove them, use the trash ⑥.
  To fit them at the closest peak, use the magnet ⑦.

Figure 14: Digital-R Zoom & Cursors

Note: When using cursors, their relative locations appear in the status bar.

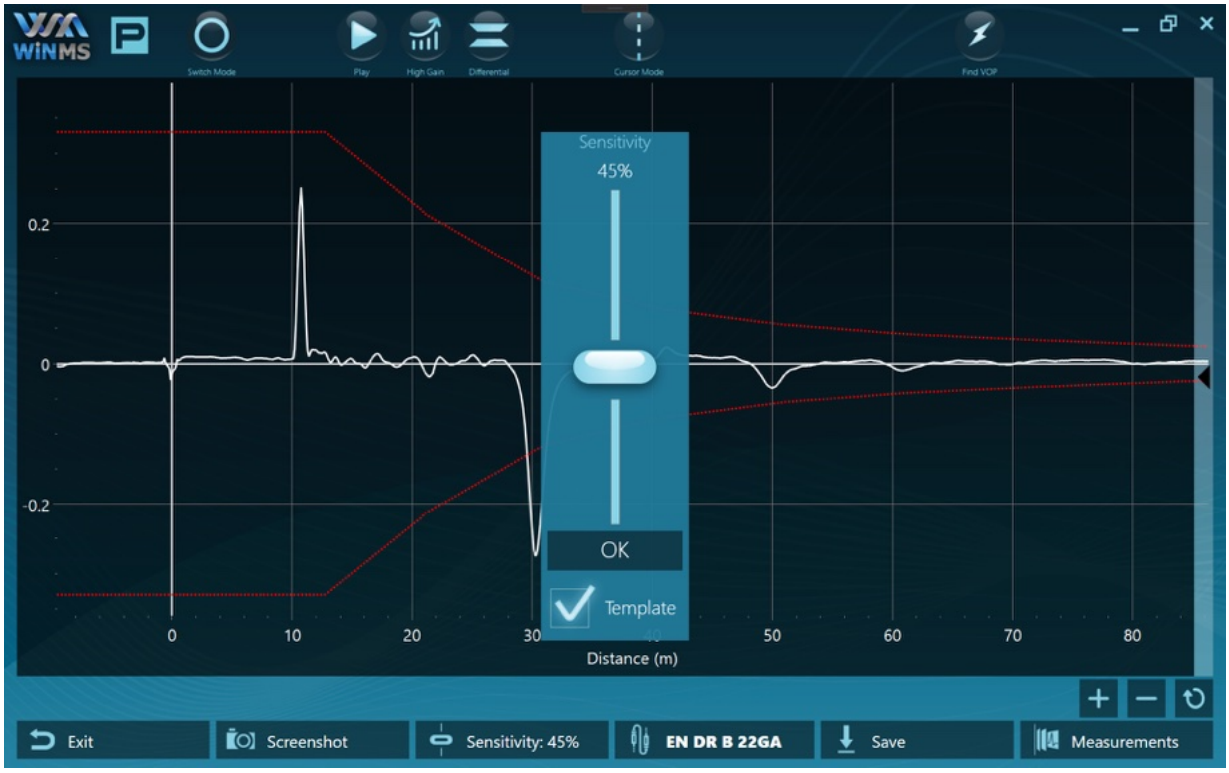
3.3.2.2. Sensitivity & Template

To help discriminate between the relevant peaks and the ones that should be ignored, it is convenient to show cable's template, built from the model.

The template is automatically displayed when modifying sensitivity using ⑩.

Figure 15: Digital-R Template usage

The template (red dashed curve) is computed from the injection point to the cable's end. It is an estimation of the expected attenuation as a function of distance. The actual template is the theoretical one multiplied by the sensitivity factor (this value can be tweaked between 0.01 and 0.99 using ⑩).



- If a peak reaches the template, it clearly indicates a hard fault
- If it does not, it can be a junction or a secondary echo. If the shape is bipolar (∿) it could be a soft fault (or that the cable is unshielded and coiled).

A checkbox in the Sensitivity popup allow to remove the template.

3.3.2.3. Run / Pause

WiN MS module is performing a continuous measurement on the LUT and sends data to the Tablet on the fly.

- To freeze the current display, use the ② button.

3.3.2.4. Storing & Saving measurements

Measurement can be saved by using the ⑫ button, a color and a name will be picked up automatically

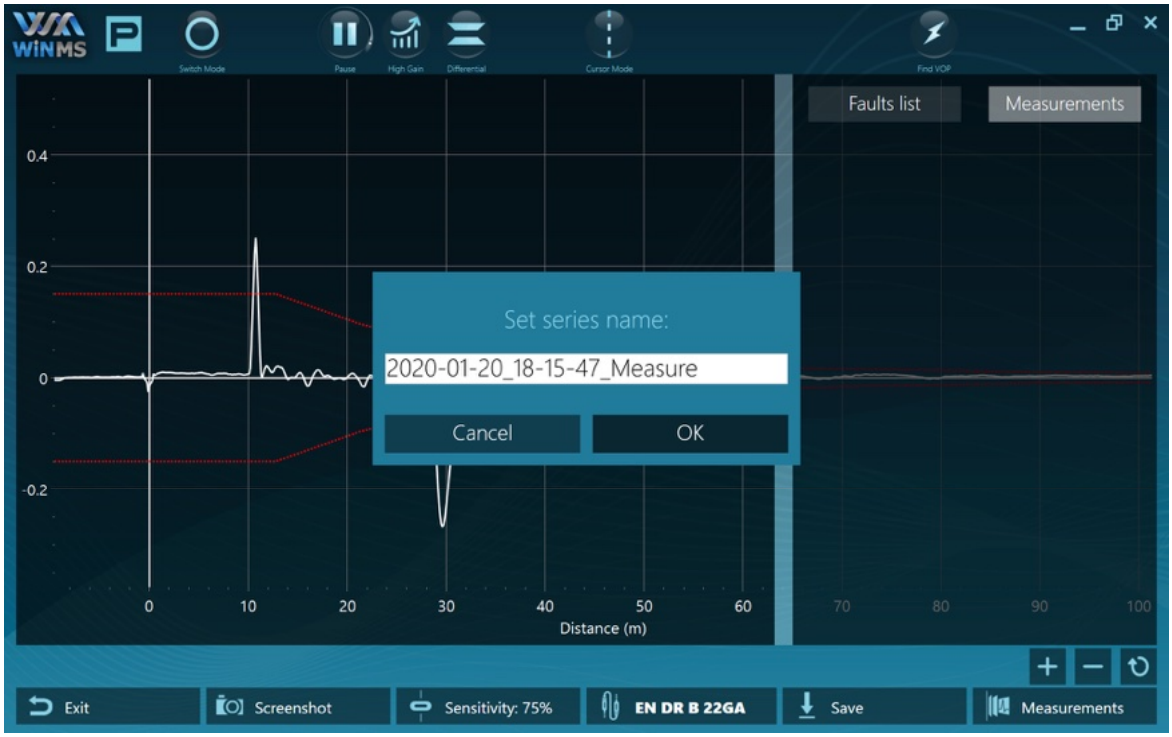


Figure 16: Digital-R Measurement Saving

To edit the curve (change the color, thickness, name, add comments), go to "Measurments" ⑬.

Saved curved can be seen in the right panel in the "Measurements" tab:

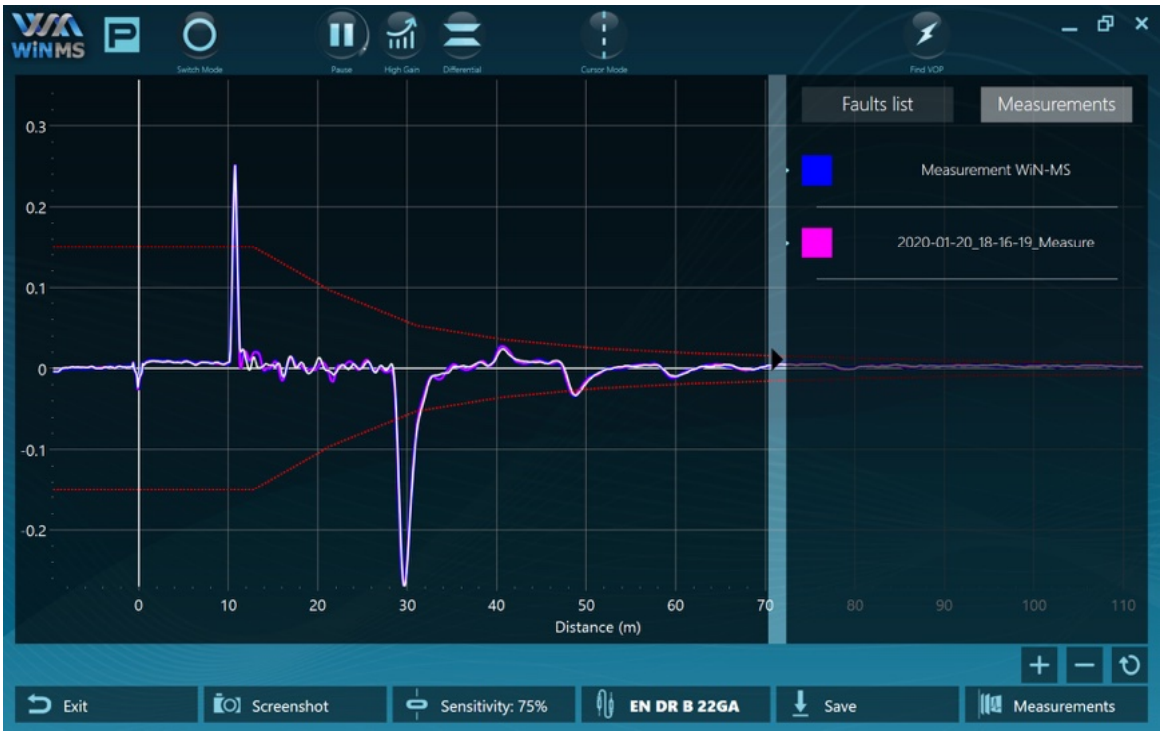


Figure 17: Measurements legend panel

3.3.2.5. Showing / Hiding & Exporting measurements

If many curves have been memorized, it can be confusing on the graph.

- It is possible to manage the curves using the ⑬ 'Measurements' button of the context menu.

Figure 18: Digital-R Memory Manager Screen

1. (Un)tick the box to (hide)show the corresponding curve. Please note that delete and export operations (see below) will only apply to checked items.
2. This timestamp cannot be changed: it corresponds to the moment the measurement was memorized
3. To perform deeper analysis later on, it is possible to export the data into a specific file.

   When clicking the 'Export' button, a file for each curve will be created into the selected directory.

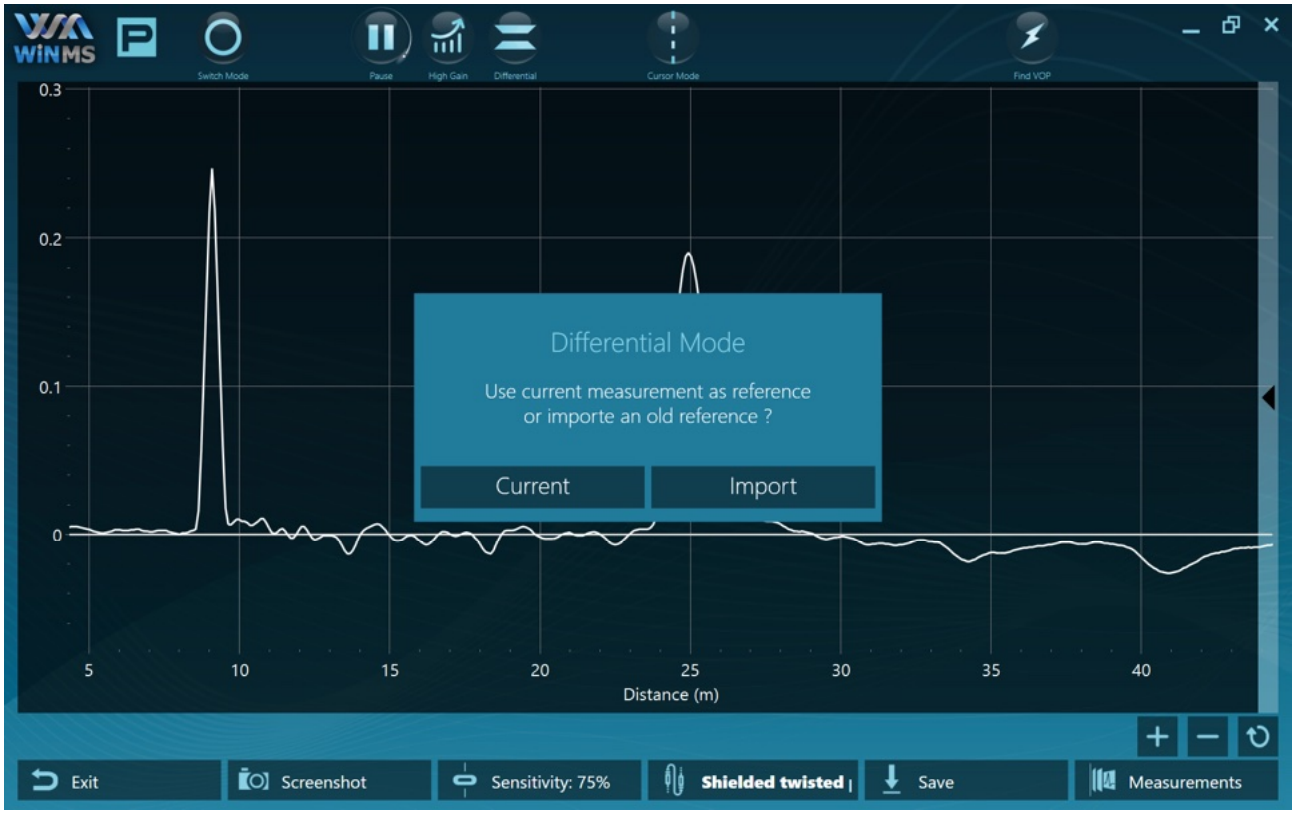
   If pictures were associated, they will be stored in the file.

   ⚠ All the curves will be stored, whether or not they are exported, into a time-dependent folder in this directory:

   `C:\Users\%user%\Documents\WiN-MS\DigitalR\Measurements\`
4. You can edit an already existing item by clicking on the pen button (color of the curve, thickness, name, add comments, assign a cable type to this curve)

3.3.2.6. Differential Mode

While making a physical change to the situation currently under measurement, it could be useful to visualize only the peak corresponding to the change, and not the other ones (coupling, junction, ghost peaks…). The best way to do so is by using the differential mode using ④ button.



- When clicking 'Current', the current measurement is going to be memorized. It will be called the *reference*.
- When clicking 'Import', a file browser will allow to select a previously exported measurement as the *reference*.

  ⚠ Do not confuse this term with the *reference wire*, which can be the ground or the second wire we are using to perform the measurement.

- From this moment on, the main curve (white) will be plotted as the difference between the live measurement and the reference. It will be called the *delta curve*.

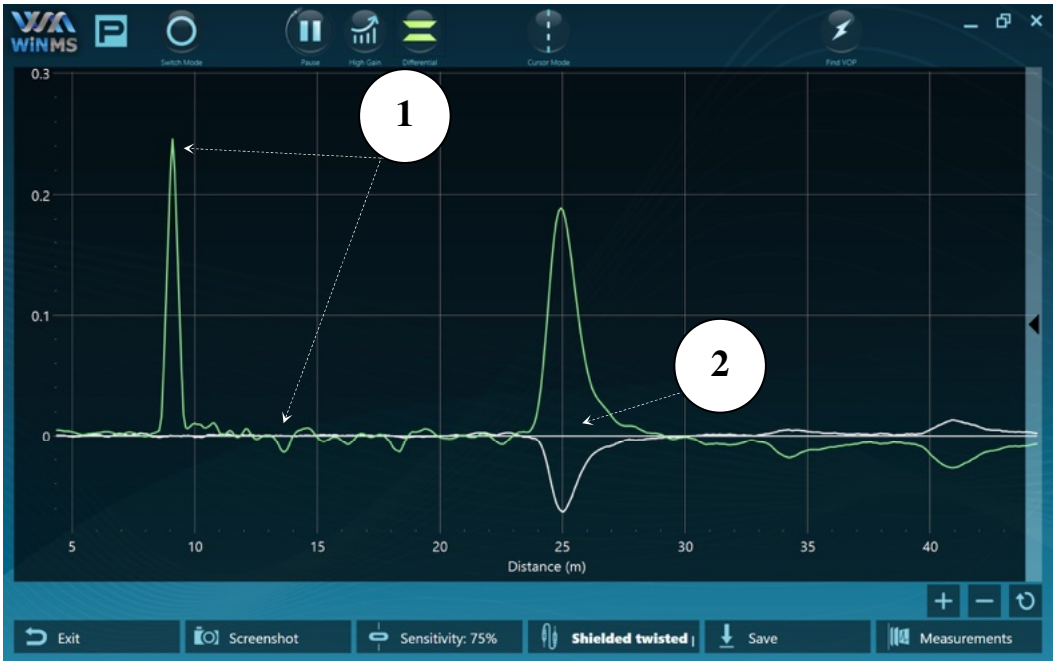


Figure 19: Digital-R Differential Mode

1. The first peaks are not visible in the delta curve (white curve), because as long as there is no fault, they are compensated (subtracted) from the reference.

2. The first significant peak corresponds to the fault and appear much more clearly

Note: Differential mode gives an opportunity to better distinguish defects of lower magnitude, like soft faults.

Note: It is also possible to use differential mode for comparison between supposedly identical scenarios. For instance, it is possible to compare the same cable on two different aircrafts:

1. Go to healthy aircraft #1

2. Perform and save measurement (Golden reference)

3. Go to faulty aircraft #2

4. Activate differential mode

5. Click ‘Manage’ button, then ‘Import’ and select the Golden reference (from aircraft #1)

6. **First peak** in delta curve will give you the location of the fault

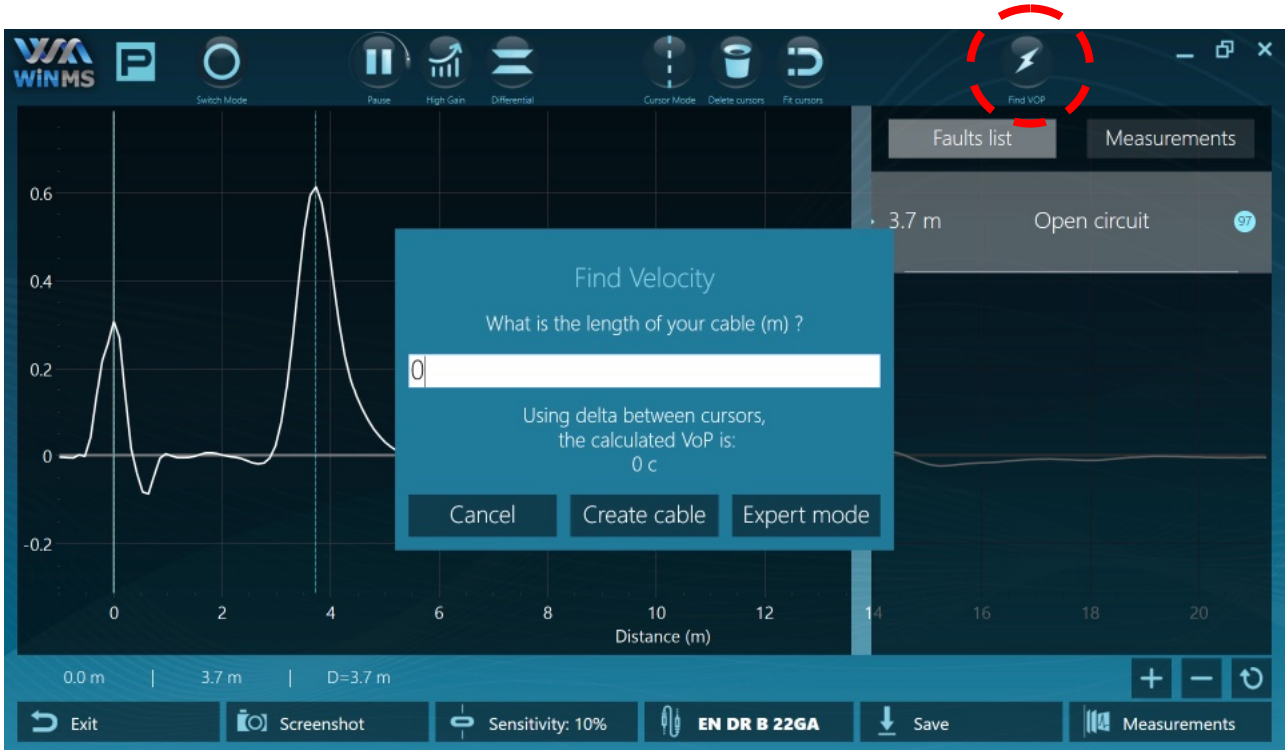
3.3.2.7. Find Velocity of Propagation (V.O.P)

In order to add a new wire in your Cable Library, or to re-adjust the VoP of an existing wire, you may use the "Find VoP" function of the Expert Mode, *via* button ⑧.

This feature allows the user to find the exact velocity factor of a cable sample. Therefore, with the real VoP, you will be able to have an accurate Distance-To-Fault reading.

In order to proceed, you need at least a 10 meters sample of the new cable that you are going to add into your Cable Library (*cf.* 3.3.2.7.1).

If you do not have any cable sample available, please use directly the "Find VoP Expert" function (*cf.* 3.3.2.7.2), and find the VoP during a measurement on the aircraft, directly on the faulty wire.



3.3.2.7.1. Auto Finding VoP with cable sample.

1. Hook-up your new cable to the Aero Module, and launch the "Expert Mode", let the cable with an Open end.

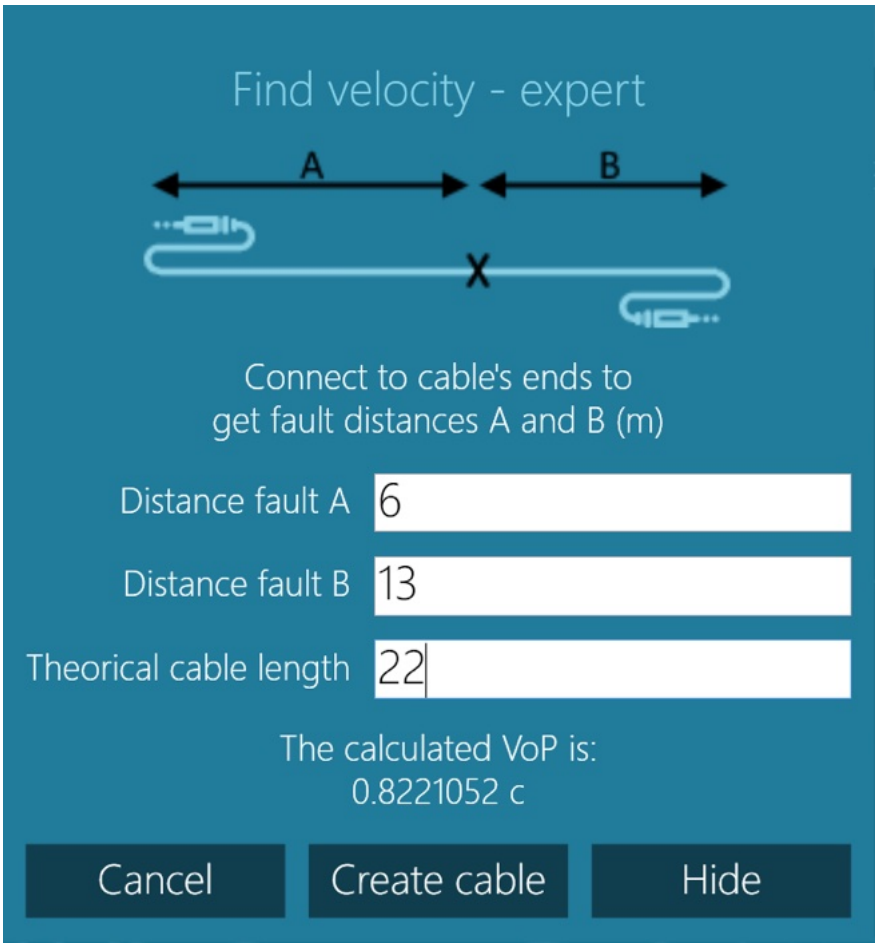
2. Click on button ⑧, "Find VoP".

3. Enter the exact length of your cable sample. The VoP is then automatically computed.

4. Click on "Create cable" to save your new wire into the library. You can name the new cable, select the Cable Type, and add the Impedance value (if you do not know it, let the field blank).

3.3.2.7.2. Auto Finding VoP on the aircraft: "Expert Find VoP"

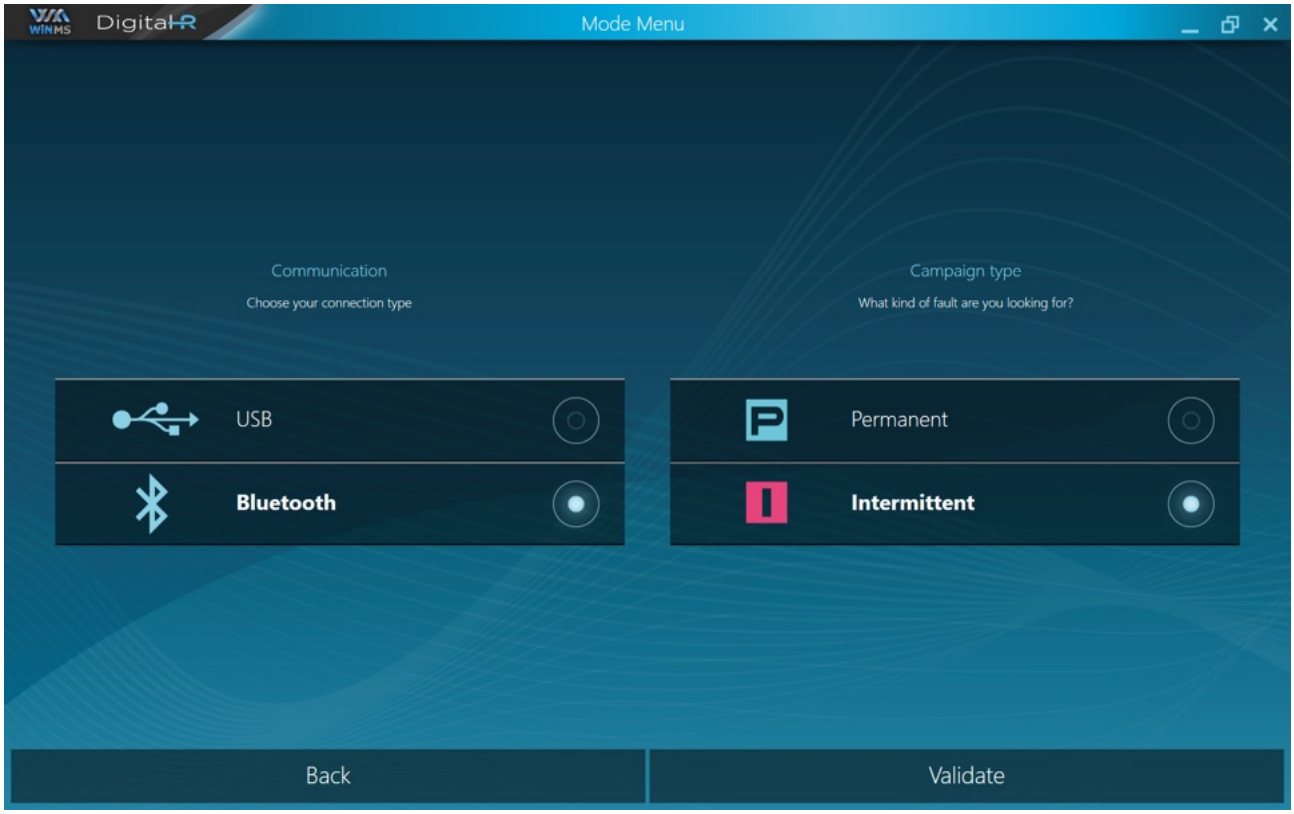
1. Hook up the Aero Module to one end of your faulty wire.
2. Click on button ⑧, "Find VoP", then click on Expert Mode.
3. The first field should be automatically filled in by the software. Otherwise, enter the Distance-To-Fault (length A) you have found (please note this DTF does not need to be accurate). Then click "Hide".
4. Hook up the Aero module to the other end of the faulty wire.
5. Click again on button ⑧ "Find VoP", the second field should be automatically filled in by the software (length B). Otherwise, enter the Distance-To-Fault you have found (please note this DTF does not need to be accurate).
6. Finally, enter the total theoretical cable length. This length should be retrieved from the Aircraft Wiring List (AWL).
7. The real VoP will be computed automatically by the software, then a new cable can be created.



3.4. INTERMITTENT FAULT TRACKING

The intermittent campaign is designed to:

- Characterize and locate transient faults (they can last as short as **1 ms**)
- Check the stability of a transmission line

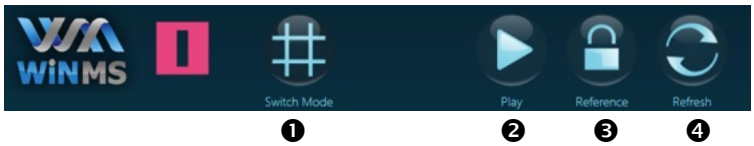


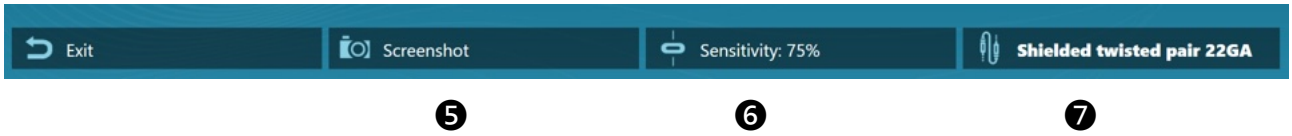
The intermittent feature can be seen as a real-time differential mode (see previous section for more information about differential mode). It performs a comparison in real time between the reference and the current measurement. All the computations are performed inside the WiN MS module to improve efficiency. An *event* is raised and data is transmitted only when the delta curve goes above a predefined threshold.

3.4.1. Standard mode

Standard mode appears by default when starting the campaign.

After starting the campaign, the screen will be blank. This is how the toolbar looks like:





- A reference can be taken at any time using ③.
- The listening of events starts as soon as ② is clicked. Doing so before taking a reference will cause a warning to appear.
- To clear the events list, the refresh button ④ should be used.
- A screenshot can be taken using ⑤. It will be stored into a time-dependent folder in this directory:

  `C:\Users\%user%\Documents\WiN-MS\DigitalR\Screenshots\`
- The sensitivity can be adjusted through the slider ⑥.

  ⚠ Changing this value will impact both the actual template (please refer to section "Sensitivity & Template") and the WiN MS module detection threshold:

  threshold = (1 – sensitivity)
- Campaign's cable can be changed using ⑦.

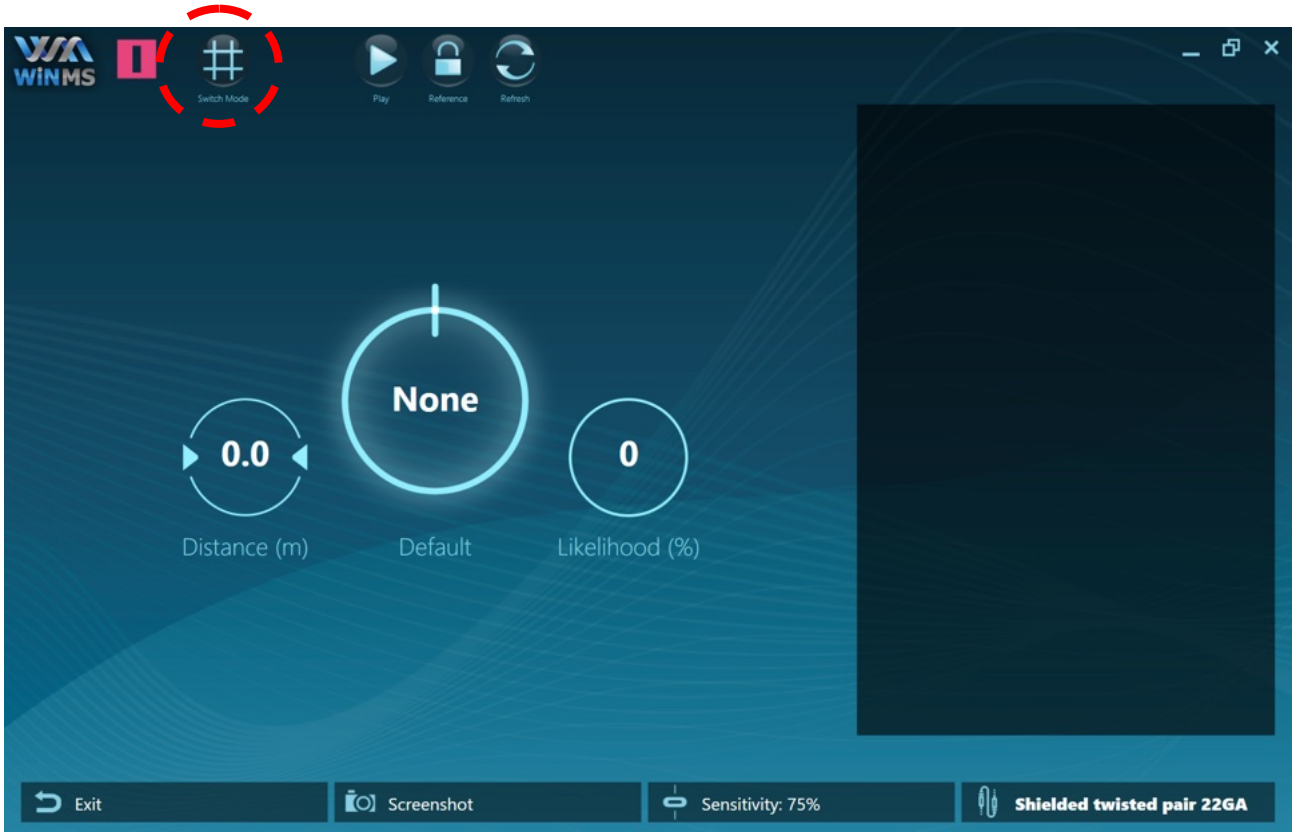
When events start to occur, the screen will look like this:

Figure 20: Digital-R Intermittent Standard Screen

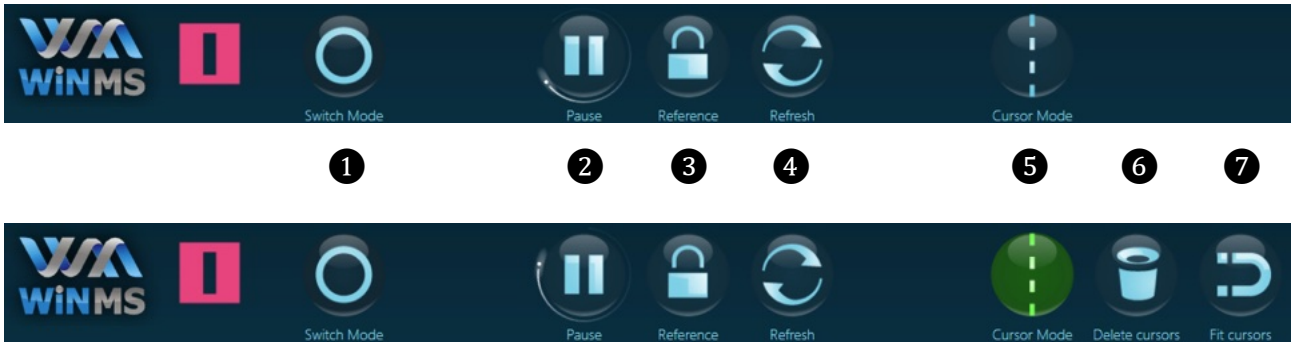
1. Detailed information about the fault: characterization (open / sort) and location.
2. Timestamp: it corresponds to the moment the measurement was memorized.
3. Number of occurrences: if multiple events giving similar results occur consecutively, this value will be incremented, instead of creating a new event item in the list.
4. Smart indicator: this does not qualify the cable's health, but indicates how certain the displayed result is. The computation takes into account:
    - The same parameters as in the permanent mode (please refer to section "Permanent fault detection" / "Standard mode")
    - A comparison between the full algorithm running on the tablet and the simplified algorithm embedded into the WiN MS module)

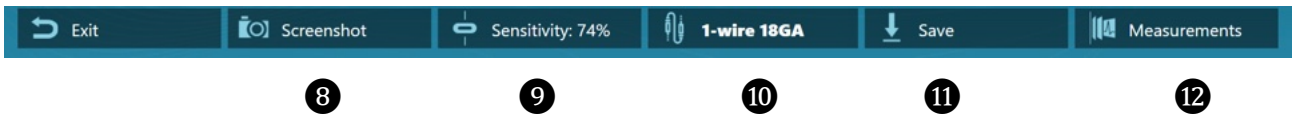
3.4.2. Expert mode

Expert mode appears when clicking on 'Switch mode'. Feel free to switch at any time.



After starting the campaign, the screen will be blank. This is how the toolbar looks like:





- Buttons ②, ③ and ④ behave just like in the standard mode (see above).
- Please refer to section "Permanent fault detection" / "Expert mode" for a thorough description of the other buttons ①, ⑤, ⑥, ⑦, ⑧, ⑨, ⑩, ⑪ and ⑫.

When events start to occur, the screen will look like this:

Figure 21: Digital-R Intermittent Expert Screen

1. The green curve is the reference curve. It corresponds to the measurement at the time ① was clicked.
2. The red curve is the delta curve (see "Permanent fault detection" / "Expert mode" / "Differential mode") at the time the last fault occurred. A short circuit at the end of the cable can be seen.
3. These unwanted peaks do not appear in the delta curve, improving the quality of the measurement and the analysis.

If multiple events occurred at different locations, each event can be recalled using the right panel:

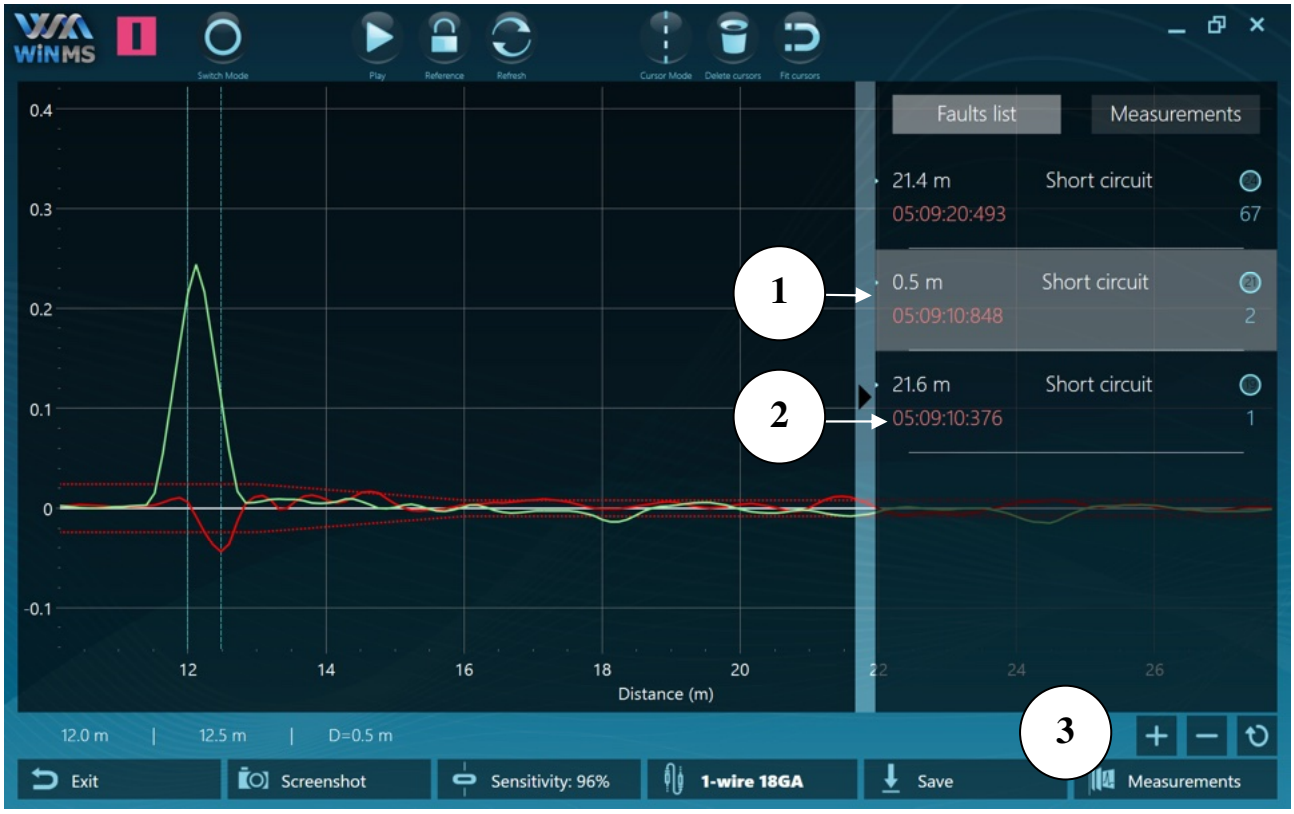


Figure 22: Digital-R Event Manager Screen

1. Click on the fault show the corresponding curve.
2. This timestamp cannot be changed: it corresponds to the moment the intermittent fault occurred
3. To perform deeper analysis later on, it is possible to save the data and export it into a file. (see “Permanent fault detection” / “Expert mode” / “Storing & Saving measurements”)

3.5. SUPPORT

1. Select ‘About DIGITAL-R’ from the main screen

2. Should you encounter a difficulty, please contact our support team at France office hours by e-mail or phone. Conditions according to your maintenance contract.

Figure 23: Digital-R Support Screen

4. SPECIFICATIONS

Table 4: WiN MS Module Aero V1 specifications

Specifications	**Description**
Size (L x W x H)	140 x 79 x 27 mm^3
Input Voltage	DC 4.7 – 9 V
Measurement Method	MCTDR
VF Range	0.5 – 0.95
Maximum Diagnosable Length	100 m typical Note: Contact WiN MS for Cable lengths outside this range
Battery Lifetime	4 – 6 Hours typical
Operating Environment	Operating temperature: 0 to 50 °C (32 to 122 °F) Storage temperature: -20 to 60 °C (-4 to 140 °F) Humidity: 10% to 90%, non-condensing
Output signal Amplitude	AC +/- 1V
Output signal Frequency	400 kHz – 200 MHz
Output impedance	50 Ω
Weight	240 g

Table 5: VOLTCRAFT PB-10-PD3.0 Power Bank specifications

Specifications	**Description**
Battery Type	Lithium polymer (Li-Po)
Rated Input	Micro-USB DC 5V / 2A USB-C DC 5V / 3A
Rated Output	USB-A DC 5V / 4.5A USB-C DC 5V / 3A
Battery Capacity	10000 mAh / 37 Wh
Recharging Time	4 – 5 hours
Operating Environment	0 – 45°C & 20 – 80% Rh
Size (L x W x H)	139 x 69 x 15.5 mm^3
Weight	215 g

Table 6: Tablet specifications

Specifications	**Description**
Operating System	Windows 10 64Bit
Screen	8,4”
Resolution	1920 x 1200
Processor	Intel Atom 1.60GHz Frequency
RAM	4 GB LPDDR3 RAM
Flash Memory	64 GB eMMC Flash
Battery	3300 mAh 7.6V rechargeable Li-Ion user replaceable 24.4Whr
Size (H x D x W)	240 x 170 x 20 mm^3
Weight	740 g