User Guide

MaxTester 635

Copper and DSL Multi-play Test Set



www.EXFO.com
Telecom Test and Measurement

EXFO
EXPERTISE REACHING OUT

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Units of Measurement

Units of measurement in this publication conform to SI standards and practices.

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Certification Information

North America Regulatory Statement on Product Safety

This unit was certified by an agency approved in both Canada and the United States of America. It has been evaluated according to applicable North American approved standards for product safety for use in Canada and the United States.

Electronic test and measurement equipment is exempt from FCC part 15, subpart B compliance in the United States of America and from ICES-003 compliance in Canada. However, EXFO Inc. makes reasonable efforts to ensure compliance to the applicable standards.

The limits set by these standards are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the user guide, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

European Community Declaration of Conformity

DECLARATION OF CONFORMITY

Application of Council Directive(s):	2004/108/EC – The EMC Directive 1999/5/EC – The R&TTE Directive 93/68/EEC – CE Marking And their amendments
Manufacturer's Name and Address:	**EXFO Inc.** 400 Godin Avenue Quebec City, Quebec G1M 2K2 CANADA Tel.: +1 418 683-0211
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Equipment Type/Environment:	Test & Measurement / Industrial
Trade Name/Model No.:	Copper, DSL and Multiplay Test Set / MaxTester 635

Standard(s) to which Conformity is declared:

EN 61010-1:2001 Edition 2.0	**Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements**
EN 61326-1:2006	**Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements**

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive and Standards.

Manufacturer:

Stephen Bull, E. Eng
Vice-President Research and Development

400 Godin Avenue,
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G1M 2K2 CANADA
June 4, 2012

CE EXFO

1 Introducing the MaxTester 635

The MAX-635 is a handheld device designed for testing ADSL2+ and VDSL2 services between the service provider and the subscriber premises. The unit also qualifies and troubleshoots copper-loop plant by using pass/fail-driven automated functionalities.

The MaxTester 635 test set case is an aluminum enclosure with rubber over mold, which makes it ideal for field use. Its display is a back-lit LCD featuring 480 x 800 resolution. A membrane keypad mounted on the face of the unit features a 14-button keypad used to operate the test set. The following describes the features of the MAX-635.

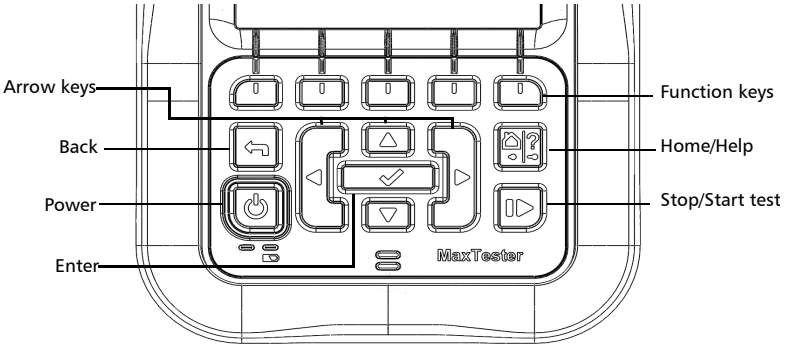
Key Features and Benefits

- Broadcom chipset
- IP login
- Single-ended copper testing - no remote device required
- DSL testing
- User-defined automatic testing
- Dual Ethernet ports
- Modem replacement
- Color display with graphical analysis
- Battery powered
- Rugged and weatherproof handheld unit

Typical Applications

- Auto tests including POTS Auto Test
- Multimeter tests
- Noise tests including power influence and PSD
- Frequency tests including balance, load coils, and locator tone
- Fault location tests including TDR and RFL
- ADSL2+ testing with optional VDSL2 for hybrid networks
- Optional ADSL2+ and VDSL2 bonding support
- Optional Web Browser, IPTV analysis, and data tests including Ping, FTP and Traceroute testing
- Ethernet testing for qualifying FTTx service at the customer premises
- Configurable pass/fail results for automated testing

Keypad



- Power button on the lower left side of the unit is used to power the unit on and off.
- Arrow keys navigate the screen to access and modify parameters.
- Function keys activate the corresponding on-screen function button.
- Home button brings you to the **Home** page of the MAX-635.

Battery

The MAX-635 is equipped with a Lithium-ion battery.

WARNING

- **Recharge the battery using only the MaxTester and with the battery properly installed in the unit.**
- **Never open the battery back panel of the MaxTester without reading the *Replacing the Battery* section in this chapter.**

When fully charged, the battery should provide between 3 and 10 hours of power depending on different factors such as: type of tests performed, display backlight level, and connected accessories.

Note: *When the battery level is very low, tests cannot be performed.*

To maximize battery power of the MAX-635:

1. Lower the display backlight level using the application found in **Display and Language** in **System Settings**, when the MAX-635 is used under low to medium light conditions.
2. Disconnect any unused USB or SD accessories.
3. Stop any running tests when the MaxTester is not in use.
4. Whenever possible, put the MAX-635 in suspend mode by pressing ⏻ until the suspend notification sound plays, about 2 seconds.
5. When not in use, turn the unit off by pressing ⏻ for at least 4 seconds.

If the battery capacity remains low or outside the previously stated values, it should be replaced. This could occur after 3 years depending on the usage. You can evaluate the battery capacity through the **Calibration** procedure, comparing the results with the **Battery Capacity** default value of **10000 mAh**. If your current battery capacity is lower than 8000 mAh, replace the battery.

Battery Calibration

In order to optimize the battery gas gauge accuracy, a battery calibration procedure is accessible in the **System Settings** menu under *Power - Calibration* on page 18. Going through this procedure may be necessary when first using the MaxTester or after time depending on the number of charging cycles the battery has undergone. It will optimize the gas gauge accuracy and not affect the MaxTester's battery capacity.

Unit Temperature Handling

When the battery temperature reaches ≥ 55 °C, the unit temperature is displayed in the bar at the top of the unit and a warning message will appear. Tests stop automatically when the battery temperature reaches 60 °C.

Replacing the Battery



WARNING

Only use an EXFO battery. Batteries from other suppliers could result in serious damage to the MaxTester or personal injuries. See the *Contacting the Technical Support Group* on page 146 for information on contacting EXFO.

Battery replacement should only be done by a qualified technician with the appropriate tools on an electronic bench or similar environment.

To replace the battery:

1. Remove all 4 screws of the battery back panel using a 1.5 mm Allen key. Put aside the screws and the panel keeping the inside foam seal clean. See *Back* on page 6.
2. Pull out the old battery using your fingers. Flipping the unit, battery-side down, will ease removal. Do not use tools in order to prevent damage to the battery envelope. Pull out the electrical connector. Put aside the old battery.

3. Remove the new battery from its package. Keep the package for future use. Connect the electrical connector ensuring the pins are correctly aligned. Place the new battery in the MaxTester.
4. Inspect the inside rib around the MaxTester battery compartment to make sure it is free from any debris. Remove any debris using a dry cloth. Replace the battery back panel. Replace the 4 screws with a moderate torque so the foam seal is evenly compressed without damaging the screws.

Disposing of the Battery

Place the old battery in the replacement battery packaging. Properly dispose it according to your local facilities for battery recycling.

Caring for the MaxTester

The MaxTester has been designed to be a rugged and lightweight piece of test equipment. However, the unit should be kept away from extremes of heat, cold, moisture, and dust. Failure to do this may shorten the life of the instrument.

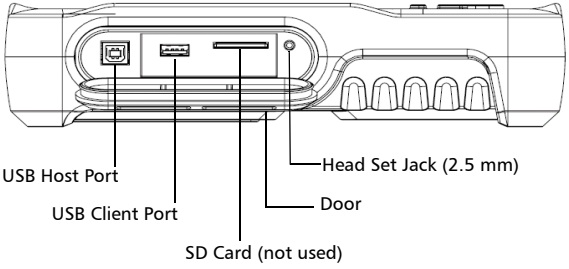
The MaxTester LCD display should only be cleaned using a soft, lint-free cloth and an anti-static cleaning solution. Ordinary detergents and other cleaning solutions may cloud or scratch the surface and should be avoided.

Using the MaxTester

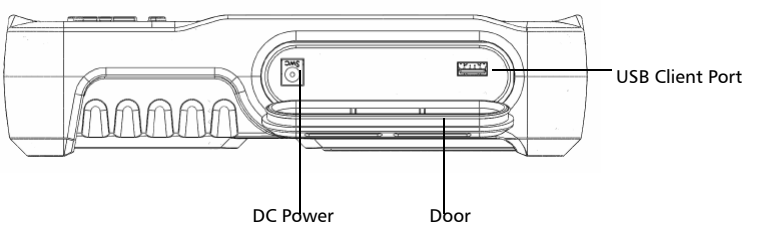
The MaxTester is tested IEC IP54 which means that it is not affected by dust or water splashing against the enclosure from any direction. This protection is only valid when both side doors are properly closed. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

The MaxTester is equipped with a series of interfaces shown in the following views:

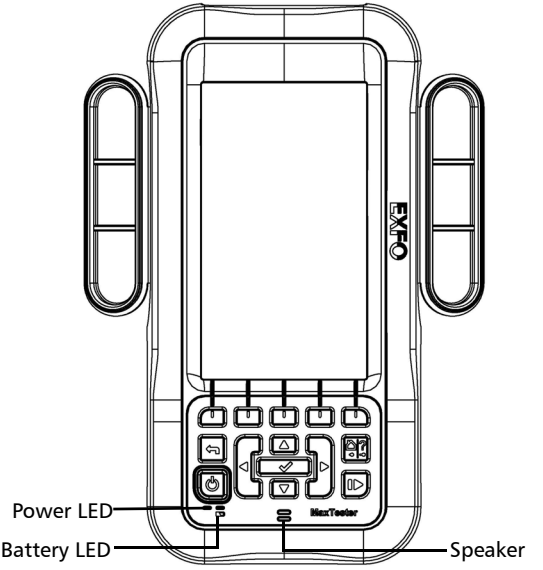
➤ Left



➤ Right


USB Client Port
DC Power
Door

➤ Front


EXFO
MaxTester
Power LED
Battery LED
Speaker

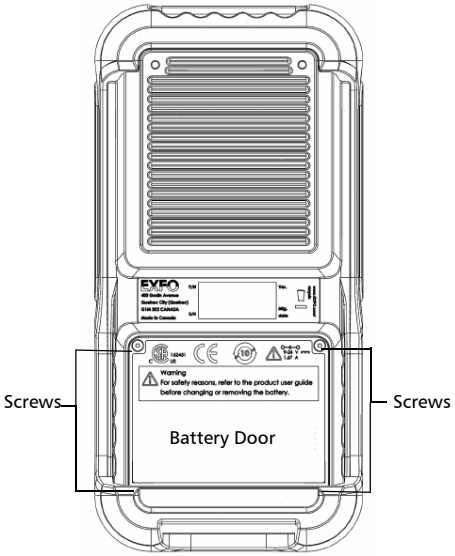
➤ LED Legend

Power state	Power Source	Power LED	Charger State	Battery Level	Battery LED
ON	DC	SOLID GREEN	ERROR	NA	RED
			CHARGING	NA	GREEN BLINKING
			CHARGED	FULL	SOLID GREEN
	BATTERY	SOLID YELLOW	NA	< 10%	RED BLICKING
				>=10%-<25%	YELLOW BLINKING
				>=25%-<75%	YELLOW
				>=75%	SOLID GREEN
FAKESUSPEND[1]	DC	SOLID GREEN	ERROR	NA	RED
			CHARGING	NA	GREEN BLINKING
			CHARGED	FULL	SOLID GREEN
SUSPEND	BATTERY	YELLOW BLINKING	NA	NA	BLACK
OFF (FAKESHUTDOWN)[2]	DC	BLACK	CHARGING	NA	SOLID GREEN
OFF	BATTERY	BLACK	NA	NA	BLACK

[1]Fake Suspend -- When AC/DC is plugged in, MaxTester will simulate the suspend mode by turning off the display in order to facilitate the charger.

[2]Fake Shutdown -- When AC/DC is plugged in, MaxTester will simulate the shutdown mode by turning off the display in order to facilitate the charger.

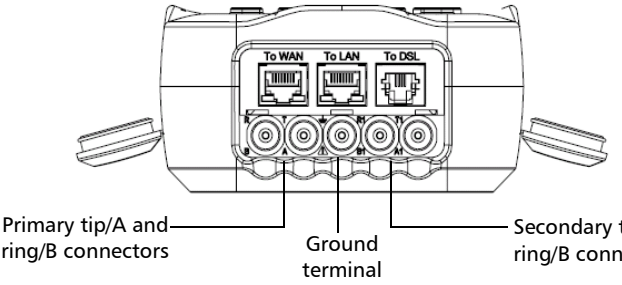
➤ Back



Note: *The MAX-635 enclosure may become warm during normal use.*

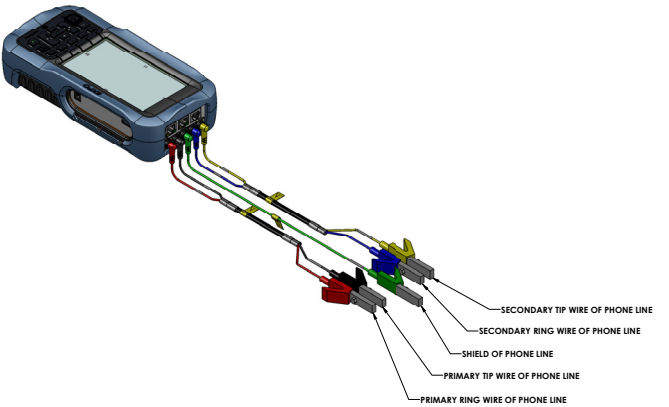
Cable Connections

The graphics below show the connectors on the MaxTester device.



Note: *When connecting a DSL cable to the DSL port, use the RJ-11 plug end of the cable provided with the unit. There is a 1500 V maximum transient voltage on telecom ports. Basic insulation is needed for external telecom circuits.*

Note: *For the connection setup, Annex B is on DSL pair 1 and Annex A is on pair 2. (Dual Annex A and B units only)*



WARNING

A 50/100/125 Vcc limited power source may be present on connector R/T/R1/T1 when the unit is testing isolation resistance. Use with caution.



WARNING

These connections are intended for the express purpose of electrical testing of common telephone line conductors, within the ranges specified in the *Technical Specifications* on page 151. The device is not intended to be used on telephone lines having voltages greater than 280 VAC or 400 VDC, and it is also not intended to be used on power distribution circuits.



CAUTION

The unit is protected against damage caused by fault voltages that may be present on lines under test. Do not connect the unit if the maximum expected fault voltage is greater than 500 volts.

Conventions

Before using the product described in this manual, you should understand the following conventions:



WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in *death or serious injury*. Do not proceed unless you understand and meet the required conditions.



CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in *minor or moderate injury*. Do not proceed unless you understand and meet the required conditions.



CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in *component damage*. Do not proceed unless you understand and meet the required conditions.



IMPORTANT

Refers to information about this product you should not overlook.

2 Safety Information



WARNING

The use of controls, adjustments and procedures other than those specified herein may result in exposure to hazardous situations or impair the protection provided by this unit.



IMPORTANT

When you see the following symbol on your unit , make sure that you refer to the instructions provided in your user documentation. Ensure that you understand and meet the required conditions before using your product.

Electrical Safety

The AC adapter/charger provided with this unit (18 W/9 V) is specifically designed to work with your MaxTester.



WARNING

- **Use the AC/DC adapter/charger indoors only.**
- **Use only with a Class II AC/DC adapter, power limited output.**
- **On the AC/DC adapter, replacing detachable mains supply cords with inadequately rated cords, may result in overheating of the cord and create a fire risk.**
- **The adapter shall have the appropriate safety mark (for example UL, CSA, TUV, CE, etc.) that is acceptable to the authorities in the country where the equipment is to be used.**



CAUTION

When using the MaxTester while connected to the AC/DC adapter/charger, make sure you do not position the equipment so that it is difficult to disconnect the adapter/charger from the AC mains.



WARNING

Use only accessories that meet EXFO specifications.

Equipment Ratings

Equipment Ratings	
Temperature	
➤ Operation	➤ 0 °C to 40 °C (32 °F to 104 °F)
➤ Storage	➤ –40 °C to 70 °C (–40 °F to 158 °F)
Relative humidity[a]	
➤ unit	➤ ≤ 95 % non-condensing
➤ AC adapter	➤ 0 % to 80 % non-condensing
Maximum operation altitude	3000 m (9842 ft)
Pollution degree	2 (when plugged to AC mains)[b] 3 (when operated from batteries)[c]
Overvoltage category	II
Input power[d]	
➤ unit	➤ ⎓ 24 V; 18 W
➤ AC adapter	➤ ~ 100 - 240 V; 50/60 Hz; 0.7 A

a. Measured in 0 °C to 31 °C (32 °F to 87.8 °F) range, decreasing linearly to 50 % at 40 °C (104 °F).
b. For indoor use only.
c. Equipment is normally protected against exposure to direct sunlight, precipitations and full wind pressure.
d. Not exceeding ± 10 % of the nominal voltage.

3 Getting Started with the MaxTester

Turning the Unit On/Off

When you turn the unit on, you may use it immediately under normal conditions. When the unit is turned off, it keeps the following parameters in its internal memory:

- Setup including application settings, phone and cable books, and test lead characteristics.
- Profiles consisting of:
  - Test parameters
  - User-defined thresholds

Note: *Save the current profile before turning the unit off or else any changes are lost. See Save Profile page 48 for more information.*

- Regional, LCD and energy-saving settings
- Test results saved internally vs. USB

There are two ways to turn off the MaxTester

- *Suspend*: the next time you turn your unit on, you will quickly return to your work environment.
- *Shutdown*: completely cuts power to the unit; the unit will perform a complete restart routine the next time you use it. You should perform a shutdown if you do not intend to use your unit for a few hours or more.

To turn the unit on:
Press ⏻ to start. The unit initializes for a few seconds and displays the Home pane.

To enter suspend mode:
Press ⏻ for about 2 seconds. The MaxTester will stay in suspend mode for 2 hours, after which it will automatically shutdown. This prevents complete battery discharge and ensures maximum battery performance.

To perform a shutdown:
Hold down ⏻ for about 4 seconds. The shutdown process starts.

Note: *In both previous cases, if the power adapter is connected, the MaxTester will simulate either a fake suspend or fake shutdown in order to facilitate the charger.*

Using Menus and Keypad

You can access various tools from the keypad or menu. Menu options may differ depending on your unit configuration.

Home menu is where you can access **Copper Test**, **xDSL Test**, or **System Settings**. Each test has a sub menu.

- To navigate through the items, use the arrow keys.
- To confirm a choice or enter a menu, press ✔.
- To cancel an action or return to the previous item or pane, press ↩.
- To return to the home pane, press ⌂.
- Press ⌂ once to return to the **Main** test menu or twice to return to the **Home** page.

Note: *Pressing ⌂ while a test is running will do nothing. The test can not be running in order to return to the main menu screen.*

Note: *You can also select an option directly by pressing the function keys corresponding to the on-screen buttons at the bottom of the screen.*

Using Online Help

Online help is available at any time. Most test operations pause while you view help, but will resume automatically when you exit help.

To access help about the current function at any time:
Press and hold the **?** key.

4 Setting Up the MAX-635

Home

Home presents the main menu page which allows you to navigate between **Copper Test**, **xDSL Test**, and **System Settings** using the left/right, up/down arrow keys on the keypad.

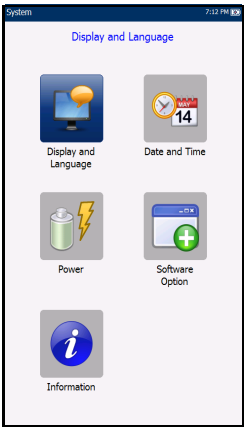


Press ✔ to bring up the sub-menu of the selected icon:

- **Copper Test** opens the **Copper Main** menu displaying the copper qualification testing applications.
- **xDSL Test** opens the **DSL Main** menu for ADSL2+, VDSL2, and multi-play services testing applications.
- **System Settings** allow you to set the parameters of the unit.

System Settings

System Settings presents a menu of items to setup the unit.



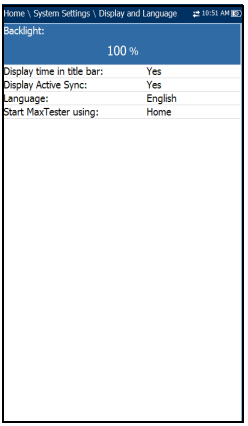
- **Display and Language** provides the setup for backlight, information on the title bar, and language choice.
- **Date and Time** sets the date and time and format.
- **Power** displays the battery status and power scheme.
- **Software Options** allows you to enable/disable purchased feature options.
- **Information** shows unit details pertaining to hardware/software/product info.

To navigate between the system settings:

1. Press the up/down left/right arrow keys on the keypad to select an icon.
2. Press ✔ to confirm your selection.

Display and Language

To fit your work environment, you may adjust the LCD brightness, display the time and Active Sync, and change the display language. The values are kept in memory when you turn the unit off.



Note: *The LCD **Backlight** consumes battery power; more brightness, more power consumption.*

To adjust the display settings:

1. From ⌂, select ***System Settings***, and then ***Display and Language***.
2. Use the up/down arrow keys to select the setting to change.
3. Press ✔ to select it.

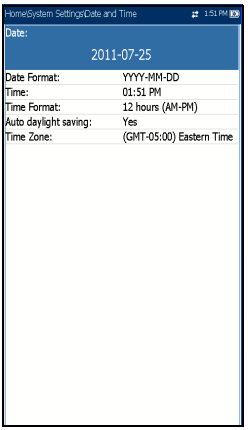
➤ By using the up/down arrow keys, you can switch between preset brightness levels in the **Backlight** item. Press ✔ to confirm.

➤ To display the time and Active Sync in the title bar, enable the item. Press ✔ after your selection to confirm.

➤ Use the up/down arrow keys to navigate between the available languages, then press ✔ to select it. You will be prompted to restart your unit.

➤ To set which **Home** page the unit defaults to when pressing ⌂ ,highlight **Start MaxTester using:** and select from the list.

Date and Time



When saving results, the unit also saves the corresponding **Date** and **Time**.

You can enter the date according to the following formats:

- yyyy-mm-dd
- dd-mm-yyyy
- mm-dd-yyyy

The time can be set according to the 12- or 24-hour formats.

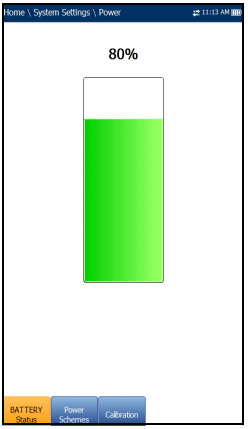
You can also modify the time zone and enable an option so that your unit automatically adjusts the time for the daylight saving period.

To set the date and time:

1. Press , select ***System Settings***, and then ***Date and Time***.
2. Use the arrows to select any of the date or time settings.
3. Press ✔ to enable the modification controls.
   - For the date and time, an edit screen is displayed with descriptive function keys. Use the arrow keys to modify the number values, then press ✔ to confirm the change and go back to the previous screen.

     Press ↩ to go back to the previous screen without saving the new value.
   - For the time format, auto daylight saving and time zone values, use the arrow keys to select the desired value, then press ✔ to confirm the change.

Power - Battery Status

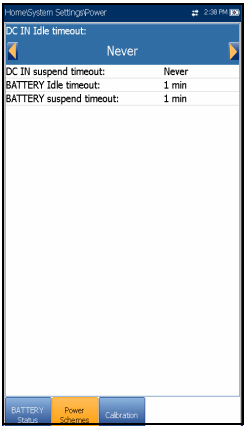


The **BATTERY Status** pane indicates the current power level for the battery.

Note: *The battery level might not display after a system upgrade but will become available again after the next full charge.*

Power Schemes

You can set your unit to automatically switch to suspend mode independently for the battery or DC power modes. This is useful for example if you want to save battery power but do not want to be hindered by unwanted switches between modes when using DC power.



- Power off completely shuts down the unit's power.
- Power suspend puts the unit in sleep mode; you can wake up the system by pressing ⏻.
- **DC IN/BATTERY Idle timeout** allows you to set the time duration for the unit to idle (no keys pressed or test being run) before turning off the LCD.
- **DC IN/BATTERY suspend timeout** allows you to set the time duration for the unit to enter sleep mode.

Note: *Setting the **DC IN suspend timeout** to the lowest value and not to **Never** ensures the unit enters suspend mode while the charger is connected. Battery charging time is quickest when the unit is in suspend mode.*

Default **Power Scheme** settings are:

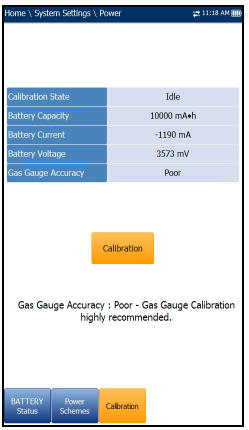
- LCD backlight turns off after system idles (no keys pressed) for 10 minutes.
- Unit switches to suspend mode after timeout: 10 min

To change the power scheme settings:

1. Press ⌂, select **System Settings**, and then **Power**.
2. Select the **Power Schemes** tab.
3. Under **DC IN** or **BATTERY**, use the arrow keys to select **Idle/suspend timeout** modes. Press ✔ to view the list of available choices or use the left/right arrow keys.
4. Select a new value, then press ✔ to confirm the choice. Repeat for the other modes as needed.

Power - Calibration

The **Calibration** tab allows you to optimize the battery gas gauge accuracy.



- **Calibration State**:
  - **Completed** displays after the calibration procedure has been started and the DC plug was not removed before the end was reached.
  - **In Progress** displays when the calibration procedure has been started but has not yet reached the end.
  - **Aborted** displays when the calibration procedure has been started but the DC plug was removed before the end.
  - **Idle** displays after the next MaxTester cold boot.
- **Gas Gauge Accuracy** indicates the estimated battery gas gauge accuracy.
  - Below 10 % accuracy error is **Very Good**.
  - Between 10 % and 20 % accuracy error is **Good**.
  - Over 20 % accuracy error is **Poor** and a gas gauge calibration is needed in order to get optimal accuracy.

The following on-screen messages may appear:

- **Calibration Completed** is displayed after the procedure has been started and successfully completed.
- **Calibration In Progress** is displayed when the procedure has been started and not yet completed.
- **Calibration Aborted** is displayed when the procedure has been started but the DC plug was removed or a power failure occurred before the end, or if you terminate the calibration.

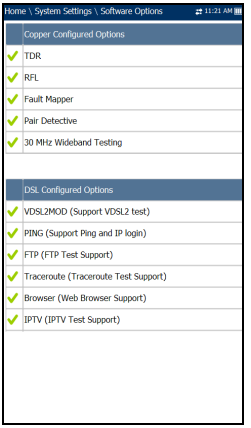
To start the gas gauge calibration:

1. Select the **Calibration** button. Completion time is up to 20 hours depending on the MaxTester's initial battery level and current power consumption.
2. Make sure the DC plug always stays connected and the unit is not turned off until completion. Failing to do so will abort the procedure and previous calibration parameters will be kept.

Note: *No other activity can be performed on the unit during calibration.*

Note: *Going through this calibration does not affect the MaxTester's battery capacity.*

Software Options



This screen lists all the **Configured Options** which are present on the unit. Possible options are as follow:

- **Copper Configured Options**
  - **TDR**
  - **RFL**
  - **Fault Mapper**
  - **Pair Detective**
  - **30 MHz Wideband Testing**
- **DSL Configured Options**
  - **VDSL2MOD (Support VDSL2 test)**
  - **PING (Support Ping and IP login)**
  - **FTP (FTP Test Support)**
  - **Traceroute (Traceroute Test Support)**
  - **Browser (Web Browser Support)**
  - **IPTV (IPTV Test Support)**

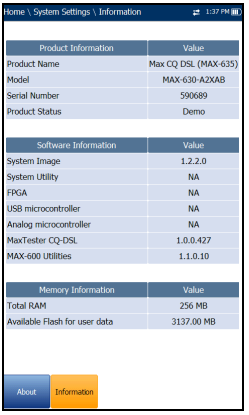
Information - About EXFO



The **About** tab contains contact information should you require technical assistance.

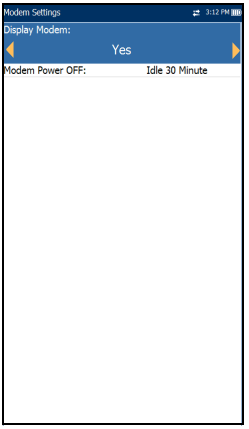
MAX-635 Information

The **Information** tab displays information about the product, software, and memory installed on the device.



Modem Settings

Modem Settings provide the means to configure the unit power scheme.



- **Display Modem** allows you to display the modem state in the title bar of the unit. Default value is **Yes**.
- **Modem Power OFF**:
  - **Immediately** for when an xDSL test is completed or stopped. In this mode, the modem is powered on when xDSL test starts.
  - **Idle** values power off the modem within a defined period after an xDSL test is completed or stopped.
  - **Never** keeps the power on all the time.

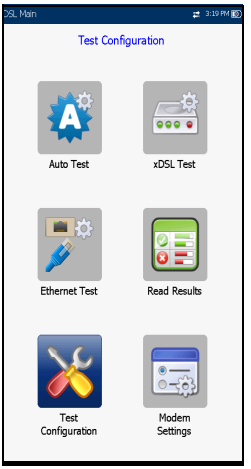
Note: *Setting the **Modem Power OFF** to **Never** disables the charging function. This means the operating time of the unit will be reduced since the battery discharges while the unit is switched on.*

To access the modem settings:

1. From ⌂, select ***xDSL Test***, and then ***Modem Settings***.
2. Use the up/down arrow keys to select the setting to change.
3. Press ✓ to view the list of available choices or use the left/right arrow keys.
4. Press ✓ to confirm.

5 Setting Up xDSL Tests

DSL Main Menu Page

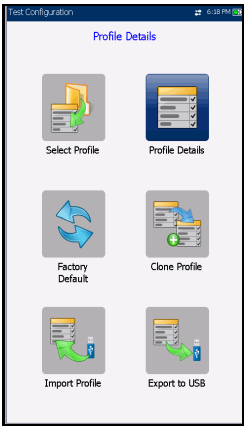


DSL Main presents the main menu page which allows you to navigate to each icon using the up/down left/right arrow keys on the keypad. Press ✔ to bring up the sub-menu of the selected icon:

- For Auto, xDSL, or Ethernet, the test will start and the screen control will navigate to the **Result Summary** page.
- **Read Results** opens the **Read Results** page of the previously saved tests.
- **Test Configuration** provides the utilities to setup test parameters.
- **Modem Settings** allows you to set the display and power parameters of the modem.

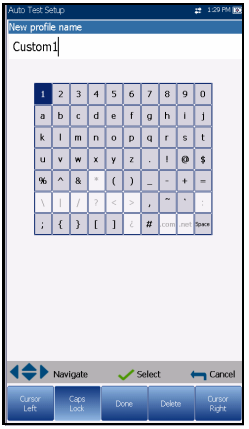
Test Configuration

The MAX-635 supports 3 types of test applications: **Auto Test**, **xDSL Test**, and **Ethernet Test**. Configuration parameters for all 3 test applications are saved into a test configuration profile. A default profile is provided with a predefined set of parameters for all test applications.



- **Select Profile** lists saved available profiles. The current active profile is shown in the upper information header. At power up, settings are read from the last loaded profile.
- **Profile Details** lists the 3 types of tests for configuration:
  - **Auto Test Setup**
  - **xDSL Test Setup**
  - **Ethernet Test Setup**
- **Factory Default** resets system profiles to factory default settings. Currently selected profiles, other than system profiles, are not affected.
- **Clone Profile** allows you to create a new profile by copying all parameters from the currently loaded profile.
- **Import Profile** allows you to copy all profiles from external USB key to the unit.
- **Export to USB** allows you to copy all profiles to USB key.

Setup Profile Name

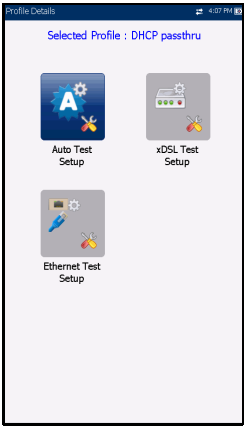


This alphanumeric editor screen allows you to change parameter values and save changes to a new profile.

To use the editor screen:

1. Press the up/down left/right arrows to navigate the on-screen keyboard.
2. Press ✔ to confirm the selection.

Profile Details Menu

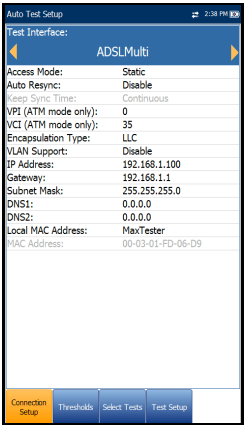


You can view any of your saved profiles on the MAX-635 from the **Profile Details** menu by selecting the desired test setup icon. This sub-menu displays an icon for each test: Auto Test, xDSL, and Ethernet.

To select a test:

1. Press the up/down left/right navigation keys to select the desired icon.
2. Press ✔ to display the test profile details.

Connection Setup



The **Connection Setup** tab allows you to configure the line and access modes, etc of your test dependent on your unit's **Software Options** and model **Information** or modem type, that is Annex A, B, or M.

The A2XAA unit only does Annex A and Bonding. Annex A is on pair 1, 30a is on pair 1, and bonding uses pair 1 and pair 2.

The A2XAB unit only does Annex A and Annex B where Annex B is on pair 1, Annex A is on pair 2, and 30a is on pair 1.

The setup options are as follow:

- **Test Interface**
  - **ADSL2+** - configured as ADSL1/2/2+ multi-mode (ITU-T G.992.1/2/3/5 and ANSI T1.413)
  - **ADSL2+ (xA/P2)** - same as previous with Annex A/Pair 2

- **ADSL2+ PTM** is in packet transfer mode.
- **ADSL2+ PTM (xA/P2)** - same as previous with Annex A/Pair 2
- **ADSLMulti** supports G.DMT and T1.413 only.
- **ADSL2Multi (xA/P2)** - same as previous with Annex A/Pair 2
- **VDSL2/ADSL2+** - (G.993.2) only available if the VDSL2 **Software Option** is activated. VDSL2 configuration allows fallback to ADSL2+, ADSL2, ADSL.
- **VDSL2/ADSL2+ (xA/P2)** - same as previous with Annex A/Pair 2
- **VDSL2/ADSL2+ PTM** is in packet transfer mode.
- **VDSL2/ADSL2+ PTM (xA/P2)** - same as previous with Annex A/Pair 2
- **VDSL2-30a (Pair 1)** supports 30a profile support, as needed in the MDU environment, for example.
- **ADSL2+/VDSL2 Bonding** is a purchasable option that allows testing of 2-pair bonded circuits.
- **Ethernet**

- **Annex M** allows you to **Enable**/**Disable** this option when **Test Interface** is **ADSL2+**, **VDSL2**, or **ADSL2+Bonding**.

Note: Annex B and Annex A 30a are on DSL pair 1. All other Annex A are on pair 2.

- **Access Mode** options are dependent on the **Test Interface** selection:
  - If ADSL2+, ADSLMulti, and VDSL2/ADSL2+- available options are Sync Only, Bridged (not in Auto Test), DHCP, Static, PPPoE, PPPoA, IPoA
  - If VDSL2-30a, ADSL2+ Bonding, and VDSL2 Bonding - available options are Sync Only, Bridged (not in Auto Test), DHCP, Static, PPPoE

    For xDSL, the default is **Bridged**.
  - For Ethernet - available options are Bridged, DHCP, Static, PPPoE.
- **Auto Resync** allows you to **Enable** the SyncLossCounter as the Pass/Fail criteria. When SyncLossCounter+1 is reached, the test will have fail status.

  If **Auto Resync** is disabled, any time the test loses sync, the result status will be fail and the test will stop automatically.
- **Keep Sync Time** is either
  - **Continuous** where the test runs until you manually stop it, or
  - **User Defined** where you can set a **Keep Sync Time Period**. Default is 5 minutes.
- **VLAN Support** enables the unit to analyze and pass WAN tagged ethernet frames through the virtual local area network (VLAN).
- **VLAN ID** is a virtual local area network (VLAN) tag ranging from 0 through 4094. The entry is available only when **VLAN Support** is **Enable**.
- **Vendor ID** is the name of the unit. This entry is available only when **Access Mode** is **DHCP**.
- **VPI (ATM mode only)** is the virtual path identifier (VPI) ranging from 0 through 255 for the downstream channel.

- **VCI (ATM mode only)** is the virtual circuit identifier (VCI) ranging from 32 through 65535 for the downstream channel.
- **Encapsulation Type** depends on the network configuration and sets the ATM to either **LLC** also known as LLC-SNAP (logical link control-sub network address protocol) or **VC_MUX** (virtual channel multiplex).
- **Local Mac Address** is the *internal* MAC address of the unit: either **MaxTester** or **User Defined**.
- **Mac Address** is a specific MAC address, in a hexadecimal format, if **User Defined** was selected for the previous parameter. This entry is available only when **Access Mode** is **DHCP** or **Static** for ADSL2+.
- **Static IP** is the address of the current location assigned by the service provider. This entry is available only if **Obtain IP** is set to **Static**.

The following parameters are available only when **Access Mode** is **PPPoE** or **PPPoA**.

- **Login Name** is your user ID.
- **Password** is your password.
- **Obtain IP** is either **Dynamic** where the access concentrator or broadband remote access server assigns a temporary IP address to the unit, or **Static** where you enter the IP address of the unit.
- **WAN Login Timeout** is a numeric setup entry.

The following parameters are available only when **Access Mode** is **IPoA** or **Static**.

- **IP Address** is the address for the unit that is actively connected to your network or the internet at the time of login.
- **Gateway** is the IP address of the default gateway.
- **Subnet Mask** is the network address used to identify if the IP address is within the same wide area network.
- **DNS1** is the address of the primary domain name server to be used by the unit. If DNS is unavailable, enter 0.0.0.0.
- **DNS2** is the address of the secondary domain name server to be used by the unit. If DNS is unavailable, enter 0.0.0.0.

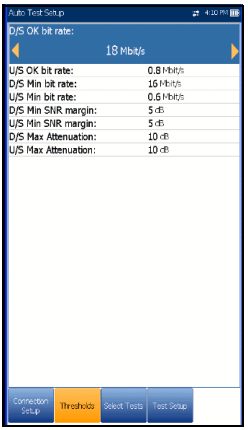
The following parameters are available only when **Test Interface** is **Ethernet**.

- **WAN/LAN Link Speed** is a choice between **Auto** (negotiated during the link establishment), **100** or **10 Mbit/s**.
- **WAN/LAN Connect Mode** is **Full-** or **Half-Duplex**, when **Link Speed** is set to either **100** or **10 Mbit/s**.

To configure the setup options:

1. Press the up/down arrows to select the desired parameter.
2. Press the left/right arrow keys to view and select the options.
3. If you make any changes to the parameter values, press the on-screen function keys to save or cancel your input.

Thresholds



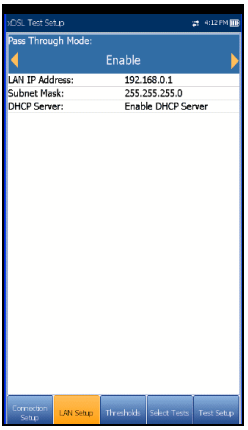
The **Thresholds** tab defines DSL parameter criteria. For **D/S** (downstream) and **U/S** (upstream) data rates, there are **OK** and **Min** (minimum) bit rates defined to indicate unacceptable, marginal, and acceptable rates.

- **D/S** and **U/S OK bit rate** (**Mbit/s**):
  - for ADSL - value limited to D/S 30 Mbit/s, U/S 2 Mbit/s.
  - for VDSL - D/S to 100 Mbit/s, U/S to 50 MBit/s.
- **D/S** and **U/S Min SNR margin** (**dB**) - values range from 0 to 63.5. Default is 5.
- **D/S** and **U/S Max Attenuation** (**dB**) - values range from 0 to 128. Default is 10.

To set threshold values:

1. Press the up/down arrows to select the desired parameter.
2. Press the left/right arrow keys to view and select the options.
3. If you make any changes to the parameter values, press the on-screen function keys to save or cancel your input.

LAN Setup



The **LAN Setup** tab is available only in xDSL test setup and when the **Access Mode** set in **Connection Setup** is *not* **Sync Only**. **LAN Setup** allows you to configure the parameters required when working in **Pass Through Mode**, and the LAN (local area network) is connected to the external device which supports 10/100 Ethernet.

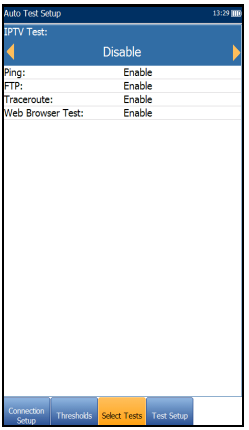
This tab is not available in **Auto Test Setup**.

- **Pass Through Mode** - **Enable** or **Disable**.
- **LAN IP Address** is the local network IP address of the unit.
- **Subnet Mask** is the network address mask used to identify if the IP address is within the same local area network.
- **DHCP Server** enables the dynamic host configuration protocol (DHCP) mode for the LAN side of the connection.
- **Platform Ip Address** displays the IP address of the unit's platform when the **DHCP Server** is disabled.

To configure LAN setup values:

1. Press the up/down arrows to select the desired parameter.
2. Press the left/right arrow keys to view and select the options.
3. If you make any changes to the parameter values, press the on-screen function keys to save or cancel your input.

Select Tests



The **Select Tests** page allows you to **Enable**/**Disable** the following optional sub-tests, within the 3 types of test applications.

- **IPTV Test** - when enabled, all other sub-tests are automatically disabled.
- **Ping** is also known as ICMP echo request and determines network connectivity and accessibility.
- **FTP** test verifies the file transfer speed of the file download and upload.
- **Traceroute** is a complement tool of the Ping test to determine why a destination cannot be reached, or where the internet is broken.
- **Web Browser Test** can only be started when a WAN connection (either through xDSL or Ethernet) has been established.

When enabled, the sub-tests' test pages are available in the results pages.

When highlighted, the sub-tests' setup contents are shown on the **Test Setup** tab.

Note: *Select Tests and* ***Test Setup*** *tabs are not available in* ***Sync Only*** *and* ***Bridged*** *Access Modes.*

To select sub-tests:

1. Press the up/down arrows to highlight the desired test.
2. Press the left/right arrow keys to toggle between **Enable**/**Disable**.

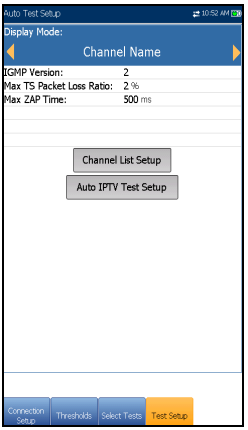
   OR

3. Press ✔ on any value to open the list box to toggle between **Enable**/**Disable**.

Test Setup

The **Test Setup** tab allows you to configure values for the optional sub-tests within the 3 types of test applications. You must highlight the sub-test on the **Select Tests** page in order to display the sub-test's parameters on the **Test Setup** page.

IPTV Test Setup



IPTV test supports STB (set-top box) emulation mode over xDSL and Ethernet interfaces enabling the MaxTester to join and leave multicast IPTV streams. The following parameters can be configured from the **Test Setup** tab:

- **Display Mode** is either the **Channel Name** or **#** used for displaying channel information in the result pages.
- **IGMP Version** is a value of either **2** or **3** used to send IGMP join/leave messages.

Note: *If you change the **IGMP Version** from the default of **2** to **3**, you must reboot your unit.*

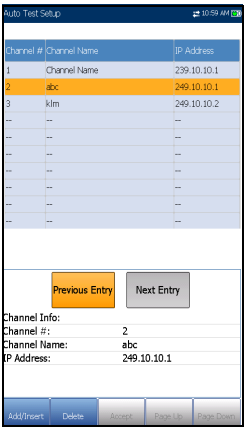
- **Max TS Packet Loss Ratio** is an editable percentage, ranging from 1 to 50, used to qualify if the IPTV stream is stable.
- **Max ZAP Time** is an editable value ranging from 0 to 10,000 that measures the channel switch time in ms.
- **Channel List Setup** button accesses the page to configure parameters for channel analysis.
- **Auto IPTV Test Setup** button accesses the setup page to automatically run an IPTV test. This function is only available in **Auto Test Setup** application.

To configure test setup values:

1. Press the up/down arrow keys to select the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR
3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.
5. If you make any changes to the parameter values, press the on-screen function keys to save or cancel your input.

Channel List Setup



The **Channel List Setup** page in the IPTV test setup provides a tool for you to create an alias table. It allows you to join/leave an IPTV stream using a symbolic name or TV channel number instead of the IP address. Maximum entries in the table are 100, divided into pages.

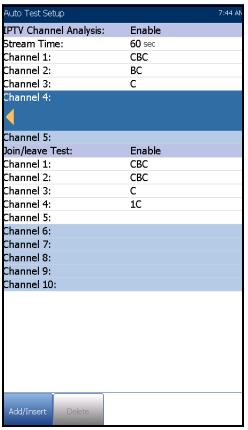
- **Channel Info** lists 3 editable parameters:
  - **Channel #** is a numeric value from 1 to 9999.
  - **Channel Name** is a 24-character alphanumeric entry.
  - **IP Address** is a multicast address from 224.1.1.1 to 239.255.255.254.
- **Previous/Next Entry** buttons highlight the previous/next entry in the table (up/down direction). When the highlight reaches the first/last entry of the alias table page, the button(s) is disabled.
- On-screen function buttons:
  - **Add/Insert** adds currently edited channel info into the alias table below the highlighted entry and moves the highlight to the newly added entry. If the page is full, the bottom entry moves to the next page. Selecting the highlight placement allows you add and group entries with similar parameters.
  - **Delete** removes the highlighted entry in the alias table. If the deleted entry was also present in the **IPTV Channel Analysis** list or **Join/leave Test** list in **Auto IPTV Test Setup** page, it will also be removed from those lists.
  - **Accept** replaces the edited value for the current highlighted entry. Use this function for modification purposes.
  - **Page Up/Down** display the previous/next page(s) of the alias table. If current page is the first/last page, the button(s) are disabled.

To setup the channel list:

1. Press the up/down, right/left keys to select the desired channel parameter.
2. Use the on-screen function buttons to create or edit the channel list.

   OR
3. Use the navigation keys to select the **Previous/Next Entry** button(s) and press ✔ to select the entry to be highlighted and edited.

Auto IPTV Test Setup



The **Auto IPTV Test Setup** page in the IPTV test setup allows you to define 2 types of IPTV tests to run automatically:

- **IPTV Channel Analysis** - **Enable** to add channels for analysis. If disabled, channel analysis in auto test is not performed.
  - **Stream Time** defines the length of time, from 1 to 60 s, to keep the channel stream(s) for analysis.
  - **Channel 1-5** allows you to define up to 5 IPTV channels for concurrent analysis.
- **Join/leave Test** - **Enable** to define a list of channels to sequentially join and leave. If disabled, no test is performed.
  - **Channel 1-10** allows you to define a list of up to 10 channels.
- On-screen function buttons:
  - **Add/Insert** is available only when a blank entry is highlighted. When the button is pressed, the first available channel from the alias **Channel List** is automatically added to this list of channels. Upon highlighting another blank entry, the next channel from the alias table is added, and so on.
  - **Delete** removes the selected channel from the list.

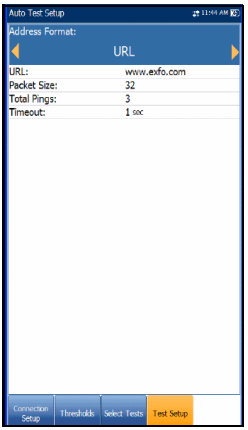
You can **Enable** either one or both, but you cannot **Disable** both of them at same time. If both tests are enabled, **Join/leave Test** runs first.

To configure test setup values:

1. Press the up/down arrow keys to select the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR
3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

Ping Test Setup



The **Test Setup** tab is available only if **Access Mode** is *not* **Sync Only**.

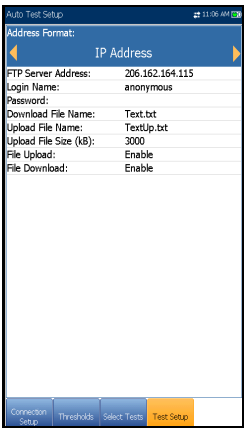
- **Address Format** is **URL**, **IP Address**, or **Gateway**.
- **URL/IP Address** lists either the URL or IP Address where the unit pings.
- **Packet Size** is a value from 32 through 1200 of the number of bytes sent in one packet. The default value is 32.
- **Total Pings** is the total number of Ping packets to send out from1 through 99. The default value is 3.
- **Timeout** is the time in seconds from 1 through 10, that the unit will wait for a response back from the destination device.

To configure test setup values:

1. Press the up/down arrow keys to select the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR
3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.
5. If you make any changes to the parameter values, press the on-screen function keys to save or cancel your input.

FTP Test Setup



The FTP test verifies the file transfer speed of the file download and upload. The FTP **Test Setup** tab allows you to configure the following parameters:

- **Address Format** is **URL** or **IP Address**.
- **FTP Server Address** lists either the URL or IP Address.
- **Login Name/Password** is your user ID and password.
- **Download File Name** is the filename requested for downloading, maximum 128 characters.
- **Upload File Name** is the filename used for uploading, maximum 128 characters.
- **Upload File Size (kB)** is the number of bytes or size of the file to be uploaded to the server.
- **File Upload/Download** - **Enable/Disable** options available only in **Auto Test Setup**. **Enable** to perform the upload/download operation automatically.

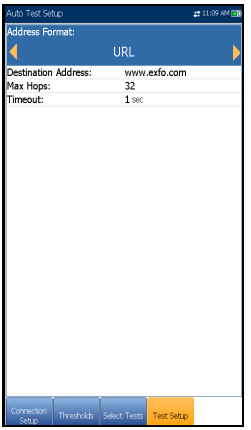
To configure test setup values:

1. Press the up/down arrow keys to select the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR
3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.
5. If you make any changes to the parameter values, press the on-screen function keys to save or cancel your input.

Traceroute Test Setup

The Traceroute **Test Setup** tab allows you the configure the following parameters:



- **Address Format** is **URL** or **IP Address**.
- **Destination Address** is the destination IP or URL address.
- **Max Hops** specifies the maximum number of hops (1 to 32) used in attempting to reach the destination address.
- **Timeout** is the time in seconds from 1 to 10, that the unit will wait for a response back from the destination device.

To configure test setup values:

1. Press the up/down arrow keys to select the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR
3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.
5. If you make any changes to the parameter values, press the on-screen function keys to save or cancel your input.

Web Browser Test Setup



The **Test Setup** page for the Web browser content is displayed when the **Web Browser Test** is highlighted on the previous **Select Tests** tab. Here you can edit the **Bookmarks** and **Home URL**.

➤ **Bookmarks** lists 9 entries. The default is **http://**.

The **Bookmarks** list is shared by all 3 tests (Auto Test, xDSL and Ethernet tests). If the list is changed in one test, the changes are reflected in the other two.

➤ **Home URL** acts as the Home URL for the Web browser test page when started. It is independent among the 3 types of test applications.

➤ **Copy to Home URL** allows you to set a highlighted URL as the **Home URL**.

To configure the Web browser setup:

1. Press the up/down arrows to highlight the desired entry in the list.
2. Press ✔ to access the edit screen.
3. If you make any changes to the test values, press the on-screen function keys to save or cancel your input.

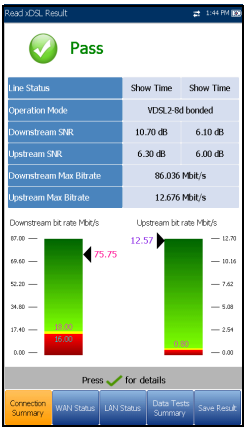
6 xDSL Test Results

The MAX-635 is designed to make xDSL turn-up easy. The unit will emulate an ATU-R to the point that it can handshake and connect with an ATU-C and report the upstream and downstream parameters. Simply connect to the line, turn on the MAX-635, and select a test to run. Results obtained include upstream and downstream throughput and noise margin.

xDSL Connection Summary

The **Connection Summary** tab allows you to view the pass/fail status and details of the test results.

When the **Test Interface** for **Auto Test** or **xDSL** is set to ADSL2+ or VDSL2 bonding mode, there will be 2 columns of results. While the test is running, 2 soft LEDs will appear above these columns displaying the 2-DSL line condition. The pass/fail status is based on the 2-DSL line connection state and combined data rate. Once the test is completed, these 2 soft LEDs disappear and the pass/fail icon is displayed. at the top of the screen.



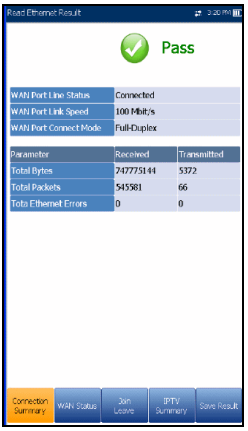
- **Line Status** displays the status of the line under test during negotiation with the DSLAM. The value changes from Idle /Activate /Handshake /Training /Showtime for ADSL2+ or VDSL2 mode.
- **Operation Mode** is the xDSL mode of operation, bonded or non-bonded, as negotiated between the unit and the DSLAM.
- **Downstream/Upstream** SNR is a value ranging from 0 through 63.5 for the minimum SNR (signal-to-noise ratio) margin.
- **Downstream/Upstream Max Bitrate** displays the D/S (downstream) and U/S (upstream) maximum attainable bit rates that the circuit can handle as determined by the remote terminal and CO during the training phase. Values can be greater than the actual bit rate.

  If the **Operation Mode** is bonded, the 2-DSL line **Max Bitrate** is combined.
- Downstream/Upstream actual bit rates are displayed by graphic bars and the current actual values appear as numbers.
  - Downstream/Upstream bit rate values are shown in yellow region if they are greater than Min threshold and less than OK threshold.
  - Downstream/Upstream bit rate values are shown in red region if they are less than Min threshold.

  If the **Operation Mode** is bonded, the actual bit rate is a summary of both DSL lines.

Ethernet Connection Summary

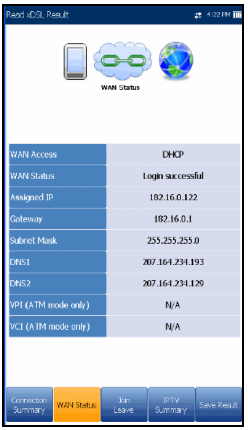
When set up over Ethernet, the available test results are the following:



- **WAN/LAN Port Line Status** displays either **Connected** or **Disconnected** for the particular line connection under test.
- **WAN/LAN Port LinkSpeed** is **Auto** (negotiated during the link establishment), **100** or **10 Mbps**.
- **WAN/LAN Port ConnectMode** is **Full-** or **Half-Duplex**, when **Link Speed** is either **100** or **10 Mbps**.
- The **Total** number of **Received** and **Transmitted Bytes**, **Packets**, and **Ethernet Errors** are also displayed during the test.

WAN Status

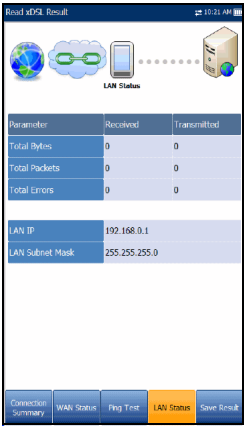
The **WAN Status** tab allows you to view the status of the connection between the WAN port of the unit and the ISP.



- **WAN Access** specifies the encapsulation method used by the network and consists of the following types:
  - **PPPoE** is point-to-point protocol over Ethernet.
  - **PPPoA** is point-to-point protocol over ATM.
  - **DHCP** is Dynamic Host Control Protocol which is used to dynamically assign an IP address for the client node on the network.
  - **Static IP** is the current location assigned by the service provider or user.
  - **IPoA** stands for classical Internet Protocol over ATM.
- **WAN Status** value changes as per current WAN Status.
- **Assigned IP** displays IP address information assigned to the unit that is connected to the network.
- **Gateway** is the IP address of the default gateway.
- **Subnet Mask** is the network address used to identify if the IP address is within the same WAN.
- **DNS1** is the address of the primary domain name server to be used by the unit.
- **DNS2** is the address of the secondary domain name server to be used by the unit.
- **VPI** is the virtual path identifier value. Not available in PTM mode.
- **VCI** is the virtual circuit identifier value. Not available in PTM mode.

LAN Status

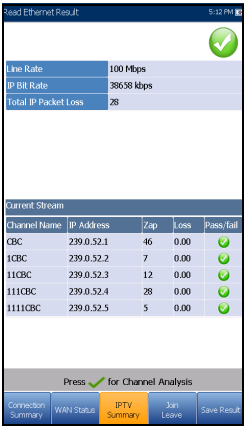
The **LAN Status** tab allows you to view the customer information configured for the LAN (local area network).



- **LAN IP** is the local network IP address of the unit.
- **LAN Subnet Mask** is the network address mask used to identify if the IP address is within the same local area network.
- The **Total** number of **Received** and **Transmitted Bytes**, **Packets**, and **Errors** are also displayed during the test.

IPTV Summary

The **IPTV Summary** tab allows you to view the pass/fail status and test results of the IPTV streams and actions (Join/Leave).

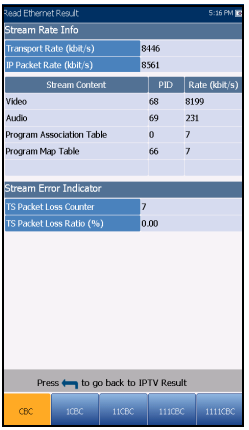


- **Line Rate** is the actual rate achieved by the circuit, in Mbps.
- **IP Bit Rate** is the IP data rate for the IPTV service, including all channels detected.
- **Total IP Packet Loss** is the total number of packets lost, with errors, or out of sequence, during the test period.
- **Current Stream** lists a maximum of 5 live channel streams by name and **IP Address**.
  - **Zap** is the time in ms, required for a channel change or join, and is one of the key factors to be considered when evaluating the IPTV quality of service (QoS).
  - **Loss** is the percentage of IP packet loss during the last one-second period.

To view the **Channel Analysis**, press ✔ from the **IPTV Summary** tab.

Channel Analysis

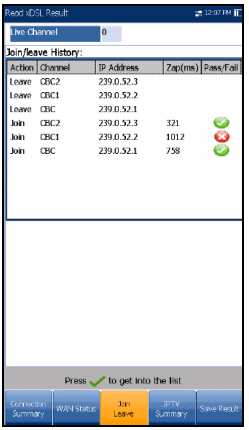
The Channel Analysis function provides a separate tab for every live stream channel. Each channel displays the following information:



- **Stream Rate Info**
  - **Transport Rate (kbit/s)**
  - **IP Packet Rate (kbit/s)**
  - **Stream Content** lists the statistical information about the **Video**, **Audio**, and **Program Association/Map Table**(s) content for each MPEG video analyzed stream.
  - **PID** is a unique integer value or packet identifier (PID) that indicates the type of data that is stored in the packet payload of the video stream.
  - **Rate (kbit/s)** is the rate calculated of a given stream content.
- **Stream Error Indicator**
  - **TS Packet Loss Counter** is the number of packets lost, with errors, or out of sequence, during the test period in the transport stream.
  - **TS Packet Loss Ratio (%)** is the percentage of IP packet loss during a one second period in the transport stream.

Join Leave

The **Join Leave** tab displays a list of IPTV channels from the alias table, their activity (measured Zap time), and pass/fail status. Upon successful WAN connection, the **Join/Leave Channel** lists and **Join** and **Leave** buttons are shown.



Note: *Join and Leave buttons are not shown in Auto Test since join and leave are automatically executed.*

To join/leave channels:

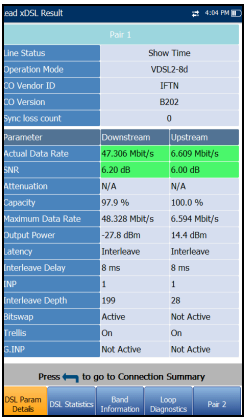
1. Press **Join** to have the STB send an IGMP report with the multicast IP address.
2. Press **Leave** to inform the network to stop sending the current stream.

DSL Parameter Details

The **DSL Param Details** tab displays the **Downstream** and **Upstream** parameter results configured in the xDSL tests.

When the **Test Interface** for **Auto Test** or **xDSL** is set to ADSL2+ or VDSL2 bonding mode, there will be 2 pages of results, one for each DSL line-pair.

To access the second-pair results, press the **Pair 1/2** function key at the bottom-right of the screen.



- **Line Status** displays the status of the line under test during negotiation with the DSLAM. The value changes from Idle /Activate /Handshake /Training /Show Time for ADSL2+ or VDSL2 mode.
- **Operation Mode** is the DSL mode of operation as negotiated between the unit and the DSLAM.
- **CO Vendor ID** is a unique 4-digit alphanumeric identifier of the DSL chipset manufacturer used on the CO (central office) side.
- **CO Version** is the version number of the unique alphanumeric identifier of the DSL chipset used on the CO side.
- **Sync loss count** is the number of times the unit lost synchronization.
- **Parameter - Downstream/Upstream**
  - **Actual Data Rate** displays the values at which the unit and CO are connected, as negotiated during the training phase. The values should represent what the CO was set to, unless the DSL link is being subjected to high levels of noise/crosstalk.
  - **SNR** is the signal-to-noise ratio margin measured on the line.
  - **Attenuation** is line attenuation measured during the training phase.

Note: ***DSL Param Details*** *displays* ***Attenuation*** *for ADSL1/2/2+ only. See* ***Band Information*** *for VDSL2 attenuation.*

  - **Capacity** is the capacity of the line as a ratio of achieved bit rate over the maximum attainable bit rate presented as a percentage (%). A high value could mean that the link is nearing its maximum capabilities while a low value could mean the link is being under utilized (sometimes intentionally – verify your local DSLAM setup).
  - **Maximum Data Rate** displays the maximum attainable bit rates that the circuit can handle as determined by the remote terminal and CO during the training phase. Values can be greater than the actual bit rate.

- **Output Power** is the current transmit power level that is a measure of the aggregated transmit power.
- **Latency** is the path type, **Fast** or **Interleave**, set by the service provider at the CO. The use of the interleaved path means greater delay in the delivery of data but it is less susceptible to noise or crosstalk due to increased Reed-Solomon coding and FEC (forward error checking). The use of the fast path means little or no delay in the delivery of data but it is more susceptible to noise and crosstalk.
- **Interleave Delay** defines the mapping (relative spacing) between subsequent input bytes at the interleave input and their placement in the bit stream at the interleave output.
- **INP** is the level of impulse noise protection.
- **Interleave Depth** defines the number of bits (or bytes) in each block of data.
- **Bitswap** specifies the status of the bit swapping mechanism - **Active**, **Not Active**, or **Unknown** - swapping bits from tone m to tone n to prevent modem retraining.
- **Trellis** or Trellis Coded Modulation (TCM) is a type of convolutional code which utilizes parity bits on each symbol within a continuous data stream. When the line is connected, Trellis displays either **On** or **Off**.
- **Phy-R** is Broadcom proprietary Physical Layer Retransmit technology which is used to overcome impulse noise.

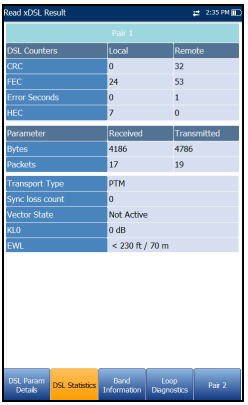
  G.INP is the level of ground impulse noise protection and is only shown if **Phy-R** is not active.

DSL Statistics

The **DSL Statistics** tab allows you to view transfer mode statistics and DSL counters.

When the **Test Interface** for **Auto Test** or **xDSL** is set to ADSL2+ or VDSL2 bonding mode, there will be 2 pages of results, one for each DSL line-pair.

To access the second-pair results, press the **Pair 1/2** function key at the bottom-right of the screen.



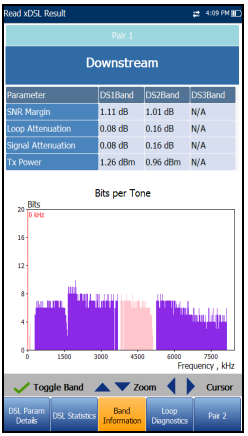
- **DSL Counters** lists the **Local** and **Remote** results for the following counters:
  - **CRC** is the cyclical redundancy check Interleaved/Fast counter.
  - **FEC** is the Reed Solomon forward error correction.
  - **FEC Seconds** is the number of seconds when FEC is detected.
  - **Error Seconds** is the number of seconds when code violation is detected.
  - **HEC** is the header error check (HEC) Interleaved/Fast counter. Available only in ATM connection mode.
- **Parameter - Received/Transmitted**
  - **Bytes** records the number of active (non-idle) PTM/ATM cells or frames on a channel.
  - **Packets** displays the number of packets.
- **Transport Type** options include PTM (packet transfer mode) and ATM (asynchronous transfer mode).
- **Sync loss count** is the number of times the unit lost synchronization.
- **Vector State** (only displayed for single VDSL2 connection) is **Active/Not Active**.
- **KL0** displays the attenuation on the line for a particular frequency.
- **EWL** is the estimated wire length and is based on the **KL0**.

Band Information

The **Band Information** tab allows you to view a list of individual upstream or downstream band parameter details.

When the **Test Interface** for **Auto Test** or **xDSL** is set to ADSL2+ or VDSL2 bonding mode, there will be 2 pages of results, one for each DSL line-pair.

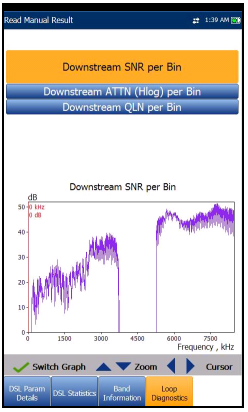
To access the second-pair results, press the **Pair 1/2** function key at the bottom-right of the screen.



- The page contains **Upstream** and **Downstream** parameters. Press ✔ to toggle between bands.
  - ADSL lists only 1 of each.
  - VDSL lists US0 to 3 and DS1 to 3 possible bands, depending on the band plan.
- **Parameter - Downstream/Upstream**
  - **SNR Margin** is the measured current signal-to-noise ratio margin across all active sub-carriers, as an amount of increased noise relative to the measured noise power that the system would be able to tolerate. Only a value of 6 or above is able to support a bit error rate of 10^{-7}.
  - **Loop Attenuation** is the current quality of the line and is measured only once during testing.
  - **Signal Attenuation** is the current reduction of signal strength and is measured periodically when the line is connected.
  - **Tx Power** is the upstream/downstream transmitting power for the selected band.

Loop Diagnostics

The **Loop Diagnostics** tab displays characteristics and potential problems on the line, in graphical format. There are 3 separate graphs for each pair:

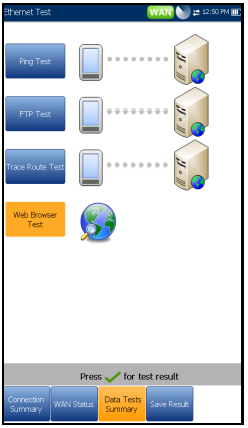


- **Downstream SNR per Bin** presents the downstream signal-to-noise ratio per bin.
- **Downstream ATTN per Bin** shows the downstream attenuation from Hlog (Channel Response).
- **Downstream QLN per Bin** shows the downstream PSD noise from quiet line noise.

Press ✔ to switch between graphs.

Data Tests Summary

The **Data Tests Summary** tab displays the pass/fail status of the selected data tests enabled in the connection setup. A successful WAN connection must be established in order to view the detailed results.

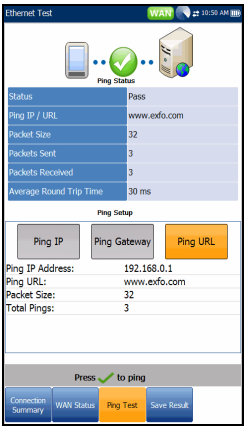


To view individual data test results:

1. Press the up/down navigation keys to select the desired test.
2. Press ✔ to display the test result details.

Ping Test

The **Ping Test** tab allows you to view the Pass/Fail summary status of either a Ping Address or Ping Gateway.

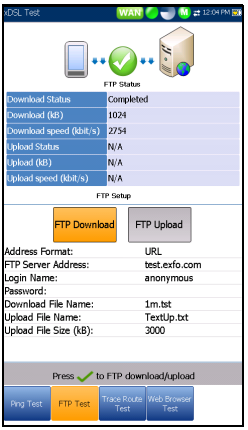


- **Status** is the status of the Ping test performed.
- **Ping IP/URL** is the IP Address or domain name of the destination being pinged.
- **Packet Size** is the number of bytes sent in one packet.
- **Packets Sent** is the number of packets sent.
- **Packets Received** is the number of packets received.
- **Average Round Trip Time** is the duration in milliseconds (ms) it took the data to reach the destination device and come back.
- **Ping IP Address** is the destination IP address.
- **Ping URL** is the destination URL address.
- **Packet Size** is the number of bytes sent in one packet ranging from 32 through 1200 (default is 32 bytes).
- **Total Pings** is the total number of Ping requests to be sent.

FTP Test

The **FTP Test** tab displays the FTP download and upload results configured in the connection setup, and a pass/fail summary status of whether or not the file transfer protocol (FTP) was completed successfully or not.

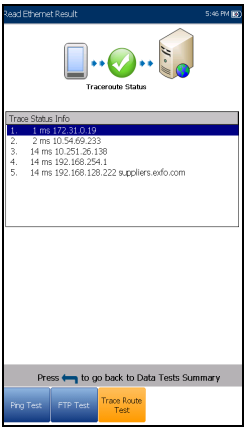
Except for Auto Test, FTP parameters can be reconfigured and have information updated from this tab by using the on-screen **FTP Download/Upload** buttons.



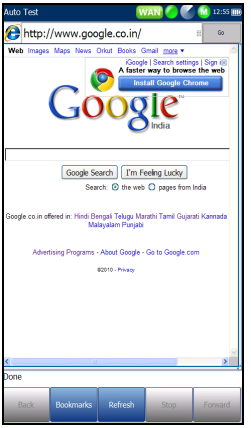
Trace Route Test

The **Trace Route Test** tab allows you to view the pass/fail status of the IP packet sent to a specified IP destination, and the path and time taken to do so.

Except for Auto Test, Traceroute parameters can be reconfigured and have information updated from this tab by using the on-screen **Trace URL** or **Trace IP** buttons.



Web Browser



The Web browser results screen is available only if the software option is enabled. Web browser results screen contains the following functions:

- URL Box displays the current Web address to be connected.
- The **Go** button starts the specified URL or reloads the previous Web page.
- On-screen function keys:
  - **Back** retrieves the previous Web page (if available). If no Web page was previously browsed, this key is disabled.
  - **Enter Text** opens the editor screen allowing you to type an entry.
  - **Bookmarks** opens the **Bookmarks** page allowing you to select a URL from the list or save the current URL to **Bookmarks**. You must press ↩ to enable the **Bookmarks** key.
  - **Refresh** reloads the current Web page.
  - **STOP** halts loading the Web page. If the Web page has already loaded, the key is disabled.
  - **Forward** takes you to the next Web page (if available). If no Web page was browsed after the current page, this key will be disabled.

To edit the Web address:

1. Press ↩ to highlight the URL box.
2. Press ✓ to bring up the edit screen and modify the Web address. The edited URL can be used to browse the Web page temporarily but it will not be saved as the **Home URL**.

To navigate the Web browser page:

1. Use the keypad arrow keys to move the on-screen cursor. When the cursor reaches the edge of the viewing area, the Web browser page scrolls up/down/left/right. The cursor turns into a text edit tool when scrolling over an editable box or a hand tool when hovering near a hyperlink.
2. Press ✓ to start the desired outcomes.
3. Press ⌂ to load the **Home URL** page.
4. Press ↩ to exit from the Web browser test.

Bookmarks

The Bookmarks page allows you to select from a list of URLs or save the current one.



- **URL** box shows the current URL in the Web browser page.
- On-screen function keys:
  - **Add to Bookmarks** copies the current URL to the **Bookmarks** list above the highlight. When the list reaches the maximum 9 URLs, the key is disabled.
  - **Set as URL** copies the highlighted URL to the **URL** box.
  - **GO** saves the bookmarks and starts the Web connection using the address in **URL** box.

Press ↩ to exit from the **Bookmarks** page avoiding all actions and return to the Web browser page.

7 Saving and Reading xDSL Test Results

Save Results

You can save a snapshot of test results into a result file during or after an xDSL test performed with the MAX-635. Each Auto Test, xDSL, and Ethernet test includes a **Save Results** tab to do so.

When a test is completed or stopped, a **Confirm Save Results** dialogue box pops up. Selecting **Yes** displays the **Save Results** screen where the following information can be entered:



- **File Name** opens an editor screen where you can enter a desired file name.
- **Save** button saves the results in binary format for the test executed.
- **Export Format** generates results of a pre-executed test in the following formats:
  - binary
  - HTML
  - XML
- **Export File Name** opens an editor screen where you can enter a desired export file name.
- **Export** button sends the results, in the selected format, to a USB key. If more than one USB key is attached to the device, you'll be asked to select one from a list of all USB keys attached to the unit.

Note: *If the test is still running (not completed or stopped), only the first two entries are available and the results are saved to binary format.*

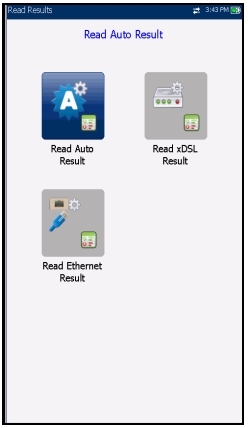
To save or export results:

1. Press the up/down arrows to select the desired parameter.
2. Press the left/right arrow keys to view and select the options,

   Or
3. Press ✔ to open the on-screen keyboard. to enter or edit a **File Name**.
4. Press the up/down left/right arrows to navigate the on-screen keyboard.
5. Select the desired function key to complete your selection.
6. Select **Save** or **Export** buttons and press ✔ to confirm your selection.

Read Results Menu

You can view any of your saved results with the MAX-635 from the **Main** menu and selecting the **Read Results** icon. The sub-menu displays an icon for each test: Auto Test, xDSL, and Ethernet.



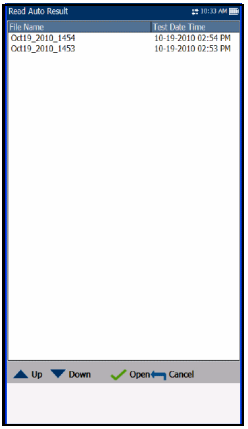
To select a test:

1. Press the up/down left/right navigation keys to select the desired icon.
2. Press ✔ to display a list of the saved test results.

Read Results

Based on the selected value for the test type, the list of result files is displayed by **File Name** and test date and time. The format of **Test Date Time** is per the selection in **System Settings**.

When a file in the list is selected and enter key is pressed, it will read the file and display the results.



To recall any of the saved data:

1. Press ⌂ and select **Read Results**.
2. Select one of the Read test Result icons.
3. Select a file in the list using the up/down arrow keys.
4. Press ✔ to open the file and display the results.

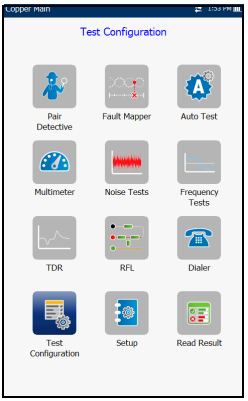
8 Setting Up Copper Tests

The MAX-635 is designed to test basic twisted pair quality, identify and locate faults, and troubleshoot noise and signal issues. These measurements offer a quick and thorough method to determine if the cable is capable of supporting xDSL technology. In addition, it utilizes noise measurements, longitudinal balance tests, and power spectral density tests to assist in the installation, maintenance, and troubleshooting of copper cables.

Copper Test Main Menu

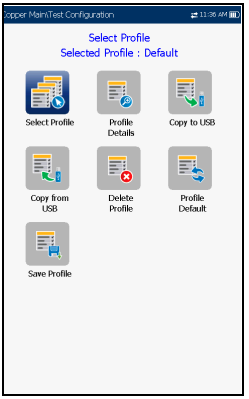
Copper Main presents the main copper menu page which allows you to navigate between all the copper qualification testing applications using the up/down, left/right arrow keys on the keypad.

Press ✔ to run a test, bring up the sub-menu, or perform the application of the selected icon.



Test Configuration

Before performing copper tests, you can set up the software settings and values for the cables. The MaxTester 635 allows you to save test parameters and threshold settings to different profiles and reuse them as needed.



The **Test Configuration** menu provides the utilities to setup test parameters. The MAX-635 supports several types of copper test applications. Test parameters and thresholds are saved into a test configuration profile. A **Profile Default** is provided with a predefined set of parameters for all test applications.

Note: *Cable parameters are not included in these profiles but can be configured in* ***Setup****.*

- **Select Profile** lists available profiles saved in the internal memory. The current active profile is shown in the upper information header.

  An asterisk "*" on the currently **Selected Profile** name indicates that modifications have been made to this profile in the **Threshold Settings** or parameters of a particular test.

  At power up, settings are read from the last loaded profile.
- **Profile Details** lists the tests for configuration:
  - Pair Detective
  - Fault Mapper
  - Auto Test
  - Multimeter
  - Noise Tests
  - Frequency Tests
  - TDR
- **Copy to USB** allows you to copy all profiles found in the internal memory to an external USB device. If the profile name already exists in the destination folder, Copy (x) will be appended to the profile name, where x corresponds to the number of copies starting from 1.
- **Copy from USB** allows you to copy all profiles found on an external USB device to the unit.
- **Delete Profile** allows you to delete a profile (except the default profile) on the unit.
- **Profile Default** resets the current test setup to the factory default profile. If selected, a dialogue box pops up to confirm that all single and auto test settings will revert to factory test settings.
- **Save Profile** allows you to save changes made to selected profile. An asterisk "*" on the **Selected Profile** name indicates that modifications have been made in the **Threshold Settings** or parameters of a particular test. the following function keys.

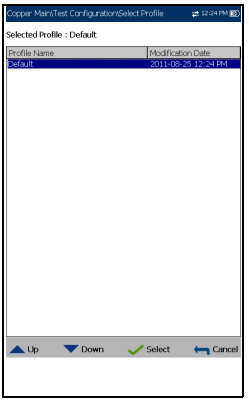
To save a profile, use one of the following function keys:

- **Save** allows you to save to the currently selected profile name.
- **Save As** opens the alphanumeric editor screen allowing you to enter a new name for the profile selected.
- **Don't Save** deletes the message box without saving the changes to the currently selected profile.

To navigate between the configuration icons:

1. Press the up/down left/right arrow keys on the keypad to select an icon.
2. Press ✔ to confirm your selection.

Select Profile



The **Select Profile** page lists the available profiles in the internal memory, by **Profile Name** and **Modification Date**.

The **Selected Profile** displays the current active profile.

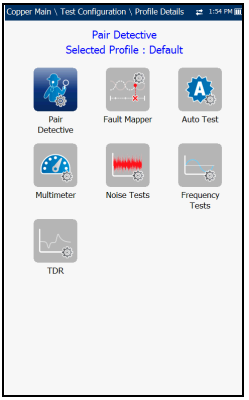
To select a profile:

1. Press the up/down arrow keys to highlight the desired entry and press ✔. The profile is loaded and the **Selected Profile** is updated with the current selection.

   OR

2. Press ↩ to cancel your selection and go back to the **Test Configuration** menu.

Profile Details Main Menu



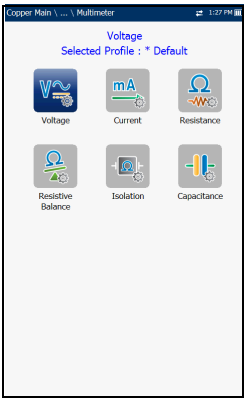
You can view any of your saved profiles on the MaxTester 635 from the **Profile Details** menu by selecting the desired test icon. An asterisk "*" on the currently **Selected Profile** name indicates that modifications have been made to this profile in the **Threshold Settings** or parameters of a particular test.

Each test displays a sub-menu of test icons to select and setup.

To select a test:

1. Press the up/down left/right arrow keys on the keypad to select an icon.
2. Press ✔ to display the sub-menu test icons.

Multimeter Profile Details



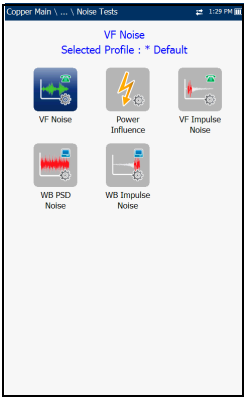
The profile details **Multimeter** main menu allows you to view the test threshold and parameters of the following tests:

- **Voltage**
- **Current**
- **Resistance**
- **Resistive Balance**
- **Isolation**
- **Capacitance/Opens**

To navigate between the test profiles:

1. Press the up/down left/right arrow keys on the keypad to select an icon.
2. Press ✔ to confirm your selection.

Noise Tests Profile Details



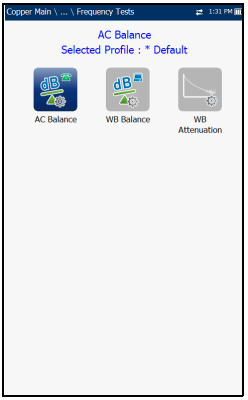
The profile details **Noise Tests** main menu allows you to view the test threshold and parameters of the following tests:

- **VF Noise**
- **Power Influence**
- **VF Impulse Noise**
- **WB PSD Noise**
- **WB Impulse Noise**

To navigate between the test profiles:

1. Press the up/down left/right arrow keys on the keypad to select an icon.
2. Press ✔ to confirm your selection.

Frequency Tests Profile Details



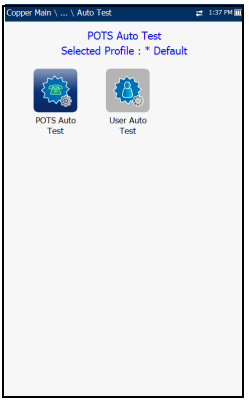
The profile details **Frequency Tests** main menu allows you to view the test threshold and parameters of the following tests:

- **VF/AC Balance**
- **WB Balance**
- **WB Attenuation**

To navigate between the test profiles:

1. Press the up/down left/right arrow keys on the keypad to select an icon.
2. Press ✔ to confirm your selection.

Auto Test Profile Details



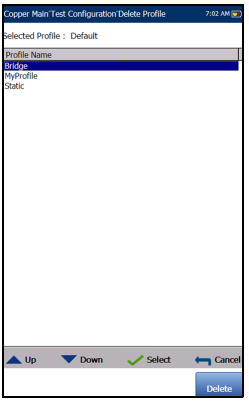
The profile details **Auto Test** main menu allows you to view the test threshold and parameters of the following tests:

- **POTS Auto Test**
- **User Auto Test**

To navigate between the test profiles:

1. Press the up/down left/right arrow keys on the keypad to select an icon.
2. Press ✔ to confirm your selection.

Delete Profile



Delete Profile lists all profiles found on the internal memory except the default profile, which cannot be removed.

Selected Profile displays the profile name in use.

To delete a profile:

1. Press the up/down arrow keys to highlight the entry to be removed and press ✔.
2. Press the **Delete** function key to remove the entry from the unit.

   OR

3. Press ↩ to cancel your selection, remove any display message, and go back without impacting any profiles.

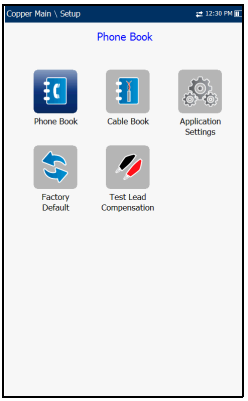
Setup

The Setup function allows you to set up parameters common to all tests.

To access the Setup function:

1. On the **Home** pane, highlight **Copper Test**, then press ✔.
2. From the **Copper Main** page select **Setup** and press ✔.

Setup presents a menu of items to setup copper tests.

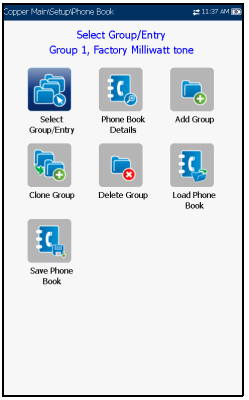


- **Phone Book** includes pages to setup and save groups of phone numbers.
- **Cable Book** includes pages to select, add, clone, and delete a cable, as well as modify its details.
- **Application Settings** include the following pages: **General**, **Standard**, **Identification**, **File Name**, and **Buzzer**. Current settings are kept in memory and are independent of the profiles.
- **Factory Default** allows you to revert the **Phone Book** and/or **Application Settings** to the factory default values.
- **Test Lead Compensation** overwrites the current test lead characteristics to start resistance and capacitance compensation based on the cable temperature of the test lead.

To navigate between the setup icons:

1. Press the up/down left/right arrow keys on the keypad to select an icon.
2. Press ✔ to confirm your selection.

Phone Book



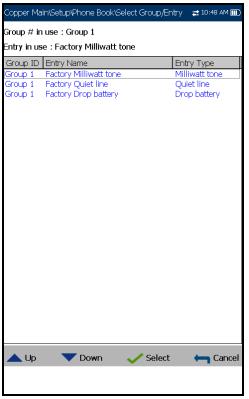
The **Phone Book** menu presents a selection of functions which allow you to manage the groups of phone numbers relevant to performing the copper tests. It can include a maximum of 50 groups of up to 3 individual entries each. The functions are as follow:

- **Select Group/Entry**
- **Phone Book Details**
- **Add Group**
- **Clone Group**
- **Delete Group**
- **Load Phone Book**
- **Save Phone Book**

To navigate between the phone book functions:

1. Press the up/down left/right arrow keys on the keypad to select an icon.
2. Press ✔ to confirm your selection.

Select Group/Entry



The page lists entries by **Group ID** and **Entry Name/Type**. There is 1 group of 3 factory default entries which cannot be edited or deleted. The **Phone Book** can include a maximum of 50 groups.

Group # in use displays the group number in use.

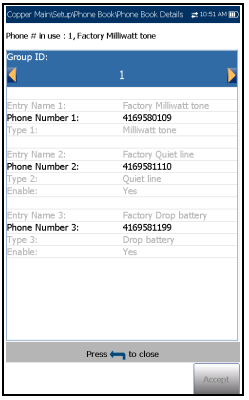
To select a group and entry:

1. Press the up/down arrow keys to highlight the desired entry and press ✔. The **Group # in Use** is updated with the current selection.

   OR

2. Press ↩ to cancel your selection and go back to the **Phone Book** menu.

Phone Book Details



The **Phone Book Details** page allows you to view and modify the **Phone Book** parameters of the currently highlighted phone entry. As well, you can enable/disable entries 2 and 3 in each phone group. When creating a new phone group, only entry 1 is enabled. Entries 2 and 3 remain disabled until entry 1 is filled in.

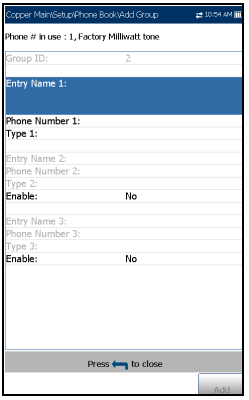
- **Group ID** displays the group ID number. This is the only parameter that cannot be modified however you can navigate between the available phone groups.
- **Entry Name** is the name of the entry in the **Phone Book**.
- **Phone Number** is the 10-digit numeric phone number of the entry.
- **Type** displays the following list of values:
  - **Milliwatt tone**
  - **Drop battery**
  - **Quiet line**
  - **-** (for additional line types)
- **Enable** displays either **Yes** or **No**.
- **Accept** function key validates and updates all the parameters of the **Phone Book**.

To view and modify the group details:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR
3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.
5. Press the **Accept** function key to update the **Phone Book** with your changes.

Add Group



The **Add Group** page allows you to add a new group entry into the **Phone Book** using the following parameters for the currently highlighted **Group ID**.

- **Group ID** displays the group ID number. This parameter that cannot be modified.
- **Entry Name** is the name of the entry in the **Phone Book**.
- **Phone Number** is the 10-digit numeric phone number of the entry.
- **Type** displays the following list of values:
  - **Milliwatt tone**
  - **Drop battery**
  - **Quiet line**
  - **-** (for additional line types)
- **Enable** displays either **Yes** or **No**.
- **Add** function key adds the new group entry to the **Phone Book**.

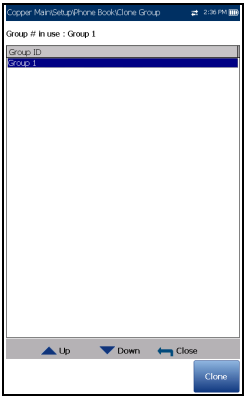
To add a new group entry:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.
5. Press the **Add** function key to append the new group entry to the end of the **Phone Book**. If the maximum number of **Phone Book** entries has been reached, delete an entry before adding a new one.

Clone Group



The **Clone Group** page allows you to copy the details of an existing entry to a new group entry in the **Phone Book**. The page lists all entries by **Group ID**.

The list can display a maximum of 50 entries.

Group # In Use displays the **Group ID** number in use.

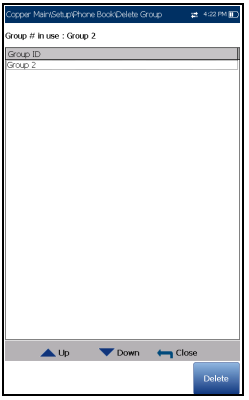
To clone a group entry:

1. Press the up/down arrow keys to highlight the desired entry.
2. Press the **Clone** function key to copy the details of the highlighted entry and append a new **Group ID** to the list.

   OR

3. Press ↩ to cancel your selection and go back to the **Phone Book** menu.

Delete Group



The **Delete Group** page allows you to delete a group entry from the **Phone Book.** The page lists all entries by **Cable ID**.

Group # in Use displays the group number in use.

To delete a group entry:

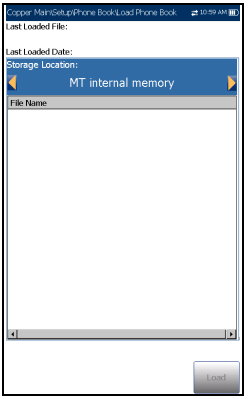
1. Press the up/down arrow keys to select the entry to be removed.
2. Press the **Delete** function key to remove the selected entry from the **Phone Book**. If you try to delete a cable in use, a warning message pops-up and changes the **Group # in Use** to Group 1 by default.

   OR

3. Press ↩ to cancel your selection, remove any display message, and go back without impacting the **Phone Book**.

Load Phone Book

The **Load Phone Book** page allows you to import a phone book. The page displays the file name and date of the last phone book loaded. Only .csv files are supported.



- The **Storage Location** lists the load destinations:
  - **MT Internal Memory**
  - **USB**
- **File Name** lists the phone book file name(s) to load.
- **Load** button imports the selected phone book. You will be prompted for confirmation since this action will overwrite the current phone book.
- **Cancel** button removes the confirmation/warning message without impacting the phone book.

To load a phone book:

1. Select the **Storage Location** using the left/right arrow keys.

   OR

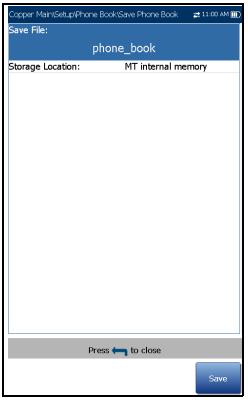
2. Press ✔ to display the list of options.
3. Using the up/down arrow keys, select a file name to load.
4. Press **Load** and confirm. The unit will remove the existing phone book and replace it by the loaded one.

   OR

5. Press **Cancel** to remove the message.

Save Phone Book

The **Save Phone Book** page allows you to save or export a phone book.



- **Save File** allows you to enter a file name of the current phone book to save. By default, the name is phone_book.csv.
- The **Storage Location** lists the save destinations:
  - **MT Internal Memory**
  - **USB**
- **Save** button saves the selected file.

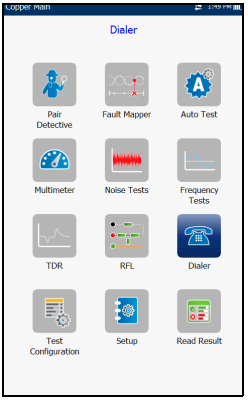
Note: *The unit will overwrite any document with the same file name found on the disk, without warning.*

To save a phone book:

1. Accept the default file name or press ✔ to create a new one using the edit screen.
2. Select a **Storage Location**.
3. Press **Save**.

Dialer Function

The **Dialer** function provides a dial-up path from the MAX-635 to another tester (or quiet termination or silent switchman) through a switched circuit network. DTMF (dual-tone multi-frequency) transmission is enabled via the phone keypad allowing you to place POTS calls. The dialer can be accessed from the **Copper Main** pane and is also integrated into individual test screens to give you quick access to the manual dialer function, speed dial and last dialed lists, without exiting the current test application.

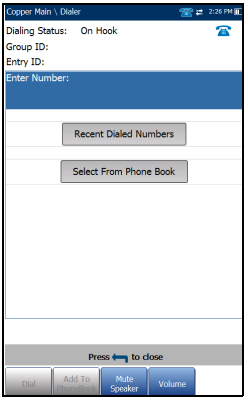


To access the Dialer function:

1. On the **Home** pane use the up/down arrow keys to highlight **Copper Test**, then press ✔.
2. From the **Copper Main** page select **Dialer** and press ✔.

Dialer

The **Dialer** function allows you to use the unit as a telephone (with the built-in speaker or external headset) and the on-screen phone keypad as a dialer when **Enter Number** is invoked, whether in the test results screens or through the separate dedicated **Dialer** application. The following functions can be accessed from this page:

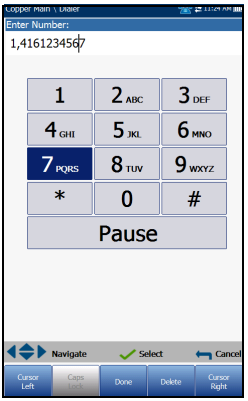


- **Dialing Status** shows the current status of the dialed number.
- **Group ID** displays the group ID number of the dialed number if it was selected from the **Phone Book**.
- **Entry ID** displays the **Entry Name** of the dialed number if it was selected from the **Phone Book**.
- **Enter Number** displays the telephone number entered or selected from the **Recent Dialed Numbers** list or **Phone Book**.
- **Recent Dialed Numbers** button opens a list of recently dialed numbers for selection.
- **Select From Phone Book** button allows you to select a number from the **Phone Book**.
- Function Keys
  - **Dial/Hang Up** allows you to dial the selected or entered number, or hang up the dialer.
  - **Add To PhoneBook** saves the entered number to the **Phone Book**.
  - **Mute/Unmute Speaker** changes the speaker status.
  - **Volume** adjusts the volume level.

To dial a number:

1. Use the up/down arrow keys to highlight an entry or button and press ✔.
2. Enter a new phone number using the on-screen keypad or select an existing one from the lists.
3. Press the Dial function key to start the call.

Enter Number



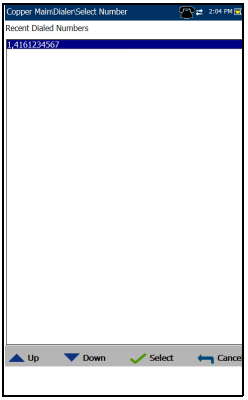
The **Enter Number** box is where you enter the phone number you wish to dial.

To enter a phone number:

1. Press any of the buttons on the key pad by using the navigation keys on the unit and pressing ✔. The selected numbers are entered in the text box.
2. Press **Pause** to enter a 1-second pause while dialing. For example, pressing **Pause** consecutively 3 times, creates a 3-second pause.
3. Move left or right in the text box by using **Cursor Left**/**Right** function keys.
4. Delete a character by moving the cursor to the left of the character and pressing the **Delete** function key.
5. Press **Done** function key when you have completed entering a phone number.

Note: *Alphabets on the key pad are for reference only. Pressing any of the buttons will not show the alpha-character in the text box.*

Recent Dialed Numbers

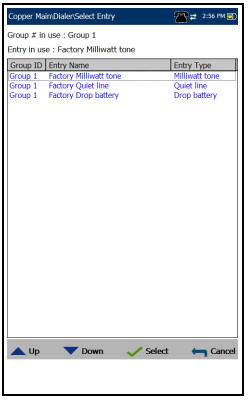


The **Select Number** page lists a maximum of 8 recently dialed telephone numbers which you can select to make your call.

To select a recently dialed number:

1. Use the up/down arrow keys to select an entry.
2. Press ✔ to confirm your choice. The number is automatically entered in the **Enter Number** field of the **Dialer** page.

Select from Phone Book



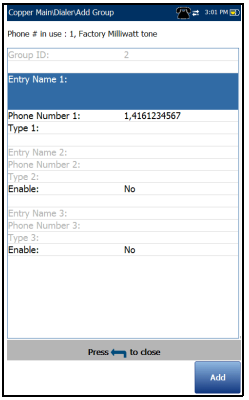
The **Select Entry** read-only page lists entries by **Group ID** and **Entry Name/Type**. There is 1 group of 3 factory default entries. The **Phone Book** can include a maximum of 50 groups.

Group # in Use displays the group number in use.

To select a group and entry:

Press the up/down arrow keys to highlight the desired entry and press ✔. The **Group # in Use** is updated with the current selection and automatically entered in the **Enter Number** field of the **Dialer** page.

Add to Phone Book



The **Add Group** page allows you to add a new group entry into the **Phone Book** using the following parameters for the currently highlighted **Group ID**.

- **Group ID** displays the group ID number. This parameter that cannot be modified.
- **Entry Name** is the name of the entry in the **Phone Book**.
- **Phone Number** is the 10-digit numeric phone number of the entry.
- **Type** displays the following list of values:
  - **Milliwatt tone**
  - **Drop battery**
  - **Quiet line**
  - **-**
- **Enable** displays either **Yes** or **No**.
- **Add** function key adds the new group entry to the **Phone Book**.

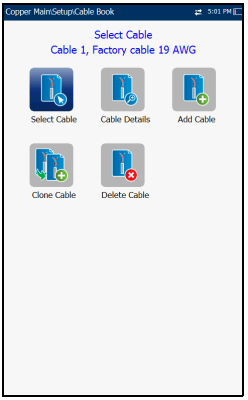
To add a number to the phone book:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR
3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.
5. Press the **Add** function key to append the new group entry to the end of the **Phone Book**. If the maximum number of **Phone Book** entries has been reached, delete an entry before adding a new one.

Cable Book

The **Cable Book** menu allows you to select, add, clone, and delete a cable, as well as modify its details, such as:



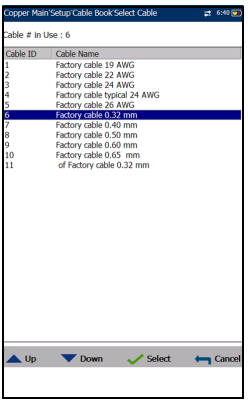
- **Select Cable**
- **Cable Details**
- **Add Cable**
- **Clone Cable**
- **Delete Cable**

To navigate between the cable book functions:

1. Press the up/down left/right arrow keys on the keypad to select an icon.
2. Press ✔ to confirm your selection.

Select Cable

The **Select Cable** page lists entries by **Cable ID** and **Cable Name**. There are a minimum of 10 factory default cable entries which cannot be edited or deleted. The list can display a maximum of 25 entries.



Cable # in Use displays the **Cable ID** number in use.

To select a cable in use:

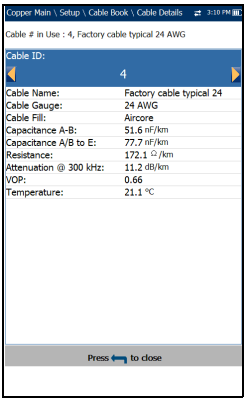
1. Press the up/down arrow keys to highlight the desired entry and press ✔. The **Cable # in Use** is updated with the current selection.

   OR

2. Press ↩ to cancel your selection and go back to the **Cable Book** menu.

Cable Details

The **Cable Details** page allows you to view the cable parameter details of the currently highlighted cable entry.



- **Cable ID** displays the cable ID number.
- **Cable Name** is the name of the cable in the **Cable Book**.
- **Cable Gauge** is the gauge system for measuring wire sizes in AWG (American Wire Gauge) units or mm (metric wire size).
- **Cable Fill** is the type of material the cable is filled with: **Aircore**, **Jelly**, **Pulp**, **5 PR**, or **2 PR**.
- **Capacitance T-R/A-B** specifies a value for the capacitance per length constant.
- **Capacitance T/R to GND/A/B to E** specifies a value for the capacitance per length to ground constant.

- **Resistance** specifies a value for the resistance constant of the cable.
- **Attenuation @ 300 kHz** specifies a value for the reduction in signal strength or insertion loss of the cable.
- **VOP** is the velocity of propagation for the cable as a ratio of the speed of light.
- **Temperature** specifies the temperature of reference at which all cable parameters have been measured, in either F (Fahrenheit) or C (Celsius) units. The measurement units are updated based on the **Temperature** settings in **Setup/Application Settings/Standard**.

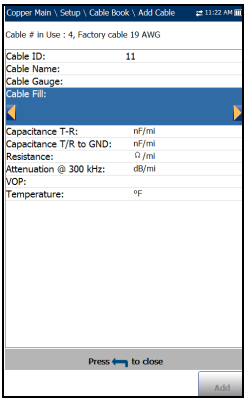
To view and modify the cable details:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR
3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.
5. Press the **Accept** function key to update the cable details with your changes.

Add Cable

The **Add Cable** page allows you to add a new cable entry into the **Cable Book** using the following parameters for the currently highlighted **Cable ID**.



- **Cable ID** displays the cable ID number. This parameter that cannot be modified.
- **Cable Name** is the name of the cable in the **Cable Book**.
- **Cable Gauge** is the gauge system for measuring wire sizes in AWG (American Wire Gauge) units or mm (metric wire size).
- **Cable Fill** allows you to select the type of material the cable can be filled with: **Aircore**, **Jelly**, **Pulp 5, PR**, or **2 PR**.
- **Capacitance T-R/A-B** allows you to specify a value for the capacitance per length constant.
- **Capacitance T/R to GND/A/B to E** allows you to specify a value for the capacitance per length to ground constant.
- **Resistance** allows you specify a value for the resistance constant of the cable.
- **Attenuation @ 300 kHz** allows you to specify a value for the reduction in signal strength or insertion loss of the cable.
- **VOP** allows you to set the velocity of propagation for the cable as a ratio of the speed of light.
- **Temperature** specifies the temperature of reference at which all cable parameters have been measured.
- **Add** function key adds the new cable entry to the **Cable Book**.

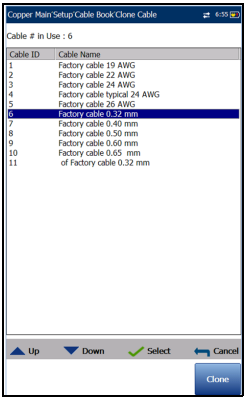
To add a new cable entry:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✓ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✓ to confirm the value.
5. Press the **Add** function key to append the new cable entry to the end of the **Cable Book**. If the maximum number of Cable Book entries has been reached, delete an entry before adding a new one.

Clone Cable



The **Clone Cable** page allows you to copy the cable details of an existing entry to a new cable entry in the **Cable Book**. The page lists all entries by **Cable ID** and **Cable Name**.

The list can display a maximum of 25 entries of which 10 are factory default.

Cable # In Use displays the **Cable ID** number in use.

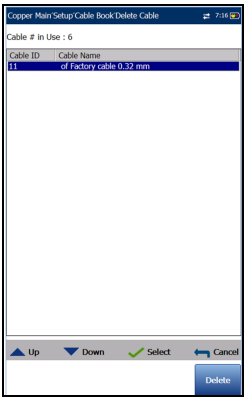
To clone a cable entry:

1. Press the up/down arrow keys to highlight the desired entry.
2. Press the **Clone** function key to copy the details of the highlighted entry and append a new **Cable ID** to the list.

   OR

3. Press ↩ to cancel your selection and go back to the **Cable Book** menu.

Delete Cable



The **Delete Cable** page allows you to delete a cable entry from the **Cable Book.** The page lists all entries, excluding the 10 factory default cable entries, by **Cable ID** and **Cable Name**.

Cable # In Use displays the Cable ID number in use.

To delete a cable entry:

1. Press the up/down arrow keys to highlight the entry to be removed and press ✓.
2. Press the **Delete** function key to remove the entry from the **Cable Book**. If you try to delete a cable in use, a warning message pops-up and changes the **Cable # in Use** to cable #1 by default.

   OR

3. Press ↩ to cancel your selection, remove any display message, and go back without impacting the **Cable Book**.

Application Settings

Before executing the copper tests, set up the software settings and values for the cables. The MAX-635 allows you to save standard parameter settings to different profiles and reuse them as needed.

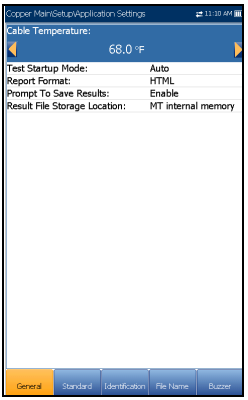
To access Application Settings:

From the **Home** pane, select **Copper Test**, then **Setup,** and **Application Settings**.

The following parameters are available to configure:

General

The **General** tab allows you to configure the unit with specific measurement values.



Each parameter is described below:

- **Temperature** specifies the temperature of the cable under test in either F (Fahrenheit) or C (Celsius) units.
- **Test Startup Mode** lists the test startup type:
  - **Auto** (default) automatically starts a test when you select the respective icon from the test sub-menu pane and press ✔.
  - **Manual** requires that you press the ▮▶ button on the MaxTester keypad to start a test.
- **Report Format** is **HTML** as the generated report format.
- **Prompt To Save Results** allows you to **Enable**/**Disable** popup confirmation messages before leaving a test and not saving results.
- **Result File Storage Location** allows you to select where to save your results: to a **USB** or the internal memory of the MaxTester.

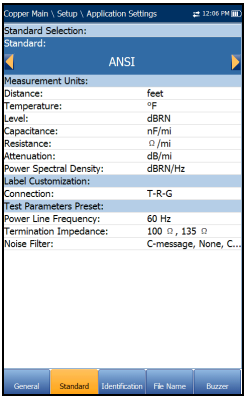
To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR
3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

Standard

The **Standard** tab allows you to set unit parameter values composed of the following:



- **Standard Selection**
  - **Standard** allows you to specify if the copper tests should conform to the ITU (International Telecommunications) or **ANSI** (American National Standards Institute) standard.

Note: *Selecting the **Standard** resets the default **Measurement Units**, **Label Customization**, and **Test Parameters Preset** for the page.*

- **Measurement Units**
  - **Distance** lists the measurement units for distance in feet or meters.
  - **Temperature** lists the measurement units for temperature in **F** (Fahrenheit) or **C** (Celsius).
  - **Level** lists the units of power level in dBm or dBRN.
  - **Capacitance** lists the units of capacitance for Tip and Ring in **(nF/km** or **nF/mi)**.
  - **Resistance** lists the units for resistance in **(Ω/km** or **Ω/mi)**.
  - **Attenuation** lists the units for the reduction in signal strength or insertion loss of the cable, in **(dB/km** or **dB/mi)**.
  - **Power Spectral Density** (PSD) lists the units to measure the noise energy at a point in a noise spectrum. Units are dependent on the previously selected **Level**.
- **Label Customization**
  - **Connection** lists the type of cable connection: **T-R-G** or **A-B-E**.
- **Test Parameters Preset**
  - **Power Line Frequency** lists the frequency value of the power line.
  - **Termination Impedance** lists the values for the impedance of the dummy load connected to the line.
  - **Noise Filter** lists the type of noise filters to use.

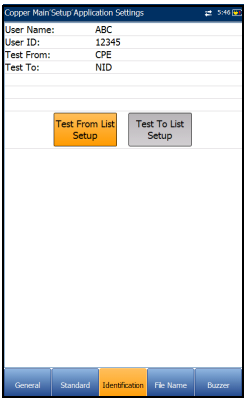
To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options.
4. Press ✔ to confirm the value.

Identification



The **Identification** tab allows you to preset values to identify each single and auto test result file when saving them. The parameters are as follow:

- **User Name/User ID** allow you to enter up to 25 alphanumeric characters, in each field.
- **Test From/To** list the following values: **DSLAM**, **NID**, **CPE**, **CROSSBOX**, **FRAME** - up to 20 entries each, including user defined values.
- **Test From/To List Setup** buttons open separate list management pages.

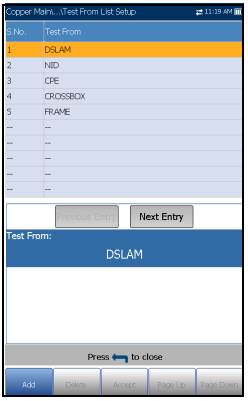
To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

Test List Setup



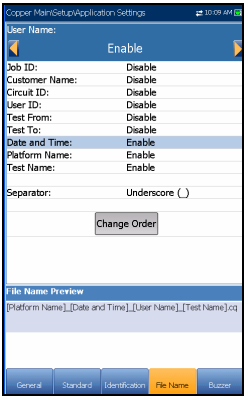
The **Test From List Setup** and **Test To List Setup** pages allow you to manage the entries of the list. However, there are 5 entries by default which cannot be edited or deleted. These are **DSLAM**, **NID**, **CPE**, **CROSSBOX**, and **FRAME**. When any of these are selected, the **Delete** and **Accept** buttons are disabled.

A maximum of 20 different entries can be added.

To manage the list:

1. Press the left/right arrow keys to select the **Previous/Next Entry** buttons and press ✔ to select the previous/next entry.
2. Press **Page Up/Down** function keys to see entries on the previous or next pages. These keys are disabled if no other pages exist.
3. Press **Add** function key to add an entry just below the selected entry in the list.
4. To edit an entry, press the up/down arrow keys to highlight the selected test. Press **Accept** function key to confirm the changes. If you press **Previous/Next Entry** buttons before the **Accept** function key, the edited value will be lost.
5. Press **Delete** function key to delete any entry you have added.

File Name



The **File Name** tab sets up the standard configuration for automatically naming a result file. You can only **Enable**/**Disable** the entries. All enabled entries are considered for file name generation.

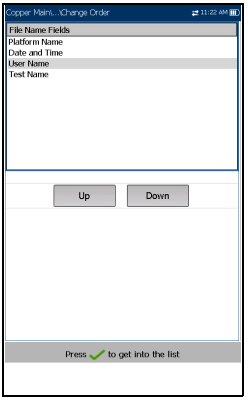
- **File Name Preview** displays a preview of the file name. The actual values of the enabled entries are not shown.
- **Date and Time** value format depends on the format selected in **System Settings**. This entry cannot be disabled.
- **Separator** allows you to choose a value to separate the enabled entries in the file name, e.g.: **Space ( )**, **Dash (-)**, **Underscore (_)**.

To select an entry and choose a value:

1. Press the up/down arrow keys to highlight the desired entry.
2. Press the left/right arrow keys to view and select the options.

   OR
3. Press ✔ on a value to open a list box of options.
4. Press the up/down arrow keys to select the option and press ✔ to confirm your selection.

Change Order

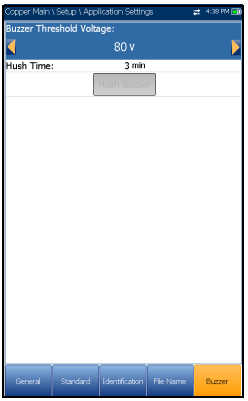


Change Order page allows you to change the order of the entries in the file name.

To change the order:

1. Press ✔ to get into the list.
2. Use the up/down arrow keys to select the desired entry.
3. Press ↩ to come out of the list.
4. Press the up or down arrow key to activate the **Up**/**Down** buttons.
5. Using the left/right arrow keys, select **Up**/**Down** and press ✔ to move the entry up/down the list.
6. Press ↩ to go back to the **File Name** tab. The **File Name Preview** will be updated with your changes.

Buzzer



The **Buzzer** tab allows you to configure values for the buzzer settings. However, due to the risk of electrical shocks, the MaxTester detects high voltages on any pair of leads without user intervention.

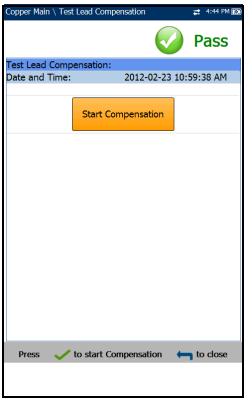
- **Buzzer Threshold Voltage** allows you to configure the hazardous voltage level from 70 to 150 volts.
- **Hush Time** allows you to configure the hush timeout from 1 to 15 minutes.
- **Hush Buzzer** button mutes the sounding buzzer.

Note: *Upon raising the hazardous voltage flag, the MaxTester opens the relays and you will have to press* ▮▶ *to re initialize the unit. In case the voltage is still too high, the MaxTester will open the relays once again preventing any damage to the equipment. If not, the test will start normally.*

To set the buzzer settings:

1. Use the up/down arrow keys to select the desired parameter.
2. Press ✔ on an entry to open the alphanumeric editor screen and use the navigation keys to scroll through.
3. Press ✔ to confirm each value.

Test Lead Compensation



Test lead compensation is required for some of the copper tests so as not to affect data accuracy, since test lead characteristics have some impact on copper test results (mainly resistance, capacitance, and TDR tests). Test lead characteristics vary with respect to cable temperature.

The **Test Lead Compensation** routine allows you to perform resistance and capacitance compensation. The page displays the **Pass/Fail** status of the last compensation done.

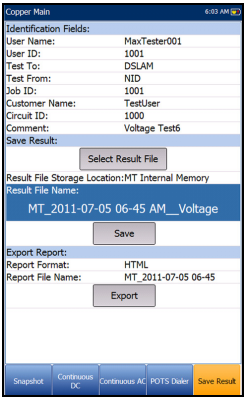
Note: *Always perform a test lead compensation before a new test session with the MaxTester unit.*

- **Date and Time** identifies when the last compensation was done or application installation time.
- **Start Compensation** button allows you to start the **Test Lead Compensation** by overwriting the current test lead characteristics. Connect all test leads to the unit and press ✔ to start compensation.

Saving Results

Save Result

You can save a snapshot of test results into a result file during or after a test performed with the MAX-635. Each copper test includes a **Save Result** tab to do so. The tab allows you to save your test results to an internal memory file or export results to an HTML report using a USB key.



Alternately, when a test is completed or stopped and you press ↩, **Confirm Save** dialogue box pops up. Selecting **Save** displays the **Save Result** screen where the following information can be entered:

- **Identification Fields**
  - **User Name/User ID** display the values set up in the **Application Settings/Identification** tab. You can edit this field using the editor screen.
  - **Test From/To** display the values set up in the **Application Settings/Identification** tab. You can edit this field using the choices from the list box.
  - **Job ID** allows you to create/edit a unique identifier for the task.
  - **Customer Name** is the name of the customer for which the test was run.
  - **Circuit ID** allows you to create/edit a unique identifier for the circuit under test.
  - **Comments** allows you to add any relevant information.
- **Save Result**
  - **Select Result File** button displays a list of existing file names where you can save your results.
  - **Result File Storage Location** gives you the option of storing results either in the MaxTester internal memory or USB device. The default selection comes from **Application Settings/General** tab.
  - **Result File Name** allows you to preview and edit the result file name. The proposed file name is based on current auto-naming parameters configured in Setup/Application Settings/File Name.
  - **Save** button confirms if the **Result File Name** is saved successfully.
- **Export Report**
  - **Report Format** is **HTML**.

    You can generate and export HTML reports from any saved test result. Reports include:

    General Information including **Pass/Fail** status.

    Identification

    Profile/Result Summary

    Blank entries for your **Signature** and the **Date**.

➤ **Report File Name** allows you to preview and edit the result file name. The proposed file name is based on current auto-naming parameters configured in Setup/Application Settings/File Name.

➤ **Export** button confirms if the **Report File Name** is saved successfully. If a USB device is not inserted, the following warning dialogue box appears: **USB device not present**.

To set parameter values and save results:

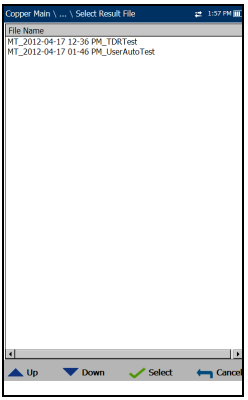
1. Press the left/right and up/down arrow keys to highlight the desired parameter.
2. Press ✔ to display the list or select the value.
3. Press the up/down arrow key to highlight the desired value.

   OR

4. Press the left arrow key to erase the existing value, and then use the alphanumeric keypad to enter a value. To cancel the entry, press ↩.
5. Press ✔ to accept the value.

Select Result File

Select Result File page displays a list of existing file names where you can save your results.

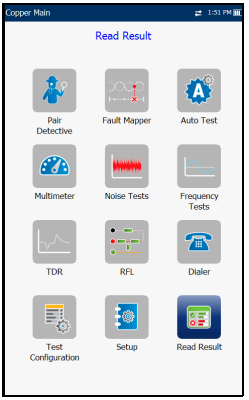


To save your results to an existing File Name:

1. Use the up/down navigation keys to highlight the desired File Name.
2. Press ✔ to confirm your selection.

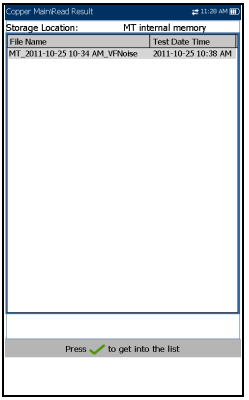
Reading Saved Results

You can view any of your saved results with the Copper and VDSL2/ADSL2+ Multi-play Test Set, by highlighting the **Read Result** icon from the **Copper Main** pane and pressing ✔.



Read Result

The **Read Result** page allows you to select a **File Name** and view the results of files previously saved. The page lists all saved result files by test date and time. The format of **Test Date Time** is per the selection in **System Settings**. Result files can be loaded from either the **MT Internal Memory** or a **USB**.



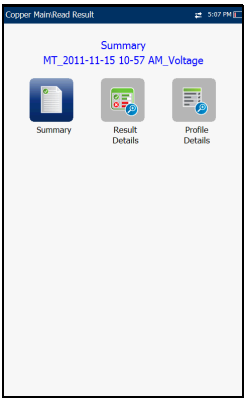
To open previously saved test results:

1. Press the left/right arrow keys to highlight the desired parameter.

   OR

2. Press ✔ to display the list or select the value.
3. Press the down arrow key to highlight the list box and press ✔ to open the list.
4. In the list, press the up/down arrows to select the test results file.
5. Press ✔ to open the result file.

Read Result Menu



The **Read Result** menu allows you to view saved test results with the following details:

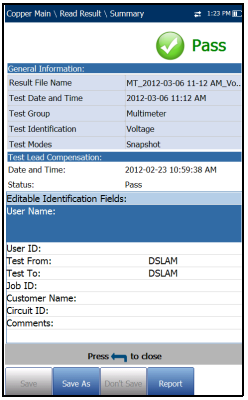
- **Summary** displays general information and parameters of the test.
- **Result Details** displays measured results for each lead combination and cable parameters of the test.
- **Profile Details** displays the thresholds and setup parameters of the test.
- **Phone Book** displays the phone entry dialed during the test.

The **File Name** of the selected saved results file is continually displayed at the top of the page.

To navigate the results menu:

1. Press the up/down left/right arrow keys on the keypad to select an icon.
2. Press ✔ to display the results.

Summary



The results **Summary** page displays pass/fail status, general and identification information, along with comments, for the test.

- **General Information** displays read-only information pertaining to the test result.
  - Result File Name
  - Test Date and Time
  - Test Group
  - Test Identification
  - Test Modes
- **Test Lead Compensation** displays read-only **Date and Time** and **Pass/Fail Status** of the compensated resistance and capacitance based on the cable temperature of the test lead.
- **Editable Identification Fields** display values from the loaded file. You can edit all fields using the editor screen or by selecting an entry from the list box.
  - User Name/ID
  - Test From/To
  - Job ID
  - Customer Name
  - Circuit ID
  - Comments

- On-screen buttons:
  - **Save** keeps any current changes with the current file name.
  - **Save As** saves the current changes under a different file name that you can configure in the editor screen.
  - **Don't Save** does not save any changes and closes the page.
  - **Report** allows you to load a result file, update the ID fields, and generate a report.

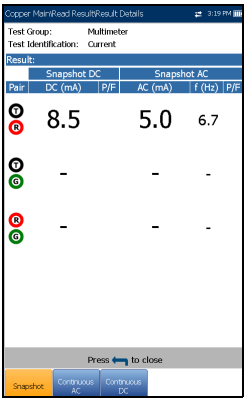
To view and edit the test result information:

1. Press the up/down arrow keys to highlight and view the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR
3. Press ✔ on an editable value to open the list box of options or the alphanumeric editor screen. Use the navigation keys to scroll through and select.
4. Press ✔ to confirm the value.

Result Details

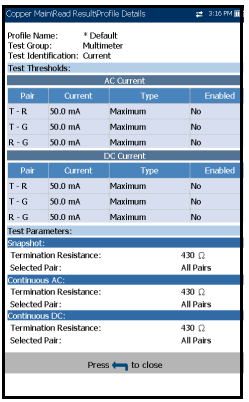
The **Results Details** page allows you to view measured results for each lead combination and cable parameters of the selected test.



Profile Details

The **Profile Details** page displays read-only **Test Thresholds** and **Test Parameters** information about the setup of the selected test.

- **Profile Name** is the file name of the selected saved results.
- **Test Group** is the overall test group of the selected saved results file, for example **Multimeter**.
- **Test Identification** is the test type of the group, for example **Current**.

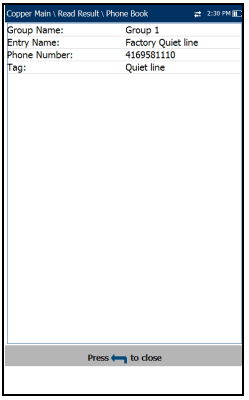


Phone Book

The **Phone Book** page summarizes the Phone Book details when loading a results file.

It contains information about group entries such as group ID, name, phone numbers, and tags.

If the dialer was not used during the test, the **Phone Book** icon will not appear as part of the **Read Result** menu page.



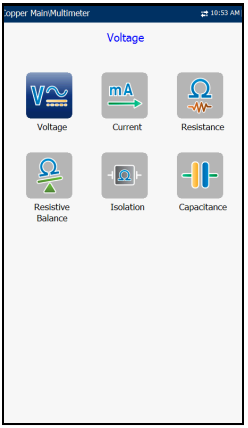
9 Multimeter Tests

The purpose of the multimeter tests function is to detect AC/DC voltages and currents, and measure resistance and capacitance in a loop. These tests allow you to make basic electrical safety checks (AC volts), check for *crossed* or coupled battery voltages, assess basic loop continuity and quality with resistance measurements, and measure total electrical length with capacitance.

To access Multimeter tests:

From the **Copper Main** pane, highlight **Multimeter** and press ✔ to open the Multimeter menu.

Multimeter Main Page



The Multimeter menu allows you to select and run the displayed tests:

- **Voltage**
- **Current**
- **Resistance**
- **Resistive Balance**
- **Isolation**
- **Capacitance/Opens**

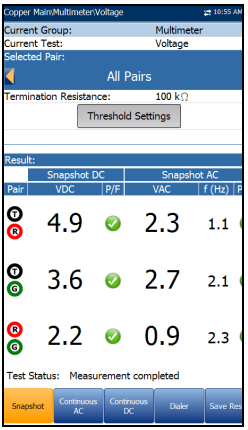
To start/stop a test:

1. Press the up/down left/right arrow keys on the keypad to select the desired test icon.
2. Press ✔ to confirm your selection.
3. The test will start automatically if the **Setup/Application Settings** - **Test Startup Mode** is set to **Auto**. If not, press the ▮▶ button on the keypad.

Voltage

The **Voltage** test detects AC RMS and DC voltages in the line and allows you to measure AC/DC voltages and **Frequency** on A/B/E or T/R/G depending on the selected **Standard** in **Setup/Application Settings**.

Snapshot



The voltage **Snapshot** shows measured volts for each lead combination. The parameters are as follow:

- **Current Group** is the current test group name, for example **Multimeter**.
- **Current Test** displays the test being measured. Here you can switch to another test from the given list. However, this action will terminate the ongoing measurement test.
- **Selected Pair** allows you to select **All Pairs** or a single wire pair for measurement.
- **Termination Resistance** defines how much resistance the tester uses to connect to the line and measure voltages.
- **Threshold Settings** button opens a new page that allows you to set the AC/DC voltage thresholds for each pair.
- **Result** displays a snapshot of the pass/fail status, volts and frequency (Hz) values for each continuous AC/DC pair.
- **Test Status** displays the current state of measurement or an error message.

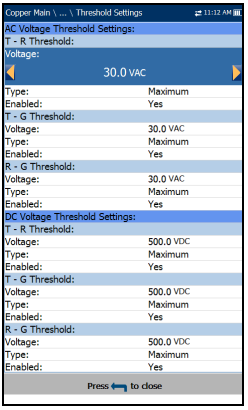
To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options.
4. Press ✔ to confirm the value.

Voltage Thresholds



The **AC/DC Voltage Threshold Settings** page allows you to set the **Threshold Voltage** for each pair.

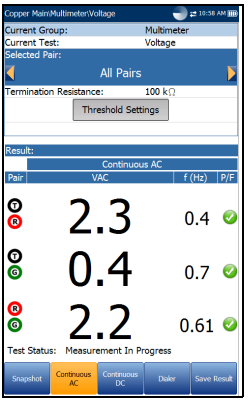
- **Type** is the threshold limit for each pair: either **Maximum** or **Minimum**.
- **Enabled** is a flag to use the voltage threshold: either **Yes** or **No**.

To set threshold values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR
3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

Continuous AC Page



The **Continuous AC** function measures each pair, displaying and updating results in *real time*, until you stop the test. The last valid results then remain displayed.

Continuous AC and **Continuous DC** are run synchronously.

Press the ▮▶ button on the keypad to run the test.

- **Current Group** is the current test group name, for example **Multimeter**.
- **Current Test** displays the test being measured. Here you can switch to another test from the given list. However, this action will terminate the ongoing measurement test.
- **Selected Pair** allows you to select **All Pairs** or a single wire pair for measurement.
- **Termination Resistance** defines how much resistance the tester uses to connect to the line and measure voltages.
- **Threshold Settings** button opens a new page that allows you to set the AC voltage thresholds for each pair.
- **Result** displays a snapshot of the pass/fail status, volts and frequency (Hz) values for each continuous AC pair.
- **Test Status** displays the current state of measurement or an error message.

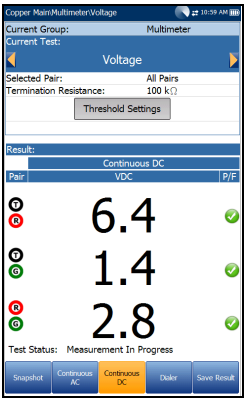
To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options.
4. Press ✔ to confirm the value.

Continuous DC Page



The **Continuous DC** function measures each pair, displaying and updating results in *real time*, until you stop the test. The last valid results then remain displayed.

Continuous AC and **Continuous DC** are run synchronously.

Press the ▮▶ button on the keypad to run the test.

- **Current Group** is the current test group name, for example **Multimeter**.
- **Current Test** displays the test being measured. Here you can switch to another test from the given list. However, this action will terminate the ongoing measurement test.
- **Selected Pair** allows you to select **All Pairs** or a single wire pair for measurement.
- **Termination Resistance** defines how much resistance the tester uses to connect to the line and measure voltages.
- **Threshold Settings** button opens a new page that allows you to set the DC voltage thresholds for each pair.
- **Result** displays a snapshot of the pass/fail status and volts for each continuous DC pair.
- **Test Status** displays the current state of measurement or an error message.

To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

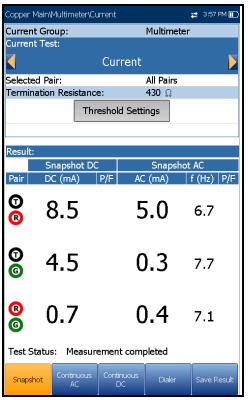
   OR
3. Press ✔ on a value to open a list box of options.
4. Press ✔ to confirm the value.

Current

The **Current** test allows you to measure the AC/DC currents and frequency in the loop.

Snapshot

The current **Snapshot** shows measured AC/DC results for each lead combination. The parameters are as follow:



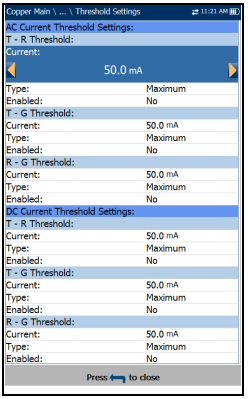
- **Current Group** is the current test group name, for example **Multimeter**.
- **Current Test** displays the test being measured. Here you can switch to another test from the given list. However, this action will terminate the ongoing measurement test.
- **Selected Pair** allows you to select **All Pairs** or a single wire pair for measurement.
- **Termination Resistance** is a read-only value of **430 Ω** that defines how much resistance the tester uses to connect to the line.
- **Threshold Settings** button opens a new page that allows you to set the AC/DC current thresholds for each pair.
- **Result** displays a snapshot of the pass/fail status, DC current, AC current and frequency (Hz) results for each selected wire pair.
- **Test Status** displays the current state of measurement or an error message.

To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR
3. Press ✔ on a value to open a list box of options.
4. Press ✔ to confirm the value.

Current Thresholds



The **AC/DC Current Threshold Settings** page allows you to set the **Threshold Current** for each pair.

- **Type** is the threshold limit for each pair: either **Maximum** or **Minimum**.
- **Enabled** is a flag to use the current threshold: either **Yes** or **No**.

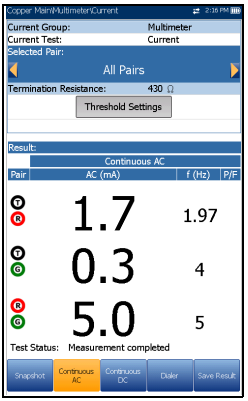
To set threshold values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

Continuous AC Page



The **Continuous AC** function measures each pair, displaying and updating results in *real time*, until you stop the test. The last valid results then remain displayed.

Continuous AC and **Continuous DC** are run synchronously.

Press the ▮▶ button on the keypad to run the test.

- **Current Group** is the current test group name, for example **Multimeter**.
- **Current Test** displays the test being measured. Here you can switch to another test from the given list. However, this action will terminate the ongoing measurement test.
- **Selected Pair** allows you to select **All Pairs** or a single wire pair for measurement.
- **Termination Resistance** is a read-only value of **430 Ω** that defines how much resistance the tester uses to connect to the line.
- **Threshold Settings** button opens a new page that allows you to set the AC current thresholds for each pair.
- **Result** displays a snapshot of the pass/fail status, AC current and frequency (Hz) results for each selected wire pair.
- **Test Status** displays the current state of measurement or an error message.

To select the parameter values:

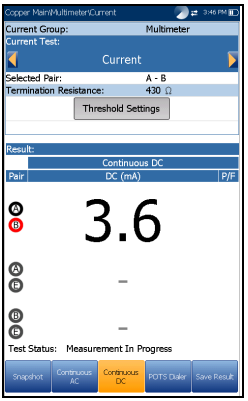
1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options.

4. Press ✔ to confirm the value.

Continuous DC Page



The **Continuous DC** function measures each pair, displaying and updating results in *real time*, until you stop the test. The last valid results then remain displayed.

Continuous AC and **Continuous DC** are run synchronously.

Press the ▮▶ button on the keypad to run the test.

➤ **Current Group** is the current test group name, for example **Multimeter**.

➤ **Current Test** displays the test being measured. Here you can switch to another test from the given list. However, this action will terminate the ongoing measurement test.

➤ **Selected Pair** allows you to select **All Pairs** or a single wire pair for measurement.

➤ **Termination Resistance** is a read-only value of **430 Ω** that defines how much resistance the tester uses to connect to the line.

➤ **Threshold Settings** button opens a new page that allows you to set the DC current thresholds for each pair.

➤ **Result** displays a snapshot of the pass/fail status and DC current results for each selected wire pair.

➤ **Test Status** displays the current state of measurement or an error message.

To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.

2. Press the left/right arrow keys to view and select the options.

OR

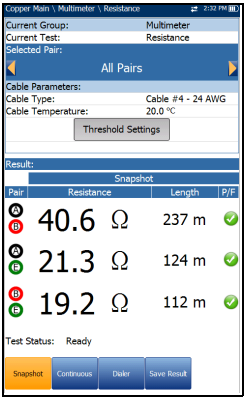
3. Press ✔ on a value to open a list box of options.

4. Press ✔ to confirm the value.

Resistance

The **Resistance** test, also know as shorts, allows you to measure the current resistance value and cable length for line under test.

Snapshot



The resistance **Snapshot** shows measured current resistance values and cable lengths for each lead combination. The parameters are as follow:

- **Current Group** is the current test group name, for example **Multimeter**.
- **Current Test** displays the test being measured. Here you can switch to another test from the given list. However, this action will terminate the ongoing measurement test.
- **Selected Pair** allows you to select **All Pairs** or a single wire pair for measurement.
- **Cable Parameters**:
  - **Cable Type** allows you to select a cable entry (with its associated parameters) from the current Cable Book, to use for testing. The selection is not saved when leaving the test. The current Cable Book entry is shown by default.
  - **Cable Temperature** is the temperature in either degree **C** or **F** of the cable under test.
- **Threshold Settings** button opens a new page that allows you to set resistance thresholds for each pair.
- **Result** displays a snapshot of the pass/fail status, **Resistance** and **Length** for each selected wire pair.
- **Test Status** displays the current state of measurement or an error message.

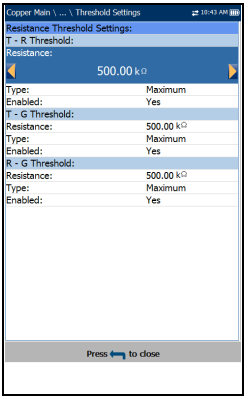
To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options.
4. Press ✔ to confirm the value.

Resistance Thresholds



The **Resistance Threshold Settings** page allows you to set the **Resistance** for each pair.

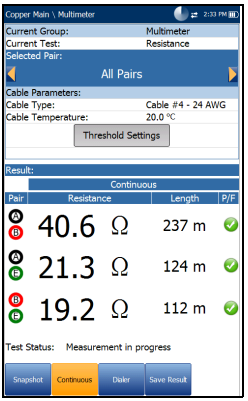
- **Type** is the threshold limit for each pair: either **Maximum** or **Minimum**.
- **Enabled** is a flag to use the current threshold: either **Yes** or **No**.

To set threshold values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR
3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

Continuous



The **Continuous** function measures each pair, displaying and updating results in *real time*, until you stop the test. The last valid results then remain displayed.

- **Current Group** is the current test group name, for example **Multimeter**.
- **Current Test** displays the test being measured. Here you can switch to another test from the given list. However, this action will terminate the ongoing measurement test.
- **Selected Pair** allows you to select **All Pairs** or a single wire pair for measurement.
- **Cable Parameters**:
  - **Cable Type** allows you to select a cable entry (with its associated parameters) from the current Cable Book, to use for testing. The selection is not saved when leaving the test. The current Cable Book entry is shown by default.
  - **Cable Temperature** is the temperature in either degree **C** or **F** of the cable under test.
- **Threshold Settings** button opens a new page that allows you to set the resistance thresholds for each pair.
- **Result** displays a snapshot of the pass/fail status, **Continuous Resistance** and **Length** for each selected wire pair.
- **Test Status** displays the current state of measurement or an error message.

To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

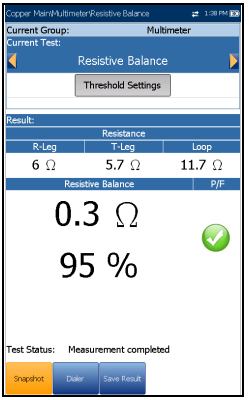
3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

Resistive Balance

The **Resistive Balance** test measures and compares the resistance of each leg. This test requires you to short Tip and Ring (T-R) to ground at the far end (T-R-G short) before proceeding with the test.

Snapshot

The resistive balance **Snapshot** shows results for **R-Leg**, **T-Leg**, **Loop** resistance, and the pass/fail status for **Resistive Balance** in Ω and %. Parameters are as follow:



- **Current Group** is the current test group name, for example **Multimeter**.
- **Current Test** displays the test being measured. Here you can switch to another test from the given list. However, this action will terminate the ongoing measurement test.
- **Threshold Settings** button opens a new page that allows you to set the resistive balance thresholds.
- **Test Status** displays the current state of measurement or an error message.

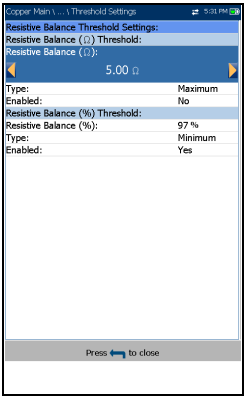
To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options.
4. Press ✔ to confirm the value.

Resistive Balance Threshold Settings



The **Threshold Settings** page allows you to set the **Threshold Resistive Balance** values for the test, in Ω and %.

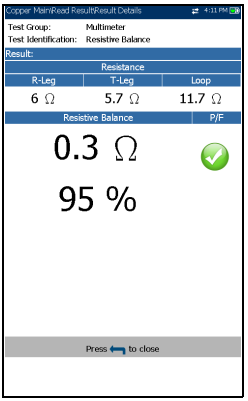
- **Type** is the threshold limit for each pair: either **Maximum** or **Minimum**.
- **Enabled** is a flag to use the current threshold: either **Yes** or **No**.

To set threshold values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

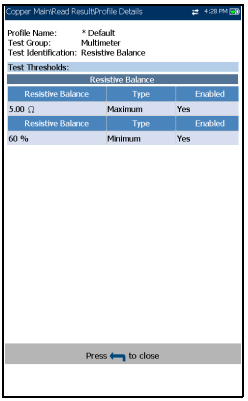
   OR
3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

Result Details



The **Results Details** read-only page displays the **Resistance** results for each lead combination and the pass/fail status for **Resistive Balance** in Ω and %.

Profile Details



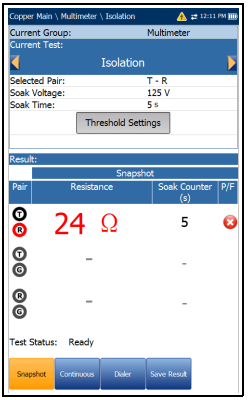
The **Profile Details** page displays read-only **Resistive Balance** thresholds.

- **Profile Name** is the file name of the selected saved results.
- **Test Group** is the overall test group of the selected saved results file, for example **Multimeter**.
- **Test Identification** is the test type of the group, for example **Resistive Balance**.

Isolation

The **Isolation** test, also known as leakage, allows you to run a resistance test over a period of time to look for high-resistive faults. The test, also referred to as a *stress* or *leakage* test, shows how cable resistance may be lowered by applying a high voltage to the pair under test. This method may also reveal poor wiring.

Snapshot



The isolation **Snapshot** shows measured isolation resistance values for each lead combination. The parameters are as follow:

- **Current Group** is the current test group name, for example **Multimeter**.
- **Current Test** displays the test being measured. Here you can switch to another test from the given list. However, this action will terminate the ongoing measurement test.
- **Selected Pair** allows you to select **All Pairs** or a single wire pair for measurement.
- **Soak Voltage** allows you to apply a voltage value to the pair(s) currently under test.
- **Soak Time** sets a soak period of time from 1 to 60 seconds.
- **Threshold Settings** button opens a new page that allows you to set isolation thresholds for each pair.
- **Result** displays a snapshot of the pass/fail status, **Resistance** and a **Soak Counter** for each selected wire pair. When running the test, the counter counts to the selected **Soak Timer** by the second, for the wire pair(s) under test.
- **Test Status** displays the current state of measurement or an error message.

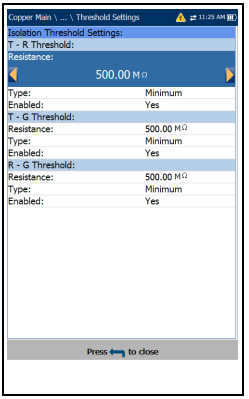
To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

Isolation Thresholds



The **Isolation Threshold Settings** page allows you to set the **Threshold Resistance** for each pair.

- **Type** is the threshold limit for each pair: either **Maximum** or **Minimum**.
- **Enabled** is a flag to use the voltage threshold: either **Yes** or **No**.

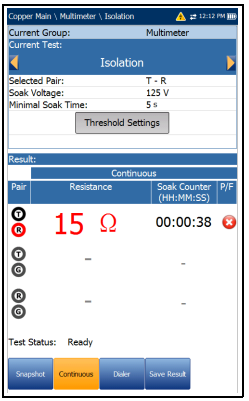
To set threshold values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

Continuous



The **Continuous** function measures each pair, displaying and updating results in *real time*, until you stop the test. The last valid results then remain displayed.

- **Current Group** is the current test group name, for example **Multimeter**.
- **Current Test** displays the test being measured. Here you can switch to another test from the given list. However, this action will terminate the ongoing measurement test.
- **Selected Pair** allows you to select a single wire pair for measurement.
- **Soak Voltage** allows you to apply a voltage value to the pair(s) currently under test.
- **Minimal Soak Time** sets a soak period of time from 1 to 60 seconds. When the test duration reaches the **Minimal Soak Time**, the pass/fail status is displayed and then periodically refreshed, until you stop the test.
- **Threshold Settings** button opens a new page that allows you to set isolation thresholds for each pair.
- **Result** displays a snapshot of the pass/fail status, **Resistance** and a **Soak Counter** for each selected wire pair. While running the test, the counter displays the soak period by the second, for the wire pair(s) under test.
- **Test Status** displays the current state of measurement or an error message.

To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

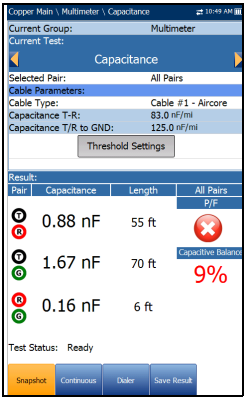
OR

3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

Capacitance/Opens

The **Capacitance/Opens** test measures the capacitance of the loop and calculates length. Capacitive balance is also measured when all pairs are selected.

Snapshot



The capacitance/opens **Snapshot** shows measured **Capacitance** values and **Length** for each lead combination. The parameters are as follow:

- **Current Group** is the current test group name, for example **Multimeter**.
- **Current Test** displays the test being measured. Here you can switch to another test from the given list. However, this action will terminate the ongoing measurement test.
- **Selected Pair** allows you to select **All Pairs** or a single wire pair for measurement.
- **Cable Parameters**:
  - **Cable Type** allows you to select a cable entry (with its associated parameters) from the current Cable Book, to use for testing. The selection is not saved when leaving the test. The current Cable Book entry is shown by default.
  - **Capacitance T-R** displays the capacitance value from Tip to Ring in nF/mi ranging from 10.0 to 500.0.
  - **Capacitance T/R to GND** displays the capacitance value from Tip or Ring to Ground, in nF/mi ranging from 10.0 to 500.0.
- **Threshold Settings** button opens a new page that allows you to set the capacitance/opens threshold for the test.
- **Result** displays a snapshot of the pass/fail status, **Capacitance** and **Length** for each selected wire pair. **Capacitive Balance** is shown in **%** when **All Pairs** are selected.
- **Test Status** displays the current state of measurement or an error message.

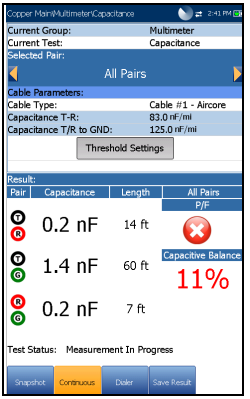
To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

Continuous



The **Continuous** function measures each pair, displaying and updating results in *real time*, until you stop the test. The last valid results then remain displayed.

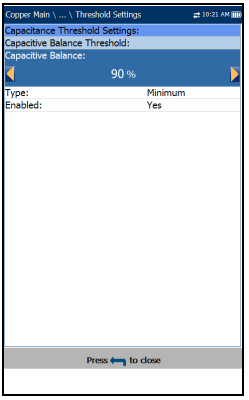
- **Current Group** is the current test group name, for example **Multimeter**.
- **Current Test** displays the test being measured. Here you can switch to another test from the given list. However, this action will terminate the ongoing measurement test.
- **Selected Pair** allows you to select **All Pairs** or a single wire pair for measurement.
- **Cable Parameters**:
  - **Cable Type** allows you to select a cable entry (with its associated parameters) from the current Cable Book, to use for testing. The selection is not saved when leaving the test. The current Cable Book entry is shown by default.
  - **Capacitance T-R** displays the capacitance value from Tip to Ring in nF/mi ranging from 10.0 to 500.0.
  - **Capacitance T/R to GND** displays the capacitance value from Tip or Ring to Ground, in nF/mi ranging from 10.0 to 500.0.
- **Threshold Settings** button opens a new page that allows you to set the capacitance/opens threshold for the test.
- **Result** displays a snapshot of the pass/fail status, **Capacitance** and **Length** for each selected wire pair. **Capacitive Balance** is shown in **%** when **All Pairs** is selected.
- **Test Status** displays the current state of measurement or an error message.

To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR
3. Press ✔ on a value to open a list box of options and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

Capacitance/Opens Threshold Settings



The **Threshold Settings** page allows you to set the **Capacitive Balance Threshold** parameters for the test between 0 and 100 %.

- **Type** is the threshold limit for each pair: either **Maximum** or **Minimum**.
- **Enabled** is a flag to use the current threshold: either **Yes** or **No**.

To set threshold values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

10 SmartR™ Features

SmartR features, consisting of **Pair Detective** and **Fault Mapper**, allow you to determine the condition of the line under test, as well as identify and locate a variety of common circuit faults.

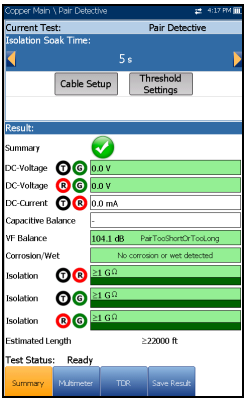
Pair Detective

The **Pair Detective** test consists of a series of 10 consecutive individual tests and applies a high voltage to the line during isolation testing. Before proceeding with this test, ensure the line is inactive.

At the start of any test, the unit checks for the presence of dangerous voltage and an active circuit. If dangerous voltage is detected, a dialog box is displayed to inform you and the test will stop. If an active circuit is detected, a dialog box is displayed to ask you whether or not to proceed with the test.

Summary

The **Summary** page displays a summary of the pass/fail status, **DC-Voltage**/**Current** and **Isolation** for each selected inactive wire pair, as well as other detailed results of the **Pair Detective** test.



Isolation results also display a five-level indicator of the measured isolation.

The **Summary** page allows you to set the following parameters:

- **Isolation Soak Time** sets a soak period of time from 1 to 60 seconds for the **Isolation** test. Default is inherited from **Multimeter Isolation** test.
- **Cable Setup** button opens a new page that allows you to set the **Cable Parameters** for the test.
- **Threshold Settings** button opens a new page that allows you to set the **Pair Detective** threshold parameters.

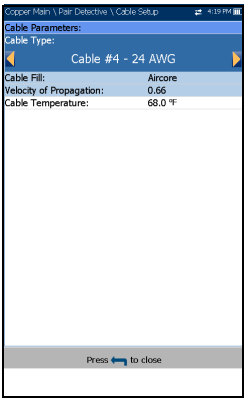
Note: *Individual test parameters can be modified by accessing their respective test pages.*

To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR
3. Press ✔ on a value to open the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

Pair Detective Cable Setup



The **Cable Setup** page allows you to set **Cable Parameters** for the **Pair Detective** test.

- **Cable Type** allows you to select a cable entry (with its associated parameters) from the current **Cable Book**, to use for testing. The selection is not saved when leaving the test. The current Cable Book entry is shown by default.
- **Cable Fill** read-only entry is the type of material the cable is filled with: **Aircore**, **Jelly**, **Pulp**, **5 PR**, or **2 PR**. Setup in the **Cable Book**.
- **Velocity of Propagation** read-only entry is the velocity of propagation for the cable as a ratio of the speed of light. Setup in the **Cable Book**.
- **Cable Temperature** allows you to change the temperature of the cable under test in either degree **C** or **F**.

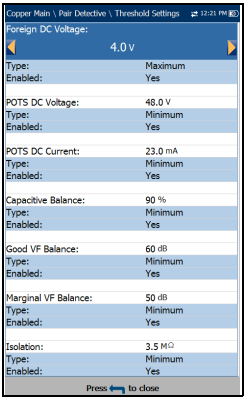
To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

Pair Detective Threshold Settings



The **Threshold Settings** page allows you to set the **Pair Detective Threshold Settings** as follow:

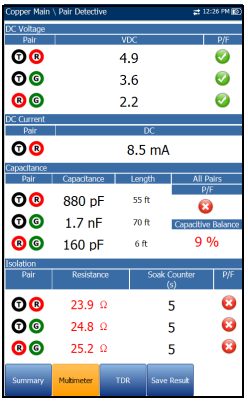
- **Foreign DC Voltage** sets the maximum foreign DC voltage value.
- **POTS DC Voltage** sets the minimum working POTS DC voltage value.
- **POTS DC Current** sets the minimum working POTS DC current value.
- **Capacitive Balance** sets the minimum capacitive balance threshold as a percentage.
- **Good VF/AC Balance** sets the good VF/AC balance threshold.
- **Marginal VF/AC Balance** sets the marginal VF/AC balance threshold.
- **Isolation** sets the isolation resistance threshold.
- **Type** is a read-only field displaying the threshold limit: either **Minimum** or **Maximum**.
- **Enabled** is a read-only field and always **Yes** for all thresholds.

To set threshold values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press ✔ on a value to open the alphanumeric editor screen and use the navigation keys to scroll through.
3. Press ✔ to select each value and use the function keys to complete your selection.
4. Press ↩ to confirm and close your selections.

Multimeter

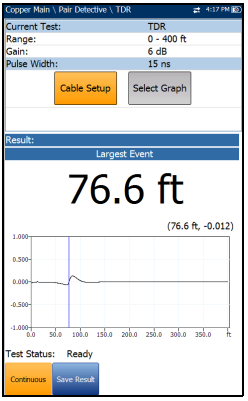
The Pair Detective **Multimeter** page displays read-only results and the **P/F** (pass/fail) status for the following tests:



- **DC Voltage** displays the volts for each DC **Pair**.
- **DC Current** displays the **DC** current results for T-R wire **Pair**.
- **Capacitance** displays **Capacitance** and **Length** for each wire **Pair** as well as **Capacitive Balance** among **All Pairs** in **%**.
- **Isolation** displays **Resistance** and a **Soak Counter** for each wire Pair.

TDR

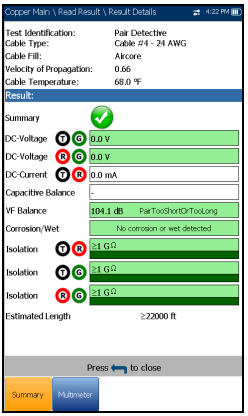
The Pair Detective **TDR** function provides a shortcut to the TDR test. A dialogue box opens, warning that you are about to leave the **Pair Detective** test. TDR results captured while running the Pair Detective test will be available upon loading TDR. Please go to *TDR* on page 125 for information on this test.



Pair Detective Result Details

Summary

The read-only **Summary** page displays the cable parameters and detailed results saved from running the **Pair Detective** test.

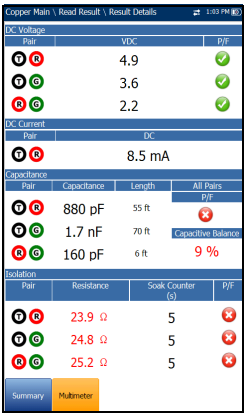


- **Test Identification** is the test type of the group, for example **Pair Detective**.
- **Cable Type** is the cable entry (with its associated parameters) from the current Cable Book, used for testing.
- **Cable Fill** is the type of material the cable is filled with: **Aircore**, **Jelly**, **Pulp**, **5 PR**, or **2 PR**.
- **Velocity of Propagation** is the velocity of propagation for the cable as a ratio of the speed of light.
- **Cable Temperature** is the temperature of the cable under test in either degree C or F.
- **Result** displays a **Summary** of the overall pass/fail status, **DC-Voltage/Current** and **Isolation** for each selected wire pair, as well as other detailed results of the **Pair Detective** test.

  Isolation results also display a five-level indicator of the measured isolation, below **Hard Short**.

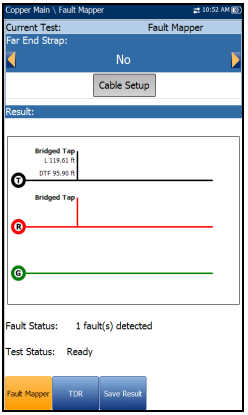
Multimeter

The read-only **Multimeter** page displays detailed results saved from running the **Pair Detective** test. Please refer to Multimeter on page 108 for more information.



Fault Mapper

The **Fault Mapper** test allows you to locate and identify service-affecting line faults using TDR (time domain reflectometry) and RFL (resistance fault locator) technology. This test is useful in locating bridged taps, shorts, grounds, and opens.



- **Current Test** displays the test being measured.
- **Far End Strap** allows you to select option **Yes** or **No** for use of a strap.

  A strap, while not required, enables **Fault Mapper** to calculate distance to a ground/earth fault.
- **Cable Setup** button opens a new page that allows you to set the **Cable Parameters** for the **Current Test**.
- **Result** displays the cable faults in text and graphical format.

Note: *Some displayed resistive faults may be* effective *faults. For example if a strap is present, a T-G short may be shown twice: first as a T-G short and second as an* effective *R-G short. In such cases, the resistance shown is the resistance that would be measured using a multimeter.*

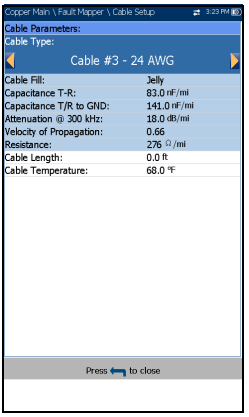
- **Fault Status** displays the number of faults detected (or **No fault detected**) after running the test.
- **Test Status** displays the current state of measurement or an error message.

To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR
3. Press ✔ on a value to open a list box of options.
4. Press ✔ to confirm the value.

Cable Setup



The **Cable Setup** page allows you to set the **Cable Type**, **Cable Length**, and **Cable Temperature** for the Fault Mapper test. All other **Cable Parameters** are read only and correspond to the current cable book entry as selected in **Setup**/**Cable Book**/**Cable Details** page.

- **Cable Type** allows you to select a cable entry (with its associated parameters) from the current **Cable Book**, to use for testing. The selection is not saved when leaving the test. The current **Cable Book** entry is shown by default.
- **Cable Fill** read-only entry is the type of material the cable is filled with: **Aircore**, **Jelly**, **Pulp**, **5 PR**, or **2 PR**.
- **Capacitance T-R/A-B** read-only entry is a value for the capacitance per length constant.
- **Capacitance T/R to GND/A/B to E** read-only entry is a value for the capacitance per length to ground constant.
- **Attenuation @ 300 kHz** read-only entry is a value for the reduction in signal strength or insertion loss of the cable.
- **Velocity of Propagation** read-only entry is the velocity of propagation for the cable as a ratio of the speed of light.
- **Resistance** read-only entry is a value for the resistance constant of the cable.
- **Cable Temperature** allows you to change the temperature of the cable under test in either degree C or F.

To select the parameter values:

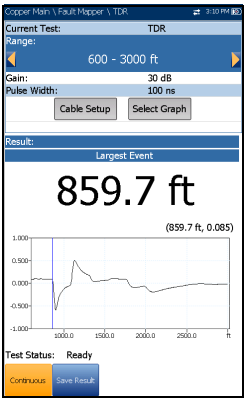
1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

TDR

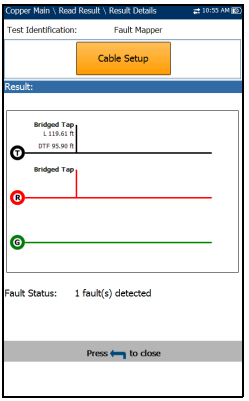
The Pair Detective **TDR** function provides a shortcut to the TDR test. A dialogue box opens, warning that you are about to leave the **Pair Detective** test. TDR results captured while running the Pair Detective test will be available upon loading TDR. Please go to *TDR* on page 125 for information on this test.



Fault Mapper Result Details

The **Result Details** read-only page displays the test results in text and graphical format.

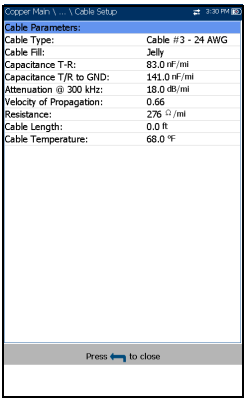
- **Test Identification** is the name of the test, for example **Fault Mapper**.
- **Cable Setup** button opens a new page displaying the cable parameters of the test. Use the left/right arrows to select the button and press ✔ to open the page.
- **Result** displays the cable fault details.



Note: *Some displayed resistive faults may be* effective *faults. For example if a strap is present, a T-G short may be shown twice: first as a T-G short and second as an* effective *R-G short. In such cases, the resistance shown is the resistance that would be measured using a multimeter.*

Result Details Cable Setup

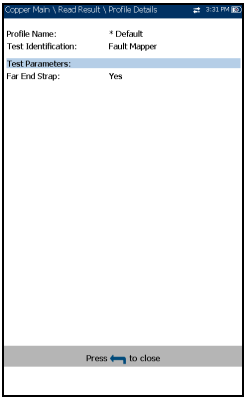
The **Cable Setup** page in the **Result Details** allows you to view the **Cable Parameters** set for the **Fault Mapper** test.



- **Cable Type** is the cable entry (with its associated parameters) from the current **Cable Book**, used for testing.
- **Cable Fill** is the type of material the cable is filled with: **Aircore**, **Jelly**, **Pulp**, **5 PR**, or **2 PR**.
- **Capacitance T-R/A-B** is the value for the capacitance per length constant.
- **Capacitance T/R to GND/A/B to E** is the value for the capacitance per length to ground constant.
- **Attenuation @ 300 kHz** is the value for the reduction in signal strength or insertion loss of the cable.
- **Velocity of Propagation** is the velocity of propagation for the cable as a ratio of the speed of light.
- **Resistance** is the value for the resistance constant of the cable.
- **Cable Temperature** is the temperature of the cable under test in either degree C or F.

Fault Mapper Profile Details

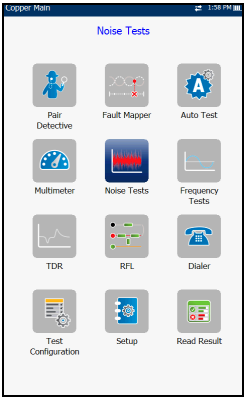
The **Profile Details** page displays read-only Fault Mapper **Test Parameters**.



- **Profile Name** is the file name of the selected saved results.
- **Test Identification** is the test type of the group, for example **Fault Mapper**.

11 Noise Tests

The purpose of the noise tests is to perform VF (voice frequency)/WB (wideband) noise and level measurements.

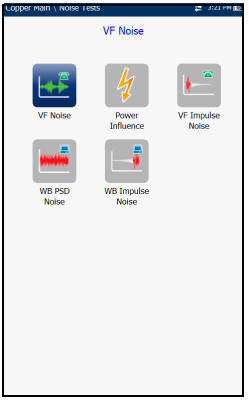


Note: *The 30 MHz Wideband Testing software option is required for the WB tests to be available.*

To access noise tests:

From the **Copper Main** pane, highlight **Noise Tests** and press ✔ to open the menu.

Noise Tests Main Page



The **Noise Tests** menu allows you to select and run the displayed tests:

- **VF Noise**
- **Power Influence**
- **VF Impulse Noise**
- **WB PSD Noise**
- **WB Impulse Noise**

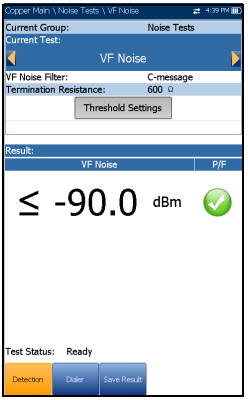
To start/stop a test:

1. Press the up/down left/right arrow keys on the keypad to select the desired test icon.
2. Press ✔ to confirm your selection.
3. The test will start automatically if the **Setup/Application Settings** - **Test Startup Mode** is set to **Auto**. If not, press ▮▶ on the keypad.

VF Noise

The **VF Noise** test allows you to measure the amount of unwanted or disturbing energy introduced into a loop from man-made and natural sources.

Detection



The **Detection** function displays and updates results in *real time*, until you stop the test. The last valid results then remain displayed.

- **Current Group** is the current test group name, for example **Noise**.
- **Current Test** displays the test being measured. Here you can switch to another test from the given list. However, this action will terminate the ongoing measurement test.
- **VF Noise Filter** allows you to define the voice frequency noise filter to be used, dependent on **ITU** or **ANSI Standard** mode and Noise Filter set in **Setup/Application Settings**.
- **Termination Resistance** is a read-only value of **600 Ω**.
- **Threshold Settings** button opens a new page that allows you to set the VF Noise threshold.
- **Result** displays the pass/fail status and **VF Noise** value.
- **Test Status** displays the current state of measurement or an error message.

Note: *The selected VF Noise Filter shown in addition to the current Level units selected in Setup/Application Settings have an influence on the measurement units displayed on this page.*

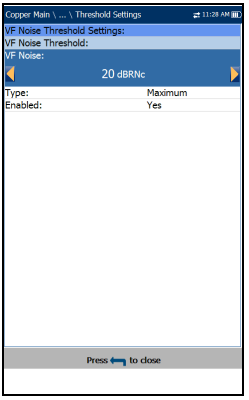
To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options.
4. Press ✔ to confirm the value.

VF Noise Threshold Settings



The **Threshold Settings** page allows you to set the **Threshold VF Noise** values for the test.

- **Type** is the threshold limit: either **Maximum** or **Minimum**.
- **Enabled** is a flag to use the current threshold: either **Yes** or **No**.

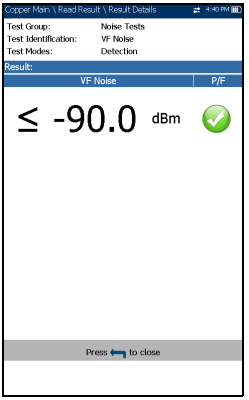
To set threshold values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

Result Details

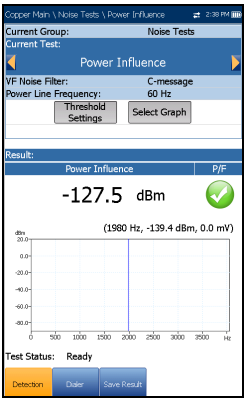


The **Results Details** read-only page displays the **VF Noise** value and the pass/fail status.

Power Influence

The Power Influence test allows you to view the effects of interference from a 50 Hz or 60 Hz power source (AC mains) on the circuit under test. The results of the power influence test are also in graphical form.

Detection



The **Detection** function displays and updates results in *real time*, until you stop the test. The last valid results then remain displayed.

- **Current Group** is the current test group name, for example **Noise**.
- **Current Test** displays the test being measured. Here you can switch to another test from the given list. However, this action will terminate the ongoing measurement test.
- **VF Noise Filter** allows you to define the voice frequency noise filter to be used, dependent on **ITU** or **ANSI Standard** mode and Noise Filter set in **Setup/Application Settings**.
- **Power Line Frequency** is a read-only value of 50 or 60 Hz based on frequency selected in **Setup/Application Settings/Standard.**
- **Threshold Settings** button opens a new page that allows you to set the power influence thresholds.
- **Select Graph** button changes to **Graph Selected** when pressed and opens a new selection of function keys which allow you to maneuver the graph as follows:
  - **Cursor** - press the left/right arrow keys to decrease/increase the values by moving the cursor. Press and hold the left/right arrow keys to accelerate the cursor. Press ✔ to recall the cursor and place it in the middle of the current x-axis limits.
  - **Zoom** references the middle of the x/y axis and *not* the cursor position. Press the arrow keys as follows:

    Right = x-axis zoom in.

    Left = x-axis zoom out.

    Up = y-axis zoom in.

    Down = y-axis zoom out.
  - **Pan** - use left/right arrow keys to pan the x-axis and the up/down arrow keys to pan the y-axis.
  - **1:1** resets the x-axis and y-axis limits to full scale.
  - **Return To Test** removes these function keys and displays the **Detection** page.
- **Result** displays a value and graph of the **Power Influence** measurement, and pass/fail status.
- **Test Status** displays the current state of measurement or an error message.

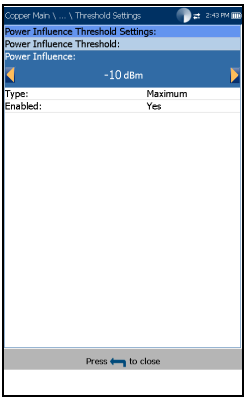
To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options.
4. Press ✔ to confirm the value.

Power Influence Threshold Settings



The **Threshold Settings** page allows you to set the **Threshold Power Influence** values for the test.

- **Type** is the threshold limit: either **Maximum** or **Minimum**.
- **Enabled** is a flag to use the current threshold: either **Yes** or **No**.

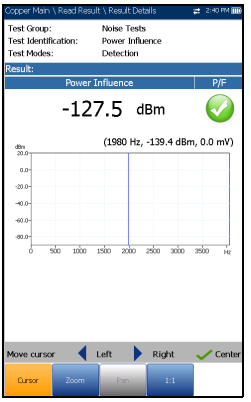
To set threshold values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

Result Details



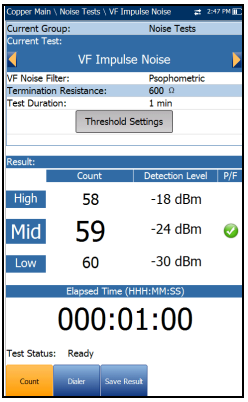
The **Result Details** read-only page displays the **Power Influence** value and graph, and the pass/fail status.

VF Impulse Noise

The **VF Impulse Noise** test allows you to measure voice frequency impulse noise on the circuit under test.

Count

The **Count** function displays and updates results in *real time*, for the length of time set in **Test Duration** or less if you stop the test. The last valid results then remain displayed.



- **Current Group** is the current test group name, for example **Noise Tests**.
- **Current Test** displays the test being measured. Here you can switch to another test from the given list. However, this action will terminate the ongoing measurement test.
- **VF Noise Filter** allows you to define the voice frequency noise filter to be used, dependent on **ITU** or **ANSI Standard** mode and **Noise Filter** set in **Setup/Application Settings**.
- **Termination Resistance** is a read-only value of **600 Ω**.
- **Test Duration** allows you to set the length of time to run the test from a list of values.
- **Threshold Settings** button opens a new page that allows you to set the VF impulse noise thresholds.
- **Result** displays the **High**, **Mid**, **Low** counts, respective detection levels, and **Elapsed Time**. The pass/fail status of the **Mid** level is displayed after 1 s and then periodically refreshed, until you stop the test.
- **Test Status** displays the current state of measurement or an error message.

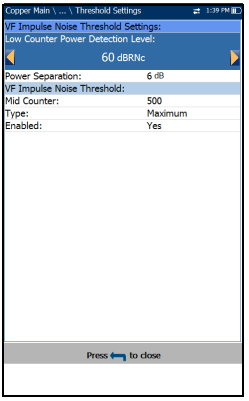
To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR
3. Press ✔ on a value to open a list box of options.
4. Press ✔ to confirm the value.

VF Impulse Noise Threshold Settings

The **Threshold Settings** page allows you to set the **VF Impulse Noise Threshold** values for the test.



- **Low Counter Power Detection Level** defines the low threshold limits for the impulse noise test.
- **Power Separation** defines the level difference between the **Low**, **Mid**, and **High** thresholds. Specify a value between 1 and 6 dB.
- **Mid Counter** allows you to set the threshold value for this counter.
- **Type** is the threshold limit of the **Mid Counter**: either **Maximum** or **Minimum**.
- **Enabled** is a flag to use the current **Mid Counter** threshold: either **Yes** or **No**.

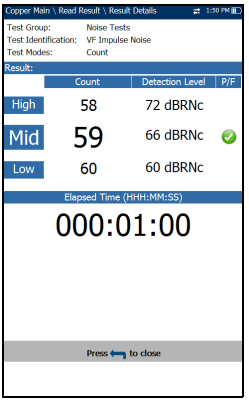
To set threshold values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR
3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

Result Details

The **Results Details** read-only page displays the **High**, **Mid**, **Low VF Impulse Noise Count** and **Detection Level** values, and the pass/fail status of the **Mid** level.

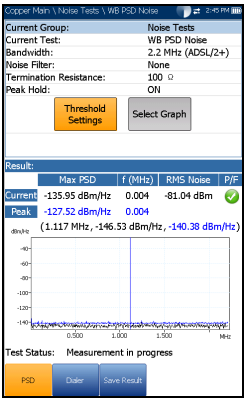


WB PSD Noise

The wideband power spectral density (PSD) noise test measures the noise energy at a point in a noise spectrum. It is expressed as power per hertz at a point in a noise spectrum.

PSD

The **PSD** page allows you to configure the parameters for the wideband PSD noise test and view the results.



- **Current Group** is the current test group name, for example **Noise Tests**.
- **Current Test** displays the test being measured. Here you can switch to another test from the given list. However, this action will terminate the ongoing measurement test.
- **Bandwidth** sets the frequency range for the test.
- **Noise Filter** defines the filter currently enabled. Options are: **None**, **ISDN-E**, **HDSL-F**, **ADSL-G**, **ADSL**, **ADSL2+**, **VDSL**, **VDSL2-8**, **VDSL2-12**, **VDSL2-17**, **VDSL2-30**.
- **Termination Resistance** defines the resistance of the dummy load connected to the line.
- **Peak Hold** allows you to measure the current PSD noise value, compare it against the peak value at each given frequency, and display the maximum value. Select either **ON** or **OFF**.
- **Threshold Settings** button opens a new page that allows you to set the **RMS Noise Threshold** parameters for the test.
- **Select Graph** button changes to **Graph Selected** when pressed and opens a new selection of function keys which allow you to maneuver the graph as follows:
  - **Cursor** - press the left/right arrow keys to decrease/increase the values by moving the cursor. Press and hold the left/right arrow keys to accelerate the cursor. Press ✔ to recall the cursor and place it in the middle of the current x-axis limits.
  - **Zoom** references the middle of the x/y axis and *not* the cursor position. Press the arrow keys as follows:

    Right = x-axis zoom in.

    Left = x-axis zoom out.

    Up = y-axis zoom in.

    Down = y-axis zoom out.
  - **Pan** - use left/right arrow keys to pan the x-axis and the up/down arrow keys to pan the y-axis.
  - **1:1** resets the x-axis and y-axis limits to full scale.
  - **Return To Test** removes these function keys and displays the **Detection** page.

- **Result** displays the following wideband PSD noise test results differentiating the **Current** trace from the **Peak** hold.
  - **RMS Noise** reading for the **Current** results including a pass/fail status.
  - **Max PSD** reading among all frequency bins for the **Current** results.
  - Frequency bin where **Max PSD** for the **Current** results are detected.

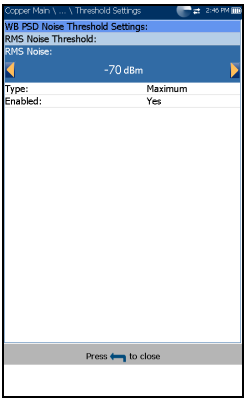
  If **Peak Hold** is **ON**:
  - **Max PSD Peak** reading among all frequency bins.
  - Frequency bin for **Max PSD Peak**.
- **Test Status** displays the current state of measurement or an error message.

To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR
3. Press ✔ on a value to open a list box of options and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

WB PSD Noise Threshold Settings



The **Threshold Settings** page allows you to set the **RMS Noise Threshold** parameters for the test.

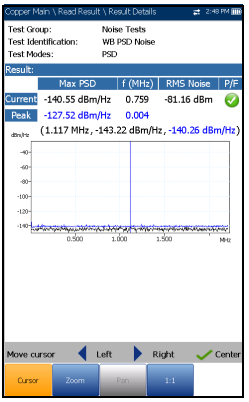
- **Type** is the threshold limit for each pair: either **Maximum** or **Minimum**.
- **Enabled** is a flag to use the current threshold: either **Yes** or **No**.

To set threshold values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR
3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

Result Details



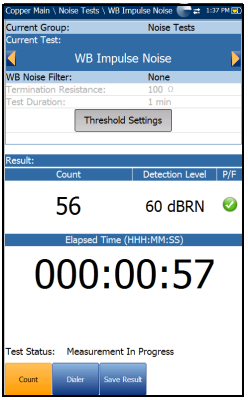
The **Results Details** read-only page displays the **WB PSD Noise** test results, in text and graphical format. You can maneuver the graph as follows:

- **Cursor** - press the left/right arrow keys to decrease/increase the values by moving the cursor. Press and hold the left/right arrow keys to accelerate the cursor. Press ✔ to recall the cursor and place it in the middle of the current x-axis limits.
- **Zoom** references the middle of the x/y axis and *not* the cursor position. Press the arrow keys as follows:
  - Right = x-axis zoom in.
  - Left = x-axis zoom out.
  - Up = y-axis zoom in.
  - Down = y-axis zoom out.
- **Pan** - use left/right arrow keys to pan the x-axis and the up/down arrow keys to pan the y-axis.
- **1:1** resets the x-axis and y-axis limits to full scale.

WB Impulse Noise

The wideband impulse noise test allows you to measure impulse noise on the circuit under test.

Count



The **Count** function displays and updates results in *real time*, for the length of time set in **Test Duration** or less if you stop the test. The last valid results then remain displayed.

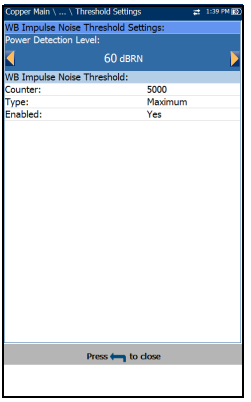
- **Current Group** is the current test group name, for example **Noise Tests**.
- **Current Test** displays the test being measured. Here you can switch to another test from the given list. However, this action will terminate the ongoing measurement test.
- **WB Noise Filter** displays the filter currently enabled. Options are: **None**, **ISDN-E**, **HDSL-F**, **ADSL-G**, **ADSL**, **ADSL2+**, **VDSL**, **VDSL2-8**, **VDSL2-12**, **VDSL2-17**, **VDSL2-30**.
- **Termination Resistance** lists the resistance of the dummy load connected to the line.
- **Test Duration** allows you to set the length of time to run the test from a list of values.
- **Threshold Settings** button opens a new page that allows you to set the **Power Detection Level** and **WB Impulse Noise** thresholds.
- **Result** displays the **Count**, **Detection Level**, **Elapsed Time**, and pass/fail status which is periodically refreshed, until you stop the test.
- **Test Status** displays the current state of measurement or an error message.

To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR
3. Press ✔ on a value to open a list box of options and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

WB Impulse Noise Threshold Settings



The **Threshold Settings** page allows you to set the **WB Impulse Noise Threshold** values for the test.

- **Power Detection Level** defines the threshold limits.
- **Counter** allows you to set the threshold value for this counter.
- **Type** is the threshold limit for each pair: either **Maximum** or **Minimum**.
- **Enabled** is a flag to use the current threshold: either **Yes** or **No**.

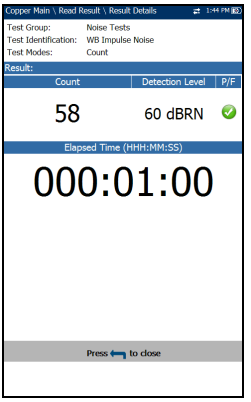
To set threshold values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

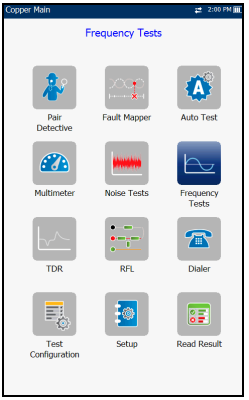
Result Details



The **Results Details** read-only page displays the **WB Impulse Noise Count, Detection Level**, and pass/fail status.

12 Frequency Tests

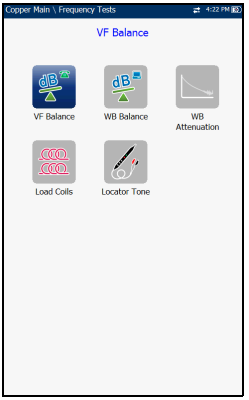
The purpose of the frequency tests is to perform VF (voice frequency) and WB (wide band) level measurements, calculate the reduction of signal strength during transmission, measure the balance of a circuit, count and detect the presence of load coils.



To access frequency tests:

From the **Copper Main** pane, highlight **Frequency Tests** and press ✔ to open the menu.

Frequency Tests Main Page



The **Frequency Tests** menu allows you to select and run the displayed tests:

- **VF/AC Balance**
- **WB Balance**
- **WB Attenuation**
- **Load Coils**
- **Locator Tone**

To start/stop a test:

1. Press the up/down left/right arrow keys on the keypad to select the desired test icon.
2. Press ✔ to confirm your selection.
3. The test will start automatically if the **Setup/Application Settings - Test Startup Mode** is set to **Auto**. If not, press ▮▶ on the keypad.

VF/AC Balance

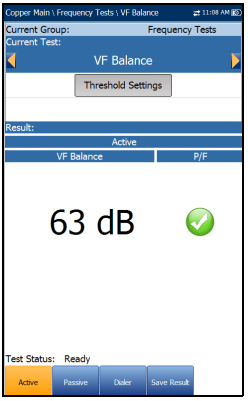
The VF/AC Balance test allows you to check that the VF longitudinal balance ratio for the twisted pair complies with applicable standards so as to reduce the effects of common-mode voltage to ground. The test is a measurement of how much the T/A leg is like the R/B leg in electrical characteristics, measured by how much noise the line can mitigate (in dB). It is an overall health indicator and a quick way to tell if the line is in good condition. The better the longitudinal balance of the cable pair, the higher the dB reading.

The name of the frequency test depends on the selected **Standard**:

- **ANSI**: **VF Balance**
- **ITU**: **AC Balance**

Active

The **Active** function takes a balance measurement, displaying and updating results in *real time*, until you stop the test. The last valid results then remain displayed.



- **Current Group** is the current test group name, for example **Frequency Tests**.
- **Current Test** displays the test being measured. Here you can switch to another test from the given list. However, this action will terminate the ongoing measurement test.
- **Threshold Settings** button opens a new page that allows you to set the **VF/AC Balance** threshold.
- **Result** displays the pass/fail status and **Active VF/AC Balance** value.
- **Test Status** displays the current state of measurement or an error message.

Note: *The selected **Standard** in **Setup**/**Application Settings** determines the name of the frequency test - **ANSI**: **VF Balance**, **ITU**: **AC Balance**.*

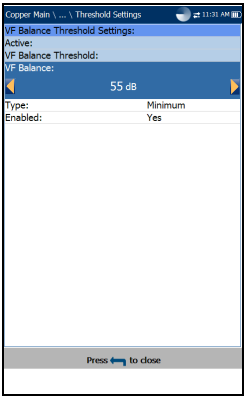
To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options.
4. Press ✔ to confirm the value.

VF/AC Balance Active Threshold Settings



The **Threshold Settings** page allows you to set the **Active VF/AC Balance Threshold** values for the test.

- **VF/AC Balance** sets the active balance threshold.
- **Type** is the threshold limit: either **Maximum** or **Minimum**.
- **Enabled** is a flag to use the current threshold: either **Yes** or **No**.

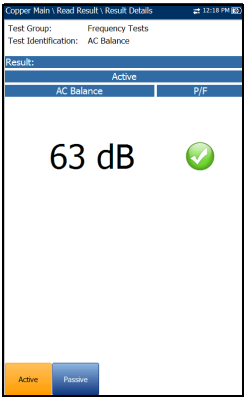
To set threshold values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

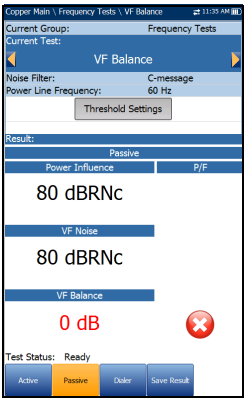
Active Result Details



The **Active Results Details** read-only page displays the **VF/AC Balance** value and the pass/fail status.

Passive

The **Passive** function computes the passive balance as the difference between **Power Influence** and **VF Noise**, displaying and updating results in *real time*, until you stop the test. The last valid results then remain displayed. The measurement results of the active and passive VF Longitudinal Balance tests will generally be different due to the fact they use different measurement techniques.



- **Current Group** is the current test group name, for example **Frequency Tests**.
- **Current Test** displays the test being measured. Here you can switch to another test from the given list. However, this action will terminate the ongoing measurement test.
- **Noise Filter** displays the type of noise filter used.
- **Power Line Frequency** displays the frequency value of the power line.
- **Threshold Settings** button opens a new page that allows you to set the **VF/AC Balance Threshold**.
- **Result** displays the **Passive** pass/fail status, **Power Influence**, **VF Noise**, and **VF/AC Balance** values.
- **Test Status** displays the current state of measurement or an error message.

Note: *The selected **Standard** in **Setup**/**Application Settings** determines the name of the frequency test - **ANSI**: **VF Balance**, **ITU**: **AC Balance**.*

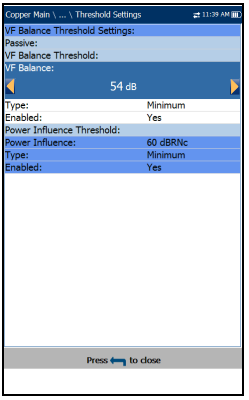
To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options.
4. Press ✔ to confirm the value.

VF/AC Balance Passive Threshold Settings



The **Threshold Settings** page allows you to set the **Passive VF/AC Balance Threshold** values for the test.

- **VF/AC Balance** sets the passive balance threshold.
- **Type** is the threshold limit: either **Maximum** or **Minimum**.
- **Enabled** is a flag to use the current threshold: either **Yes** or **No**.
- **Power Influence Threshold** displays the **Power Influence** threshold values set in relation to **VF/AC Balance** threshold values.

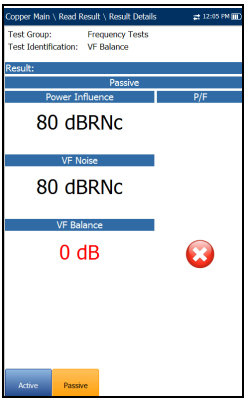
To set the passive VF/AC balance threshold values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

Passive Result Details

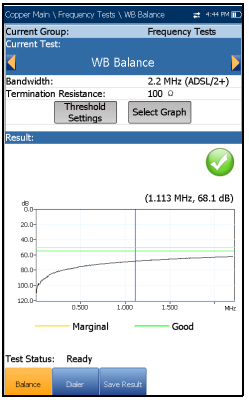


The **Passive Results Details** read-only page displays the **Passive** pass/fail status, **Power Influence**, **VF Noise**, and **VF/AC Balance** values.

WB Balance

The wideband balance test ensures that the balance ratio for the twisted pair complies with applicable standards so as to reduce the effects of common-mode voltage to ground. The better the balance of the cable pair, the higher the dB reading.

Balance



The **Balance** page allows you to allows you to configure the parameters for the **WB Balance** test and view the results.

- **Current Group** is the current test group name, for example **Frequency Tests**.
- **Current Test** displays the test being measured. Here you can switch to another test from the given list. However, this action will terminate the ongoing measurement test.
- **Bandwidth** sets the frequency range for the test.
- **Termination Resistance** defines the resistance of the dummy load connected to the line.
- **Threshold Settings** button opens a new page that allows you to set the **WB Balance Thresholds**.
- **Select Graph** button changes to **Graph Selected** when pressed and opens a new selection of function keys which allow you to maneuver the graph as follows:
  - **Cursor** - press the left/right arrow keys to decrease/increase the values by moving the cursor. Press and hold the left/right arrow keys to accelerate the cursor. Press ✔ to recall the cursor and place it in the middle of the current x-axis limits.
  - **Zoom** references the middle of the x/y axis and *not* the cursor position. Press the arrow keys as follows:

    Right = x-axis zoom in.

    Left = x-axis zoom out.

    Up = y-axis zoom in.

    Down = y-axis zoom out.
  - **Pan** - use left/right arrow keys to pan the x-axis and the up/down arrow keys to pan the y-axis.
  - **1:1** resets the x-axis and y-axis limits to full scale.
  - **Return To Test** removes these function keys and displays the **Detection** page.
- **Result** displays a graph of the **Marginal** and **Good** balance results, and pass/fail status.
- **Test Status** displays the current state of measurement or an error message.

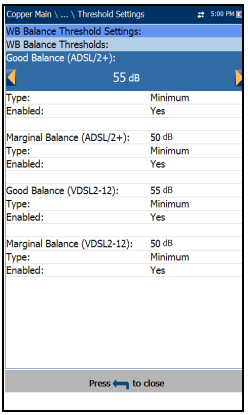
To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options.
4. Press ✔ to confirm the value.

WB Balance Threshold Settings



The **Threshold Settings** page allows you to set the **Good/Marginal Balance** thresholds for both **ADSL/2+** and **VDSL2-12**.

➤ **Type** is the threshold limit: either **Maximum** or **Minimum**.

➤ **Enabled** is a flag to use the current threshold: either **Yes** or **No**.

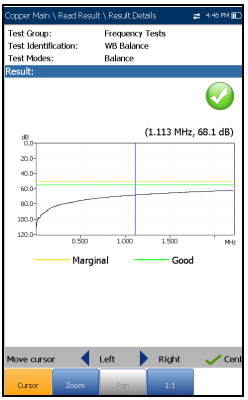
To set threshold values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

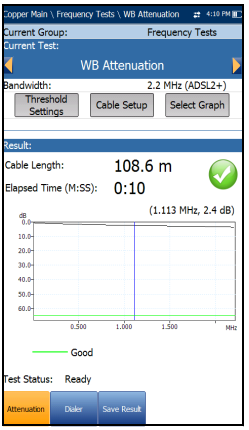
Result Details



The **Results Details** read-only page displays a graph of the **Marginal** and **Good** wideband balance results, and pass/fail status.

WB Attenuation

Attenuation



The WB (wideband) single-ended attenuation test allows you to calculate the dissipation of power of a transmitted signal as it travels over the copper line. This test is performed from one end of the cable and does not require a remote second device. The test does require an out-of-service wire pair that is open at the far end. Faults should be repaired first.

- **Current Group** is the current test group name, for example **Frequency Tests**.
- **Current Test** displays the test being measured. Here you can switch to another test from the given list. However, this action will terminate the ongoing measurement test.
- **Bandwidth** allows you to select the bandwidth of the frequency range for the test. Available frequency bandwidths are: **2.2 MHz**, 8 **MHz**, **12 MHz**, **17.6 MHz**, and **30 MHz**.
- **Threshold Settings** button opens a new page that allows you to set the **Attenuation** threshold.
- **Cable Setup** button opens a new page that allows you to set **Cable Parameters** for the **Current Test**.
- **Select Graph** button changes to **Graph Selected** when pressed and opens a new selection of function keys which allow you to maneuver the graph as follows:
  - **Cursor** - press the left/right arrow keys to decrease/increase the values by moving the cursor. Press and hold the left/right arrow keys to accelerate the cursor. Press ✔ to recall the cursor and place it in the middle of the current x-axis limits.
  - **Zoom** references the middle of the x/y axis and not the cursor position. Press the arrow keys as follows:

    Right = x-axis zoom in.

    Left = x-axis zoom out.

    Up = y-axis zoom in.

    Down = y-axis zoom out.
  - **Pan** - use left/right arrow keys to pan the x-axis and the up/down arrow keys to pan the y-axis.
  - **1:1** resets the x-axis and y-axis limits to full scale.
  - **Return To Results** removes these function keys and displays the **Attenuation** page.
  - **Result** displays the **Cable Length**, **Elapsed Time**, pass/fail status, and test results in graphical format.
  - **Test Status** displays the current state of measurement or an error message.

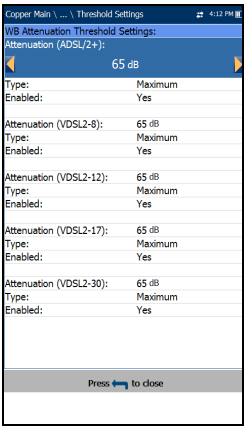
To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options.
4. Press ✔ to confirm the value.

WB Attenuation Threshold Settings



The **Threshold Settings** page allows you to set the **WB Attenuation** threshold values for the test.

- **Attenuation** sets up the good attenuation threshold parameters.
- **Type** is the threshold limit: either **Maximum** or **Minimum**.
- **Enabled** is a flag to use the current threshold: either **Yes** or **No**.

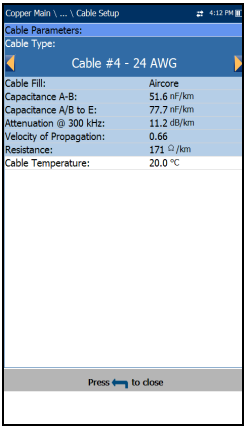
To set threshold values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

Cable Setup



The **Cable Setup** page allows you to set the **Cable Type** and **Cable Temperature** for the **WB Attenuation** test. All other **Cable Parameters** are read only and correspond to the current cable book entry as selected in **Setup**/**Cable Book**/**Cable Details** page.

- **Cable Type** allows you to select a cable entry (with its associated parameters) from the current **Cable Book**, to use for testing. The selection is not saved when leaving the test. The current **Cable Book** entry is shown by default.
- **Cable Fill** read-only entry is the type of material the cable is filled with: **Aircore**, **Jelly**, **Pulp**, **5 PR**, or **2 PR**.
- **Capacitance T-R/A-B** read-only entry is a value for the capacitance per length constant.
- **Capacitance T/R to GND/A/B to E** read-only entry is a value for the capacitance per length to ground constant.

- **Attenuation @ 300 kHz** read-only entry is a value for the reduction in signal strength or insertion loss of the cable.
- **Velocity of Propagation** read-only entry is the velocity of propagation for the cable as a ratio of the speed of light.
- **Resistance** read-only entry is a value for the resistance constant of the cable.
- **Cable Temperature** allows you to change the temperature of the cable under test in either degree **C** or **F**.

To select the parameter values:

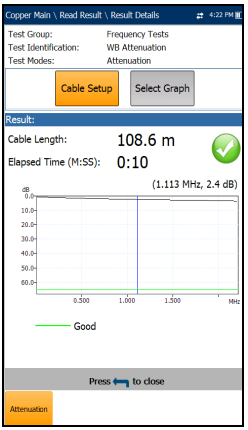
1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

WB Attenuation Result Details

The **Results Details** read-only page displays the **Cable Length**, **Elapsed Time**, pass/fail status, and **WB Attenuation** test results in graphical format.



- **Test Group** is the overall test group of the selected saved results file, for example **Frequency Tests**.
- **Test Identification** is the test type of the group, for example **WB Attenuation**.
- **Test Mode** is the mode of test, for example **Attenuation**.
- **Cable Setup** button opens a new page displaying the cable parameters of the test. Use the left/right arrows to select the button and press ✔ to open the page.
- **Select Graph** button changes to **Graph Selected** when pressed and opens a new selection of function keys which allow you to maneuver the graph as follows:
  - **Cursor** - press the left/right arrow keys to decrease/increase the values by moving the cursor. Press and hold the left/right arrow keys to accelerate the cursor. Press ✔ to recall the cursor and place it in the middle of the current x-axis limits.
  - **Zoom** references the middle of the x/y axis and not the cursor position. Press the arrow keys as follows:

    Right = x-axis zoom in.

    Left = x-axis zoom out.

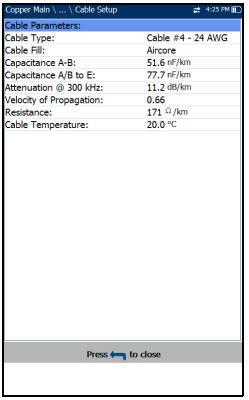
    Up = y-axis zoom in.

    Down = y-axis zoom out.

- **Pan** - use left/right arrow keys to pan the x-axis and the up/down arrow keys to pan the y-axis.
- **1:1** resets the x-axis and y-axis limits to full scale.
- **Return To Results** removes these function keys and displays the **Attenuation** results page.

Result Details Cable Setup

The **Cable Setup** page in the **Result Details** allows you to view the **Cable Parameters** set for the **WB Attenuation** test.

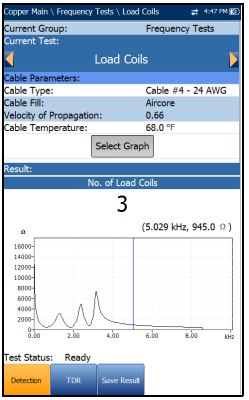


- **Cable Type** is the cable entry (with its associated parameters) from the current **Cable Book**, used for testing.
- **Cable Fill** is the type of material the cable is filled with: **Aircore**, **Jelly**, **Pulp**, **5 PR**, or **2 PR**.
- **Capacitance T-R/A-B** is the value for the capacitance per length constant.
- **Capacitance T/R to GND/A/B to E** is the value for the capacitance per length to ground constant.
- **Attenuation @ 300 kHz** is the value for the reduction in signal strength or insertion loss of the cable.
- **Velocity of Propagation** is the velocity of propagation for the cable as a ratio of the speed of light.
- **Resistance** is the value for the resistance constant of the cable.
- **Cable Temperature** is the temperature of the cable under test in either degree **C** or **F**.

Load Coils

The Load Coils test allows you to detect the presence of load coils, which are detrimental to the use of DSL technologies on the line. If a load coil is detected, use the time domain reflectometry (TDR) test to quickly locate and remove it from the cable.

Detection



The **Detection** function specifies the presence or absence of load coil in the cable section, and displays the number of load coils in the line and measured values in graphical form.

- **Current Group** is the current test group name, for example **Frequency Tests**.
- **Current Test** displays the test being measured. Here you can switch to another test from the given list. However, this action will terminate the ongoing measurement test.
- **Cable Parameters**:
  - **Cable Type** allows you to select a cable entry (with its associated parameters) from the current **Cable Book**, to use for testing. The selection is not saved when leaving the test. The current Cable Book entry is shown by default.
  - **Cable Fill Material** read-only entry is the type of material the cable is filled with: **Aircore**, **Jelly**, **Pulp**, **5 PR**, or **2 PR**. Setup in the **Cable Book**.
  - **Velocity of Propagation** read-only entry is the velocity of propagation for the cable as a ratio of the speed of light. Setup in the **Cable Book**.
  - **Cable Temperature** allows you to change the temperature of the cable under test in either degree **C** or **F**.
- **Select Graph** button changes to **Graph Selected** when pressed and opens a new selection of function keys which allow you to maneuver the graph as follows:
  - **Cursor** - press the left/right arrow keys to decrease/increase the values by moving the cursor. Press and hold the left/right arrow keys to accelerate the cursor. Press ✔ to recall the cursor and place it in the middle of the current x-axis limits.
  - **Zoom** references the middle of the x/y axis and *not* the cursor position. Press the arrow keys as follows:

    Right = x-axis zoom in.

    Left = x-axis zoom out.

    Up = y-axis zoom in.

    Down = y-axis zoom out.
  - **Pan** - use left/right arrow keys to pan the x-axis and the up/down arrow keys to pan the y-axis.

- **1:1** resets the x-axis and y-axis limits to full scale.
- **Return To Test** removes these function keys and displays the **Detection** page.

- **Result** displays the number of load coils in text and graphical format.
- **Test Status** displays the current state of measurement or an error message.

To select the parameter values:

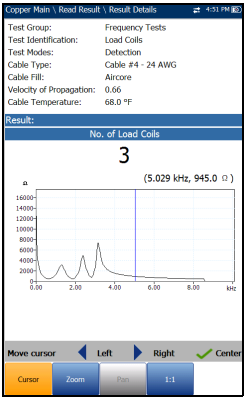
1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

Result Details

The **Results Details** read-only page displays the number of load coils, in text and graphical format. You can maneuver the graph as follows:



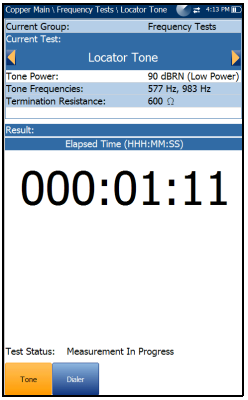
- **Cursor** - press the left/right arrow keys to decrease/increase the values by moving the cursor. Press and hold the left/right arrow keys to accelerate the cursor. Press ✔ to recall the cursor and place it in the middle of the current x-axis limits.
- **Zoom** references the middle of the x/y axis and *not* the cursor position. Press the arrow keys as follows:
  - Right = x-axis zoom in.
  - Left = x-axis zoom out.
  - Up = y-axis zoom in.
  - Down = y-axis zoom out.
- **Pan** - use left/right arrow keys to pan the x-axis and the up/down arrow keys to pan the y-axis.
- **1:1** resets the x-axis and y-axis limits to full scale.

Locator Tone

When **Locator Tone** is selected from the **Frequency Tests** menu, a 577 Hz signal and a 983 Hz signal are sent separately for 200 ms each. The sequence of this tone is repeated continuously until you stop the test. Sinusoidal waveform is used to generate these signals.

Tone

The **Tone** function allows you to set the **Tone Power** and generate a pulsed tone on the line to trace a cable pair at the far end.



- **Current Group** is the current test group name, for example **Frequency Tests**.
- **Current Test** displays the test being measured. Here you can switch to another test from the given list. However, this action will terminate the ongoing measurement test.
- **Tone Power** allows you to select either low or high power for the **Locator Tone**.
- **Tone Frequencies** displays the frequencies of the **Locator Tone**.
- **Termination Resistance** is a read-only value of **600 Ω**.
- **Result** displays the **Elapsed Time** the locator tone is being sent.
- **Test Status** displays the current state of measurement or an error message.

To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

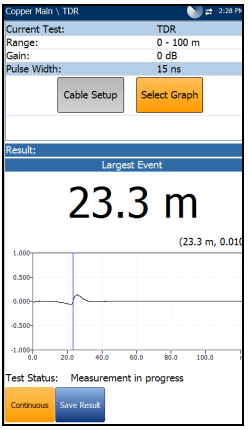
   OR
3. Press ✔ on a value to open a list box of options.
4. Press ✔ to start/stop the test.
5. Press ▮▶ to start/stop the test.

13 TDR

The **TDR** test first attempts to find the length of the circuit and then searches all ranges from shortest to longest for significant events. Upon completion, the test selects the nearest major event, sets the range to match, and aligns the cursor with the event. TDR can see events as close as the ends of the test leads.

Continuous

The **Continuous** function displays the line trace and is continuously on and ready to use. It displays and updates results in *real time*, until you stop the test. The last valid results then remain displayed.



- **Current Test** displays the test being measured.
- **Range** allows you to set the range from the given list.
- **Gain** allows you select the gain test parameter from the given list.

  The previous 2 parameters have 2 modes of operation:

  - **Auto** is the default mode upon loading the test page. TDR automatically optimizes the test parameters and scans each band individually looking for one largest event in each band (if any). **Range** and **Gain** are updated to reflect optimized TDR settings. Once results are displayed, TDR switches to manual mode. The test keeps running until you press ▮▶.
  - **Manual** mode allows you set the test parameters to be used as inputs for the TDR measurements.

Note: *If either of the above 2 test parameters are set to Auto, respective parameter values will be updated by TDR test.*

- **Pulse Width** is a non-editable value that is updated dependent on whether the parameters are set to **Auto** or manual.
- **Cable Setup** button opens a new page that allows you to set the **Cable Parameters** for the **Current Test**.
- **Select Graph** button changes to **Graph Selected** when pressed and opens a new selection of function keys which allow you to maneuver the graph as follows:

  - **Cursor** - press the left/right arrow keys to decrease/increase the values by moving the cursor. Press and hold the left/right arrow keys to accelerate the cursor. Press ✔ to recall the cursor and place it in the middle of the current x-axis limits.
  - **Zoom** references the middle of the x/y axis and *not* the cursor position. Press the arrow keys as follows:

    Right = x-axis zoom in.

    Left = x-axis zoom out.

Up = y-axis zoom in.

Down = y-axis zoom out.

- **Pan** - use left/right arrow keys to pan the x-axis and the up/down arrow keys to pan the y-axis.
- **1:1** resets the x-axis and y-axis limits to full scale.
- **Return To Test** removes these function keys and displays the **Continuous** page.

- **Result** displays the distance to the most significant reflection.
- **Test Status** displays the current state of measurement or an error message.

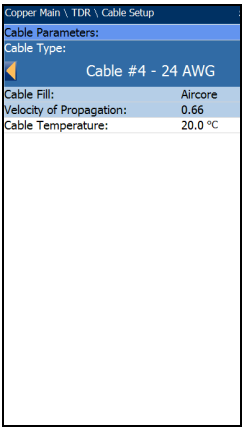
To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options.
4. Press ✔ to confirm the value.

Cable Setup



The **Cable Setup** page allows you to set **Cable Parameters** for the TDR test.

- **Cable Type** allows you to select a cable entry (with its associated parameters) from the current **Cable Book**, to use for testing. The selection is not saved when leaving the test. The current Cable Book entry is shown by default.
- **Cable Fill** read-only entry is the type of material the cable is filled with: **Aircore**, **Jelly**, **Pulp**, **5 PR**, or **2 PR**. Setup in the **Cable Book**.
- **Velocity of Propagation** read-only entry is the velocity of propagation for the cable as a ratio of the speed of light. Setup in the **Cable Book**.
- **Cable Temperature** allows you to change the temperature of the cable under test in either degree **C** or **F**.

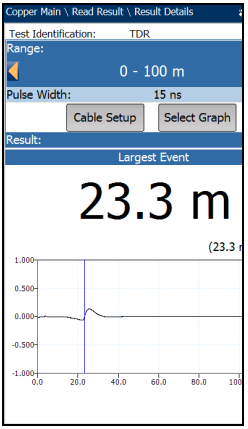
To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

Result Details



The **Results Details** read-only page displays the TDR test result cable parameters and the distance to the most significant reflection or **Largest Event**, in text and graphical format.

- **Test Identification** is the test type of the group, for example **TDR**.
- **Range** allows you to set the range from the given list.
- **Pulse Width** is a non-editable value that is updated dependent on whether the parameters are set to **Auto** or manual.
- **Cable Setup** button allows you to view the **Cable Parameters** of the **TDR** test.
- **Select Graph** button changes to **Graph Selected** when pressed and opens a new selection of function keys which allow you to maneuver the graph as follows:
  - **Cursor** - press the left/right arrow keys to decrease/increase the values by moving the cursor. Press and hold the left/right arrow keys to accelerate the cursor. Press ✔ to recall the cursor and place it in the middle of the current x-axis limits.
  - **Zoom** references the middle of the x/y axis and *not* the cursor position. Press the arrow keys as follows:

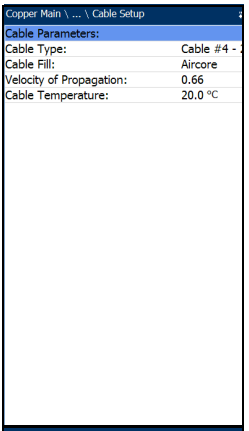
    Right = x-axis zoom in.

    Left = x-axis zoom out.

    Up = y-axis zoom in.

    Down = y-axis zoom out.
  - **Pan** - use left/right arrow keys to pan the x-axis and the up/down arrow keys to pan the y-axis.
  - **1:1** resets the x-axis and y-axis limits to full scale.
  - **Return To Results** removes these function keys and displays the results details page.

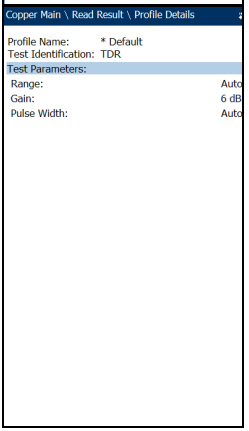
Cable Setup



The **Cable Setup** page allows you to view the **Cable Parameters** set for the TDR test.

- **Cable Type** is the cable entry (with its associated parameters) from the current Cable Book, used for testing.
- **Cable Fill** is the type of material the cable is filled with: **Aircore**, **Jelly**, **Pulp**, **5 PR**, or **2 PR**. Setup in the **Cable Book**.
- **Velocity of Propagation** is the velocity of propagation for the cable as a ratio of the speed of light. Setup in the **Cable Book**.
- **Cable Temperature** is the temperature of the cable under test in either degree **C** or **F**.

TDR Profile Details



The **Profile Details** page displays read-only **TDR Test Parameters**.

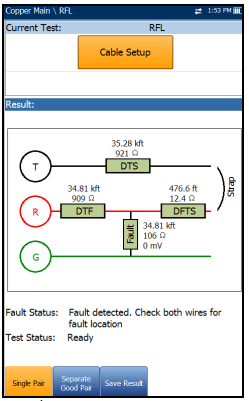
- **Profile Name** is the file name of the selected saved results.
- **Test Identification** is the test type of the group, for example **TDR**.

14 RFL

Resistance fault locator (RFL) testing is a powerful means to locate resistive faults such as shorts, grounds, and battery crosses. Before performing RFL tests, install the strap(s) at the other end of the cable. Use of an oscillator as a far end strap is not recommended. It will induce errors.

Single Pair

The RFL **Single Pair** or 2-wire test allows you to locate resistive faults between tip to ground, or ring to ground. By default, the unit assumes that the fault cable is connected to ring.



Connect the strap to the far end of the wires connected to T and R.

The *connection diagram* shows you how to connect the cables to the unit. The green lead is used as reference.

Note: *Results are less accurate than a separate good pair setup.*

- **Current Test** displays the test being measured.
- **Cable Setup** button opens a new page that allows you to set the cable parameters for the **Current Test**. Press ✔ to open the page.
- **Result** displays single pair RFL test results. Based on the cable condition, corresponding values are added into the diagram at their specific positions. Test result units are dependent on **Standard** in **Setup/Application Settings**.
  - Distance to strap (DTS).
  - Resistance to strap (RTS).
  - Distance from fault to strap (DFTS).
  - Resistance from fault to strap (RFTS).
  - Resistance to fault (RTF).
  - Distance to fault (DTF).
  - Faulted cable (FC).
  - Resistance at fault (Rf) is resistance from the fault to the resistance wire.
  - Voltage at fault (Vf).

  If the test reports that it cannot detect the strap when the measured loop resistance is >10 k Ohm, this may mean:

  - There is no strap connected.
  - There is a strap, but the cable is too long and has a loop resistance >10 k Ohm.
  - There is a strap, but there is a high resistance fault or open in the cable.
  - The connection (leads or strap) may be faulty.

  The resistance test may be used to troubleshoot this problem.

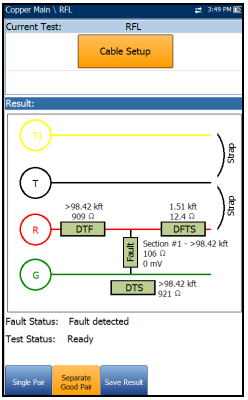
- **Fault Status** displays the status of the RFL test.
- **Test Status** displays the current state of measurement or an error message.

Separate Good Pair

The RFL **Separate Good Pair** or 4-wire test allows you to determine the distance to a short, ground, or battery cross in a faulty cable pair using a separate good cable pair.

Connect a first strap to the far ends of the wires connected to T1 and T, and a second strap to the far ends of the wires connected to T and R.

The *connection diagram* shows you how to connect the cables to the unit.



Note: *Results are more accurate than a 2-wire setup because the 4-wire setup requires you to connect the faulted wire to the Ring (red) jack only.*

- **Current Test** displays the test being measured.
- **Cable Setup** button opens a new page that allows you to set the cable parameters for the **Current Test**. Press ✔ to open the page.
- **Result** displays the separate good pair RFL test results. Based on the cable condition, corresponding values are added into the diagram at their specific positions. Test result units are dependent on **Standard** in **Setup/Application Settings**.
  - Distance to strap (DTS).
  - Resistance to strap (RTS).
  - Distance from fault to strap (DFTS).
  - Resistance from fault to strap (RFTS).
  - Resistance to fault (RTF).
  - Distance to fault (DTF).
  - Faulted cable (FC).
  - Resistance at fault (Rf) is resistance from the fault to the resistance wire.
  - Voltage at fault (Vf).

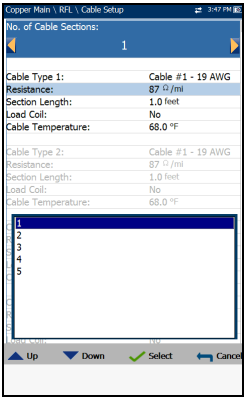
  If the test reports that it cannot detect the strap when the measured loop resistance is >10 k Ohm, this may mean:

  - There is no strap connected.
  - There is a strap, but the cable is too long and has a loop resistance >10 k Ohm.
  - There is a strap, but there is a high resistance fault or open in the cable.
  - The connection (leads or strap) may be faulty.

  The resistance test may be used to troubleshoot this problem.

- **Fault Status** displays the status of the RFL test.
- **Test Status** displays the current state of measurement or an error message.

RFL Cable Setup



The **Cable Setup** page allows you to set cable parameters for an RFL test. Settings are shared by both **Single Pair** and **Separate Good Pair** tests. Changes done in **Cable Setup** for one test are reflected in the other.

- **No. of Cable Sections** allows you to set the number of consecutive cable sections, to a maximum of 5. If unknown, set the number to 1.
- **Cable Type** allows you to select a cable entry (with its associated parameters) from the current **Cable Book**, to use for testing. The selection is not saved when leaving the test. The current Cable Book entry is shown by default.
- **Resistance** specifies a value for the resistance constant of the cable in each section.
- **Section Length** allows you to specify the cable length of each section. If the cable length is unknown, specify 0 and the RFL test will measure the length.
- **Load Coil** allows you to set the detection of the presence of load coils to either Yes or No.
- **Cable Temperature** allows you to change the temperature of the cable under test in either degree **C** or **F**.

To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

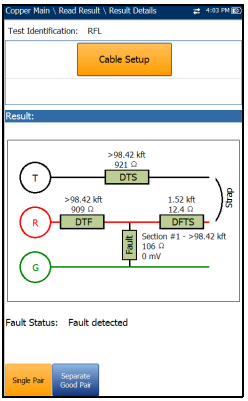
   OR

3. Press ✔ on a value to open a list box of options or the alphanumeric editor screen and use the navigation keys to scroll through.
4. Press ✔ to confirm the value.

Result Details

Single Pair

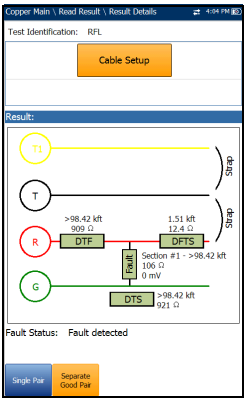
The **Results Details** read-only page displays the **Single Pair** RFL results using text and a connection diagram.



- **Test Identification** displays the current test, for example **RFL**.
- **Cable Setup** button opens a new page displaying the cable parameters of the **RFL** test. Press ✔ to open the page.

Separate Good Pair

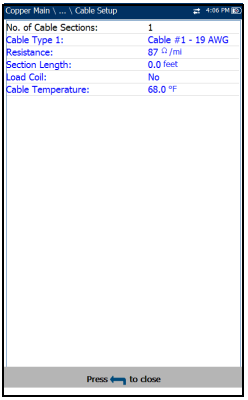
The **Results Details** read-only page displays the **Separate Good Pair** RFL results using text and a connection diagram.



- **Test Identification** displays the current test, for example **RFL**.
- **Cable Setup** button opens a new page displaying the cable parameters of the **RFL** test. Press ✔ to open the page.

Cable Setup

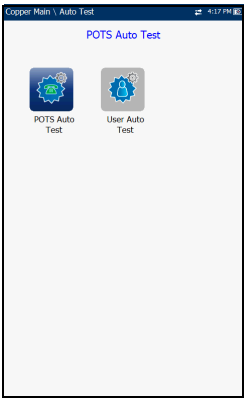
The **Cable Setup** page displays the cable parameters for each section used while running the RFL test. Settings are shared by both **Single Pair** and **Separate Good Pair** tests.



15 Copper Auto Tests

Main Menu

Auto Test allows you to automatically run tests used in pre-qualification, installation, and maintenance of different circuit types from POTS to VDSL2.



POTS Auto Test

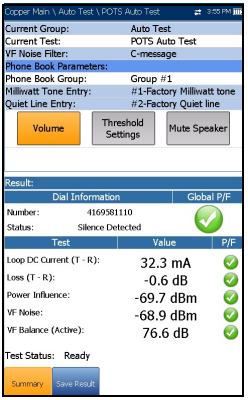
The purpose of the **POTS Auto Test** is to detect the loop current and measure the voice frequency parameters in a copper telephone loop. This test allows you to compare measured results against stored threshold values to provide pass or fail status results of the POTS circuit type.

To access POTS Auto Test:

1. From the **Copper Main** menu, use the up/down, left/right arrow keys to highlight **Auto Test** and press ✔.
2. Highlight **POTS Auto Test** and press ✔ to start the test.

Summary

The **Summary** page displays detailed results of the loop current, **Power Influence** and voice frequency measurement values, pass/fail status, and parameters. **POTS Auto Test** consists of a combination of multiple tests.



- **Current Group** is the current test group name, for example **Auto Test**.
- **Current Test** displays the test being measured. Here you can switch to another test from the given list. However, this action will terminate the ongoing measurement test.
- **VF Noise Filter** displays the voice frequency noise filter used, dependent on **ITU** or **ANSI Standard** mode and Noise Filter set in **Setup/Application Settings**.
- **Phone Book Parameters**:
  - **Phone Book Group** allows you to select the **Group #** from a list of phone book groups that include mW tone entries.
  - **Milliwatt Tone Entry** displays at least 1 mW tone entry number from the selected **Phone Book Group**.
  - **Quiet Line Entry** displays the quiet line entry number from the selected **Phone Book Group**.

  The dialer will contact the above 2 phone numbers at specific points of time while the test is running.
- **Volume** button adjusts the volume level.

- **Threshold Settings** button opens a new page that allows you to set the **POTS Auto Test** threshold parameters.
- **Mute/Unmute Speaker** button changes the speaker status.
- **Result** displays the number dialed and its status, measurement values of the multiple test parameters and their pass/fail status.
- **Test Status** displays the current state of measurement or an error message.

To select the parameter values:

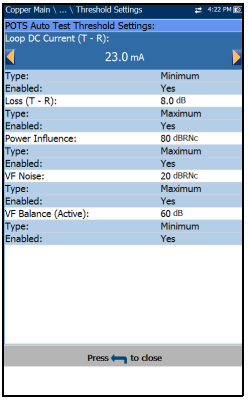
1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR

3. Press ✔ on a value to open a list box of options.
4. Press ✔ to confirm the value.

POTS Auto Test Threshold Settings

The **Threshold Settings** page allows you to set the **POTS Auto Test Threshold Settings** for the combination of multiple tests. The threshold values do not come from individual tests but are unique to POTS.



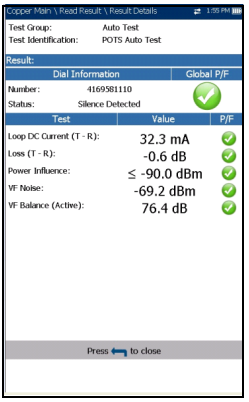
- **Loop DC Current** sets the DC current value for the wire pair.
- **Loss** sets the loss value for the wire pair.
- **Power Influence** sets the power influence value for the test.
- **VF Noise** sets the level of voice frequency noise to be used.
- **VF/AC Balance (Active)** sets the VF/AC longitudinal balance value for active mode.
- **Type** is a read-only field displaying the threshold limit: either **Minimum** or **Maximum**.
- **Enabled** is a read-only field and always **Yes** for all thresholds.

To set threshold values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press ✔ on a value to open the alphanumeric editor screen and use the navigation keys to scroll through.
3. Press ✔ to select each value and use the function keys to complete your selection.
4. Press ↩ to confirm and close your selections.

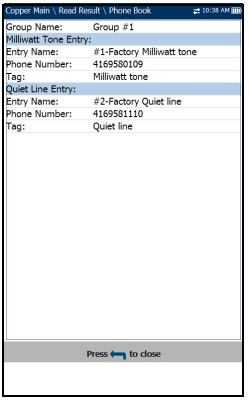
Result Details

The **Results Details** read-only page displays the number dialed and its status, measurement values of the test parameters and their pass/fail status.



Phone Book

The **Phone Book** results page displays the **Group #** and type entry parameters when loading the results file.



User Auto Test

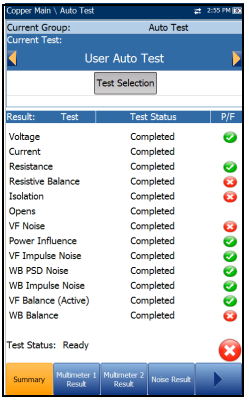
User Auto Test runs a range of different user-defined tests that compare measured results against stored threshold values to provide pass or fail status and results. Test parameters and thresholds are inherited from individual tests.

To access User Auto Test:

1. From the **Copper Main** menu, use the up/down, left/right arrow keys to highlight **Auto Test** and press ✔.
2. Highlight **User Auto Test** and press ✔ to start the test.

Summary

The **Summary** page displays the overall pass/fail status of all tests selected for auto testing.



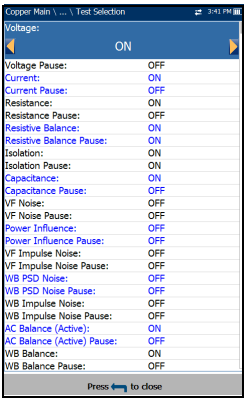
- **Current Group** is the current test group name, for example **Auto Test**.
- **Current Test** displays the test being measured. Here you can switch to another test from the given list. However, this action will terminate the ongoing measurement test.
- **Test Selection** button opens a new page that allows you to select the tests to include in the **User Auto Test**.
- **Result** displays each test selected and its status.
- **Test Status** displays the current state of measurement or an error message.

To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR
3. Press ✔ on a value to open a list box of options.
4. Press ✔ to confirm the value.

Test Selection



The **Test Selection** page allows you to select up to 13 test types to include in the auto test, and set a **Pause** between tests by selecting **ON** or **OFF**. All listed tests have a fixed duration (snapshot) and are not continuous. Graphs are not displayed.

The following tests are available:

- **Voltage** detects AC RMS and DC voltages in the line.
- **Current** checks for AC RMS and DC currents in the line.
- **Resistance** uses DC current to measure the opposition to flow, or resistance, between each of the lead combinations. It is also used to identify possible faults, and to measure the resistance of the twisted pair cable for estimating loop length.
- **Resistive Balance** measures and compares the resistance of each leg.
- **Isolation** measures the quality of insulation or sheathing for the copper pairs.
- **Capacitance** measures the capacitance of the cable for estimating loop length.
- **VF Noise** measures voice frequency noise in the line.
- **Power Influence** measures the effects that 50 Hz and 60 Hz power line (AC Mains) interference has on the circuit under test.
- **VF Impulse Noise** measures the random occurrences of energy spikes in the voice frequency range that have random amplitude and spectral content.
- **WB PSD Noise** measures power spectral density noise.
- **WB Impulse Noise** measures the irregular occurrences of energy spikes in the wideband range that have random amplitude and spectral content.
- **VF/AC Balance (Active)** is very useful in identifying loops that will suffer from crosstalk.
- **WB Balance** ensures that the balance ratio for the twisted pair complies with applicable standards so as to reduce the effects of common-mode voltage to ground.
- **WB Attenuation** measures the dissipation of power of a transmitted signal as it travels over the copper line.
- **Load Coils** detects the presence of load coils in the line.

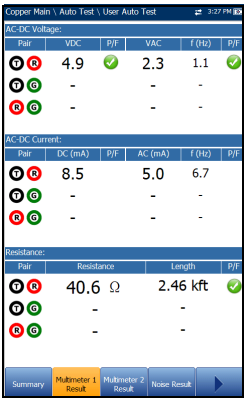
To select the tests:

1. Press the up/down arrow keys to scroll through all the tests and highlight the desired parameter.
2. Press the left/right arrow keys to view and select the options.

   OR
3. Press ✓ on a value to open a list box of options.
4. Press ✓ to confirm the value.
5. Press ↩ to confirm and close your selections.

Multimeter 1 Result

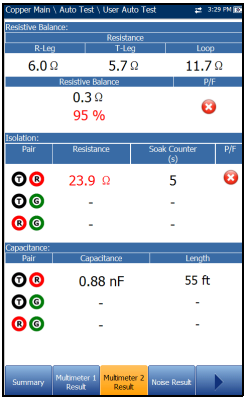
The **Multimeter 1 Result** page displays the following results and pass/fail status:



- **AC-DC Voltage** - volts and frequency **(Hz)** values for each continuous AC/DC **Pair**.
- **AC-DC Current** - **DC** current, **AC** current and frequency **(Hz)** values for each wire **Pair**.
- **Resistance** and **Length** for each wire **Pair**.

Multimeter 2 Result

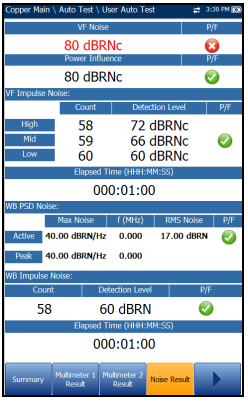
The **Multimeter 2 Result** page displays the following results:



- **Resistive Balance** - **R-Leg**, **T-Leg**, **Loop** resistance, and pass/fail status and values in Ω and %.
- **Isolation** - pass/fail status, **Resistance** and a **Soak Counter(s)** for each wire **Pair**.
- **Capacitance/Opens** and **Length** for each wire **Pair**.

Noise Result

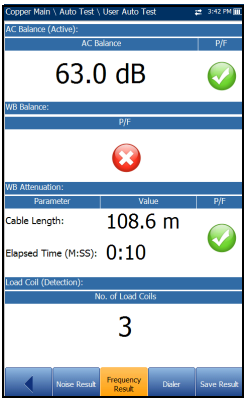
The **Noise Result** page displays the following results and pass/fail status:



- **VF Noise**
- **Power Influence**
- **VF Impulse Noise** - **High**, **Mid**, **Low** counts, respective detection levels, and **Elapsed Time**. Here the pass/fail status is for the **Mid** level only.
- **WB PSD Noise** - **Max PSD** and frequency and **RMS Noise** values differentiating the **Current** trace from the **Peak** hold.
- **WB Impulse Noise** - impulse **Count**, **Detection Level**, and **Elapsed Time**.

Frequency Result

The **Frequency Result** page displays the following results:



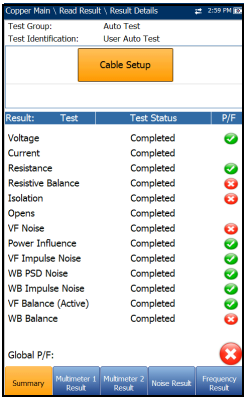
- **VF/AC Balance (Active)** and pass/fail status.
- **WB Balance** pass/fail status.
- **WB Attenuation** pass/fail status, parameters and values for:
  - **Cable Length**
  - **Elapsed Time (M:SS)**
- **Load Coil (Detection)** - number of load coils.

Result Details

The **Result Details** for **User Auto Test** display all the saved results presented during the test. Please see *The Multimeter 1 Result page displays the following results and pass/fail status:* on page 138, *The Multimeter 2 Result page displays the following results:* on page 138, *Noise Result* on page 138, *Frequency Result* on page 139 for more information.

Summary

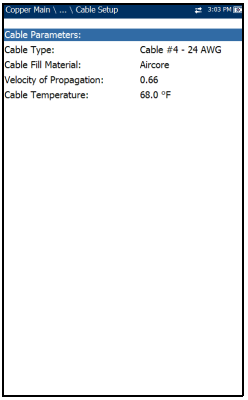
The **Read Result Summary** page displays the overall pass/fail status of all tests selected for auto testing. This page varies slightly from the run **User Auto Test** page in that there are no configurable parameters.



- **Test Group** is the overall test group of the selected saved results file, for example **Auto Test**.
- **Test Identification** is the test type of the group, for example **User Auto Test**.
- **Cable Setup** button opens a new page that allows you to view the parameters of the cable used in the Auto Test. Press ✔ to open the page.

Cable Setup

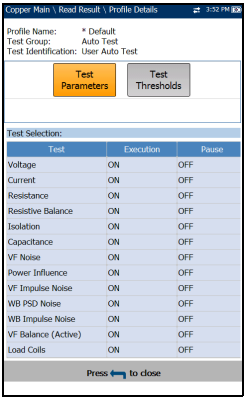
The **Cable Setup** page displays read-only parameters of the cable used in the **Auto Test**.



- **Cable Type** is the cable entry (with its associated parameters) from the current Cable Book, used for testing.
- **Cable Fill** is the type of material the cable is filled with: **Aircore**, **Jelly**, **Pulp**, **5 PR**, or **2 PR**.
- **Velocity of Propagation** is the velocity of propagation for the cable as a ratio of the speed of light.
- **Cable Temperature** is the temperature of the cable under test in either degree C or F.

Profile Details

Profile Details contains the details of the Test Selection settings for User Auto Test.



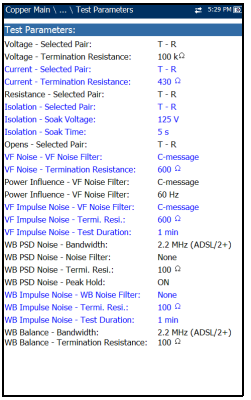
- **Test Parameters** button opens a new page displaying read-only parameter details of all tests.
- **Test Thresholds** button opens new pages displaying read-only threshold values for all tests.

To access the test parameter and threshold results:

1. Press the left/right arrow keys to highlight a button.
2. Press ✔ to open the page.

Test Parameters

The **Test Parameters** page displays read-only parameter details of all tests.

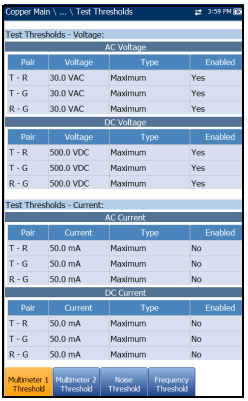


Test Thresholds

The Test Thresholds pages display read-only threshold values for each test.

Multimeter 1 Threshold

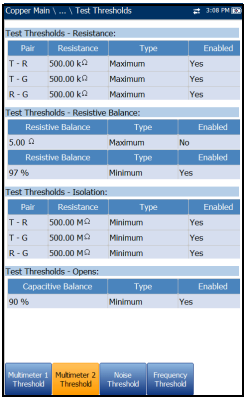
The **Multimeter 1 Threshold** page displays the **AC/DC Voltage** and **Current Test Thresholds** and limits for each Pair.



Multimeter 2 Threshold

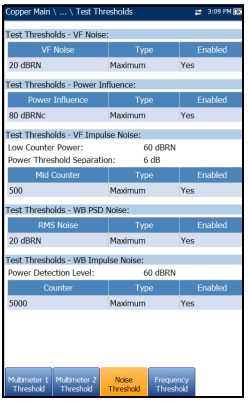
The **Multimeter 2 Threshold** page displays the **Test Thresholds** and limits for the following tests:

- **Resistance** displays values for each **Pair**.
- **Resistive Balance** displays values for the test, in Ω and %.
- **Isolation** displays the **Resistance** thresholds for each **Pair**.
- **Capacitance** displays the **Capacitive Balance** threshold for the test.



Noise Threshold

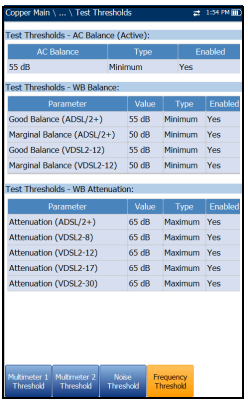
The **Noise Threshold** page displays the **Test Thresholds** and limits for the following tests:



- **VF Noise**
- **Power Influence**
- **VF Impulse Noise** displays the **Mid Counter** threshold value and limit as well as the **Low Counter Power** and **Power Threshold Separation**.
- **WB PSD** Noise displays the **RMS Noise** and limit.
- **WB Impulse Noise** displays the **Power Detection Level**, **Counter** threshold value and limit.

Frequency Threshold

The **Frequency Threshold** page displays the **VF/AC Balance (Active)** and **WB Balance/Attenuation** threshold values and limits.



16 Maintenance

General Maintenance

To help ensure long, trouble-free operation:

- Keep the unit free of dust.
- Clean the unit casing and front panel with a cloth slightly dampened with water.
- Store unit at room temperature in a clean and dry area. Keep the unit out of direct sunlight.
- Avoid high humidity or significant temperature fluctuations.
- Avoid unnecessary shocks and vibrations.
- If any liquids are spilled on or into the unit, turn off the power immediately and let the unit dry completely.



WARNING

The use of controls, adjustments and procedures other than those specified herein may result in exposure to hazardous situations or impair the protection provided by this unit.

Battery Maintenance Recommendations

- To ensure that batteries function or charge properly, keep them in temperatures between 10 °C and 40 °C (50 °F and 104 °F).
- To prevent battery cells from leaking, do not leave a battery discharged for several days.

Battery Charging and Replacing

Charging the MaxTester battery can take up to 5 hours. This battery was custom made for your unit; replacement batteries must be ordered from EXFO.

For more information about the battery, refer to *Battery* on page 2 of this user guide.

Recycling and Disposal (Applies to European Union Only)

For complete recycling/disposal information as per European Directive WEEE 2002/96/EC, visit the EXFO Web site at www.exfo.com/recycle.

17 Troubleshooting

Solving Common Problems

The table below presents common problems and their solution.

Problem	Possible Cause	Solution
Impossible to turn on unit.	➤ You did not press ⏻ long enough.	➤ Press ⏻ for a few seconds.
	➤ Battery discharged.	➤ Charge battery by connecting the AC adapter/charger.
	➤ Battery is missing.	➤ Insert a battery and replace battery back panel.
	➤ Unit temperature is too cold or too hot.	➤ Make sure that the unit is within the operation temperature range. You might have to wait for the unit to warm up/cool down.
Battery does not charge as expected.	➤ Temperature is too high.	➤ Ensure temperature is within specifications.
	➤ Battery is incorrectly connected.	➤ Ensure battery is connected properly.
A battery status LED is red.	➤ Battery temperature is too high.	➤ Shut down the unit by pressing ⏻ and holding it down for more than 10 seconds and/or until the power LED goes off.
		➤ Wait for the unit to cool down, and then reboot it.
	➤ Battery is defective.	➤ Contact EXFO or replace the battery.
The unit is not responding.		➤ Shut down the unit, as above.
		➤ Turn the unit on again to reset it.

LED Statuses

The power and battery LEDs are used to indicate specific statuses of your unit. If you notice that one of the LEDs displays a particular status, refer to the *Power and Battery Status LED Legend* in the *Introduction* chapter of this manual to see what could be causing it.

Contacting the Technical Support Group

To obtain after-sales service or technical support for this product, contact EXFO at one of the following numbers. The Technical Support Group is available to take your calls from Monday to Friday, 8:00 a.m. to 7:00 p.m. (Eastern Time in North America).

For detailed information about technical support, visit the EXFO Web site at www.exfo.com.

Technical Support Group
400 Godin Avenue
Quebec (Quebec) G1M 2K2
CANADA

1 866 683-0155 (USA and Canada)
Tel.: 1 418 683-5498
Fax: 1 418 683-9224
support@exfo.com

To accelerate the process, please have information such as the name and the serial number (see the product identification label), as well as a description of your problem, close at hand.

Transportation

Maintain a temperature range within specifications when transporting the unit. Transportation damage can occur from improper handling. The following steps are recommended to minimize the possibility of damage:

- Pack the unit in its original packing material when shipping.
- Avoid high humidity or large temperature fluctuations.
- Keep the unit out of direct sunlight.
- Avoid unnecessary shocks and vibrations.

18 Warranty

General Information

EXFO Inc. (EXFO) warrants this equipment against defects in material and workmanship for a period of one year from the date of original shipment. EXFO also warrants that this equipment will meet applicable specifications under normal use.

During the warranty period, EXFO will, at its discretion, repair, replace, or issue credit for any defective product, as well as verify and adjust the product free of charge should the equipment need to be repaired or if the original calibration is erroneous. If the equipment is sent back for verification of calibration during the warranty period and found to meet all published specifications, EXFO will charge standard calibration fees.



IMPORTANT

The warranty can become null and void if:

- **unit has been tampered with, repaired, or worked upon by unauthorized individuals or non-EXFO personnel.**
- **warranty sticker has been removed.**
- **case screws, other than those specified in this guide, have been removed.**
- **case has been opened, other than as explained in this guide.**
- **unit serial number has been altered, erased, or removed.**
- **unit has been misused, neglected, or damaged by accident.**

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL EXFO BE LIABLE FOR SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

Liability

EXFO shall not be liable for damages resulting from the use of the product, nor shall be responsible for any failure in the performance of other items to which the product is connected or the operation of any system of which the product may be a part.

EXFO shall not be liable for damages resulting from improper usage or unauthorized modification of the product, its accompanying accessories and software.

Exclusions

EXFO reserves the right to make changes in the design or construction of any of its products at any time without incurring obligation to make any changes whatsoever on units purchased. Accessories, including but not limited to fuses, pilot lamps, batteries and universal interfaces (EUI) used with EXFO products are not covered by this warranty.

This warranty excludes failure resulting from: improper use or installation, normal wear and tear, accident, abuse, neglect, fire, water, lightning or other acts of nature, causes external to the product or other factors beyond the control of EXFO.

Certification

EXFO certifies that this equipment met its published specifications at the time of shipment from the factory.

Service and Repairs

EXFO commits to providing product service and repair for five years following the date of purchase.

To send any equipment for service or repair:

1. Call one of EXFO's authorized service centers (see *EXFO Service Centers Worldwide* on page 150).Support personnel will determine if the equipment requires service, repair, or calibration.
2. If equipment must be returned to EXFO or an authorized service center, support personnel will issue aReturn Merchandise Authorization (RMA) number and provide an address for return.
3. If possible, back up your data before sending the unit for repair.
4. Pack the equipment in its original shipping material. Be sure to include a statement or report fully detailing the defect and the conditions under which it was observed.
5. Return the equipment, prepaid, to the address given to you by support personnel. Be sure to write the RMA number on the shipping slip. *EXFO will refuse and return any package that does not bear anRMA number.*

Note: *A test setup fee will apply to any returned unit that, after test, is found to meet the applicable specifications.*

After repair, the equipment will be returned with a repair report. If the equipment is not under warranty, you will be invoiced for the cost appearing on this report. EXFO will pay return-to-customer shipping costs for equipment under warranty. Shipping insurance is at your expense.

Routine recalibration is not included in any of the warranty plans. Since calibrations/verifications are not covered by the basic or extended warranties, you may elect to purchase FlexCare Calibration/Verification Packages for a definite period of time. Contact an authorized service center (see *EXFO Service Centers Worldwide* on page 150).

EXFO Service Centers Worldwide

If your product requires servicing, contact your nearest authorized service center.

EXFO Headquarters Service Center
400 Godin Avenue
Quebec (Quebec) G1M 2K2
CANADA

1 866 683-0155 (USA and Canada)
Tel.: 1 418 683-5498
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support@exfo.com

EXFO Europe Service Center
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support.europe@exfo.com

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support.asia@exfo.com

A Technical Specifications

IMPORTANT

The following technical specifications can change without notice. The information presented in this section is provided as a reference only. To obtain this product's most recent technical specifications, visit the EXFO Web site at *www.exfo.com*.

DSL SPECIFICATIONS		
DSL chipset	Broadcom	
Standards compliance	ADSL1/2/2+	ITU-T G.992.5 (ADSL2+ including Annex A, B, M), ITU-T G.992.3 (ADSL2 including Annex A, B, L), ITU-T G.992.1 (G.DMT including Annex A, B) ATIS/ANSI T1.413 Issue 2 IEEE 802.3ah (PTM) ITU-T G.998.x (ATM, Ethernet bonding)
	VDSL2	ITU-T G.993.2 Annex A,B Profiles: 8a/b/c/d, 12a/b, 17a, 30a Band Plan: 997, 998, US0 IEEE 802.3ah (PTM) ITU-T G.998.x (ATM, Ethernet bonding)
DSL parameters	Maximum attainable bit rates Actual achieved bit rates Actual bonded achieved rates Latency mode: fast, interleaved Data mode: ATM, PTM Capacity (%) Signal-to-noise ratio (SNR) margin Output power Attenuation Bits/bin Attenuation/bin (Hlog/bin) QLN/bin SNR/bin Vendor code, revision	Interleave depth Interleave delay Trellis coding Bit swapping INP Nitro PhyR, G.INP Vectoring (single pair) Modes: PTM, ATM, Nitro LOS, FEC, CRC, HEC LATN per band SATN per band

MULTIPLAY TESTING SPECIFICATIONS

Test interfaces	VDSL2 ADSL1/2/2+ Ethernet 10/100BT	
Encapsulation methods	RFC 2684 supporting bridged Ethernet (IPoE) IPoA (RFC 1577)	PPPoE (RFC 2516) PPPoA/LLC and PPPoA/VC-MUX (RFC 2364)
Operating modes	DSL Terminate Modem Replacement (DSL to Ethernet) Pass Through	Ethernet Terminate Ethernet/Ethernet Pass Through
Login format	Username and password using PAP/CHAP	
Connectivity support	LAN/WAN status DNS, gateway DHCP client/server, DHCP vendor class NAT	VLAN ID, VLAN tagging VPI/VCI
Ping test	Ping destination Number of pings Packet size Timeout Results	Gateway, IP address or URL 1 to 99 32 to 1200 bytes (32 is default) 1 to 10 seconds Packets sent/received, average round-trip delay (ms)
Traceroute test	Traceroute destination Timeout Packet size Number of hops Results	Gateway, IP address or URL In seconds, default is 1 s, maximum is 10 s 32 bytes 1 to 32 (default is 30) Indicate IP address of hop and round-trip time in milliseconds (ms)
FTP speed test	Address Direction Results Bookmarks	IP or URL Upload and/or download Time, kB transferred, speed in kbit/s User-definable
Web browser (software option)	Address	IP address or URL
IPTV testing (software option)	Supported video standards Operating modes IPTV parameters/functionality	MPEG2, MPEG4 part 2 and 10 (H.264/AVC), Microsoft Mediaroom/WM9/VC1 DSL Terminate Ethernet Terminate IGMP join/leave requests with STB emulation Automatic tests to join/leave and analyze up to five simultaneous streams Programmable channel list for storage of commonly used channels Bandwidth usage per channel IGMP packet and rate information per line and channel Multicast/unicast RTP/UDP IP stream support Key IP video QoS parameters, packet loss, zap time, PID statistics Graphical results Transport stream packet loss histogram

COPPER SPECIFICATIONS [a, b, c]

Receiver characteristics	Reception frequency		200 Hz to 20 kHz 20 kHz to 30 MHz	
	Frequency uncertainty (accuracy)		±(50 ppm + 1 digit)	
	VF reception level range (dBm)		–90 to 20 at 600 Ω	
	VF level uncertainty (accuracy)		200 Hz to 20 kHz –90 dBm to –50 dBm, uncertainty (accuracy) ±2 dB –50 dBm to 20 dBm, uncertainty (accuracy) ±1 dB	
	WB reception level range (dBm)		–90 to 20 at 100 Ω and 135 Ω	
	WB level uncertainty (accuracy)		20 kHz to 2.2 MHz –90 dBm to –50 dBm, uncertainty (accuracy) ±2 dB –50 dBm to 20 dBm, uncertainty (accuracy) ±1 dB 2.2 MHz to 30 MHz –90 dBm to –50 dBm, uncertainty (accuracy) ±2 dB –50 dBm to 20 dBm, uncertainty (accuracy) ±1 dB	
	Impedance (Ω)		100, 135, 600	
POTS dialer	DTMF		0 – 9, #, *	
	Phonebook		25 entries	
Digital multimeter (DMM)	Test type		Snapshot and continuous	
	Impedance selection (for voltage measurement)		100 kΩ, 1 MΩ	
	Measurement	**Range**	**Resolution**	**Uncertainty (accuracy)**
	DC voltage	0 to 400 V	0.1 V for 0 to 99.9 V 1 V for 100 V to 400 V	±(|1 %| + 0.5 VDC)
	AC voltage	0 to 280 Vrms	0.1 V for 0 to 99.9 V 1 V for 100 V to 280 V	±(1 % + 0.5 VAC)
	Isolation resistance (stress/leakage)	0 to 1 GΩ, auto-ranging 1 kΩ to 99 MΩ 100 MΩ to 999 MΩ	Three digits	±(2 % + 1 digit) ±(5 % + 1 digit)
	Resistance	0 to 100 MΩ 0 to 999 Ω 1 kΩ to 100 MΩ	Three digits	±(1 % + 5 ohms) ±(2 % + 1 digit)
	Capacitance	0.1 nF to 2 µF	Four digits	±(2 % + 50 pF)
	DC current	0 to 110 mA	0.1 mA	±(|2 %| + 1 mA)
	AC current	0 to 110 mA	0.1 mA	±(|2 %| + 1 mA) [d]
Isolation resistance (stress/leakage) (continued)	Source		50 to 125 VDC (current safely limited to 0.5 mA)	
	Soak timer (s)		1 to 60	

NOTES

a. Subject to change without notice.

b. Typical, at 23 °C ± 3 °C, on batteries, with no type B USB connection.

c. Specifications based on 24 AWG (PE 0.5 mm) cabling.

d. From 10 mA to 110 mA.

COPPER SPECIFICATIONS[a, b, c] (continued)		
VF noise measurement	Frequency range	200 Hz to 20 kHz
	Level range (dBm)	–90 to 20
	Resolution (dB)	0.1
	Uncertainty (accuracy)	–90 dBm to –50 dBm, uncertainty (accuracy) ±2 dB –50 dBm to +20 dBm, uncertainty (accuracy) ±1 dB
	Filters	ITU: none, psophometric, P-notched, 3.4 kHz, D-filter, 15 kHz ANSI: none, C-message, C-notched, 3.4 kHz, D-filter, 15 kHz
	Impedance	600 Ω
VF impulse noise	Low threshold (dBm)	–40 to 0, in 1 dB steps
	Mid threshold	Low threshold plus separation
	High threshold	Mid threshold plus separation
	Separation (dB)	1 to 6, in 1 dB steps
	Dead time (ms)	125
	Filters	None, 3 kHz flat, C-message, psophometric, notched and D filter (IEEE 743-1995)
	Counter	Maximum 999 for each threshold
	Timer	1 minute to 24 hours, default is 15 minutes
Power influence (noise to ground)	Noise range (dBm)	–60 to 10
	Uncertainty (accuracy)	–60 dBm to –50 dBm ± 2 dB –50 dBm to 10 dBm ± 1 dB
VF longitudinal balance	Frequency (Hz)	1004
	Level range (dB)	0 to 100
	Level uncertainty (accuracy) (dB)	±1
	Impedance	600 Ω
Time-domain reflectometer (TDR)	Modes	Fully automatic operation with location of most significant event(s)
	Distance range (m)	0 to 6700 (0 ft up to 22 000 ft)
	Pulse width	15 ns to 20 µs
	Test signals	Sine wave, compensated sine wave, half-sine wave and square wave
	Amplitude	7.5 V p-p on cable, 9 V p-p open circuit
	Velocity of propagation (VOP)	0.400 to 0.999
	Distance uncertainty (accuracy)[d] (m)	±(0.5 m + 1 % x distance)
	Units	Meters and feet
Load coil detection	Count	Up to 5
	Plot (kHz)	Up to 10
	Distance range (m)	Up to 8000 (up to 27 000 ft)

NOTES

a. Subject to change without notice.

b. Typical, at 23 °C ± 3 °C, on batteries, with no type B USB connection.

c. Specifications based on 24 AWG (PE 0.5 mm) cabling.

d. Qualified up to 300 m (1000 ft) and does not include the uncertainty due to VOP.

COPPER SPECIFICATIONS[a, b, c] (continued)		
Power spectral density (PSD)	Test type	Continuous with peak-hold
	Vertical scale	15 dBm/Hz to –140 dBm/Hz or 20 dBm to –90 dBm
	Horizontal scale	4.3125 kHz to 17 MHz, in 4.3125 kHz steps or 8.625 kHz to 30 MHz, in 8.625 kHz steps
	Noise filters	None or E, F, G, VDSL2-8, VDSL2-12, VDSL2-17 and VDSL2-30
Wideband impulse noise	Threshold	–50 dBm (40 dBrn) to 0 dBm (90 dBrn) in 1 dB steps
	Counter maximum	65 000 000
	Test duration	1, 5, 10, 15 and 60 min, 24 h or continuous
	Uncertainty (accuracy) (dB)	±2
	Noise filters	None or E, F, G, VDSL2-8, VDSL2-12, VDSL2-17 and VDSL2-30
Wideband longitudinal balance	Level range (dB)	0 to 50 up to 2.2 MHz 0 to 40 up to 12 MHz
	Level resolution (dB)	0.1
	Level uncertainty (accuracy) (dB)	±2 (up to 2.2 MHz)
	Frequency uncertainty (accuracy) (ppm)	±(50 ppm + 1 digit)
	Frequency scale	ADSL/2+: 20 kHz to 2.2 MHz VDSL/VDSL2-12: 20 kHz to 12 MHz
Single-ended frequency response (attenuation) [d]	Distance range (m)	100 m to 5000 m (300 ft to 16000 ft)
	Frequency range (Hz)	4.3 kHz to 30 MHz
	Frequency uncertainty (accuracy)	± (50 ppm + 1 digit)
	Level uncertainty (accuracy) (dB)	± 2.0 dB typical for 2.2 MHz and 8 MHz ranges ± 3.0 dB for VDSL2-12 and VDSL2-17 ± 4.0 dB for VDSL2-30 ranges
	Resolution (dB)	0.1
	Horizontal scale (MHz)	ADSL2+ = 2.208, VDSL2-8, VDSL2-12 = 12, VDSL2-17 = 17.66, VDSL2-30 = 30
	Vertical scale (dB)	0 to +100
Resistive fault location (RFL)	Test type	Single pair (two wire) and separate good pair (four wire)
	Fault detection (MΩ)	0 to 20
	Resolution	Three digits
	Loop resistance (kΩ)	10 maximum
	Multiple cable sections	Five (includes gauge and temperature setting)
	Fault location	Total resistance, near-end to fault resistance, fault to strap resistance (three significant digits, least significant digit 0.1 Ω) Total length, distance to fault, distance from fault to strap (three significant digits, least significant digit 1 m)
	Uncertainty (accuracy)	±(0.1 Ω + 1 % x RTS)

NOTES

a. Subject to change without notice.

b. Typical, at 23 °C ± 3 °C, on batteries, with no type B USB connection.

c. Specifications based on 24 AWG (PE 0.5 mm) cabling.

d. Specification based on 1 kft 24 AWG cabling. Range depends on cable type and condition.

GENERAL SPECIFICATIONS

Display	TFT LCD with backlight 152 mm (6 in) diagonal 800 x 480 resolution, WVGA
Test connections	RJ11 for ADSL2+/VDSL2 Five-color banana connector for T/B, R/A, G, T1/B1, R1/A1 RJ45 for Ethernet 10/100 WAN RJ45 for Ethernet 10/100 LAN
Results storage	1.2 GB internal memory
Temperature range operating storage	 0 °C to 40 °C (32 °F to 104 °F) –40 °C to 70 °C (–40 °F to 158 °F)
Humidity	5 % to 95 % relative, non-condensing
Shock	1 m (39 in) drop per GR-196-CORE
Altitude	3000 m (9842 ft)
Input power	9-24 VDC, 2 A, 18 W via 90-220 VAC adapter or 12 V vehicle adapter
Battery	Internal rechargeable lithium polymer, with battery-state and level indications, ajustable auto-power down
Safety	CE and CSA marked
Size (H x W x D)	254 mm x 124 mm x 62 mm (10 in x 4 $^{7}/_{8}$ in x 2 $^{7}/_{16}$ in)
Weight (with battery)	1.9 kg (4.2 lb)
Water/dust ingress	Designed to comply with IP54
Differential voltage protection	354 VRMS or 1000 VDC max
Common mode voltage protection	354 VRMS or 1000 VDC
Voltage detection	>20 V will trigger alarm message
Self-test	Routine on power-up
Connectivity	Two USB 2.0 client ports One USB Type B host port
Languages	English, French, Spanish

STANDARD ACCESSORIES

DSL test cables: RJ14 to RJ11 and telco clip with bed of nails (ACC-RJ11-TC), or RJ14 to RJ11 and 4 mm plugs with crocodile clips (ACC-RJ11-4MM)
Copper test cable: Three-color (black, red, green) 4 mm banana plugs terminated with telco clips, or Three-color (black, red, green) 4 mm banana plugs terminated with crocodile clips RFL strap (ACC-STRP)
Certificate of compliance
AC adapter (GP-2146)
Soft carrying case (GP-10-072)

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NOTICE
通告
CHINESE REGULATION ON RESTRICTION OF HAZARDOUS SUBSTANCES
中国关于危害物质限制的规定

NAMES AND CONTENTS OF THE TOXIC OR HAZARDOUS SUBSTANCES OR ELEMENTS CONTAINED IN THIS EXFO PRODUCT
包含在本 **EXFO** 产品中的有毒有害物质或元素的名称和含量

O	Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ/T11363-2006 表示该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T11363-2006 标准规定的限量要求以下。
X	Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in SJ/T11363-2006 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 SJ/T11363-2006 标准规定的限量要求。

Part Name 部件名称	Toxic or hazardous Substances and Elements 有毒有害物质和元素					
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 隔 (Cd)	Hexavalent Chromium 六价铬 (Cr VI)	Polybrominated biphenyls 多溴联苯 (PBB)	Polybrominated diphenyl ethers 多溴二苯醚 (PBDE)
Enclosure 外壳	O	O	O	O	O	O
Electronic and electrical sub-assembly 电子和电子组件	X	O	X	O	X	X
Optical sub-assembly[a] 光学组件 [a]	X	O	O	O	O	O
Mechanical sub-assembly[a] 机械组件 [a]	O	O	O	O	O	O

a. If applicable.
如果适用。

MARKING REQUIREMENTS
标注要求

Product 产品	Environmental protection use period (years) 环境保护使用期限 (年)	Logo 标志
This Exfo product 本 EXFO 产品	10	
Battery[a] 电池 [a]	5	

a. If applicable.
如果适用。

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EXPERTISE REACHING OUT