LinkIQ™

Cable+Network Tester

Users Manual

BC
2/2021, Rev. 1, 1/2022 (English)

LIMITED WARRANTY AND LIMITATION OF LIABILITY

Each Fluke product is warranted to be free from defects in material and workmanship under normal use and service. The warranty period is 1 year and begins on the date of shipment. Parts, product repairs, and services are warranted for 90 days. This warranty extends only to the original buyer or end-user customer of a Fluke authorized reseller, and does not apply to fuses, disposable batteries, or to any product which, in Fluke's opinion, has been misused, altered, neglected, contaminated, or damaged by accident or abnormal conditions of operation or handling. Fluke warrants that software will operate substantially in accordance with its functional specifications for 90 days and that it has been properly recorded on non-defective media. Fluke does not warrant that software will be error free or operate without interruption.

Fluke authorized resellers shall extend this warranty on new and unused products to end-user customers only but have no authority to extend a greater or different warranty on behalf of Fluke. Warranty support is available only if product is purchased through a Fluke authorized sales outlet or Buyer has paid the applicable international price. Fluke reserves the right to invoice Buyer for importation costs of repair/ replacement parts when product purchased in one country is submitted for repair in another country.

Fluke's warranty obligation is limited, at Fluke's option, to refund of the purchase price, free of charge repair, or replacement of a defective product which is returned to a Fluke authorized service center within the warranty period.

To obtain warranty service, contact your nearest Fluke authorized service center to obtain return authorization information, then send the product to that service center, with a description of the difficulty, postage and insurance prepaid (FOB Destination). Fluke assumes no risk for damage in transit. Following warranty repair, the product will be returned to Buyer, transportation prepaid (FOB Destination). If Fluke determines that failure was caused by neglect, misuse, contamination, alteration, accident, or abnormal condition of operation or handling, including overvoltage failures caused by use outside the product's specified rating, or normal wear and tear of mechanical components, Fluke will provide an estimate of repair costs and obtain authorization before commencing the work. Following repair, the product will be returned to the Buyer transportation prepaid and the Buyer will be billed for the repair and return transportation charges (FOB Shipping Point).

THIS WARRANTY IS BUYER'S SOLE AND EXCLUSIVE REMEDY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. FLUKE SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, INCLUDING LOSS OF DATA, ARISING FROM ANY CAUSE OR THEORY.

Since some countries or states do not allow limitation of the term of an implied warranty, or exclusion or limitation of incidental or consequential damages, the limitations and exclusions of this warranty may not apply to every buyer. If any provision of this Warranty is held invalid or unenforceable by a court or other decision-maker of competent jurisdiction, such holding will not affect the validity or enforceability of any other provision.

Fluke Corporation
P.O. Box 9090
Everett, WA 98206-9090
U.S.A.

11/99

Table of Contents

Title	Page
Introduction	1
Automatic Test Discovery	1
Contact Fluke	2
Safety Information	2
Product Familiarization	3
Parts	3
Controls and Connections	4
Hang Strap	5
Display	6
Main Menu	7
Menu Controls	7
Settings Menu	9
Configure a Static Address	12
Change the IP Address of the Product	12
Change the IP Address of a Device to Ping	12
Configure an IPv4 Address	13
Configure an IPv6 Address	14
Tools Menu	15
Before a Test	15
Cable Tests	16
Do a Cable Test	17
Cable Test Results	18
Wire Map Screen Multiple Failures	21
Open Pairs Failure	22
Short Failure	23
Split Pairs Failure	23
Test Limit Failure	24
Switch Tests	25
Switch Connectivity Tests	25
Ping Tests	25
Power over Ethernet (PoE) Tests	25
Do a Switch Test	26
Switch Test Results	26
Switch Test Detail Results	29
Ping Test Results	29
PoE Test Results	32

PoE Test Pass Example 34
PoE Test Fail Reasons 35
Save a Test Result 36
Results Menu 36
Delete Test Results 38
Upload Results to LinkWare PC 39
Tests with MS-IE-Adapter Set 39
Maintenance 40
Clean the Product 40
Battery 40
Product Specifications 41

Introduction

The Fluke Networks LinkIQ Cable+Network Tester (the Product or Tester) is a unique handheld test instrument for use in many applications to test twisted pair cables, network connectivity, and Power over Ethernet (PoE). These applications include system integration, cable installation, and network and security system maintenance. The Product provides an automatic test discovery suite that recognizes a connected device and automatically selects the appropriate type of test for the device. See *Automatic Test Discovery*. The Product can be set manually to do a cable or switch test.

The Product shows images on a high-visibility, industrial-quality LCD touch screen. The Product saves data to internal memory which can be transferred to a PC through a direct USB connection to the PC.

The Product includes LinkWare™ PC desktop software. LinkWare PC software is a high-performance, professional software suite for quality analysis and reporting.

The Product is compatible with the MicroScanner™ PoE Remote Identifer and the IntelliTone™ Pro Toner, Tracer, and Probe.

Automatic Test Discovery

The Product is set up in Auto Test mode by default. The automatic test discovery feature recognizes a connected device and automatically selects the appropriate type of test compatible with the device.

Automatic test discovery selects a:

- **Cable test** if:
  - There is no cable connected to the Product.
  - There is a cable connected to the Product but not connected to a port on an external device.
  - The Product detects a Remote ID.

  See *Cable Tests*.

- **Switch test** if the Product detects a network device. See *Switch Tests*.
- **Switch test with Ping test** with Ping enabled and the Product detects a network device. See *Switch Tests*.
- **Switch test with Power over Ethernet (PoE)** with PoE enabled and the Product detects a Power Sourcing Equipment (PSE) device. See *Switch Tests*.

Contact Fluke

Fluke Corporation operates worldwide. For local contact information, go to our website: www.flukenetworks.com.

To register your product, or to view, print, or download the latest manual or manual supplement, go to our website.

Fluke Corporation
P.O. Box 9090
Everett WA 98206-9090
U.S.A.

Fluke Europe B.V.
P.O. Box 1186
5602 BD Eindhoven
The Netherlands

+1-425-446-5500 info@flukenetworks.com

Safety Information

General Safety Information is in the printed Safety Information document that ships with the Product and at www.flukenetworks.com. More specific safety information is listed where applicable.

A **Warning** identifies hazardous conditions and procedures that are dangerous to the user. A **Caution** identifies conditions and procedures that can cause damage to the Product or the equipment under test.

Note

Before you use the Product for the first time, charge the battery for a minimum of 1.5 hours. See Battery.

⚠Caution

To activate the input protection circuitry of the Product, turn on the Product before you connect a cable to the Product. To turn on the Product, push ⏻.

Product Familiarization

Unpack the Product and identify the items shown in Table 1.

Parts

Table 1 shows the parts of the Product.

Table 1. Parts

Item	Description	Item	Description
1	Product	5	Remote ID 1[2]
2	Battery charger	6	Office locator holder
3	Universal power adapter kit[1]	7	USB C to USB A cable
4	Hang strap	8	CAT6A Copper patch cable

[1] Not available in all kits.
[2] The Product can work with Remote ID 2 to Remote ID 7 (available separately as REMOTE-ID KIT or included with LIQ-KIT)

Controls and Connections

Table 2 shows the controls and connections of the Product.

Table 2. Controls and Connections

Item	Description	Item	Description
1	RJ-45 jack	4	LCD touch screen (display)
2	Hang strap attachment slots	5	Power button.
3	USB C input terminal used to charge the battery or upload results to LinkWare PC. The Product cannot do a test while the battery charges or while results upload to LinkWare PC.		

Hang Strap

Figure 1 shows how to attach the hang strap.

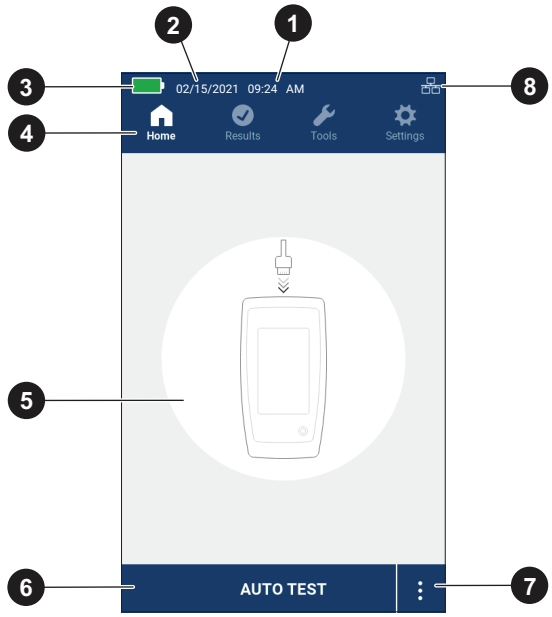
Figure 1. Hang Strap Attachment

Display

When you turn on the Product for the first time, the language selection screen shows on the display. If needed, scroll to see more languages, tap a language, and tap **OK** to set the language to use in the user interface (UI).

The users manual shows English screens in examples and translates the explanations as appropriate in tables or text. Table 3 shows the items on the display.

Table 3. Display



Item	Description	Item	Description
1	Time	5	Results and information screen
2	Date	6	Information/Command button. The function changes based on the screen. Tap **AUTO TEST** to do a test and automatically select the appropriate type of test for the device. See *Automatic Test Discovery*.
3	Battery status	7	Manual test selection button. Tap to select to do a cable or switch test.
4	Main menu toolbar. See *Main Menu*.	8	Network status. The icon shows when the Product detects an active network connection..

Main Menu

Table 4 lists the submenus available in the Main Menu.

Table 4. Main Menu

Submenu		Function
	Home	If necessary, tap to return to the Home screen. Use the Home screen to start a test or upload results to LinkWare PC.
	Results	Tap to view or manage results. See *Results Menu*.
	Tools	Tap to access additional tools. The tools cannot be used while in a test. See *Tools Menu*.
	Settings	Tap to set user preferences and view information about the Product. See *Settings Menu*.

Menu Controls

To use the menus to change and view settings:

1. Tap an icon on the main menu to open a submenu. See Table 4.

   The foreground of the selected icon changes to white.

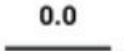
2. Tap a menu control to set and change options. See Table 5.

   Some menus contain a scroll bar on the right side to indicate there are additional options. The scroll bar is not a control. To view additional options, touch the display and slide the screen up or down. The scroll bar indicates the location in the menu.

3. To close a submenu and return to the Home screen, tap .

Table 5 is a list of the menu controls.

Table 5. Menu Controls

Item	Control	Function
Slider bar		Adjusts a value. Touch and slide the bar to the left to decrease the value or to the right to increase the value.
Selection indicator		When shown under a selection, indicates which of two options is selected.
		Option selected.
Toggle switch		Turns on or off a feature. Feature is on or enabled.
		Feature is off or disabled.
Selection indicator		To select an item from a list, tap an option. The indicator shows the selected option. In the Results menu more than one item may be selected at a time. See *Results Menu*.
Option menu button		Tap to open an option menu to adjust a setting.
Numerical value adjuster buttons		Decreases a numerical value.
		Increases a numerical value.
Back arrow		Return to the previous screen and, if necessary, save changes.
Exit button		Return to the previous screen without saving changes.
OK button	**OK**	Save changes or do an action. Then, return to the previous screen.
Cancel button	**CANCEL**	Do not do an action and return to the previous screen.
Add feature button		Tap to add a feature such as an IP address.
Delete feature button		Tap to delete a feature such as an IP address.
Delete text button		Tap to delete text typed in a field.

Settings Menu

Table 6 is a list of the options available in the Settings menu. The Product uses the last saved settings when the Product is turned off and back on.

Table 6. Settings Menu

Option Menu	Option	Description
Wire map Settings		
Shield Test		Uses the continuity of the shield on the cable to determine if a test passes.
		Even if a shield is connected to a cable, the continuity of the shield is not used to determine if a test passes. Default setting.
Allow Crossover		The wire map of either a straight through cable or a crossover cable is used to determine if a test passes.
		The wire map of a straight through cable is used to determine if a test passes. A wire map of a crossover cable fails. Default setting.
Pinout	<options>	Select to set the wire color configuration to use to do a test. **T568A** is the default setting.
Cable Settings		
Test Limit	**10BASE-T**	Verify if a cable with continuity on at least the 1,2 and 3,6 pairs can support 10BASE-T (10) data rate throughput.
	100BASE-TX	Verify if a cable with continuity on at least the 1,2 and 3,6 pairs can support 100BASE-TX (100) data rate throughput.
	1000BASE-T	Verify if a 4-pair cable with continuity on all 4 pairs can support 1000BASE-T (1G) data rate throughput.
	2.5GBASE-T	Verify if a 4-pair cable with continuity on all 4 pairs can support 2.5GBASE-T (2.5G) data rate throughput.
	5GBASE-T	Verify if a 4-pair cable with continuity on all 4 pairs can support 5GBASE-T (5G) data rate throughput.
	10GBASE-T	Verify if a 4-pair cable with continuity on all 4 pairs can support 10GBASE-T (10G) data rate throughput. Default setting.

Table 6. Settings Menu (cont.)

Option Menu	Option	Description
NVP	<options>	Set the Nominal Velocity of Propagation (NVP) value based on the cable. NVP value range is 50-99. The default NVP value is **68**.
General Settings		
Auto Increment		Automatically increments the Test ID by one number or letter for the next test. Default setting.
		Use to manually increment or edit the Test ID.
PoE Test		Enable PoE detection. Use to automatically do a PoE test after you do a network switch test. Default setting.
		Disable PoE detection. Use to decrease the time to do a switch test.
Network	<options>	Tap to select: • **DHCP** to automatically assign an IP address to the Product. • **Static** to configure the IP address, Subnet Mask, Gateway, and DNS of the Product. See *Change the IP Address of the Product*. The default settings are: **IPv4 Address**: **DHCP** **IP**, **Gateway**, and **DNS** addresses: 0.0.0.0 **Subnet Mask**: /24 (255.255.255.0) **IPv6 Address**: **DHCP** (which is SLAAC/DHCPv6 for IPv6) **IP**, **Gateway**, and **DNS** addresses: ::0 **Subnet Mask**: /64

Table 6. Settings Menu (cont.)

Option Menu	Option	Description
Ping	<options>	With the IP address of the Product automatically assigned or configured in the Network setting, tap to open the Ping screen to: • Enable or disable the Ping feature. Enabled is the default setting. • With Ping enabled, use to: ○ Automatically do a Ping test after you do a network switch test. Default Setting: IPv4 address 8.8.8.8 ○ Use the saved protocol (IPv4 or IPv6) and enter a new target IP address that uses the same protocol. ○ Delete an IPv4 target address to add and configure an IPv6 target address or vice versa. See *Change the IP Address of a Device to Ping*.
CDP/LLDP Timeout	<options>	Tap to select the time in seconds to wait for a CDP/LLDP response before the Product retries network discovery. The default is **30 sec**.
☀	--	Use the slider bar at the right of the image to adjust the brightness of the image.
Auto Shutoff		The Product turns off after 15 minutes of no use. While the Product charges, Auto Shutoff is disabled. Default setting.
		The Product remains on until the battery needs to be charged again.
Sound		The Product emits an audible sound at the completion of a test. Default setting.
		The Product does not emit an audible sound at the completion of a test.
Numbers	--	Set or view the decimal point indicator.
Units	--	Set or view the units to use in measurements.

Table 6. Settings Menu (cont.)

Option Menu	Option	Description
Date/Time	<options>	Tap to select options to set the date, time, date format, and time format.
Language	<options>	Tap to select a language after initial setup.
About	--	Tap to view the serial number, MAC address, and version information of the Product.
Factory Reset	--	Tap to delete all test results and reset the Product to the factory default settings.

Configure a Static Address

Use the directions below to configure an IPv4 or an IPv6 address to use for the Product or to use on a device connected to a network.

Change the IP Address of the Product

To change the IP address of the Product:

1. Tap > **Network** > **IPv4** or **IPv6** > **Static**.

   With **Static** selected, the IP, Subnet Mask, Gateway, and DNS buttons show. With Static selected for both IPv4 and IPv6, a scroll bar also shows.

2. Configure the address. See *Configure an IPv4 Address* or *Configure an IPv6 Address*.

Change the IP Address of a Device to Ping

Set up the Product to use either an IPv4 or an IPv6 address of a device to ping, but not both.

To set up a ping test:

1. Turn on the Product.
2. Connect the Product to a network.
3. Go to > **Ping**.
4. If needed, turn on Ping.
5. To change from an IPv4 address to another IPv4 address or from an IPv6 address to another IPv6 address, tap > on the IP button and enter the new address. See *Configure an IPv4 Address* or *Configure an IPv6 Address*.

6. To change from an IPv4 address to an IPv6 address or vice versa:
   a. On the IP button, tap 🗑.
   b. Tap **OK** to delete the address.
   c. Tap **IPv4** or **IPv6**.
   d. Tap ⊕ to add an IP address button.
   e. On the IP button, tap › and enter a new address. See *Configure an IPv4 Address* or *Configure an IPv6 Address*.

Configure an IPv4 Address

To manually configure an address:

1. Tap **IP** to open the IP address screen.
2. Enter the IP address.

   An IPv4 address is 32 bits represented in dot-decimal notation. The address consists of four groups of decimal digits (0 to 255) separated by a dot or period. The UI has a separate entry field for each group of digits.

   Examples of valid IPv4 addresses:

   - 8.8.8.8 (Google DNS servers)
   - 192.168.10.1
   - 10.10.10.1

   Examples of invalid IPv4 addresses:

   - 0.0.0.0
   - 255.255.255.255
   - An address with “0” as the first byte
   - An address with a decimal number greater than 255
   - 224.0.0.0 /4
   - 127.0.0.0 /8
3. Tap **Subnet Mask**, scroll if needed, and tap a subnet mask.

   The Product shows subnet mask notation for example, 255.255.0.0. The corresponding prefix length values are /1 to /31.
4. Tap **Gateway** to enter the Gateway address.
5. Tap **DNS** to enter the DNS address.

Configure an IPv6 Address

To manually configure an address:

1. Tap **IP** to open the IP address screen.
2. Enter the IP address.

   An IPv6 address is 128 bits represented as eight groups of four hexadecimal digits (16 bits) with a colon between each group. The UI has a separate entry field for each group of digits.

   Examples of valid IPv6 addresses:

   - 2001:4860:4860::8888 (Google DNS servers)
   - 2001:0db8:0000:0000:8a2e:0000:0370:7334

     Examples of invalid IPv6 addresses:

   - 0:0:0:0:0:0:0:0
   - ffff:ffff:ffff:ffff:ffff:ffff:ffff:ffff
   - ff00:: /8
   - ::ffff:0:0 to ::ffff:ffff:ffff

   Because IPv6 addresses can be long, there are valid ways to shorten them.

   - Omit leading zeros within a group. In the second example of valid addresses above, the second and seventh groups may be shortened to db8 and 370, respectively.
   - If two or more adjacent groups contain 0000, replace them with two colons as in the first example above.
   - If a group contains 0000 and is not adjacent to another group that contains 0000, replace it with one zero.

   According to the rules above, the full address of the first example is: 2001:4860:4860:0000:0000:0000:0000:8888, and the shortened address of the second address is 2001:db8::8a2e:0:370:7334.
3. Tap **Subnet Mask**, scroll if needed, and tap a subnet mask.

   Although the Product uses the term subnet mask, the prefix length from /1 to /127 shows.
4. Tap **Gateway** to enter the Gateway address.
5. Tap **DNS** to enter the DNS address.

Tools Menu

Table 7 is a list of the options available in the Tools Menu.

Table 7. Tools Menu

Options Menu	Option	Description
Tone Generator	**IntelliTone**	The Product emits a digital tone that an IntelliTone™ probe can use to locate and isolate cables behind walls, at patch panels, or in bundles.
	Analog Tone 1	The Product emits an analog signal that a standard analog probe can use to identify cables in bundles.
	Analog Tone 2	
	Analog Tone 3	
Blink Port Light	--	Tap to blink a port light on a hub or switch to verify connectivity and cable routes.

Before a Test

Read the warnings below before you do a test.

⚠⚠ Warning

To prevent possible electrical shock, fire, personal injury, or damage to the Product:

- **To activate the input protection circuitry of the Product, turn on the Product before you connect a cable to the Product.**
- **During a test, do not connect a cable to the Product.**
- **During a test, do not disconnect a cable from the Product.**
- **The tester is not intended to be connected to active telephone inputs, systems, or equipment, including ISDN devices. Exposure to the voltages applied by these interfaces may damage the tester and create a potential shock hazard.**

- **Use caution when working in potentially hazardous locations such as an elevated location on a ladder or roof top, especially if work is occurring in proximity to a lightning storm. Also use caution if external communication cables are run at length in parallel to electrical power installation cables. These types of installations can expose communication cables to coupled electrical transients that could be accessible on exposed conductive parts of the equipment during operation. While in general these transients are not expected to be an electric shock hazard, startled reaction from these transients could lead to a secondary hazard such as loss of balance and lead to a fall or other injury. To reduce risk of exposure, limit contact to accessible conductive parts of I/O terminals during operation.**

Cable Tests

In a twisted pair cable test, the Product performs a series of radio frequency (RF) tests to determine the transmission parameters of the cable. The parameters are compared to the test limits specified by IEEE 802.3 for Ethernet. Unlike transmission testers that pass bits across the cable, the Product evaluates the physical qualities of the cable.

- Measures length up to 304.8 m (1000 feet)
- Delay skew between pairs
- Transmission parameters used to qualify the cable:
  - Insertion loss
  - Return loss
  - NEXT
  - Delay skew
  - Length
  - Wire map
- Cable qualification to IEEE 802.3 standards:
  - 10BASE-T
  - 100BASE-TX
  - 1000BASE-T
  - 2.5GBASE-T
  - 5GBASE-T
  - 10GBASE-T
- Uses wire maps to show:
  - Opens
  - Shorts
  - Split pairs
  - Miswires

Do a Cable Test

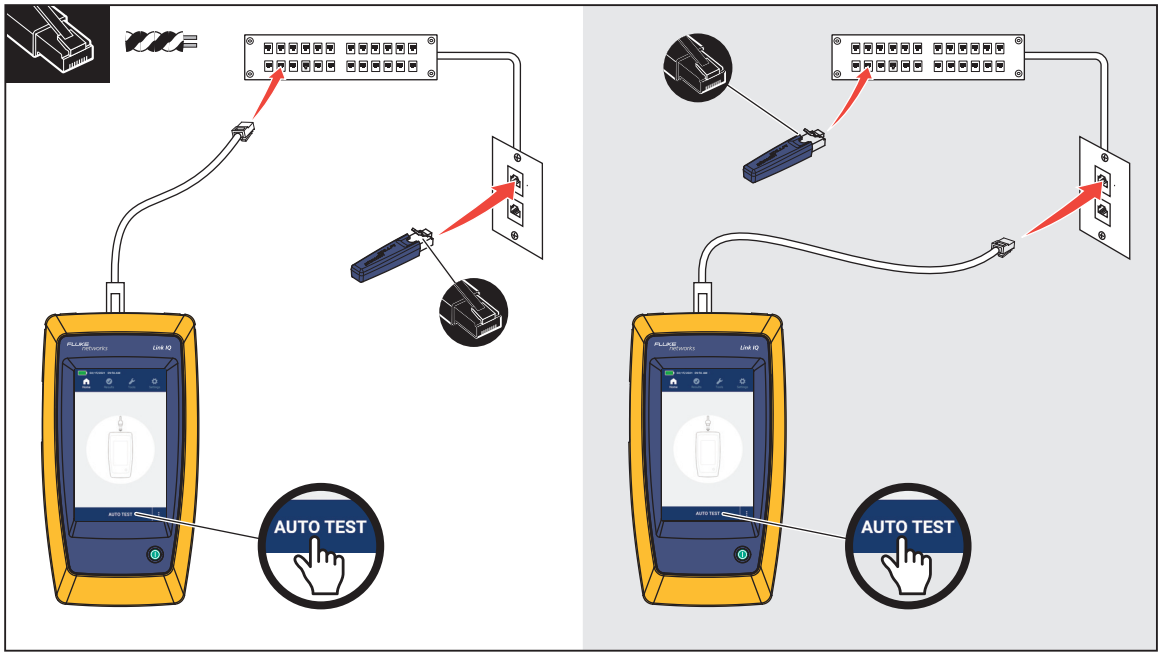
Cable tests pass or fail based on the settings selected for the test. To pass a test:

- The Product must detect a Remote ID.
- The wire map must match the selected wire map settings.
- The cable under test must meet or exceed the selected test limit.

To do a cable test:

1. Turn on the Product.
2. If necessary, adjust the settings. See *Settings Menu*.
3. Connect one end of the CAT6A copper patch cable or other approved cable into the RJ-45 jack on the Product. See Figure 2.

Figure 2. Cable Test Set Up



4. Connect the other end of the patch cable into an RJ-45 jack or into an adapter that is connected to the near end of the cable under test. Then, connect the Remote ID into an RJ-45 jack or adapter that is connected to the far end of the cable under test.

   Or,

   Connect the Remote ID into an RJ-45 jack or into an adapter that is connected to the near end of the cable under test. Then, connect the other end of the patch cable into an RJ-45 jack or into an adapter that is connected to the far end of the cable under test.

5. Tap **AUTO TEST** to do a test.

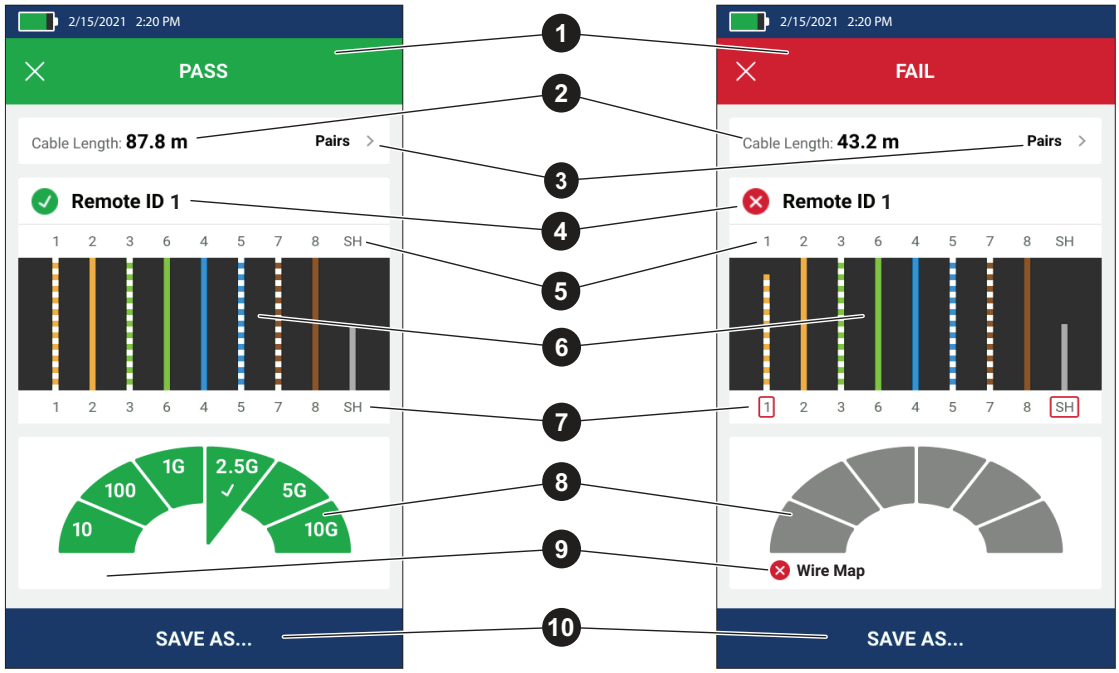
   The results show on the display. See Table 8.

6. To save the results, tap **SAVE AS...**. See *Save a Test Result*.

Cable Test Results

Table 8 shows examples of results of cable tests.

Table 8. Cable Test Results



Item	Description	Function
❶	Result label	The background is green if the test passed. The background is red if the test failed. The background is blue if the screen is for information only.
❷	Cable length	Shows the length of the shortest pair in the cable.
❸	**Pairs** button	Tap to open the PAIRS screen. If a cable end length is found, the lengths of the cable pairs show.

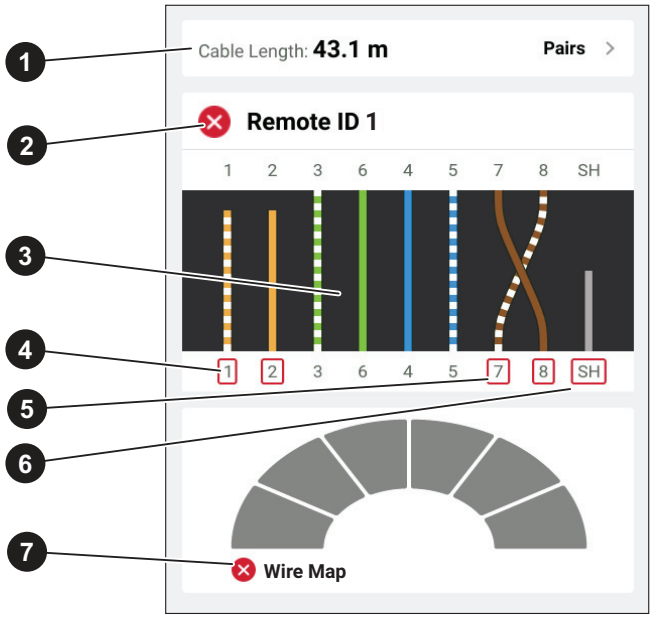
Table 8. Cable Test Results (cont.)

Item	Description	Function
❹	Remote ID label	Shows the Remote ID number used in the test and information about the test. ✓ **Remote ID** The Product detects the Remote ID and the wire map test passes. ✕ **Remote ID** The Product detects the Remote ID, but the wire map test fails. ✕ **No Remote ID** There is a short on the cable under test, so the Product cannot detect the Remote ID. The wire map test fails. ⓘ **No Remote ID** The test did not detect the Remote ID because a Remote ID is not connected. See *Wire Map Screen Multiple Failures*.
❺	Wire and shield identifiers (far end)	Numbers: Indicates which wire from the near end maps to which wire on the far end. SH: Indicates the shield on the far end of a cable.
❻	Wire map results	Shows the results of the wire map. See *Wire Map Screen Multiple Failures*.
❼	Wire and shield identifiers (near end)	A red box around a wire number indicates that the wire did not pass based on the settings selected for the test. A red box around SH indicates that the continuity of the shield test did not pass.
❽	Cable performance results	When a wire map passes, the results show: • The cable performance capability. • Whether the cable performance test passes (green) or fails (red) based on the test limit selected for the test. If a wire map fails, the segments show gray because the Product cannot determine the cable performance capability.
❾	Fail explanation label	When a test fails, the label shows the reason why the test fails.
❿	**SAVE AS...**	When there is memory available to save the result, tap **SAVE AS...** to save the result. See *Save a Test Result*.

Wire Map Screen Multiple Failures

Table 9 shows a wire map of a cable test that failed for multiple reasons.

Table 9. Multiple Failures



Item	Description
1	Pairs 1,2 are the shortest pair of the cable and open at 43.1 m.
2	The Product detected the Remote ID, and the wire map failed. The wires are not wired correctly based on the settings selected for the test.
3	The wire map shows how the cable is wired. The wire map passes or fails based on the settings selected for the test. For this test, the settings are set to test: • A straight through cable (**Allow Crossover** can be on or off to test a straight through cable). • The continuity of the shield on the cable (**Shield** > ⬤) • The test limit is set to ≥1000BASE-T (1G) to verify a 4-pair cable.

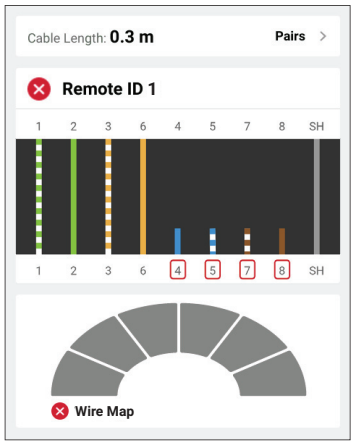
Table 9. Multiple Failures (cont.)

Item	Description
❹	Pairs 1,2 fail because they are open.
❺	Pairs 7,8 fail because they are a reverse pair.
❻	The continuity of the shield fails because the continuity of the shield cannot be verified.
❼	Because the wire map failed, the Product cannot test the performance capability of the cable.

Open Pairs Failure

Figure 3 shows a wire map of a cable test that fails because wires 4, 5, 7, and 8 are open. The wires are not connected on the far end and the test limit is set to ≥1000BASE-T (1G) to verify a 4-pair cable. With a test limit set to 10BASE-T or 100BASE-TX, the wire map of the cable test passes. The length of the wires on the wire map indicates the distance to the open.

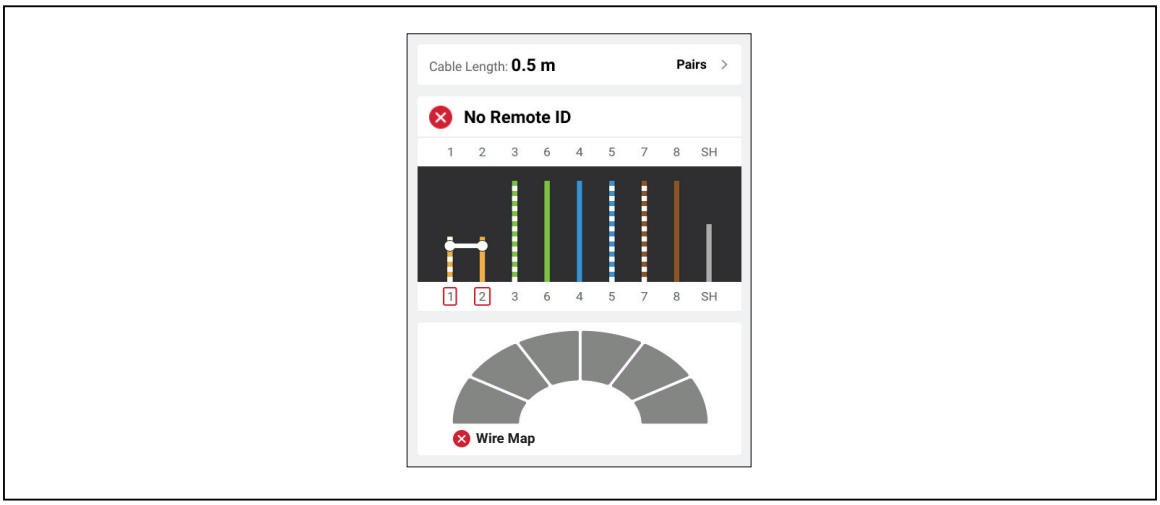
Figure 3. Open Pairs



Short Failure

Figure 4 shows a wire map that fails because wires 1 and 2 are shorted together. The length of the wire on the wire map indicates the distance to the short. With wires shorted together, the Product cannot detect the Remote ID. Repair the short and do the test again to verify the wire map of the other pairs.

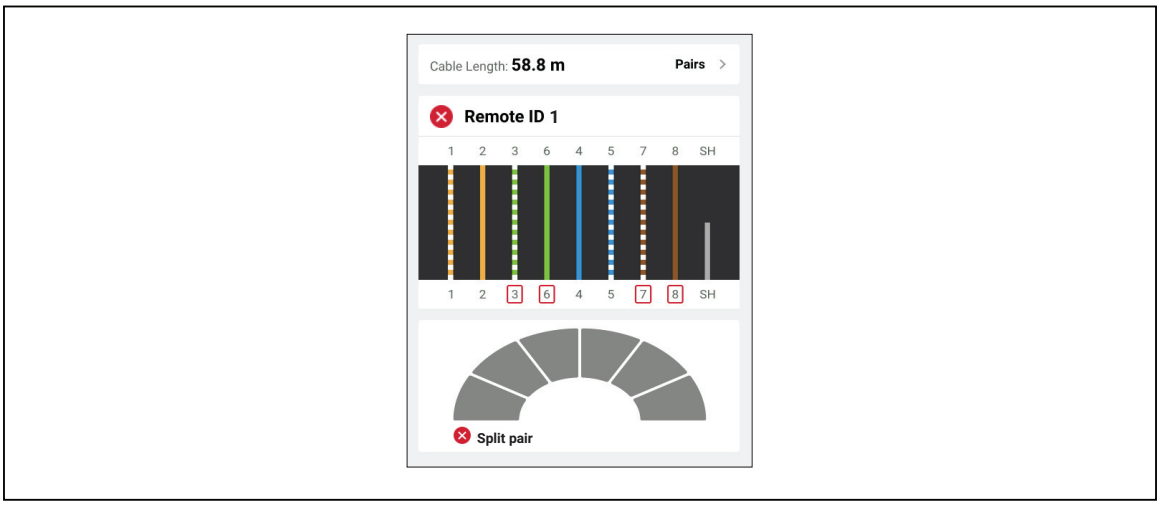
Figure 4. Wires Shorted Together



Split Pairs Failure

Figure 5 shows a wire map of a cable test that fails because pairs 3,6 and 7,8 are split pairs.

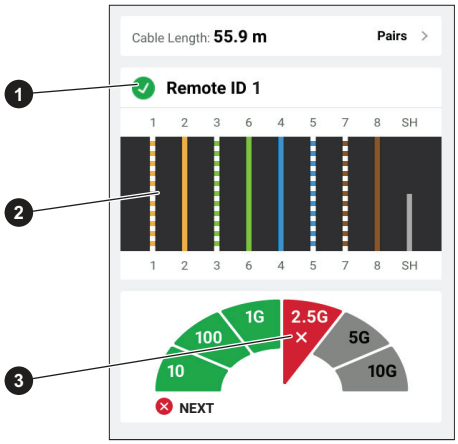
Figure 5. Split Pairs



Test Limit Failure

Table 10 shows a cable test that fails because of near end cross talk (NEXT).

Table 10. NEXT Failure



Item	Description
1	The Product detected the Remote ID, and the wire map passed.
2	The wire map passes because: • The wires are all connected correctly on both the near and far ends for a straight through cable. **Allow Crossover** can be on or off to test a straight through cable. • The continuity of the shield is not included as part of the test. (**Shield** >).
3	The test fails because the test limit is set to verify the cable can support a 2.5BASE-T (2.5G) data rate throughput. • The cable can support 10BASE-T (10), 100BASE-TX (100), and 1000BASE-T (1G) data rate throughputs. • The cable cannot support 2.5BASE-T (2.5G) data rate throughput.

Switch Tests

The Product can do switch connectivity, Ping, and Power over Ethernet (PoE), and tests.

Switch Connectivity Tests

In a network test, the Product performs a series of queries to determine and report information about a switch or device. The Product determines information about the device and reports advertised data rates with full-duplex or half-duplex. See *Switch Test Results*.

Ping Tests

The Product supports IPv4 and IPv6 addresses. Both protocols may be configured based on what is available on the network.

With Ping enabled, the Product pings the device specified in **Settings** > **Ping** and the DNS servers and gateways that the Product detects. The Product pings each device four times with a 1 second threshold timeout for each attempt and shows:

- If an IP address is accessible.
- The round-trip response time in milliseconds (ms).

Power over Ethernet (PoE) Tests

With PoE Test enabled, the Product automatically does a PoE test after the completion of a network switch test.

Definitions:

- Power Sourcing Equipment (PSE) is a device, such as a switch, that can provide PoE.
- A Powered Device (PD) is a device that can receive PoE from a PSE.
- PoE negotiation standards are defined in IEEE 802.3af/at/bt.

In a PoE test:

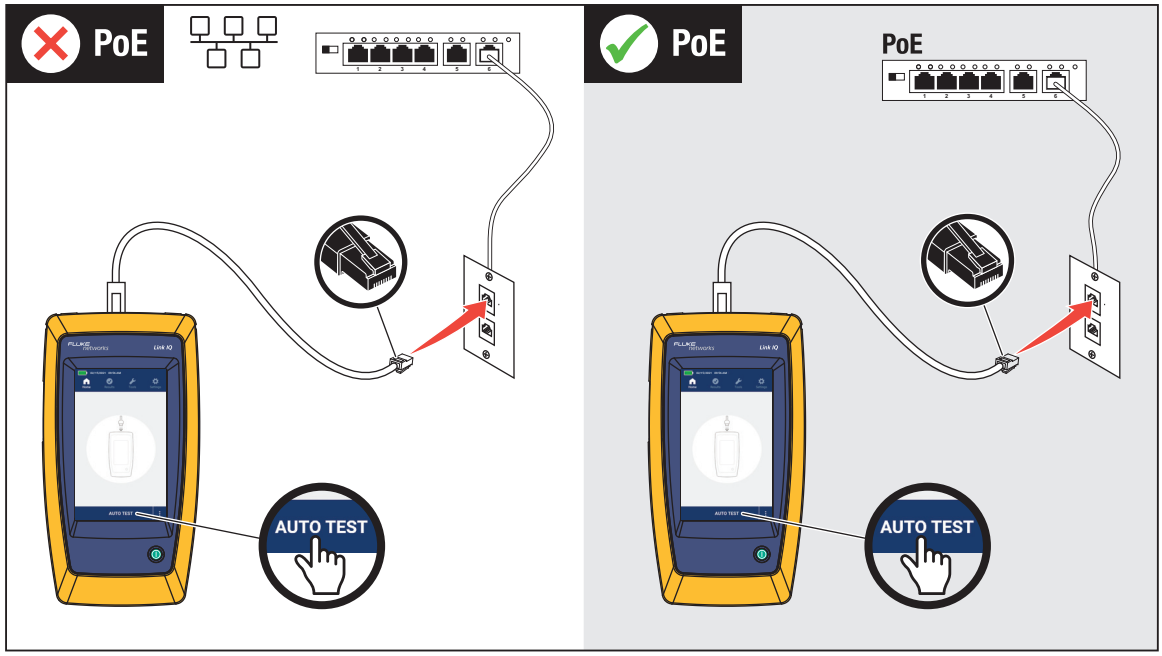
1. With the Product connected to a PSE, the Product acts as a PD and starts a hardware negotiation with the PSE.
2. If the PSE is compliant with the IEEE 802.3 standard, the Product determines the maximum power the PSE can offer (Class 0 to Class 8).
3. The Product places a load on the PSE to determine if the PSE delivers the power required to meet the negotiated hardware power class at the PD.
4. If the PSE meets the hardware negotiation power class, the Product attempts a software negotiation with LLDP/CDP to determine the software power level offered.
5. The Product places a load on the PSE to determine if the PSE delivers the software negotiated power at the PD.

Do a Switch Test

To do a switch test:

1. Turn on the Product.
2. Connect one end of the CAT6A copper patch cable or other approved cable into the RJ-45 jack on the Product. See Figure 6.

Figure 6. Switch Test Set Up



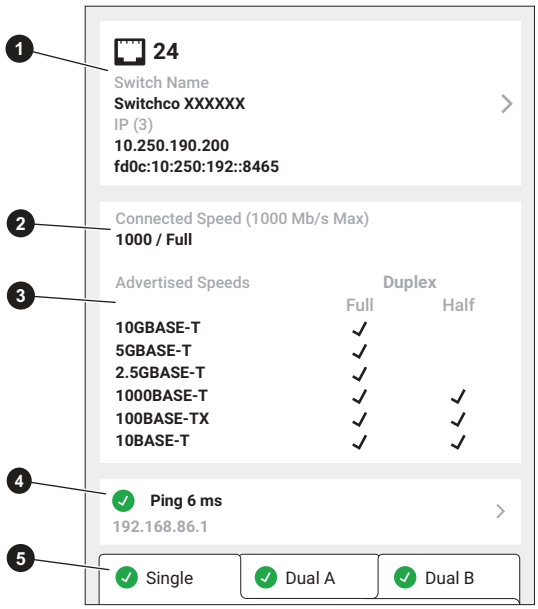
3. Connect the other end of the patch cable into an RJ-45 jack in an outlet connected to a switch.
4. If needed, adjust the settings. See *Settings Menu*.
5. Tap **AUTO TEST** to do a test.

   The results show on the display.
6. On a test result screen, tap **SAVE AS...**. See *Save a Test Result*.

Switch Test Results

Table 11 shows possible results of a switch test.

Table 11. Switch Test Results



Item	Description	Function
❶	Switch summary button	When the Product receives a compliant LLDP or CDP packet from a device, the summary button shows the: • The number of the switch port that the device connects to • The switch name • The IP addresses of the switch. A maximum of two IP addresses can show. Additional IP address may be listed on the details screen. The number in parentheses indicates how many IP addresses identify as available. Tap to view detailed results. See *Switch Test Detail Results*. An unmanaged or non-compliant device may not report the details of the switch.
❷	Connected speed	When connected to a network, the maximum speed that the Product connects to the switch. The maximum speed that the Product connects to the switch may be slower than the maximum advertised speed (❸) of the switch.

Table 11. Switch Test Results (cont.)

Item	Description	Funcition
❸	Advertised speeds	Shows the advertised speeds of the device and whether they have full-duplex or half-duplex capability at the advertised speed. Speeds in black indicate the switch advertises that speed. Speeds in gray indicate the switch does not advertise that speed. **Full Duplex** A check mark (✓) indicates the device can send and receive communication simultaneously at the advertised speed. A dash (—) indicates the device does not have full-duplex capability at the advertised speed. **Half Duplex** A check mark (✓) indicates the device can send and receive communication but not simultaneously at the advertised speed. A dash (—) indicates the device does not have half-duplex capability at the advertised speed. A blank space indicates that half-duplex capability is not available at the advertised speed.
❹	Ping summary button	This button shows only when Ping is enabled. • ✓: Indicates the test passes. • ✕: Indicates the test fails. • The maximum round trip time in ms of the 4 ping attempts or -- ms if no ping attempts are successful. • The IP address of the device on the network that is pinged. Tap to open the Ping screen to view detailed ping results. See *Ping Test Results*.
❺	PoE test results	PoE results show only when PoE is on and the Product is connected to a PoE device. If needed, scroll down to see all the results. See *PoE Test Results*.

Switch Test Detail Results

Table 12 shows possible detail results of a switch test. When an item is not configured with a name or description, **--** shows.

Table 12. Switch Test Detail Results

Name	Description
Switch Name	The name of the nearest switch
Switch Description	The description of the nearest switch
Port ID	The port number of the switch that the Product is connected to
Port Description	The description of the port
VLAN	The VLAN that is configured on the switch port
VLAN Name	The name assigned to the VLAN
IP Address	A list of IP addresses reported by the switch
MAC Address	The MAC address of the switch
Protocol	The discovery protocols used by the switch protocols show. There may be a combination of LLDP, CDPv1, or CDPv2.

Ping Test Results

The Product pings a user-defined IP address, DNS server, and gateway 4 times.

With a successful test, the Product shows the IP address of each device and the response time in milliseconds (ms) from each ping shows in the results.

If a ping attempt fails, ⊗ shows instead of a time value.

If one or more ping attempt fails, an error message shows with a description of the problem of the first ping attempt that fails.

Table 13 shows possible results of a ping test.

Table 13. Ping Test Results

Item	Description
General section	
IP Address	The IP address configured in **Settings** > **Ping**,
Round Trip Times	The round trip time in ms from each time the Product pings the IP address.
Packets	✓ shows if no packets are lost. ✗ shows if one or more packets is lost.
Lost	The number of lost packets. For example 1/4 indicates one packet is lost of the four packets sent.
Size	The size in bytes (typically 64 bytes) of the ping packet sent for each test.
Error information	If one or more packets is lost, an error message shows with a description of the problem of the first lost packet.
Network	The information that shows depends on the configuration of the network. If the Product detects only one protocol (IPv4 or IPv6) on a network, the information for that protocol shows. If the Product detects both protocols, the information for both protocols shows. Information for the DHCPv6 server shows only if the network uses DHCPv6. If the network uses SLAAC without DHCPv6, the DHCP server address, offer, ACK, and lease times do not show.
My IPv4 or My IPv6	The address the Product receives from the DHCP server as an offer or the user-defined static address.
Subnet Mask	The subnet mask of the network the Product connects to and tests on.
DHCP Server	The IP address of the DHCP server.
Offer Time	For IPv4 addresses, this is the length of time between when the Product sends the discovery signal and receives an address offer from the DHCP server. For IPv6 addresses, the DHCPv6 advertised time shows. The advertised time is the time between when the Product sends the DHCPv6 solicit packet and receives the advertise response packet.

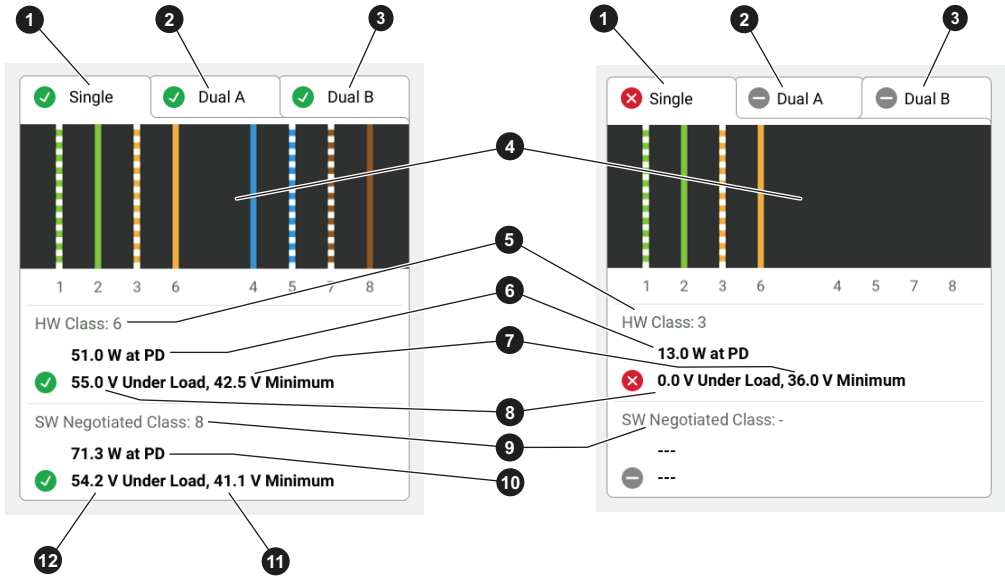
Table 13. Ping Test Results (cont.)

Item	Description
ACK Time	For IPv4 addresses, the length of time between when the Product sends the request and receives the acknowledgment from the DHCP server. For IPv6 addresses, the DHCPv6 reply time shows. The reply time is the length of time between when the Product sends the DHCPv6 request and receives the reply response packet.
Lease Time	For IPv4 addresses, the length of time the offered address is valid. Lease time shows in D (days), H (hours), and M (minutes). For IPv6 addresses, the DHCPv6 preferred-lifetime shows. The preferred-lifetime is a the length of time in seconds that an address is in the preferred state and can be used without restrictions. If the preferred-lifetime expires, the address becomes deprecated. *Note* *Deprecated addresses may be used for an existing communication. Do not use a deprecated address for new communications.*
DNS	With the network configured to automatically detect DHCP, up to four DNS server results show. IPv4 results show before IPv6 server results. With the network configured statically, only one DNS server per protocol shows in the results with a maximum of two total results. For example, one IPv4 or one IPv6 result shows, or one of each protocol shows.
Gateway	This section shows when the Product detects the availability of a gateway or router. With the network configured to automatically detect DHCP, up to four gateway results show. IPv4 results show before IPv6 server results. With the network configured statically, only one gateway per protocol shows in the results with a maximum of two total results. For example, one IPv4 or one IPv6 result shows, or one of each protocol shows.

PoE Test Results

Table 14 shows possible results of a PoE test.

Table 14. PoE Test Results



Item	Description	Function
❶	**Single**	Tap to view single signature power results. ✓: Indicates the switch can negotiate single signature power. ✗: Indicates the switch cannot negotiate single signature power.
❷	**Dual A**	Tap to view Dual A signature power results. ✓: Indicates the switch can negotiate dual signature power on pairs 1,2 and 3,6. –: Indicates the switch cannot negotiate dual signature power.
❸	**Dual B**	Tap to view Dual B signature power results. ✓: Indicates the switch can negotiate dual signature power on pairs 4,5 and 7,8. –: Indicates the switch cannot negotiate dual signature power.

Table 14. PoE Test Results (cont.)

Item	Description	Function
4	Powered pairs	Shows which pairs have power.
5	**HW: Class**	The hardware negotiated power class (Class 0 to Class 8) of the PSE device.
6	Watts at PD	The loaded power in watts provided by the PSE at the PD.
7	Volt minimum	The minimum required volts the device needs to meet under load per the IEEE 802.3 standard based on the HW negotiated power class (5).
8	Volts under load	Measured voltage under load at reported power draw. ✓: Indicates the voltage meets the requirements for the HW negotiated power class (5). ✗: Indicates the voltage does not meet the requirements for the HW negotiated power class (5). Or, The switch under test cannot deliver power to the device because the maximum power which the switch can deliver is already in use.
9	**SW Negotiated Class:**	The software negotiated power class (Class 1 to Class 8) of the device. This section does not show information, If: • The device does not support the voltage required to meet the HW negotiated power class. • The device does not support software negotiation.
10	Watts at PD	The loaded power in watts provided by the PSE at the PD.

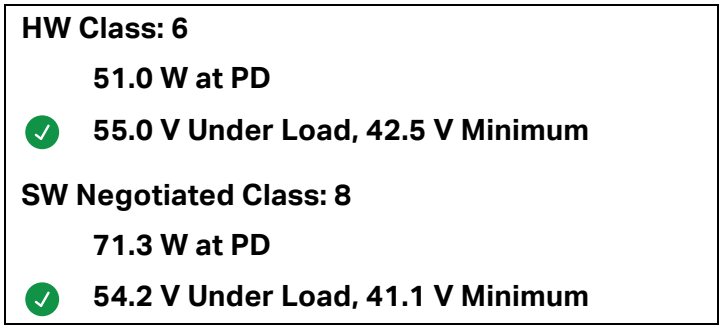
Table 14. PoE Test Results (cont.)

Item	Description	Function
⓫	Volt minimum	The minimum required volts the device needs to meet under load per the IEEE 802.3 standard based on the SW negotiated power class (⑨).
⓬	Volts under load	Measured voltage under load at reported power draw. ✓: Indicates the voltage meets the requirements for the SW negotiated power class (⑨). ✕: Indicates the voltage does not meet the requirements for the SW negotiated power class (⑨). Or, The switch under test can deliver the HW negotiated power class, but the switch cannot deliver the additional power to the device required to meet the SW negotiated power class because the maximum power which the switch can deliver is already in use. —: Indicates the device does not support the voltage required to meet the HW negotiated power class.

PoE Test Pass Example

Figure 7 shows an example of test results of a single signature PoE device that passes. See the explanation of the results below the figure.

Figure 7. PoE Test Pass Example



The hardware class section passes because:

- The device identifies as a HW Class 6 capable of 51.0 W at PD.
- The Product applies a load to the device to validate if the available power from the PSE at the PD meets the standard of the negotiated class (in this example, a Class 6 device).
- The device delivers 55.0 V under the load which is ≥42.5 V, the minimum amount required for a device to meet the Class 6 standard.

The software class section passes because:

- The device identifies as a SW Negotiated Class 8 capable of 71.3 W at PD.
- The Product applies a load to the device to validate the available power from the PSE at the PD meets the standard of the negotiated class (in this example, a Class 8 device).
- The device delivers 54.2 V under the load which is ≥41.1 V, the minimum amount required for a device to meet the Class 8 standard.

PoE Test Fail Reasons

A PoE device fails a test if:

- The device identifies as capable of a negotiated hardware class greater than the power the device can deliver under the load required to meet the standard for the stated class.
- The device identifies as capable of a negotiated software class greater than the power the device can deliver under the load required to meet the standard for the stated class.
- The switch under test cannot deliver power to the device because the maximum power which the switch can deliver is already in use.

Save a Test Result

To save a test:

1. On a test result screen, tap **SAVE AS...**.

   Switch, Ping, and PoE results save in the same test result.

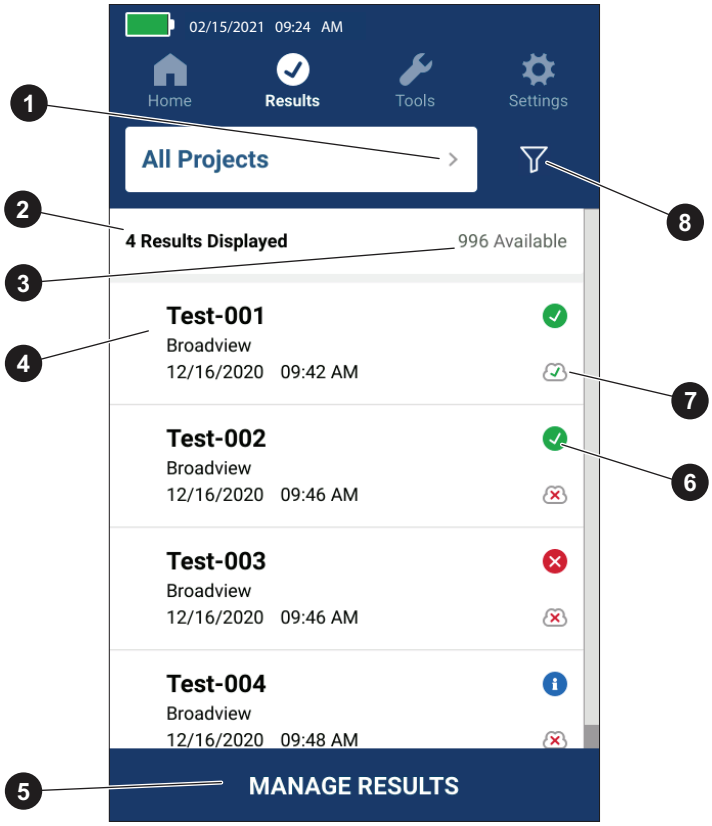
2. If necessary, use the onscreen keyboard to enter the **Test ID**, **Project Name**, and **Operator Name**.

3. Tap **OK**.

Results Menu

Table 15 shows possible symbols in the Results menu.

Table 15. Results Menu



Item	Description	Function
❶	Project selection box	Tap to view the results of all the projects or to select a single project to view the results from.
❷	Number of results	Shows the number of results selected to view. In the Project selection box (❶): • With **All Projects** selected, shows the total number of test results saved. • With a single project selected, shows the number of test results saved in that project.

Table 15. Results Menu (cont.)

Item	Description	Function
❸	Available results	Shows the remainder of available results that can be saved in memory. The Product can save a maximum of 1000 results.
❹	Test information	Shows the Test ID, Project Name, and the date and time of the test.
❺	**MANAGE RESULTS**	Tap to select which results to delete. See *Delete Test Results*.
❻	Result symbol	The result passed. The result failed. The result is for information only.
❼	Upload symbol	The result is uploaded to LinkWare PC. The result is not uploaded to LinkWare PC.
❽	Sort button	Tap to select how to sort the results: **Oldest, Newest, Test ID (A-Z), Test ID (Z-A)**.

Delete Test Results

To delete a test result:

1. Tap **Results** > **MANAGE RESULTS**.
2. Tap the box to the left of each result to delete.
3. Tap **DELETE**.
4. Tap **OK**.

To delete all of the test results:

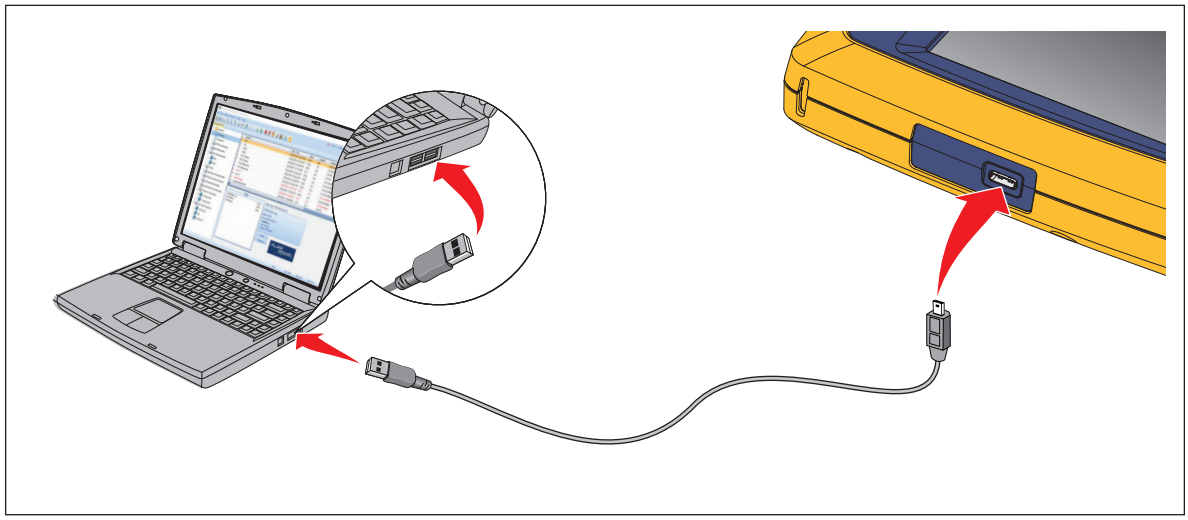
1. Tap **Results** > **MANAGE RESULTS** > **SELECT ALL**.
2. Tap **DELETE**.
3. Tap **OK**.

Upload Results to LinkWare PC

To upload results to LinkWare PC:

1. If necessary, tap on **Home**.
2. Connect the USB-C end of the USB cable into the USB port on the Product. See Figure 8.
3. Connect the USB-A end of the USB cable into a USB port on a PC.
4. On a PC, use LinkWare PC to upload results.

Figure 8. Product to PC Connection



Tests with MS-IE-Adapter Set

To do a test with an MS-IE Adapter Set, see the *MS-IE-Adapter Set QRG* on www.flukenetworks.com.

Maintenance

⚠⚠ Warning

To prevent possible electrical shock, fire, or personal injury:

- **Do not open the case. You cannot repair or replace parts in the case.**
- **Use only specified replacement parts.**
- **Have an approved technician repair the Product.**

Clean the Product

Clean the case and display with a soft cloth dampened with water and a mild soap solution. Do not use solvents, isopropyl alcohol, or abrasive cleansers.

To clean the ports, use a pressurized can of air or a dry nitrogen-ion gun, if available, to blow the particulates from the ports.

Battery

Note

The Product only operates on battery power. You cannot do a test while the battery charges.

⚠⚠ Warning

To prevent possible electrical shock, fire, personal injury, or damage to the Product:

- **Use only Fluke Networks approved power adapters to charge the battery.**
- **Batteries contain hazardous chemicals that can cause burns or explode. If exposure to chemicals occurs, clean with water and get medical aid.**
- **Do not disassemble the battery.**
- **Do not put battery cells and battery packs near heat or fire. Do not put in sunlight.**
- **Do not disassemble or crush battery cells and battery packs.**
- **Do not short the battery terminals together.**
- **Use only the external mains power supply included with the Product.**

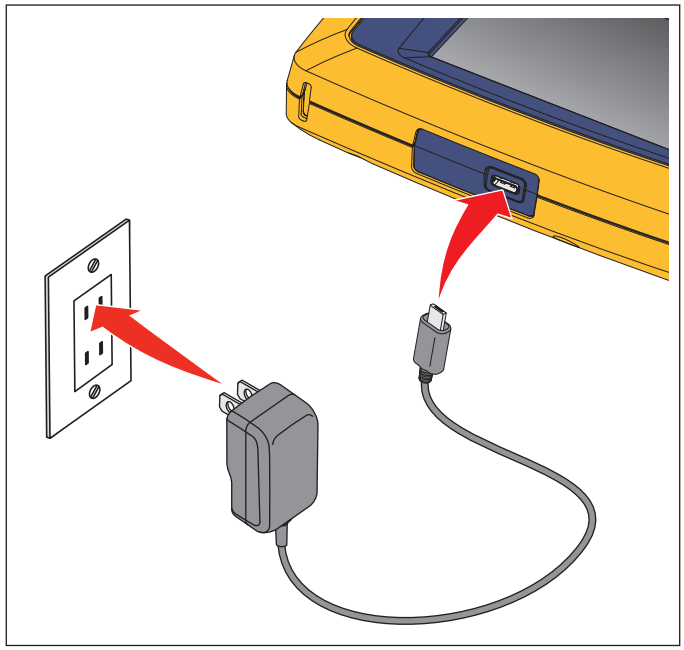
- **Disconnect the battery charger and move the Product or battery to a cool, non-flammable location if the rechargeable battery becomes hot (>50 °C) during the charge period.**
- **Replace the rechargeable battery after 5 years of moderate use or 2 years of heavy use. Moderate use is defined as recharged twice a week. Heavy use is defined as discharged to cutoff and recharged daily.**
- **To replace the battery, send the product to an authorized Fluke Networks Service Center.**

To get the best performance from the lithium-ion battery:

- Do not charge the Product for more than 24 hours as a reduced battery life may result.
- Charge the Product for at least 1.5 hours every 6 months for maximum battery life. Without use, the battery will self-discharge in approximately 6 months.

Figure 9 shows how to charge the battery.

Figure 9. Charge the Battery



Product Specifications

For complete *Product Specifications* go to our website.