



# TS<sup>®</sup> 22 Series

## Craft Test Sets

### Users Guide

PN 2451689

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## LIMITED WARRANTY AND LIMITATION OF LIABILITY

Each Fluke Networks product is warranted to be free from defects in material and workmanship under normal use and service unless stated otherwise herein. The warranty period for the mainframe is 18 months and begins on the date of purchase. Parts, accessories, product repairs and services are warranted for 90 days, unless otherwise stated. Ni-Cad, Ni-MH and Li-Ion batteries, cables or other peripherals are all considered parts or accessories. The warranty extends only to the original buyer or end user customer of a Fluke Networks authorized reseller, and does not apply to any product which, in Fluke Networks' opinion, has been misused, abused, altered, neglected, contaminated, or damaged by accident or abnormal conditions of operation or handling. Fluke Networks 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 Networks does not warrant that software will be error free or operate without interruption.

The TS22 Series Test Set contains an embedded 3 V lithium battery. The 9 V battery in the Test Set should be changed when low, or once a year if not in use, to prevent the 3 V battery from draining. A 3 V battery that drains after its 42-month warranty must be replaced by an authorized service facility at a charge to you.

Note also that the speakerphone will not work when the 9 V battery is low or dead. You should replace the 9 V battery whenever it is low.

The 3 V battery in the Test Set is warranted to operate for 42 months after the original purchase of the product. If it does not, send the Test Set to an authorized service facility and we will replace the 3 V battery free of charge (excluding shipping costs).

Fluke Networks 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 Networks. Warranty support is available only if product is purchased through a Fluke Networks authorized sales outlet or Buyer has paid the applicable international price. To the extent permitted by law, Fluke Networks reserves the right to invoice Buyer for repair/replacement when a product purchased in one country is submitted for repair in another country.

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Following warranty repair, the product will be returned to Buyer, transportation prepaid (FOB destination). If Fluke Networks determines that failure was caused by neglect, misuse, contamination, alteration, accident or abnormal condition of operation or handling, or normal wear and tear of mechanical components, Fluke Networks 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).


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# TS<sup>®</sup>22 Series Craft Test Sets

## Introduction



**Good safety practices prohibit the connection of the TS22 Series and similar test sets to 117 volts ac commercial electrical power. Should the TS22 Test Set be connected to commercial power, all warranties are immediately voided.**

The TS22 Series Test Sets employ the latest in integrated circuit design to provide both DTMF and dial pulse output. They also provide last number redial and repertory memory (auto dial) for 9 individual numbers.

The TS22 Series Test Set often called a “butt-in,” is a self-contained, line-powered, combination handset used by installers, repair technicians, and other authorized personnel for line testing and temporary communications. Specifications herein apply to TS22 and TS22A models, unless otherwise noted.

## Registration

Registering your product with Fluke Networks gives you access to valuable information on product updates, troubleshooting tips, and other support services. To register, fill out the online registration form on the Fluke Networks website at [www.flukenetworks.com/registration](http://www.flukenetworks.com/registration).

## Contacting Fluke Networks



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Fluke Networks operates in more than 50 countries worldwide. For more contact information, go to our website.

## Symbols

The following IEC symbols are used either on the test set or in the manual:

	Warning: Risk of personal injury. See the manual for details.  Caution: Risk of damage or destruction to equipment or software. See the manual for details.
	Warning: Risk of electric shock.
	Do not put products containing circuit boards into the garbage. Dispose of circuits boards in accordance with local regulations.

## Safety Information



**Do not use the test set if it is damaged. Before you use the test set, inspect the case. Look for cracks or missing plastic. Pay particular attention to the insulation surrounding the connectors.**

**If this product is used in a manner not specified by the manufacturer, the protection provided by the product may be impaired.**

## RFI Interference

The TS22 Series Test Sets are designed to resist Radio Frequency Interference (RFI). If RFI is encountered during the operation, take the following steps to minimize the effects:

- Reorient or relocate the line cord, the test set, or both.
- Increase separation between the source of the interference and the test set.
- Try connecting to another working pair.

## Physical Characteristics

### Housing

See Figure 1.

The housing for the TS22 Series Test Set is made of high-impact polycarbonate which provides excellent insulating properties. The test set is designed to provide rugged service and withstand the rough handling and shocks normally associated with craft tools.

The back of the handgrip is contoured and has a non-slip pad, freeing both hands while the test set rests on the shoulder.

### Belt Clip

See Figure 1.

The belt clip is located on the transmitter end of the housing. It has a spring-loaded, locking clip that assures a secure connection to belt loops and D-rings. The belt clip may be replaced. See "Replacing the Belt Clip" on page 10.

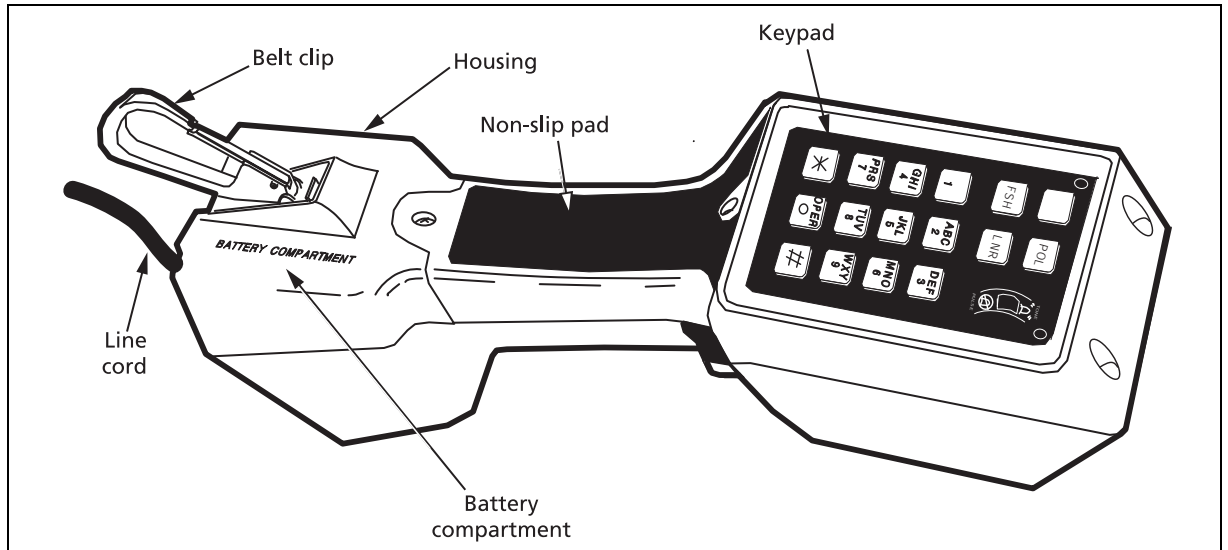


Figure 1. Physical Characteristics

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## Battery

See Figure 1.

### Warning

**When not in use, the 9 V battery in the TS22 Series Test Set should be changed once a year to prevent the 3 V lithium battery from draining.**

**When the 9 V battery is low your speakerphone will no longer work. You should replace the 9 V battery with a new battery immediately so as to not drain the 3 V lithium battery.**

The TS22 and TS22A Test Sets have a replaceable 9 V (alkaline) battery that powers the speaker. If the battery is low, only the speaker should be affected. The test set will continue to function as a normal butt-in test set. The TS22A speakerphone operates from line voltage in the TALK mode only.

When the speaker fails to operate at all, operates intermittently, or sounds distorted, replace the 9 V battery with a similar battery. See “Replacing the Battery” on page 9 for instructions on changing the battery.

### Note

*If the test set fails to operate properly at any time, first replace the battery and retest before sending the test set in for repair.*

If further assistance is needed, please contact Fluke Networks Technical Support.

## Line Cords

The test set has a field replaceable line cord; however, if the replacement cord is not installed properly, the warranty will be void. For information on availability of line cords, contact your local Fluke Networks authorized distributor. Figure 2 describes some of the line cords available.

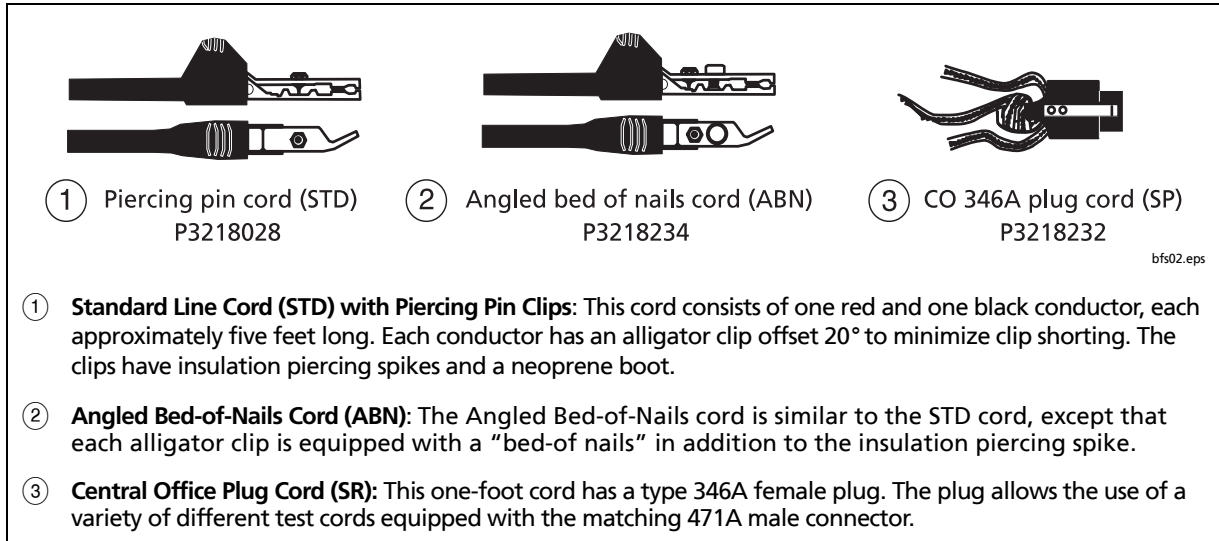


Figure 2. Line Cords

## Switchable Electronic Ringer

With the amplified monitor speaker on, the audible warble is enabled. The amplified speaker can be used to hear incoming ringing, as the amplified speaker amplifies any audio receive signal in either the TALK or MONITOR mode.

## TS22A DataSafe™ Feature

The TS22A Test Set is designed to Bellcore Technical Reference TR-TSY-000344. The high impedance monitor allows connection in Monitor mode to DSO and DS1 data circuits without disturbing transmission.

## Voice Controls

Figure 3 describes the voice controls for the TS22 Series Test Set.

## TS22 Amplified Speaker

The TS22 Test Set has an amplified speaker that amplifies the received signal in TALK or MONITOR mode. This lets you listen to the test set without holding it to your ear.

The **SPEAKER** button controls the volume of the amplified speaker. The speaker has three volume levels (low, medium, and high).

### Note

*When the speaker is on, the polarity LEDs go out. They will turn back on when the speaker timer elapses or is turned off via the **SPEAKER** button.*

When the speaker is on, the transmitter and receiver are automatically switched off to prevent acoustic feedback. With no signal present, the speaker will automatically turn off after 5 minutes to conserve battery power. Any signal greater than a nominal -30 dBm will reset the timer and keep the speaker turned on.



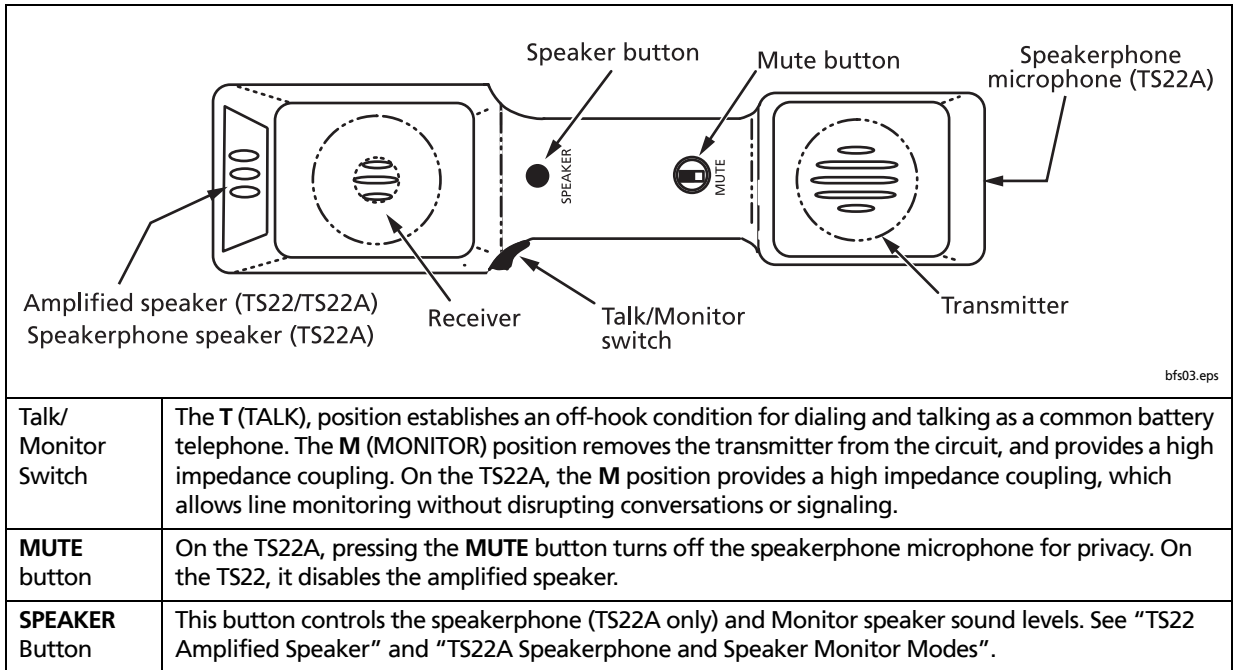


Figure 3. Voice Controls

## TS22A Speakerphone and Speaker Monitor Modes

See Figure 3.

The TS22A speakerphone feature lets you carry on a conversation hands-free. This increases safety when working on ladders or in congested areas where the restriction of line cords may cause a hazard.

The **SPEAKER** button controls the volume in speakerphone and speaker modes. Speakerphone and speaker modes have three volume levels (low, medium, and high).

The speaker may be turned on in MONITOR mode.

Speakerphone mode may be used only in TALK mode. With the speakerphone on, pressing the **MUTE** button turns off the speakerphone microphone for privacy.

A call may be initiated with the speakerphone on or off by moving the TALK/ MONITOR switch to the TALK (off-hook) position.

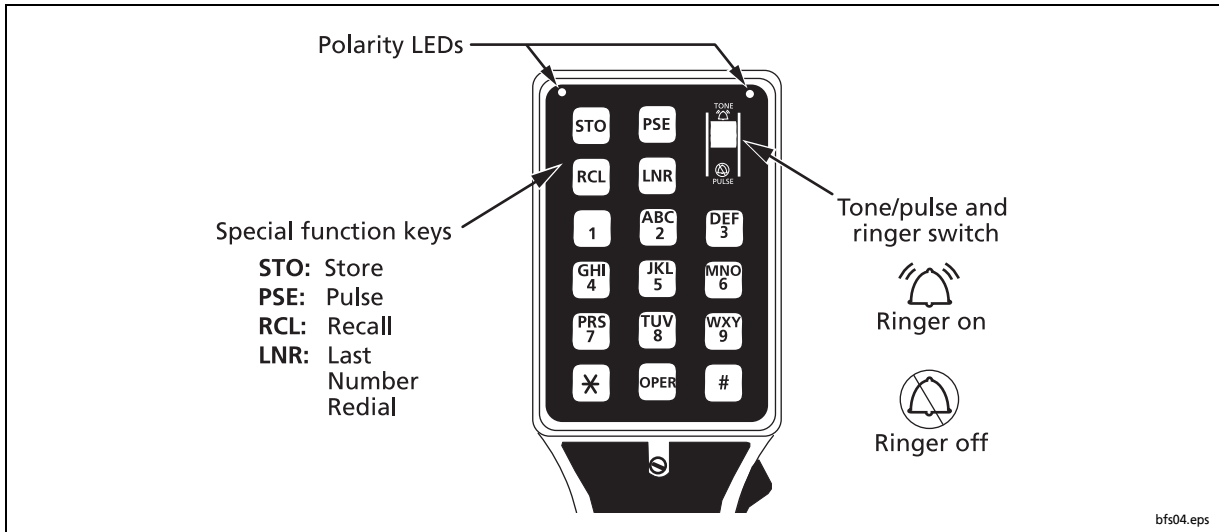
When making a call in speakerphone mode, the number keys being dialed can be heard from the speaker. This feature gives an audible feedback to the user and assures that each number is being dialed out.

In speakerphone and speaker modes, the TS22A Test Set mutes the regular transmitter and receiver to prevent acoustic feedback from the speaker. The polarity LEDs turn off when the TS22A unit is switched from Talk mode to either the speakerphone mode or the speaker mode.

To prolong battery life, the TS22A Test Set will automatically shut off the speakerphone or speaker after approximately five minutes when there has been no signal greater than -30 dBm. Because of the automatic shut off feature, this function will have to be reactivated every 5 minutes if no signal greater than -30 dBm is detected.

## Keypad Controls and Indicators

Figure 4 describes the keys, controls, and indicators in the keypad area of the TS22 test sets.



Numeric Keypad	The numeric keypad is used to dial telephone numbers and make function selections. The numeric keypad includes 12 standard dialing keys including the star (*) and the pound (#) keys. The four special purpose keys are labeled <b>STO</b> , <b>RCL</b> , <b>LNR</b> , and <b>PSE</b> .
<b>STO</b> Key	The <b>STO (Store)</b> key is used for storing the last number dialed into repertory memory (18 digits maximum).
<b>RCL</b> Key	The <b>RCL (Recall)</b> key recalls a number stored in repertory memory.
<b>LNR</b> Key	The <b>LNR (Last Number Redial)</b> key redials the last number called. This feature works in either tone or pulse modes.
<b>PSE</b> Key	The <b>PSE (Pause)</b> key places a four-second pause between numbers that are being entered into repertory memory. The pause will take place when the stored numbers are redialed, and is used to access second dial tone when dialing through a PBX.
Tone/Pulse Switch	In <b>MONITOR</b> mode, this switch turns off the ringer. In <b>TALK</b> mode, this switch selects <b>TONE</b> or <b>PULSE</b> dialing mode.
Polarity Light Emitting Diodes (LEDs)	These LEDs indicate line polarity when off hook. The green LED lights if the red test lead is connected to the Ring (negative) side of the line and the black test lead is connected to the Tip (positive) side of the line. The red LED lights if the red test lead is connected to the Tip (positive) side and the black test lead is connected to the Ring (negative) side. The LEDs will flash momentarily during pulse or tone dialing, and are off while in speakerphone mode or amplified speaker mode.  <p style="text-align: center;"><i>Note</i></p> <p style="text-align: center;"><i>The TS22 Series Test Sets function in either polarity.</i></p>

Figure 4. TS22 Series Test Set Keypad Area

## Operation

### TS22 Amplified Speaker Mode

To put the TS22 Test Set into amplified speaker mode:

- 1 Connect the test set to a line. The TALK/MONITOR switch may be in either position.
- 2 Press the **SPEAKER** button once to enter amplified speaker mode with low volume.
- 3 Press the **SPEAKER** button a second and third time for medium and high volume.
- 4 Press the **SPEAKER** button a fourth time to turn the amplified speaker off.

Pressing the **MUTE** button while in amplified speaker mode turns the speaker off.

### TS22A Speakerphone Mode

To put the TS22A Test Set into speakerphone mode:

- 1 Connect the test set to a line. Set the TALK/MONITOR switch to **T**.
- 2 Press the **SPEAKER** button once to enter speakerphone mode with low volume.
- 3 Press the **SPEAKER** button a second and third time for medium and high volume.
- 4 Press the **SPEAKER** button a fourth time to turn the speakerphone off and return to Talk mode.

Pressing the **MUTE** button while in speakerphone mode mutes the speakerphone microphone for privacy.

### TS22A Speaker Monitor Mode

To put the TS22A Test Set into speaker monitor mode:

- 1 Set the TALK/MONITOR switch to **M**, then press the **SPEAKER** button once to enter speaker mode with low volume.
- 2 Press the **SPEAKER** button a second and third time for medium and high volume.
- 3 Press the **SPEAKER** button a fourth time for off and return to Monitor mode.

### Selecting a Dial Signal

Select the type of dial signaling required, DTMF or dial pulse, with the TONE/PULSE switch:

- 1 Set the TALK/MONITOR switch to **M**.
- 2 Connect test set to the line; listen to verify that the line is idle.
- 3 Set the TALK/MONITOR switch to **T**, and verify that dial tone is received.
- 4 Enter the number to be called. If DTMF signaling has been selected, the tones associated with each digit are generated as each key is pressed. If rotary dial pulse signaling has been selected, the number may be entered at any rate on the keypad; digits will automatically be pulsed out at the correct rate.

To terminate the call, either during or after dialing, return the TALK/MONITOR switch to the **M** position.

### Last Number Redial

#### Note

*When dialing out through a PBX, you may use the **PSE** key to insert a pause before initially dialing the number. See "Putting a Pause in a Stored Number".*

In the Tone or Pulse mode, the last number dialed can be automatically redialed by pressing the **LNR** key after going on-hook and then back off-hook.

## Storing Number in Repertory Memory (Auto Dialer)

The TS22 and TS22A Test Sets have 9 memory locations, which correspond to number keys 1 through 9. Each location will store up to 18 digits. If a nineteenth digit is entered, the previous digits will be cleared and the last digit (the nineteenth entered) starts a new string. If more than 18 digits are required, a second memory can be used.

Numbers can be placed in memory at any time. The test set may be either on-hook or off-hook, and does not need to be connected to the line.

## Storing a Number When On-Hook Or Disconnected (Preferred Method)

- 1 Press **STO** (STORE).
- 2 Press the number key for the desired memory location (1-9). This clears all extraneous digits from memory and will prepare the memory for storing a new number.
- 3 Enter the number to be stored.

### Note

*When either on-hook or off-hook, a number in memory can be lost if the "STO" (STORE) key and then a number key are accidentally pressed. The "#" key can not be stored when in the on-hook mode. Use the off-hook mode method discussed below.*

- 4 Press **STO** (STORE).
- 5 Press the number key for the chosen memory location (1-9).

## Storing a Number You are Calling

- 1 Connect the test set to the line and receive dial tone.
- 2 Dial the number.

### Note

*In the Pulse mode, pressing **STO** will stop any further digits from being outpulsed, although all digits will be stored. Therefore, wait until all digits have been outpulsed before pressing **STO**.*

- 3 Press the **STORE/PROG** key.
- 4 Press one of the number keys (0 through 9) to select the desired memory location.

## Putting a Pause in a Stored Number

### Note

*Each time the **PSE** key is pressed, it counts as one dialing digit.*

In some situations it may be necessary to put a pause between digits of a stored number, as when accessing a trunk through a PBX that requires a **9** to get an outside line. You can do this by pressing the **PSE** (PAUSE) key at the point where the pause is required. For example, to store the number 9-647-5430, with a pause between the **9** and **6**, enter **9[PAUSE]6475430**. When the number is dialed out, there will be a four-second pause between the **9** and **6**. You can insert a longer pause by pressing **PSE** more than once.

## Dialing a Stored Number

After receiving dial tone, press **RCL** (RECALL) and then the number key (1-9) for the memory location. For example, to dial a number stored in location 5, press **RCL** and then **5**. The number will be automatically dialed.

## Line Monitoring

### Caution

When testing circuits which are relatively close to the battery source, the clicks may be loud enough to cause acoustical shock if the receiver is held tightly against the ear.

The TS22 Series Test Sets are designed to rest comfortably on the shoulder with the receiver away from the ear. They should be used in this position when listening for clicks.

Set the TALK/MONITOR switch to **M** and connect test leads to circuit under test. Monitoring may now be done without disrupting traffic. The high impedance of the TS22A Test Set prevents the spiking of data traffic.

## Troubleshooting

The following troubleshooting procedures are based largely on the click heard when the two test leads on are placed on battery and ground, or across a charged capacitor. These clicks and other sounds from the receiver can help you locate open circuits, shorts, crosses, and grounds:

- 1 To locate a short circuit, open one side of the line and place the TS22 or TS22A Test Set in the loop – one test lead to each side of the opened line. On the Central Office (CO) side of the fault, a loud CLICK will be heard; on the field side of the fault, NO CLICK will be heard. The TS22 and TS22A Test Sets should be in the Monitor mode (with or without the amplified speaker on).
- 2 Locating an open circuit is accomplished by bridging the TS22 or TS22A Test Sets across the circuit – one test lead on Tip, the other on Ring. Moving away from the CO, the fault is located at the point the loud CLICK disappears.

- 3 Continuity of each side of the loop may be verified by placing one of the line leads on a local ground and the other on the conductor in question. On a good Ring conductor, a CLICK will be heard; on a good Tip conductor, an inductive HUM will be heard (due to the difference in ground potential between the CO ground and the local ground).

## Maintenance

### Warning

Disconnect clips from any metallic connections before performing any maintenance. Read all instructions completely and understand possible hazards to end user if repairs are not performed properly.

Batteries are hazardous to handle. Do not allow the terminals to be shorted together. Severe burns or explosion can result if not handled properly. Dispose of battery properly to ensure contacts cannot short. Disposal may be restricted by local laws.

### Caution

Do not use CRC Cable Clean® or any similar chlorinated solvent on the test set. Doing so will damage the test set.

## Replacing the Battery

### Warning

When not in use, the 9 V battery in the TS22 Series Test Sets should be changed once a year to prevent the 3 V lithium battery from draining.

### Warning

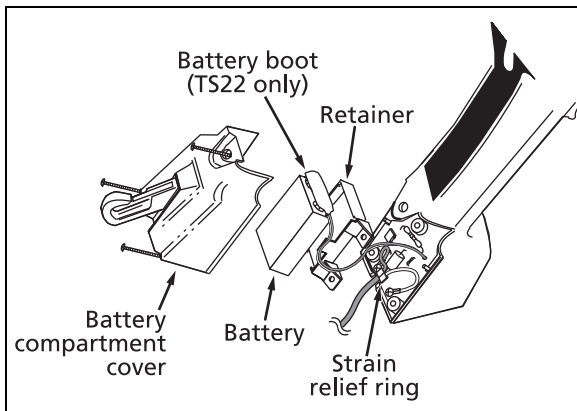
When your 9 V battery is low your speakerphone will no longer work. You should replace your 9 V battery with a new battery immediately as to not drain the 3 V lithium battery.

*Note*

*Be sure to replace the battery with a good 9 V battery or the test set will not operate at all.*

To replace the battery (see Figure 5):

- 1 Disconnect the test set from the line and place on a flat work surface with battery cover up.
- 2 Using a Phillips screwdriver, remove the three screws from the battery compartment.
- 3 Remove the battery compartment cover.
- 4 Lift out the battery retainer.
- 5 Remove the old battery from the battery boot.
- 6 Insert a new alkaline 9 V battery.
- 7 Replace the battery boot, retainer, cover, and screws. Strain relief ring must be inside the case as shown. Avoid pinching battery wires.



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**Figure 5. Battery Replacement**

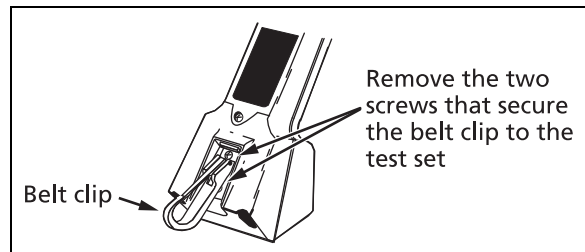
## Replacing the Belt Clip

See Figure 6.

The belt clip assembly is field replaceable in the event of damage or prolonged wear. To order a replacement belt clip, contact your local Fluke Networks authorized distributor.

To replace the belt clip assembly:

- 1 Using a Phillips screwdriver, remove the two screws that secure the belt clip to the test set housing.
- 2 Remove the old belt clip and replace with a new one. Secure the belt clip assembly to the test set housing with the original screws.



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**Figure 6. Belt Clip Replacement**

## Specifications

Electrical	
Loop Limit	2 k $\Omega$ maximum at 48 VDC (nominal 20 mA minimum loop current)
DC Resistance (Talk Mode)	300 $\Omega$ typical
Maximum voltage	300 V with transient protection to 1500 Vpk
Monitor Impedance	
TS22	5 k $\Omega$ nominal at 1 kHz
TS22A	120 k $\Omega$ nominal at 1 kHz
Rotary Dial Output	
Pulsing Rate	10 pps $\pm$ 5 pps
Percent Break	61 % $\pm$ 2 %
Interdigit Interval	1000 ms typical
Leakage During Break	>50 k $\Omega$
DTMF Output	
Tone Frequency Error	$\pm$ 1% maximum
Tone Level	-3 dBm combined (typical)
High versus Low Tone Difference	4 dB maximum
Monitor Amplifier Power Source	9 V battery; provides 25 hours continuous use, typical
Speaker Levels for TS22	Low, medium, high and off
Automatic Power Shut Off	After 5 min. of no audio signal
Speakerphone Levels TS22A	Low, medium, high and off
Power Source	Shared line and battery power

Physical	
Measurement	10.25 in x 2.69 in x 3.38 in (26 cm x 6.83 cm x 8.57 cm)
Weight	
TS22	21 ounces (.595 kg)
TS22A	22 ounces (.624 kg) typical
Environmental	
Temperature Operating:	29 °F to 140 °F (-34 °C to 60 °C)
Storage	-40 °F to 150 °F (-40°C to 66 °C)
Altitude	To 10,000 feet (3,000 meters)
Relative Humidity	5 % to 95 %
<i>Note</i>	
<i>Specifications subject to change without notice.</i>	

