FLUKE networks

# TS®22 Series
## Craft Test Sets

## Users Guide

PN 2451689
October 2005

## 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. 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.

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

To obtain warranty service, contact your nearest Fluke Networks 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 Networks assumes no risk for damage in transit. 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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4/04-18

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USA

# Table of Contents

# TS®22 Series Craft Test Sets

## Introduction

**⚠⚠Warning**

**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**.

## Contacting Fluke Networks

**www.flukenetworks.com**

**support@flukenetworks.com**

**+1-425-446-4519**

- Australia: 61 (2) 8850-3333 or 61 3 9329 0244
- Beijing: 86 (10) 6512-3435
- Brazil: 11 3044 1277
- Canada: 1-800-363-5853
- Europe: +44-(0)1923-281-300
- Hong Kong: 852 2721-3228
- Japan: 03-3434-0510
- Korea: 82 2 539-6311
- Singapore: 65-6799-5566
- Taiwan: (886) 2-227-83199
- USA: 1-800-283-5853
- Anywhere in the world: +1-425-446-4519

Visit our website for a complete list of phone numbers.

# Safety Information

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.<br><br>Caution: Risk of damage or destruction to equipment or software. See the manual for details. |
|  | Warning: Risk of electric shock. |
|  | Earth ground |
|  | Conformité Européenne. Conforms to relevant European Union directives. |
|  | Do not put products containing circuit boards into the garbage. Dispose of circuits boards in accordance with local regulations. |

**Warning**

**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 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.

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- 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.

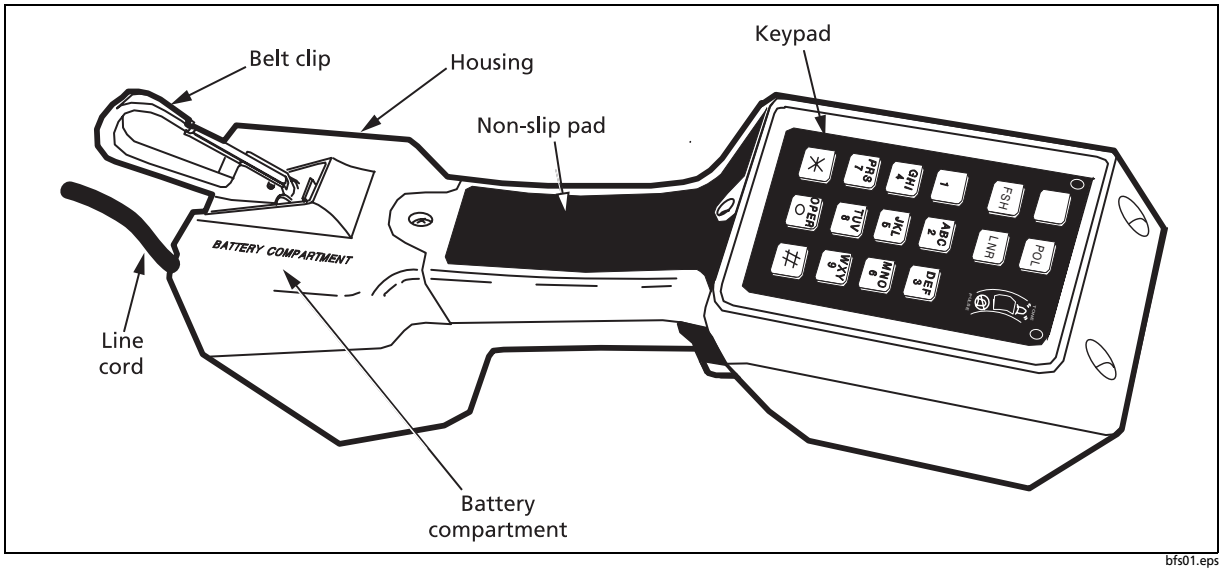



**Figure 1. Physical Characteristics**

## 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.

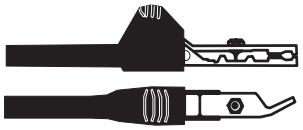
*Note*

*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.*

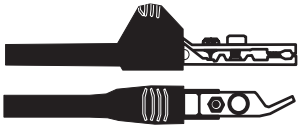
If further assistance is needed, please contact Fluke Networks Technical Support.

## 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.



① Piercing pin cord (STD)
P3218028



② Angled bed of nails cord (ABN)
P3218234

③ CO 346A plug cord (SP)
P3218232

bfs02.eps

① **Standard Line Cord (STD) with Piercing Pin Clips**: This cord consists of one red and one black conductor, each approximately five feet long. Each conductor has an alligator clip offset 20° to minimize clip shorting. The clips have insulation piercing spikes and a neoprene boot.

② **Angled Bed-of-Nails Cord (ABN)**: The Angled Bed-of-Nails cord is similar to the STD cord, except that each alligator clip is equipped with a "bed-of nails" in addition to the insulation piercing spike.

③ **Central Office Plug Cord (SR):** This one-foot cord has a type 346A female plug. The plug allows the use of a variety of different test cords equipped with the matching 471A male connector.

**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

TheTS22A 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

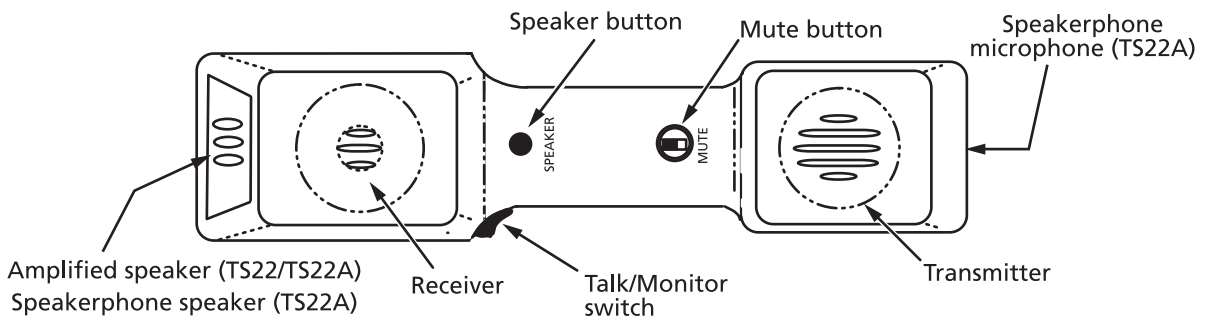
The TS22 Test Set has an amplified speaker that amplifies the received signal in TALK or MONITOR mode. This lets you listen to the test set without holding it to your ear.

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.




| | |
|---|---|
| Talk/ Monitor Switch | The **T** (TALK), position establishes an off-hook condition for dialing and talking as a common battery telephone. The **M** (MONITOR) position removes the transmitter from the circuit, and provides a high impedance coupling. On the TS22A, the **M** position provides a high impedance coupling, which allows line monitoring without disrupting conversations or signaling. |
| **MUTE** button | On the TS22A, pressing the **MUTE** button turns off the speakerphone microphone for privacy. On the TS22, it disables the amplified speaker. |
| **SPEAKER** Button | This button controls the speakerphone (TS22A only) and Monitor speaker sound levels. See "TS22 Amplified Speaker" and "TS22A Speakerphone and Speaker Monitor Modes". |

**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.

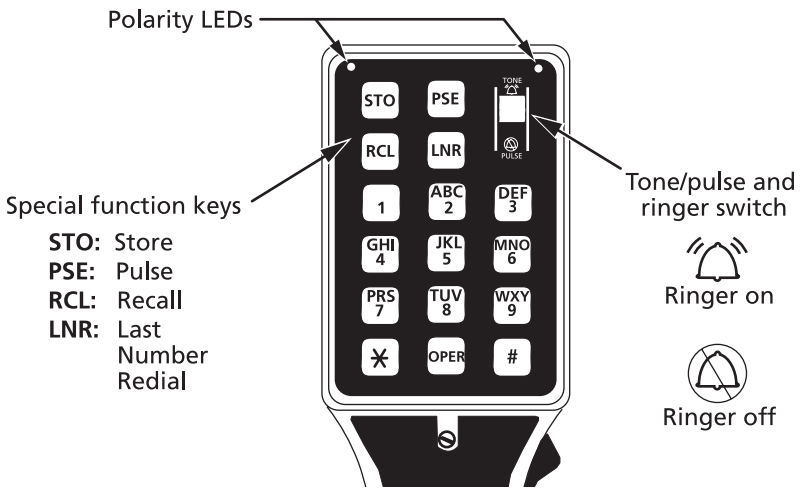
When making a call in speakerphone mode, the number keys being dialed can be heard from the speaker. This feature gives an audible feedback to the user and assures that each number is being dialed out.

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 **STO**, **RCL**, **LNR**, and **PSE**. |
| **STO** Key | The **STO** (**Sto**re) key is used for storing the last number dialed into repertory memory (18 digits maximum). |
| **RCL** Key | The **RCL** (**Recall**) key recalls a number stored in repertory memory. |
| **LNR** Key | The **LNR** (**L**ast **N**umber **R**edial) key redials the last number called. This feature works in either tone or pulse modes. |
| **PSE** Key | The **PSE** (**Pause**) 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 MONITOR mode, this switch turns off the ringer. In TALK mode, this switch selects TONE or PULSE 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.<br>*Note*<br>*The TS22 Series Test Sets function in either polarity.* |

**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 or lithium 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.

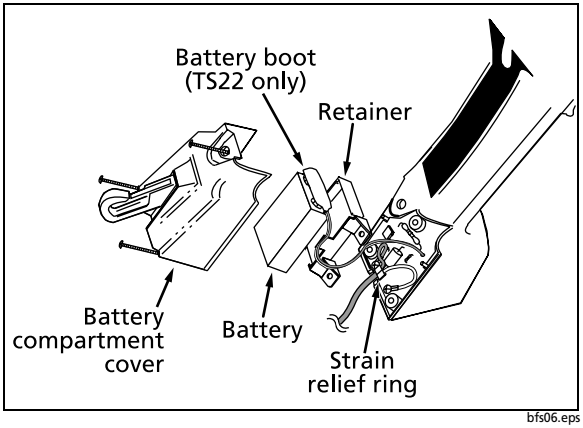



**Figure 5. Battery Replacement**

## 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.

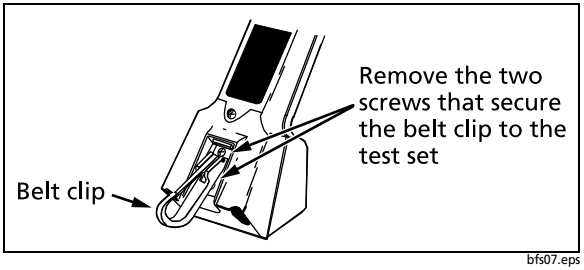



**Figure 6. Belt Clip Replacement**

# Specifications

| Electrical | |
|---|---|
| Loop Limit | 2 kΩ maximum at 48 VDC (nominal 20 mA minimum loop current) |
| DC Resistance (Talk Mode) | 300 Ω typical |
| Monitor Impedance | |
| TS22 | 5 kΩ nominal at 1 kHz |
| TS22A | 120 kΩ nominal at 1 kHz |
| Rotary Dial Output | |
| Pulsing Rate | 10 pps ±5 pps |
| Percent Break | 61 % ± 2 % |
| Interdigit Interval | 1000 ms typical |
| Leakage During Break | >50 kΩ |
| DTMF Output | |
| Tone Frequency Error | ±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 % |
| **Certifications and Compliance** | |
| CE | Conformité Européenne. Conforms to relevant European Union directives. |
| *Note* | |
| *Specifications subject to change without notice.* | |