



Network Support Division

***TS22<sup>®</sup> Series  
Craft Test Set  
Description and Use***

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**NOTICE**





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**TRADEMARKS**

TS is a registered trademark of Harris Corporation.

**REGULATORY INFORMATION**

**WARNING:** This equipment generates, uses, and can radiate radio frequency energy, and, if not installed and used in accordance with the installation manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15, Subpart J of the FCC rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of the equipment in a residential area is likely to cause interference, in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference.

<b>Declaration of Conformity</b>	
Manufacturer: Harris Corporation Network Support Division 809 Calle Plano Camarillo, CA 93012 U.S.A.	Standards Used:  FCC part 15 CISPR 22 EN300386-2:97 EMC, ESD Directives EN61010.1 (1993). Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use. CSA/CAN C22.2 No. 1010.1-92 Safety
Signature: _____ Print: Ed Zoiss, Director of Engineering	
Importer: _____ _____ _____	
Signature: _____ Print: _____	
<b>Model:</b> TS22 Series Craft Test Sets	
<b>Serial:</b> _____	
Harris Corporation officially declares the test equipment listed above is in conformity with Electromagnetic Compatibility Directive 89/336/EEC and Low Voltage Directive 73/23/EEC based on test results performed in a typical configuration. This Conformity is indicated by the following symbols representing the European Community and compliance organizations:	
   	



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## Safety Information

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### Read First Before Use

**WARNING:**

*Means conditions and hazards may pose risk to user.*

**CAUTION:**

*Means conditions and hazards may damage the test set.*

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



See Manual for details



Earth Ground



Conformité Européenne



Industry Canada and U.S.  
Safety Approval



## **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.*

## **INFORMATION**

The TS22 Series Test Sets have been designed with reasonable care against Radio Frequency Interference (RFI). If RFI is encountered during the operation of the test set, the following steps may be taken to minimize the effects:

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

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.

This test set (see [Figure 1](#)) 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. The TS22DS includes all the features of the TS22 while providing a higher monitor impedance, increased reliability and improved battery life. Specifications herein apply to TS22 and TS22DS and TS22A models, unless otherwise noted.

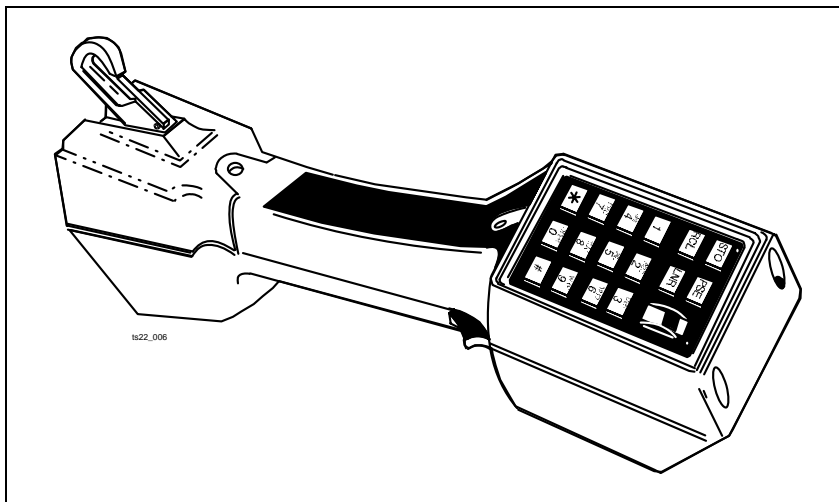


Figure 1. TS22 Series Test Set

# Physical Characteristics

The housing (A) (see [Figure 2](#)) is injection molded of high impact polycarbonate which provides excellent insulating properties. The three-piece case is designed to give rugged service and withstand the rough handling and shocks normally associated with craft tools.

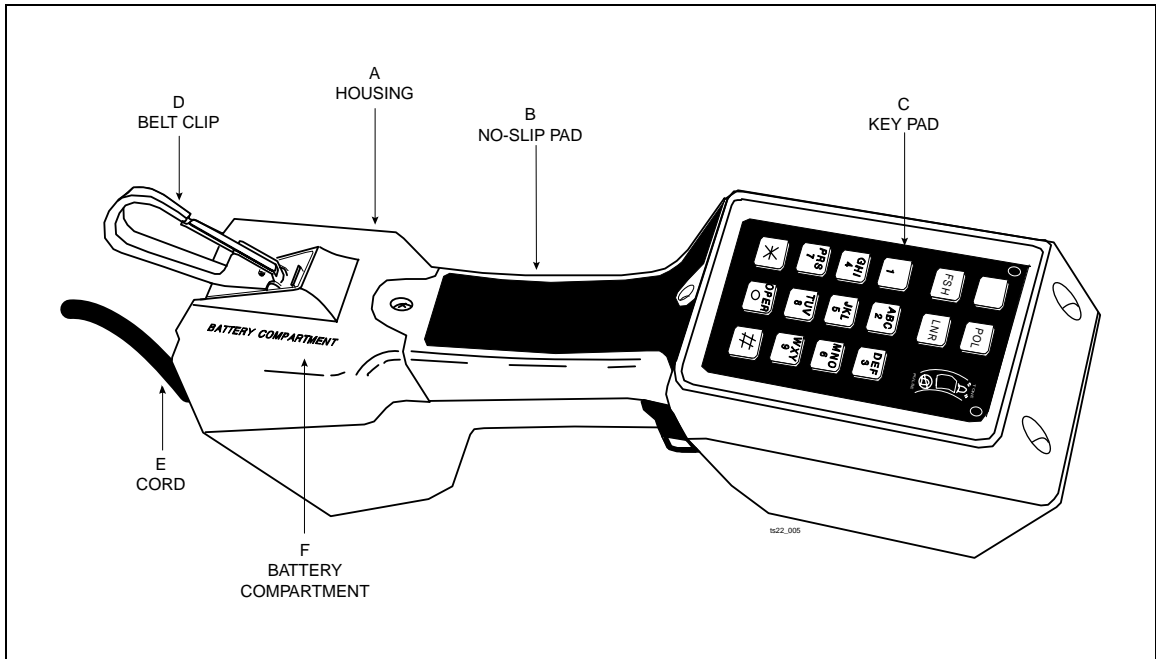


Figure 2. Physical Characteristics

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

The keypad (C) has 16 buttons on a black plastic bezel that is recessed into the receiver end of the housing. The recessed bezel provides physical protection to the keypad and helps prevent accidental button operation.

The spring-loaded belt clip (D), located on the transmitter end of the housing, ensures a secure connection to a belt loop or D-ring. The belt clip may be replaced in the field. See [Replacing the Belt Clip](#).

The test sets are equipped with several different cord configurations (E). See [Power and Connections](#).

The test sets provide a dedicated battery compartment (F) which makes battery replacement a simple procedure. See [Warranty](#).

# Controls and Indicators

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## Voice Controls

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- Talk/Monitor Switch** This slide switch is located on the side of the test set (see [Figure 3](#)). 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. In the TS22DS and TS22A, the M position provides a high impedance coupling, which allows line monitoring without disrupting conversations or signaling.
- Mute Switch** This momentary and locking switch is located on the inside of the handgrip just above the transmitter.
- Speaker Button** This pushbutton is centered on the handgrip just below the receiver. It controls the built-in Speakerphone (TS22A only) and Monitor speaker sound levels. (See [Amplified Speaker](#), [Speakerphone and Speaker](#), [SpeakerPhone Mode](#), and [Monitor Mode](#).)

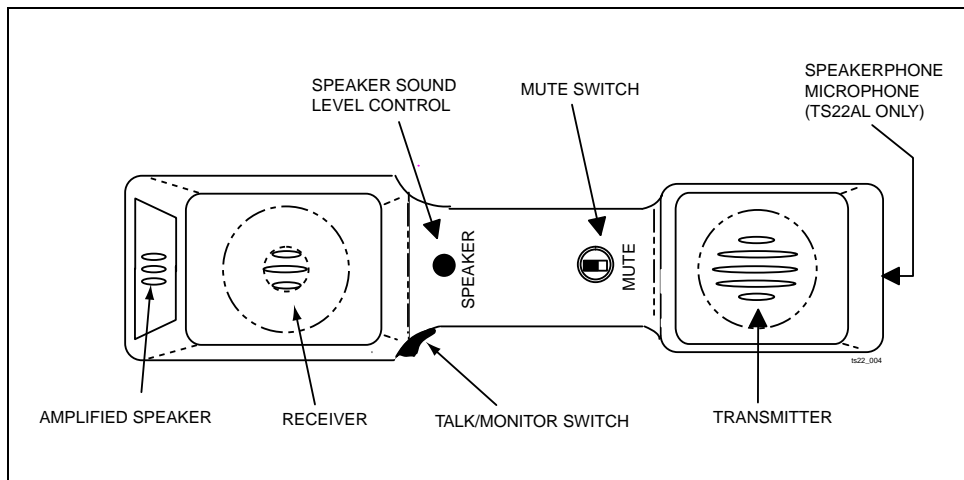


Figure 3. Controls and Indicators

# Keypad Controls and Indicators

## Keys

There are 12 standard keys and 4 special purpose keys (see [Figure 4](#)). The special purpose keys are STO, RCL, LNR, and PSE.

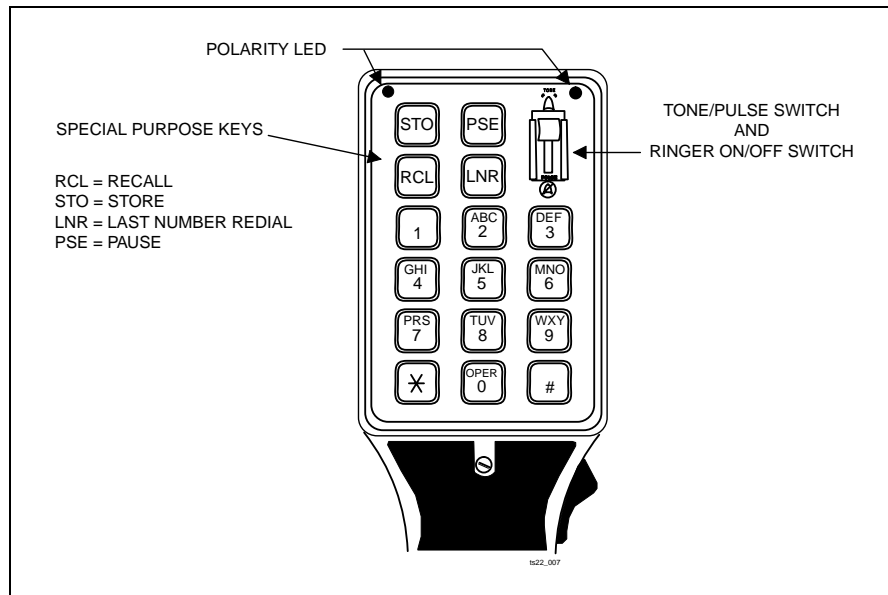


Figure 4. Keypad

Key to Figure 4.

Special Purpose Keys	Abbreviation	Function
STORE	STO	Stores the last number dialed into repertory memory (18 digits maximum).
RECALL	RCL	Recalls a number stored in repertory memory.
LAST NUMBER REDIAL	LNR	Redials the last number called. This feature works in either tone or pulse modes.
PAUSE	PSE	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.



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## TONE/PULSE Switch

This toggle switch has two functions: as a TONE/PULSE switch and as a ringer on/off switch.

## Polarity Light Emitting Diodes (LEDs)

Located at the top of the keypad, these round LEDs illuminate automatically to indicate line polarity when off hook. The green LED will light 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 will light if the test leads are reversed; that is, with the red test lead connected to the tip (positive) side and with the black test lead connected to the ring (negative) side. The LEDs will flash momentarily during pulse or tone dialing, and are turned off while in Speakerphone mode or Amplified Speaker mode.

*Note: The TS22 Series Test Sets are not polarity sensitive, and will function in either polarity.*

## Switchable On/Off Ringer

The TS22, TS22DS, and TS22A each use an electronic ringer. For convenience, the ringer can be switched on and off by the dual function TONE/PULSE switch. In talk mode, this dual function switch selects the TONE or PULSE) dialing mode. In monitor mode, it selects ringer on and ringer off (see [Figure 5](#)).

## 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.

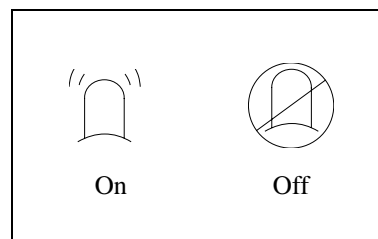


Figure 5. Ringer On/Off

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## Amplified Speaker (TS22 and TS22DS)

The TS22 and TS22DS are equipped with an Amplified Speaker that amplifies the receive signal in either the TALK or MONITOR mode. This allows you to listen to the test set without holding it to your ear. The speaker control button is located on the inside of the handgrip, just below the receiver. There are three volume settings and an OFF position.

When the speaker is off, pressing the button once turns the speaker to low volume. Pressing the button again raises the volume to medium, pressing the button a third time turns the speaker OFF.

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*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.

## Speakerphone and Speaker (TS22A)

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The TS22A Speakerphone feature allows you to listen and talk back; in other words, to carry on a conversation handsfree. This feature helps free the user's hands to do other work related activities nearby. The handsfree capability of the Speakerphone provides for increased safety when working on CO ladders or in other congested areas where restriction of line cords may cause a hazard.

The Speakerphone speaker is located near the TS22A Test Set receiver end. The Speakerphone microphone is located at the transmitter end of the TS22A Test Set below the belt clip. The speaker button, located below the receiver, controls the volume levels of both the Speakerphone and the speaker. The Speakerphone mode and the speaker mode have three volume levels (low, medium, and high) and OFF.

The Speakerphone mode can only be used with the TS22A TALK/MONITOR switch in Talk mode; with the Speakerphone on, depressing the mute button turns the Speakerphone microphone off for privacy. The speaker may be turned on in the MONITOR mode just like the TS22 and TS22DS. 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.

The TS22A Test Set mutes the regular transmitter and receiver to prevent acoustic feedback from the speaker during Speakerphone mode and speaker mode. 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 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.

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## TS22A Speakerphone Mode

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To put the TS22A Test Set into Speakerphone mode, connect the TS22A unit to a line, verify that the test set is in Talk mode, and press the speaker button once to put it in Speakerphone mode and low volume. Press it a second time for medium volume. Press it a third time for high volume. Press the speaker button a fourth time to turn the Speakerphone off or back to Talk mode.

Depressing the MUTE button while in Speakerphone operation mutes the transmit microphone for privacy.

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## TS22A Test Set Speaker Monitor Mode

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Put the TS22A unit in Monitor mode, then press the speaker button once to put it into the Speaker mode with low volume. Press the speaker button a second time for medium volume. Press the button a third time for high volume. Press the button a fourth time for off or back to Monitor mode.

TS22DS and TS22A DataSafe™ feature: The TS22DS and TS22A Test Sets are 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.

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## Power and Connections

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### Battery

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The TS22, TS22DS and TS22A Test Sets have a replaceable 9V (Alkaline) battery that powers the speaker. If the 9V battery should run down during operation of the TS22, TS22DS and TS22A 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.
- Sounds distorted.

*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.*

Replace the 9V battery with a similar battery. See [Replacing the Monitor Speaker Battery](#) for instructions on changing the battery.

If further assistance is required, please contact Professional Services at 1-800-437-2266.

## Cords

Following is a description of the various available line cords for the TS22 Series Test Sets. The line cord on the TS22 Series Test Sets is replaceable; however, if the replacement cord is not installed properly, the warranty will be void. For information on availability of line cords, contact your Harris authorized distributor.

*Note: When using the Ground Start Cord with the Data Lockout series of test sets, the red lead must be connected to the Tip side of the line in order to start the line properly. Some noise ground start lines will cause the test set to falsely indicate data detection.*



### WARNING:

*Grounding either side of a high speed data line will cause disruption of service on that data line.*

### Standard Cord with Piercing Pin (STD)

This cord consists of one red and one black conductor, each approximately five feet long. Each conductor is fitted with an alligator clip offset 20° to minimize clip shorting. The clips have insulation piercing spikes and a neoprene boot. Cord Number: P3218-028 (see [Figure 6](#)).

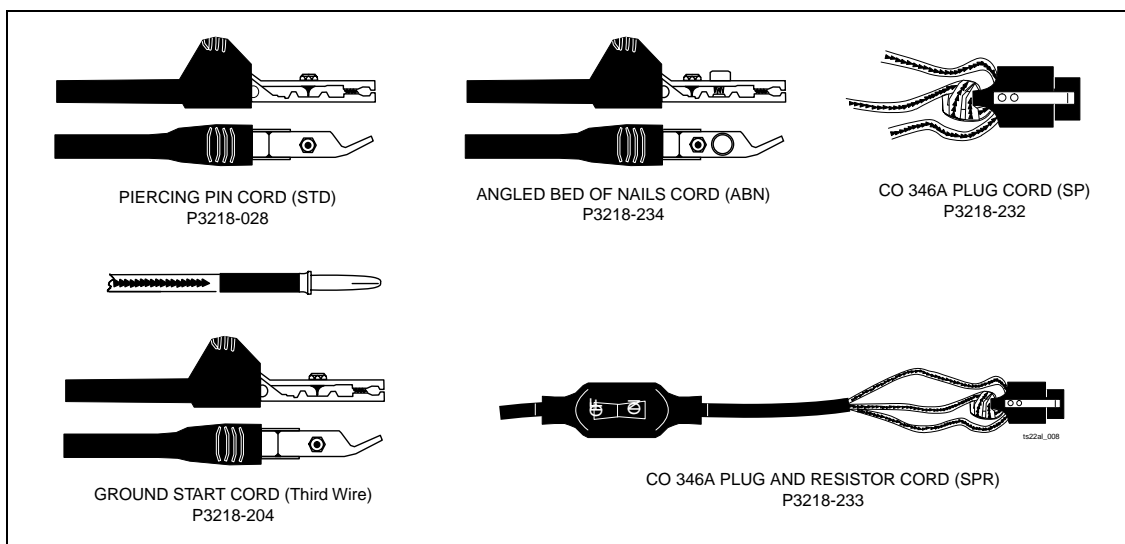


Figure 6. Cords

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### 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. Cord Number: P3218-234 (see [Figure 6](#)).

### Central Office Plug Cord (SP)

This one foot long cord is fitted with a type 346A female plug. The plug allows the use of a variety of different test cords equipped with the matching 471A male connector. Cord Number: P3218-232 (see [Figure 6](#)).

### Central Office Plug and Resistor Cord (SPR)

This cord is fitted with a type 346A female plug and switchable 1500 ohm resistor, and is approximately 18 inches long. When switched on, the resistor is inserted in series with the ring side of the cord to simulate a long loop condition. The plug allows the use of a variety of different test cords equipped with the matching 471A male connector. Cord Number: P3218-233 (see [Figure 6](#)).

### Ground Start Cord (3W)

This cord consists of two conductors with alligator clips. In addition, the red (ring) conductor has a banana jack connected to it. This jack is located six inches below the test set, and is partially covered by the outer fabric of the cord. Cord Number: P3218-204. A separate green cord is also included. This cord is 36 inches long and has a banana plug on one end and a straight piercing pin clip on the other end. Cord Number: P2280-063. The complete 3W Cord Assembly is available as Number P2280-062 (see [Figure 6](#)).

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## Operation

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### Select Dial Signal

Select the type of dial signaling required, DTMF or dial pulse, with the TONE/PULSE switch. Place the TALK/MONITOR switch in the M position, and connect test set to the line; listen to verify that the line is idle.

Set the TALK/MONITOR switch to T, and verify that dial tone is received. Enter the desired number to be called on the keypad. If DTMF signaling has been selected, the tones associated with each digit will be generated as its respective button is pressed. If rotary dial pulse signaling has been selected, the desired 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.

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## Last Number Redial

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*Note: When dialing out through a PBX, you may use the PSE key to insert a pause before initially dialing the number. See To Put 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 Numbers In Repertory Memory (Auto Dialer)

The TS22, TS22DS 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.

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

*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.*

### To Store a Number You Are Calling

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

1. Connect the test set to the line and receive dial tone.
2. Dial the number.
3. Press STO (STORE).
4. Press a number key for the desired memory location (1-9).

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## To Put a Pause in a Stored Number

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 out. 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[PSE]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.

## To Dial 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.

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## 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. It should be used in this position when listening for CLICKS.*

Set the TALK/MONITOR switch to the M position and connect test leads to circuit under test. Monitoring may now be done without disrupting traffic. The high impedance of the TS22DS and TS22A Test Sets prevents the spiking of data traffic.

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## Troubleshooting

The following troubleshooting procedures are based largely on the CLICK that will be heard when the two test leads on the TS22, TS22DS or TS22A units are placed on battery and ground respectively, or across a charged capacitor. These CLICKS and other sounds from the receiver can greatly assist a craftsperson in locating open circuits, shorts, crosses, and grounds:

1. To locate a short circuit, open one side of the line and place the TS22, TS22DS or TS22A Test Set in the loop – one test lead to each side of the opened line. On the 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, TS22DS and TS22A units should be in the Monitor mode (with or without the Amplified Speaker on).

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2. Locating an open circuit is accomplished by bridging the TS22, TS22DS or TS22A Test Set 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

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### **WARNING:**

*Disconnect clips from any metallic connections before performing any maintenance. Read all instructions completely and understand possible hazards to end user if not performed by authorized service personnel.*



### **CAUTION:**

*1. 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.*

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

## Replacing the Monitor Speaker Battery

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

To replace the Monitor Speaker Battery (see [Figure 7](#)):

1. Remove the three screws from the battery compartment.
2. Remove the battery compartment cover.
3. Lift out the battery retainer.
4. Remove the battery from the battery boot and install an Alkaline or Lithium 9V battery.
5. Replace the battery boot, retainer, cover, and screws. Strain relief ring must be inside the case as shown. Avoid pinching battery wires.



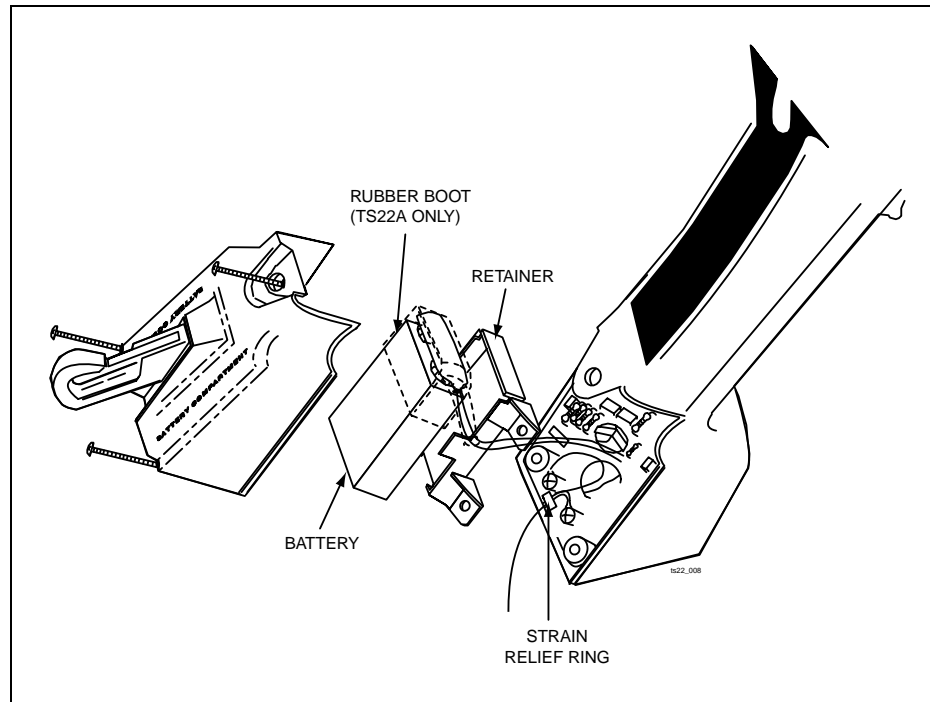


Figure 7. Replacing the Monitor Speaker Battery

## Replacing the Belt Clip

The TS22, TS22DS and TS22A Belt Clip Assembly is field replaceable in the event of damage or prolonged wear. To order a replacement belt clip, contact Harris Corporation Customer Service Department at 1-800-437-2266.

To replace the belt clip assembly (see [Figure 8](#)):

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.

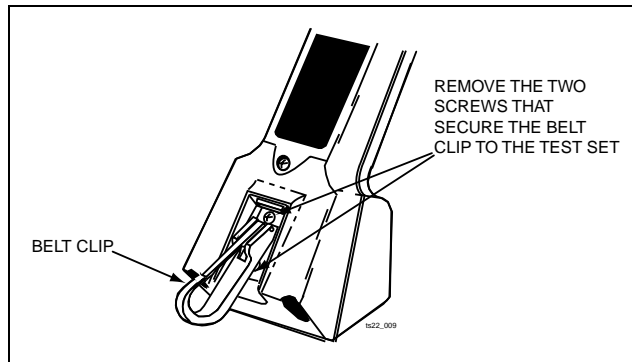


Figure 8. Belt Clip Replacement

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## Warranty

Harris Corporation warrants that its products are free from defects in material and workmanship for the following periods:

- Butt Sets and Test Sets — 18 months from date of manufacture.
- Line cords and Accessories — 90 days from date of purchase.

This warranty constitutes the sole and exclusive warranty for products sold by Harris Corporation, Network Support Division, and is in lieu of any other warranty, express, implied, or statutory, including the warranty of merchantability and fitness for a particular purpose. In no event shall Harris be liable for any special, incidental, indirect, or consequential damages arising out of the use of any product or from any other cause.

This warranty shall not apply to products which have been subjected to mishandling, abuse, misuse, negligence, or accident, nor to products which have been modified, altered, or repaired by personnel not authorized by Harris.

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## Non-Warranty

Out-of-warranty maintenance, service, or repair of products is available from the Harris Corporation, Network Support Division, on a time and materials basis. In addition, Harris offers for sale some replacement components. Harris Corporation recommends that out-of-warranty service and repair of electronic products be completed at its Harris Corporation Network Support Division, facility or authorized representative. Contact Harris Repairs for the location of the Harris authorized repair facility nearest you.

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## Return of Equipment

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To return the test set to Harris, first obtain a Return Authorization Number from our Customer Service by calling 1-800-437-2266. This Return Authorization number must be clearly marked on the shipping label, or the container will not be accepted by Harris. See the sample label below:

To: HARRIS CORPORATION  
809 Calle Plano  
Camarillo, California 93012-8516  
Attention: Customer Service, RA XXXXXX

## Specifications

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Table 1 lists the TS22L and TS22ALO Test Set specifications.

Table 1. Specifications

Parameter	Working Limits
<b>ELECTRICAL</b>	
Loop Limit	2 k $\Omega$ maximum at 48 VDC (nominal 20 mA minimum loop current)
DC Resistance (Talk Mode)	300 $\Omega$ typical
Monitor Impedance	TS22: 5 k $\Omega$ nominal at 1 kHz TS22A: 120 k $\Omega$ nominal at 1 kHz TS22DS: k $\Omega$ nominal at 1 kHz
Rotary Dial Output	
Pulsing Rate	10 pps + 0.5 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

Table 1. Specifications (Continued)

Parameter	Working Limits
<b>ELECTRICAL</b> (Continued)	
Memory Dialing	
Memory Capacity	9 memories plus last number redial
Digit Capacity	18 digits per memory
PBX Pause	4 seconds
Monitor Amplifier Power Source	9V transistor battery; provides 25 hours continuous use, typical
Speaker Levels TS22; TS22DS	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
<b>PHYSICAL</b>	
Length	10-1/4 inches (26.0 cm)
Width	2-11/16 inches (6.83 cm)
Height	3-3/8 inches (8.57 cm)
Weight	TS22DS and TS22: 21 ounces (.595 kg) TS22A: 22 ounces (.624 kg) typical
<b>ENVIRONMENTAL</b>	
Temperature	Operating: -34 to 60° C Storage: -40 to 66° C
Altitude	To 10,000 feet
Relative Humidity	5 to 95%

Patents D258061, 4682346, and 4691336 apply. Other patents pending.  
Specifications subject to change without notice.

Model Numbers			Cord Type*
TS22A	TS22DS	TS22	
22801-001	22802-001	22800-001	Standard Cord (STD) with Piercing Pin
22801-004	22802-004	22800-004	CO Plug (346A) Cord (SP)
22801-007	22802-007	22800-007	Ground Start Cord (3W)
22801-008	22802-008	22800-008	CO Plug (396A) and Resistor Cord (SPR)
22801-009	22802-009	22800-009	Angled Bed-of-Nails Cord (ABN)
*See Description Of Cords.			

