SAGE INSTRUMENTS

# Automated Local Loop Test System

## Comprehensive Local Loop Testing for Voice, Data, Fax and Internet Services

### Two-way Testing of Copper, Wireless, and Hybrid-Fiber Coax Local Loops

A whole new concept in Local Loop Testing. The 923*LTS* Hand-held unit works in conjunction with the Sage Instruments 356E *Plus* Central Office Responder to form the fastest and most comprehensive Local Loop Test System in the industry. A single technician can profile a Local Loop in less than 1 minute (additional time required for a 2-way Impulse Noise Test).

Using the 23-Tone testing concept as defined in IEEE Standard 743-1995, the system quickly profiles the transmission characteristics of the local loop. Measurements are compared to a user-defined template and the technician receives a PASS or FAIL indication at the subscriber's site.

In addition, the system allows you to enter the circuit number, work order number and the technician's identification.

The Callback option measures ringing voltage, verifies that the switch translations have been programmed for the correct telephone number and confirms that the station under test is capable of receiving a call.

The unit has a programmable phone list for storing frequently called test numbers and also features an optional built-in Butt Set.

The unit is capable of storing the last 10 tests. All data is time/date stamped and stored for easy retrieval. An RS-232 port is provided for printing.

### Comprehensive Measurements

The 923*LTS* is designed to be connected to the customer network interface (CUST-NI) and automatically performs or measures the following:

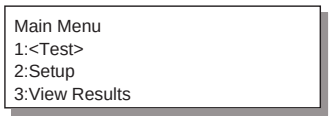
- Loop Voltage
- Loop Current
- Call Setup Time
- Verifies Number Translation (requires callback option)
- Ringing Voltage (requires callback option)
- Dial Tone Delay
- 23-Tone to Measurements:
  - Attenuation Distortion @ 23 Frequencies
  - 2-Wire Group Delay @ 22 Frequencies
  - Signal-to-Noise Ratio
  - Signal-to-Total Distortion
  - 2nd & 3rd Order Intermodulation Distortion

## Comprehensive Measurements, Continued

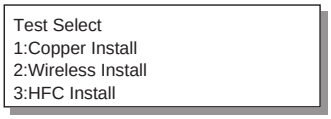
3-Tone Slope
C-Message Noise (Psophometric Noise - *International*)
C-Notch Noise (P-Notch Noise - *International*)
Noise-to-Ground
Absolute Delay
2-Wire Echo Return Loss (ERL, SRH, SRL)
Hits:
- 3-Level Impulse Noise, Timed
- Phase Hits
- Gain Hits
- Dropouts

Jitter:
- Phase Jitter (hi and low)
- Amplitude Jitter (hi and low)

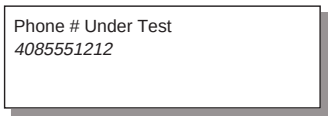
## Quick, Easy-to-Use, and Comprehensive. PASS/FAIL indications take the mystery out of interpreting results.



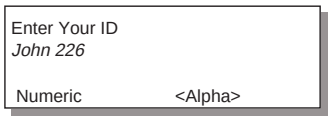

From the Main Menu, Select 1: <Test>




The unit advances to the Test Select Menu. In this menu, select the test you wish to perform, such as 1: <Copper Install>. This will tell the 356E *Plus* to use the test suite and measurement template associated with this type of service.

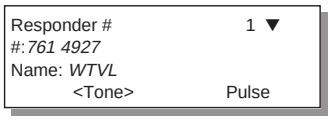



The unit will automatically advances to the Phone # Under Test screen. Here you enter the number for the circuit that you are testing. Press NEXT to advance to the next entry screen.

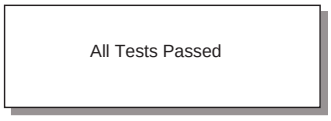



Enter your Name or Company Identification and press NEXT.


Enter the Work or Service Order Number and press NEXT.




Manually enter a Responder Test Number or select one from the phone list. Press NEXT and the number will be dialed.




The 923*LTS* will automatically make 2-way tests on the selected circuit. The 923*LTS* will display All Tests PASSED or FAILED. At this point, press NEXT to view the individual results or start another test.

*What could be easier?*

# 356E Plus Central Office Unit


## Central Office Responder

The 356E *Plus* is a stand-alone responder designed to be rack mounted in the Central Office. The unit is connected to a 2-wire or 4-wire analog test number appearance in the central office. The 356E *Plus* automatically emulates a 105, 105E, 107 or 23-Tone responder as required.

Working in conjunction with the 923*LTS* Hand-held Unit, the 356E *Plus* will emulate a 23-Tone responder. In this mode, it is sensitive to the same impairments that affect high speed modem traffic. To minimize any communications problems, a very robust protocol is used to communicate back and forth between the 923*LTS* and the 356E *Plus*. This protocol is used to pass status and commands and to transport test results from one unit to another. The 356E *Plus* is also capable of downloading new test templates to the 923*LTS*. The unit has an RS-232 port for local printing or remote access.

The 356E *Plus* is the "brain" behind the Sage Instruments Automated Local Loop Test System. It stores all the test templates and determines which tests should be initiated. It then compares all test results to the individual templates. It generates a Pass/Fail indication and sends it to the 923*LTS*. The 356E *Plus* has a real-time clock that time-date stamps all results.

It stores over 100 individual records, including the circuit number, order number, technician's ID number and all individual test measurements.

Each time a test suite is completed, the 356E *Plus* passes the results of the tests to the 923*LTS*. The 923*LTS* maintains in its memory results of the last 10 test suites run.

## A Wide Range of Applications

In addition to working with the 923*LTS* in the Sage Automated Local Loop Test System, the 356E *Plus* can be used in a variety of other applications.

The 356E *Plus* can be used in conjunction with the 923*LTS*, the Sage Instruments 930A Communications Test Set, or the 950RTS Remote Test System to address a wide variety of applications in the Central Office, PABX and private network environments.
Uses include: provisioning, quality assurance and preventative maintenance of voice, data, fax and special services.

The 356E *Plus* can be placed at Internet ISPs to conduct special studies on Internet modem performance.

## Test System Controller (TSC)

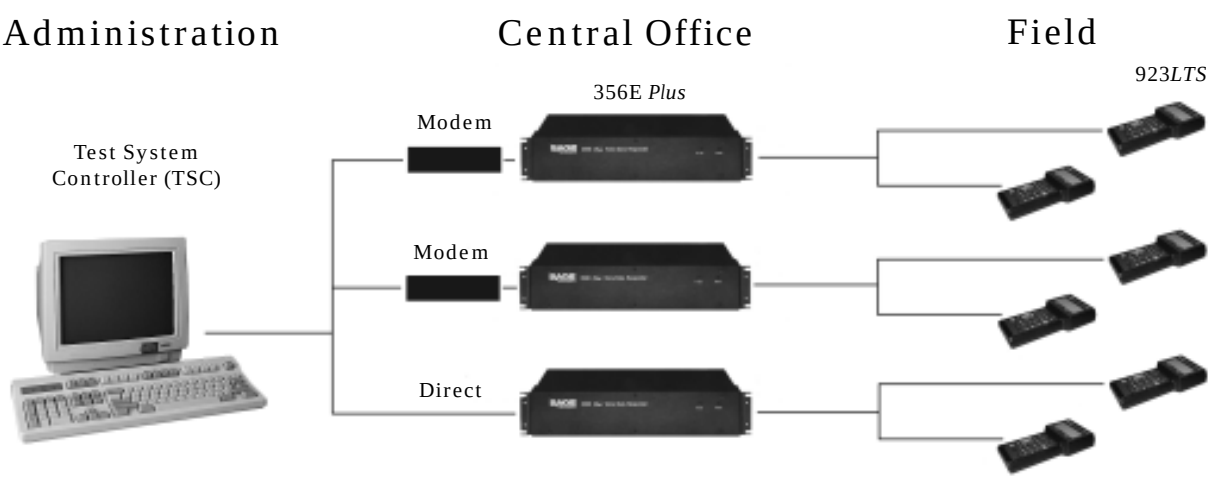
This TSC software package resides on a Personal Computer and allows the user to remotely communicate with the 356E *Plus*. The user may download circuit performance templates, update software revisions, and extract stored data from the 356E *Plus*. Separate templates may be stored for Copper, Wireless, HFC, or any type of loop required. Individual templates may also be developed for installation tests, maintenance tests and special studies.

Stored data can be formatted for reporting, or printed for review.

## TSC Software Utilities

The *Test File Definition Editor* allows the user to create test templates and test limit files for individual service testing.

The *Test File Viewer* utility allows review of extracted test results and generation of printed reports.




The 923LTS, 356E Plus and TSC form an exciting new concept in Local Loop Testing. If you are "lean and mean," concerned about "productivity" and demand "cost effective solutions" CHECK IT OUT!

*There's nothing like it anywhere in the industry.*

# Automated Local Loop Test System


## Standard Features and Options

### 356E Plus Central Office Unit

Basic Unit
Includes Operator's Manual

For Information on
Pricing and Availability
Consult Your Local Distributor

Options
Callback
Additional Operator's Manual

### Test System Controller (TSC)

TSC Software Package
Windows-based software used to download circuit, performance templates and update application software, and extract stored data from the 356E *Plus*.

For Information on
Pricing and Availability
Consult Your Local Distributor

### 923LTS Hand-held Field Test Unit

Basic Unit
Includes Operator's Manual,
AC Adapter, RJ-48 to RJ-11
Test Cord and Grounding Cable.

For Information on
Pricing and Availability
Consult Your Local Distributor

Options

Built-in Butt Set
Callback
(Verifies Switch Translations and Measures Ringing Voltage. Callback is also required in the 356E *Plus*.)
Hits and Jitter Measurements
(Impulse Noise, Phase/Amplitude Jitter, Phase/Gain Hits, and Dropouts)
Soft Pack Carrying Case
Test Cord, RJ-48 to Alligator Clips
Cable, RS-232
Additional RJ-48 to RJ-11 Test Cord
Additional Grounding Cable
Additional Operator's Manual

## 923LTS Hand-held Field Test Unit Line Interface Specifications

| | |
|---|---|
| Input: | 2-Wire Loop |
| Holding: | ≥ 20 ma 42.5 to 105 VDC open circuit voltage with line resistance of ≤1700Ω. Compatible with constant current source |
| DC Blocking: | 150 VDC |
| Balance: | >90 dB, 50 to 120 Hz, decreasing 6 dB/Octave above 120 Hz |
| Termination: | 600 or 900Ω or complex imepdence; return loss ≥30 dB from 200 to 4000 Hz, ≥15 dB from 20 to 5000 Hz |
| Listen and Talk: | Built-in speaker (standard)<br>Talk capabilities (optional) |
| Return Loss Termination: | 600Ω or 900Ω (1%) in series with 2.16 µ (3%) or custom termination |
| AC Bridging Impedance: | > 20,000Ω, 50 to 5000 Hz |
| AC Impedance to Ground: | > 20,000Ω, tip or ring to ground |
| Signaling: | |
| Dial Pulse: | 10 PPS, accuracy ± 2 PPS, 60% break, accuracy ±2%, 700 msec. interdigit timing |
| DTMF: | |
| Frequency: | ±0.5% of Bell standard frequencies |
| Level: | -7.0 dBm0 per tone, accuracy ±0.5 dB |
| Timing: | 50 msec. On/Off, accuracy 0.5 msec. |

## 923LTS AC and DC Measurements

| | |
|---|---|
| DC Measurements: | |
| Range: | +99 VDC to -99 VDC (with overrange indication) |
| Voltage Resolution: | 0.1 VDC |
| Voltage Accuracy: | ±2% of reading, ±0.3 VDC |
| DC Measurement Modes | Tip-to-Ring<br>Tip-to-Ground<br>Ring-to-Ground |
| Tip-to-Ring Current: | |
| Range: | ±125 mA |
| Resolution: | 1 mA DC |
| Accuracy: | ±2% of reading, ±1 mA DC |
| AC Measurements: | |
| Voltage Range: | 0 to 150 V rms |
| Voltage Resolution: | 1 V rms |
| Voltage Accuracy: | ±2% of reading, ±0.5 V rms |
| Frequency Range: | 20 to 120 Hz |
| Frequency Resolution: | 1 Hz |
| Frequency Accuracy: | ±1 Hz |
| Ringing: | |
| Ring Detect: | 40 V rms ±8 V |
| Termination: | (1 REN) resistor in series with capacitor; impedance = 8000Ω @ 20 Hz, 1.5 watts; impedance ≥ 7000Ω @ 70 Hz |

Isolation:

Tip and ring and station ground are isolated from data interface connector, charging connector, and case by more than 500 Volts.

## 923LTS/356E Plus Send/Receive Performance Specifications

| | |
|---|---|
| Send: | |
| Frequency Range: | 50 to 5000 Hz |
| Resolution: | 1 Hz |
| Accuracy: | ±0.5 Hz |
| Level Range: | +10 to -40 dBm |
| Resolution: | 0.1 dB |
| Level Accuracy: | |
| 1000 Hz: | ±0.1 dBm, 0 to -19 dBm |
| 50 to 5000 Hz: | ±0.2 dBm, +10 to -40 dBm |
| Distortion: | |
| 1 kHz | 70 dB, 0 dBm |
| 200 to 3700 Hz: | ≤65 dB, 0 to -16 dBm |
| 100 to 5000 Hz: | ≤50 dB, +10 to -40 dBm |
| Receive: | |
| Frequency Range: | 20 to 5000 Hz |
| Resolution: | 1 Hz |
| Accuracy: | ±1 Hz |
| Level Range: | +10 to -50 dBm |
| Resolution: | 0.1 dB |
| Level Accuracy (terminated): | |
| 1000 to 1020 Hz: | ±0.1 dB, 0 to -19 dBm |
| 200 to 5000 Hz: | ±0.2 dB, +10 to -50 dBm |
| 20 to 200 Hz: | ±0.5 dB, +10 to -50 dBm |
| Noise: | |
| Level Range: | +10 to +100 dBrnC |
| Resolution: | 1 dB |
| Level Accuracy: | 1 dB |
| Filters: | C-Message, C-Notch, 3 kHz Flat |
| Noise-to-Ground: | |
| Level Range: | +40 to +130 dBrnC |
| Resolution: | 1 dB |
| Level Accuracy: | 1 dB |
| Filters: | C-Message, C-Notch, 3 kHz Flat |

## 923LTS/356E Plus Test Specifications

| | |
|---|---|
| 3-Tone Gain Slope: | |
| Frequency: | Programmable 50 to 5000 Hz |
| Level: | 0 to -40 dBm |
| Loss: | +2.0 dB to -20.8 dBm |
| Accuracy: | ±0.2 dB |
| C-Message Noise: | |
| Range: | 10 dBrnC to 90 dBrnC |
| Accuracy: | ±1 dB |
| C-Notch Noise: | |
| Frequency: | 1020 Hz |
| Level: | 0 to -40 dBm |
| Range: | 20 dBrnC to 70 dBrnC |
| Accuracy: | ±1 dB |
| Return Loss: | |
| Bands: | ERL, SRL High & Low |
| Level: | 0 to -40 dBm |
| Range: | 0 dB to +40.0 dB |
| Accuracy: | ±1 dB |
| 3kHz Flat Noise: | |
| Range: | 20 dBrn to 90 dBrn |
| Accuracy: | ±1 dB |
| Filter: | 3 kHz Flat |
| Phase and Amplitude Jitter: (standard and low frequency) | |
| Frequency: | 1020 Hz |
| Level: | 0 to -40 dBm |
| Filters: | 20-300 Hz or 4-300 Hz |
| Range: | 0-20.0% amplitude, 0-20.0º phase |
| Accuracy: | ±5% of reading, ±0.2 |

## 923LTS/356E Plus Test Specifications, *Continued*

| | |
|---|---|
| Impulse Noise/Hits: | |
| Frequency: | 1020 Hz |
| Level: | 0 to -40 dBm |
| Threshold: | 50-90 dBrnC |
| Spread: | 1-9 dB (±1 dB) |
| Measurements per Second: | 1-99 |
| Phase Hit Threshold: | 5-30º (±10%, ±5º) |
| Gain Hit Threshold: | 1-8 dB (±5 dB) |
| Test Length: | 1 to 99 minutes (each way) |
| Range: | 0 to 999 impulses/hits |
| Accuracy: | ±1 impulse/hit |
| 23-Tone Test Transmitter: | |
| Composite Level: | 0 dBm to -40 dBm |
| Individual Tones: | |
| Level: | -13.6 dB below Composite Level |
| Flatness: | ± 0.1 dB |
| Frequencies: | 203.125 to 3640.625 Hz in 156.25 Hz steps ± 10 ppm |
| Phase: | per IEEE 743 ± 0.25° |
| Peak to RMS Ratio: | 8.79 |
| Receiver: | |
| Range: | -40 dBm to -6 dBm |
| Level: | ± 0.2 dB |
| Attenuation: | ± 0.2 dB |
| Envelope Delay Distortion: | |
| Accuracy: | ± 10 µsecs |
| Range: | 10,000 µsecs |
| Frequencies: | 281.15 to 3562.5 Hz in 156.25 Hz steps |
| Signal-to-Noise: | ± 2 dB from 10 dB to 24 dB<br>± 1 dB from 25 dB to 40 dB<br>± 2 dB from 41 dB to 45 dB |
| Signal-to-Total Distortion: | ± 2 dB from 10 dB to 24 dB<br>± 1 dB from 25 dB to 40 dB<br>± 2 dB from 41 dB to 45 dB |
| Intermodulation Distortion: (2nd and 3rd order) | ± 2 dB from 20 dB to 29 dB<br>± 1 dB from 30 dB to 46 dB<br>± 2 dB from 47 dB to 55 dB<br>± 3 dB from 56 dB to 60 dB |

## General

| | |
|---|---|
| 923*LTS* | |
| General: | |
| Weight: | Approximately 20 oz. |
| Size: | Approximately 4” Wide, 1.5” High X 9” Long |
| Temperature: | 0 to 50º C, operating -20 to + 60º C, storage |
| Humidity: | 85% Noncondensing |
| Serial Data Input/Output: | 1200, 9600, 38,400 and 115,200 bps |
| Power: | 120 VAC, 60 Hz or battery |
| 356E *Plus* | |
| General: | |
| Weight: | 7 lbs., 12 lbs. Shipping |
| Size: | 3.5” High X 17” Wide X 10” Deep |
| Humidity: | 85% Noncondensing |
| Temperature: | 0-50° C |
| Power: | 120 VAC, 60 Hz @ 0.2 Amp |

Price and Specifications subject to change without notice



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