

MAKING
COMMUNICATIONS
BETTER

935AT

POWERFUL PACKET VOICE AND LEGACY COM TEST SET



The 935AT is a multi-functional portable unit that features a powerful Next Generation Voice Test Suite. It offers a laboratory quality VF TIMS, a full-featured BERT, RS-232, and a host of other functions as standard equipment.

The 935AT's versatile signaling features enables it to simulate, test and monitor at almost any point in a hybrid network. It is equally at home at the IAD, IP phone, gateway, switchroom, PBX closet, customer or carrier DEMARC, in the lab, or on the production floor. Its ability to simulate and monitor both sides of a connection makes it an indispensable troubleshooting tool.

- Performs voice processing design verification
- Characterized & Test Echo Cancellers
- Troubleshoot and Quantify packet voice impairments

935AT FEATURES A POWERFUL NEXT GENERATION VOICE SUITE

CAPABILITIES

Qualify Voice Services

- Test the networks ability to transmit distortion free voice in both directions
- Provides Clarity Merit Score (MOS)
- Measures audio level
- Measures background noise

Bad MOS Scores?

- Detect and measure packet loss
- Detect and measure voice clips
- Detect and measure noise hits

Isolate echo problems

- Detect and measure echo
- Verify echo cancellation

Verify End-to-End Network Performance and Provisioning

- Measure network delay
- Measure jitter buffer performance
- Verify codec type
- Measure call completion time (post dial delay)

935AT Transmission Features

- Level and Frequency (20Hz – 5000Hz)
- Noise (C– Message and 3Khz Flat)
- Noise-to-Ground
- Signal-to-Noise Ratio
- Return Loss (2– and 4–wire)
- Frequency Sweep
- Dual Tone Gen (level, freq, cadence)
- Programmable Echo Can Disable Tone
- 100/102/105 Test Line

continued

935AT

MOST VERSATILE LEGACY AND NEXT GENERATION TEST SET

CAPABILITIES *continued*

935AT Digital Features

- 1.544 Mbit/s T1 (D4/SF, ESF and SLC-96 framing)
- Internal High Stability Clock or Loop
- Terminate dual direction drop and insert or monitor modes
- Real time display & cntrl of ABCD bits
- uLaw or aLaw encoding
- Voltage measurement
- Full rate and 64kbit BERT measurements (G.821 and M.2100)
- Generate and detect Alarms
- DSO Loop back with gain control

935AT Signaling Capabilities

- Loop start (2/4-wire, contact, normal and reverse battery)
- Ground Start (2/4-wire, contact, normal and reverse battery)
- E&M Types I-V (Send-M, Send-E)
- PCM (Normal, FXO/FXS and CCIS supervision)
- Dry (no supervision)

PHYSICAL CHARACTERISTICS

- Test Interface: T1, 2/4-wire Analog Bantam and 310 jacks
- Telset & Bertset Interfaces: 310 jacks and terminal blocks

- T1 span status LEDs
- Com Port: RS-232
- Power 120VAC
- Size: 14"x6"x12.5"
- Available with rack mount kit

OTHER FEATURES

- Real-time clock for time stamping
 - Store and Recall up to 999 Results
 - Speaker & Volume Control
- Certifications: UL, CE

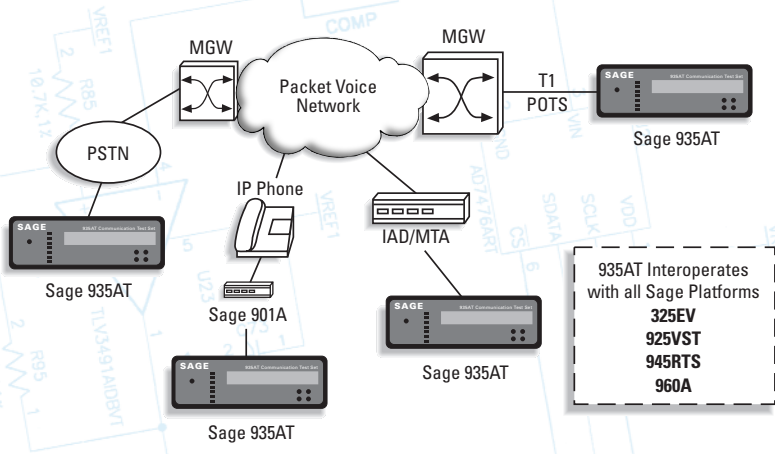
OPTIONS

Standard Features: See http://www.sageinst.com/935AT_Tech.html

- 7935-0000-01** Base Unit
- 7935-0100-01** Advanced TIM Package
- 7935-0110-01** Voice Circuit Test Package
- 7935-0130-01** Next Gen Voice Test Pack
- 7935-0200-01** BERT & DDS Test Package
- 7935-0210-01** SS7 Call Trace & Error
- 7935-0246-01** B8ZS Mismatch DSO
- 7935-0330-01** Ring Generator
- 7935-0340-01** Wideband TIMS
- 7935-0348-01** 48 VDC Power Supply
- 7935-0505-01** ROTL 105
- 7935-0522-01** ATME 0.22
- 7935-0523-01** 23 Tones
- 7935-0555-01** Echo Sounder
- 7935-0556-01** Echo Gen and Test Line
- 7935-0568-01** ITU G.168 Suite
- 7935-0575-01** Packet Voice Impair Test
- 7935-0576-01** SMOS Packet Voice Test

935AT APPLICATIONS

Voice Quality • Echo Canceller • Computer Telephony • Qualification
Manufacturing • Laboratory Standard



ACCESSORIES

- 7901-0000-01** Universal Audio Adapter
- 9400-2425-01** Talon 93X T-TIMS GUI

935AT Communications Test Set Specifications



Level/Frequency/Noise

Transmitter

Frequency Range	50 Hz to 5 kHz
Resolution	1 Hz
Accuracy	± 1.0 Hz
Output Steps	1, 10, 100, or 1000 Hz steps
Level Range	-60 dBm to +12 dBm
Resolution	0.1 dB
Accuracy	± 0.1 dB at 1020 Hz (0 to -19 dBm)
Flatness	± 0.2 dB (200 Hz to 5 kHz referenced to level at 1 kHz)
Distortion	-70 dB at 1020 Hz, 0 dBm

Receiver

Frequency Range	50 Hz to 5 kHz
Resolution	1 Hz
Accuracy	± 1.0 Hz
Level Range	-40 dBm to +12 dBm
Resolution	0.1 dB
Accuracy	± 0.1 dB at 1020 Hz (0 to -19 dBm), ± 0.2 dB at 200 Hz to 5 kHz

Noise Measurement

Input	Balanced or noise-to-ground
Weighting Filters	C-Msg, C-Notch, 3 kHz Flat
Notch Filter	1010 Hz (995–1025 Hz Notch); >50 dB Notch depth
Range	10–100 dBm (balanced); 50–130 dBm (noise-to-ground)
Resolution	1.0 dB
Accuracy	± 0.5 dB

Signal-to-Noise Measurement

Level Range	-40 dBm to +10 dBm
Signal-to-Noise Range	10–50 dB
Accuracy	± 0.5 dB

Return Loss Measurement

General

Modes	ERL, SRL-low, SRL-high, or sine wave (OSC)
Transmitted Signal	Meets the specifications of IEEE Standard 743-1995

Echo Canceller Disable Tone

Frequency	2100 Hz \pm 1 Hz
Phase Reversals	450 ms \pm 5ms; 180° \pm 5°
Level	-12 dBm0 \pm 1 dB

2-Wire Return Loss

Transmitter Level	-10 dBm0
Receiver Range	0-40 dB
Resolution	1.0 dB
Accuracy	\pm 0.5 dB
Internal Hybrid Impedance	600 or 900 Ohms \pm 0.1% in series with 2.16 μ F \pm 1%

4-Wire Return Loss

Impedance	135, 600, 900, or 1200 Ohms
Transhybrid Loss Compensation	-30 dB to +30 dB
Transmitter Level	-10 dBm0 (relative to TLP in OSC mode)
Receiver Range	-10 dB to +50 dB
Resolution	1.0 dB
Accuracy	\pm 0.5 dB

Supervision and Signaling

Wink Timing

Resolution	5 ms
Accuracy	\pm 5 ms
Wink Fail Event	Fails for wink period >600 ms
Off-Hook Fail Event	Fails for off-hook period <600 ms

E/M Supervision

Types	I, II, III, IV, V
Battery	-48 V DC current limited to 200 mA
Threshold Voltages (defaults)	

	E Lead	M Lead
on-hook	< -39 V	> -11 V
off-hook	> -11 V	< -39 V

Loop Supervision

Types	2- and 4-wire loop start, ground start, loop reverse battery, and SX supervision
Battery	-48 V DC series limited to 120 mA

MF and DTMF Sender

Frequency Accuracy	\pm 0.1% of ITU-T standard frequencies
Adjustment Range	Tone frequencies adjustable in 0.1% steps to \pm 10% of standard frequencies for margining tests
Level	-7 dBm0 per tone (default)

Level Adjustment Range	Tone level adjustable in 0.1 dB steps from -40.0 dBm to +6.0 dBm
Resolution	0.1 dB
Accuracy	±0.2 dB
Default Timing	MF: 70 ms Tone On and Tone Off (KP is 100 ms Tone On) DTMF: 50 ms Tone On and Tone Off
Timing Adjustment Range	Tone On and Tone Off times adjustable in 1 ms steps from 13–267 ms (KP adjustable from 45–300 ms)
Resolution	1 ms
Accuracy	±1.0 ms

Dial Pulse Sender

PPS	
Range	2–35 PPS
Resolution	0.1 PPS
Accuracy	±1.0% at 10.0 PPS
% Break	
Range	25–80%
Resolution	0.1%
Accuracy	±1.0% for 25–75% BRK at 10 PPS
Interdigit Timing	
Range	100–990 ms
Resolution	10 ms
Accuracy	±5.0 ms

MF/DTMF/DP Receiver and Analyzer

MF and DTMF	
Input Level Range	-25 dBm0 to 0 dBm0
Accuracy	±0.2 dB
Resolution	0.1 dB
Input Frequency Range	±10% of ITU-T standard frequencies for MF and DTMF tones
Accuracy	±0.1%
Resolution	1 Hz
Input Tone on/off Range	35–250 ms Tone on; 35–250 ms Tone off
Accuracy	±5 ms
Resolution	1 ms
Dial Pulse (DP)	
PPS Range	5–30 PPS
Accuracy	±2% at 10 PPS
Resolution	0.1 PPS
% Break	25–80%
Accuracy	±2% (25–75% break at 10 PPS)
Resolution	1%

Interdigit Timing Range	200–990 ms
Accuracy	±5 ms
Resolution	1 ms

DS-1 PCM Channel Access

Format	DS-1 AMI or B8ZS Line Code
Input Frequency	1.544 Mbps ±300 bps
Jitter Tolerance	Exceeds Bell Publication 43802 Requirements
Sequence	D1D, D2, D3/D4
Signaling Modes	Robbed bit and clear channel
Framing Format Selection	D4 Superframe, Extended Superframe, or SLC-96@*
	Automatic or manual selection of frame format—D4/SF or ESF
Input Mode	Terminated: 100 Ohms nominal Bridging: >1000 Ohms
Input Level	200 mV to 6 V base to peak
Input Level Measurement	200 mV to 6 V or -23 dBdsx to +3 dBdsx
DS-1 Output	1.544 Mbps (Stratum 4) in INTERNAL clock mode ±5 ppm; Equal to input rate in LOOP-TIMED mode
Output Pulse Level	3.0 V ±0.3 V base to peak
Output Imbalance	Positive and negative pulses are within 0.1 V base to peak
Channel Selection	Any one of 24 selectable from keypad
PCM Supervision Displays	40-character vacuum fluorescent display shows A & B bit signaling states for all 24 channels (Option Menu # 20) simultaneously. In ESF Mode A, B, C, and D bits are displayed. Four LEDs show on- and off-hook supervision status of selected time slot.
Operating Modes	TERMINATE: selected channel connected to channel generator and receiver; other 23 channels send IDLE code (7F) MONITOR: monitor selected channel in dual direction; all 24 channels passed through unchanged; framing regenerated DROP & INSERT: dual-direction only; selected channel dropped out for testing; other 23 channels passed through unchanged
Pattern Simulation	Idle code (7F), Received PCM. Optional patterns require Purchase Option 933AT-200, BERT Test Package.
Frame Loss Criteria	Superframe and SLC-96@: loss of frame occurs when two out of five Ft frame bits are in error. ESF: loss of frame occurs when two out of five FPS bits are in error.
Error Displays	Detects and counts frame errors, bipolar violations, frame slips, and CRC errors (ESF only)
Alarms	Sends Blue alarm (all ones) or Yellow alarm (ALL bit #2=0) on Superframe and sent on Facility Data Link for ESF.

* SLC-96 is a registered trademark of AT&T.

Alarm Displays	Detects and displays frame loss, carrier loss, excess 0s, Yellow alarm, and Blue alarm.
PCM Channel Encoder	
Analog Tone Generation	20–3904 Hz selectable in 1.0 Hz steps from keypad
Basic Accuracy	±0.1 dBm @ 1020 Hz
Frequency Response	±0.2 dB
Supervision	NORMAL (E&M), USER DEFINED states of A and B bits (C and D bits in ESF), FXO/FXS, SLC-96
Signaling	MF, DTMF, and DP
PCM Channel Decoder	
Basic Accuracy	±0.1 dBm @ 1020 Hz
Frequency Response	20–3904 Hz ±0.2 dB
Intrinsic Noise	10 dBmC (with Idle Code received)

SLC-96

- Central office terminal (COT) and remote terminal (RT) testing—can originate an SLC-96 signal that emulates the COT or the RT.
- Send and receive SLC-96 signaling bits—perform drop and insert testing, monitoring A and B signaling states, and transmitting A and B signaling states.

Signaling Types

Supported signaling types include Single Party, Coin, Universal Voice Grade, and Direct Inward Dial.

	From the RT	From the COT
Single Party	On-hook Off-hook Unequipped	Channel test Idle Forward disconnect -R ringing
Coin	On-hook Off-hook Unequipped Coin ground	Negative loop mode Channel test Positive loop mode Ground start -R ringing Positive coin check Negative coin check Positive coin control Negative coin control
Universal Voice Grade	On-hook Off-hook Unequipped Ring ground	Ground start Channel test -R ringing Idle
Direct	Normal battery Reverse battery	Loop open Loop closure

General

Impedances	135, 600, 900, 1200 Ohms and >50 kOhms bridging
Maximum DC Blocking	160 V DC
Audio Bandwidth	± 3.0 dB 300 Hz to 3.0 kHz
Audio Volume	Adjustable by front panel control
Longitudinal Balance	90 dB at 60 Hz
Receiver Return Loss	>30 dB 200 Hz to 5 kHz (600, 900, 1200 Ohms) >30 dB 800 Hz to 5 kHz (150 Ohms)
Display	40-character vacuum fluorescent plus four LEDs for on- and off-hook status
AC Power Supply	115 V AC $\pm 10\%$, 60 Hz
Operating Temperature	0° C to 50° C
Storage Temperature	-40° C to +70° C
Dimensions	5.79" H x 14.33" W x 14.25" D
Weight	16 lbs. to 18 lbs. depending upon options

