235A+

T1/F-T1/DS0 ANALYZER

The 235A+ passes the test. Compare for yourself:

1. Is the set intuitive?

We went to great lengths to make the 235A+ an intuitive, simple-to-use test set. Its receiver automatically identifies the monitored signal framing and the payload test pattern if any. At the touch of a key, a SUMMARY screen provides the test status and ID of the pattern on which sync is obtained. Errors and alarms are displayed unambiguously by dedicated LEDs.

2. Is it reasonably priced?

You could spend $2,000 to $4,000 *more* for test sets that do less than the 235A+. The 235A+ is a full featured T1 set that includes: in-service monitoring, turn-up stress testing, auto-pattern sync, auto-frame, NI/CSU loop codes, and T1 measurements including clock slippage, level and frequency.

3. Are the receiver and transmitter independent?

The 235A+ has the unique ability to auto-sync and auto-frame to a stress pattern while transmitting a completely different bit stream. For instance, it can send an ESF 55-Octet pattern while monitoring a D3/D4 (SF) 3/24 stress pattern from a far-end test set for true end-to-end testing.

4. Can it support DS0 channelized testing?

The 235A+ with option 08 performs VF measurements including level, frequency, noise, and DC offset. It also displays the signaling bit states for the selected DS0 channel and for all 24 DS0 channels simultaneously.

5. Can its software be readily upgraded?

A flash memory card containing all the software allows for easy field software upgrade.

6. Can the battery pack be easily removed?

The optional battery pack is self-contained and secured to the back of the 235A+; consequently, it can be readily added or removed in the field. This compares favorably with instruments which include the batteries in the base unit.

7. Can it operate as a CSU?

In addition to operating as a test set, it can be used as a loopable CSU, perfect for pre-qualification of a T1 circuit.

8. Is it backed by a solid reputation?

T-COM has designed and manufactured high quality digital test instruments for well over a decade. As a supplier to the largest telephone companies and smallest telecom users, we are recognized as an innovative, no-nonsense manufacturer of high quality DS3, DS1, and channel access test sets.

T-COM

Telecommunications Instrumentation

About The 235A+

The T-COM 235A+ was designed to provide, in a moderately priced and easy-to-use instrument, all the capabilities you need to reliably qualify and maintain a variety of DS1 transmission systems and equipment, in the CO, the outside plant, or in customer's premises.

The 235A+ contains a DS1 receiver providing real-time impairment diagnostics, with dedicated LEDs, on any DS1 signal observed at DSX-1 access jacks (IN/OUT or monitor). The receiver provides level and frequency measurement of the T1 signal; it can also indicate bit and frame slippage if a clock signal is supplied to the reference receiver. At the press of a key, the receiver provides a comprehensive impairment statistics report for a specified time period. The receiver recognizes automatically the (SF/ESF/SLC-96) framing format of the monitored signal. It also identifies automatically the test pattern presented. These features, not only contribute in simplifying the operation of the set, they also make it foolproof.

The 235A+ transmitter can deliver a variety of standard and user-defined test patterns to stress and qualify a T1 transmission system. The transmitter can also be used for sending various loop codes (CSU or NI), simulating alarm conditions, and injecting errors.

The receiver and the transmitter can be used completely independently or in combination. When used independently, the receiver can monitor for example a SF 3/24 pattern while the transmitter delivers an ESF QRS pattern. When used in combination, programmed tests such as the repeater test or the bridge-tap test can be carried-out automatically. The receiver and the transmitter can also combine to act as a "golden" CSU; this is of great value when you need to verify the transmission integrity at the customer's premises.

A hard copy of the test results can be obtained by connecting a printer to the RS-232-C port. The 235A+ basic capabilities can be extended by adding several hardware and/or software based options.

Available Options

– **Option 01: Add-on Battery Pack**
This NiCd pack is secured to the back of the instrument; a fully charged battery provides in excess of four hours of powering.

– **Option 03: a RCVR/XMTR enhancement package**
This package enables testing:
- of fractional T1 systems
- with up to four long user patterns
- with DDS test patterns
- ESF data link messaging (send and receive)
- SLC-96 Data Link messaging (send and receive)

– **Option 06: Smart Repeater Loop Codes**
Supports smart repeater codes for Teltrend, Westel, and XEL repeaters.

– **Option 08: DS0 Monitor**
With this option, you can:
- select a single DS0 channel and obtain a reconstructed VF signal on a jack for further processing
- listen to the reconstructed tone with the built-in speaker observe the signaling states in the selected channel
- measure the VF signal level and frequency
- measure the noise level (w/ and w/o weighting filters)
- display the 8-bit word in the selected DS0 channel
- display the A, B, C, D signaling states for all 24 DS0 channels simultaneously.

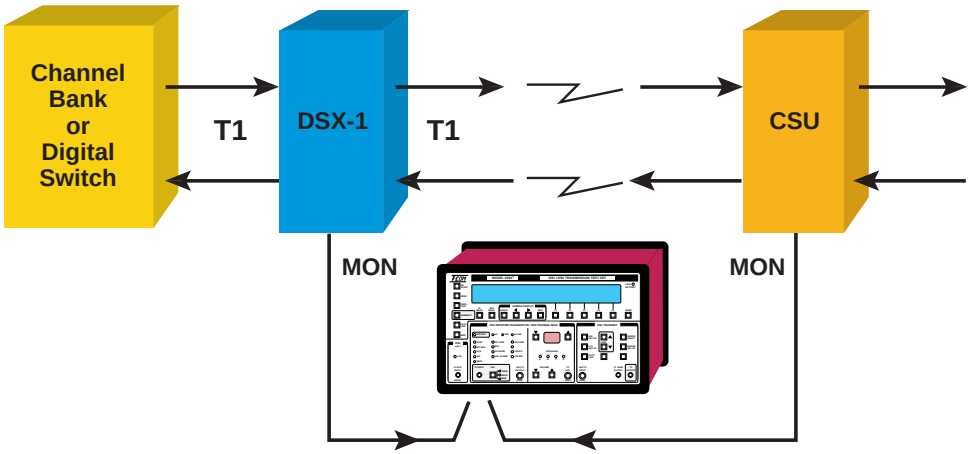
– **Option 09: DS0 Tones and Signaling**
This option allows inserting into a selected DS0 channel one of three tone frequencies at three different levels. The signaling states in this channel as well as in the other 23 channels is independently selectable. (requires opt 08)

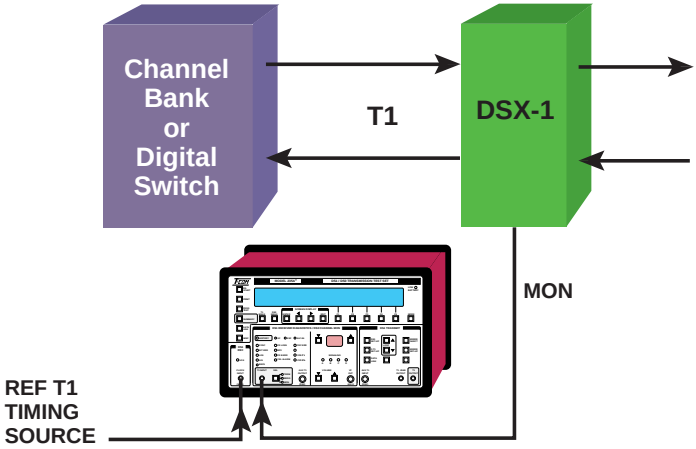
– **Option 33: Imbedded Property Identification**
Causes the display to read "property of..." during the self-test sequence.

Applications

Non-Intrusive DS1 Monitoring (with DS0 Analysis)

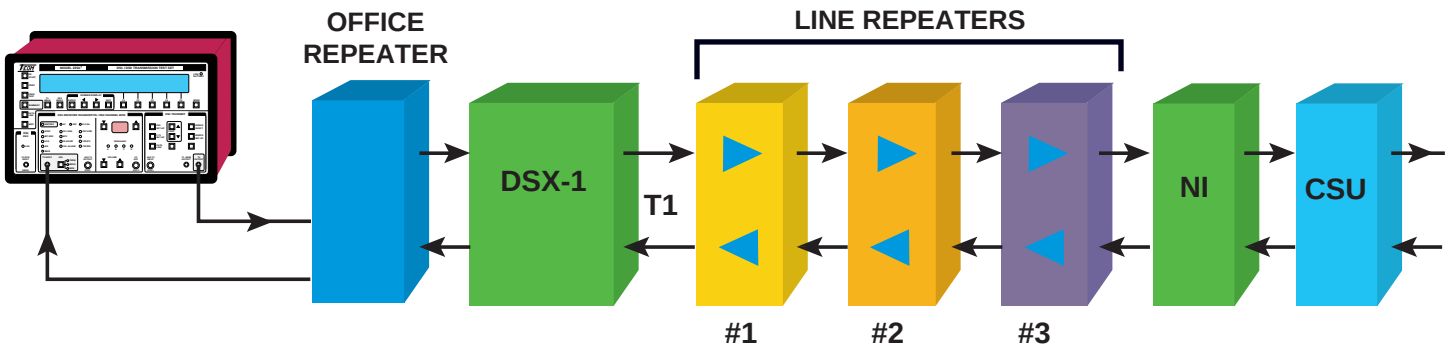
If patched at a DS1 MONITOR jack (DSX-1 bay or CSU) or bridged across the T1 line, the 235A+ can analyze the transmitted bit stream for impairments without affecting the traffic. The 235A+ identifies automatically the framing (SF/ESF/SLC-96), if any, and provides comprehensive transmission impairment statistics. Time and date stamping of impairments is provided on the print-out obtained when a printer is connected to the RS-232-C port. When the 235A+ is equipped with the option 08, you can also, among other things, measure the level and frequency of a tone in a selected DS0 channel, the C-message weighed idle channel noise level, and observe the state of the signaling bits in all 24 DS0 channels simultaneously. When the 245A+ is equipped with the option 03, you can capture and print messages carried by the ESF or the SLC-96 data links.





DS1 Bit Slippage and Jitter Checking

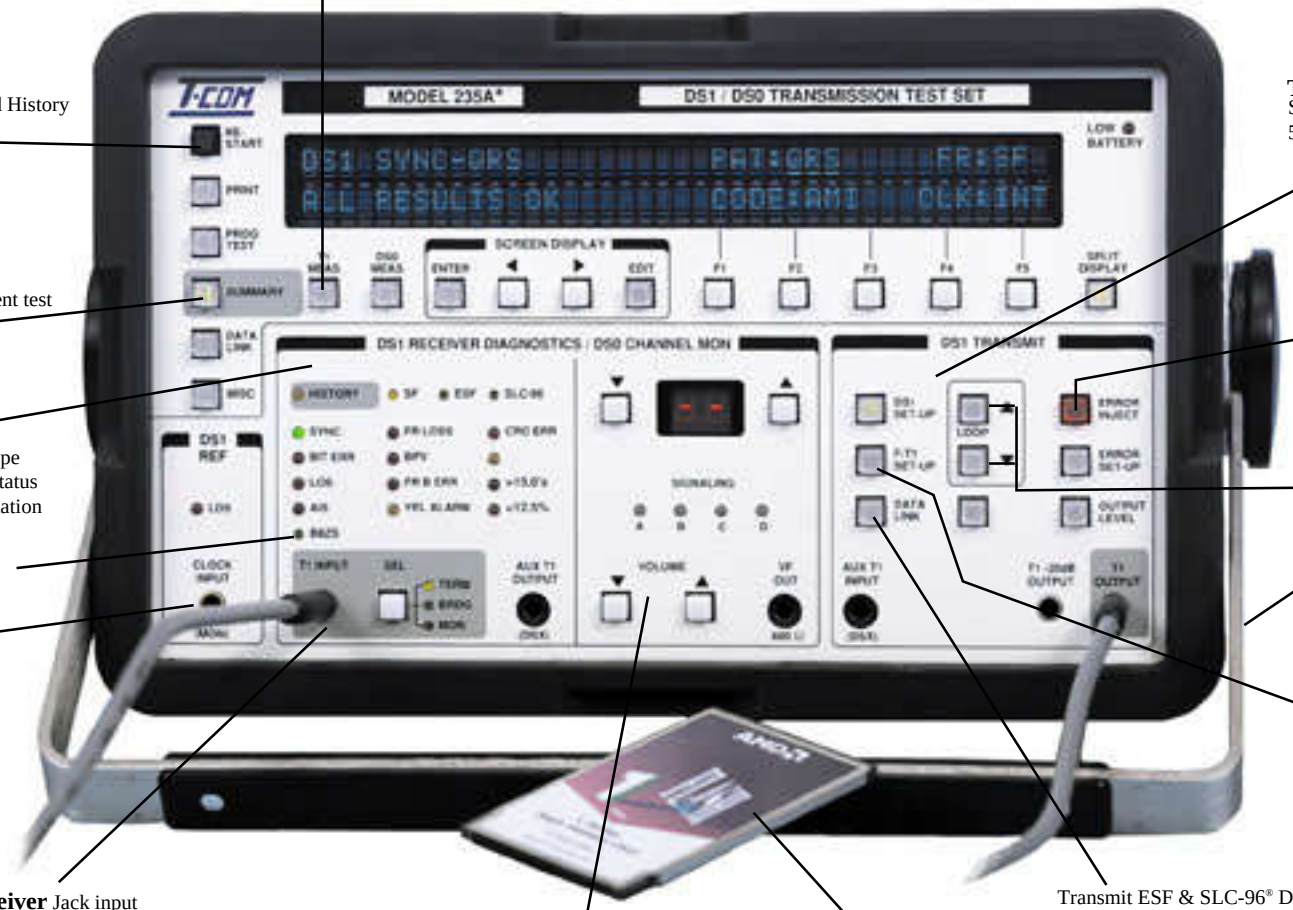
When patching the DS1 REF receiver input to a T1 timing source while the DS1 RCVR is patched to a MONITOR jack or bridged across a T1 line, the 235A+ can display bit slippage and count frame slips. By observing the slippage you can readily assess whether timing lock is lost or jitter is present on the system. This test can be carried-out on any live circuit without causing any interference.



Looping CSUs, NIs, and Smart Repeaters

When patched to a T1 office repeater, the 235A+ can send loop commands to selectively loop a CSU or an NI unit. If the set is equipped with option 06, smart repeaters made by Teltrend, Westell and XEL can be selectively looped as well.

The 235A+: Ideal for central office and field use.



T1 Measurements displays level, frequency, slip timing

RESTART clears all errors and History

SUMMARY displays current test status, pattern sync

DS1 Receiver
Provides automatic Frame type
Real time LED error/alarm status
Bright flashing History indication

Automatic B8ZS detection

Reference input
Used for performing
T1 Synchronization/slip timing measurements

DS1 Receiver Jack input with selectable input levels

DS0 Channel Access with measurements

Memory Card

Transmit ESF & SLC-96® DATA Link Commands/Requests

Set-Up Fractional T1 tests on contiguous and non-contiguous DS0 channels

Adjustable Handle

Send CSU/Network interface Loop codes

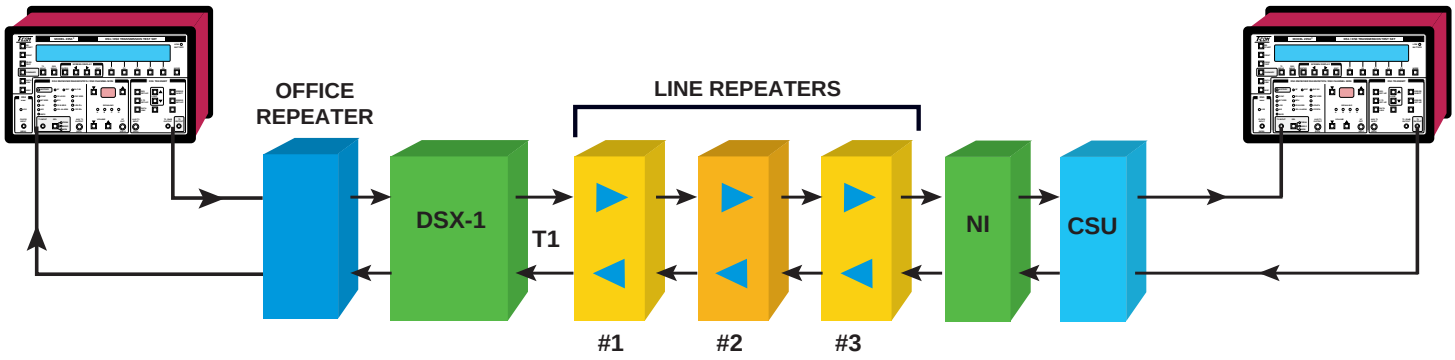
Inject a variety of errors at selectable rates

Transmitter
Select stress patterns including 3/24, QRS, 55 Octet, MinMax and DDS1-4

Applications

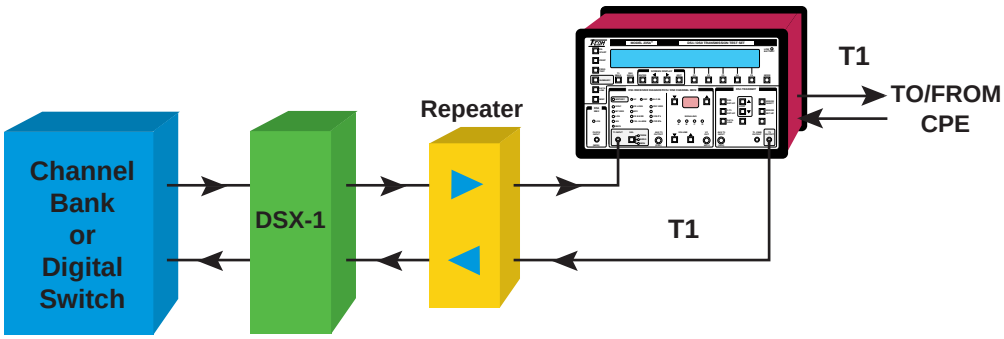
T1 Transmission System Qualification

Bit Error Rate Testing (BERT) can be performed from the CO or the customer premise location by either looping the other end (as illustrated in the previous application) or by using a test set at both ends of the transmission system. This second approach offers the advantage of letting you identify the direction in which a fault exists. An extensive family of test patterns is provided to stress the repeaters and identify bridge taps.



Golden CSU

The auxiliary XMT/RCV T1 port on the side of the 235A+ is provided to let you use the instrument as a reference CSU. Like a CSU, it can loop the path back to the CO when a CSU or NI loop-up command is received and condition the line signal as required to yield a standard 0 dBDSX T1 stream to the CPE. In this mode, the 235A+ can also monitor and analyze T1 transmission impairments.

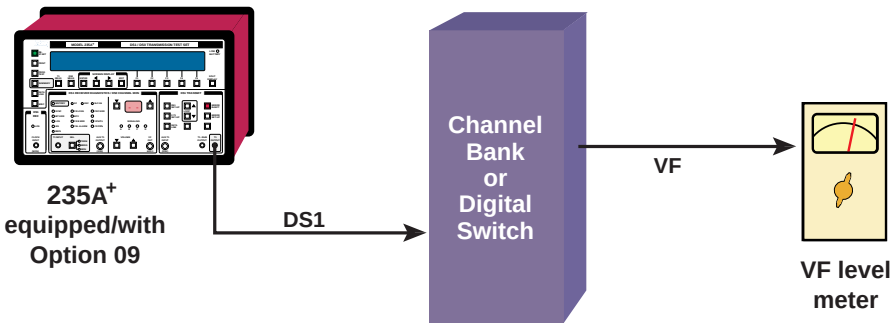


Fractional T1 Qualification Testing

When the 235A+ is equipped with option 03, you can perform BER testing and qualify the transmission system for any number (from 1 to 24) of 56 or 64 kb/s channels together. The channel assignment may be contiguous or random. In this mode, the transmitter can delivers any bit pattern in its library (QRS, DDS1-4, long-user patterns, 55 Octet, etc.) over the combined bandwidth of the active DS0 channels. Meanwhile, the T1/F-T1 receiver can monitor/analyze the full T1 bit stream.

Half-channel gain-slope measurement and receive gain calibration.

The gain-slope measurement on the receive half of the DS0 channel is obtained by patching the DS1 stream delivered by the 235A+ to a channel bank or a digital switch. For each selected tone frequency, the decoded receive level may be measured and the receive gain adjusted as necessary.



Specifications

System Format Compatibility

Transmission	T1/AMI and B8ZS
Channel bank	D1D, D2, D3/D4, ESF and SLC-96®

DS1 Reference Section

Input level	600 mV pk-pk across 100 Ω nominal
Diagnostics	LOS (loss of signal)

DS1 Receive Diagnostics Section

Input level	+6 to -34 dBDSX in TERM or BRDG -17 to -23 dBDSX in MON
Input impedance	TERM or MON: 100 ± 5% Ω, BRDG: >1000 Ohms
Diagnostics LEDs	LOS, >15 0's, < 12.5% 1's density, BPV, Frame Bit Error, Frame Loss, Bit Error, CRC Error, AIS, Yellow Alarm, Sync, B8ZS
Framing format	Auto-frame to SF, ESF, SLC-96
Pattern sync	on pattern sent by transmitter or auto-search
Fractional T1	see option 03
Auxiliary T1 output	Nominal 6.0 Vpk-pk across 100 Ω (*)

DS1 Transmit Section

Output level	T1 port: 0 (*), -7.5, -15 dBDSX T1-20 dB port: 20 dB below level at T1 port
Patterns	External, framed and unframed 2^{15}-1, 2^{20}-1, QRS, 2^{23}-1, 3/24 all 1's, 1/8 and 24-bit user-defined code. (See option 03 for additional patterns.)
Clock selection	Master, recovered and externally supplied
Error injection	BPV, BIT, CRC, FR BIT
Error rate	10^{-9} to 9 x 10^{-3}
Loop codes	CSU, NI and user-defined (See option 06 for additional loop codes)
Auxiliary T1 input	Nominal 6.0 V pk-pk/100 Ω input impedance

Control and Measurements Section

T1/DS1 Statistics	
- Error counts	BPV, frame bit, CRC
- Time based statistics	ES, SES, CSES
- Bit error rates	Logic Bit Error Rate (BER), Frame Bit Error Rate (FBER), CRC Bit Error Rate (CBER)
- Timing slips	Bit-by-bit slippage display & frame slip count
- Level	(DSX): +6 to -6 dB ± 1 dB (TERM/BRDG): +6 to -34 dB, ± 3 dB
- Bit rate accuracy	± 10 Hz
Span line current	0 -160 mA, ± 1%
Test time	Settable by 1 min steps to 100 hours

RS-232-C Interface Port

Access	9 pin D-sub female
Baud rate	300-9600

Miscellaneous

AC powering	108 to 126 VAC, 7W
Battery power	Up to 4 hours (option 01)
Operating temp	-20 to +40 ºC
Humidity	Up to 90% non-condensing
Dimensions	7" x 11" x 9" (H x W x D), the battery module adds 1" to the depth
Weight	12 lbs including detachable front cover, the battery adds 4 lbs

Option 03 (enhancement package) Specifications

Fractional T1	BER testing of contiguous or non-contiguous DS0 channels (56 kb/s to 1.536 Mb/s)
ESF data link messaging	XMT and RCV messages in compliance with ANSI T1.403 and AT&T Pub 54016; including PRMs and BOMs Received messages can be downloaded to the RS-232-C port
SLC-96 data link mes'g	XMT and RCV messages in compliance with Bellcore TR-000008 for Modes 1 and 2
Additional T1/F-T1 stress patterns	55 Octet, Trip Test, MinMax, DDS1-DDS4, four 255 Octet User-Programmable patterns

Option 06 (smart repeater loop codes) Specifications

Repeater manufacturers	- Teltrend (Ameritech, Nynex, Bell South, US West, Pac Bell, Bell Atlantic) - Westell (3150-70) - XEL (7853 and 7854)

Option 08 (DS0 Channel Access) Specifications

VF decoder	
Bank format	D1D, D2, D3/D4, and ESF
DS0 access	Any one of the 24 channels
Supervision	A, B bits for SF; A, B, C, D for ESF
VF level range	+3.2 to -50 dBm0
Freq response	300 Hz - 3000 Hz within ± 0.15 dB
Gain linearity	0 to -30 dBm0 £0.25 dB
S/N ration	0 to -30 dBm0 ³ 30 dB
Idle noise	13 dBm0 max
Output impedance	600 Ω nominal
Connector	Bantam jack

DS0 VF measurements

Level accuracy	± .1dB in range +.3 to -59.9 dBm0
C-MSG noise accuracy	± 1 dB in range +10 to +93 dBnC0
Flat noise accuracy	± 1 dB in range +10 to +93 dBnC0
Supervision	Real time A, B, C, D signaling bit display for selected channel. Simultaneous display of signaling bits for all 24 channels
DS0 data	Eight bit word display. Automatic display of network DDS test messages and control codes

Speaker amplifier

Gain	0 to 40 dB gain, continuously adjustable
Freq response	50 - 3000 Hz within 3 dB
Power	Up to 150 mW

Option 09 (DS0 Tones and Signaling) Specifications

- Selected DS0 channel	
Tone frequency	405, 1005, 2805 Hz +0, -1 Hz
Tone level	0, -10, -16 dBm0 ± .1dB
Signaling states	A, B, C, D independently settable(*)
- Other 23 DS0 channels	
Signal	idle or 1005 Hz/-20 dBm0
Signaling states	A, B, C, D independently settable(*)

(*) C and D bits apply to ESF Framing only.

Additional T-COM Products

Our most versatile turn-up and maintenance communication test set

The 440B/T-ACE can be equipped with a number of options to test a broad range of digital transmission systems and services. While the base unit tests and characterizes T1/F-T1 and DS0 signals, optional add-on modules extend the test capabilities to DS1C, DS3, and STS-1 (SONET). The 440B/T-ACE is ideally suited for use in the central office as well as on the production line to test the operation of digital switches, multiplexers, channel banks, CSUs/NIs, etc.

The 440B/T-ACE independent receivers and transmitters can be readily set-up to perform a variety of tests: dual DS1/DS0 drop-and-insert, sending a calibrated tone into a selected DS0 channel, measuring the signal and noise level in a DS0 channel, setting-up MJUs, BER testing on a DDS/DS0 subrate primary and secondary channels, looping smart repeaters, sending and monitoring ESF and SLC-96 data link messages, sending and receiving MF/DTMF/DP signaling, and much more. For instance, when the 440B/T-ACE is equipped with the 52C add-on unit, you may perform BER tests at DS3 and STS-1 rates or monitoring the contents of a DS0 channel from the DS3 or STS-1 (VT1.5) streams.

An RS-232-C port is provided for time and date stamped report downloading to a printer and for remote control of the set.

The 440B/T-ACE is a multi-purpose digital communications analyzer, ideal for Central Office and CPE testing.

A powerful and easy-to-use DS3 Turn-Up and Maintenance test set

The 160A^{+} DS3/DS2/DS1 Analyzer

In addition to providing BER testing at DS3 with a family of standard test patterns, the 160A^{+} can be optioned to perform BER testing at DS1 directly from any T1 access. When acting as a M13 or C-bit multiplexer, all DS1 groups can be framed (SF, ESF or SLC-96); this is of great value for testing all "low speed" cards in a multiplexer. Optionally, the testing of each DS1 group can also be performed automatically in a sequential manner. When equipped with the 54B add-on module, the VF signal or noise level in a DS0 channel selected from the monitored DS1 or DS3 stream can be measured and displayed along with the instan-taneous signaling states.

The 160A^{+} ease-of-use is accomplished by providing auto-framing (M13 or C-bit), auto-pattern sync, single key access to several of the most frequently used screens and unambiguous impairments/alarm display by dedicated LEDs.

The RS-232-C port provides automatic time and data stamp of DS3, DS2, and DS1 errors. This interface is also used for complete remote control capabilities.

T-COM

Telecommunications Instrumentation

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