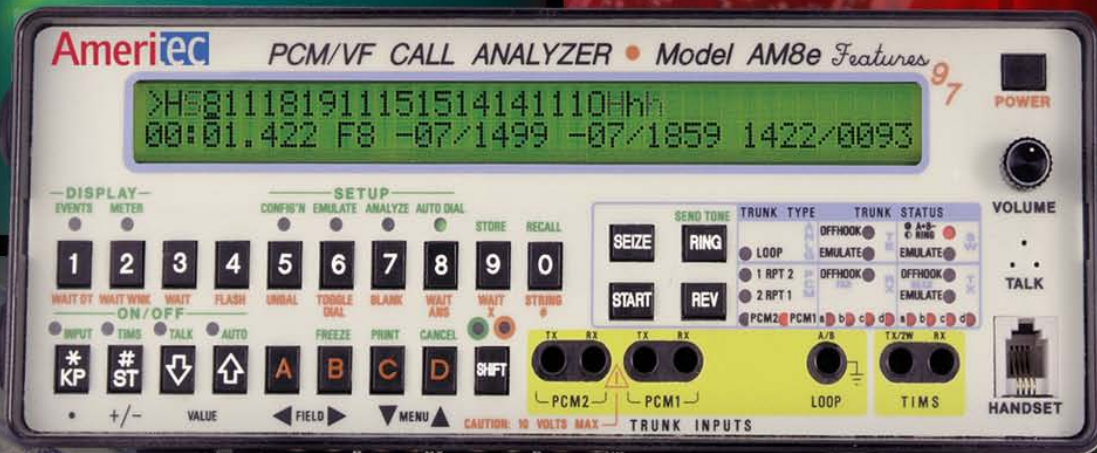
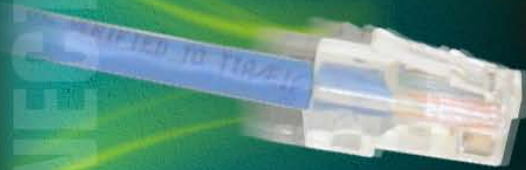


AM8e PCM/VF Call Analyzer

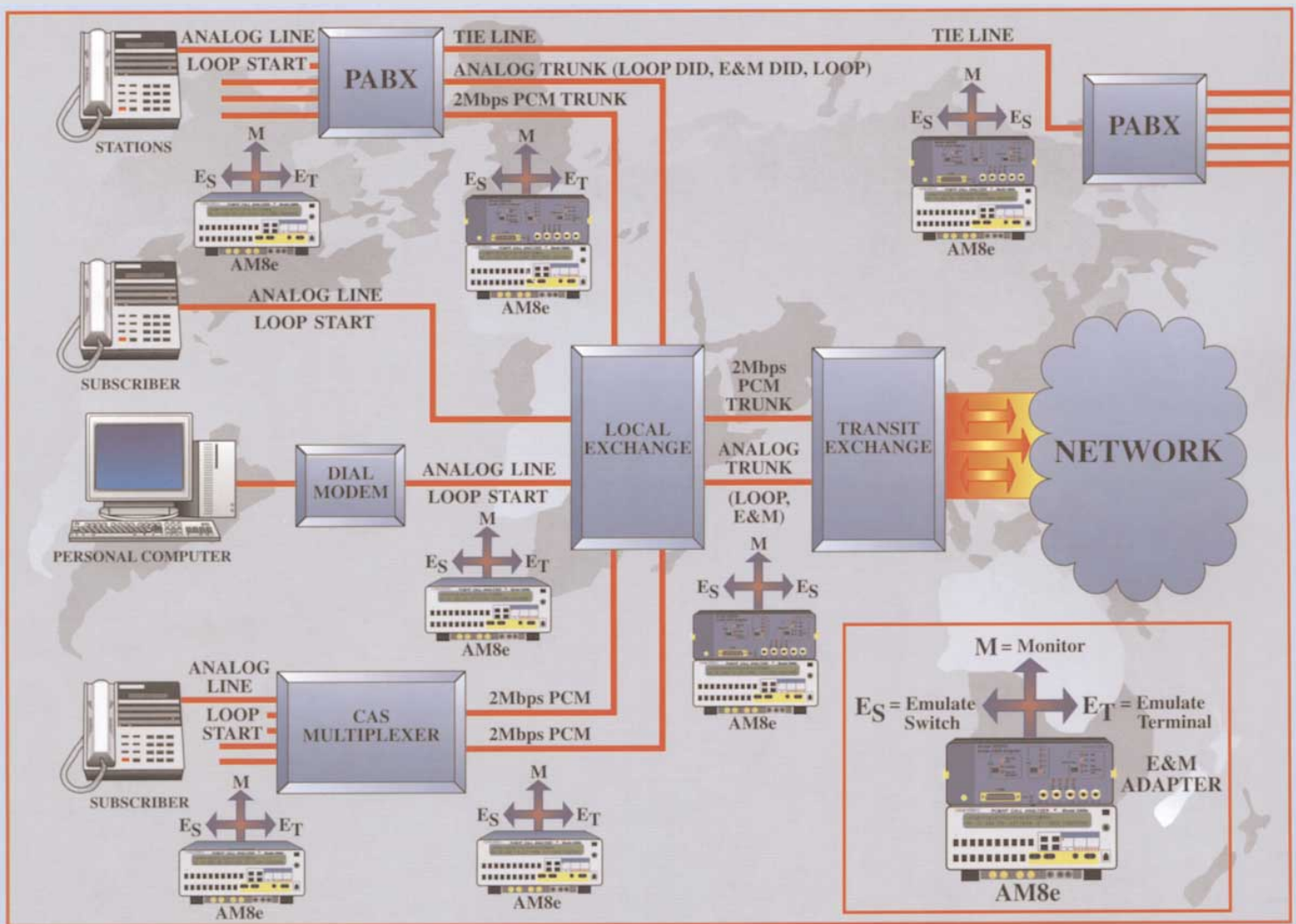
Complete Emulation and Analysis of
International 2 Mbps CAS PCM
and Analog Signaling



Ameritec Corporation is an ISO 9001:2000 Certified Company

- Signaling Monitor/Emulator/Analyzer
- Dialed Digital Monitor/Emulator/Analyzer
- Complex Sequence Dialer
- Analog Loop and E&M Trunk Capabilities
- User Programmable Signaling Protocols
- VF Level, Frequency, Noise Measure
- Dual Multimeter
- 2 Mbps PCM Drop & Insert
- Non-Intrusive PCM Measure
- CO Battery, Ring Generator, and Dial Tone Generator Sources
- Portable and Battery Powered

Ameritec



Introduction

Whether you are a telecommunications service provider or a telecommunications equipment manufacturer, the global marketplace has requirements for a multitude of signaling protocols within countries and between countries.

In-service circuits need troubleshooting. New products need testing and, eventually, manufacturing test and field support. Until now, the only solution may have been numerous test instruments or expensive in-house test equipment development for each country or application.

The Ameritec Model AM8e is a Call Analyzer capable of emulating, observing and troubleshooting signaling protocols on a wide variety of analog circuits or 2 Mbps channel associated signaling PCM circuits. The AM8e is user programmable. You can modify existing signaling protocols or develop new signaling protocols based on your requirements.

2 Mbps PCM Testing

The AM8e is compatible with worldwide CCITT recommendations for 2 Mbps, 30-channel, channel associated signaling PCM lines. The unit is compatible with all country specific A, B, C, D bit signaling and MF-R1, MF-R2, CCITT #5, DTMF, and dial pulse protocols.

The AM8e provides for emulation and non-intrusive monitoring of 2 Mbps PCM circuits. Specific channels can also be monitored. Also provided is a drop and insert capability which allows testing of individual PCM channels.

Complete decoding and analysis of MF-R1, MF-R2, CCITT #5, DTMF, and dial pulse signaling is provided. Precise, one-millisecond time stamping of digits and events will tell you exactly what happened and when.

Exception reports can be printed by connecting an accessory printer and using the built-in programmable signaling thresholds to automatically screen for out of tolerance digits and events.

User Programmable Signaling Protocols

To provide the utmost in flexibility to accommodate worldwide signaling variations, the AM8e is protocol driven. Protocols may be purchased from Ameritec's extensive library, custom developed by Ameritec or developed by the user. The AM8e can store up to 10 complex protocols which can be simply recalled and executed. The protocols allow for various WAIT conditions, such as Wait for 3 Seconds, Wait For Call Progress Tone, Wait For Wink and so on. The protocols can select any of the available 10 autodial strings and each string can point to another string for virtually unlimited dialed digit lengths. Calling and called party numbers may be stored in different autodial strings and executed at the appropriate stimulus from within the protocol. Dialing may be dependent upon a Wait condition. These capabilities allow the user to test complex Intelligent Network functions as well as CTI applications such as Voice Mail.

Protocols can also cause tones to be transmitted with a specific level and frequency. For dual tone dialing, the level and frequency of each tone of the two tones can be specified, allowing for testing of an application over the full range of specified dialed digit capability. Simple loops can be set up in a protocol for incremental worst case testing.

Analog Loop Trunk/Line Emulation

The AM8e is also compatible with two-wire analog type trunks and lines. User programmable emulation, monitoring and analysis are provided for the following parameters:

- Battery Voltage, Loop Length & Termination
- Start Dial Signals including Dial Tone
- MF-R1, DTMF & Dial Pulse Signaling
- Dial Pulse Speed, Make/Break & Interdigit Time
- MF/DTMF Digit Timing, Twist & Skew
- Dial Tone Delay, Cadence, Frequencies & Level
- Hookflash & Line Unbalance
- Ringing Voltage, Frequency & Cadence
- Delay & Wink Start Signals
- Single Test Tone Frequency & Level

The analysis functions allow measurement thresholds to be set in order to capture erroneous digits and events. This, along with the precise, one-millisecond time stamping of digits and events, allows detection of even the most subtle problems.

AM8e E&M Adapter

The AM8e E&M Adapter replaces the protective front panel cover of the AM8e and offers convenient access to analog E&M signaling emulation, monitoring, and analysis capabilities. This includes North American standards too! Simply attach the E&M Adapter to the LINE/TIMS Connector of your AM8e with the ribbon cable and you are ready to apply the same troubleshooting and testing power available for PCM and two-wire loop circuits. In combination with the AM8e, the E&M Adapter provides the following analog E&M capabilities:

- E&M Signaling Emulator/Monitor/Analyzer
- E&M Types I through V, 2-Wire and 4-Wire
- 4-Wire E&M² and 4-Wire Phantom E&M
- Programmable Signaling Protocols to Control E&M Leads
- Digit Emulator/Monitor/Analyzer (MF-R1, MF-R2, CCITT #5, DTMF, Dial Pulse)
- Complex Sequence Dialer
- High/Low Thresholds for Capturing Erroneous Digits and Events
- Precise, One-Millisecond Time Stamping of Digits and Events
- VF Level, Frequency and Noise Measure
- CO Battery and Dial Tone Generator

Ameritec E&M signaling protocols are available or users may develop their own protocols.

T1/E1 Adapter

The AM8e T1/E1 Adapter replaces the protective front panel cover of the AM8e. The Adapter converts the AM8e E1 input/output to T1 input/output and accommodates both PCM1 and PCM2. With this Adapter the power of the AM8e protocols can be used in a T1 environment to allow test of very complex interface protocols. Additionally, an AM8e with this Adapter can also be used for standard T1 testing, significantly improving the utility and versatility of the AM8e.



AM8e with E&M Adapter.

Detailed Digit, Event Analysis

When connected to a circuit, the unit will display signaling events occurring in either direction on a large backlighted liquid crystal display (LCD). Up to 80 dialed digits and/or events (on hook, off hook, wink, etc.) are collected and displayed for each call.

By merely placing a cursor under the digit or event of interest, the operator can observe, on the second line of the display, all details associated with that event. For example, when observing a DTMF digit, the unit will display the time of the digit and its duration, as well as the measured high and low band frequency and level.

If the operator had previously entered good/bad thresholds, then any out-of-spec detail would be highlighted to the operator.

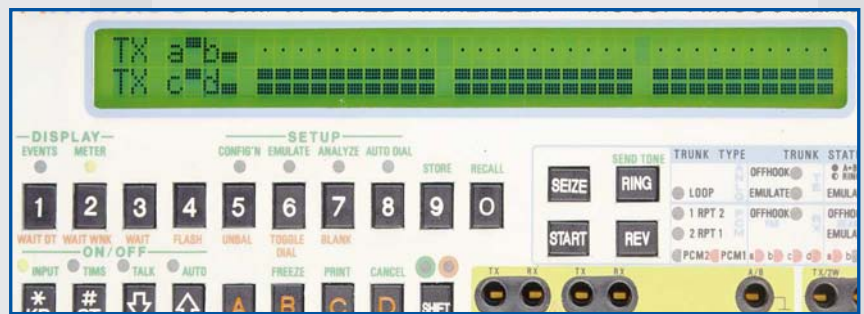
With each event in a complex sequence captured in detail, troubleshooting becomes a matter of *solving* the problem instead of *searching* for the problem.

Built-in Analog and PCM Testing

The ability to measure VF level, frequency and noise on analog circuits and PCM channels is built into the AM8e. For more extensive testing, a TIMS access port is provided.

The unit also provides a variety of non-intrusive PCM digital tests including bit and frame slips, CRC errors, and framing errors. A display of all 30 PCM channel A/B signaling bits can also be viewed for the transmit and receive directions.

All front panel test ports appear on the rear panel LINE/TIMS connector which simplifies integration into a test system.



Display of A/B signaling bits for all 30 E1 time slots (transmit and receive).

Time from off-hook to MF-R2 forward digit 8, level/freq. low tone, level/freq. high tone, and interdigit time/digit duration.

Dialed MF-R2 Digits each followed by a backward acknowledge digit.

Out of Dialing Digits (Near End)

Near End On Hook

Far End Answer

Far End On Hook

Detailed Call Analysis

Off Hook

Far End Start Dial

Display Selection for Events or Voltmeter

Direct Entry Keypad

ON/OFF Toggles for connection to Trunk inputs & TIMS. Enable hands-free talk and auto send of start signal

Unit setup including emulation parameters. Analyzer Thresholds and Auto Dial sequences

- Built-in Speaker.
- Optional Battery Pack for 8 Hours Use

Scrolling up & down pages within each setup menu

Grouping of Direct Function Switches

2 Mbps PCM span connections

ON/OFF Power Button

Volume control for speaker

Visual LED indicators to show configuration of unit.

Microphone to communicate over circuit under test

Connection of telephone handset for private conversations

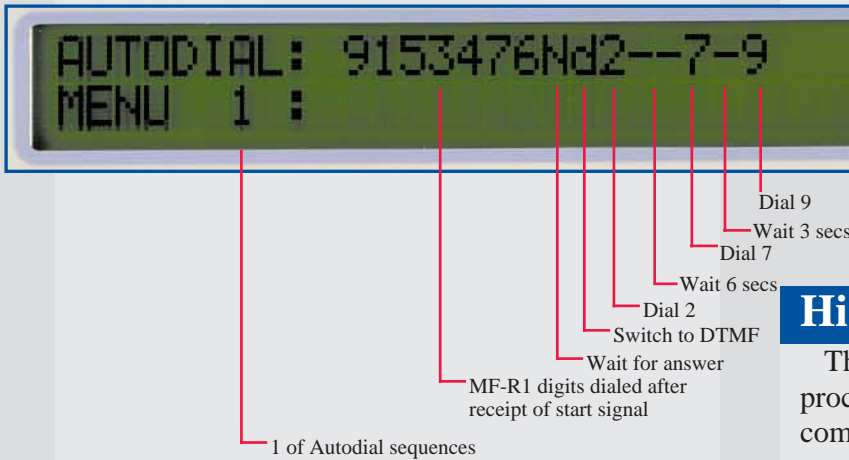
Connection of external Transmission Impairment Measuring Set (such as Ameritec's AM5eXT)

- RS232 Port for exception reporting & remote control.
- Decoding of MF-R1, MF-R2, CCITT #5, DTMF and dial pulse digits without pre-determination of type.

Complex Sequence Auto-Dialer

Through the front panel keypad or via a protocol, the operator can dial any sequence of digits and events either manually or automatically. Up to 10 complex dialing sequences can be stored and later recalled for execution under the "autodial" function. One autodial sequence can "point" to another so that a complex dialing routine can effectively be hundreds of events long.

For example, the following sequence might be used to initiate test calls from a PABX station and use multiple signaling modes to reach and communicate with specialized equipment.



Simulated Voice Response System Test Call

Easy Setup

Commonly used AM8e test setups can be stored in non-volatile memory for later use. 20 non-volatile memories are available for instant recall of personalized AM8e configuration setups.



Easy setup store and recall.

An additional 20 memories are available for recall of emulate/analyze parameters. This is in addition to the previously mentioned memories for 10 auto-dial sequences plus last number redial.

High Tech, Small Size

The AM8e incorporates multiple digital signal processors and microprocessors in a highly compact portable package. The unit may be powered from commercial mains, where it automatically adjusts for compatibility with local line voltage and frequency, or it may be powered from an optional internal rechargeable battery pack. An optional RS232 port and aux port allows for automatic hard copy reporting and remote control. A 24-pin LINE/TIMS connector on the rear of the AM8e provides secondary access to all front panel connections and is useful for permanent AM8e installations in systems and other test equipment.

PCM Drop & Insert

The AM8e provides two PCM ports with dual receivers and transmitters. These ports can be used for passive monitoring of a PCM span or the AM8e may be inserted in series with the PCM span for full duplex drop and insert testing of individual channels.



Dual PCM ports.

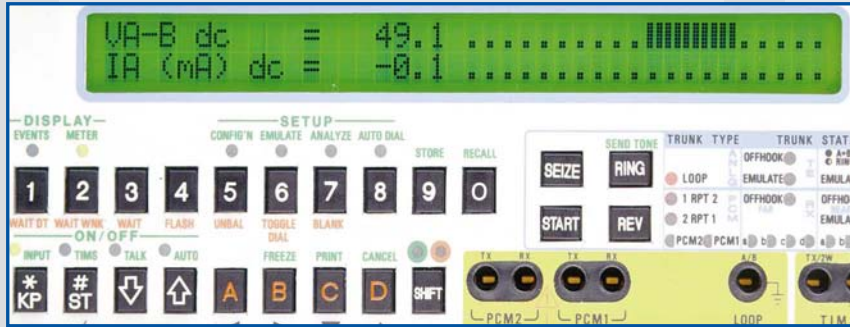
The two PCM ports can also be used for clock synchronization testing of PCM spans where one port is connected to a reference span while the second port is connected to the span under test.



Rear of AM8e with RS232 ports for hard copy output and remote control.

Built-in Voltmeter

A dual multimeter with analog and digital display is provided. AC volts, DC volts, and current measurements may be operator selected for tip to ring, tip to ground or ring to ground connections. PCM signal amplitude can be measured when using the AM8e in PCM mode.



Dual multimeter display showing battery and loop current measurements.

Accessories and Options

Provided

Model AM8e, removable front cover with storage, power cord, monitor cables and instruction manual.

Optional Battery

An optional internal, rechargeable battery pack is available for fully portable "cordless" operation. The batteries are of sealed lead-acid type and require no maintenance. A front panel low battery indicator indicates when recharging is needed.

The built-in charger allows the batteries to be charged even while the unit is in operation.

Portable or Rack Mount

No other signaling test set of this type is as full featured, small and convenient. About the size and weight of a telephone directory, it is easily transported from lab to field. For permanent installations, a rack mounting kit is available which will allow 19" relay rack mounting in only two rack increments (3 1/2") of space.



AM8e with manual, cables, cover, and optional soft carrying case.



AM8e shown in rack mount configuration.

European Community Standards

The AM8e is fully certified to meet the safety and emission standards of the European Community. The ce marked version of the AM8e is designated the AM8e (ce).

Options

- 30-0056** AM8e E&M Adapter
- 19-0004** Protocol Development Kit (softtools® Assembler/linker & PC required)
- 24-0018** Internal Power Pack (Sealed Rechargeable Lead Acid Batteries) and Internal Charger. (included in the AM8e (ce)).
- 85-0233** 19" Rack Mount Shelf.
- 48-0062** 6 Ft. Bantam to Clip Input Cable.
- 48-0047** 6 Ft. Bantam to Bantam Input Cable.
- 48-0048** 6 Ft. Bantam to 310 Input Cable.
- 87-0070** Padded Carrying Case

AM8e Technical Specifications

LINE INTERFACES

Analog Loop:

Trunk monitor or emulation of either the Switch or Subscriber interface.

Digital Circuits (PCM1 or PCM2)

2.048 Megabits/second Pulse Code Modulation (PCM). Conforms to CCITT Rec. G.703. Channel Associated Signaling. Two spans (ports) provided to support drop-and-insert channel. Line Coding: HDB3. CRC-4 is selectable.

Dialing

Supports any of these dialing modes with full digit set—1, 2, 3, 4, 5, 6, 7, 8, 9, 0, *, #, A, B, C, and (for DTMF only) D:

Dual Tone Multi-Frequency (DTMF)

Dial Pulse

Multi-Frequency-R1 — MF(R1)

Multi-Frequency-R2 — MF(R2) (PCM only)

CCITT System No. 5

Start Signaling

Immediate, Wink, Delay Dial, Dial Tone

Line Signaling

Detects And Generates: On Hook, Off hook, Wink, Flash, Unbalance (generate only), Ring, Reverse Battery

EMULATION

User-controlled parameters for circuit emulation. When shown as a range, parameters are selectable in unit steps unless noted.

Digital Ports

Impedance: 75 Ω at 2.048 Megabits/Second, 1575 Ω provided in monitor cable for monitor mode

Office Battery

Voltage: 20 V to 72 V $\pm 2\%$

Current: 120 mA maximum (not selectable)

Analog Loop

DC Loop Length: 0 to 2100 Ω , adjustable in 300 Ω steps (At 2100 Ω Loop Length, AM8e cannot detect Ring Trip)

DC Hold Resistance: 10 Ω , 330 Ω , 430 Ω

AC Impedance: 150 Ω , 600 Ω , 900 Ω , 1200 Ω at 300 to 3300 Hz, 2.16 μF in or out (24 μF)

Ringer Load: 0.68 μF in series with 2K Ω , 2W

Ring Generation

Voltage: 30 Vrms to 105 Vrms $\pm 4\%$ in 5 Vrms steps (At 2100 Ω Loop Length, AM8e cannot detect Ring Trip)

Frequency: 15.0 Hz to 70.0 Hz in 0.1 Hz steps

Load: 5 telephone ringers maximum

Cadence:

Rings: 1 to 3, individual on/off timers

Cadence:(Continued)

On Time: 0 to 5000 ms

Off Time: 0 to 9999 ms

Ring Time: (before thermal shutdown)

Minimum: 5 minutes (max load)

Typical: 20 minutes

Call Progress Tones

Dial Tone Generation:

Low Frequency: 0, or 300 Hz to 3300 Hz

Low Freq. Level: -40 dBm to -3 dBm

High Frequency: 0, or 300 Hz to 3300 Hz

High Freq. Level: -40 dBm to -3 dBm

Cadence: 1 to 3, individual on/off timers

Cadence On Time: 0 to 9999 ms

Cadence Off Time: 0 to 9999 ms

Start Signals

Wink Begin: 15 to 999 ms

Wink Duration: 50 to 999 ms

Delay Begin: 15 to 999 ms

Delay End: 100 to 9999 ms

Dial Tone Delay From Seizure: 15 to 9999 ms

Dialing

Pulse Dialing:

Speed: 5 to 25 pps

Percent Break: 40% to 85%

Interdigit Time: 120 to 999 ms ± 2 ms

Accuracy at 10 pps: ± 0.1 pps (40% to 75% break)

DTMF:

Low Band Frequencies: 697, 770, 852, 941 Hz

Low Band Offset: -5% to +5%, in 0.1% steps

Low Band Level: -40 dBm to -3 dBm

High Band Frequencies: 1209, 1336, 1477, 1633 Hz

High Band Offset: -5% to +5%, in 0.1% steps

High Band Level: -40 dBm to -3 dBm

On Time: 25 to 99 ms

Off Time: 25 to 99 ms

MF(R1):

Frequencies: 700, 900, 1100, 1300, 1500, 1700 Hz

Low Freq. Offset: -5% to +5%, in 0.1% steps

Low Freq. Level: -40 dBm to -3 dBm

High Freq. Offset: -5% to +5%, in 0.1% steps

High Freq. Level: -40 dBm to -3 dBm

On Time: 25 to 99 ms

Off Time: 25 to 99 ms

MF(R2) Forward Signals:

Frequencies: 1380, 1500, 1620, 1740, 1860, 1980 Hz

Low Freq. Offset: -5% to +5%, in 0.1% steps

Low Freq. Level: -40 dBm to -3 dBm

High Freq. Offset: -5% to +5%, in 0.1% steps

High Freq. Level: -40 dBm to -3 dBm

Acknowledgement Timeout: 40 to 999 ms

MF(R2) Backward Signals:

Frequencies: 540, 660, 780, 900, 1020, 1140 Hz

Low Freq. Offset: -5% to +5%, in 0.1% steps

MF(R2) Backward Signals: (Continued)

Low Freq. Level: -40 dBm to -3 dBm

High Freq. Offset: -5% to +5%, in 0.1% steps

High Freq. Level: -40 dBm to -3 dBm

Acknowledgement Timeout: 100 - 9999 ms

CCITT System No. 5

Frequencies: 2400Hz, 2600Hz

Frequency Offset: -2.0% to 2.0%, in 0.1% steps

Level: -30 dBm to -3 dBm

On Time: 10 ms min.

Tone Generation

Frequency: 300 Hz to 3300 Hz

Level: -40 dBm to 0 dBm

Generation Accuracy (Unless otherwise specified)

Frequency: ± 1 Hz

Level: ± 1 dB

Timing: ± 1 ms

ANALYSIS

User-controlled threshold parameters for event detection. Ranges shown are selectable in unit steps unless otherwise noted.

Flash

Minimum On Hook Time: 50 to 1250 ms

Disconnect

Minimum On Hook Time: 50 to 1250 ms

Call Progress Tones

First Frequency: 350, 440, 480, or 620 Hz

Second Frequency: 350, 440, 480, or 620 Hz

Frequency Tolerance: $\pm 0.2\%$

Minimum Level per Tone: -35 dBm to -3 dBm

Start Signals

Wink Begin: 15 to 999 ms

Wink Duration: 50 to 999 ms

Delay Begin: 0 to 999 ms

Delay End: 0 to 9999 ms

Dial Tone Receive: 0 to 999 ms

Special Dialing Commands

Wait for Dialtone

Wait for 3 Seconds

Wait for Wink

Wait for Unidentified Tone

Wait for Call Progress Tone

Wait for Single Frequency Tone

Wait for Answer

Wait for User Defined Event A or B

Change Dialing Type (d to DTMF, p to Pulse, m to MF R1, r to MFC R2)

Tone Dialing (DTMF)

Frequency Tolerance: 0% to 3.5%, in 0.1% steps

Accuracy: $\pm 0.2\%$

Level Range per Frequency: -30 dBm to -3 dBm

Allowable Twist: -12 dB to +12 dB

Minimum On Time: 40 ms ± 5 ms

Minimum Off Time: 25 ms ± 5 ms

Tone Dialing MF (R1)

Frequency Tolerance: 0 to 3.5%, in 0.1% steps

Accuracy: $\pm 0.2\%$

Level Range per Frequency: -30 dBm to -3 dBm

Allowable Twist: -12 dB to +12 dB

Min. On Time: 40 ms ± 5 ms

Min. Off Time: 25 ms ± 5 ms

Tone Dialing MF (R2)

Frequency Tolerance: 0 to 3.5%, in 0.1% steps

Accuracy: $\pm 0.2\%$

Level Range per Frequency: -30 dBm to -3 dBm

Allowable Twist: -12 dB to +12 dB

Min. On Time: 40 ms ± 5 ms

Min. Off Time: 25 ms ± 5 ms

CCITT System No. 5

Frequency Tolerance: 0 to ± 15 Hz

Accuracy: ± 1 Hz

Level Range: -30 dBm to -3 dBm

Allowable Twist: -10 dB to +10 dB

Min. On Time: 60 ms ± 5 ms

Pulse Dialing

Speed Range: 5 to 25 pulses/second

Percent Break: 40% to 85%

Accuracy at 10 pps: ± 0.2 pps (40% to 75% break $\pm 2\%$)

Interdigit Time: 120 to 999 ms ± 5 ms

Tone Threshold

Level Threshold: -40 dBm to 0 dBm

On/Off Hook Threshold

Level Threshold: 2 to 60 V

Accuracy: $\pm 3\% \pm 0.7$ V

Measurement Accuracy (Unless otherwise specified)

Frequency: ± 1 Hz

Level: ± 1 dB

Timing: ± 2 ms

Guard Time: 0 to 99 ms (for all tones)

METER MEASUREMENTS

Analog AC Volts

Range: 0 to 130Vrms $\pm 2\%$, ± 1 Vrms⁴ (0°C - 50°C) (DC offset < 75V, crest factor < 1.6) (15 to 75 Hz)

Loop Start: Tip-Ring¹, Tip-Ground², Ring-Ground², Common mode Tip-Ring²

Analog DC Volts

Range: -150V to +150V $\pm 2\%$, ± 1 V over 0°C - 50°C range

Loop Start: Tip-Ring¹, Tip-Ground², Ring-Ground², Common mode Tip-Ring²

Analog DC A-lead Loop Current*

5 to 180mA $\pm 2\%$, ± 1 mA (72 Vdc MAX)

Noise (Analog or Selected PCM Channel)

Level Range: -40 to 0 dBm \pm dBm

Frequency Range: 300 Hz to 3300 Hz ± 1 Hz

Filter: Psophometric or Flat (CCITT Rec. 468-2 & J16) (Analog signals are also filtered 300 to 3300 Hz by codec.)

Analog Loop: Tip-Ring

PCM1/PCM2: Tx, Rx (selected channel)

Tone (Analog or selected PCM Channel)

Level Range: -40 to +2 dBm ± 1 dBm

Frequency Range: 300 Hz to 3300 Hz ± 1 HZ

Analog Loop: Tip-Ring

PCM1/PCM2: Tx, Rx (selected channel)

Analog Bipolar Amplitude³ on PCM1/PCM2

Range: 500 mVp to 3.00 Vp $\pm 2\%$ (Rx only)

Types: Emulation, Monitor.

PCM1 and PCM2 METER MEASUREMENTS

Transmission Errors

Frame Error: Counts by 16 errors.

Slips: Insertion or deletion of data bits in data stream

CRC: Cyclic Redundancy Check calculated if enabled by user.

Frame Synchronization

TX, RX: Shows phase relationship on dual bar graphs.

Signaling Bits

TX, RX: Shows a, b, c, d signaling bits for each of 30 TX and RX channels (Emulate and Monitor Mode)

Channel Noise and Tone Measurements

TX, RX: Noise and tone measurements on any one of 30 channels (see Analog)

TRANSMISSION IMPAIRMENT MEASUREMENT

Direct and Reversed Connections are provided for an AM5, or similar Transmission Impairment Measurement Set (TIMS), to Tip-Ring of TX/2W and RX circuits.

GENERAL

Size: 8.3"W X 3.5"H X 12.1"D

Weight: 7.5 lb, 12 lb with battery option

Shipping Weight: 10 lb, 15 lb with battery option

Operating Temperature: 0°C to 50°C

Humidity: 10 to 90% non-condensing

Power Requirements: 90VAC to 264VAC, 50 to 60 Hz, 45 Watts. If <100VAC AM8e will work with 3REN or less.

COMMUNICATIONS PORT

RS232C: Up to 9600 Baud, (2400 for AM8e (ce)), selectable parity

Printing: Set-ups, Events, Meters

OPTIONS

Battery: Sealed lead acid battery and charger. Provides up to 8 hours of portable use before recharging. Recharges in 8 hours or less at 25° C.

ACCESSORIES

Soft Case

Rack Mount

AM8e E&M ADAPTER

Termination Impedance: 600 ohm

High Impedance Monitor: > 200k ohm

Office Battery Voltage: 20 V to 72 V $\pm 2\%$

Office Battery Current: 120 mA maximum (not selectable)

Power Requirements: Powered by AM8e
When calibrated with a host AM8e, the E&M Adapter has the signaling and transmission characteristics of an AM8e
Not usable with the AM8e (ce)

T1/E1 Adapter

Inputs: PCM1 and PCM2

Modes: Monitor or Emulate

T1

Rate: 1.544 MB/S

Framing: D3/D4 or ESF

Zero Suppression: AML, B8Zs or ZCS

Voice Encoding: μ -law or A-law

Impedance: 100 ohms at 1.544 Mb/s Bipolar PCM

Cables: Padded cables required for monitor, padded and terminated cables required for terminate; cables included with unit

E1

Compatible with AM8e

Power Requirements: Powered by AM8e

All specifications subject to change without notice

*- Protection Circuits assume a source impedance >300 Ω to limit current.

- 1- Common mode AC plus DC voltage < 100V peak
- 2- Common mode AC plus DC voltage < 10V peak
- 3- Measurements are displayed as peak voltage at the RX point.
- 4- Event details display of ringing is 0 to 130Vrms $\pm 3\%$, ± 1 Vrms over 0°C - 50°C range.