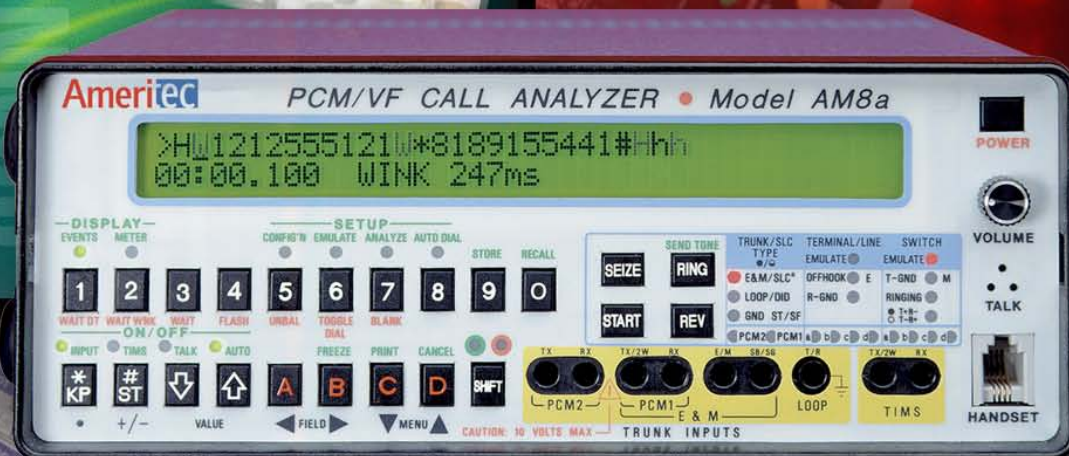


AM8a PCM/VF Call Analyzer

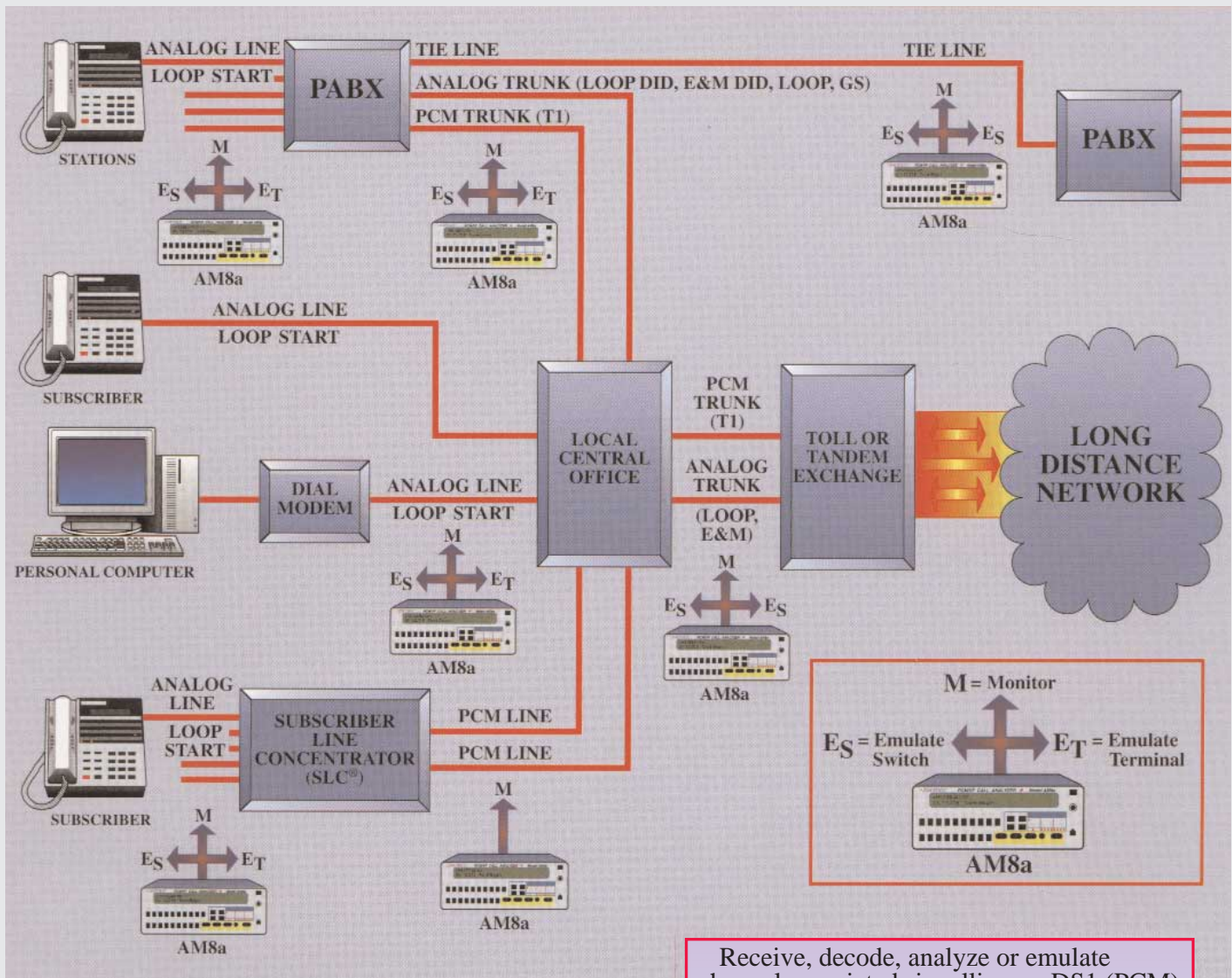
Complete Emulation and Analysis of
T1 and Analog Signaling



Ameritec Corporation is an ISO 9001:2000 Certified Company

- Signaling Monitor/Emulator
- Dialed Digital Monitor/Emulator
- Dialed Digit Analyzer
- Complex Sequence Dialer
- VF Level, Frequency, Noise Measure
- Dual Multimeter
- DS1 PCM Drop & Insert
- Non-Intrusive PCM Measure
- SLC® 96 Monitoring
- CO Battery, Ring Generator, and Dial Tone Generator Sources

Ameritec



Introduction

In a switched public or private telephone network, “signalling” is the process of setting up a call connection through the network at the beginning of a call and tearing it down at the end of the call.

A businessman using his telephone sends “signals” into his PBX, the PBX “signals” the local central office, the local central office “signals” into a long distance carrier and so on.

The Ameritec Model AM8a is a Call Analyzer capable of observing and troubleshooting signalling problems on a wide variety of analog or channel-associated PCM circuits.

Receive, decode, analyze or emulate channel associated signalling on DS1 (PCM) circuits or analog lines and trunks.

Analog
 2w Loop Start
 2w Ground Start
 2w E&M
 4w E&M
 DID
 SF
 SS4

1.544 Mbps PCM (DS1)
 D3/D4
 ESF
 SLC® Mode I *
 SLC® Mode II *

* Monitor Only

Built-in Programmable Emulation:

- C.O. Battery Supply
- Ring Generator
- Dial Tone Generator
- Pulse and DTMF/MF Tone Dialling Generator
- Tone Generator

Built-in Programmable Analysis:

- Pulse/Tone/Signalling event receiver, decoder, analyzer
- AC/DC Voltmeter

The AM8a is capable of non-intrusive monitoring or intrusive emulation at most points in the signalling path.

Highly portable and battery powered, it is equally useful in the field, in the switch room or in laboratory applications.

PABX Demarcation Testing

The AM8a can monitor or emulate the station (line) side or the central office (trunk) side of a PABX. The PABX can be emulated for the purpose of testing the central office trunk signalling, or the central office can be emulated looking toward the PABX.

The AM8a has built-in central office battery power supply, loop length emulation, ring generator and dial tone generator. All of which are variable, and programmable to provide for a wide variety of test configurations. These facilities, for example, allow the unit to simulate *DID* or *911 terminal equipment*.

Limit testing of all signalling parameters is possible due to the full programmability of the built-in generators and the detailed signalling decode and analysis capability of the built-in receivers.

Precise one millisecond time tagging of all decoded signalling events allows easy identification of signalling timing problems.

At the PBX or at the central office, demarcation testing is simple and comprehensive.

Inter-Exchange or Long Distance Carrier Testing

Monitoring or troubleshooting of analog or 1.544 Mbps PCM trunks is easy with the AM8a.

The unit can non-intrusively monitor a T1 span and either camp on a specific channel or scan channels for new both-way activity. Signalling detection is completely automatic as the unit automatically differentiates between dial pulse, DTMF or MF signalling and decodes them appropriately. No more missing unanticipated events.

When moving the unit around the central office to different trunk types, reconfiguration of the AM8a is easily accomplished through the set-up "Store and Recall" feature.

It is even possible to print out exception reports by connecting an accessory printer and using the built-in signalling thresholds feature to automatically screen for problems. This is a very effective feature when dealing with intermittent or elusive problems.

Subscriber Line Concentrator (SLC®) Testing

The AM8a provides a full, comprehensive analysis of AT&T SLC®96 PCM circuits (or industry equivalent). Signalling problems between the central office and an AT&T SLC®96 remote terminal are easy to detect and troubleshoot using the AM8a as a signalling monitor.



AM8a and printer with printout showing SLC®96 channel assignment.

Together with the optional hard copy output capability, the AM8a provides a printed activity report in addition to a powerful problem solving tool.

The following SLC®96 analysis features are provided:

1. Ability to monitor SLC®96 Mode I (unconcentrated) and Mode II (concentrated) calls and record signalling transitions (off/on hook, digits, tones, etc.)
2. Ability to monitor the 4 Kbps data link in Mode II and time stamp to 1ms accuracy any or all Concentrator Field Messages sent by both the RT and the integrated SLC®.
3. Provide monitoring of all Maintenance, Protection and Alarm Field change of values in both TX and RX directions.
4. Ability to map a specific channel to its appropriate time slot assignment for Mode II operation.
5. Programmable display fields to allow the user to analyze all events or only those exceeding programmed thresholds.

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.) may be 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 selecting 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 mask parameters, then any out-of-spec detail would be high-lighted to the operator.

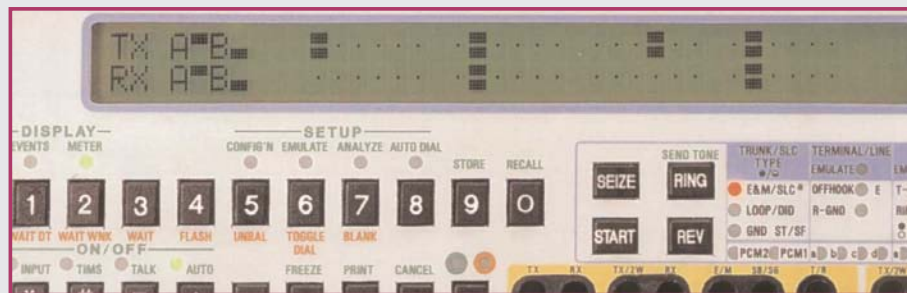
With each event in a complex sequence captured in detail, troubleshooting becomes a matter of *solving* the problem instead of *searching* for the problem.

Built-in Analog and PCM Testing

The ability to measure VF level, frequency and noise on analog circuits is built into the AM8a.

The unit also provides a variety of non-intrusive PCM digital tests, including bit and frame slips, CRC errors, framing errors, bi-polar violations, yellow and blue alarms.

For more extensive analog or channel-associated PCM testing, a port is provided (labeled TIMS) which allows connection of a full range test set such as the Ameritec Model AM5XT.



Display of A/B signalling bits for all 24 T1 time slots (transmit and receive).

Elapsed time from Off-Hook to selected event. (In this example a Wink of 247ms duration.)

Off Hook

Dialed DTMF Digits

Far End Wink

Far End Wink

MF Digits including KP and ST

Far End Answer

Near End On Hook

Far End On Hook

Detailed Call Analysis

Display Selection for Events or Voltmeter

Direct Entry Keypad

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

Unit setup including variables when emulating. Analyzer Thresholds and Auto Dial sequences

Scrolling up & down pages within each setup menu

Scrolling across choices for setup parameters

PCM 1.554 Mbps span connections

ON/OFF Power Button

Volume control for speaker

Visual LED indicators to show configuration of unit.

Microphone to communicate over line under test

Connection of telephone handset for private conversations

E & M Trunk Connections

Loop St/Ground St Analog Connection

Grouping of Direct Function Switches

Connection of external Transmission Impairment Measuring Set (such as Ameritec's AM5XT)

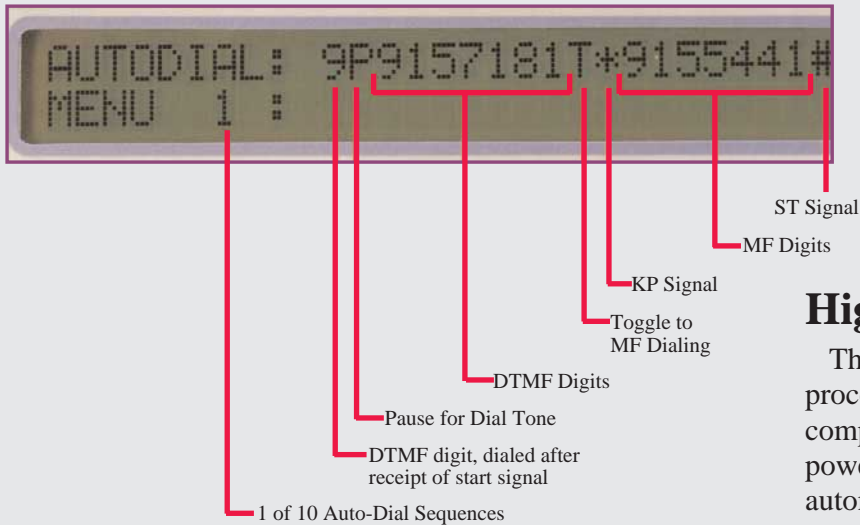
- Built-in Speaker.
- Optional Battery Pack for 8 Hours Use
- Optional RS232 Port for exception reporting & remote control.
- Decoding of MF, DTMF and dial pulse digits without pre-determination of type.

Complex Sequence Auto-Dialer

Through a front panel keypad 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 "auto dial" function.

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



Easy Setup

Commonly used AM8a test setups can be stored in non-volatile memory for later use. 20 non-volatile memories are available for instant recall of personalized AM8a 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 AM8a 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 AM8a provides secondary access to all front panel connections and is useful for permanent AM8a installations in systems and other test equipment.

PCM Drop & Insert

The AM8a provides two PCM ports with dual receivers and transmitters. These ports can be used for passive monitoring of a PCM span or the AM8a may be inserted in series with the PCM span for full duplex drop and insert testing of individual channels.



Dual PCM ports.

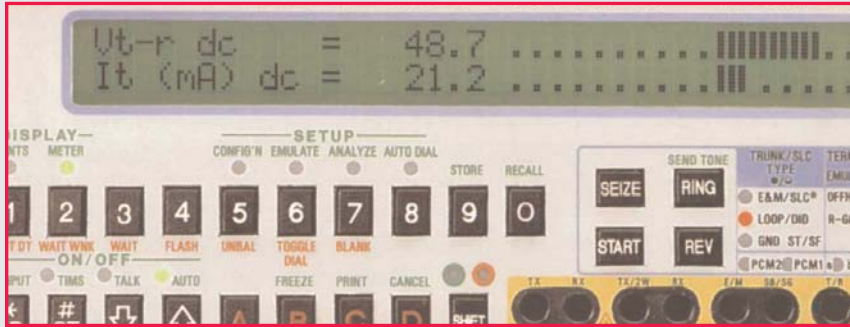
The two PCM ports can also be used for clock synchronization testing of PCM spans where one port is connected to a reference span while the second port is connected to the span under test.



Rear of AM8a 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. A display of all 24 PCM channel A/B bits can also be viewed.



Dual multimeter display showing battery and loop current measurements.

Accessories and Options

Provided

Model AM8a, removable front cover with storage, power cord, monitor cables and instruction manual.

Optional Battery

An optional internal, rechargeable battery pack is available for full 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 of space.



AM8a with manual, cables, cover, and optional soft carrying case.



AM8a shown in rack mount configuration.

Options

- 25-0071** RS232 Remote Control Port with Auxiliary RS232 Output Port.
- 24-0018** Internal Power Pack (Sealed Rechargeable Lead Acid Batteries) and Internal Charger.
- 85-0076** 19" Rack Mount Kit.
- 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

AM8a Technical Specifications

LINE INTERFACES

Analog Circuits (Switch or Terminal/Line)

Loop/Ground Start:

E & M: 2 wire and 4 wire, Types I, II, III, IV, and V
DID

SF

SS4 (optional)

Digital Circuits (PCM1 or PCM2)

1.544 megabits-per-second Pulse Code Modulation (PCM). Emulation and monitoring of all major circuit types. Two span (ports) provided to support drop-and-insert channel testing.

Framing: D3/D4, ESF, SLC[®]96 Mode I and II

NOTE: SLC[®]96 is monitor-only

Zero Suppression: B8ZS, ZCS, and AMI

Dialing

All circuit types support applicable dialing modes with full digit set: 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, *(KP), #(ST), A, B, C, D (for DTMF only).

Dual Tone Multi-Frequency (DTMF)

Dial Pulse

R1 Multi-Frequency (MF)

Single Frequency (SF)

Start Signalling

All Circuit Types Support Applicable Start

Signals: Immediate, Delayed, Wink, Dial Tone

Line Signalling

Detect and Generate All of These Line

Signals: On Hook, Off hook, Wink, Flash, Unbalance (generate only), Ringing, Ground Start (tip and ring), Answer supervision (reverse battery).

EMULATION

User-controlled parameters for circuit emulation.

Digital Ports

Impedance: 100 Ω at 1.544 megabits-per-second bipolar PCM (1K Ω in DSX monitor mode).

Analog 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

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

AC Impedance: 135 Ω , 600 Ω , 900 Ω , 1200 Ω at 300 to 3300 Hz, 2.16 μ F (IN or OUT). OUT= 24 μ F

Ringer Load: 2.0 type B ringer equivalents (2 REN)

Ringer Generation

Voltage: 30 Vrms to 105 Vrms $\pm 4\%$ in 5 Vrms steps

Frequency: 15.0 Hz to 70.0 Hz in 0.1 Hz steps

Load: 5.0 ringer equivalents (5 REN) maximum (If no battery option and AC input is less than 100 volts, will work with 3 REN or less. Loop Length must be 1500 ohms or more.)

Ring Trip: Below 2100 ohms; 2100 ohm loop length will not detect ring trip (Loop Closure, answer).

Cadence:

Rings: 1 to 3, individual on/off timers

On Time: 0 to 5000 ms

Off Time: 0 to 9999 ms

Ring Time (before thermal shutdown)

Minimum: 5 minutes (max load)

Typical: 10 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 Tone Burst: 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 :

Speed: 5 to 25 pps

Percent Break: 40% to 85%

Interdigit Time: 120 to 999 ms ± 3 ms

Accuracy at 10 pps: ± 0.1 pps (40% to 75% break $\pm 1\%$)

SF:

Frequency: 2600 Hz

Level: -30dBm to 0 dBm

Speed: 8 to 16 pps

Percent Break: 40% to 85%

Interdigit Time: 120 to 999 ms ± 2 ms

Accuracy at 10 pps: ± 0.1 pps (40% to 85% break $\pm 1\%$)

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

[KP digit ON time is twice programmed value.]

Tone Generation

Frequency: 300 Hz to 3300 Hz

Level: -40 dBm to 0 dBm

Generation Accuracy for Emulation Parameters (Unless otherwise specified)

Frequency: ± 1 Hz

Level: ± 1 dB

Timing: ± 1 ms

ANALYSIS

User-controlled threshold parameters for event detection.

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: 0% to 3.5% in 0.1% steps

Minimum Level per Tone: -30 dBm to -3 dBm

Allowable Twist: -12 dB to +12 dB

Guard Time: 0 to 99 ms

Start Signals

Wink Begin: 15 to 999 ms

Wink Duration (Min/Max): 50 to 999 ms

Delay Begin (Min/Max): 0 to 999 ms

Delay End: 0 to 9999 ms

Dial Tone Delay From Seizure (Min/Max): 0 to 9999 ms

Tone Dialing (DTMF and MF)

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

Low Freq. Level Range: -30 dBm to -3 dBm

High Freq. Level Range: -30 dBm to -3 dBm

Allowable Twist: -12 dB to +12 dB

DTMF Tone On/Off Duration: 25 to 99 ms ± 2 ms

MF Tone On/Off Duration: 35 to 99 ms ± 5 ms

Guard Time: 0 to 99 ms

Pulse Dialing

Speed Range: 5 to 25 pps

Percent Break: 40% to 85%

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

Interdigit Time: 200 to 999 ms ± 5 ms

SF Dialing

Speed Range: 8 to 13 pps

Percent Break: 40% to 75%

Accuracy at 10 pps: ± 0.3 pps (40% to 75% break ± 2 ms)

Interdigit Time: 200 to 999 ms ± 4 ms

Tone Threshold

Level Threshold: -40 dBm to 0 dBm

On/Off Hook Threshold

Level Threshold: 2 to 60 V

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

Measurement Accuracy of Analysis

(Unless otherwise specified)

Frequency: ± 2 Hz (DTMF ≥ 25 ms; MF ≥ 35 ms)

Level: ± 1 dB

Timing: ± 2 ms

METER MEASUREMENTS

Analog AC Volts*

Range: 0 to 130Vrms $\pm 2\%$, $\pm 1Vrms^4$ ($\pm 0.7Vrms$ with $cm^{1,2}$ 0°C - 50°C). (DC offset < 75V, crest factor < 1.6) (15 to 75 Hz)

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

E&M: Tip-Ring¹, Tip 1-Ring 1¹ (Emulation Range : 0 to 3Vrms), Common mode Tip-Ring², Common mode Tip1-Ring1², E-Ground², M-Ground², SG-Ground², SB-Ground²

PCM1/PCM2: Tx Common mode, Rx Common mode

Analog DC Volts*

Range: -150V to +150V $\pm 2\%$, $\pm 1V$ ($\pm 1V$ with $cm^{1,2}$ 0°C - 50°C)

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

E&M: Tip-Ring¹, Tip-Ring1¹ (Emulation Range : -4V to +4V) Common mode Tip-Ring², Common mode Tip1-Ring1², E-Ground², M-Ground², SG-Ground², SB-Ground²

PCM1/PCM2: Tx Common mode, Rx Common mode

Analog Tip Current*

Loop/Ground Start: Tip current¹

DC Range: 5 to 120mA $\pm 2\%$, $\pm 1mA$ (72Vdc MAX)

Noise (Analog or Selected PCM Channel)

Range: 50 to 90 dBm ± 2 dBm

Filter: CMSG or Flat (Analog signals are also filtered 300 to 3300Hz flat by codec)

Loop/Ground Start: Tip-Ring

E & M: Tip-Ring, Tip1-Ring1

PCM1/PCM2: Tx, Rx (selected channel)

Tone (Analog or Selected PCM Channel)

Range: -40 to +2 dBm ± 1 dBm (300 to 3300 Hz)

Loop/Ground Start: Tip-Ring

E & M: Tip-Ring, Tip1-Ring1

PCM1/PCM2: Tx, Rx (selected channel)

Analog Bipolar Amplitude on PCM1/PCM2⁴

Range: -16 to +3 dBdsx ± 1 dBdsx

Types: Emulation (Line), DSX monitor

PCM1 and PCM2 (T1 and SLC[®]96) METER MEASUREMENTS

Transmission Errors

BPV: Bipolar Violations: 1 displayed count for every 64 BPV

FERR: Frame errors: 1 displayed count for every 4 FERR

CRC: Cyclic Redundancy Check: Calculated for ESF framing mode

SLIPS: Counts insertion or deletion of data bits in data stream.

ALARMS: Counts YELLOW and BLUE alarms. Indicates "yes" or "no" occurrence of YELLOW and BLUE alarms.

Frame Synchronization

TX, RX: Shows phase relationship on dual bar graphs

Signalling Bits

TX, RX: Shows a and b signalling bits for each of 24 TX and RX channels

Channel Noise Measurements

TX, RX: Noise measurements on each of 24 channels (See Noise above)

SLC[®]96 Alarm Conditions

TX, RX: Display of "flags" for A through D shelf/ lines, and power

SLC[®]96 Protection Status

TX, RX: 4-bit display which "decodes" to indicate status

SLC[®]96 Maintenance Message

TX, RX: Display of "flags" to indicate presence or absence of messages and indicates Channel Number and Time Slot.

TRANSMISSION IMPAIRMENT MEASUREMENT

Direct and Reversed Connections are provided for connection of an AM5XT or similar Transmission Impairment Measurement Set (TIMS) to TX/2W and RX circuits.

GENERAL

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

Weight: 6.5 lb, 11.5 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 (Ring load capacity reduced to 3 REN at 100 Vac)

OPTIONS

RS232c: Up to 9600 baud, selectable parity (even or odd with character length of 7 bits + 1 stop bit; or no parity with character length of 8 bits + 1 stop bit)

Printing: (Set-ups, Events, Meters)

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

ACCESSORIES

Soft Case

Rack Mounting Kit

About Ameritec

Ameritec Corporation is a micro-electronics design and manufacturing company located in the Greater Los Angeles area.

Dedicated to the special testing needs of the telecommunications industry, we proudly offer products which employ the latest microcomputer techniques. Everything we produce is highly sophisticated in circuitry and software, yet is easy to use because of the degree of "human engineering" incorporated into the design.

If you would like more information about the AM8a or any of our other products please write to us or call. A demonstration of the AM8a can be easily arranged.

SLC[®]96 is a registered trademark of AT&T

All specifications subject to change without notice.

*- Protection Circuits assume a source impedance >300Ω 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 DSX point. $VdBdsx = 20 \log(Vpeak/3)$

4- Event details display of ringing is 0 to 130Vrms $\pm 3\%$, $\pm 1 Vrms$ ($\pm 0.7Vrms$ w/ $cm^{1,2}$ 0°C - 50°C).

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