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Leading Edge Technology

Crescendo products feature a multiprocessor architecture, which guarantees that call volume is not affected by the number of operating channels or the nature of the tests that the user chooses to perform. Extensive use of high speed micro-processors and Digital Signal Processors (DSPs) make Crescendo versatile, accurate and fast. All tone detectors and VoP measurements are based on DSPs. Never needing calibration, Crescendo systems will last well into the next generation of switching systems.

Every line or channel in Crescendo Analog and Digital models are served by four “local” DSPs to identify call progress tones, detect digits and to verify the voice path after a connection has been established. Each local DSP can serve 32 lines, or all channels in a single trunk group simultaneously.

Each group of four U-interface lines in Crescendo ISDN-BRI models are served by a dedicated DSP, which is responsible for all signaling on these lines. Each group of sixteen lines is served by four “local” DSPs to identify call progress tones, sending and detecting dual tone digits and for verify the voice path after a connection has been established. Each local DSP can serve all 16 lines group simultaneously.

Each trunk line of the Primary Rate ISDN option is served by a Common Channel Signaling processor, which is responsible for all signaling on that line, as well packet-switched data testing on up to eight B-channels on each trunk. Any time slot can be selected to be the signaling D-channel by menu entry. A single D-channel can be shared by multiple trunks for non-associated signaling applications. Every channel is served by “four” DSPs to identify In-Band call progress tones, digits and for verifying the voice path after a connection has been established. Each local DSP can service all circuit switched voice channels in a single trunk simultaneously.

The eight SS7 signaling links of the Signaling System 7 Option is served by dedicated Common Channel Signaling processor, which is responsible for all signaling. Through a menu selection the user can select any of the eight links to make a call. These 8 links can be shared by all voice/data trunks. Every channel is served by “four” DSPs to identify In-Band call progress tones, digits and for verifying the voice path after a connection has been established. Each local DSP can service all circuit switched voice channels in a single trunk simultaneously.The open architecture of Crescendo not only makes it perfectly compatible with today’s needs, but also allows the unit to grow without obsolescence as new requirements develop.

The Ameritec Commitment

Ameritec Corporation has been manufacturing Bulk Call Generators for testing switches with analog, EBS, T1/E1 Digital, ISDN and SS7 interfaces, as well as other telecommunications test equipment, for over nineteen years. Ameritec test equipment is used by major telecommunications equipment manufacturers, telephone companies, network service providers and PTTs worldwide. Ameritec is an independent test equipment manufacturer, not owned or affiliated with any switch manufacturer or service provider -- your assurance of neutral and unbiased testing.

Ameritec



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SYSTEM CALL GENERATORS

- Analog
- T1/E1 CAS
- ISDN-BRI (U, S/T)
- ISDN-PRI
- SS7
- P-Phone (EBS)

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Introduction

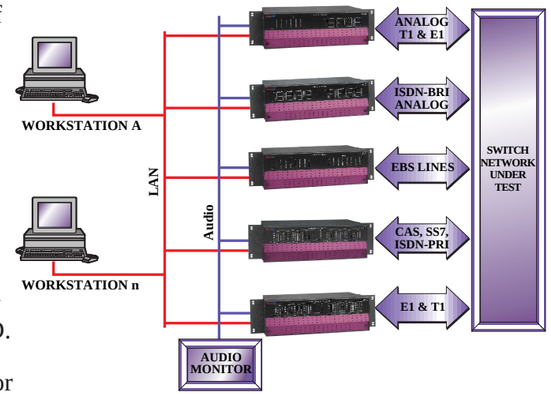
Ameritec's Crescendo® family of products is comprised of test instruments designed to meet the rigid demands of today's telephony developers in laboratory applications. The Crescendo, simply put, makes telephone calls -- and lots of them! Each Crescendo unit allows interfacing to different line types. Models interface to Analog POTS lines, to Analog P-Phones lines, others to T1, E1, PRI, BRI, and SS7. The Crescendo family allows users to develop a test environment with the ability to test highly complex call scenarios.

Test configurations can, via Ameritec's FeatureCall GUI, control up to 32 Crescendo's over a TCP/IP LAN.

Through the use of user defined call scripts and line protocols, users can tailor test scenarios to meet a wide range of testing requirements. Whether focused on development, production testing, quality assurance or regression testing, the Crescendo family provides the flexibility to satisfy your testing needs.

Physical Interfaces

Crescendo units have the flexibility to serve a wide range of applications associated with switch and network testing. Whether your application calls for a single desk top unit, or multiple test heads supporting various physical interfaces, the Crescendo family of products provides a configuration that will satisfy your testing requirements.



- Analog: provides the physical interface for loop start lines and can be equipped with the following options: 600/900 ohm impedance, Ground Start, Meter Pulse Detection, DTMF Digit Decode, Voice Over Packet, Voice Replay and Analog Display Service Interface (ADSI)/Caller ID.
- The Basic Rate ISDN provides the physical interface for BRI/BRA-ISDN 2B1Q U-Interface Ports or 4-wire S/T Interface Ports and can be optionally equipped with the Voice Replay Option.
- T1/E1: provides the physical interfaces for 1.544 Mbps T1 CAS trunks or 2.048 Mbps E1 CAS trunks. Available options are Primary Rate ISDN and SS7/CSS7 Voice Over Packet and Voice Replay (CAS only).
- EBS (P-Phone): provides the physical interfaces for Northern Telecom EBS lines, and can simulate both primary and extension sets.

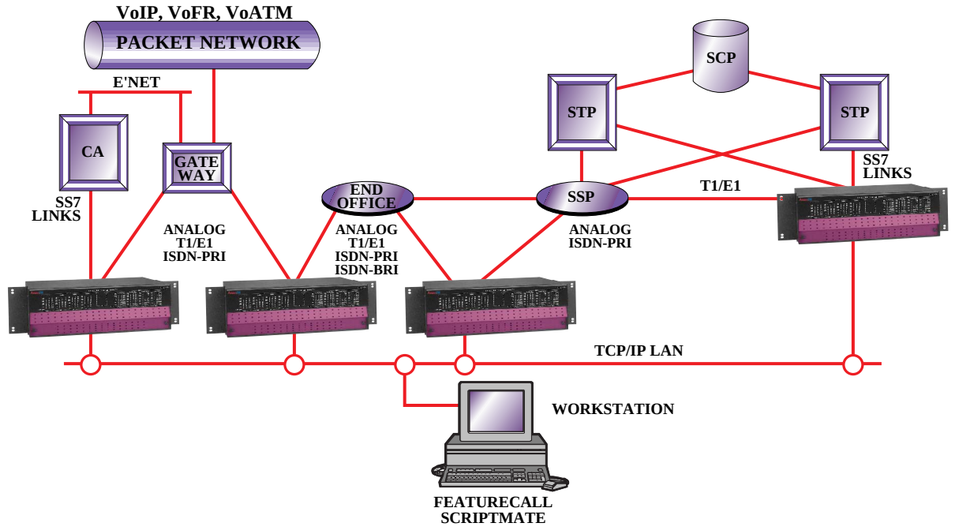
Testing Applications

Crescendo units are ideally suited for testing complex, interactive applications under high call loads on dozens of lines simultaneously in a dedicated lab environment.

Applications that previously were too costly to test automatically can now be easily automated with Crescendo.

Such test applications include:

- Central Office or PBX Switches and Networks
- Voice Over Packet (VoIP, VoFR) Systems
- Intelligent Network (IN) applications
- Voice Mail systems
- Computer Telephony Integration (CTI) systems and applications
- Automatic Call Distribution (ACD) systems
- Interactive Voice Response (IVR) systems
- Paging systems



Each Crescendo can simulate one to hundreds of telephony subscribers and when grouped in a system environment they can simulate thousands of telephony subscribers. The actions of each simulated subscriber are independently controlled through unique parameter fields defined in user programmed Call Scripts.

Scripts define calling patterns and can simulate practically any action a live caller can perform. Scripts also simulate multiple subscribers allowing testing of multiple-party calls such as conference calling.

Capabilities in Call Scripts include:

- ***Signaling:*** All interface specific signaling functions supported through Call Scripts and user programmable signaling protocols.
- ***Dialing:*** Multiple unlimited length dial strings, multiple dialing types, including in-band end-to-end signaling (e.g. DTMF digits for interactive applications).
- ***Voice Over Packet:*** Characterize the performance of voice over a packet base network using directional delay and dropout measurements, plus leading and trailing edge clipping and jitter.
- ***Digit decoding:*** Decode in-band DTMF or MF digits.
- ***Tone Send:*** Send pre-programmed single frequency tones.
- ***Path Verification:*** Comprehensive two-way verification of multiple party voice and data path connections via in-band sequences, BERT patterns, X.25 packet data, or packet drop detection (VoP).
- ***Voice Replay:*** Optional feature allowing replay of pre-recorded audio samples on demand.
- ***Tone Receive:*** Detect any single frequency tone.
- ***ADSI:*** Optional feature permits the testing of caller ID functionality.

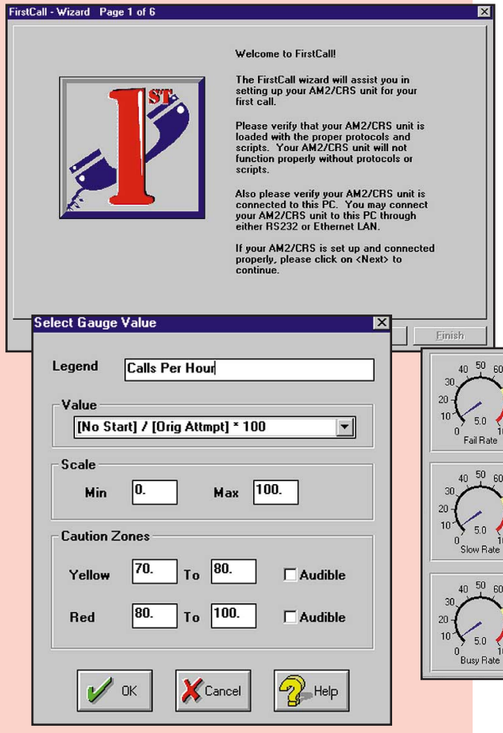
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FeatureCall™ - Graphical User Interfaces

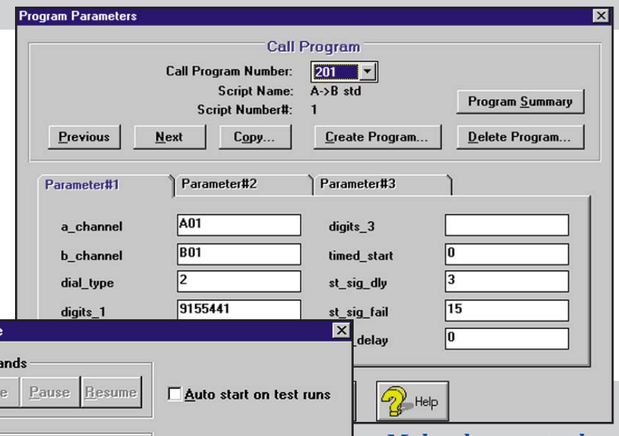
FeatureCall, a Windows based Graphical User Interface (GUI) provides control and management, via a personal computer, of one or more Ameritec Call Generators via a TCP/IP LAN or a single RS232 port. FeatureCall provides the user with simple, easy to use tools that allow you to:

- Create a system of 1 to 32 Crescendo® Call Generators also (AM2 Niagara®, and AM2S Squirt™).
- Create and start a test case in five easy steps using the FirstCall™ TestCase Wizard.
- Using TestCase™ create batteries of tests that can be set to start on a schedule that you define days, weeks, or months in advance.
- Create traffic profiles using TrafGen™.
- Automatically load executable test cases into your call generator(s) from a test library that you build using the backup and restore function of FeatureCall.
- See your test case results as they run via a Gauge field that allows you to define the areas of the test that are critical for you to monitor.
- Create reports the way you like them using the Statistic Logging and Report Generation capability of FeatureCall.

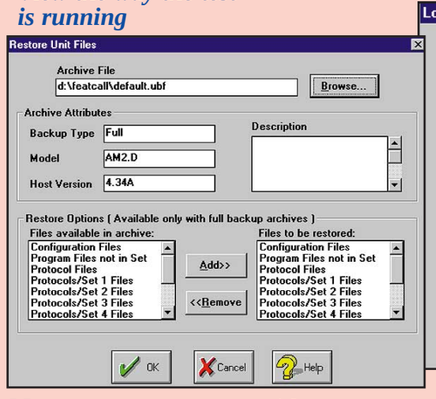
Create a test case in 5 simple steps



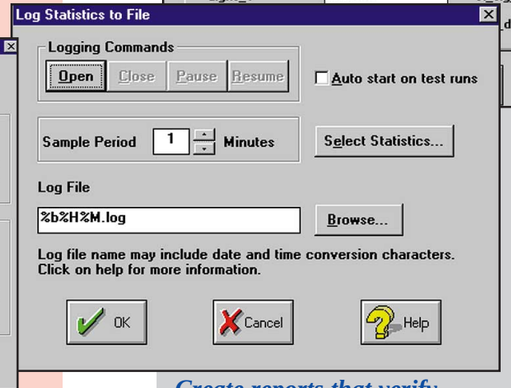
View the way the test is running



Make changes to the test case as it runs



Manage your test cases with a test case repository



Create reports that verify your test results

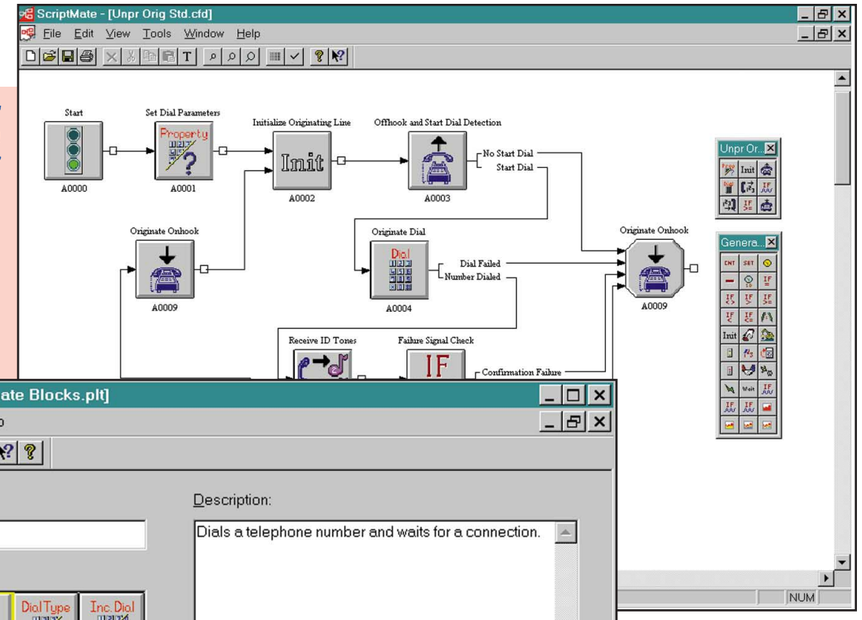
ScriptMate™ - Graphical Test Script Builder

Testing complex telephony applications requires you to develop many test cases. Limited programmability or learning a programming language used to be your choices - until ScriptMate! ScriptMate is a graphical tool that allows you to develop sophisticated test scripts by simply drawing the test sequence!

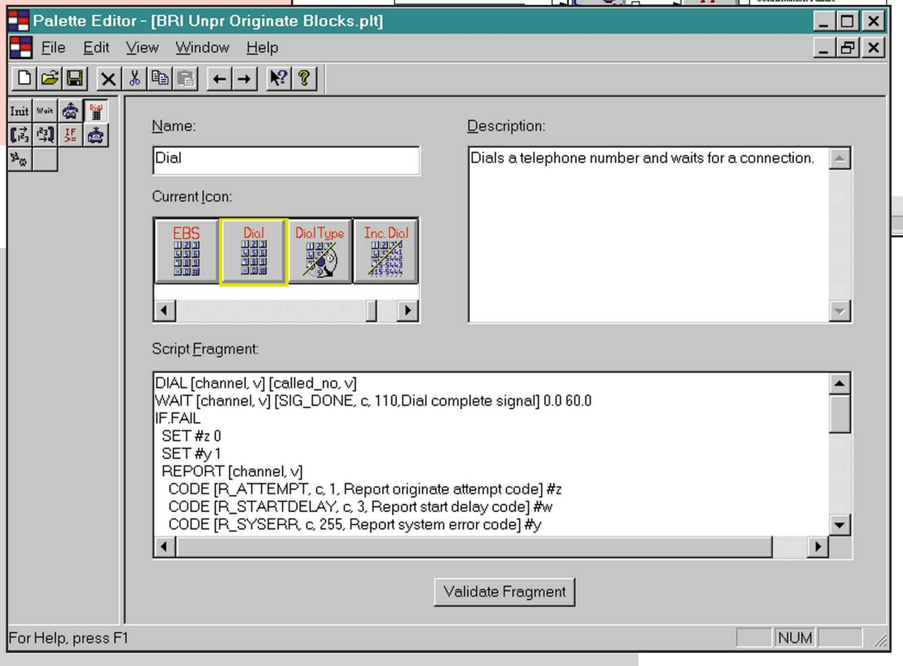
Crescendo offers you the ultimate in flexibility by providing powerful built-in test case scripting capabilities. This level of flexibility is what gives the Crescendo its power. ScriptMate is a tool that unlocks this power with an intuitive, easy-to-use, graphical test script generation method.

ScriptMate is a companion program to FeatureCall and allows you to easily develop call test scripts by dragging, dropping and interconnecting simple icons to create a graphical Call Flow Diagram. With a single click of the mouse, the Call Flow Diagram is converted into a complete Script source file that can be loaded into your Crescendo using FeatureCall.

Create or modify your call flow diagram interactively



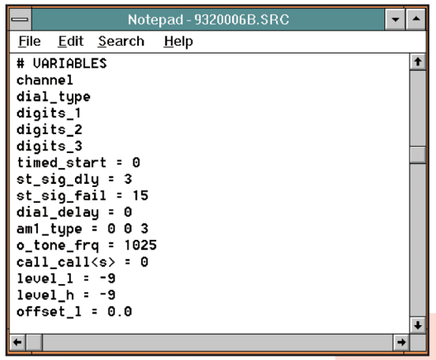
View script detail fragment whenever you wish



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User Defined Functionality

FeatureCall, provides control for test applications over a TCP/IP LAN and provides an easy method for configuring units, creating test parameters and running a test case.



Creating A Test Call

Creating a test call to stimulate the equipment under test is easily done by selecting a call script and then adding parameter values to define the specific test criteria.

Call Program Test Sets

A Call Program Test Set consists of a collection of Call Programs that have been assigned to various lines or channels for convenient pre-programmed or automated testing.

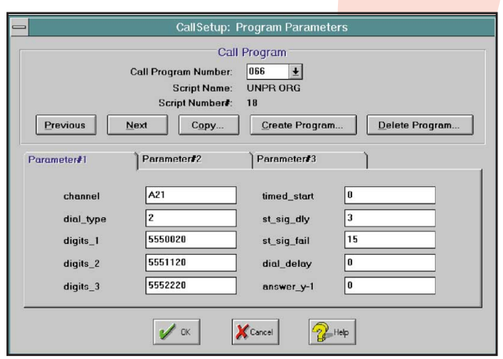
Call Scripts & Call Programs

Call Scripts are templates defining the actions of a single call. The Call Script defines calling patterns, voice path confirmation requirements and the supplemental tones and digits used in simple applications or a complex calling scenarios, such as voice mail testing. A number of scripts for common testing needs are provided with each unit. Using the Call Script as a template, call variables (parameters) such as “dialed number” are added to create a Call Program. There is a separate Call Program for each line or channel in the unit. Call variables can be changed by the user to build new Call Programs, even with the unit running tests. All Call Programs are stored in non-volatile memory.

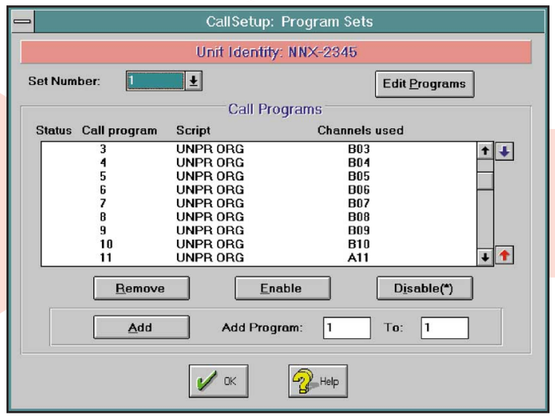
Call Scripts (Template)

Call Programs

Call Variables (Parameters)



Multiple Call Programs = Call Program Test Sets



Call Instructions

Customizing Call Scripts & Protocols

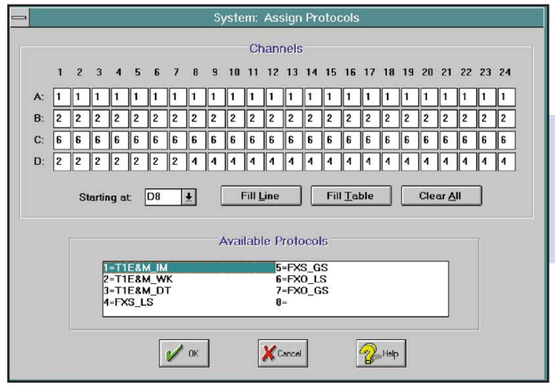
The Crescendo allows users to develop scripts and protocols to meet their specific needs. Custom scripts and protocols may be developed by simply modifying the ones supplied with the unit, or new ones may be developed from the ground up using available tools. Call Scripts are developed in ScriptMate, or a standard Text Editor. Scripts can be automatically downloaded to a unit through FeatureCall’s Call Setup Script window.

Protocols can be developed or customized using Ameritec’s Protocol Development Kit. The kit runs on a personal computer and consists of a protocol development guide and a third party assembler/linker.

Automation Interface

As an alternative to FeatureCall, the Crescendo provides a control interface for users with proprietary test systems software. The communication is a command line format that allows easy integration of the Crescendo into an automated test system.

Protocol Assignments



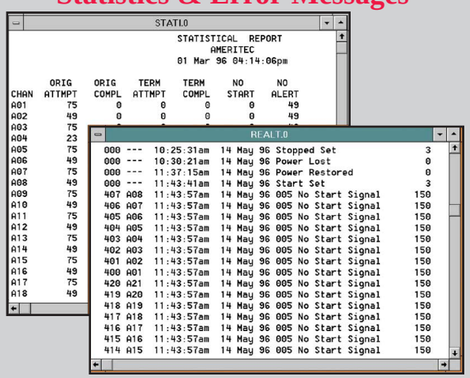
Call Signaling

Statistics & Error Messages

Statistics are automatically accumulated in the unit. Reports include totals for each line/channel, the number of errors recorded as well as totals for the system. The amount of statistical information reported is at the control of the user. Reports may be output to a printer or computer.

The Real Time Error Log automatically records error conditions occurring in the running Test Set. Errors are reported on call setup, call completion and other conditions defined by Protocol State Table and Call Script. Each error record contains the Call Program name, line or channel affected, time and date of the error, the error type, and a short description of the error. The report also contains the start and stop times of the Test Set.

Statistics & Error Messages



Protocol Assignments

The Crescendo uses Protocol State Tables to translate the call instructions from the Call Program Test Set to a sequence of signaling events that are recognized by the network. The Crescendo can support multiple protocols running simultaneously and the user has the ability to assign them to lines and channels as necessary. Each Crescendo is supplied with protocols that are standard for their model type.

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Specifications

Crescendo Unit Specifications The Crescendo product line consists of platforms that provide physical interfaces for Analog, Basic Rate ISDN, 1.544 Mbps PCM T1 Trunks, 2.048 Mbps PCM E1 Trunks, and Northern Telecom EBS. Options are available that add Primary Rate ISDN and SS7 functionality to Crescendo Digital Models.

General Specifications: The general specifications define the features and capabilities that are common to all Crescendo Models.

General Characteristics

User Interface:	• Command line control via Telnet (TCP/IP Ethernet®) or RS232C • Optional Windows 3.1 based GUI
Ethernet Port: (CRS-D, -De, Dm, AB, AD(e) & BD(e) have two Ethernet ports)	• One RJ45 connector and six LED indicators per Network interface • 10BaseT (10 Mbps) Interface • Complies with IEEE 802.3
RS232C, V.24 Ports: (CRS-D, -De, Dm, AB, AD(e) & BD(e) have two sets of RS232C, V.24 ports)	• Two serial ports, Main (DB-25P, twenty-five pin male) and Auxiliary (DB-9S, nine pin female), per Group • 3 wire, full duplex
Dimensions:	Table Top: 21.0" Wide (53.3 cm) x 7.0" High (17.8 cm) x 14.0" Deep (35.6 cm) Rack Mounting specifications: Minimum Rack Opening: 21.0” (53.3 cm) Mounting Flanges, edge-to-edge: 27.0" (68.6 cm) Mounting hole width, center-to-center: 25.31" (64.3 cm) Mounting hole height, center-to-center: 5.25” (13.3 cm) or 6.0” (15.3 cm) Maximum enclosure height: 6.97” (17.7 cm) Maximum enclosure depth: 14.0” (35.6 cm) Rack Increments (RETMA): Four 1.75" (4.5 cm) Bracket offset: adjustable 0.0” to 4.0” (0 cm to 10.7 cm) measured from the font of the unit
Power:	90 to 264 VAC, 47 to 65 Hertz, 300 Watts
Weight:	30 Pounds (13.6 Kilograms)

Audio Monitor Option: Provides external access to audio channels via a 1.544 Mbps T1 PCM Trunk (24 channel, µ-law companding) or 2.048 Mbps E1 PCM Trunk (30 channel, A-Law companding) that can be assigned to monitor any B-channel or line. A local monitor option ia available that provides connection for 4 monitor ports and unit synchronization for multi-unit VoP testing.

Audio Monitor

Remote Port:	• One DB-9P, 9 pin male connector, paired transmit and receive connections • T1 (µ-law) or E1 (A-law) interface • T1 interface, 100 ohm impedance, balanced D3/D4 framing ZCS zero-suppression • E1 interface, 120 ohm impedance, balanced HDB3 Framing No CRC-4 checking
Local Monitor option:	• Provides local monitoring for 1-4 remote audio monitor ports • Rack mount (19”, 23”, 27”), or table top • Size: 16.8” wide (730mm) x 5.22” high (130mm) x 8” deep (200mm) • Provides synchronization for 1-4 units • Optional GPS input

Call Programs and Scripts

Call Program Sets:	4 per Group, stored in non-volatile memory
Call Programs:	480 per Group, stored in non-volatile memory
Features:	• Commonly used scripts supplied with unit • Scripts created and downloaded from Workstation or PC

Voice Channel Functions
Tone Detectors and Generators

Detectors:	• Tone detectors are based on Digital Signal Processors (DSPs)
Call Progress Detectors:	• One detector per line or B-channel • Detects: dial tone, busy, reorder, ring, ring back, supervision, wink
Path Confirmation Receiver:	• One receiver per line or B-channel • Frequency range: 10 to 2500 Hertz • Accuracy: 1%, ± 10 Hertz • Sensitivity: 0 dBm to -24 dBm • Response Time: 12.5 ms
Signaling Tone Decoders: (CRS-D, -De & CRS-Dm only)	• One receiver per channel • Detects signaling tones for SOCOTEL and ITU-T (CCITT) #5 signaling schemes
Digit Receiver:	• Decodes received DTMF, MFR1, MFR2 digits • Response time: under 40 ms • Dynamic range: 35 dB
Single Frequency Tone Generator	• 64 Selectable Tones

Voice Over Packet Option:

Adds VoP measurement capabilities to all models except CRS-B, CRS-P.

Voice Over Packet Option

Voice Path Confirmation:	• Golden Voice™ signal designed to pass through vocoder
Packet Drop Out Count:	• Count lost packets for frame sizes of 5, 10, 15, 20, 30, 40 and 100ms
Measure Delays Through Systems:	• Round Trip Delay ± 10ms resolution • One Way Delays ± 5ms resolution
Measure Clipping of Voice: (Leading & Trailing Edge)	• Peak and average clipping of standard reference with ± 5ms accuracy
Jitter	• Peak and average clipping of standard reference with ± 5ms accuracy

Printouts and Reports - Call Statistics
Data is internally stored

Manual Reports:	• Call statistics for each line or channel • Totals for all lines and channels
Automatic Reports	• Prints automatically on the hour or every half or quarter hour • Contents of each column in the printout are user selectable
Call Statistics for each originate line or channel:	• Call attempt count • Call completion count • Delayed dial tone (analog only) • No dial tone count (analog only) • Delayed start signal count (Except analog) • No start signal count (Except analog) • No alert signal count • No Voice path or B-channel confirmation count • Busy signal encountered count • No answer signal count • Ring time-out count (Except ISDN-BRI and ISDN-PRI Option) • Average dial tone delay • Average post dial delay • Custom code report count (programmable in test script)
Call Statistics for each terminate line or channel:	• Attempted calls count • Completed calls count • Custom code report count (programmable in test script)
For each packet-switched originate channel (ISDN-BRI and ISDN-PRI only)	• Call Attempts • Completed Calls • Average connect acknowledge delay • Slow connect acknowledge delay • No connect acknowledge • Number of packets sent • Number of packets re-sent • Average packet delay • Custom code report count (programmable in test script)
For each packet-switched terminate channel (ISDN-BRI and ISDN-PRI only)	• Attempted calls count • Completed calls count • Custom code report count (programmable in test script)

Real Time Error Reports:	• Displayed or printed as they occur
	• Details of the last 100 errors are stored
	• Error reports include: type, the line(s) or channel(s), time
	• Error types recognized and reported:
	  • Slow dial tone (analog only)
	  • No dial tone (analog only)
	  • Slow start
	  • No start
	  • No alert tone
	  • Path or B-channel confirmation failed
	  • No answer signal
	  • Ring time-out (Except ISDN-BRI & PRI option)
	  • Busy
	  • Protocol cause values (ISDN-BRI, ISDN-PRI & SS7 only)
	  • Custom code report count (programmable in test script)

Digit Generators
Dialed digit strings are of unlimited length

Dial Pulse Generator:	• Programmable dial speed: 1 pps to 999 pps • Dial break: 1 to 99% • Inter-digit time: 1 to 999 ms
Digit Generators:	• One digit generator per line • Dialing codes: MF R1, MF R2, DTMF • Default level: -9 dBm • Default frequencies: Nominal ± 0.005% • Programmability: Each line individually • Programmable for level 0 dBm to -50 dBm in 1 dB steps for each frequency component • Programmable frequency range: Up to 12.5% above or below nominal in 0.1% steps for each frequency component

Confirmation Tone Generator
Ten preprogrammed single tone signals, used to send the line ID from each side encoded as a three tone sequence

Encoding Scheme:	0: 1,025 Hz	1: 1,150 Hz	2: 1,275 Hz	3: 1,400 Hz
	4: 1,525 Hz	5: 1,650 Hz	6: 1,775 Hz	7: 1,900 Hz
	8: 2,025 Hz	9: 2,150 Hz		

Voice Replay Option: This option provides up to 64 two second recorded messages for all Crescendo Models except when equipped with ISDN-PRI and SS7 options.

Expanded System Specifications for Voice Replay Option

Number of channels per option:	• 64 per option - available in ROM or RAM based version
Length of each phrase:	• 2 seconds, repeated until a new phrase, or quiet, is selected
Phrase selection:	• SENDVOX command in script
Voice output:	• Selected voice signal is output on the channel assigned in the Call Program
Output level:	• Determined at the time of recording
Recording:	• Created in a PC with a sound card and Ameritec software
Required recording hardware:	• Creative Labs Soundblaster™, or equivalent, 16-bit audio card • EPROM Programmer • PC running DOS 3.x or higher • RAM based version downloadable to VR resource

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CRS-D & CRS-Dm



CRS-D & CRS-De Specifications: The CRS-D Feature Call Generator provides the interface for eight (two groups of four) 1.544 Mbps T1 CAS trunks. The CRS-De Feature Call Generator provides eight (two groups of four) 2.048 Mbps E1 CAS trunks.
Available option(s): Primary Rate ISDN provided in four trunk increments, SS7/CSS7 provided in four trunk increments, VoP, Audio Monitor and Voice Replay.

System	
Capacity:	• **CRS-D:** • Group A: Four 1.544 Mbps PCM 24 channel T1 CAS trunks • Group B: Four 1.544 Mbps PCM 24 channel T1 CAS trunks • Menu selectable D3/D4 Framing or ESF formats • Up to 96 simultaneous calls per group • **CRS-De:** • Group A: Four 2.048 Mbps PCM 32 channel E1 CAS trunks • Group B: Four 2.048 Mbps PCM 32 channel E1 CAS trunks • Menu selectable CRC-4 • Up to 120 simultaneous calls per group • All channels can originate or terminate calls • PCM timing may be sourced internally or from one of the four trunks within the group
Call Volume:	• CRS-D: 96,000 confirmed calls per hour • CRS-De: 120,000 confirmed calls per hour
Test Interface:	**CRS-D:** 8 T1 Transmit and Receive spans. • 50 pin female amphenal connectors, 100 ohm balanced **CRS-De:** 8 E1 Transmit and Receive spans. • 50 pin female amphenal connectors, 120 ohm balanced, or • 75 ohm unbalanced BNC connectors
System Start Modes:	• Synchronous • Random • Manual • Stagger Start • Sequential
Trouble Encounter Response:	• Continue • Call stop • Unit stop on trouble
Front Panel Indicators:	• One per channel or timeslot • Channel Status Display: Dark: Idle line Green: Originate call Yellow: Terminate call Red: Error • Group Active Display: Dark: Unit off Green: Power on • Layer 1 Indicators: PCM Sync (Green: normal, red: out-of-sync) Frame Error, CRC Error, Slip (Dark: Normal, Red: Error) • CRS-D Alarm Indicator: Dark: Normal Red: Indicates red, yellow or blue alarm received • CRS-De: (equipped with ISDN-PRI, optional) Provides status of TS16 (Dark: Normal, Yellow: Distant multiframe alarm, Red: Signal all ones alarm) • Link indicators (requires SS7 option) Dark: Idle or not equipped Green: Active Red: Link error



CRS-Dm Specifications: The CRS-Dm Feature Call Generator provides four 1.544 Mbps T1 CAS trunks and four 2.048 Mbps E1 CAS trunks.
Available option(s): Primary Rate ISDN provided in four trunk increments, SS7/CSS7 provided in four trunk increments, VoP, Audio Monitor and Voice Replay.

System	
Capacity:	• Group A: Four 1.544 Mbps PCM 24 channel T1 CAS trunks • Menu selectable D3/D4 Framing or ESF formats • Up to 96 simultaneous calls per group • Group B: Four 2.048 Mbps PCM 32 channel E1 CAS trunks • Menu selectable CRC-4 • Up to 120 simultaneous calls per group • All channels can originate or terminate calls • PCM timing may be sourced internally or from one of the four trunks within the group
Call Volume:	• Group A: 48,000 confirmed calls per hour per unit • Group B: 60,000 confirmed calls per hour per unit
Test Interface:	**Group A:** 4 T1 Transmit and Receive spans. • Amphenal connectors, 50 pin female, 100 ohm balanced **Group B:** 4 E1 Transmit and Receive pairs • Amphenal connectors, 50 pin female, 120 ohm balanced, or • 75 ohm unbalanced BNC connectors
System Start Modes:	• Synchronous • Random • Manual • Stagger Start • Sequential
Trouble Encounter Response:	• Continue • Call stop • Unit stop on trouble
Front Panel Indicators:	• One per channel or timeslot • Channel Status Display: Dark: Idle line Green: Originate call Yellow: Terminate call Red: Error • Group Active Display: Dark: Unit off Green: Power on • Layer 1 Indicators: PCM Sync (Green: normal, red: out-of-sync) Frame Error, CRC Error, Slip (Dark: Normal, Red: Error) • Group A, T1: Alarm Indicator: Dark: Normal Red: Indicates red, yellow or blue alarm received • Group B, E1: (equipped with ISDN-PRI optional) Provides status of TS16 (Dark: Normal, Yellow: Distant multiframe alarm, Red: Signal all ones alarm) • Link indicators (requires SS7 option) Dark: Idle or not equipped Green: Active Red: Link error

CRS-AD & CRS-BD



CRS-AD & CRS-ADe Specifications: The CRS-AD/CRS-ADe Call Generators provide both analog terminal (station) equipment simulation an digital trunk simulation for 16 to 64 analog lines and 1 to 4 T1/E1 PCM CAS trunks.
Available Options; *Analog section*: 600 ohm impedance, Ground Start, Meter Pulse Detection, Precise Call Progress Detection, DTMF Digit Decode, VoP, Voice Replay and Analog Display Service Interface (ADSI). *Digital section*: Primary Rate ISDN provided in four trunk increments, SS7/CSS7 provided in four trunk increments and VoP, Voice Replay.

System	
Capacity: Analog Section: Digital section:	• 16 to 64 analog lines CRS-AD: 1 to 4 T1 PCM 24 channel CAS spans Menu selectable D3/D4 Framing or ESF formats Up to 96 simultaneous calls, 4 spans CRS-ADe: 1 to 4 E1 PCM CAS spans Menu selectable CRC-4 Up to 120 simultaneous calls, 4 spans
Call Volume: Analog section: Digital section:	• Typically 12,000 confirmed calls per hour (DTMF dialing, tone ID confirmation, 24 paired lines) CRS-AD: 48,000 confirmed calls per hour (4 spans) CRS-ADe: 60,000 confirmed calls per hour (4 spans)
Analog Test Interface:	• Three 50 Pin (24 pair per) Amphenol female connectors
Digital Test Interface:	• CRS-AD: Two 50 Pin Amphenol female connectors. Four T1 Transmit and Receive spans, 100 ohms balanced for twisted pair cabling • CRS-ADe: 6 pairs (4 Tx & Rx Voice & Data, 2 Tx & Rx SS7 signaling links) BNC connectors. 75 ohm unbalanced
Front Panel Indicators: Analog section:	• 64 LEDs, one per line • Line Status Display: Dark: Idle line Green: Originate line off-hook Yellow: Terminate line off-hook Red: Line error • Unit Active Display: Dark: Unit off Green: Power on
Digital section:	• One per channel or time slot • Channel Status Display: Dark: Idle line Green: Originate call Yellow: Terminate call Red: Error • Group Active Display: Dark: Unit off Green: Power on • Layer 1 Indicators: PCM Sync (Green: normal, res: out-of-sync) Frame Error, CRC Error, Slip (Dark: Normal. Red: Error) • CRS-AD Alarm Indicator: Dark: Normal Red: Indicates red, yellow or blue alarm received • CRS-ADe: (equipped with ISDN-PRI optional) Provides status of TS16 (Dark: Normal, Yellow: Distant multiframe alarm, Red: Signal all ones alarm • Link indicators (requires SS7 option) Dark: Idle or not equipped Green: Active Red: Link error



CRS-BD & CRS-BDe Specifications: The CRS-BD/CRS-BDe Call Generators provide both Basic Rate ISDN terminal (station) equipment simulation and digital trunk simulation for 8 to 32 U-interface Basic Rate ISDN lines and 1 to 4 T1/E1 PCM CAS trunks.
Available Options; *Basic Rate ISDN section*: Voice Replay. *Digital section*: Primary Rate ISDN provided in four trunk increments, SS7/CSS7 provided in four trunk increments, VoP and Voice Replay.

System	
Capacity: Basic Rate section:	• 8 to 32 2B1Q encoded 2-wire Basic Rate ISDN U-interface lines
Digital section:	• CRS-BD: 1 to 4 T1 PCM 24 channel CAS spans Menu selectable D3/D4 Framing or ESF formats Up to 96 simultaneous calls, 4 spans CRS-BDe: 1 to 4 E1 PCM CAS spans Menu selectable CRC-4 Up to 120 simultaneous calls, 4 spans
Call Volume: Basic Rate section:	• Typically 48,000 confirmed calls per hour B1 & B2 CSV, CSD & X.25 D-channel packet (depending on switch performance X.25 Packets per second: Up to 2,024 packets per second
Digital section:	• CRS-BD: 48,000 confirmed calls per hour (4 spans) CRS-BDe: 60,000 confirmed calls per hour (4 spans)
Basic Rate Test Interface:	• Two 50 Pin (24 pair per connector) Amphenol female connectors Trace Port • One RJ-45 Trace/Insert Port • 4-wire, ISDN-S/T Interface provides access to any U-interface line • Switch selectable: insert or trace
Digital Test Interface:	• CRS-BD: Two 50 Pin Amphenol female connectors. Four T1 Transmit and Receive spans, 100 ohms balanced for twisted pair cabling • CRS-BDe: 6 pairs (4 Tx & Rx Voice & Data, 2 Tx & Rx SS7 signaling links) BNC connectors. 75ohm unbalanced
Front Panel Indicators: Basic Rate section:	• B-channel: 64 LEDs, one per B-channel • B-channel Status Display: Dark: Idle line Green: Originate call Yellow: Terminate call Red: Error • D-channel: 32 LEDs, one per D-channel Dark: Idle line Green: Call in progress Red: Error • Unit Active Display: Dark: Unit off Green: Power on
Digital section:	• One per channel or time slot • Channel Status Display: Dark: Idle line Green: Originate call Yellow: Terminate call Red: Error • Group Active Display: Dark: Unit off Green: Power on • Layer 1 Indicators: PCM Sync (Green: normal, res: out-of-sync) Frame Error, CRC Error, Slip (Dark: Normal. Red: Error) • CRS-AD Alarm Indicator: Dark: Normal Red: Indicates red, yellow or blue alarm received • CRS-ADe: (equipped with ISDN-PRI optional) Provides status of TS16 (Dark: Normal, Yellow: Distant multiframe alarm, Red: Signal all ones alarm • Link indicators (requires SS7 option) Dark: Idle or not equipped Green: Active Red: Link error

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CRS-A & CRS-B



CRS-A Specifications: The CRS-A Analog Feature Call Generator provides the line interface for 128 loop start lines.
Available Options: 600 ohm AC impedance, Ground Start, Meter Pulse Detection, Audio Monitor, VoP, Voice Replay and Analog Display Service Interface (ADSI)/Caller ID.

System	
Capacity:	• 128 analog lines
Call Volume:	• Typically 32,000 confirmed calls per hour (DTMF dialing, tone ID confirmation, 64 paired lines)
Line Types:	• Loop Start, 2 wire (optional Ground Start) • Pulse, DTMF, MF R1 & MF R2 dialing • 900 ohm AC impedance (optional 600 ohm AC impedance) • Optional 12/16kHz Meter Pulse Detection
System Start Modes:	• Synchronous • Random • Manual
Trouble Encounter Response:	• Continue • Call stop • Unit stop on trouble
Test Interface:	• Six 50 Pin Amphenol female connectors
Front Panel	• 128 LEDs, one per line • Line Status Display: Dark: Idle line Green: Originate line off-hook Yellow: Terminate line off-hook Red: Line error • Unit Active Display: Dark: Unit off Green: Power on



CRS-B Specifications: The CRS-B Basic Rate ISDN Feature Call Generator provides 64 BRI/BRA-ISDN U-Interface Ports.
Available option(s): Audio Monitor and Voice Replay.

System	
Capacity:	• 64 BRI/BRA ISDN U-Interface ports • Each U-Interface port emulates 1 to 8 TEs
Call Volume:	• Typically 96,000 confirmed calls per hour (depending on switch performance) • X.25 Packets per second: Up to 2,000 packets per second
Test Interface:	• Three 50 Pin Amphenol female connectors
Front Panel Indicators:	• B-Channel: 128 LEDs, one per B-channel • B-Channel Status Display: Dark: Idle line Green: Originate call Yellow: Terminate call Red: Error • D-Channel: 64 LEDs, one per D-channel Dark: Idle line Green: Call in progress Red: Error • Unit Active Display: Dark: Unit off Green: Power on
Trace Port	• One RJ-45 Trace/Insert Port
Test Loops:	• 4-wire, ISDN-S/T Interface provides access to any U-interface D-channel • Switch selectable: Insert or Trace • Meets transmission requirements for loop #1 through Loop #15 of ANSIs 15 telephone plant test loops
Warm and Cold	• Warm Start: 300 millisecond synchronization
Starts	• Cold Start: 15 second synchronization

Signaling Systems:	
Layer 1:	• 2B1Q, ANSI T1.601-1992 ISDN Basic Access Interface for use on metallic loops for application on the network side of the NT • Data Transmission: Full duplex at a rate of 160 kBps
Layer 2:	• Q.921/LAPD and LAPB (X.25)
Layer 3:	• Q.931 and equivalent standards • Up to 8 different L3 protocols may be downloaded to unit • Permits L3 protocol assignment for each U-Interface • Various international protocols supported downloaded from Workstation or PC
Packet Data:	• X.31 Case A and Case B • BPS: B-channel X.25 packet data • DPS: D-channel X.25 packet data
Circuit Switched:	• CSD: Circuit switched data • CSV: Circuit switched voice
Call Start Modes:	• Synchronous • Random • Manual • Stagger start
Trouble Encounter Response:	• Continue • Call stop • Unit stop on trouble

B-Channel Path Confirmation	
Circuit Switched Voice:	• 10 user selectable single tone signals to send unique channel ID tones • 64 user selectable single tone signals • In-Band Digit Send/Decode (DTMF, MF)
Circuit Switched Data: Packet Switched Data:	• 64 kBps BERT test • Up to 5 user selectable X.25 packets for confirmation

CRS-AB & CRS-P



CRS-AB Specifications: The CRS-AB Call Generator provides the terminal (station) equipment simulation for 16 to 48 analog lines and 8 to 32 U-interface Basic Rate ISDN lines.
Available Options; *Analog section*: 600 ohm impedance, Ground Start, Meter Pulse Detection, Precise Call Progress Detection, DTMF Digit Decode, VoP, Voice Replay and Analog Display Service Interface (ADSI). *Basic Rate ISDN section*: Voice Replay.

System	
Capacity:	
Analog Section:	• 16 to 48 analog lines
Basic Rate section:	• 8 to 32 2 B1Q encoded 2-wire Basic Rate ISDN U-interface lines
Call Volume:	
Analog section:	• Typically 12,000 confirmed calls per hour (DTMF dialing, tone ID confirmation, 24 paired lines)
Basic Rate section:	• Typically 48,000 confirmed calls per hour: B1 & B2 CSV, CSD & X.25 D-channel packet (depending on switch performance) X.25 Packets per second: Up to 2.024 packets per second
Analog Test Interface:	• Two 50 Pin (24 pair per) Amphenol female connectors
Basic Rate Test Interface:	• Two 50 Pin (24 pair per connector) Amphenol female connectors Trace Port • One RJ-45 Trace/Insert Port • 4-wire, ISDN-S/T Interface provides access to any U-interface line • Switch selectable: insert or trace
Front Panel Indicators:	
Analog section:	• 48 LEDs, one per line • Line Status Display: Dark: Idle line Green: Originate line off-hook Yellow: Terminate line off-hook Red: Line error • Unit Active Display: Dark: Unit off Green: Power on
Basic Rate section:	• B-Channel: 64 LEDs. one per B-channel • B-Channel Status Display: Dark: Idle line Green: Originate call Yellow: Terminate call Red: Error • D-Channel: 32 LEDs. one per D-channel Dark: Idle line Green: Call in progress Red: Error • Unit Active Display: Dark: Unit off Green: Power on



CRS-P Specifications: The CRS-P Feature Call Generator 64 Northern Telecom (P-Phone) EBS lines.
Available option(s): Audio Monitor.

System	
Capacity:	• 64 P-phone (EBS) originating/terminating lines. Each line emulates up to: • 1 Primary Set and 3 add-ons • 1 Extension Set and 3 add-ons
Call Volume:	• 15,000 Call per hour
Line Types	• Lines compatible with NIS S106-1 • DTMF, MF R1 & MF R2 dialing • 900 ohm impedance • Simulated sets are not loop powered
System Start Modes:	• Synchronous • Random • Manual
Trouble Encounter Response:	• Continue • Call stop • Unit stop on trouble
Test Interface:	• Three 50 Pin Amphenol female connectors
Front Panel Indicators:	• 128 LEDs, two per line 1 Primary Set 1 Extension Set • Line Status Display: Dark: Idle line Green: Originate line off-hook Yellow: Terminate line off-hook Red: Line error • Unit Active Display: Dark: Unit off Green: Power on

Signaling Channel	
Message Format:	• Amplitude Shift Keying (ASK), 16 bit envelope
Carrier Frequency:	• Transmit: 8,000 Hz ± 200 ppm Level: 1.3 Volts peak-to-peak ± 0.2 Volts • Receive: 8,000 Hz ± 200 ppm Level: Maximum 1.5 Volts peak-to-peak Minimum 0.9 Volts peak-to-peak
Bit Rate:	• 1,000 bits per second ± 2% half duplex

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Digital Options

Primary Rate ISDN Option: Provides Primary Rate ISDN test functionality on four 1.544 Mbps T1 or four 2.048 Mbps E1 trunks for Crescendo Models CRS-D, CRS-De, CRS-Dm, CRS-AD, CRS-ADe, CRS-BD and CRS-BDe.

Expanded System Specifications for ISDN-PRI Option

Capacity:	• Four 1.544 Mbps PCM CCS Trunks (T1)
	  • 24 timeslots (23B+D)
	  • AMI and B8ZS Line Coding
	  • Menu selectable D4 or ESF framing
	  - or -
	• Four 2.048 Mbps PCM CCS Trunks (E1)
	  • 32 timeslots (30B+D)
	  • HDB3 Framing
	  • Menu selectable CRC 4

Signaling System Layer 1:	• Complies with ANSI T1.408 (T1) • Complies with ITU-T (CCITT) 1.412 and 1.431 (E1)
Signaling System Layer 2:	• Q.921/LAPD and LAPB (X.25)
Signaling System Layer 3	• Q.931 and equivalent standards • Up to 8 different L3 protocols may be downloaded to unit • Menu selection of L3 protocol for each B- and D-channel • D- or signaling channel may be assign to any physical timeslot • Various international protocols supported (US, ETSI, ITU) • Additional protocols can created and downloaded from Workstation or PC
Packet Data:	• X.31 Case A and Case B • BPS: B-channel X.25 packet data • DPS: D-channel X.25 packet data
Circuit Switched:	• CSD: Circuit switched data (BERT) • CSV: Circuit switched voice

B-Channel Path Confirmation

Circuit Switched Voice:	• 10 user selectable single tone signals to send unique channel ID tones • 64 user selectable single tone signals • In-Band Digit Send/Decode (DTMF, MF)
Circuit Switched Data:	• 56 kBps or 64 kBps HDLC packets containing channel ID or BERT test
Packet Switched Data:	• Up to 5 user selectable X.25 packets for confirmation

Signaling System 7 Option: Provides signaling System 7 (SS7) test functionality via eight signaling links and four 1.544 Mbps T1 or four 2.048 Mbps E1 trunks for Crescendo Models CRS-D, CRS-De, CRS-Dm, CRS-AD, CRS-ADe, CRS-BD and CRS-BDe.

Expanded System Specifications for SS7/CSS7 Option

Capacity:	• Signaling Links: Eight 56 kBps or 64 kBps SS7 links
	• Fully associated links using timeslots in the voice & data circuits are also supported
	• Voice and Data Circuits:
	  • Four 1.544 Mbps PCM Trunks
	  • 24 timeslots per trunk, 96 total timeslots
	  • 100 ohm impedance, balanced
	  • AM1 and B8ZS Line Coding
	  • Menu selectable D4 or ESF framing
	  - or -
	  • Four 2.048 Mbps PCM30-/PCM-31 Trunks
	  • 120 total timeslots
	  • 120 ohm impedance, balanced
	  • HDB3 Framing
	  • Selectable CRC-4

Signaling Protocols

Protocol State Tables:	• Up to Eight within the unit at any one time
US Signaling Protocols:	• Level 1: Bellcore Q.702 • Level 2: Bellcore Q.703 • Level 3: Bellcore Q.704 • ISUP: Bellcore Q.761 to Q.766
Non-US Signaling Protocols:	• Level 1: ITU-T (CCITT) Q.702 • Level 2: ITU-T Q.703 • Level 3: ITU-T Q.704 • ISUP: ITU-T Q.761 to Q.766 • BTNR 167 • TUP: Regional varieties supported – call for availability

Voice and Data Circuit Confirmation

Circuit Switched Voice	• 10 user selectable single tone signals to send unique channel ID tones • 64 user selectable single tone signals • In-Band Digit Send/Decode (DTMF, MF)
Circuit Switched Data	• 511 and 2047 BERT patterns for 56 kBps channels
Packet Switched Data	• Up to 5 user selectable X.25 packets for confirmation

Analog Options

ADSI Option: Provides Analog Display Service Interface (ADSI)/ Caller ID test functionality on Crescendo Model CRS-A, CRS-AB, CRS-AD and CRS-ADe.

Expanded System Specifications for ADSI Option

Capacity:	• 64 Analog lines per option
Signaling Protocols:	• Bellcore TR-NWT-000030, British Telecom (BT) SIN 227 and SIN 242, Cable Television Association (CTA) TW/P&E/312

Dual Tone Alert Signal Detection

US Signaling Protocols:	Low tone frequency:	2,130 Hz ± 0.5%
	High tone frequency:	2,750 Hz ± 0.5%
	Receive signal level:	-14 dBm to -32 dBm per tone, off hook
	Signal reject level:	-45 dBm
	Twist:	Up to 6 dB
	Unwanted signals:	Less than -7 dBm ASL near end of speech
	Duration:	75 to 85 ms
	Speech present:	Yes
Non-US Signaling Protocols:	Low tone frequency:	2,130 Hz ± 1.1%
	High tone frequency:	2,750 Hz ± 1.1%
	Receive signal level:	-2 dBV to -40 dBV per tone, off hook
	Signal reject level:	-45 dBm
	Unwanted signals:	Less than -20 dBm 300 to 3,400 Hz
	Duration:	88 to 110 ms
	Speech present:	No

FSK

US Signaling Protocols:	Mark frequency (logic 1):	1,200 Hz ± 1%
	Space frequency (logic 0):	2,200 Hz ± 1%
	Received signal level mark:	-12 dBm to -32 dBm
	Received signal level space:	-12 dBm to -32 dBm
	Twist:	Up to 10 dB
	Unwanted signals:	Less than -25 dB 200 to 3,200 Hz
	Transmission rate:	1,200 Baud ± 1%
	Word format:	1 start bit = 0, 8 bit word (LSB first), 1 stop bit =1
Non-US Signaling Protocols:	Mark frequency (logic 1):	1,300 Hz ± 1.5%
	Space frequency (logic 0):	2,100 Hz ± 1.5%
	Received signal level mark:	-8 dBV to -40 dBV
	Received signal level space:	-8 dBV to -40 dBV
	Twist:	Up to 6 dB
	Unwanted signals:	Less than -20 dB 300 to 3,400 Hz
	Transmission rate:	1,200 Baud ± 1%
	Word format:	1 start bit = 0, 8 bit word (LSB first), 1 stop bit =1

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