Specifications

This section begins with a brief description of the CTS 700-Series Test Sets. Following the description, the section contains a complete listing of the instrument specifications.

Product Description

The CTS 700-Series Test Sets are rugged, portable test sets designed for installing and maintaining telecommunications networks. The CTS 710 SONET Test Set and CTS 750 SDH Test Set combine bit error rate test capabilities with overhead testing, payload mapping, and demapping in one unit. The CTS test sets feature the following capabilities (options are required for some features):

- STS-1, STS-3, OC-1, OC-3, and OC-12 transmit and receive (CTS 710)

- STM-1 and STM-4 transmit and receive (CTS 750)

- DS1/DS3 Add/Drop/Test (with CTS 710 Option 22)

- 2, 34, and 140 Mb/s Add/Drop/Test (with CTS 750 Option 36)

- Bit Error Rate testing

- BIP error monitoring and analysis

- Payload mapping and demapping

- Alarm generation and analysis

- APS testing

- DCC and user channel access

- Programmable via IEEE 488.2 and RS-232

- Jitter generation and analysis (with CTS 750 Option 14)

- Wander generation and measurement (with CTS 750 Option 14)

The CTS test sets meet the needs of the craftsperson and the network engineer. The instruments meet the requirements of those working in network installation and maintenance by providing the following capabilities:

- Network integrity testing

- In-service performance monitoring

- Stimulus and response testing

■ Stress testing

■ Overhead testing

Guide to the Specifications

The following sections contain the complete specifications for the CTS 700-Series Test Sets. The first section contains the CTS 710 specifications. The next section, beginning on page 1–17, covers the specifications for the CTS 750.

All specifications are warranted unless they are designated *typical*. Warranted characteristics that are directly checked by a procedure contained in the *Performance Verification* section of this manual are marked with a ✔ symbol.

If the characteristic is noted as *typical*, the characteristic is not warranted. Typical characteristics describe typical or average performance and provide useful reference information.

Performance Conditions

The electrical characteristics found in these tables apply when the CTS has been adjusted at an ambient temperature between +20° C and +30° C, has been warmed up for at least 20 minutes, and is being operated at an ambient temperature between 0° C and +50° C (unless otherwise noted).

CTS 710 Specification Tables

The CTS 710 SONET Test Set specifications, as referenced to the ANSI and Bellcore SONET standards, are arranged by functional groups in Tables 1–1 through 1–5.

Table 1–1: Standard CTS 710 Specifications

Characteristic	Description
Generator Output	
Electrical Output	
Data Rates	STS-1: 51.84 Mb/s STS-3: 155.52 Mb/s
Data Formats	STS-1: AMI, B3ZS STS-3/STS-3c: CMI
✔ Signal Level at Transmit Output	STS-1 Hi: $\pm$1.0 V_{pk} $\pm$10% into 75 Ω STSX-1: with 450 feet of cable loss STS-3 Hi: $\pm$0.5 V_{pk} $\pm$10% into 75 Ω STSX-3: with 225 feet of cable loss
✔ Pulse Shape at Transmit Output	Meets ANSI T1-102, Bellcore GR-NWT-000253 Eye Pattern Masks
Return Loss	>15 dB, with instrument power on
Output Protection	Open and short circuit protected
Connector	Unbalanced, 75 Ω BNC
Optical Output	
Data Rates	OC-1: 51.84 Mb/s OC-3: 155.52 Mb/s OC-12: 622.08 Mb/s
Data Format	Scrambled NRZ
Optical Module Options	Opt. 03: 1310 nm, IR, OC-1/3 Opt. 04: 1310 nm, IR, OC-1/3/12 Opt. 05: 1550 nm, LR, OC-1/3/12 Opt. 06: 1310/1550 nm, OC-1/3/12
Signal Level & Wavelength	Opt. 03, 04, 06: $-$10 dBm, typical 1310 nm Opt. 05, 06: 0 dBm, typical, 1550 nm
✔ Pulse Shape	Meets Bellcore GR-253-CORE Eye Pattern Masks
Wavelength	1308 nm, typical (Opt. 03, 04, 06) 1550 nm, typical (Opt. 05, 06)
Spectral Width	$\leq$ 4 nm, 1310 nm (Opt. 03, 04, 06) $\leq$ 1 nm, 1550 nm (Opt. 05, 06)
Extinction Ratio	$\geq$ 10 dB
Laser Classification	Class 1 laser, complies with 21 CFR 1040.10 and 1040.11, complies with IEC 825, Section 9.4
Connectors	FC-PC Standard (optical connector kit with ST, SC, and DIN 47256 included)

Table 1–1: Standard CTS 710 Specifications (Cont.)

Characteristic	Description
Signal Structure	
✔ Standards Compliance	Meets the requirements of ANSI T1.105A, Section 8 and Bellcore GR-NWT-000253
Payload Channel (SPE)	One active STS-1 in STS-3 Selection (The other 2 channels are unequipped) One active STS-1 in STS-12 (The other 11 channels are unequipped) One active STS-3c in STS-12 (The other 3 channels are unequipped)
Unequipped Payload	C2 byte is set to 00
Internal Pattern Generator	
Patterns Bulk Fill in a selected SPE channel (STS-1 or STS-3c)	PRBS: 2^9–1, 2^{15}–1, 2^{20}–1, 2^{23}–1; All 1s, All 0s, 8-bit programmable word
Errors Single or Continuous	Section BIP (B1) Line BIP (B2) Path BIP (B3), Path FEBE Payload pattern bit
Error Rate Range	1×10^{-3} to 1×10^{-10} with 0.1 resolution (depends on error type)
Alarms	Line AIS, Line FERF Path AIS, Path FERF
✔ Failures	LOS, LOF, LOP
Transmitter Clock	
Internal Clock	
✔ Accuracy	±4.6 ppm, for instrument calibrated within 24 months
Line Output Jitter	< 0.01 UI_{RMS} in the frequency band between 12 kHz and 5 MHz (complies with Bellcore TR-NWT-000253, Sections 5.6.1 and 5.6.5.2; and Bellcore TR-NWT-000499, Section 7.3.3)
External Clock Reference	
✔ Rate	1.544 MHz ±40 ppm
Input	Balanced, 100 Ω ±5%, Bantam connector
Recovered Clock	
Loop timing	Clock is recovered from received signal
✔ Frequency lock range	Nominal line rate ± 125 ppm
Transmit Line Frequency Offset	
✔ Frequency offset rate	±100 ppm of nominal line rate
Receive Input	
Electrical Input	
Data Rates	STS-1:　　　　　51.84 Mb/s ±100 ppm STS-3:　　　　　155.52 Mb/s ±100 ppm
Data Formats	STS-1E:　　　　　AMI, B3ZS coded STS-3/STS-3c:　　CMI

Table 1–1: Standard CTS 710 Specifications (Cont.)

Characteristic	Description
✔ Signal Sensitivity	STS-1 Hi: 0.5 Vpk min to 1.2 Vpk max STSX-1: 0.25 Vpk min to 0.6 Vpk max STS-1 Lo: 0.125 Vpk min to 0.35 Vpk max STS-1 Monitor: 20 dB of flat loss below Xcon STS-3: 0.35 Vpk min to 0.6 Vpk max STSX-3: 0.35 Vpk min to 0.6 Vpk max STS-3 Lo: 0.07 Vpk min to 0.3 Vpk max STS-3 Monitor: 26 dB of flat loss below Hi
Signal Level Display	Readout for electrical signal level in mV

Signal Equalization	STS-1: Cross-connect equalization for 450 feet of AT&T 728A cable
	                 Low-level equalization for 900 feet of AT&T 728A cable
	
	STS-3: Automatic equalization for 0 to 450 feet of cable loss to ITU-T Rec. G.708
	                 and ANSI TI-102

Return Loss	>15 dB, with instrument power on
Input Protection	Up to ± 5V, short term
Connector	Unbalanced, 75 Ω BNC
Optical Input	
Data Rates	OC-1: 51.84 Mb/s (±100 ppm) OC-3: 155.52 Mb/s (±100 ppm) OC-12: 622.08 Mb/s (±100 ppm)
Data Format	Scrambled NRZ
Maximum Input Power	–7 dBm (Opt. 05 and 06 include a 10 dB attenuator)
Operating Wavelength	1310 nm and 1550 nm (1100 nm to 1570 nm operating range)
✔ Signal Sensitivity	–28 dBm for BER $\leq 10^{-10}$
Optical Power Meter Accuracy	2 dBm, typical (for input power in a range of –30 dBm to –6 dBm)
Connectors	FC-PC standard (optical connector kit with ST, SC, and DIN 27256 included)
Through Mode	Monitors a selected channel and passes the signal through unchanged.
Transmit and Receive Functional Specifications	
Transport Overhead	
Access	Set overhead bytes to any value from binary 00000000 to 11111111: A1, A2, C1, E1, F1, D1–D3, K1, K2, D4–D12, S1, Z2, M2, E2 View all Transport Overhead bytes
Add/Drop	Insert data from the Overhead Add/Drop connector into the Section DCC, Line DCC or F1 user byte. Drops data from the Section DCC, Line DCC, or F1 user byte out to the Overhead Add/Drop connector.
K1 and K2 (APS)	Set the APS Bytes, K1 and K2, to any code defined in ANSI T1.105A. Selectable by text description for all Span and Ring messages.

Table 1–1: Standard CTS 710 Specifications (Cont.)

Characteristic	Description
Path Overhead	
Access	Set Path Overhead bytes to any value from binary 00000000 to 11111111: C2, F2, Z3, Z4, and Z5 View all Path Overhead bytes
Add/Drop	Insert data from the Overhead Add/Drop connector into the F2 user byte. Drop data from the F2 user byte out to the Overhead Add/Drop connector.
Path Trace Byte J1	Send user-defined 64-byte sequence, or set to 00000000 View Path Trace J1
Pointer Movement	
Single	Single pointer justification (increment or decrement)
Burst	Bursts of two to eight pointer justifications spaced four frames apart. All adjustments within a given burst are in the same direction. Subsequent bursts are in alternating directions.
↙ Continuous	Pointer justifications occur continuously at a predetermined rate in an incrementing, decrementing, or alternating direction. Rate between movements: 2 ms to 10 s, with a resolution of 1 ms.
Set to Value	Set to a new location with or without the NDF being set. Range is 0 to 1023 (783 – 1023 are illegal locations).
Pointer Test Sequences	
Single pointer adjustment	Time between pointer adjustments: 30 s.
Alternating pointer adjustment	Alternating, single Alternate, double
Pointer adjustment burst	Time between 3 pointers is 0.5 ms, 0.5 ms Time between pointer burst: 30 s
Phase transient pointer adjustment burst	Time between 7 pointers is 0.25 s, 0.25 s, 0.5 s, 0.5 s, 0.5 s, 0.5 s. Time between pointer bursts: 30 s.
Periodic pointer adjustment – 87–3 pattern	– 87–3 pattern – 87–3 pattern with cancelled pointer movement number 87 – 87–3 pattern with added pointer after the 43rd pointer
Periodic pointer adjustment – continuous pattern	– continuous pattern – continuous pattern with cancellation of one pointer – continuous pattern with added pointer
Pointer Direction	Positive or Negative
Initialization Period	On or Off Thirty second burst of 1 pointer per second in the same direction as the selected test.
Cool Down Period	On or Off This will last at least 60 seconds.

Table 1–1: Standard CTS 710 Specifications (Cont.)

Characteristic	Description
Measurements	
Error Count, Error Rate, and Errored Seconds for	B1, B2, B3, Payload, Line-FEBE, Path-FEBE
Alarm and Failure Seconds	LOS, OOF, LOF, SPE LOP, Line AIS & FERF, Path AIS & FERF, Loss of Power, Loss of Pattern Sync
STS SPE Pointer Measurements	Seconds: Count: LOP Illegal pointers Illegal pointers Positive justifications NDF Negative justifications
T1M1.3 Analysis	
Section B1 Seconds and ratio	Error Blocks, ES, SES, UAS Background Block Errors
Line B2 & FEBE Seconds and % of total time	Error-Count, ES, ES-A, ES-B, SES, UAS, EFS FEBE-Count, FEBE-ES, FEBE-UAS, FEBE-EFS
Path B3 & FEBE Seconds and % of total time	Error-Count, ES, ES-A, ES-B, SES, UAS, EFS FEBE-Count, FEBE-ES, FEBE-UAS, FEBE-EFS
Pattern Bit Seconds and % of total time	Error-Count, ES, ES-A, ES-B, SES, UAS, EFS
LEDs	
Status Indicators	LOS, LOF, LOP, Line AIS, Line FERF, Path AIS, Path FERF, Errors, Pointer Adjust, Signal Present, Pattern Lock
Histograms	

Error Count,
   Bit Error Rate and
   Errored Seconds
	B1, B2, B3, Line-FEBE, Path-FEBE, Pattern Bit

Alarms & Failures On/Off	LOS, OOF, LOF, SPE-LOP, Line-AIS, Line-FERF, Path-AIS, Path-FERF, Pattern Loss, Loss of Power
Pointers	STS Pointer Value, Pointer Justification
Measurement Utilities	
Measurement Control	Manual Start/Stop Timed: 1 s to 99 days with 1 s resolution Continuous
Histogram Display Resolution	1 min, 5 min, 15 min, 1 hour (displays 72 hours with 1 min resolution) 15 min, 60 min, 4 hrs, 12 hrs (displays 45 days with 15 min resolution)
Result Logging	All measurements are recorded with start, stop time and date. The current and previous results are stored in memory both totalized and graphical. Both graphical and totalized results can be stored on a disk.

Table 1–1: Standard CTS 710 Specifications (Cont.)

Characteristic	Description
Utilities	
TroubleScan	Scans all measurement results for key violations.
AutoScan	AutoScan to incoming signal (rate, mapping, framing, and pattern). Identifies incoming signal and presents graphical display of SPE and VT structure. Identifies VT signal status by showing VT number, equipped vs unequipped, alarms and pattern.
Stored Setups	5 front panel setups in memory 200 front panel setups per disk
Pass/Fail Tests	Predefined Pass/Fail Tests can be created, stored and executed Pass/Fail tests are stored on disk 200 Pass/Fail test setups per disk
Add/Drop Interface for Data Communication Channels and User Channels	A DB-37 female connector provides the interface to an external protocol analyzer. Clock and data signals are differential TTL, conform to RS-422 specifications, and are also compatible with single-ended TTL signals. Add/Drop: D1–D3, D4–D12, F1, F2 Connector: 37 Pin DIN (DTE and DCE)
Triggering	Pulse at start of each frame, (Tx and Rx) Connector: 37 Pin DIN
Disk Drive	3.5 inch, 1.44 MB, DOS compatible Measurement Result stored in ASCII Stored Setups and Pass/Fail Tests in IEEE 488.2 format
Printer	Optional printer in pouch (thermal): HC 411 Printer support: Epson, HP Thinkjet Serial Printer Port: RS-232 Print to disk: BMP format, Interleaf format, and Encapsulated PostScript
Computer Interface	IEEE-488.2 interface RS-232-C interface (DB9)
Help Mode	Online task-oriented help
Display	7 inch diagonal CRT, magnetic deflection Horizontal raster-scan green phosphor Resolution: 640 by 480 pixels VGA output: 15 pin connector

Table 1–2: Option 22 DS1/DS3/VT1.5 Capabilities

Characteristic	Description
DS1/DS3 Generator	
Electrical Output	
Data Rates	DS1 (1.544 Mb/s) DS3 (44.736 Mb/s)
Formats	DS1: AMI, B8ZS coded DS3: B3ZS coded
✔ Signal Level	DS1: 3 V_{pk} ±0.6 V into 100 Ω DS3: 0.6 V_{pk} ±0.24 V into 75 Ω
✔ Pulse Shape	Meets ANSI T1-102 Pulse Masks
Connectors	DS1: Bantam 100 Ω DS3: BNC 75 Ω

Data Source	DS1: DS1 Generator
	         SONET VT1.5 Drop
	DS3: DS3 Generator
	         SONET SPE Drop

DS1/DS3 Internal Pattern Generator	

Framing	DS1: SF(D4)
	         ESF
	         Unframed
	DS3: M13
	         C-bit Parity
	         Unframed

Patterns	PRBS: 2^{15}–1, 2^{20}–1, 2^{23}–1; All 1's, All 0's, Fixed Pattern 8 bit, Fixed Pattern 16 bit, Fixed Pattern 24 bit, QRSS (DS1 only), 1 in 8 (DS1 only), 3 in 24 (DS1 only)

Errors
Single or Continuous
	DS1: Frame Bit Error
	         CRC-6 Error (ESF only)
	         Pattern Bit Error
	DS3: Frame Bit Error
	         P Parity Bit Error (M13 framing only)
	         C Parity Bit Error (C-Bit parity only)
	         Pattern Bit Error

Error Rate Range	1×10^{-2} to 1×10^{-8} with 0.1 resolution (depends on error type)

Alarms and Failures	DS1: Yellow
	         AIS
	DS3: Yellow
	         AIS (DS3 blue)
	         Idle

VT1.5/DS3 Mapping	
VT1.5 Map Signal Source	Internal DS1 Generator Received DS1 signal
VT1.5 Mapping	Floating Asynch

Table 1–2: Option 22 DS1/DS3/VT1.5 Capabilities (Cont.)

Characteristic	Description
VT1.5 Active Map Channel Selection	Allows selection of any one of 28 VT channels Remaining 27 VT channels are background
VT1.5 Background Channels	
Background Channel Content	When internal DS1 generator is used: QRSS or Idle pattern (11010101) When external source is used: QRSS
Background Channel Framing	When internal DS1 generator is used: Same as active channel When external source is used: Unframed
VT1.5 Errors (Single or Continuous)	VT BIP-2 VT FEBE
VT1.5 Alarms and Failures	VT AIS VT FERF VT Loss of Pointer VT Loss of Multiframe
DS3 SPE Add Source	Internal DS3 Generator Received DS3 signal
Transmitter Clock	
Internal Clock	
Accuracy	±4.6 ppm, for instrument calibrated within 24 months
External Clock Reference	
Rates	1.544 MHz ±40 ppm
Input	Balanced, 100 Ω ±5%, DS1 Bantam connector
Recovered Clock	
Loop timing	Clock is recovered from received signal
Transmit Line Frequency Offset	
Frequency offset rate	±100 ppm of nominal line rate with 0.1 ppm resolution
External DS1/DS3	Clock Input (for Jitter Generation)
✔ Rates	1.544 Mb/s, 44.736 Mb/s
Input	Unbalanced, 75 Ω BNC, AC coupled
Signal Level	0.5 volts to 1.5 volts peak to peak

Table 1–2: Option 22 DS1/DS3/VT1.5 Capabilities (Cont.)

Characteristic	Description
DS1/DS3 Receiver	
Electrical Input	
Data Rates	DS1: (1.544 MHz) ±150 ppm DS3: (44.736 MHz) ±150 ppm
Formats	DS1: AMI, B8ZS DS3: B3ZS
Impedance	DS1: 100 Ω balanced DS1 Bridged: 1 kΩ balanced DS3: 75 Ω to ground, unbalanced
↙ Signal Level	DSX-1: 3 Vpk ±0.6 V into 100 Ω DS-1 Monitor: 20 dB flat loss below DSX-1 DSX-3: 0.6 Vpk ±0.24 V into 75 Ω DS-3 Monitor: 20 dB flat loss below DSX-3
Connectors	DS1: Bantam 100 Ω DS3: BNC 75 Ω
DS1/DS3 Internal Pattern Receiver	

Pattern Receiver Source	DS1: Rx Signal (ext)
	          VT1.5 Drop
	DS3: Rx Signal (ext)
	          SONET SPE Drop

Framing	DS1: SF(D4)
	          ESF
	          Unframed
	DS3: M13
	          C-bit Parity
	          Unframed

Demultiplexing	
Demux DS3 to DS1	Allows selection of any one of 28 DS1 channels from a DS3
VT1.5/DS3 Demapping	
VT1.5 Demapping	Floating Async
VT1.5 Active Demap Channel Selection	Allows selection of any one of 28 VT channels
Drop VT1.5 to	Internal DS1 Receiver External DS1 signal output
Drop DS3 from	Selected STS-1 Channel
Drop DS3 to	Internal DS3 Receiver External DS3 signal output
VT Path Overhead	
VT1.5 Path Overhead Access	V5 control (——xxxx–) Set VT Path Overhead bytes to any value from binary 00000000 to 11111111: Z3, Z4, and Z5 View all Path Overhead bytes

Table 1–2: Option 22 DS1/DS3/VT1.5 Capabilities (Cont.)

Characteristic	Description
VT1.5 Path Trace Byte J2	Send user-defined 16-byte sequence, or set to 00000000 View Path Trace J2
VT Pointer Movement	
VT1.5 Pointer Interaction	VT1.5 or STS, but not both at the same time
Single	Single pointer justification (increment or decrement)
Burst	Bursts of two to eight pointer justifications spaced four multi-frames apart. All adjustments within a given burst are in the same direction. Subsequent bursts are in alternating directions.
Continuous	Pointer justifications occur continuously at a predetermined rate in an incrementing, decrementing, or alternating direction. Rate between movements: 48 ms to 1 s, with a resolution of 1 ms.
Set to Value	Set to a new location with or without the NDF being set. Range is from 0 to 1023 (104 – 1023 are illegal locations).
VT Pointer Test Sequences	
Single pointer adjustment	Time between pointer adjustments: 30 s
Alternating pointer adjustment	Single Double
Pointer adjustment burst	Time between 3 pointers is 2 ms, 2 ms Time between pointer burst: 30 s
Phase transient pointer adjustment burst	Time between 7 pointers is 0.25 s, 0.25 s, 0.5 s, 0.5 s, 0.5 s, 0.5 s Time between pointer bursts: 30 s
Periodic pointer adjustment test sequence – 26–1 pattern	– 26–1 pattern – 26–1 pattern with cancelled pointer movement number 26 – 26–1 pattern with added pointer after the 13th pointer
Periodic pointer adjustment – continuous pattern	– continuous pattern – continuous pattern with cancellation of one pointer – continuous pattern with added pointer
Pointer Direction	Positive or Negative
Initialization Period	On or Off Thirty second burst of 1 pointer per second in the same direction as the selected test.
Cool Down Period	On or Off This will last at least 60 seconds.
Measurements	
DS1 Error Count, Error Rate and Error seconds for	Frame Bit CRC-6 (ESF only) Pattern Bit
DS3 Error Count, Error Rate and Error seconds for	Frame Bit P Parity Bit (M13 framing only) C Parity Bit (C-Bit parity only) Pattern Bit
VT1.5 Error Count, Error Rate and Error seconds for	VT BIP-2 VT FEBE

Table 1–2: Option 22 DS1/DS3/VT1.5 Capabilities (Cont.)

Characteristic	Description
DS1 Alarm and Failure Seconds for	AIS Yellow Loss of Pattern Sync Loss of Frame Loss of Signal
DS3 Alarm and Failure Seconds for	AIS (DS3 Blue) Yellow (DS3 FERF) Idle Loss of Pattern Sync Loss of Frame Loss of Signal
VT1.5 Alarm and Failure Seconds for	VT AIS VT FERF VT Loss of Pointer VT Loss of Multiframe
VT1.5 Pointer Measurements	Seconds: Count: LOP Illegal pointers Illegal pointers Positive justifications NDF Negative justifications
T1M1.3 Analysis	
VT1.5 BIP-2 & FEBE Seconds and % of total time	Error-Count, ES, ES-A, ES-B, SES UAS, EFS, FEBE-Count, FEBE-ES, FEBE-UAS, FEBE-EFS
DS1 Frame Error (SF) & CRC-6 Error (ESF), Seconds and % of total time	Error-Count, ES, ES-A, ES-B, SES, UAS, EFS
DS3 P-Bit Error (M13) & C-Parity Error (C-Bit Parity), Seconds and % of total time	Error-Count, ES, ES-A, ES-B, SES, UAS, EFS
DS1/DS3 Payload (Pattern Bit Errors), Seconds and % of total time	Error-Count, ES, ES-A, ES-B, SES,UAS, EFS
LEDs	
Status Indicators	VT AIS DS1/DS3 AIS VT FERF DS1/DS3 YELLOW VT BIP-2 ERROR DS1/DS3 ERROR

Table 1–2: Option 22 DS1/DS3/VT1.5 Capabilities (Cont.)

Characteristic	Description
Histograms for DS1, DS3 and VT1.5	
DS1/DS3/VT1.5 Error Count, Bit Error Rate and Errored Seconds	CRC, Frame, Parity, VT-BIT2, VT-FEBE, Pattern Bit
DS1/DS3/VT1.5 Alarms & Failures On/Off	LOS, LOF, AIS, Yellow (FERF), VT-LOP, VT-AIS, VT-FERF, VT-LOM, Pattern Loss, Loss of Power
VT1.5 Pointers	VT Pointer Value, Pointer Justification
Measurement Utilities	
Measurement Control	Manual Start/Stop Timed: 1 s to 99 days with 1 s resolution Continuous
Histogram Display Resolution	1 min, 5 min, 15 min, 1 hour (displays 72 hours with 1 min resolution) 15 min, 60 min, 4 hrs, 12 hrs (displays 45 days with 15 min resolution)
Result Logging	All measurements are recorded with start, stop time and date. The current and previous results are stored in memory both totalized and graphical. Both graphical and totalized results can be stored on a disk.

Table 1–3: Environmental Specifications

Characteristic	Description	
Temperature	Operating:	0° C to +40° C
	Nonoperating:	–40° C to +75° C
Altitude	Operating:	4,572 m (15,000 ft)
	Nonoperating:	12,192 m (40,000 ft)
Humidity	Operating:	To 95%, relative humidity at or below +40° C for 2 hours or less
		To 90% relative humidity at or below 30° C, continuous
Transportation Handling	Qualifies under National Safe Transit Association 1s Pre-shipment Test; 1A-B-1.	

Table 1–4: Physical Characteristics

Characteristic	Description
Dimensions	Height: 165 mm (6.5 in) 191 mm (7.5 in) with accessory pouch Width: 362 mm (14.25 in) Depth: 490 mm (19.25 in) with front cover 564 mm (22.2 in) with handle extended
Weight	Net: Approximately 8.7 kg (19.3 lb) Shipping: Approximately 14.1 kg (31 lb)
Power Requirements	*Line Voltage* *Line Frequency* 90 V to 132 V 50/60 Hz 180 V to 250 V 50/60 Hz 100 V to 132 V 400 Hz Maximum current is 6 A_{RMS}.

Table 1–5: Certifications and compliances

Characteristic	Description

EC Declaration of Conformity – EMC	Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:
	
	EN 55011 Class A Radiated and Conducted Emissions
	
	EN 50082-1 Immunity:
	    IEC 801-2 Electrostatic Discharge Immunity
	    IEC 801-3 RF Electromagnetic Field Immunity
	    IEC 801-4 Electrical Fast Transient/Burst Immunity
	    IEC 801-5 Power Line Surge Immunity

FCC Compliance	Emissions comply with FCC Code of Federal Regulations 47, Part 15, Subpart B, Class A Limits
EC Declaration of Conformity – Low Voltage	Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities: Low Voltage Directive 73/23/EEC EN 61010-1/A1 Safety requirements for electrical equipment for measurement, control, and laboratory use
Approvals	UL3111-1 – Standard for Electrical Measuring and Test Equipment CAN/CSA C22.2 No. 1010-1 – CSA Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use

Table 1–5: Certifications and compliances (Cont.)

Characteristic	Description
Conditions for Safety Certification	Operating temperature: +5 to +40 °C
	Relative Humidity: (maximum operating) — 80% up to 31 °C ,decreasing linearly to 50% at 40 °C
	Max. Operating altitude: 2000 m
	Equipment Type: Test and measuring
	Safety Class: Class I, grounded product (IEC1010-1)
	Overvoltage Category: CAT II (IEC1010-1)
	Polution Degree: Polution Degree 2, rated for indoor use only (IEC1010-1)
Installation Category Descriptions	Terminals on this product may have different installation category designations. The installation categories are:
	CAT III Distribution-level mains (usually permanently connected). Equipment at this level is typically in a fixed industrial location
	CAT II Local-level mains (wall sockets). Equipment at this level includes appliances, portable tools, and similar products. Equipment is usually cord-connected
	CAT I Secondary (signal level) or battery operated circuits of electronic equipment