



ZT4620 Series Specifications

Digital Storage Oscilloscope
VXI, PCI, PXI, and LXI

M - Class



Technical support is available from the ZTEC Support Center at www.ztecinstruments.com/support
Specifications are subject to change without notice. For the most recent specifications, download your product's manual at www.ztecinstruments.com/support



Browse our knowledgebase of programming examples & answers to frequently asked questions at www.ztecinstruments.com/support/kb

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Additional Resources

ZTEC Instruments, Inc. offers several hardware and software resources to use with the M-Class series. Please visit the website www.ztecinstruments.com for the latest information and versions. Detailed information is also available in the individual manuals. Resources include: ZScope® M-Class soft front panel, instrument drivers, cables and probes.

Terminology

Numeric Prefixes

When referring to large numeric values this manual will use SI (International System of Units) and IEC (International Electrotechnical Commission) standard prefixes.

Prefix	Multiplier
n (nano)	1/(1000x1000x1000)
μ (micro)	1/(1000x1000)
m (mili)	1/1000
k (kilo)	1000
M (Mega)	1000x1000
G (Giga)	1000x1000x1000
Ki (Kibi)	1024
Mi (Mebi)	1024x1024
Gi (Gibi)	1024x1024x1024

Acquisition

Sample Rate 10 S/s to 1 GS/s, non-interleaved real-time
 2.5 GS/s to 100 GS/s, equivalent-time

Any sample rate that is an integer multiple of an available sample rates can be created using interpolation.

Mode	Sample Rate
Real-Time	10 S/s
	25 S/s
	50 S/s
	100 S/s
	250 S/s
	500 S/s
	1 kS/s
	2.5 kS/s
	5 kS/s
	10 kS/s
	25 kS/s
	50 kS/s
	100 kS/s
	250 kS/s
	500 kS/s
	1 MS/s
	2.5 MS/s
	5 MS/s
	10 MS/s
	25 MS/s
50 MS/s	
100 MS/s	
250 MS/s	
500 MS/s	
1 GS/s	
Equivalent Time	2.5 GS/s
	5 GS/s
	10 GS/s
	25 GS/s
	50 GS/s
100 GS/s	

Acquisition 2-channel @ up to 1 GS/s real-time (ZT4628)
 4-channels @ up to 1 GS/s real-time (ZT4629)

Acquisition Re-Arm Time ≤ 10 μs

Total Memory Options ZT4628: 512 MiSamples
 ZT4629: 1 GiSamples

Maximum Record Length 256 MiSamples

Acquisition (cont')

Waveform Size

Acquisition Mode	Minimum Waveform Size	Maximum Waveform Size
Normal or Fast	10 Samples	256 MiSamples
All other modes	10 Samples	512 KiSamples

Maximum Segments 32 Ki waveforms @ ≤ 8 KiSamples

Vertical

Number of Channels ZT4628: Quantity 2
ZT4629: Quantity 4

Connectors BNC

Maximum Input (50 Ω) ± 5 Vrms, CAT I
Input load protection @ ± 6 VDC

Maximum Input (1 M Ω) ± 250 V [DC + peak AC (<10 kHz)], CAT I
Peak AC, de-rated 20 dB/decade above 10 kHz

Full Scale Input Range & Offset Adjust

Range	Full Scale	Offset
6.25 V/div to 1.251 V/div	50 Vpp to 10.008 Vpp	± 250 V
1.25 V/div to 251 mV/div	10 Vpp to 2.008 Vpp	± 50 V
250 mV/div to 51 mV/div	2 Vpp to 408 mVpp	± 10 V
50 mV/div to 1 mV/div	400 mVpp to 8 mVpp	± 2 V
Input Range Adjust Res.	Total Ranges	
8 mV	6250	

Table A1.45: ZT462x Input Voltage Range and Offset

Analog Bandwidth 50 Ω : DC to 500 MHz minimum (-3dB)
1M Ω : DC to 100 MHz minimum

Vertical (cont')

Analog Bandwidth, Probe	DC to 100 MHz minimum ZT6103 Passive X10 ³
Rise time ¹	700 ps
Slew Rate	2,000 V/μs
Impedance	1 MΩ 12 pF or 50 Ω
Impedance Accuracy	± 1%
DC Gain Accuracy	< ±1% full scale range
DC Offset Accuracy (+25 °C)	< ±(1% full scale range + 1% offset + 1 mV) (50Ω) < ±(1% full scale range + 1% offset + 5 mV) (1MΩ)
DC Offset Drift (per °C)	< ±0.1% full scale range/°C
Input VSWR (50 Ω)	≤ 1.4:1, DC to 500 MHz
Input Bias	≤ ±10 μA (50 Ω) ≤ ±1 nA (1 MΩ)
Coupling	DC, AC, or AC LF reject
AC Coupling	1.8 MHz high-pass (50 Ω) 90 Hz high-pass (1 MΩ)
Low Frequency Reject	450 Hz high pass (1 MΩ) 9 MHz high pass (50 Ω)
Analog Filter	30 MHz or Bypass Filter Stopband Rejection: approximately 3dB @ 30 MHz
Probe Attenuation	0.9 to 1000:1
RMS Noise	≤ (0.5% of full scale range + 350 μV) (50Ω Full Bandwidth) ≤ (0.5% of full scale range + 75μV) (50Ω + 30 MHz Filter) ≤ (0.5% of full scale range + 350 μV) (1MΩ Full Bandwidth) ≤ (0.5% of full scale range + 125 μV) (1MΩ + 30 MHz Filter)
Channel-to-Channel Isolation	DC to 100 MHz: ≥ 50 dB 100 MHz to 500 MHz: ≥ 40 dB
Digitizer Resolution	8 bits (0.390% of full scale) Up to 32 bits with averaging

Dynamic Range (1GS/s, 50Ω)

Input Range & Signal Frequency	Signal-to Noise Ratio (SNR)	Total Harmonic Distortion (THD)	Signal-to-Noise + Distortion (SINAD)
10 Vpp, 10.7 MHz	46.6 dBc	-53.0 dBc	45.7 dBc
1 Vpp, 10.7 MHz	47.9 dBc	-56.8dBc	47.4 dBc
10 Vpp, 101 MHz	39.5 dBc	-45.0 dBc	38.4 dBc
1 Vpp, 101 MHz	41.3 dBc	-46.9 dBc	40.2 dBc

Horizontal

Horizontal Position	Pre-Trigger: 0 to 100% of acquisition window Post-Trigger: 0 to 10,000*Gate Resolution ±1 sample interval position accuracy
Channel-to-Channel Skew	Channels at same input settings Channels 1-to-2: ≤ 100 ps Channels 3-to-4: ≤ 100 ps (ZT4442) Channels 1-to-3, 1-to-4, 2-to-3, 2-to-4: ≤ 200 ps (ZT4442)
Timebase Reference	10 MHz
Timebase Reference Source	Internal TCXO, External Input, Backplane (PXI, VXI), Timing Expansion Connector (PCI)
Internal TCXO Timebase	± 2.5 ppm accuracy
Timebase Output	External Output, Timing Expansion Connector Reference I/O (PCI)
Sweep Time Range ²	Minimum: 1.25 ns/div (12.5 ns total) Maximum: 10 s/div (100 seconds total)
Sweep Time Resolution	10ns to 10ms dependent on sweep points and sample rate
Skew Adjust	±10 μs channel-to-channel skew adjustment 1 sample interval resolution ±1 sample interval accuracy

Trigger

Sweep Modes	Auto or normal triggered
Trigger Source	Channels 1 to 2, Channels 3 to 4 (ZT4442), External Input, Pattern, Software, TTL Trigger 0-7, Star Trigger (PXI/PCI), ECL Trigger 0-1 (VXI)
Trigger Slope/Polarity	Positive or Negative

² Horizontal time range assumes 10 divisions for horizontal axis

Trigger (cont')

Trigger B	Qualify trigger on second source for edge trigger event
Trigger A Holdoff	Programmable delay after trigger A before recognizing next trigger A event
Trigger B Holdoff	Programmable delay after trigger A before recognizing trigger B event
Trigger A or B Holdoff Range	0 to 100 seconds
Trigger A or B Event Counter	Qualify trigger on N th trigger event, N = 1 to 65536
Trigger A Modes	Edge, Pattern, State, Pulse Width, Video
Trigger B Modes	Edge, Pattern
Edge Trigger Mode	Rising or falling edge
Pattern Trigger Mode	Pattern match true or false
Pattern Sources	Channels 1 to 2, Channels 3 to 4 (ZT4442), External Input, Pattern, Software, TTL Trigger 0-7, Star Trigger (PXI/PCI), ECL Trigger 0-1 (VXI)
State Trigger Mode	Edge event when pattern match true or false Pattern source used as Arm qualifier
Pulse Width Trigger Mode	Triggers on pulse width greater than, less than, within limits, or outside limits
Pulse Width Type	< limit1, > limit1, < limit1 & > limit2, > limit1 & < limit2
Pulse Width Limits	10 ns to 500 ms, 5ns resolution, ±5ns accuracy
Pulse Width Minimum	2 ns pulse width captured for < limit1
Video Trigger Mode	PAL (50 Hz), NTSC (60 Hz), SECAM (50 Hz) Standard, Field, Line selectable
Trigger Timestamp	100 ns resolution, 1 second rollover

Trigger, Analog Input

Analog Input Triggers	Channels 1 & 2, Channels 3 & 4 (ZT4442)
Trigger Level	(offset - full scale range/2) to (offset + full scale range/2)
Trigger Hysteresis	2.5% (overdrive required)
Trigger Level Resolution	0.025% of full scale range
Trigger Level Accuracy	±(2% full scale range + 5mV + offset accuracy)
Trigger Sensitivity	5% of full scale range (DC to 100 MHz) 10% of full scale range (> 100 MHz)

Trigger Bandwidth	DC to 300 MHz typical, 250 MHz minimum
Glitch Detection	≥ 500 ps glitch captured in edge trigger mode

External Input

Functionality	External Trigger, External 10 MHz Timebase Reference, or External Arm
Maximum Input	±5 V (DC + peak AC), CAT I
Threshold Adjustment	±2V
Threshold Accuracy	±20 mV
Threshold Resolution	0.5 mV
Input Impedance	1 MΩ 30 pF or 50 Ω
Impedance Accuracy	± 2%
Input Bandwidth	300 MHz typical 250 MHz minimum
Input Hysteresis	20 mV (overdrive required)
Connector	BNC (VXI, LXI) SMB (PCI, PXI)

External Output

Functionality	Trigger Output, 10 MHz Timebase Reference Output, Event Output, Programmable Clock Output, Programmable Pulse Output, Limit Test Successful, and 10 kHz Probe Compensation Output
Output Level	TTL Compatible into High Impedance (≥ 200 Ω) ± 24 mA Output Drive Capability
Output Enable	Tri-State Output Capability
Output Source	Arm Event, Trigger A Event, Trigger B Event, Trigger Complete Event, Capture Complete Event, Operation Complete Event, Master Summary Status event, Constant Level, Reference Clock, Programmable Clock, Programmable Pulse, Limit Test Successful Event, Probe Compensation
Output Event Pulse	Programmable from 50 ns to 0.163 seconds
Programmable Clock	Clock Period: 26.667 ns to 100 seconds 50% Duty Cycle
Programmable Pulse	Pulse Repetition Interval: 26.667 ns to 100 seconds Pulse Width: 26.667 ns
Probe Compensation	10kHz Clock which can be used to compensate probes

Limit Test Successful	1 μ s pulse after each capture upon limit or mask test success
Connector	BNC (VXI, LXI) SMB (PCI, PXI)

Event Outputs

Functionality	Event Output Signals
Outputs	TTL Trigger 0-7, ECL Trigger 0-1 (VXI) Timing Expansion Connector (PCI)
Source	Arm Event, Trigger A Event, Trigger B Event, Trigger Complete, Capture Complete, Operation Complete, Master Summary Status, Constant Level
Output Event Pulse	Programmable from 50 ns to 0.163 seconds

Arm

Functionality	Arm to qualify trigger event
Source	External Input, TTL Trigger 0-7, Star Trigger (PXI/PCI), ECL Trigger 0-1 (VXI), Software
Polarity	Positive or Negative

Measurements

Measurements	AC RMS, Amplitude, Average, Cycle Average, Cycle Frequency, Cycle Period, Cycle RMS, DC RMS, Duty Cycle High, Duty Cycle Low, ENOB, Number of Falling Edges, Fall Crossing Time, Fall Overshoot, Fall Preshoot, Fall Time, Frequency, High, Low, Maximum, Mid, Minimum, Peak-to-Peak, Period, Phase, Pulse Width Positive, Pulse Width Negative, Number of Rising Edges, Rise Crossing Time, Rise Overshoot, Rise Preshoot, Rise Time, SFDR, SINAD, SNR, Standard Deviation, THD, Time of Maximum, Time of Minimum
Edge Measurements	Nth edge selectable, N = 1 to 65535
Maximum Measurements	Nth maximum selectable, N = 1 to 100, Applies to Maximum and Time of Maximum measurements
Measurement Methods	Entire Waveform, Gated by Time, Gated by Points, Gated by Frequency, Gated by Cursors
Measurement Levels	Low, Mid, High reference levels for edge measurements set in absolute voltages or relative percentages
Cursors	Quantity 2 Horizontal & Vertical Axis Location Markers X, Y, Δ X & Δ Y Measurements
Measurement Lists	Quantity 4 Lists Up to eight measurements that are performed upon acquisition Stored for rapid measurement setup Measurement Trending History buffer of past measurement data stored in Calculate channel (See Calculate section.)

Measurement Accuracy	Delta DC Voltage \pm (DC gain accuracy)
Absolute DC Voltage	\pm [(DC gain accuracy)+(offset accuracy)]
Time	\pm (time resolution)
Frequency	\pm [1/(time resolution)]

Note: time resolution = one sample interval, one equivalent-time sample interval, or one interpolated-time sample interval (depending upon acquisition mode)

Reference Waveforms

Reference Channels	Quantity 4
Reference Storage	Non-volatile memory storage
Reference Size	32 KiSample maximum waveform size

Calculations

Calculate Channels	Quantity 4
Calculate Size	512 KiSample maximum waveform size
Calculate Data	32-bit resolution
Calculate Functions	Add, Subtract, Multiply, Copy, Invert, Integral, Derivative, Absolute Value, Limit Test, Mask Test, Frequency Transform, Time Transform, Histogram, Measurement Trending
Limit Test	Measurement Limit Range Testing or Waveform Mask Testing
Limit Test Reporting	Measurement maximum, minimum, average, current value, pass/fail counts
Frequency Transform	FFT Magnitude
FFT Windowing	Rectangular, Hamming, Hanning, Blackman, Flattop
FFT Data Format	Linear Magnitude, Logarithmic Magnitude, Phase, Real, Imaginary
Time Transform	Digital Infinite Impulse Response (IIR) filter
IIR Filter Type	Auto-generate: low-pass, 2 to 40 data point smoothing
Histogram	65536 bins for up to 16-bit histogram horizontal resolution
Measurement Trending	Historical waveform of past measurement data Provides trend data of 1 measurement point per capture

Data Processing & Download

Auto Scale	Automatic adjust to input signals: Input Range, Offset, Sample Rate, Trigger Source, and Trigger Level	
Waveform Download Mode	Normal:	every real-time data point
	Decimated:	every Nth real-time point (N = 2 to 100,000)
	Interpolated:	N points for every real-time point (N = 2 to 100), points interpolated by sin(x)/x reconstruction

Instrument Setup Storage

Reset	Non-volatile storage of default instrument setup configuration
Save & Recall	Non-volatile storage of 30 instrument setup configurations

PCI/PXI Data Interface

PCI Bus	33 MHz, 32 bit
PCI Data Transfer Rate	132 MByte/s burst up to 120 MByte/s sustained ³
PCI Voltage	Universal, +3.3V or +5V
PCI Compatibility	Version 2.2
PXI Compatibility	PXI Standard Slot and PXI Express Hybrid Slot Compatible
PXI Signals (XJ4 connector)	PXI_TRIGO-7 input/output selectable PXI_STAR input 10 MHz reference input Left and right side buses not used
Primary ID	3712 (0E80 ₁₆)

VXI Data Interface

Command Interface	A16 message-based servant, SCPI compatible
Interrupt Operation	Programmable interrupter, Level 1–7
Manufacturer ID	3712 (0E80 ₁₆)

³ Sustained transfer rates are dependent upon host system configuration.

LXI Data Interface

Command Interface	LAN 10/100, 1000 SCPI compatible
Manufacturer ID	3712 (0E80 ₁₆)

PXI XJ4 Trigger & Clock Pin Usage

Pin A5	PXI Trigger 3	(TTL level bi-directional)
Pin A6	PXI Trigger 2	(TTL level bi-directional)
Pin A7	PXI Trigger 1	(TTL level bi-directional)
Pin B5	PXI Trigger 4	(TTL level bi-directional)
Pin B7	PXI Trigger 0	(TTL level bi-directional)
Pin C5	PXI Trigger 5	(TTL level bi-directional)
Pin D6	PXI Star Trigger	(TTL level input)
Pin E5	PXI Trigger 6	(TTL level bi-directional)
Pin E6	PXI CLK10	(TTL level input)
Pin E7	PXI Trigger 7	(TTL level bi-directional)

PCI Timing Expansion Connector Pin Usage

Pin 1	Reference	(TTL level bi-directional)
Pin 3	Star Trigger	(TTL level bi-directional)
Pin 5	Trigger 7	(TTL level bi-directional)
Pin 7	Trigger 6	(TTL level bi-directional)
Pin 9	Trigger 5	(TTL level bi-directional)
Pin 11	Trigger 4	(TTL level bi-directional)
Pin 13	Trigger 3	(TTL level bi-directional)
Pin 15	Trigger 2	(TTL level bi-directional)
Pin 17	Trigger 1	(TTL level bi-directional)
Pin 19	Trigger 0	(TTL level bi-directional)

VXIbus P2 Trigger & Clock Pin Usage

Pin A1	ECLTRG0	(ECL level bi-directional)
Pin A3	ECLTRG1	(ECL level bi-directional)
Pin A23	TTLTRG0*	(TTL level bi-directional)
Pin A24	TTLTRG2*	(TTL level bi-directional)
Pin A26	TTLTRG4*	(TTL level bi-directional)
Pin A27	TTLTRG6*	(TTL level bi-directional)
Pin C1	CLK10+	(ECL level input)
Pin C2	CLK10-	(ECL level input)
Pin C23	TTLTRG1*	(TTL level bi-directional)
Pin C24	TTLTRG3*	(TTL level bi-directional)
Pin C26	TTLTRG5*	(TTL level bi-directional)
Pin C27	TTLTRG7*	(TTL level bi-directional)

LED Indicators

Ready(RDY)	OFF: Hardware failure ON: Unit has passed power-up self-diagnostics TOGGLE: unit has an error pending in error queue
Host(HST/LAN)	OFF: Interface fault ON: Normal interface operation TOGGLE: device identify command received
Trigger(TRG)	OFF: trigger event not detected ON/PULSE: trigger complete event detected
Active(ACT)	OFF: Instrument Idle ON/PULSE: Data acquisition initiated
1588 Clock Status (LXI only)	OFF: IEEE 1588 clock not synchronized or fault ON: clock locked as IEEE 1588 slave TOGGLE @ 1s: clock synchronized as IEEE 1588 master TOGGLE @ 2s: clock synchronized as IEEE 1588 grand master
Power (PWR, LXI only)	ON: Instrument is powered on OFF: Instrument is powered off

Status Reporting

IEEE-488.2 Device Status	Reporting Structure including Status Byte, Standard Event Registers, Questionable Registers, Operation Registers
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Identification

Secondary ID	PCI/PXI: 4620 (1130 ₁₆) VXI/LXI: 4620 (1B8 ₁₆)
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Power

Power Supplies

Product Option	Platform	Voltage	Typical Current	Maximum Current
ZT4628	PCI or PXI	+3.3 VDC	4.4 A	6.4 A
		+5 VDC	1.1 A	2.1 A
		+12 VDC	0.0 A	0.0 A
		-12 VDC	0.0 A	0.0 A
	VXI	+5 VDC	4.0 A	6.1 A
		+12 VDC	0.0 A	0.0 A
		+24 VDC	0.0 A	0.0 A
		-2 VDC	0.02 A	0.05 A
		-5.2 VDC	0.5 A	0.7 A
		-12 VDC	0.0 A	0.0 A
LXI	115 VAC	0.22 A	0.33 A	
ZT4629	VXI	+5 VDC	7.1 A	10.9 A
		+12 VDC	0.0 A	0.0 A
		+24 VDC	0.0 A	0.0 A
		-2 VDC	0.02 A	0.05 A
		-5.2 VDC	0.8 A	1.2 A
		-12 VDC	0.0 A	0.0 A
		-24 VDC	0.0 A	0.0 A
	LXI	115 VAC	0.38 A	0.58 A

Total Cooling & Power Consumption

Product Option	Platform	Typical Cooling & Power	Maximum Cooling & Power
ZT4628	PCI or PXI	20.3 W	20.3 W
	VXI	22.5 W	22.5 W
	LXI	25.0 W	25.0 W
ZT4629	VXI	39.4 W	39.4 W
	LXI	43.8 W	43.8 W

AC Power (LXI)

Line Voltage	90-264 VAC, 47-63 Hz, automatic selection
Input Protection	AC line fuse, 250 VAC, 2.0 A, fast-acting
Harmonic Distortion	Meets EN61000-3-2
Surge Withstand	Meets EN61000-4
EMI Filtering	CISPR 11 and 22 and FCC Part 15 Class B (conducted)

Physical

PCI Physical size	Single-Slot Short PCI Card 7.65" x 0.85" x 4.97" (LxWxH) 19.43 cm x 2.16 cm x 12.62 cm (LxWxH)
PXI Physical size	Single-Wide 3U CompactPCI/PXI Instrument 8.25" x 0.79" x 5.25" (LxWxH) 22.23 cm x 2.01 cm x 13.34 cm (LxWxH)
VXI Physical size	Single-Wide C-size VXIbus Instrument 14.45" x 1.20" x 10.35" (LxWxH) 36.70 cm x 3.05 cm x 26.29 cm (LxWxH)
LXI Physical size	Half-Width 1U LXI Instrument 13.35" x 7.25" x 1.75" (LxWxH) 33.91 cm x 18.42 cm x 4.45 cm (LxWxH)
PCI Weight	12.3 oz or 349 g
PXI Weight	12.3 oz or 349 g
VXI Weight	2.82 lbs or 1.28 kg (ZT4628) 3.11 lbs or 1.41 kg (ZT4629)
LXI Weight	4.48 lbs or 2.03 kg (ZT4628) 4.77 lbs or 2.16 kg (ZT4629)

Operating and Storage Conditions

Temperature Range

Operating	0 °C to +50 °C Ambient
Storage	-40 °C to +75 °C
Over-Temperature	Automatic shutdown if internal temperature exceeds +70 °C
Calibration Range	+20 °C to +30 °C Ambient, after a 20 minute warm-up period, to meet all calibration specification accuracies.

Relative Humidity

Operating or Storage	10 to 90%, non-condensing, up to +40 °C
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Altitude

Operating	Up to 3,000 m Up to 5,000 m with Maximum Input (1 M Ω) of \pm 100 V
Storage	Up to 15,000 m

Safety

This product is designed to meet the requirements of the following standard of safety for electrical equipment for measurement, control and laboratory use:

EN 61010-1

Electromagnetic Compatibility

CE Marking EN 61326-1:1997 with A1:1998 and A2:2001 Compliant

FCC Part 15 (Class A) Compliant

Emissions

EN 55011	Radiated Emissions, ISM Group 1, Class A, distance 10 m, emissions < 1 GHz
EN 55011	Conducted Emissions, Class A, emissions < 30 MHz Immunity
EN 61000-4-2	Electrostatic Discharge (ESD), 4 kV by Contact, 8 kV by Air
EN 61000-4-3	RF Radiated Susceptibility, 10 V/m
EN 61000-4-4	Electrical Fast Transient Burst (EFTB), 2 kV AC Power Lines
EN 61000-4-5	Surge
EN 61000-4-6	Conducted Immunity
EN 61000-4-8	Power Frequency Magnetic Field, 30 A/m
EN 61000-4-11	Voltage Dips and Interrupts

CE Compliance

This product meets the necessary requirements of applicable European Directives for CE Marking as follows:

73/23/EEC	Low Voltage Directive (Safety)
89/336/EEC	Electromagnetic Compatibility Directive (EMC)

See Declaration of Conformity for this product for additional regulatory compliance information.

LXI Conformance

This product's LXI models are conformant to the LXI Consortium's Functional Class C, Revision 1.2