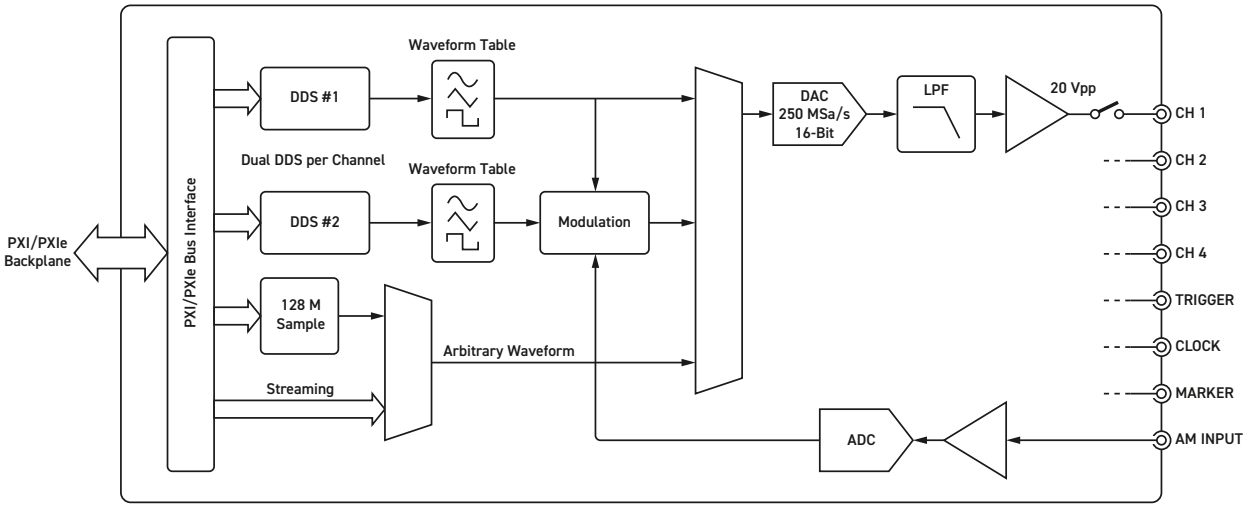
PXI/PXIe Arbitrary Waveform Generator 41/43-621

- Available as PXI or PXIe Modules
- 2 or 4 Channels in one 3 U Slot
- Streaming Arbitrary Waveform
- 20 Vpp DC - 20 MHz, Full Amplitude
- 20 MHz - 40 MHz, Reduced Amplitude
- 250 MSa/s, 16-bit DAC per Channel
- 128 MSample Buffer per Channel
- Sweep / FSK / RFSK / PSK / Chirp / AM / FM / PSK / PWM / OOK
- 1 µHz Frequency Resolution
- 1 ppm (typical) On-board Reference Clock
- Front Panel & PXI Trigger Support
- Kernel & VISA Drivers, LabVIEW, Python, C# API Plus Soft Front Panel
- PXI Version Supported by PXI/e or LXI/USB Chassis
- 3 Year Warranty



The 41-621 (PXI) and 43-621 (PXIe) are compact 2 or 4 channel waveform generators in 3 U single slot modules. They are capable of generating sine waves to 40 MHz with 1 µHz frequency resolution referenced to the 10 MHz PXI clock, a 1 ppm internal clock or to an external standard. Each channel can output common waveform types such as Sine, Square, Triangle, and Ramping, as a single tone or in sweep mode from µHz to MHz.

Waveforms are generated using continuous phase DDS and a 16-bit DAC with an update rate of 250 MSa/s, per channel. Sweep mode allows for linear ramping of frequency or a more complex, non-linear ramp that is user defined, supporting complex Chirp waveforms. Common modulation techniques and custom waveforms are supported.



Functional Diagram for the 41/43-621 Arbitrary Waveform Generator

Issue 1.0 October 2026

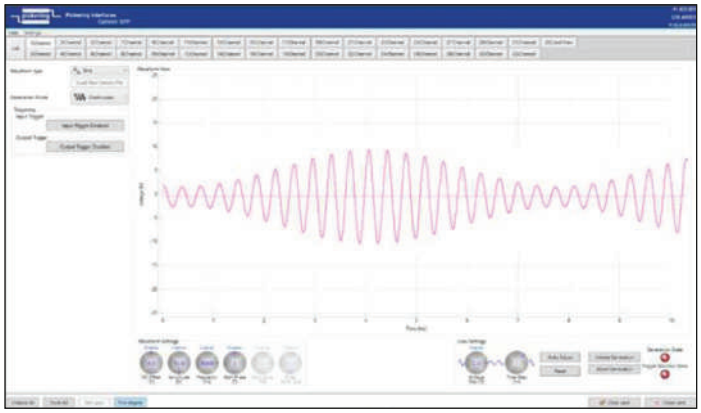
Arbitrary waveforms can be loaded into the internal 128 M sample memory, per channel, allowing emulation of many signal types, including the typical waveforms of automotive and aerospace sensors. Waveforms are easily created, using Excel or similar tools, and loaded into each channel's memory. Waveforms are then converted by the DAC at a programmable conversion rate, up to 250 MSa/s. Waveform streaming from disk is also supported, per channel, at rates up to 1 MSa/s aggregate.

Each channel can be amplitude modulated from a single AM input connector to allow independent time varying output levels to be produced. Frequency modulation, Phase modulation, FSK, and PSK are available, per channel, with a user defined pattern.

All channels can be synchronized and phase aligned. Channels on multiple cards can also be synchronized and phase aligned using the external clock and trigger inputs or the PXI backplane triggers.

PXI trigger functions are supported allowing events from other instruments to initiate waveform generation or sweeps.

The supplied soft front panel allows quick generation of common waveforms and the importing of external waveforms. It also supports swept modes of operation.



Example Soft Front Panel for the 41/43-621 Arbitrary Waveform Generator

Specification - DDS Mode

DAC Conversion:	250 MSa/s
Waveforms:	Sine (40 MHz), Square/Triangle/Sawtooth (20 MHz), Custom
Adjustment:	Amplitude[5], Offset[5], Frequency, Duty Cycle[4] can be adjusted at any time.
Modulation[1]:	AM with external input or internal waveform, programmable % modulation. FM[2] with internal waveform. FSK (Frequency Shift Keying) with external input or internal waveform. Ramped FSK with external input or internal waveform. PSK (Phase Shift Keying) with external input or internal waveform. PWM with external input or software control. OOK (On/Off Keying) with external input or internal waveform. Chirp[2] with external input or internal waveform. Custom[3] with two internal waveforms multiplied or added.
Sweep:	Linear (Up, Down, programmable time). AM with swept carrier or swept modulator. Custom (512 entry table of frequency and dwell time).
Trigger Options:	Edge, Level, software, front panel, PXI_TRIG. Start, pause, stop, reset to phase zero.
Marker:	Marker output can indicate phase or sample clock (divided by 2 or 25).

Notes:
1. Each channel has 2 DDS waveform generators to generate both carrier and modulating waveforms.
2. FM and Chirp are done by defining frequencies (up to 40 MHz) and dwell times (50 ns to 42 s) in a 512-entry table. An external input can then reset the table to the first entry or hold at current entry.
3. Each channel can define 2 different waveforms (function, frequency, amplitude) that are then multiplied or added.
4. Duty Cycle can be adjusted at any time – for rectangular/square/triangle waves only.
5. Amplitude and Offset can be independently adjusted with 16-bit precision.

Specification - ARB Mode

DAC Conversion[1]:	0.058 Sa/s to 250 MSa/s
Waveform Memory:	128 MSa/ch 16 kSample Minimum 128 MSample Maximum
Waveforms[2]:	Arbitrary waveform, each 16-bit sample defines a voltage: -10 V to +10 V
Trigger Options:	Edge, Level, software, front panel, PXI_TRIG. Start, pause, stop, reset to phase zero.
Marker:	Marker output can indicate sample number or sample clock[3]

Notes:
1. Programmable as 250 MSa/s / N, N = 32-bit integer.
2. All channels in arbitrary mode must be stopped when updating any channel with a new arbitrary waveform. Any channel in DDS mode can continue to run without interruption.
3. The marker is taken high on one sample number and taken low on another sample number. The marker can also be driven with the sample conversion rate divided by 2 or divided by 25.

Specification - Output

Range:	-10 V to +10 V (Open) -5 V to +5 V (50 Ω)
Output Type:	Single-ended, Shell GND
DAC Resolution:	16-bits
Voltage Resolution[1]:	< 344 µV typical
DC Accuracy[2]:	± 0.55 % of setting ± 5 mV
DC Stability[5]:	± 2 mV
AC Accuracy[2]:	± 0.2 % typical, < 100 kHz
Temp Coefficient[6]:	Offset: 1.6 mV/°C typical Gain: 0.003 %/°C typical
Output Impedance:	50 Ω
Slew Rate[3]:	4 kV/µs typical
Output Current[4]:	100 mA max
Capacitive Load:	100 pF max

Notes:
1. Calibration dependent.
2. No load, 20 min warm up, 21 °C ±5 °C, excludes noise, with autozero applied.
3. Less than 10 % overshoot/undershoot, 100 MHz LPF path.
4. Channel will be automatically turned off if exceeded.
5. Temperature ± 2 °C, consistent air flow, apply autozero after unit is operating and thermally stable.
6. Without applying autozero.

Specification - Frequency

Range[4]:	DC to 40 MHz
Resolution:	< 1 uHz (DDS Mode)
Accuracy[1,3]:	1 ppm typical 3 ppm maximum
Jitter[1,2]:	2 ps RMS typical
Clock Sources:	On board oscillator, PXI_CLOCK10, Front panel Clock input

Notes:
1. On-board oscillator is 250 MHz.
2. 20 kHz to 20 MHz band.
3. 21 °C ±5 °C.
4. Output period has deterministic cycle to cycle timing variation when not an integer multiple of 4 ns.

Specification - Clocking, Trigger, Modulation

Clock/Trigger/ Marker[3]:	Front panel SMB Input or Output 50 Ω 5 V CMOS (Vil <1.5 V, Vih >3.5 V) -0.5 V to +5.5 V maximum input 50 mA maximum output 50 ns minimum input pulse width
AM Input[1]:	Front panel SMB ± 5 V Analog Input ± 20 V Maximum overvoltage 200 kΩ input impedance DC to 100 kHz bandwidth -70 dBc THD at 1 kHz -61 dBc THD at 10 kHz 3.5 µs typical delay
Trigger Inputs:	Front Panel SMB, PXI_TRIG on backplane Software, Marker from any channel 440 ns typical latency from SMB 8 ns typical jitter
Trigger Outputs:	Front Panel SMB, PXI_TRIG on backplane
Trigger Options:	Start, Stop, Reset[2] Waveform Immediate Rising and Falling Edge, Level N-Shot Mode Auto-Rearm
Marker Accuracy:	± 20 ns 20 ns minimum output pulse width

Notes:
1. The AM Input is digitized at 1 MSa/s (12-bit) and then interpolated to 250 MSa/s (16-bit) for modulation in the digital domain. Offset and gain are adjustable.
2. Resetting a waveform sets phase back to 0 degrees (DDS Mode) or the first sample (ARB Mode).
3. When any of the digital inputs are use to modulate a waveform, there is a typical delay of 440 ns.

Specification - Throughput

DDS Mode:	250 MSa/s x 4 channels
ARB Mode:	250 MSa/s x 4 channels when waveform is uploaded to module 1 MSa/s aggregate, 43-621, streaming 1 MSa/s aggregate, 41-621, streaming

Specification - Typical AC Characteristics

Passband Flatness:	± 0.5 dB DC to 20 MHz Rolloff of -2.2 dB at 40 MHz, see curve
Total Harmonic Distortion[1,2]:	-78 dBc, up to 100 kHz -73 dBc, up to 1 MHz -55 dBc at 10 MHz -50 dBc at 20 MHz -38 dBc at 40 MHz
Spurious Free Dynamic Range[2,3]:	80 dBc, up to 1MHz 70 dBc at 10MHz 70 dBc at 20MHz 70 dBc at 40MHz
Noise:	1.9 mV rms
Crosstalk:	-100 dB, DC to 40 MHz

Notes:
1. Full scale (20 Vpp) except 40 MHz (15 Vpp), first 7 harmonics, no load, 20 min warm up.
2. 64 k point FFT, Blackman-Harris window, 60 MHz LPF path.
3. SFDR excludes harmonics.

Power Requirements - 41-621

+3.3 V	+5 V	+12 V	-12 V
3 A	2.5 A	0.5 A	0

Power Requirements - 43-621

+3.3 V	+12 V
3 A	1.5 A

Mechanical Characteristics

41-621 - Single slot 3U PXI (CompactPCI card).
43-621 - Single slot 3U PXIe, compatible with PXIe hybrid slot.

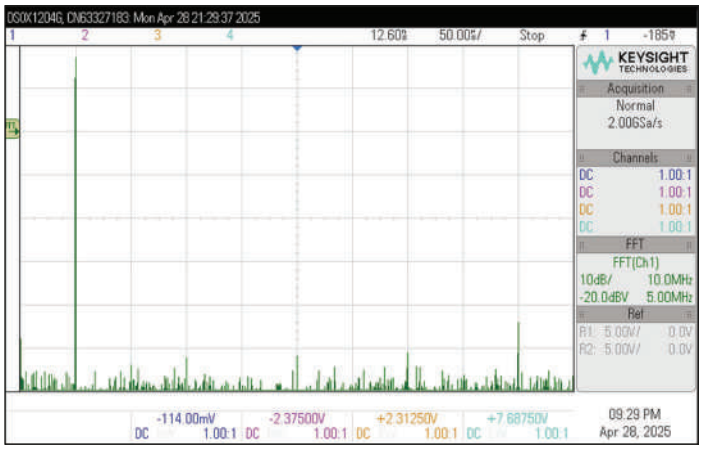
Module weight: <500 g

3D models for all versions in a variety of popular file formats are available on request.

Connectors

41-621 - PXI bus via 32-bit P1/J1 backplane connector.
43-621 - PXIe bus via XJ3 and XJ4 backplane connectors.

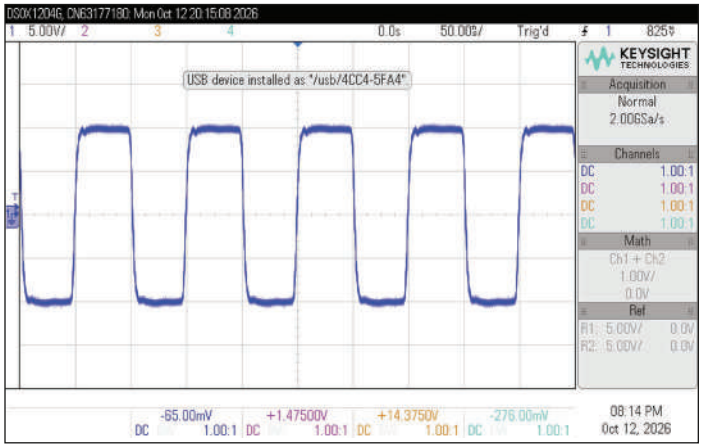
Front panel signals via SMB jacks with male pin connectors.



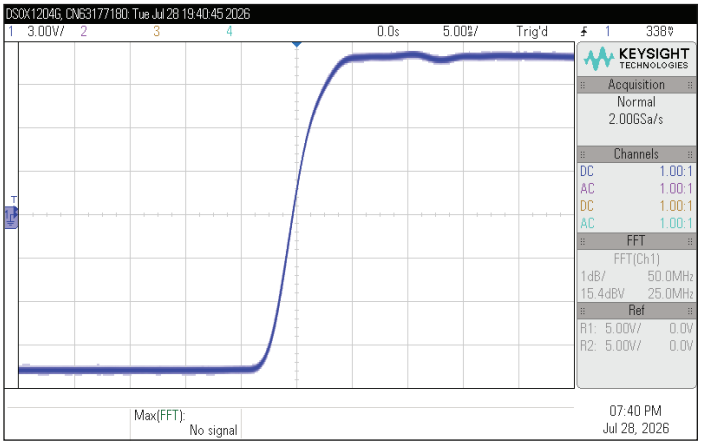
FFT of full scale 1 MHz sine wave



Amplitude rolloff near 40 MHz, 1 dB/div



Full scale, 20 Vpp Square Wave at 10 MHz



Full scale, 20 Vpp Slew Rate

Operating/Storage Conditions

Operating Temperature:	0 °C to +55 °C
Humidity:	10 to 90 % non-condensing
Storage/Transport Temperature:	-20 °C to +70 °C
Humidity:	10 to 90 % non-condensing

PXI & CompactPCI Compliance - 41-621

The module is compliant with the PXI Specification 2.2. Local Bus is not implemented. Uses a 33 MHz 32-bit backplane interface.

PXIe Compliance - 43-621

The module is compliant with the PXIe Specification 1.0. Local Bus and Differential Star Triggers are not implemented.

Safety & CE Compliance

All modules are fully CE compliant and meet applicable EU directives:

Low-voltage safety EN61010-1:2010,
EMC Immunity EN61326-1:2013,
Emissions EN55011:2009+A1:2010.



43-621 Waveform Generator Module in PXIe Format

Product Order Codes

PXI Arbitrary Waveform Generator, 4 Channel	41-621-004
PXI Arbitrary Waveform Generator, 2 Channel	41-621-002
PXIe Arbitrary Waveform Generator, 4 Channel	43-621-004
PXIe Arbitrary Waveform Generator, 2 Channel	43-621-002

Product Customization

Pickering modules are designed and manufactured on our own flexible manufacturing lines, giving complete product control and enabling simple customization to meet very specific requirements.

All customized products are given a unique part number, fully documented and may be ordered at any time in the future. Please contact your local sales office to discuss.

Support Products

Mating Connectors & Cabling

For connection accessories for the 41/43-621 module please refer to the 90-011D RF Cable Assemblies data sheet where a complete list and documentation can be found for accessories.

Chassis Compatibility

The PXI versions of this module are compatible with the following chassis types:

- All chassis conforming to the 3U PXI and 3U Compact PCI (cPCI) specification
- Legacy and Hybrid Peripheral slots in a 3U PXI Express (PXIe) chassis
- Pickering Interfaces LXI or LXI/USB Modular Chassis

The PXIe versions of this module are compatible with the following chassis types:

- All chassis conforming to the 3U PXIe specification
- PXIe and Hybrid Peripheral slots in a 3U PXI Express (PXIe) chassis

Chassis Selection Guide

PXI and PXIe (with PXIe and/or Hybrid slots) Chassis from any Vendor:



- Mix our 1000+ PXI/PXIe switching & simulation modules with any vendor's PXI/PXIe instrumentation
- Embedded or remote Windows PC control
- Real-time Operating System Support
- High data bandwidths, especially with PXI Express
- Integrated module timing and synchronization

Pickering LXI or LXI/USB Modular Chassis Only accept our PXI Switching & Simulation Modules:



- Choose from 1000+ Pickering PXI Modules
- Ethernet or USB control enables remote operation
- Low-cost control from practically any controller
- LXI provides manual control via Web browsers
- Driverless software support
- Power sequencing immunity
- Ethernet provides chassis/controller voltage isolation
- Independence from Windows operating system

Connectivity Solutions



We provide a full range of supporting cable and connector solutions for all our switching products—20 connector families with **1200+** products. We offer everything from simple mating connectors to complex cables assemblies and terminal blocks. All assemblies are manufactured by Pickering and are guaranteed to mechanically and electrically mate to our modules. These accessories are detailed in Connector Accessories data sheets, where a complete list and documentation can be found for each accessory.



Connectors & Backshells



Multi-way Cable Assemblies



RF Cable Assemblies



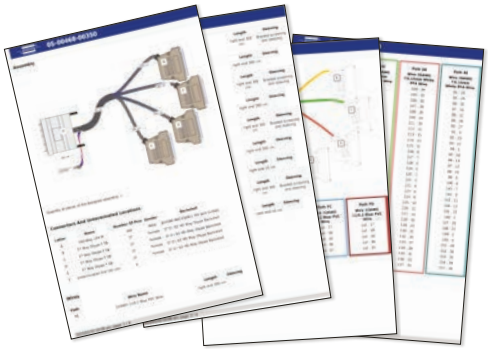
Breakouts



Connector Blocks

We also offer customized cabling and have a free online **Cable Design Tool** that can be used to create custom cable solutions for many applications.

- Fully supported on modern browsers and tablet operating systems.
- Built-in tutorials and videos allow you to get quickly up to speed.
- Store cable assemblies in the Cloud and develop over time.
- Each cable design has a downloadable PDF documentation file detailing all specifications



Start designing your custom cabling, go to pickeringtest.com/cdt

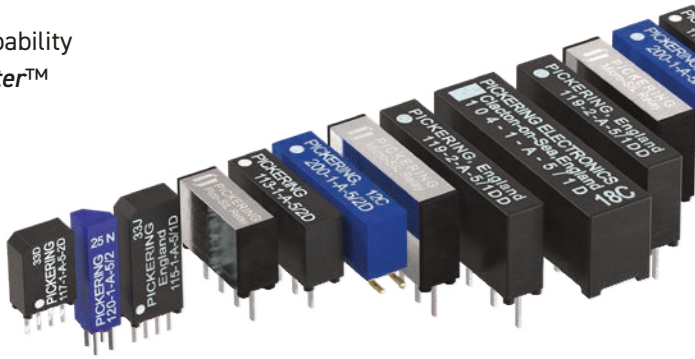
Mass Interconnect

We recommend the use of a mass interconnect solution when an Interchangeable Test Adapter (ITA) is required for PXI/LXI based test systems. Our modules are fully supported by Virginia Panel and MacPanel.

Pickering Reed Relays

We are the only switch provider with in-house reed relay manufacturing capability via our Relay Division. These instrument grade reed relays feature ***SoftCenter***™ technology, ensuring long service life and repeatable contact performance.

To learn more go to pickeringrelay.com



Programming

Pickering provide kernel, IVI and VISA (NI & Keysight) drivers which are compatible with all Microsoft supported versions of Windows and popular older versions.

For more information go to pickeringtest.com/os

The VISA driver support is provided for LabVIEW Real Time Operating Systems (Pharlap and Linux-RT). For other RTOS support contact Pickering. These drivers may be used with a variety of programming environments and applications including:

- **Pickering Interfaces Switch Path Manager**
- **National Instruments** products (LabVIEW, LabWindows/CVI, Switch Executive, MAX, TestStand, VeriStand, etc.)
- **Microsoft Visual Studio** products (Visual Basic, Visual C++)
- **Programming Languages** C, C++, C#, Python
- **Keysight** VEE and OpenTAP
- **Mathworks MATLAB, Simulink**
- **Marvin** ATEasy
- **MTQ Testsolutions** Tecap Test & Measurement Suite

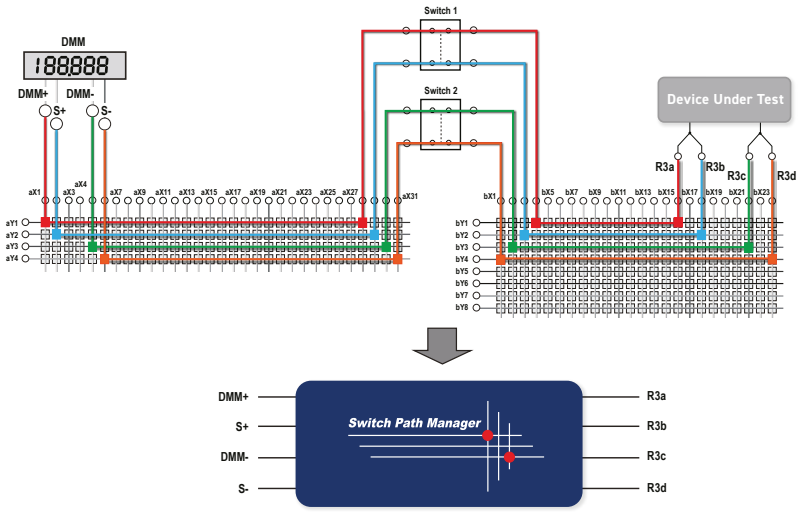
Drivers for popular Linux distributions are available, other environments are also supported, please contact Pickering with specific enquiries. We provide Soft Front Panels (SFPs) for our products for familiarity and manual control, as well as comprehensive documentation and example programs to help you develop test routines with ease.

To learn more about software drivers and development environments go to pickeringtest.com/software

Signal Routing Software

Our signal routing software, Switch Path Manager, automatically selects and energizes switch paths through Pickering switching systems. Signal routing is performed by simply defining test system endpoints to be connected together, greatly accelerating Test System software development.

To learn more go to pickeringtest.com/spm



Diagnostic Relay Test Tools

eBIRST Switching System Test Tools are designed specifically for our PXI, PCI or LXI products, these tools simplify switching system fault-finding by quickly testing the system and graphically identifying the faulty relay.

To learn more go to pickeringtest.com/ebirst



Three Year Warranty & Guaranteed Long-Term Support

All standard products manufactured by Pickering Interfaces are warranted against defective materials and workmanship for three years from the date of delivery to the original purchaser. Extended warranty and service agreements are available with various levels for your requirements. Although we offer a 3-year warranty as standard, we also include guaranteed long-term support—with a history of supporting our products for typically 15-20 years.

To learn more go to pickeringtest.com/support

Available Product Resources

We have a library of resources including success stories, product and support videos, articles and white papers as well as application-specific brochures to assist you. We have also published reference books on switching technology and the PXI and LXI standards.

To view, download or request any of our product resources go to pickeringtest.com/resources



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