PRODUCT DATA

3-ch. Bridge Input Module LAN-XI 102.4 kHz Type 3057-B-030

Bridge Input Module Type 3057-B-030 is a three-channel 102.4 kHz LAN-XI module intended primarily for dynamic measurements using PULSE Reflex™, piezoresistive and variable-capacitance accelerometers and pressure sensors. The module also supports strain gauges – full, half and quarter-bridge – as well as strain-gauge-based transducers such as force, pressure and torque sensors. Direct input and CCLD transducers are also supported.

Type 3057 contains a built-in bridge excitation supply which can be configured either as a 0 – 10 V constant voltage source with optional remote sensing, or as a 0 – 25 mA constant current source.

The module has additional support for CCLD transducers, including microphones and accelerometers for general sound and vibration measurements.

Type 3057 can be combined with other LAN-XI modules across a network or in LAN-XI frames to create very compact high-channel systems. The individual modules have a very rugged industrial design that is perfect for use in the field, and at the same time are plug and play modules that you can easily reconfigure in different setups for maximum flexibility and return on investment.

Uses and Features

Uses

- High-frequency sound and vibration measurements
- High-energy impact measurements
- Shock testing and pyroshock testing (satellites and launchers)
- Vibration testing (blade resonances in gas turbines)
- Pressure testing (wind tunnel or gas turbines, flight test)
- Sound pressure testing (wind tunnel, with microphones or pressure sensors)
- Strain gauge measurements
- Measurement front-end module for PULSE Reflex™
- Single-module measurements
- Multi-module measurement/distributed system

Features

- 102.4 kHz measurement bandwidth, 262 ksample/s sampling rate
- Dyn-X technology input channels, 160 dB input range
- Built-in excitation supply for bridge sensors
- Built-in quarter-bridge and half-bridge completion
- Built-in shunt calibration
- Built-in Constant Current Line Drive (CCLD) supply to power accelerometers, microphones and tacho probes
- Interchangeable front panel – sub-D for bridge measurements
- Individual monitor outputs for each input channel (available on sub-D connector)
- LAN interface allows the front end to be close to the test object, reducing the transducer cable length
- Extremely low noise floor, with optional 316 mV_{peak} super-low-noise input range setting
- Flexible power options when used as a single module: mains, DC, battery and PoE (IEEE 802.3af)
- Fanless for silent operation when used as a single module
- Automatic configuration with TEDS (IEEE 1451.4) transducers
- Robust casing for industrial and hard everyday use
- Display on each module's front panel:
  - Simplifies system configuration and reduces the time for setting up a measurement system
  - Provides module status information on self-test and error conditions

Brüel & Kjær

Description

Bridge Module Type 3057-B-030 is a low-noise data acquisition unit designed for dynamic measurements with bridge transducers at frequencies from DC to 102.4 kHz.

Type 3057 is part of the family of Brüel & Kjær LAN-XI Data Acquisition Hardware, a versatile system of modular hardware that can be used as a stand-alone, single-module front ends, as part of a distributed module setup, or collected in 5- or 11-module frames.

The module has a true differential input and can be used with transducers providing a differential output, including piezoresistive bridge accelerometers and pressure sensors, variable-capacitance accelerometers, and strain-gauge setups based on the Wheatstone bridge topology. Furthermore, dynamic strain gauges (single constant-current-fed strain gauges) can be connected for AC strain measurements with minimum mounting and cabling effort. The module supports CCLD transducers, including microphones and accelerometers for general sound and vibration measurements, as well as laser tachometers. The module can also be used for differential or single-ended voltage measurements in general.

Type 3057 has a built-in excitation supply for bridge transducer applications, individual for each measurement channel and configurable either as a 0 – 10 V constant voltage source, or as a 0 – 25 mA constant current source. In the voltage-source mode, you can use remote sensing of the excitation level for minimum loss of signal with longer cable runs, using either one- or two-wire sensing. CCLD transducers are powered from a 4.5 mA constant current source.

The module has built-in bridge completion for half-bridges and for 120 Ω, 350 Ω, and 1 kΩ quarter-bridges. The completion resistors are protected against over-dissipation. The module also has a fixed built-in 50 kΩ shunt calibration resistor, which can be connected to any arm of the bridge. Initial DC output from the bridge due to resistive imbalance or static preloads can be removed by the built-in nulling functionality which is implemented as an offset-voltage adjustment. All bridge conditioning features are fully software configurable.

Type 3057 comes with LAN-XI Bridge Front Panel UA-2121-030 featuring sub-D input connectors for easy connection of bridge transducer cables. Non-standard bridge-completion resistors can be connected in the transducer cable connector. Fig. 1 shows the pinout of the sub-D front panel.

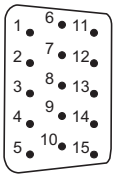


Fig. 1
Sub-D connector pinouts of UA-2121-030 (front view)

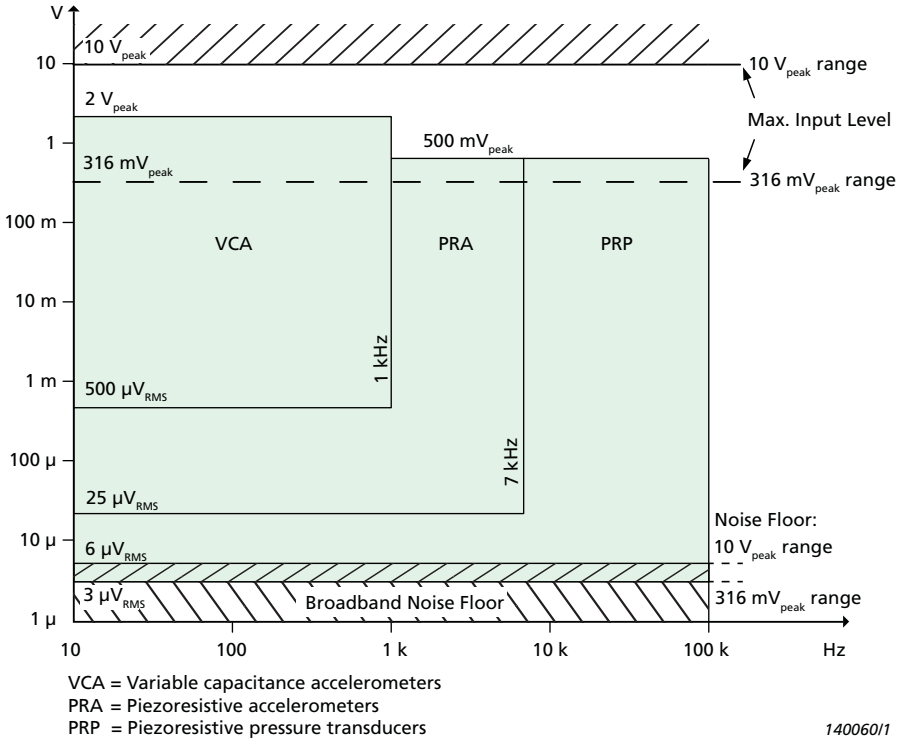
1	Cal1	Shunt calibration resistor, terminal 1
2	Exc–	Bridge excitation return
3	Exc+	Bridge excitation output
4	Not used	
5	In+	Non-inverting input
6	TEDS	TEDS communication
7	RS–	Remote sense low side
8	RS+	Remote sense high side
9	For future use	
10	In–	Inverting input
11	Cal2	Shunt calibration resistor, terminal 2
12	QB midpoint	Midpoint of quarter bridge completion (tied to Exc+ via completion resistor)
13	Mon–	Monitor return
14	Mon+	Monitor output
15	GND	Analogue ground
Shield	GND	Analogue ground

Type 3057 has a maximum input range of ±10 V_{peak} with a corresponding broadband noise floor of approximately 6 µV at 102.4 kHz measurement bandwidth.

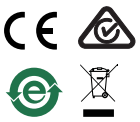
Fig. 2 illustrates how a range of typical bridge sensor types fit into the dynamic range of the module.

The module offers a special ultra-low-noise setting with ±316 mV_{peak} input range, in which the noise floor drops by approximately 6 dB for measurements of low-level signals.

Fig. 2
Dynamic ranges for typical bridge transducers



Compliance with Standards

	The CE marking is the manufacturer's declaration that the product meets the requirements of the applicable EU directives RCM mark indicates compliance with applicable ACMA technical standards – that is, for telecommunications, radio communications, EMC and EME China RoHS mark indicates compliance with administrative measures on the control of pollution caused by electronic information products according to the Ministry of Information Industries of the People's Republic of China WEEE mark indicates compliance with the EU WEEE Directive
Safety	EN/IEC 61010–1 and ANSI/UL 61010–1: Safety requirements for electrical equipment for measurement, control and laboratory use
EMC Emission	EN/IEC 61000–6–3: Generic emission standard for residential, commercial, and light-industrial environments CISPR 22: Radio disturbance characteristics of information technology equipment. Class B Limits
EMC Immunity	EN/IEC 61000–6–1: Generic standards – Immunity for residential, commercial and light industrial environments EN/IEC 61000–6–2: Generic standards – Immunity for industrial environments EN/IEC 61326: Electrical equipment for measurement, control and laboratory use – EMC requirements **Note:** The above is only guaranteed using accessories listed in this Product Data
Temperature	IEC 60068–2–1 & IEC 60068–2–2: Environmental Testing. Cold and Dry Heat Ambient Operating Temperature: –10 to +55 °C (14 to 131 °F) Storage Temperature: –25 to +70 °C (–13 to +158 °F)
Humidity	IEC 60068–2–78: Damp Heat: 93% RH (non-condensing at 40 °C (104 °F))
Mechanical (non-operating)	IEC 60068–2–6: Vibration: 0.3 mm, 2 g, 10 – 500 Hz IEC 60068–2–27: Shock: 100 g IEC 60068–2–29: Bump: 1000 bumps at 25 g
Enclosure	IEC 60529: Protection provided by enclosures: IP 31

EFFECT OF RADIATED AND CONDUCTED RF, MAGNETIC FIELD AND VIBRATION
Radiated RF: 80–2700 MHz, 80% AM 1 kHz, 10 V/m
Conducted RF: 0.15–80 MHz, 80% AM 1 kHz, 10 V
Magnetic Field: 30 A/m, 50 Hz
Vibration: 5–500 Hz, 12.7 mm, 15 m/s^2

Noise Floor During Specified Test:

Input	Radiated RF	Conducted RF	Magnetic Field
Bridge	<60 µV	<20 µV	<60 µV
Direct	<60 µV	<20 µV	<60 µV

Measured with shorted input. All values are rms in 102.4 kHz bandwidth. Conducted RF immunity on all channels is only guaranteed using an external connection from measuring ground to chassis terminal

Specifications – LAN Interface

CONNECTOR
Modules: RJ 45 (10baseT/100baseTX) connector complying with IEEE 802.3 100baseX. Individual modules communicate at 100 Mbit/s
Frames: Types 3660-C-100 and -D-100 permit the use of a ruggedized RJ45 data connector (Neutrik NE8MC-1) to screw the cable to the frame
Types 3660-C-100 and -D-100 communicate at 1000 Mbit/s. Shielded cables of type "CAT 5e" or better should be used
All LAN connectors support MDIX, which means that cables may be "crossed" or not
For stand-alone modules, PoE is also supported (IEEE 802.3af). PoE requires screened shielded twisted pair (S/STP or S/FTP) CAT6 LAN cables

PROTOCOL
The following standard protocols are used:
- TCP
- UDP
- DHCP (incl. Auto-IP)
- DNS (on top of UDP)
- PTP v2, IEEE 1588–2008 (on top of UDP)
- IP
- http (on top of TCP; for web server, etc.)
- Ethernet (IEEE 802.3 with IEEE 802.3X)

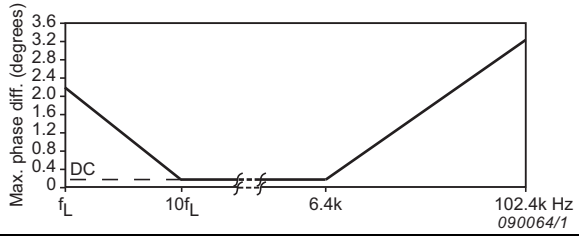
ACQUISITION PERFORMANCE
Each LAN-XI module generates data at almost 20 Mbit/s when acquiring data at maximum bandwidth. The modules are capable of handling their own maximum traffic while the built-in switch in the frame's backplane has more than sufficient capacity. This is very scalable and means that bottlenecks can only occur outside these, for example in:
- External switches
- PC

For convenience, it is possible to daisy-chain two LAN-XI frames. It is not recommended to daisy-chain more than two frames. Generally, a star configuration with a central switch is recommended. This must have a switch capacity well beyond $N \times 20$ Mbit/s, where N is the total number of modules. Be aware that this includes data cascaded from other switches "upstream"

PTP PERFORMANCE
PTP Synchronization (with 1 Gigabit LAN Switch): Typical sample synchronization better than 200 ns
(approximately ±0.07° @ 1 kHz, ±2° @ 25.6 kHz)
Tested with:
- Cisco® SG300-10MP, 10-port 10/100/1000 Managed Gigabit Switch with Maximum PoE (8 ports)
- Hirschmann PTP switches

Better performance can be expected with a dedicated PTP switch:
- UL-0265: PULSE Measurement System Switch, 8-port LAN-switch with PoE and PTPv2 support. This is a dedicated PTP switch, preconfigured for optimal use with LAN-XI

Frequency Range		DC to 102.4 kHz Lower frequency range can be set in PULSE software			
A/D Conversion		2 × 24 bit			
Data Transfer		24 bit			
Input Voltage Range	+0 dB Gain	10 V_{peak}			
	+30 dB Gain	316 mV_{peak}			
Differential or Single-ended Input – Bridge or Direct	Differential	True differential input with inverting and non-inverting terminals. Impedance input-to-input >1 MΩ || 400 pF			
	Single-ended	Inverting signal is grounded			
CCLD Input		Floating: Signal ground is >1 MΩ re chassis			
		Grounded: Signal ground is connected to chassis			
Absolute Maximum Input		±30 V_{peak} on measurement inputs without damage			
High-pass Filters * Defined as the lower frequency, f_L, for guaranteed fulfilment of −0.1 dB accuracy in 10 V_{peak} range ** Defined as the nominal −10%/3 dB filter frequency		**– 0.1 dB ***	**–10% @ ****	**–3 dB @ ****	**Slope**
	0.1 Hz −10% analog high-pass filter 0.7 Hz −0.1 dB digital high-pass filter	0.5 Hz 0.7 Hz	0.1 Hz 0.15 Hz	0.05 Hz 0.073 Hz	−20 dB/dec.
	1 Hz −10% digital high-pass filter 7 Hz −0.1 dB digital high-pass filter	5 Hz 7 Hz	1.0 Hz 1.45 Hz	0.5 Hz 0.707 Hz	−20 dB/dec.
	22.4 Hz −0.1 dB analog high-pass filter	22.4 Hz	15.8 Hz	11.5 Hz	−60 dB/dec.
Absolute Amplitude Precision, 1 kHz, 1 V		±0.05 dB, typ. ±0.01 dB			
Amplitude Linearity (linearity in one range)	0 to 80 dB below full scale	±0.05 dB, typ. ±0.01 dB			
	80 to 100 dB below full scale	±0.2 dB, typ. ±0.02 dB			
	100 to 120 dB below full scale	typ. ±0.02 dB			
	120 to 140 dB below full scale	typ. ±0.02 dB			
	140 to 160 dB below full scale	typ. ±1 dB			
Overall Frequency Response re 1 kHz, from lower limit f_L to upper limit f_U f_L is defined as the lower frequency for guaranteed fulfilment of −0.1 dB accuracy in 10 V_{peak} range (see under High-pass Filters) f_u is defined as the chosen frequency span. DC (f_L = 0)		±0.1 dB in 10 V_{peak} range +0.1/–1 dB in 316 mV_{peak} range			
Noise * Measured lin. 10 Hz to 25.6 kHz and 10 Hz to 102.4 kHz (Input terminated by 50 Ω or less)		**Input Range**	**Guaranteed**		**Typical**	
			Lin*	1 kHz	**Lin***	1 kHz
	Signal level <316 mV_{peak} 10 Hz 25.6 kHz 10 Hz 51.2 kHz 10 Hz 102.4 kHz	10 V_{peak}	< 4 μV_{rms} < 6 μV_{rms} < 8 μV_{rms}	< 25 $nV_{rms}/\sqrt{Hz}$	< 3 μV_{rms} < 4.5 μV_{rms} < 6 μV_{rms}	< 19 $nV_{rms}/\sqrt{Hz}$
	Signal level >316 mV_{peak} 10 Hz 25.6 kHz 10 Hz 51.2 kHz 10 Hz 102.4 kHz	10 V_{peak}	< 50 μV_{rms} < 70 μV_{rms} < 100 μV_{rms}	< 315 $nV_{rms}/\sqrt{Hz}$	< 37 μV_{rms} < 57 μV_{rms} < 80 μV_{rms}	< 250 $nV_{rms}/\sqrt{Hz}$
	Signal level <10 mV_{peak} 10 Hz 25.6 kHz 10 Hz 51.2 kHz 10 Hz 102.4 kHz	316 mV_{peak}	< 1.7 μV_{rms} < 2.4 μV_{rms} < 3.4 μV_{rms}	< 11 $nV_{rms}/\sqrt{Hz}$	< 1.3 μV_{rms} < 1.9 μV_{rms} < 2.7 μV_{rms}	< 8.5 $nV_{rms}/\sqrt{Hz}$
Spurious-free Dynamic Range re Full-scale Input (Input terminated by 50 Ω or less) Spurious-free Dynamic Range is defined as the ratio of the rms full-scale amplitude to the rms value of the largest spurious spectral component (non-harmonic)			**Typical**			
			160 dB in 10 V_{peak} range 140 dB in 316 mV_{peak} range			

DC Offset		**Input Range**	**Typical**
	Initial offset voltage Indicated DC voltage residual within 10 seconds after Zero adjustment has settled. Inputs shorted and grounded	10 V_{peak}	± 15 µV
		316 mV_{peak}	± 1 µV
	Drift versus temperature Ambient temperature cycled between –10 °C and +50 °C. Measured in steady-state conditions. Inputs shorted and grounded	10 V_{peak}	± 10 µV/°C
		316 mV_{peak}	± 1 µV/°C
	Drift versus time Measured over a 20-hour period with module in thermal steady-state at 25 °C ambient temperature. Inputs shorted and grounded	10 V_{peak}	Within ± 20 µV
		316 mV_{peak}	Within ± 500 nV
Harmonic Distortion (all harmonics)		**Guaranteed**	**Typical**
		–80 dB @ 1 V_{rms} 1 kHz in 10 V_{peak} range	–100 dB @ 1 V_{rms} 1 kHz in 10 V_{peak} range
Crosstalk: Between any two channels of a module or between any two channels in different modules	**Frequency Range**	**Guaranteed**	**Typical**
	0 – 102.4 kHz	–100 dB in 10 V_{peak} range	–110 dB in 10 V_{peak} range –110 dB in 316 mV_{peak} range
Channel-to-Channel Match		**Guaranteed**	**Typical**
	Maximum Gain Difference f_L is defined as the –0.1 dB frequency of the high-pass filter	0.1 dB from lower frequency limit, f_L, to 102.4 kHz (0.4 dB at –10% filter frequency)	±0.01 dB in 10 V_{peak} range
	Maximum Phase Difference (within one frame) f_L is defined as the –0.1 dB frequency of the high-pass filter		
	Additional PTP sync. error (phase difference) between modules/frames (using a single standard gigabit switch)	**Typical:** <200 ns (approximately ±0.07° @ 1 kHz, ±2° @ 25.6 kHz)	
Common Mode Rejection	**10 V_{peak} input range**	**Guaranteed**	**Typical**
	0 – 120 Hz	> 80 dB	96 dB
	120 Hz – 1 kHz	> 70 dB	86 dB
	0 – 102.4 kHz	> 40 dB	56 dB
	316 mV_{peak} input range	**Typical**	
	0 – 120 Hz	96 dB	
	120 Hz – 1 kHz	86 dB	
	0 – 102.4 kHz	56 dB	
Absolute Max. Input Voltage		(Common mode + signal peak) ±10 V_{peak} per input – working ±30 V_{peak} per input – non-destructive	
		If common mode voltage exceeds the max. value, care must be taken to limit the current in order to prevent damage	
Anti-aliasing Filter At least 90 dB attenuation of those frequencies which can cause aliasing	Filter Type	3rd order Butterworth	
	–0.1 dB @	102.4 kHz	
	–3 dB @	256 kHz	
	Slope	–18 dB/octave	
Supply for CCLD		4.5 mA typical from 22 V source	
Tacho Supply		CCLD for Type 2981 (Power supply for legacy types MM-0012 and MM-0024 not available)	
Analog Special Functions	**Transducers:** Supports IEEE 1451.4-capable transducers with standardized TEDS (up to 100 m (328 ft) cable length) **CCLD Cable Break:** Detection of cable break or short-circuit. Detection level: +2 V/20 V		
Overload Detection	**Signal Overload:** Adjustable detection level can be set in PULSE Transducer Database 10 V_{peak} range: ± 1 V_{peak} to ± 11 V_{peak}, Default level: ± 11 V_{peak} 316 mV_{peak} range: ± 30 mV_{peak} to ± 350 mV_{peak}, Default level: ± 350 mV_{peak} CCLD: ± 1 V_{peak} to ± 11 V_{peak}, Default level: ± 7 V_{peak}		

Protection	If signal input level exceeds the measuring range significantly, the input will go into protection mode until the signal goes below the detection level again for at least 0.5 s. While in protection mode, the input is partly switched off and the input impedance is greatly increased. (The measured value will be strongly attenuated but still detectable) Similarly, the internal quarter-bridge completion resistors are protected against over-dissipation and will be disconnected if more than ± 6.8 V_{peak} is applied across them.	
Bridge Conditioning	Bridge Completion	Half-bridge and quarter-bridge
	Bridge Completion Impedances	120 Ω, 350 Ω and 1 kΩ
	Constant Voltage Excitation	Output voltage: 0 – 10 V Max. load current: 25 mA, short-circuit protected Max. resolution: 0.74 mV/step typ. DC stability: Drift is within ±0.002% typ. over a 20-hour period at 25 °C ambient temperature with module in thermal steady-state condition at 10 V output Thermal drift: ±60 ppm/°C typ. at 10 V output
	Constant Current Excitation	Current excitation: 0 – 25 mA Max. usable load resistance in current mode: $R_{max} = \frac{10.9\ V}{I_{exc}} - 200\ \Omega$ Max. resolution: 1.6 µA/step typ. DC stability: Drift is within ±0.003% typ. over a 20-hour period at 25 °C ambient temperature with module in thermal steady-state condition at 10 mA output. Thermal drift: ±30 ppm/°C typ. at 10 mA output
	Voltage Remote Sense	Off, one-wire and two-wire modes Max. supported supply wire resistance: 2 × 20 Ω @ 10 V 25 mA output
	Protection	The bridge excitation supply is protected against externally applied voltages between –15 V and +60 V
Monitor Output (before anti-aliasing filter)	Full Scale Deflection	±10 V_{peak}
	Gain re Diff. Input	0 dB in 10 V_{peak} range +30 dB in 316 mV_{peak} range
	Frequency Response	–0.1 dB typ. @ 100 kHz in 10 V_{peak} range –0.6 dB typ. @ 100 kHz in 316 mV_{peak} range
	Input coupling (high-pass filters)	No filter in DC setting –1 dB typ. @ 0.1 Hz in 0.1 Hz setting –0.02 dB typ. @ 0.7 Hz in 0.7 Hz setting –0.01 dB typ. @ 1 Hz in 1 Hz setting –0.00 dB typ. @ 7 Hz in 7 Hz setting –1 dB typ. @ 22.4 Hz in 22.4 Hz setting
	Z_{out}	125 Ω
	Drive Capability	Max. 25 mA

POWER REQUIREMENTS
DC Input: 10−32 V DC
Connector: LEMO coax., FFA.00.113, ground on shield
Power Consumption:
DC Input: <15 W
Supply via PoE: According to IEEE 802.3af, max. cable length 50 m

Temperature Protection:
Temperature sensor limits module's internal temperature to 80 °C (176 °F). If temperature exceeds limit, system will automatically enable fan in LAN-XI frame or shut down module outside frame

DIMENSIONS AND WEIGHT
Height: 132.6 mm (5.22″)
Width: 27.5 mm (1.08″)
Depth: 248 mm (9.76″)
Weight: 750 g (1.65 lb)

Ordering Information

Type 3057-B-030 LAN-XI Bridge Module
includes the following accessories:
- UA-2121-030: LAN-XI Detachable front panel with three sub-D connectors
- ZG-0426: Mains Adaptor (100 – 240 V)
- AO-1450: Shielded CAT 6 LAN Cable with RJ 45 (2 m)

OPTIONAL ACCESSORIES

AO-0546	DC Power Cable, Car Utility Socket to 1 module
AO-0548	DC Power Cable, Source to 4 modules
UA-1713	10 × 2 mm Hex Wrench (QX-1315) for front panel exchange
UL-0265	PULSE Measurement System Switch, 8-port LAN-switch with PoE and PTPv2 support
WB-1497	20 dB Attenuator

Service Products

3057-CAI	Type 3057 Initial Accredited Calibration
3057-CAF	Type 3057 Accredited Calibration
3057-CTF	Type 3057 Traceable Calibration
3057-TCF	Type 3057 LAN-XI Conformance Test with Certificate

A wide range of Brüel & Kjær Accelerometers, Microphones, Preamplifiers and Sound Intensity Probes is available for use with a LAN-XI system. The system supports IEEE 1451.4-capable transducers with standardized TEDS

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