PRODUCT DATA

Piezoelectric Accelerometer Types 4511-T-001, 4511-T-002 and 4511-T-003

Family of Industrial Centre Bolt CCLD Accelerometers

Types 4511-T-001, 4511-T-002 and 4511-T-003 are CCLD accelerometers that have been specifically designed for measuring in harsh environments, maintaining reliability under extreme conditions and yielding quality measurements regardless of mechanical, electrical and environmental influences.*

Uses and Features

Uses

- Measurement in harsh environments

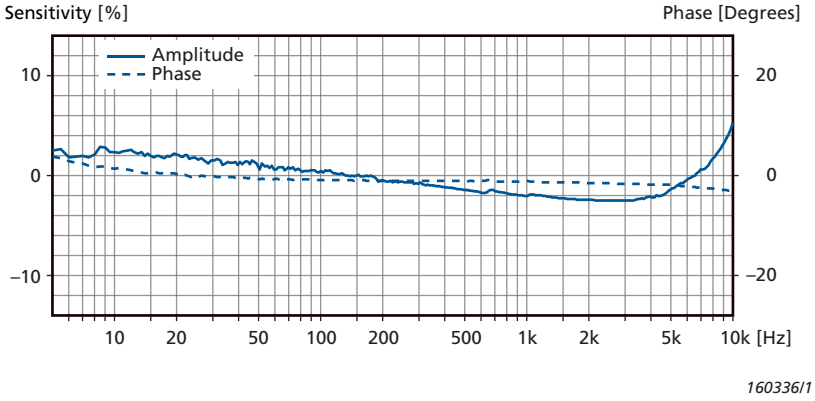
Features

- Centre bolt mounting for 360° orientation
- Insulated case
- Internal shielding
- Hermetic sealing
- Rugged connector
- Resistant to electromagnetic interference (EMI) and radiation

Table 1 *Overview of sensitivity and measuring range for Type 4511-T versions*

		4511-T-001	**4511-T-002**	**4511-T-003**
Sensitivity, ±10%	mV/ ms^{-2} (mV/*g*)	1.0 (10)	2.6 (25)	10.2 (100)
Measuring Range	ms^{-2} (*g*)	±5000 (±500)	±2000 (±200)	±500 (±50)

Fig. 1 *Example of frequency response, Type 4511-T-003*



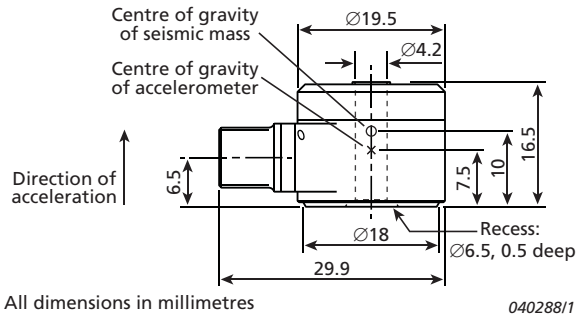
* CCLD: Constant current line drive, also known as DeltaTron® (ICP and IEPE compatible)

Brüel & Kjær

Description

Fig. 2 *Dimensions of the Type 4511-T family*

This is a family of piezoelectric CCLD accelerometers constructed using the Annular Shear design. They feature a rugged Glenair, Inc.® Series 800 connector (male), are made of Stainless Steel AISI 316-LS and are hermetically sealed, making them well suited to harsh industrial applications.



The central mounting hole accommodates an M4 or 6–32 UNC mounting bolt. The mounting hole also features 10–32 UNF threading for stud mounting.

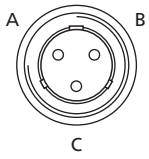
For maximum safety, the accelerometer and included mounting bolt have holes for threading safety wires.

Electrical Connection

Fig. 3 *Accelerometer pin configuration, front view*

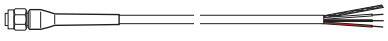
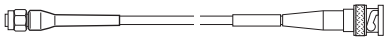
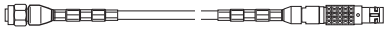
The accelerometers feature a 3-pin, male connector with the following pin designation:

- **A:** Signal/power supply
- **B:** Ground, insulated from case
- **C:** Not connected



Brüel & Kjær cables AO-0642, AO-0642-W-002 and WL-3418 are recommended for use with Types 4511-T-001, 4511-T-002 and 4511-T-003. The cables have MIL-C-5015 3-pin, female connectors for connection to the accelerometer, but each one has a different terminal.

Table 2 *Connectors and pin designation for cables compatible with Type 4511-T family*

Cable No.	Connector A	Cable	Connector B		Temperature	Notes
AO-0642	MIL-C-5015, 3-pin (F) B A C 160338	 160339/1	Open end	White = A Black = B Red = C	−75 to +250 °C (−103 to +482 °F	• 3-wire (twisted) shielded • PTFE insulated • Low-smoke • Halogen-free
AO-0642-W-002		 160340/1	BNC (M)	Centre pin = A Housing = B Not connected = C Not connected = housing	−60 to +250 °C (−76 to +482 °F	• PTFE insulated • Low-smoke • Halogen-free
WL-3418		 160341/1	LEMO*	Centre pin = A Housing = B Not connected = C Housing = Housing	−75 to +250 °C (−103 to +482 °F	• Low-smoke • Halogen-free

* The LEMO connector is ideal for sound level meters and Hand-held Analyzer Types 2250, 2250-L and 2270

Maximum Cable Length

The maximum output voltage of a CCLD accelerometer when driving long cables depends on the supply current at which it is operating, and on the capacitive load due to the connecting cable. The maximum cable length in metres (for distortion ≤1%) is given by:

$$L = 140000 \times \frac{I_s - 1}{f \times V_o \times C_m}$$

where:
I_s = supply current (mA)
f = frequency (kHz)
V_o = output voltage (V_{peak})
C_m = cable capacitance (pF/m)

Calibration

Each accelerometer is calibrated using random excitation and 1600-line FFT transformation to provide a high-resolution (amplitude and phase) frequency response. This yields a unique characterization and secures the integrity of your vibration measurements.

The sensitivity given on the calibration chart is measured at 159.2 Hz with 95% confidence level using coverage factor k = 2.

The upper frequency limits given on the calibration chart are frequencies where the deviation from the reference sensitivity at 159.2 Hz is within ±10%. The upper frequency limit is approximately 30% of the mounted resonance frequency. This assumes that the accelerometer is correctly mounted on the test structure − poor mounting can have a marked effect on the mounted resonance frequency.

The lower frequency limits and phase response are determined by the built-in preamplifiers. The lower frequency limits are given in the specifications for deviations from reference sensitivity within ±10%.

Specifications – Accelerometer Types 4511-T-001, 4511-T-002 and 4511-T-003

All values typical at 25 °C (77 °F) unless measurement uncertainly is specified

			Unit	4511-T-001	4511-T-002	4511-T-003
General Characteristics						
Weight			g (oz)	35 (1.23)		
Voltage Sensitivity (at 159.2 Hz and 20 ms^{-2} rms)			mV/ ms^{-2}	1.0 ±10%	2.6 ±10%	10.2 ±10%
			mV/g	10 ±10%	25 ±10%	100 ±10%
Frequency Range	Amplitude (±10%)		Hz	1 to 10,000		
	Phase (±5°)			2 to 10,000		
Mounted Resonance Frequency			kHz	30		
Transverse Sensitivity (at 30 Hz, 100 ms^{-2})			%	<5		
Measuring Range			ms^{-2} (g)	±5000 (±500)	±2000 (±200)	±500 (±50)
Electrical Characteristics						
Bias Voltage	at 25 °C and 4 mA		V DC	11 ±0.5		
	at full temperature and current range		V DC	8.5 to 14		
Power Supply	constant current		mA	2 to 20		
	unloaded supply voltage		V	18 to 30		
Output Impedance			Ω	<100		
Start-up Time (to final bias ±10%)			s	<2		
Inherent Noise (rms)	Broadband	1 to 10 kHz	µV (µg)	7 (700)	15 (600)	30 (300)
	Spectral	10 Hz	ms^{-2}/√Hz (µg/√Hz)	6×10^{-4} (60)	5×10^{-4} (50)	2×10^{-4} (20)
		100 Hz		2×10^{-4} (20)	2×10^{-4} (20)	8×10^{-5} (8)
		1000 Hz		1×10^{-4} (10)	8×10^{-5} (8)	4×10^{-5} (4)
Insulation Resistance (body to mounting surface)			MΩ	>100		

		Unit	4511-T-001	4511-T-002	4511-T-003
Environmental Characteristics					
Operating Temperature Range		°C (°F)	–54 to +125 (–65 to +257)		
Temperature Coefficient of Sensitivity		%/°C	0.09		
Magnetic sensitivity (at 50 Hz, 0.038 T)		ms^{-2}/T	20	21	
		g/kG	0.2	0.21	
Base Strain Sensitivity (at 250 με in base plane)		$ms^{-2}/\mu\varepsilon$	0.05	0.001	0.001
		$g/\mu\varepsilon$	0.005	0.0001	0.0001
Max. Non-destructive Shock (± peak)		kms^{-2} (g)	51 (5000)		
Mechanical Characteristics					
Case material			Stainless steel AISI 316-L		
Sealing			Hermetic		
Sealing Class (Helium leak rate)		$Pa{\cdot}m^3/s$ (mbar·l/s)	$<10^{-7}$ ($<10^{-6}$)		
Connector			3-pin hermetic, all pins insulated from case		
Mounting					
Centre Bolt Hole			Fits an M4 or 6–32 UNC (DIN 912) bolt		
Threading			10–32 UNF-2B, depth 3.2 mm		
Torque	10–32 UNF stud	Nm (lbf-in)	**Max:** 3.5 (31), **Min:** 0.5 (4.4)		
	M4 bolt		**Max:** 1.5 (12), **Min:** 1.1 (9.5)		
	6–32 UNC bolt		**Max:** 1.5 (12), **Min:** 1.1 (9.5)		

Ordering Information

Type 4511-T-001 **Industrial Centre Bolt Accelerometer**, Sensitivity: 1.0 mV/ ms^{-2}
Type 4511-T-002 **Industrial Centre Bolt Accelerometer**, Sensitivity: 2.6 mV/ ms^{-2}
Type 4511-T-003 **Industrial Centre Bolt Accelerometer**, Sensitivity: 10.2 mV/ ms^{-2}

Include the following accessories in a carrying box:
- Calibration chart
- 1 × M4 stainless steel bolt (DIN 912) with safety wire hole, length 22 mm (0.87 in)

Brüel & Kjær Calibration Services

ACC-M-CAF	Accredited calibration, monoaxial accelerometer
ACC-M-CAI	Initial accredited calibration, monoaxial accelerometer
ACC-M-CTF	Traceable calibration, monoaxial accelerometer

Supported Brüel & Kjær Hardware

CABLING

AO-0642-D-030	Cable, 3-pin MIL-C-5015 (F) to open end (pigtail), max. 250 °C (482 °F), 3 m (10 ft)
AO-0642-D-050	Cable, 3-pin MIL-C-5015 (F) to open end (pigtail), max. 250 °C (482 °F), 5 m (16.4 ft)
AO-0642-W-002	Cable, 3-pin MIL-C-5015 (F) to BNC (M), max. 250 °C (482 °F), 5 m (16.4 ft)
WL-3418-D-025	Cable, 3-pin MIL-C-5015 (F) to LEMO (M), max. 250 °C (482 °F), 2.5 m (8.2 ft), reinforced at the accelerometer
WL-3418-D-050	Cable, 3-pin MIL-C-5015 (F) to LEMO (M), max. 250 °C (482 °F), 5 m (16.4 ft), reinforced at the accelerometer

MOUNTING

UA-0021	Bolt, M4 × 22 mm (0.87 in), hex socket cap (DIN 912), safety wire hole, stainless steel, set of 10
UA-0022	Bolt, 6–32 UNC × 22 mm (0.87 in), fully threaded, hex socket cap (DIN 912), stainless steel, set of 10
UA-2063	Stud, 10–32 UNF × 7.9 mm (0.31 in), fully threaded, steel, set of 10
UA-2064	Stud, 10–32 UNF × 5.3 mm (0.21 in), double ended with flange, steel, set of 10
QS-0007	Tube of cyanoacrylate adhesive
YJ-0216	Beeswax for mounting

CALIBRATION

Type 4294	Vibration Calibrator

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BP 2558 – 12

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