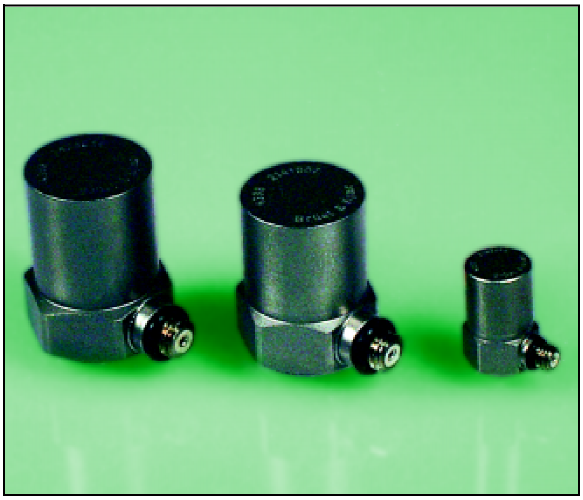
PRODUCT DATA

Miniature DeltaTron® Accelerometer — Type 4397A
DeltaTron Accelerometers — Types 4398A, 4399A

DeltaTron is the generic name for the family of accelerometers and signal conditioning products from Brüel & Kjær that operate on a constant-current power supply and give output signals in the form of voltage modulation on the power supply line.

FEATURES

- All DeltaTron products operate on constant-current line-drive (CCLD) ICP® principles
- All accelerometers have:
  - Integral preamplifiers
  - All-welded construction
  - Delta Shear Uni-Gain® design
  - Low sensitivity to all environments
  - Individual standard-traceable calibration
  - Individual data for best fit to measured frequency response



USES

- Shock and vibration measurement
- Vibration analysis
- Vibration monitoring
- Vibration test control
- Product and quality control

Description

The DeltaTron name identifies products that operate with a constant-current power supply and give output signals in the form of voltage modulation on the power supply line. These DeltaTron accelerometers are constructed to the proven Brüel & Kjær Delta Shear design with the addition of an integral DeltaTron preamplifier. They require an external constant-current power supply and operate as voltage sources. They are specially designed to withstand rough environment.

Miniature Accelerometer Type 4397A

Suitable for measurements on lightweight structures where relatively high-level, high-frequency vibrations are encountered. Type 4397A uses a M3 connector.

Shock and Vibration Accelerometer Type 4398A

Designed for the measurement of relatively high levels of continuous vibration and mechanical shock up to 7500 ms^{-2}. Type 4398A uses a 10 – 32 UNF Connector.

General Purpose Accelerometer Type 4399A

For general purpose vibration measurements. Type 4399A uses a 10 – 32 UNF Connector.

Type numbers without an A-suffix include a connection cable.

Design

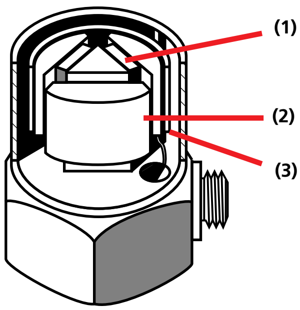


Fig. 1 Exploded view of DeltaShear design (preamplifier not shown)

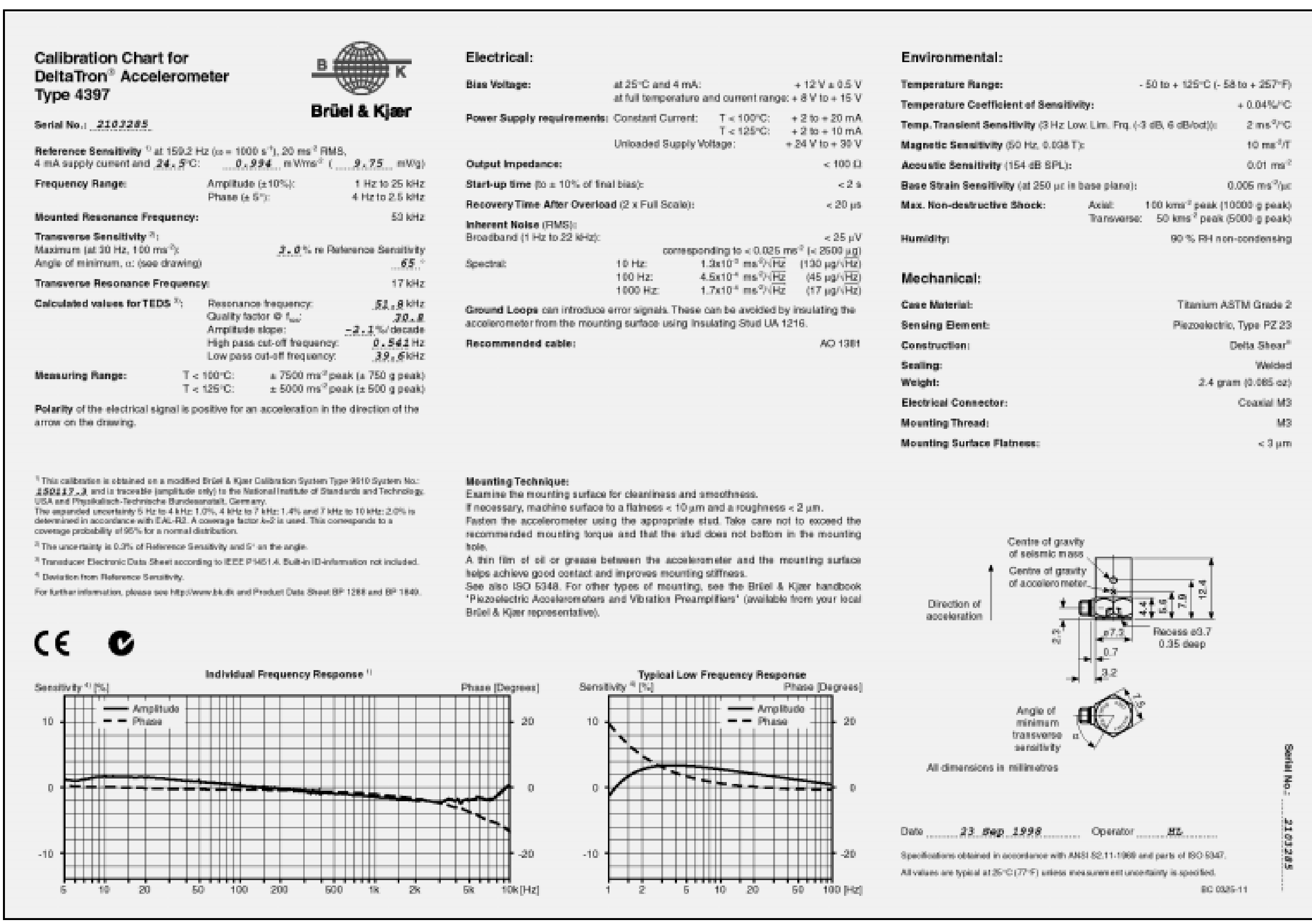
DeltaShear® design

Three piezoelectric elements (1) and three seismic masses (2) are arranged in a triangular configuration around a triangular centre post. They are held in place using a high-tensile clamping ring (3). The DeltaShear design gives a high sensitivity-to-mass ratio compared to other designs, and has a relatively high resonance frequency and high isolation from base strains and temperature transients. The excellent overall characteristics of this design make it ideal for both general purpose accelerometers and more specialised types. A single-pole filter at the input of the built-in preamplifier extends the accelerometer's usable frequency range to approximately 50% of the mounted resonance frequency. Special efforts have been made to minimise interference from RF (radio frequency) electromagnetic fields.

Characteristics

The accelerometers are supplied with individual calibration charts.

Fig. 2 Example of the calibration chart supplied with Brüel & Kjær DeltaTron accelerometers



Calibration Chart for DeltaTron® Accelerometer Type 4397

Brüel & Kjær

Serial No.: 2103285

Reference Sensitivity [1] at 159.2 Hz (ω = 1000 s^{-1}), 20 ms^{-2} RMS, 4 mA supply current and 24.5°C: 0.994 mV/ms^{-2} (9.75 mV/g)

Frequency Range: Amplitude (±10%): 1 Hz to 25 kHz; Phase (± 5°): 4 Hz to 2.5 kHz

Mounted Resonance Frequency: 53 kHz

Transverse Sensitivity [2]:
Maximum (at 30 Hz, 100 ms^{-2}): 3.0 % re Reference Sensitivity
Angle of minimum, α: (see drawing) 65°

Transverse Resonance Frequency: 17 kHz

Calculated values for TEDS [3]:
Resonance frequency: 51.8 kHz
Quality factor @ f_{res}: 30.8
Amplitude slope: -2.1 %/decade
High pass cut-off frequency: 0.541 Hz
Low pass cut-off frequency: 39.6 kHz

Measuring Range: T < 100°C: ± 7500 ms^{-2} peak (± 750 g peak); T < 125°C: ± 5000 ms^{-2} peak (± 500 g peak)

Polarity of the electrical signal is positive for an acceleration in the direction of the arrow on the drawing.

[1] This calibration is obtained on a modified Brüel & Kjær Calibration System Type 9610 System No.: 150117.3 and is traceable (amplitude only) to the National Institute of Standards and Technology, USA and Physikalisch-Technische Bundesanstalt, Germany.
The expanded uncertainty 5 Hz to 4 kHz: 1.0%, 4 kHz to 7 kHz: 1.4% and 7 kHz to 10 kHz: 2.0% is determined in accordance with EAL-R2. A coverage factor k=2 is used. This corresponds to a coverage probability of 95% for a normal distribution.
[2] The uncertainty is 0.3% of Reference Sensitivity and 5° on the angle.
[3] Transducer Electronic Data Sheet according to IEEE P1451.4. Built-in ID-information not included.
[4] Deviation from Reference Sensitivity.
For further information, please see http://www.bk.dk and Product Data Sheet BP 1288 and BP 1849.

Electrical:

Bias Voltage: at 25°C and 4 mA: + 12 V ± 0.5 V; at full temperature and current range: + 8 V to + 15 V

Power Supply requirements: Constant Current: T < 100°C: + 2 to + 20 mA; T < 125°C: + 2 to + 10 mA. Unloaded Supply Voltage: + 24 V to + 30 V

Output Impedance: < 100 Ω

Start-up time (to ± 10% of final bias): < 2 s

Recovery Time After Overload (2 x Full Scale): < 20 μs

Inherent Noise (RMS):
Broadband (1 Hz to 22 kHz): < 25 μV corresponding to < 0.025 ms^{-2} (< 2500 μg)
Spectral: 10 Hz: 1.3×10^{-3} $ms^{-2}/\sqrt{Hz}$ (130 μg/$\sqrt{Hz}$); 100 Hz: 4.5×10^{-4} $ms^{-2}/\sqrt{Hz}$ (45 μg/$\sqrt{Hz}$); 1000 Hz: 1.7×10^{-4} $ms^{-2}/\sqrt{Hz}$ (17 μg/$\sqrt{Hz}$)

Ground Loops can introduce error signals. These can be avoided by insulating the accelerometer from the mounting surface using Insulating Stud UA 1216.

Recommended cable: AO 1381

Mounting Technique:
Examine the mounting surface for cleanliness and smoothness.
If necessary, machine surface to a flatness < 10 μm and a roughness < 2 μm.
Fasten the accelerometer using the appropriate stud. Take care not to exceed the recommended mounting torque and that the stud does not bottom in the mounting hole.
A thin film of oil or grease between the accelerometer and the mounting surface helps achieve good contact and improves mounting stiffness.
See also ISO 5348. For other types of mounting, see the Brüel & Kjær handbook 'Piezoelectric Accelerometers and Vibration Preamplifiers' (available from your local Brüel & Kjær representative).

Environmental:

Temperature Range: - 50 to + 125°C (- 58 to + 257°F)

Temperature Coefficient of Sensitivity: + 0.04%/°C

Temp. Transient Sensitivity (3 Hz Low Lim. Frq. (-3 dB, 6 dB/oct)): 2 ms^{-2}/°C

Magnetic Sensitivity (50 Hz, 0.038 T): 10 ms^{-2}/T

Acoustic Sensitivity (154 dB SPL): 0.01 ms^{-2}

Base Strain Sensitivity (at 250 με in base plane): 0.005 ms^{-2}/με

Max. Non-destructive Shock: Axial: 100 kms^{-2} peak (10000 g peak); Transverse: 50 kms^{-2} peak (5000 g peak)

Humidity: 90 % RH non-condensing

Mechanical:

Case Material: Titanium ASTM Grade 2

Sensing Element: Piezoelectric, Type PZ 23

Construction: Delta Shear®

Sealing: Welded

Weight: 2.4 gram (0.085 oz)

Electrical Connector: Coaxial M3

Mounting Thread: M3

Mounting Surface Flatness: < 3 μm

Date 23 Sep 1998 Operator HS

Serial No.: 2103285

Specifications obtained in accordance with ANSI S2.11-1969 and parts of ISO 5347.
All values are typical at 25°C (77°F) unless measurement uncertainty is specified.

BC 0325-11

Uni-Gain Sensitivity

The Brüel & Kjær Uni-Gain design means that the accelerometer sensitivity is adjusted during manufacture to within 2% of either 1 or 10 mV/ms^{-2}.

Frequency Response

The upper frequency limits given in the specifications are the frequencies where the deviation from the reference sensitivity is less than 10%. It is approximately 50% of the mounted resonance frequency. This assumes that the accelerometer is correctly mounted onto the test structure – a 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 of less than 10%.

Increased measurement accuracy can be achieved by dividing the actual measurement with the individual frequency response.

Individually measured frequency response curves

The frequency response curves given on the calibration chart are individually measured over most of the frequency range. At low frequencies, the curves given are typical (Fig. 2).

Individual data for best-fit to measured frequency response

The calibration chart also includes individual data that, together with a general formula, best fits the measured frequency response. The expression can be used for frequency response compensation in the specified frequency range. The relative frequency response including amplitude and phase is:

$$S_{rel}(f,T) = (Sign)(1+b(T-T_{ref}))\times\frac{j\frac{f}{f_{hp}}}{\left(1+j\frac{f}{f_{hp}}\right)}\times\frac{1}{\left(1+j\frac{f}{f_{lp}}\right)}\times\frac{1}{\left(1+\left(j\frac{f}{f_{res}}\right)^2+j\frac{f}{Qf_{res}}\right)}\times\left(j\frac{f}{f_{ref}}\right)^{\frac{a}{\ln 10}}$$

$Sign$ = Polarity

b = Temperature coefficient

T = Temperature

T_{ref} = Reference temperature

f = Frequency

f_{hp} = High-pass cut-off frequency

f_{lp} = Low-pass cut-off frequency

f_{res} = Resonance frequency

f_{ref} = Reference frequency

Q = Quality factor

a = Amplitude slope/decade

Combining this equation with the amplitude sensitivity S_{ref} and f_{ref} and T_{ref} we have:

$$S(f,T) = S_{ref}\times\frac{S_{rel}(f,T)}{|S_{rel}(f_{ref}T_{ref})|}$$

Implementation of this formula in either real-time data acquisition systems or in post-processing will support automatic update of amplitude and/or phase.

The direction of minimum transverse sensitivity is indicated on the calibration chart of each DeltaTron accelerometer.

Transverse Sensitivity

All piezoelectric accelerometers are slightly sensitive to acceleration perpendicular to their main sensitivity axis. This transverse sensitivity is measured during factory calibration using 30 Hz and 100 ms^{-2} excitation, and is given as a percentage of the corresponding main axis sensitivity.

Transverse Resonance Frequency

Typical values for the transverse resonance frequency are obtained by mounting an accelerometer on the side of a steel cube attached to a Calibration Exciter Type 4290.

The dynamic range of an accelerometer is the range over which its electrical output is directly proportional to the acceleration applied to its base.

Dynamic Range

Upper Limit

In general, the smaller the accelerometer, the higher the vibration level at which it can be used. The upper limit depends on the type of vibration to which the accelerometer is subjected and is determined by the prestressing of the piezoelectric elements as well as by the mechanical strength of the element.

The acceleration ranges given in the specifications are determined by the measuring limits of the integral preamplifiers. For transporting and handling, the maximum non-destructive shock is given.

When short duration transient signals are measured, care must be taken to avoid ringing effects due to the high-frequency resonance of the accelerometer. As a general rule, the duration of a half sine shock pulse should be greater than $5/f_R$ for an amplitude error of less than 10%, where f_R is the mounted resonance frequency of the accelerometer.

Lower Limit

The lower limit is imposed by the noise level of the integral preamplifier, which has been constructed to give very low noise levels, and by the environment in which the measurements are made.

Electrical Impedance

All DeltaTron accelerometers have integral preamplifiers and can be regarded as voltage sources. The output impedance is typically less than 100 Ω. With a supply current of >4 mA, the output impedance is typically less than <30 Ω.

Environment

A discussion of the effect of environmental influences, can be found in the Brüel & Kjær handbook "Piezoelectric Accelerometers and Vibration Preamplifiers".

Temperature

DeltaTron accelerometers have an operating temperature range of –50°C to +125°C. Throughout this range, the sensitivity of the accelerometers has a small temperature dependence, details of which are given on the individual calibration charts (see Fig. 2).

The procedure for measuring temperature transient sensitivity is also described in the handbook.

Temperature Transients

All piezoelectric accelerometers have slight sensitivity to temperature fluctuations. This effect may be significant when low frequency, low level acceleration is being measured.

Humidity

DeltaTron accelerometers have all-welded titanium housings to give them a high resistance to the majority of corrosive agents found in industry. The low impedance of the preamplifier gives it a low sensitivity to humidity on the output terminal and allows the accelerometers to be used without protection in conditions where there is a small amount of condensation.

Where heavy condensation is encountered, the use of moisture impervious cables and sealing will permit operation. Suitable sealants are Dow Corning's RTV 738 or similar compounds.

Sound Pressure

The acoustic sensitivity is low, and can be neglected for most vibration measurements. The vibration signal from the structure under test is normally much greater than the signal due to acoustic sensitivity.

Acoustic sensitivity is specified as an equivalent acceleration caused by a 154 dB sound pressure level in the frequency range 2 Hz to 100 Hz, but the specified value is normally valid outside this range.

Electromagnetic Compatibility (EMC)

Susceptibility of DeltaTron accelerometers to radio-frequency electromagnetic radiation is also low.

The accelerometers comply with Standards EN 50081–1 and EN 50082–2 for emission and immunity, respectively.

Base Strain

Base strains can be introduced into an accelerometer by distortion of the surface to which it is attached.

Base strain sensitivity, which is minimised by the Delta Shear construction, is specified in $ms^{-2}/\mu\varepsilon$.

Connecting Cables

For direct connection to DeltaTron accelerometers, miniature, double-screened, low-noise, single-core, coaxial cables are available.

Type 4397A requires cables with an M3 connector while Types 4398A and 4399A require cables with 10 – 32 UNF connectors. See Optional and Additional Accessories, the Transducer & Conditioning Catalogue (BF 0189) and Sound & Vibration Catalogue (BF 0201) for additional cable lengths and connectors.

Note, however, that for many non-critical applications, lower quality cables or twisted pairs can be used. However, when such cables are used, the EMC certification is not valid.

Details of the accelerometer connections and recommended plug clearances are given in the section entitled Accelerometer Dimensions.

Maximum Cable Length

The maximum output voltage of a DeltaTron accelerometer depends on the supply current at which it is operating, and on the capacitive load due to the connecting cable.

Fig. 3 shows typical curves for maximum output levels with supply currents of 2 and 20 mA (for distortion ≤1%).

The maximum cable length in metres is given by:

$$L = 75000 \times \frac{I_s}{f \times V_o \times C_m}$$

where

I_s = supply current [mA]

f = frequency [kHz]

V_o = output voltage [V_{peak}]

C_m = cable capacitance [pF/m]

If the supply current is less than 4 mA, the power consumption of the built-in preamplifier becomes significant and this formula cannot be applied.

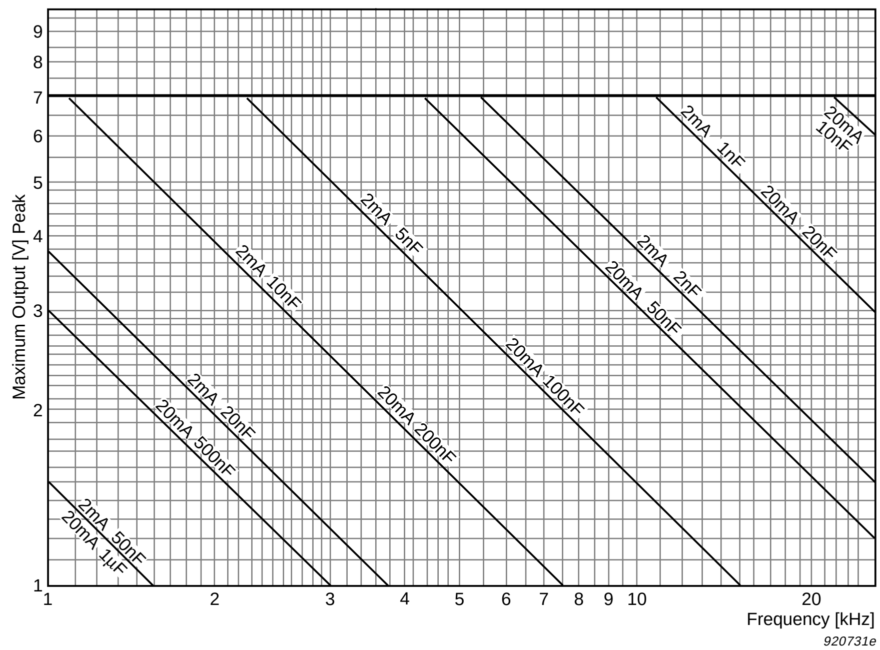


Fig. 3 Typical curves for maximum output level of DeltaTron accelerometers, showing maximum capacitive load over the recommended current supply range

Mounting

Brüel & Kjær accelerometers can be mounted with their main sensitivity axis aligned in any direction.

Recommended Mounting Technique

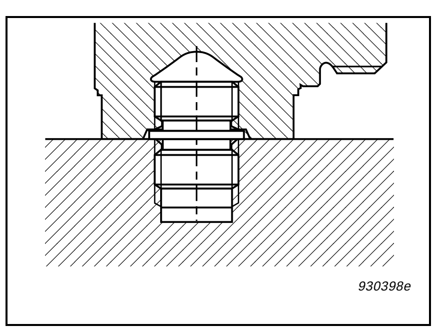


Fig. 4 Recommended mounting technique for Type 4397A using Steel Stud YS 8321 and for Types 4398A/–9A using Steel Stud YG 0150

Fig. 4 shows the recommended mounting method for these accelerometers. The accelerometers are screwed onto a clean metal surface using a threaded steel stud and meet the requirements specified in Fig. 5.

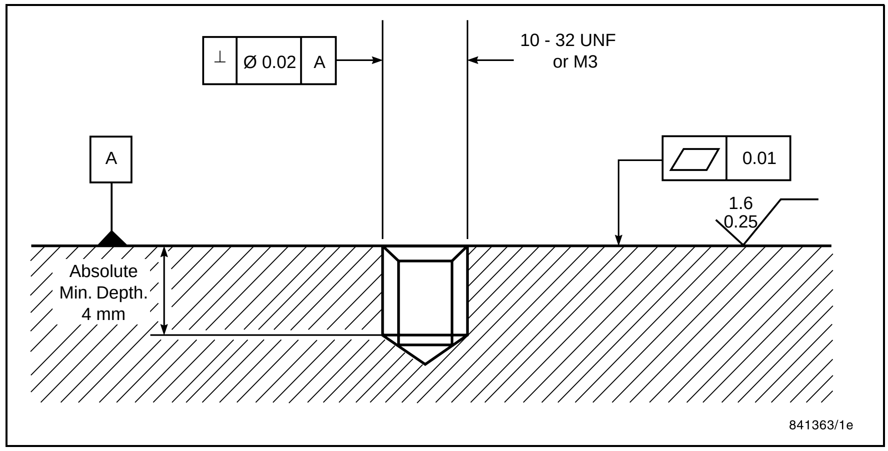


Fig. 5 Recommended tolerances for the mounting surfaces. Dimensions and symbols are in accordance with ISO 1101

Under normal circumstances the absolute minimum depth of 4 mm is not sufficient to accommodate the mounting stud, but is the minimum depth required to hold a stud securely. The optimum torque for tightening 10 – 32UNF steel studs is 0.5 – 3.5 Nm, for M3 steel studs it is 0.2 – 0.6 Nm. The required tolerances on the clean metal mounting surface are shown in Fig. 5.

When using the recommended technique, note that if the mounting surface is not perfectly smooth, applying a thin layer of grease to the base of the accelerometer before screwing it into the mounting surface will improve the mounting stiffness.

Alternative Mounting Techniques

When mounting techniques other than the recommended technique are used, the accelerometer mounted resonance frequency will probably be lower.

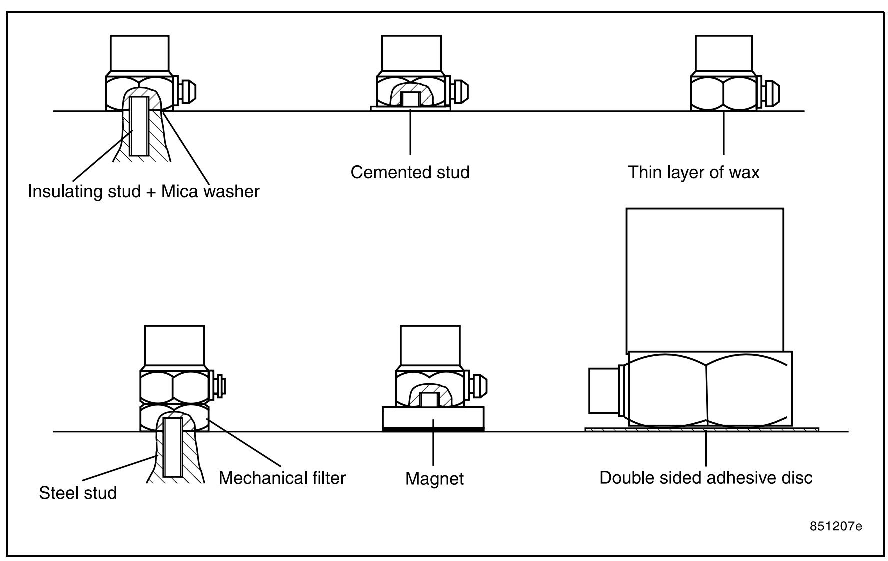


Fig. 6 Alternative mounting techniques

Fig. 6 shows some alternative mounting techniques. The section entitled Accessories Included lists the mounting accessories supplied with the individual accelerometer types. These mounting techniques are described in detail in Brüel & Kjær's "Piezoelectric Accelerometers and Vibration Preamplifiers" handbook (BB 0694), which illustrates the effects of the different methods on the frequency response curve of an accelerometer.

Calibration

All Brüel & Kjær accelerometers are thoroughly checked and examined at each stage of manufacture and assembly. Each accelerometer undergoes an extensive calibration procedure and artificial ageing process to ensure completely predictable performance and stable operation. Accurate numerical details of the calibration are reported on the calibration chart supplied with each transducer (see Fig. 2).

Factory Calibration

At Brüel & Kjær, piezoelectric accelerometers are calibrated by back-to-back comparison with a primary reference standard accelerometer which is regularly calibrated by laser interferometry at the Danish Primary Laboratory of Acoustics and by both the American National Institute of Standards and Technology and the German Physikalisch–Technische Bundesanstalt. The overall accuracy of the back-to-back comparison is ±2% with a 99.9% confidence level (±1.6% for a 99% confidence level), while for the interferometry method the accuracy is better than ±0.6% with a 99% confidence level.

Subsequent Calibration

Regular calibration of accelerometers helps maintain confidence in the measurements taken and indicates whether accelerometers have been damaged. Brüel & Kjær offers a factory Standard Calibration as a re-calibration service including a new calibration chart (see Ordering Information). Brüel & Kjær manufactures a range of equipment for frequency response, sensitivity and system calibrations, details of which are available in separate Product Data.

Compliance with Standards

	CE-mark indicates compliance with: EMC Directive and Low Voltage Directive. C-Tick mark indicates compliance with the EMC requirements of Australia and New Zealand
Safety	EN 61010–1 and IEC 61010–1: Safety requirements for electrical equipment for measurement, control and laboratory use. UL 3111–1: Standard for Safety – Electrical measuring and test equipment
EMC Emission	EN 50081–1: Generic emission standard. Part 1: Residential, commercial and light industry. EN 50081–2: Generic emission standard. Part 2: Industrial environment. CISPR 22: Radio disturbance characteristics of information technology equipment. Class B Limits. FCC Rules, Part 15: Complies with the limits for a Class B digital device.
EMC Immunity	EN 50082–1: Generic immunity standard. Part 1: Residential, commercial and light industry. EN 50082–2: Generic immunity standard. Part 2: Industrial environment. **Note 1:** The above is guaranteed using optional accessories listed in this Product Data sheet only. **Note 2:** The above is guaranteed only when the AC output is not in use.
Temperature	IEC 68–2–1 & IEC 68–2–2: Environmental Testing. Cold and Dry Heat. Operating Temperature: –50 to +125°C (–58 to +257°F)
Humidity	IEC 68–2–3: Damp Heat: 90% RH (non-condensing at 40°C (104°F)

Accessories Included

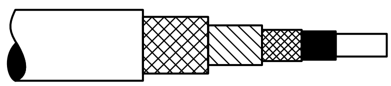
Part Number		4397A	4398A	4399A
YS 8321	Steel Stud M3/M3 (UA 1221 is a set of 25 of these studs)	x		
YG 0150	Steel Stud 10 – 32 UNF/10 – 32 UNF		x	x
BC 0325	Individual Calibration Chart	x		
BC 0326	Individual Calibration Chart		x	
BC 0327	Individual Calibration Chart			x

Optional Accessories

Part Number		4397A	4398A	4399A
AO 1381*	Teflon Low-noise Cable, double screened AC 0104 (∅ 1.6 mm). Fitted with one 10–32 UNF and one M3 connector. Length 1.2 m	x		
AO 1382*	Teflon Low-noise Cable, double screened AC 0104 (∅ 1.6 mm). Fitted with two 10–32 UNF connectors. Length 1.2 m		x	x
JJ 0032	Extension Connector for cables fitted with 10–32 UNF connectors	x	x	x
JP 0145	10–32 UNF to BNC Adaptor	x	x	x
YS 8321	Steel Stud M3/M3 (UA 1221 is a set of 25 of these studs)	x		
YQ 2003	Steel Stud M3, 5 mm long	x		
YG 0150	Steel Stud 10 – 32 UNF/10 – 32 UNF		x	x
YQ 2960	10–32 UNF Threaded Steel Stud. Length 0.5 in.		x	x
YQ 2962	10–32 UNF Threaded Steel Stud. Length 0.3 in.		x	x
YM 0414	10–32 UNF Nut		x	x
QA 0041	Tap for M3 Thread	x		
QA 0029	Tap for 10–32 UNF Thread		x	x
DB 0757	Cement Stud M3. Diameter 8 mm	x		
DB 0756	Cement Stud 10–32 UNF. Diameter 14 mm		x	x
QA 0042	Hexagonal Key for M3 studs	x		
QA 0013	Hexagonal Key for 10–32 UNF studs		x	x
YJ 0216	Beeswax for mounting	x	x	x
UA 0642	Mounting Magnet with 10–32 UNF stud		x	x
YO 0073	25 × Adhesive Mounting Discs. Diameter 5.5 mm	x		
QS 0007	Tube of Cyanoacrylate Adhesive	x	x	x
UA 1218	Standard Accessory Set	x		
UA 1219	Standard Accessory Set		x	x
WB 1372	DeltaTron Power Supply	x	x	x
ZG 0328	Power Supply Adaptor	x	x	x

*The EMC certification is only valid for AO 1381 and AO 1382

Additional Accessories

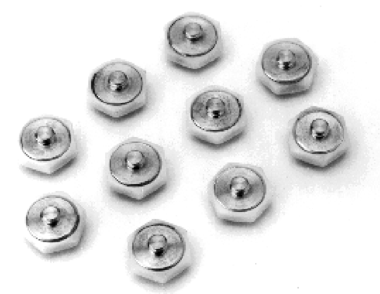


Free-length Cables

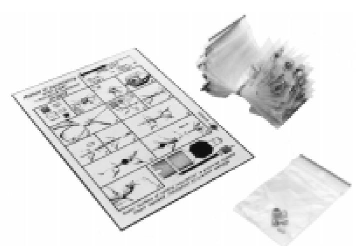
AC 0005 Teflon Insulated Super Low-noise Cable
AC 0066 Teflon Insulated Low-noise Cable
AC 0104 Teflon Insulated Double Screened Low-noise Cable (illustrated)
AC 0200 Reinforced double screened version of AC 0005
AC 0208 PVC Coated Cable
The EMC certification is only valid for AC 0104

Cables with Connectors

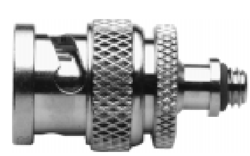
a) M3/10 – 32 UNF
AO 0283 Cable AC 0205, 1.2 m
AO 0339 Cable AC 0066, 1.2 m
b) 10 – 32UNF/10 – 32 UNF
AO 0038 Cable AC 0005, 1.2 m
AO 0122 Cable AC 0200, 3 m
AO 0463 Cable AC 0208, 1.2 m
AO 1419 Cable AC 0066, 1.2 m
c) **AO 0531** Cable AC 0208, 5 m



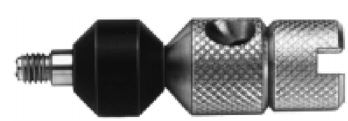
UA 1192 Set of 10 Insulating Studs 10 – 32 UNF/10 – 32 UA 1215
UA 1193 Set of 10 Insulating Studs M3/M3 UA 1216



Accessories for Self-assembly Cables (only 10 – 32 UNF connector)
UA 0130 Set of 25 Plugs JP 0012 for Cables AC 0104 and AC 0005
UA 0730 Set of 25 Plugs JP 0056 for Cable AC 0200. For mounting the plugs, the Assembly Tool QA 0035 is required

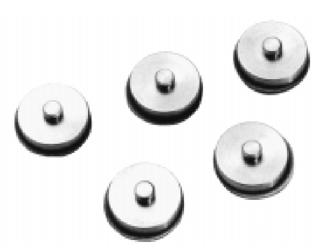


JP 0145 10–32 UNF to BNC adaptor for connection of cables with Miniature Coaxial Plugs JP 0012 and JP 0056

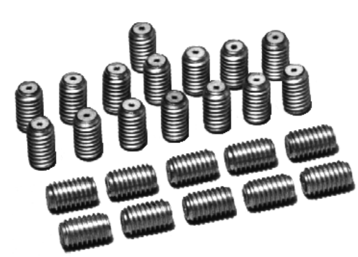


QA 0035 Assembly Tool for mounting miniature plugs on accelerometer cables

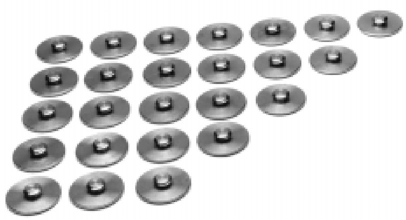
UA 0553 Set of 5 electrically insulated10 – 32 UNF Mechanical Filters UA 0559, plus a tommy bar for mounting
WA 0224 same as UA 0553 but for M3



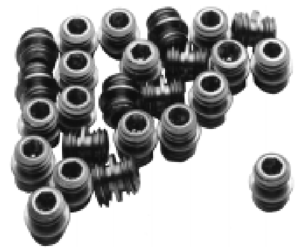
UA 0643 Set of 5 10 – 32 UNF Mounting Magnets UA 0642. Includes PTFE self-adhesive discs for electrical insulation



UA 0186 Set of 25 Extension Connectors JJ 0032 for miniature cables with Plugs JP 0012 or JP 0056



UA 0866 Set of 25 10–32 UNF Cement Studs DB 0756
UA 0867 Set of 25 M3 Cement Studs DB 0757

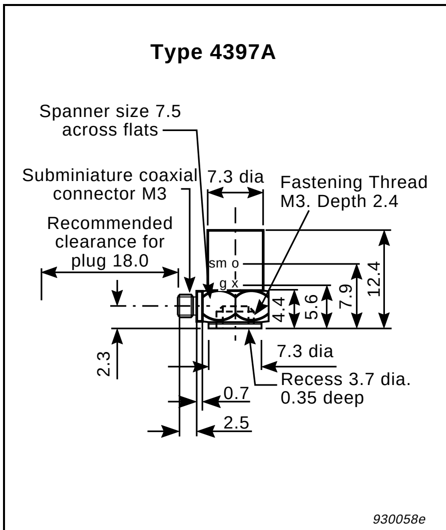


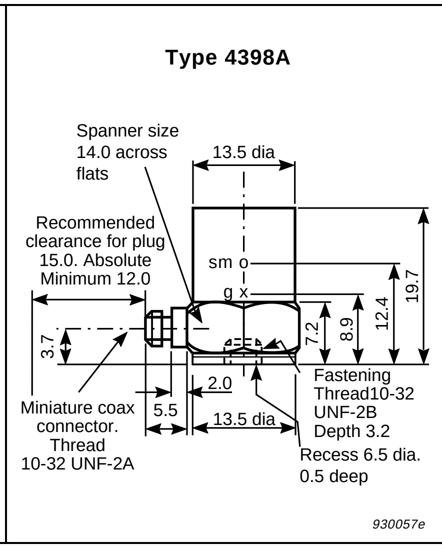
UA 1221 Set of 25 Steel Studs M3/M3 with Flange YS 8321

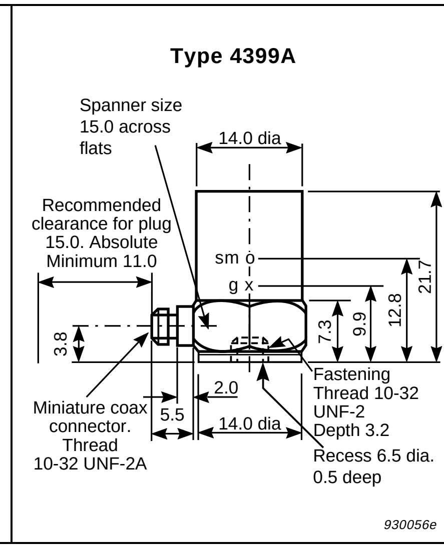
UA 0125 Set of 10 Insulating Studs YP 0150, 10 Steel Studs YQ 2960, 10 Nuts YM 0414, 10 Mica Washers YO 0534 plus 10–32 UNF tap and hexagonal key for 10–32 UNF studs

Accelerometer Dimensions

Fig. 7 Accelerometer dimensions – shown full scale, all dimensions in mm







Specifications

Dynamic

			Type 4397A	Type 4398A	Type 4399A
					
Mounted Resonance Frequency, typical		kHz	53	38	29
Transverse Resonance Frequency, typical		kHz	17	14	10
Sensitivity (axial) at 159.2 Hz, 100 ms^{-2} (10.2 g), 25°C (77°F), 4 mA		mV/ms^{-2} (/g)	1.00 (9.807) ±2 %		10.0 (98.07) ±2 %
Measuring Range (peak), typical	temperature <100°C (212°F)	ms^{-2} (g)	±7500 (765)		±750 (76)
	temperature <125°C (257°F)	ms^{-2} (g)	±5000 (510)		±500 (51)
Frequency Range (±10%), typical.*		Hz	1 to 25000	0.3 to 18000	1 to 14000
Maximum Transverse Response		%	<4		

*Note: The frequency range from 5 Hz to 10 kHz is measured individually and shown on the calibration chart supplied. The expanded uncertainty 5 Hz to 4 kHz: 1.0%, 4 kHz to 7 kHz: 1.4% and 7 kHz to 10 kHz: 2% is determined in accordance with EAL-RZ. A coverage factor $k = 2$ is used. This corresponds to a coverage probability of 95% for a normal distribution.

Electrical

Constant Current Supply	temperature <100°C (212°F)	mA	+2 to +20		
	temperature <125°C (257°F)	mA	+2 to +10	+2 to +20	
Supply Voltage, unloaded	for full specification	V DC	+24 to +30		
	minimum (reduced specification)	V DC	+18		
Output Impedance		Ω	<100		
Bias Voltage	at 25°C (77°F), 4 mA	V	12 ±0.5		
	full temperature and current range	V	8 to 15		
Residual Noise, typical	from 1 to 22000 Hz	μV	<25	<15	<40
	equivalent acceleration	ms^{-2} (g)	<0.025 (0.0026)	<0.015 (0.0015)	<0.004 (0.0004)
Polarity (acceleration directed from base into body)			Positive		
Recovery time from Overload (2×maximum level)		μs	<20	<15	<25

Environmental

Base Strain Sensitivity, typical		ms^{-2} (g)/με	0.005 (0.0005)	0.02 (0.002)	0.01 (0.001)
Maximum Non-destructive Shock (peak)	Axial	ms^{-2} (g)	100000 (10200)	50000 (5100)	20000 (2040)
	Transverse	ms^{-2} (g)	50000 (5100)	20000 (2040)	10000 (1020)
Temperature Range		°C (°F)	–50 to +125 (–58 to +257)		
Humidity			Welded, sealed		
Temperature Transient Sensitivity, typical		ms^{-2}/°C (g/°F)	2 (0.1)	0.2 (0.01)	0.1 (0.006)
Magnetic Sensitivity (50 Hz, 0.038T), typical		ms^{-2}(g)/T	10 (1)	20 (2)	5 (0.5)
Acoustic Sensitivity (154 dB SPL), typical		ms^{-2} (g)	0.01 (0.001)	0.005 (0.0005)	0.002 (0.0002)

Physical

Weight		gram (oz.)	2.4 (0.09)	11.8 (0.42)	17.1 (0.60)
Height		mm (in)	12.4 (0.49)	19.7 (0.77)	21.7 (0.85)
Spanner Size		mm (in)	7.5 (0.30)	14.0 (0.55)	15.0 (0.59)
Construction			Delta Shear		
Piezoelectric Material			PZ 23		
Case Material	Titanium		ASTM Gr. 2		
Connector	Coaxial		M3 miniature	10–32 UNF	
Mounting Thread	Tapped centre hole		M3	10–32 UNF	
Mounting Torque		Nm (lb.in)	0.2 to 0.6 (1.8 to 5.3)	0.5 to 3.5 (4.4 to 31)	

Ordering Information

Type 4397A Miniature DeltaTron Accelerometer		4397 – CFF	Re-calibration
Types 4398A, 4399A DeltaTron Accelerometers		4398 – CFF	Re-calibration
See tables for Included, Optional and Additional Accessories		4399 – CFF	Re-calibration

Brüel & Kjær reserves the right to change specifications and accessories without notice

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BP 1849–11

HEADQUARTERS: DK-2850 Nærum · Denmark · Telephone: +4545800500 · Fax: +4545801405 · http://www.bk.dk · e-mail: info@bk.dk
Australia (02)9450-2066 · Austria 0043-1-8657400 · Brazil (011)5182-8166 · Canada (514)695-8225 · China (86) 1068029906
Czech Republic 02-67021100 · Finland (0)9-755 950 · France (01)69906900 · Germany 06103/908-5 6 · Hong Kong 25487486 · Hungary (1)2158305
Ireland (01) 450 4922 · Italy (02)57604141 · Japan 03-3779-8671 · Republic of Korea (02)3473-0605 · Netherlands (0)30 6039994 · Norway 66771155
Poland (22)858 9392 · Portugal (1)4711453 · Singapore (65) 377-4512 · Slovak Republic 421 7 544 307 01 · Spain (91)3681000 · Sweden (08)4498600
Switzerland 01/9436070 · Taiwan (02)7139303 · United Kingdom (0181)954-2366 · USA 18003322040
Local representatives and service organisations worldwide

Brüel & Kjær