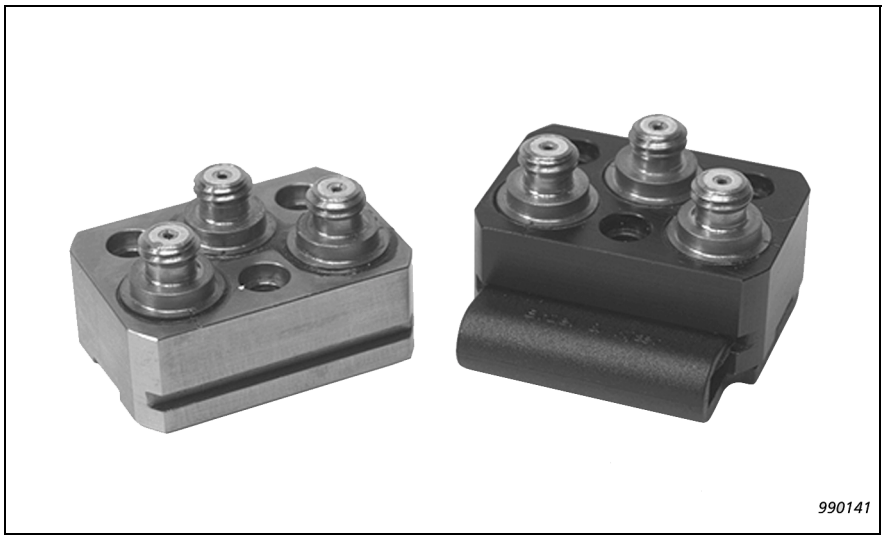
PRODUCT DATA

Miniature Triaxial Charge Accelerometer — Types 4326 A, 4326 A–001

Miniature Triaxial Accelerometers Types 4326 A and 4326 A–001 are piezoelectric accelerometers that provide a low sensitivity to extraneous environmental effects achieved through the patented ThetaShear® design.

FEATURES



- Low-weight, ThetaShear design giving high sensitivity/weight ratio and very low sensitivity to environmental factors
- All cable connectors on a single surface allowing a choice of five mounting surfaces
- High resonance frequency giving a (+10%) frequency range of 8 to 16 kHz (axis dependent)
- Electrically insulated for ground loop protection
- Mounting slots for interface to Mounting Clips UA 1408, UA 1474, UA 1473 and UA 1563. These allow for easy fitting to almost any test object – including fitting on objects with curved surfaces
- Easily accessible output via three robust 10–32 UNF titanium connectors
- No need for expensive and delicate multi-wire cables and connectors

USES

- Triaxial vibration and structural analysis in automotive, aerospace and general machinery applications
- Vibration test control
- General purpose multi-axis vibration and shock measurements on low-mass structures and in confined spaces
- Triaxial vibration measurements on running engines, hot engine components and other medium to high temperature applications (up to 230°C 446°F)
- Multichannel modal analysis measurements

Description

Types 4326 A and 4326 A–001 are composed of three separate ThetaShear accelerometers in a single lightweight aluminium (4326 A) or titanium (4326 A–001) housing, and aligned so that vibration can be measured in three mutually perpendicular directions.

Types 4326 A and 4326 A – 001 have been designed for triaxial vibration measurement applications with particular emphasis on low mass and small physical dimensions, combined with relatively high sensitivity and the greatest possible flexibility in mounting.

Both types have been designed with particular emphasis on low mass and small physical dimensions. They differ only in weight and temperature range. Type 4326 A–001 has a more robust titanium housing but is heavier than Type 4326 A.

To avoid triboelectrical noise originating in the connector and to provide maximum measurement reliability and confidence, special attention has been paid to the three connectors. Both accelerometers feature three separate and rugged 10 – 32 UNF connectors.

ThetaShear

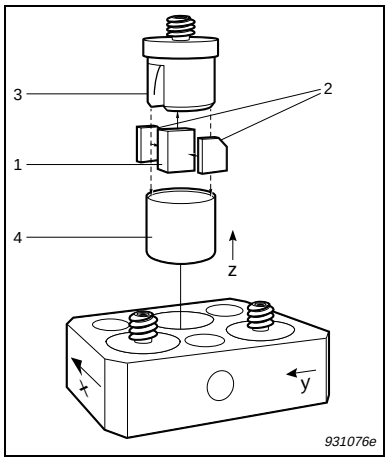


Fig. 1
Exploded view of Type 4326 showing the ThetaShear design

The patented ThetaShear design, based on a development of the renowned Brüel & Kjær DeltaShear® design, provides for a combination of highest measurement stability, excellent sensitivity-to-weight ratio and industry leading low sensitivities to extraneous environmental effect.

The ThetaShear design is illustrated in Fig. 1. A slotted cylindrical stanchion (3) holds a central seismic mass (1) flanked by two piezoelectric plates (2). This assembly is clamped rigidly by the cover (4). To ensure optimum accuracy and reliability, no bonding agent other than molecular adhesion is required to hold the assembly together.

A remarkable feature of the ThetaShear principle is the fact that the transverse resonance frequency will always be found outside the 10% frequency limit. This ensures minimum interference from orthogonal vibration components in the useful frequency range of the accelerometer.

Environmental Sensitivity

One of the most troublesome environmental factors encountered when using piezoelectric accelerometers is temperature transients.

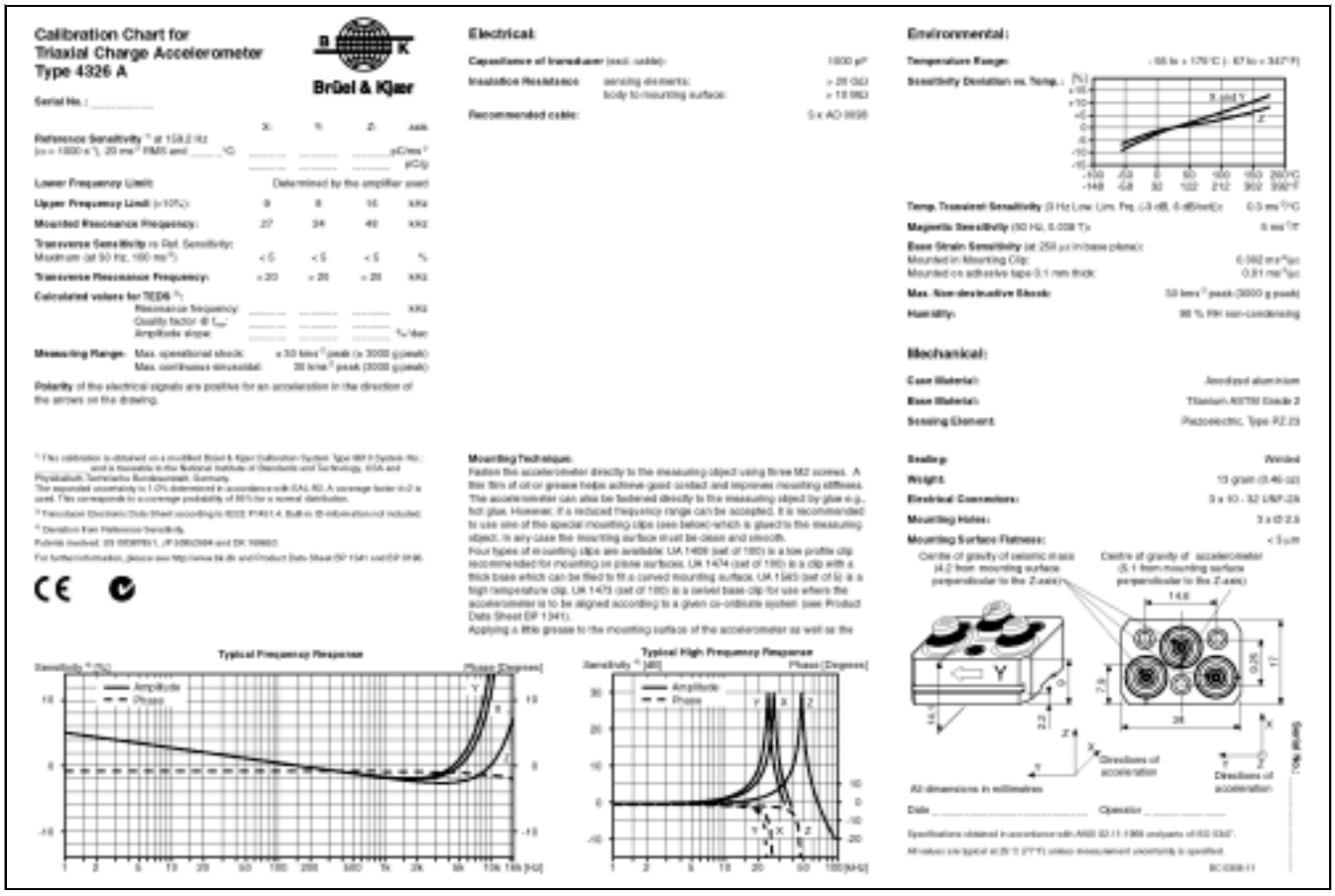
By careful choice of materials and mechanical design, this has been reduced to a minimum. The ThetaShear design also provides excellent immunity to other environmental effects such as base strains, magnetic sensitivity and acoustic fields.

Calibration

Each Type 4326 A is individually calibrated and supplied with a calibration chart (see Fig. 2). Long-term stability and reliability are ensured by artificial ageing during the

production process. Field checking and system calibration are straightforward using Brüel & Kjær's hand-held Calibration Exciter Type 4294 and Calibration Clip DV 0460. The latter can only be used for calibration in the Z direction. For calibration in the X and Y direction use adhesive mounting.

Fig. 2 *Calibration chart for Type 4326 A*



Mounting

Special effort has been put into making mounting as flexible as possible. For fast and easy mounting, Mounting Clips UA 1408, UA 1473 and UA 1474 can be used. Five of the six surfaces can be used for mounting with adhesive cement or mounting wax. Where threaded holes can be provided in the test piece, Types 4326 A and 4326 A – 001 can be mounted from the top via mounting holes in the base. The base can accommodate three M2 screws for top mounting.

Fig. 3
Mounting Clip UA 1408
Weight: 2.1 g
Upper limiting frequency, 10%
– mounted with grease: 2 kHz
– dry mounting: 1.2 kHz

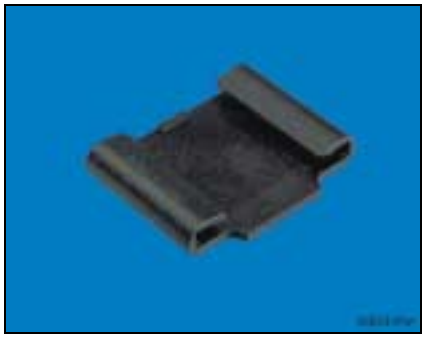


Fig. 4
Mounting Clip with Thick Base UA 1474 can be filed down to suit your mounting surface needs (see picture, far right)
Weight: 3.9 g
Upper limiting frequency, 10%
– mounted with grease: 2 kHz
– dry mounting: 1.2 kHz

Fig. 5
High Temperature Mounting Clip UA 1563
Temperature Range: –55 to 175°C (–67 to 347°F)
If discoulouring can be accepted: –55 to 250°C (–67 to 482°F)
Weight: 11.0 g
(Perpendicular to mounting surface: 50 g peak)
Material: Base: anodized aluminium;
Spring: Stainless spring steel

Fig. 6
Mounting Clip with Swivel Base UA 1473
Weight: 5.0 g
Upper limiting frequency, 10% (mounted with grease):
– excited along one of the accelerometer's axes of sensitivity but with mounting surface of the hemispherical part perpendicular to the direction of excitation: 1.3 kHz
– excited along one of the accelerometer's axes of sensitivity but with mounting surface of the hemispherical part at 45° to the direction of the excitation: 1.0 kHz

Fig. 7
Water Cooling Mounting Block UA 3014 for high temperature applications

Fig. 8
Spirit Level UA 1480
Max. dimensions: 85 × 23 × 17 mm
Material: Black anodised aluminium

Ground Insulation

Ground loop noise, particularly troublesome in multichannel measurements, is avoided by electrically insulating the sensing elements from the common body. Both Type 4326 A and Type 4326 A – 001 feature this electrical insulation with respect to signal ground and have a resistance of more than 10 MΩ.

The electrical insulation of Type 4326 A comes from its fully hard anodised common body, with insulation at the three cylindrical mounting surfaces. The hard anodized mounting surfaces provide additional insulation.

The electrical insulation of Type 4326 A – 001 comes from the special mounting technique for the three sensing elements. A non-conductive glue is used to bond the sensing elements to the holes in the common body. Advanced production techniques ensure that a thin and even layer of this glue is applied to the cylindrical surfaces of the sensing elements prior to placing them in the common body. This technique ensures correct electrical insulation as well as a rigid mechanical connection between the sensing elements and the common body. The three individually insulated sensing elements ensure that no ground loop currents are induced in the measurement setup. This is particularly beneficial in engine test applications.

Cables and Connectors

Extension cables of virtually any length can be supplied to order, or you can make your own using cable AC 0005 and a connector kit. An extension adaptor is used to couple the extension cable (for detailed information about these options see Ordering Information). To maintain the x-y-z colour coding of the extension cables, colour code clips are available to fit the thicker AC 0005 cable.

Cable Clamping

When using miniature accelerometers, the accelerometer cable can affect the measurement result because of forces exerted by the cable on the accelerometer connector. This can then cause amplitude irregularities in the output from the accelerometer at frequencies up to approximately 200 Hz. This can be reduced by using a flexible cable. To effectively reduce the problem at low frequencies, it is generally recommended to clamp the cable. One way of doing this is to make a small loop in the cable close to the accelerometer (max. diameter 30 mm) and clamp the cable beside the base of the

accelerometer with mounting wax or double-sided tape. This also reduces the possibility of dynamically induced noise generated by the cable.

Specifications – Miniature Triaxial Accelerometers Types 4326 A, 4326 A–001

	Units	4326–A	4326–A–001
Charge Sensitivity	pC/ms^{-2} (pC/g)	0.3 (3)	0.3 (3)
Sensitivity Tolerance		±15%	±15%
Frequency Range, ±10%			
x-axis	kHz	9	9
y-axis	kHz	8	8
z-axis	kHz	16	16
Mounted Resonance Frequency			
x-axis	kHz	27	27
y-axis	kHz	24	24
z-axis	kHz	48	48
Transverse Resonance Frequency			
x-axis	kHz	>20	>20
y-axis	kHz	>20	>20
z-axis	kHz	>20	>20
Transverse Sensitivity		<5% of sensitivity	<5% of sensitivity
Capacitance	pF	1000	1000
Base insulation to mounting surface	MΩ at 100 V	10	10
Maximum Non-destructive Shock	g	3000	3000
Ambient Temperatures	°C (°F)	–55 to +175 (–67 to +347)	–55 to +230 (–67 to +446)
Humidity		Sealed Connector	Sealed Connector
Temperature Transient Sensitivity	ms^{-2}/°C	0.3	0.3
Base Strain Sensitivity[a]	ms^{-2}/με	0.01	0.005
Magnetic Sensitivity	ms^{-2}/Tesla	5	5
Case Material		Aluminium	Titanium
Base Material		Titanium	Titanium
Piezoelectric Element		PZ23	PZ23
Design Construction		ThetaShear	ThetaShear
Connectors		10–32UNF	10–32UNF
Dimensions (H×W×L)	mm	9×17×24	9×17×24
Weight	gram (oz)	13 (0.46)	17 (0.60)

a.Mounted on adhesive tape 0.1 mm thick

Compliance with Standards

TYPE 4326 AND TYPE 4326 A – 001 UNLESS STATED ELSEWHERE

CE, C-Tick	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 and IEC 61000–6–3: Generic emission standard. Part 1: Residential, commercial and light industry. EN 50081–2 and IEC 61000–6–4: 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 and IEC 61000–6–1: Generic immunity standard. Part 1: Residential, commercial and light industry. EN 50082–2 and IEC 61000–6–2: Generic immunity standard. Part 2: Industrial environment. **Note 1:** The above is guaranteed using 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 (4326 A): –55 to +175 °C (–67 to +347 °F) Operating Temperature (4326 A – 001): –55 to +230 °C (–67 to +446 °F) Storage Temperature: –25 to +70 °C (–13 to +158 °F)
Humidity	IEC 68–2–3: Damp Heat: 90% RH (non-condensing at 40 °C (104 °F))
Mechanical	Non-operating: IEC 68–2–6: Vibration: 0.3 mm, 20 m/s^2, 10–500 Hz IEC 68–2–27: Shock: 1000 m/s^2 IEC 68–2–29: Bump: 1000 bumps at 250 m/s^2

Ordering Information

Types 4326 A/4326 A – 001 Miniature Triaxial Accelerometers include the following accessories:
Carrying Box
Individual Calibration Chart
One Mounting Clip DV 0456

Optional Accessories

Cables

AO 0038	1.2 m (4 ft) super low-noise Teflon cable, AC 0005 with 10 – 32 UNF connectors, 250°C (482°F)
AO 0122	3 m (10 ft) reinforced super low-noise cable, AC 0200 with 10 – 32 UNF connectors, 250°C (482°F)
AO 0406	5 m (16 ft) double-screened low-noise cable, AC 0104 with 10 – 32 UNF connectors, 250°C (482°F)
AO 1419	Low-noise cable, AC 0066 with 10 – 32 UNF connectors, 1.2 m (4 ft), 250°C (482°F)
AO 1382	1.2 m (4 ft) double screened, low-noise Teflon cable, AC 0104 with 10 – 32 UNF connectors, 200°C (392°F)

Cables AO 0038, AO 0122 and AO 1382 are available in other lengths with 10 – 32 UNF connectors. The following suffixes to the order numbers are used to specify the length when ordering:
F: 3 m (10 ft) (except AO 0122)
G: 5 m (16 ft)
H: 10 m (33 ft)
K: 30 m (100 ft)

Customer specified lengths:
AO 0038V – AC 0005-x
AO 0122V – AC 0200-x
AO 1382V – AC 0104-x
where x specifies the length in metres

UA 1243	3 × 30 pieces of red/green/yellow cable markers for Cable AC 0104
UA 1244	As above for Cable AC 0005
YJ 0216	Mounting Wax
QS 0007	Cyanoacrylate Adhesive
UA 1408	Set of 100 Mounting Clips
DV 0460	Calibration Clip
UA 1480	Spirit Level
UA 1563	Set of 5 High-temperature Mounting Clips
UA 1473	Set of 100 Swivel Bases
UA 1474	Set of 100 Mounting Clips with Thick Base
JP 0192	Solder Connector Adaptor
UA 1075	Set of five Mounting Magnets M3, Ø10.2 mm
4326A–CFF	Recalibration (sensitivity)
4326A–001–CFF	Recalibration (sensitivity)

Connectors

UA 0130	Set of 25 10 – 32 UNF Microdot Connectors JP 0012
UA 0730	Set of 25 reinforced Microdot Connectors JP 0056
UA 0186	Set of 25 10 – 32 UNF Extension Adaptors JJ 0032

Tools

QA 0035	Connector Assembly Tool for Cable AC 0005 and Connector JP 0012

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

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