

## Miniature CCLD Accelerometer Types 4394 and 4397-A

Piezoelectric Accelerometers

### Features

- High frequency
- High sensitivity-to-mass ratio

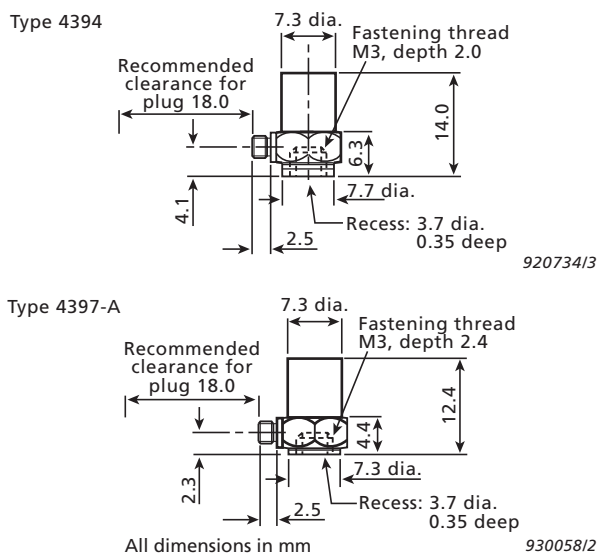
### Description

Types 4394 and 4397-A are piezoelectric DeltaShear™, Unigain accelerometers with side connectors. They feature an M3 connection and can be mounted on the test object with an M3 threaded steel stud. The two types differ from each other in that Type 4394 has a ceramic isolated base.

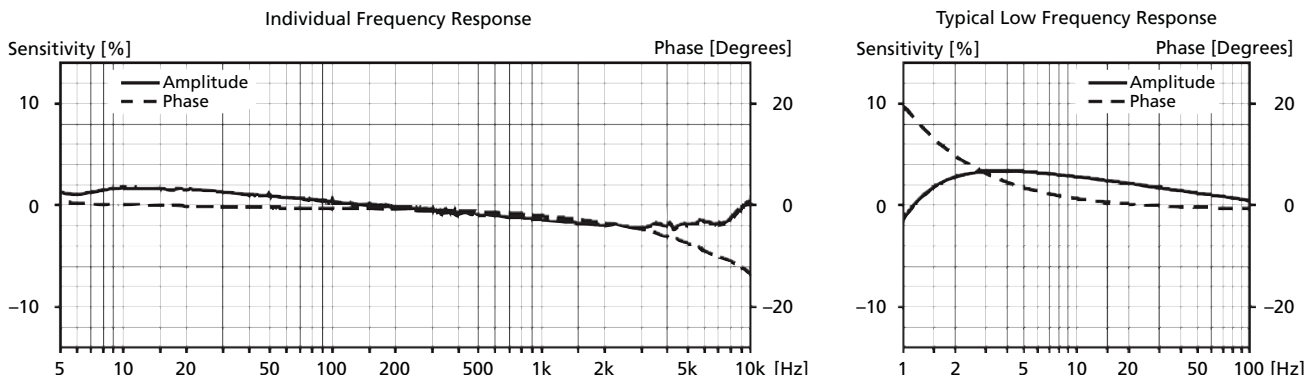
### Characteristics

These miniature accelerometers may be treated as voltage sources. Their sensitivity is expressed in terms of voltage per unit acceleration ( $\text{mV}/\text{ms}^{-2}$ ).

**Fig. 1** Dimensions of Type 4394 and 4397-A



**Fig. 2** Frequency response curves for Types 4394 and 4397-A



The DeltaShear design involves three piezoelectric elements and three masses in a triangular configuration around a central triangular post. A clamping ring pre-stresses these elements to give a higher degree of linearity. The signal is collected between the housing and the clamping ring and amplified in the built-in CCLD\* preamplifier. The piezoelectric element used in Types 4394 and 4397-A is PZ 23 lead zirconate titanate. The housing material is titanium.

### Calibration

The sensitivity given in the calibration chart is measured at 159.2 Hz. For a 95% confidence level, the accuracy of the factory calibration is  $\pm 0.7\%$ .

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

## Specifications – Types 4394 and 4397-A

| Type No.   |                               | 4394*                              | 4397-A*                            |
|--|-------------------------------|------------------------------------|------------------------------------|
| <b>General</b>   |                               |                                    |                                    |
| Weight (excluding cable, wherever applicable)                                      | gram                          | 2.9                                | 2.4                                |
|  | oz                            | 0.102                              | 0.085                              |
| Voltage Sensitivity (at 159.2 Hz and 4 mA supply current)                          | mV/ms <sup>-2</sup>           | 1 ±2%                              |                                    |
|  | mV/g                          | 9.8 ±2%                            |                                    |
| Frequency Range  | Amplitude (±10%)              | 1 to 25000                         |                                    |
|  | Amplitude (±5%)               | 1 to 10000                         |                                    |
|  | Phase (±5°)                   | 4 to 2500                          |                                    |
| Mounted Resonance Frequency  | kHz                           | 52                                 | 53                                 |
| Max. Transverse Sensitivity (at 30 Hz, 100 ms <sup>-2</sup> )                      | %                             | <4                                 |                                    |
| Transverse Resonance Frequency   | kHz                           | 15                                 | 17                                 |
| Measuring range (± peak)   | kms <sup>-2</sup>             | 5 (7.5 when T < 100 °C)            |                                    |
|  | g                             | 500 (750 when T < 100 °C)          |                                    |
| TEDS   |                               | No                                 |                                    |
| <b>Electrical</b>  |                               |                                    |                                    |
| Bias Voltage   | at 25 °C and 4 mA             | V                                  | 12 ±0.5                            |
|  | at full temp. and curr. range |                                    | 8 to 15                            |
| Power Supply   | Constant current              | mA                                 | 2 to 10 (2 to 20 mA if T < 100 °C) |
|  | Unloaded supply voltage       | V                                  | 24 to 30                           |
| Output Impedance   |                               | Ω                                  | 100                                |
| Start-up time (to final bias ±10%)   |                               | s                                  | <5                                 |
| Residual Noise (inherent RMS broadband noise in the specified frequency range)     |                               | μV                                 | <25      <15                       |
|  |                               | μg                                 | <2500      <1500                   |
| Noise Spectral   | 10 Hz                         | mms <sup>-2</sup> /√Hz<br>(μg/√Hz) | 1.3 (130)      0.79 (79)           |
|  | 100 Hz                        |                                    | 0.45 (45)      0.21 (21)           |
|  | 1000 Hz                       |                                    | 0.17 (17)      0.14 (14)           |
| <b>Environmental</b>   |                               |                                    |                                    |
| Operating Temperature Range  |                               | °C                                 | -50 to +125                        |
|  |                               | °F                                 | -58 to +257                        |
| Temperature Coefficient of Sensitivity   |                               | %/°C                               | 0.04      0.05                     |
| Temperature Transient Sensitivity<br>(3 Hz Lower Limiting Freq. (-3 dB, 6 dB/oct)) |                               | ms <sup>-2</sup> /°C               | 2                                  |
|  |                               | g/°F                               | 0.11                               |
| Magnetic Sensitivity (50 Hz, 0.038 T)  |                               | ms <sup>-2</sup> /T                | 10      50                         |
|  |                               | g/kGauss                           | 0.1      0.5                       |
| Base Strain Sensitivity (at 250 με in base plane)                                  |                               | ms <sup>-2</sup> /με               | 0.005                              |
|  |                               | g/με                               | 0.0005                             |
| Max. Non-destructive Shock (± peak)  |                               | kms <sup>-2</sup>                  | 100 (axial), 50 (transverse)       |
|  |                               | g                                  | 10000 (axial) 5000 (transverse)    |
| <b>Mechanical</b>  |                               |                                    |                                    |
| Case Material  |                               |                                    | Titanium ASTM Grade 2              |
| Piezoelectric Sensing Element  |                               |                                    | PZ 23                              |
| Construction   |                               |                                    | DeltaShear                         |
| Sealing  |                               |                                    | Welded                             |
| Electrical Connector   |                               |                                    | Coaxial M3                         |
| Mounting   |                               | M3 × 2 mm threaded hole            | M3 × 2.4 mm threaded hole          |
| Mounting Torque  | Nm (lbf-in)                   | Max. 0.6 (5.3), Min. 0.2 (1.8)     |                                    |

\* All values are typical at 25 °C (77 °F) unless otherwise specified

### COMPLIANCE WITH STANDARDS



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## Ordering Information

### Type 4394

includes the following accessories:

- Carrying Box
- Calibration Chart
- AO-1381-D-012: Cable M3 (M) to 10–32 UNF (M), 1.2 m, 250 °C (482 °F)
- 3×YS-8321: Steel stud with flange, M3/M3, 3.5 mm

### Type 4397

includes the following accessories:

- Carrying Box
- Calibration Chart
- AO-1381-D-012: Cable M3 (M) to 10–32 UNF (M), 1.2 m, 250 °C (482 °F)
- 4×YS-8321: Steel stud with flange, M3/M3, 3.5 mm

### Type 4397-A

includes the following accessories:

- Carrying Box
- Calibration Chart
- 1×YS-8321: Steel stud with flange, M3/M3, 3.5 mm

| Optional Accessories  |  |
|-----------------------|--|
| AO-0283               | Super low-noise coaxial cable, M3 to 10–32 UNF, 250 °C (482 °F)                    |
| AO-0339               | Flexible low-noise coaxial cable, M3 to 10–32 UNF, 250 °C (482 °F)                 |
| AO-1381               | Flexible double-screened low-noise coaxial cable, M3 to 10–32 UNF, 250 °C (482 °F) |
| AO-0641               | Low-cost coaxial cable, M3 to BNC, 90 °C (194 °F)                                  |
| AO-0698               | Super low-noise coaxial cable, M3 to SMB, 250 °C (482 °F)                          |
| UA-0867               | 25 × cement stud, M3, 8.0 mm dia.  |
| UA-0186               | 25 × extension connector 10–32 UNF   |
| UA-1075               | 5 × mounting magnet  |
| UA-1221               | 25 × steel stud with flange, M3/M3, 3.5 mm   |
| WA-0224               | Mechanical filter  |
| JP-0145               | Plug adaptor, BNC/10–32 UNF  |
| QA-0041               | Tap for M3 thread  |
| QA-0042               | Hexagonal key for M3 studs   |
| QS-0007               | Tube of cyanoacrylate adhesive   |
| YJ-0216               | Beeswax for mounting   |
| Type 4397-A only      |  |
| UA-1193               | 10 × insulated stud, M3/M3, 2.4 mm   |
| YQ-2003               | M3 threaded steel stud, 5 mm   |
| YQ-2007               | M3 threaded steel stud, 8 mm   |
| Calibration Services* |  |
| 439x-CAF              | Accredited calibration   |
| 439x-CAI              | Accredited initial calibration   |
| 439x-CFF              | Factory standard calibration   |
| 439x-CTF              | Traceable calibration  |

\* x = 4 or 7