

# PRODUCT DATA

## 3-channel Human Vibration Front-end — Type 1700



Type 1700 is a 3-channel Human Vibration Front-end that allows triaxial accelerometer measurements to be done with single-channel, 1/3-octave sound measuring instruments – for example 2260 Investigator™, 2260 Observer™, Portable PULSE™ Type 3560 C and Mediator™ Type 2238.

Type 1700 is battery powered and contains conditioning amplifiers for DeltaTron® transducers. After pre-amplification, the signals are band limited and can be weighted according to ISO 8041 standards. This means that Type 1700 is suitable for measuring whole-body vibration to ISO 2631 and hand-arm vibration to ISO 5349 standards. The incorporation of analogue filters also means Type 1700 is suitable for measuring according to GOST standards.

Type 1700 is functionally identical to 3-channel Human Vibration Front-end WB 3461

**Type 1700**

- USES*
  - Triaxial accelerometer measurements
  - Occupational health surveys
  - Product certification
  - Hand-arm vibration risk assessment
  - Whole-body vibration risk assessment
  
- FEATURES*
  - Whole-body filters ( $2 \times W_d, W_k$ ) in X, Y and Z channels respectively
  - Hand-arm filter ( $W_h$ ) available in each channel
  - Battery powered
  
- STANDARDS COVERED*
  - ISO 5349:1986
  - ISO 5349-1:2001, ISO 5349-2:2001
  - ISO 2631-1:1997
  - EC Physical Agents (Vibration) Directive

## Description

Type 1700 is a 3-channel front-end that allows triaxial human vibration measurements to be done on single-channel, 1/3-octave sound measuring instruments. Type 1700 has been specifically designed for use with 2260 Investigator™ and 2260 Observer™, but also functions with 2238 Mediator™ and 3560 C PULSE™. The unit runs on six LR6/AA-size 1.5 V alkaline batteries, but can also be powered via an optional mains adaptor.

Type 1700 has three BNC inputs that are configured to accept DeltaTron® transducers. In measurement mode, you can choose to measure whole-body vibration (WBV) in three axes simultaneously, or hand-arm vibration (HAV) sequentially. Band-limiting filters, as defined by ISO/CD 8041, are provided in each channel, as are the principle weightings given in ISO 2631 and ISO 5349. These allow you to measure and assess whole-body vibration for seated persons (ISO 2631 § 8.2.2.1), for standing persons (ISO 2631 § 8.2.2.2), for recumbent persons (ISO 2631 § 8.2.2.3), and hand-arm vibration (ISO 5349).

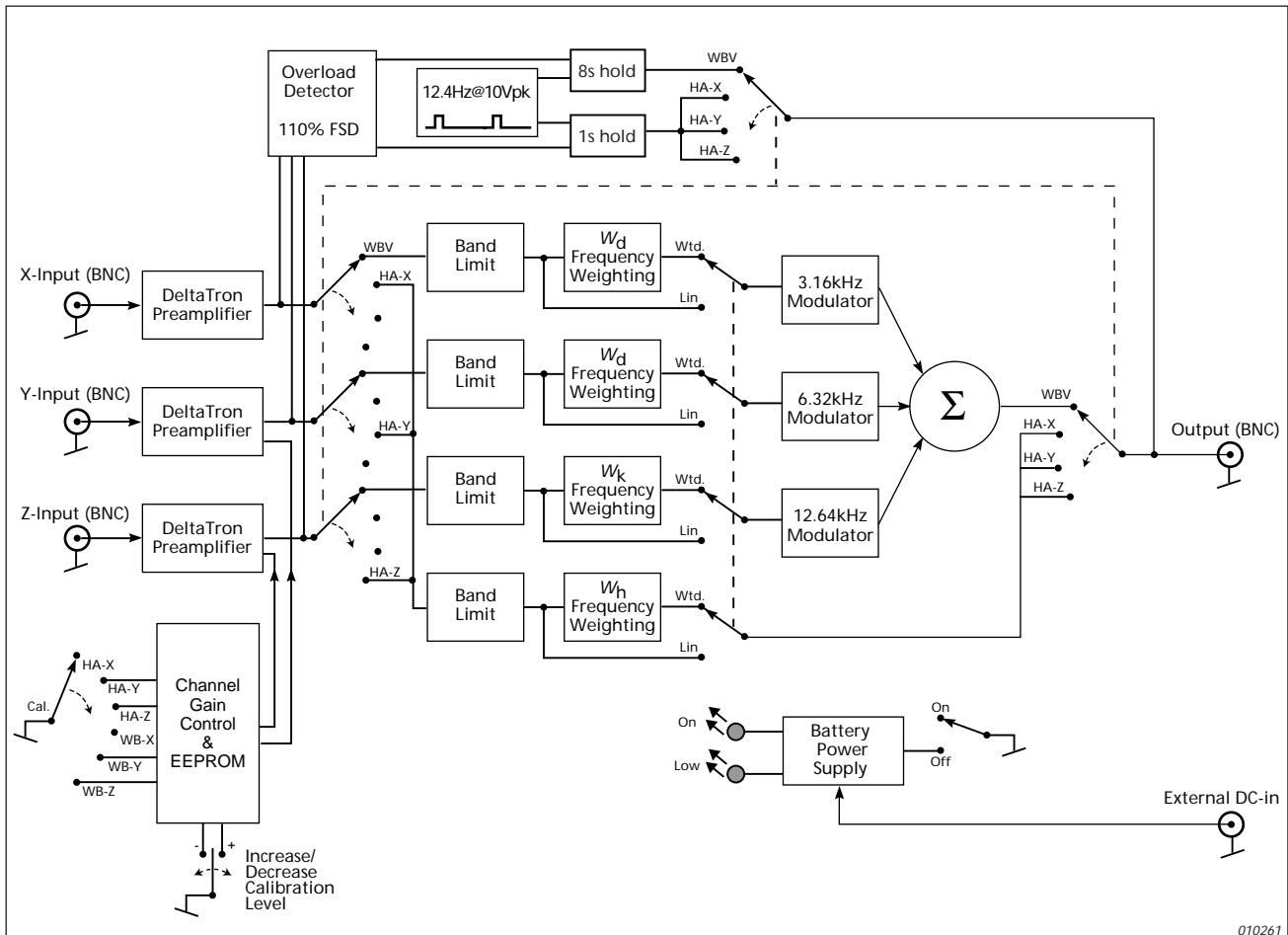
WBV signals are modulated to convert the baseband vibration information into double-sideband a.m. signals with carrier frequencies of 3.16 kHz, 6.32 kHz and 12.64 kHz (these lie within standard 1/3-octave bands). The outputs of the three modulators are summed together to produce a combined signal containing representations of all the energy from each baseband signal, but split up within the three independent 1/3-octave bands. The combined signal is then sent on to the measuring instrument for detection and display.

HAV signals are not modulated in the same way as WBV signals<sup>1</sup>, but pass through Type 1700 as baseband signals. This allows you to see HAV signals as 1/3-octave spectra directly on the measuring instrument. This feature is not possible with WBV because the lower frequency of interest (0.4 Hz) is below the 1/3-octave capability of Type 2260 and Type 2238.

Type 1700 contains one overload detector per channel, set to 110% of maximum signal level. If any channel overloads the power-on LED flashes, and an overload condition is sent, embedded within the output signal, to the measuring instrument. When measuring WBV, the overload condition is latched for 8 seconds, and when measuring HAV, it is latched for 1 second.

<sup>1</sup>The modulation products of a HAV signal exceed the available 1/3-octave filter bandwidths

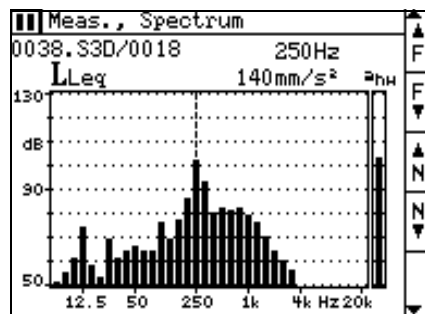
Fig. 1 Schematic diagram of Type 1700



### Calibration

Calibration of Type 1700 in combination with a sound level meter/analyzer (SLM) is a two stage process. Firstly, a known input is applied to the X-channel, after which the SLM sensitivity is adjusted to give the correct measured reading. For example, using Calibration Exciter Type 4294 to produce an acceleration of  $10 \text{ m/s}^2$ , the sensitivity of the SLM is adjusted, using the SLM's calibration routine, to give a display reading of 140 dB (re  $1 \mu\text{m/s}^2$ ). Transferring the calibration exciter to the Y and Z channels respectively, their gain is adjusted to give the same displayed level as the X-channel, e.g., 140 dB.

Fig. 2 Spectrum display of 2260 Observer™ showing a HAV measurement. The cursor is placed at 250Hz and shows an acceleration value of  $140 \text{ mm/s}^2$ . The bar on the extreme right shows the total acceleration value,  $a_{hw}$



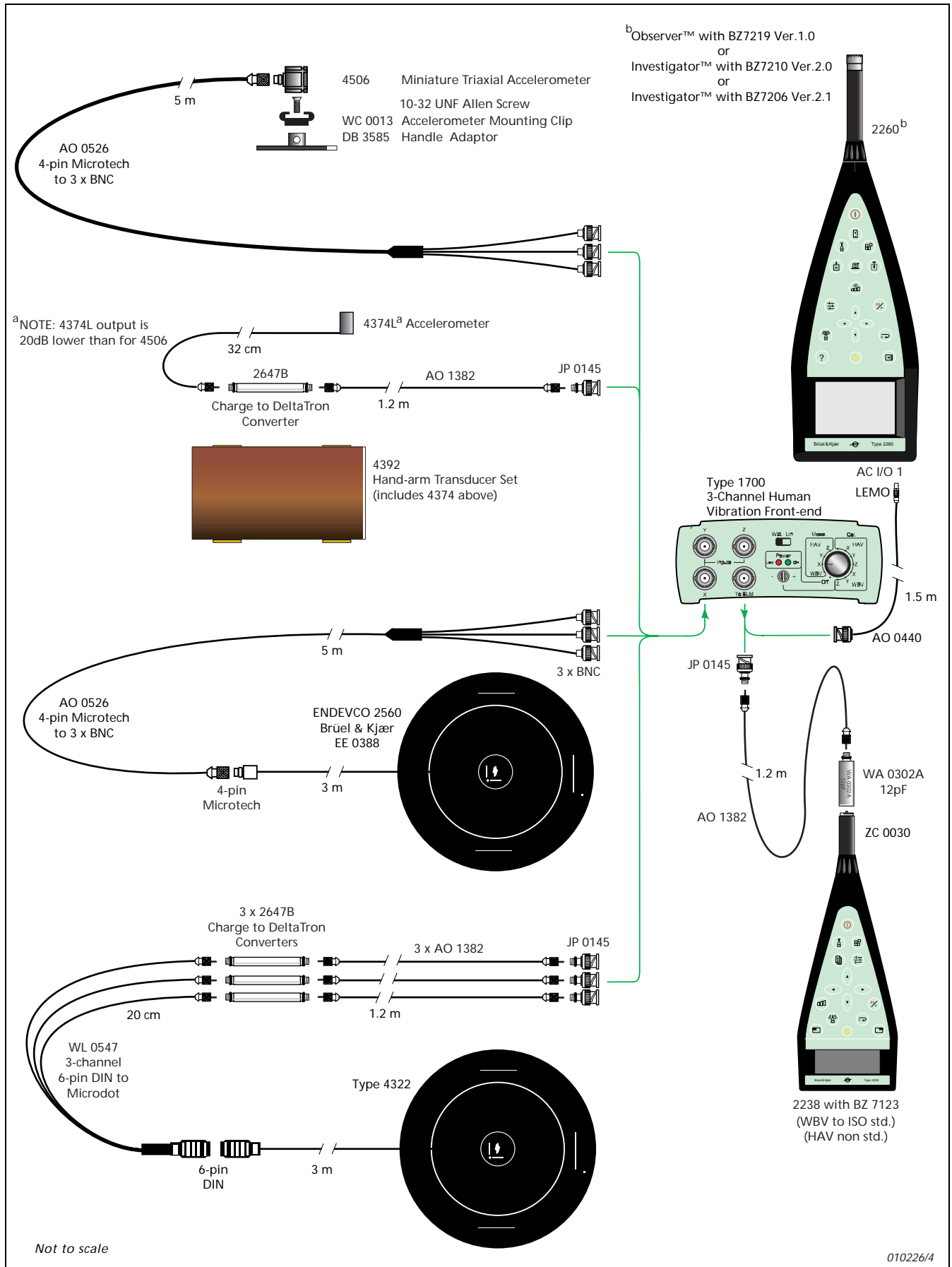
### Measurement Results

When using 2260 or 3560 C, the measured acceleration levels can be displayed in  $\text{m/s}^2$  (see Fig. 2), or in dB re  $1 \mu\text{m/s}^2$  (all instruments). For post-processing and reporting, measurement data from 2260 and 2238 can be transferred to PC programs Type 7820 Protector™ or Type 7815 Noise Explorer™. As well giving you the tools to inspect and archive results, you can also use Type 7815 and Type 7825 to export your data to a spreadsheet.

### Accessories

Fig. 3 shows the preferred combinations of accelerometers, cables and instruments for use with Type 1700. Please note that because all the signal conditioning is done within Type 1700, any Type 1 instrument capable of measuring linear 1/3-octaves with nominal centre frequencies from 6.3 Hz to 12 kHz can be used, for example PULSE™ Type 3560 C.

Fig. 3 System diagram for Type 1700 when used with 2260 Observer™, 2260 Investigator™ or 2238 Mediator™



# Specifications – 3-channel Human Vibration Front-end Type 1700

Unless otherwise noted, specifications are given when Type 1700 is used with Type 2260; values are given under reference ambient conditions with nominal sensitivities for the accelerometer.

## STANDARDS:

Type 1700 can measure according to the following:

- ISO 5349:1986
- ISO 5349-1:2001
- ISO 5349-2:2001
- ISO 2631-1:1997
- EC Physical Agents (Vibration) Directive

Type 1700 complies with ISO 8041:1990

## MEASUREMENT MODES:

**HAV-lin, X or Y or Z:** Hand-arm monoaxial mode with band-limited linear frequency weighting (6.3 Hz–1250 Hz, –3 dB)

**HAV-wtd., X or Y or Z:** Hand-arm monoaxial mode with  $W_h$  frequency weighting complying with ISO 5349, ISO/CD 8041

**WBV-lin:** Whole-body triaxial mode with band-limited linear frequency weighting (0.4 Hz–100 Hz, –3 dB)

**WBV-wtd.:** Whole-body triaxial mode with  $W_d$ ,  $W_d$  and  $W_k$  frequency weightings in the X, Y and Z channels respectively, complying with ISO 2631-1 and ISO/CD 8041

## MEASUREMENT UNITS (set by the Sound Level Meter):

$m/s^2$  (only 2260 or 3560 C) or dB re  $1 \mu m/s^2$

## DETECTOR TIME CONSTANT (set in the Sound Level Meter):

1/8 second (Fast)

1 second (Slow)

## MEASURED PARAMETERS:

2260 with BZ 7210 ver. 2.0, BZ 7219 ver. 1.0 or BZ 7206 ver. 2.1:

**WBV:**  $a_{wx}$ ,  $a_{wy}$ ,  $a_{wz}$ ,  $a_v$

**HAV:**  $a_{hw}$

2238 with BZ 7123 ver. 1.1.0:

**WBV:**  $Leq_x$ ,  $Leq_y$ ,  $Leq_z$ ,

**HAV<sup>\*</sup>:**  $Leq_{hw}$

Please refer to the Sound Level Meter / Analyzer documentation for details of all the L-parameters available when the instruments are used in the following modes:

- 2260/3560 C: 1/3-octave spectrum, 6.3 Hz to 20 kHz
- 2238: 1/3-octave sequential spectrum, 20 Hz\* to 12.5 kHz

## POST-PROCESSING:

Measured and stored data can be imported into Type 7815 Noise Explorer™ and Type 7820 Protector™ for documentation of results and export to spreadsheet.

## OVERLOAD DETECTOR:

Overload detector on all three input channels within Type 1700. For HAV, overload condition is latched for 1 s, for WBV 8 s. Overload condition is transferred to the SLM via the output cable as a series of 12.4 Hz pulses. The SLM overload detection/indication system is then used for reporting. NOTE: The SLM must be set to the highest range.

## OVERLOAD INDICATION:

When an overload condition is present, the Power On LED flashes for the duration of the overload plus the latch time.

## CALIBRATION:

**Type 1700:** X-channel gain  $\approx$  0 dB, Y and Z channels set relative to X-channel, approximately  $\pm 2$  dB in 0.06 dB steps, using front-panel control

**Sound Level Meter/Analyzer:** With a known signal on X-channel, use the SLM's calibration procedure to give the correct reading. Then adjust Y and Z channels on Type 1700 to give the same reading on the SLM display.

**Storage:** Type 1700 stores the last Y and Z channel gain settings for WBV or HAV settings. The SLM stores the last sensitivity adjustment.

## MEASUREMENT STORAGE:

Measured values are stored, if required, in the SLM. Refer to SLM documentation to find exact specifications.

## INPUTS:

X, Y AND Z inputs are DeltaTron® compatible

**Connector:** BNC

**Grounding:** Single-ended

**Input Impedance:** 16 k $\Omega$  @ 10 kHz

**Max. Input:** 0.78 VRMS (1.1 V peak)

**Max. Cable Length:** 30 m

**Input Protection:** No damage between –6 V and +30 V peak, or max. 30 mA RMS input current, whichever is the greatest

**Constant Current Supply ( $\pm 15\%$ ):** +3 mA +28 V voltage source

**Inherent Noise (linear weighting selected):** HAV: <10  $\mu$ V (1 Hz to 10 kHz bandwidth), WBV: <30  $\mu$ V in each 1/3-octave band

**Harmonic Distortion and Noise:** <0.1% (1 Hz to 10 kHz,  $V_{in} = V_{out}$  ( $\approx$  0.1 VRMS))

## OUTPUT:

**Connector:** BNC

**Grounding:** Single-ended

**Output Impedance:** 50  $\Omega$

**Max. Output:** 0.7 VRMS (1 V peak) for Type 1700–A (2260/PULSE™), 1.4 VRMS (2 V peak) for Type 1700–B (2238)

**Dynamic Range:** > 90 dB

**Output Protection:**  $\leq$ 18 VRMS or 50 mA, whichever is the greatest

## BATTERIES:

**Type:** 6  $\times$  LR6/AA-size 1.5 V alkaline

**Lifetime (at 20°C):** Greater than 12 hours with three DeltaTron® channels powered

**Power Low Indication:** Lights when battery voltage falls below approximately 5.8 V

## EXTERNAL DC POWER SUPPLY:

**Voltage:** Regulated or smoothed 10 to 14 V, max. ripple 100 mV

**Power:** 3.5 W, current: 300 mA, Inrush current: 1000 mA

**Socket:**  $\varnothing$ 5.5 mm with  $\varnothing$ 2.1 mm pin (positive)

## MAINS SUPPLY:

Supported via Mains Adaptor ZG 0386 (EU), ZG 0387 (UK) or ZG 0388 (US) (not included)

## WARM-UP TIME:

Approximately 60 seconds

## WEIGHT AND DIMENSIONS:

1.2 kg (2.6 lb.) with batteries

221  $\times$  110  $\times$  45 mm (14.8  $\times$  4.7  $\times$  2.0")

## ENVIRONMENTAL SUSCEPTIBILITY:

**Magnetic Field:** <0.7  $\mu$ V/A/m

**Electromagnetic Field (Radiated):** <50  $\mu$ V @ 10 V/m

**Electromagnetic Field (Conducted):** <50  $\mu$ V @ 10 V HF

## COMPLIANCE WITH STANDARDS:



compliance with EMC Directive



compliance with EMC Requirements of Australia and New Zealand

**Safety:** EN 61010–1, IEC 61010–1, UL 3111–1

**EMC Emission:** EN 50081–1 (1992), EN 61326–1, FCC class B,

**EMC Immunity:** EN 61000–6–2 (1999), EN 61326–1

Environmental testing according to IEC 60068 standards. See also ENVIRONMENTAL SUSCEPTIBILITY above

**Operating temperature:** –10 to +50°C (14 to 122°F)

**Storage Temperature:** –25 to +70°C (–13 to 158°F)

**Humidity:** 90% RH (non-condensing at 40°C (104°F))

\*NOTE: This does not conform to ISO 5349, but can be used for explorative measurements

# Ordering Information

**Type 1700-A:** 3-channel Human Vibration Front-end for use with 2260 Investigator™, 2260 Observer™ or PULSE™ Type 3560 C  
**Type 1700-B:** 3-channel Human Vibration Front-end for use with 2238 Mediator™

## Also Required for Type 2260 Systems

### BASIC REQUIREMENTS: (excluding transducer)

Type 2260 | Observer™ Modular Precision Sound Analyzer with Sound Analysis Software BZ 7219  
or  
Type 2260 | Investigator™ Modular Precision Sound Analyzer with Basic Sound Analysis Software BZ 7210 version 2.0\*  
or  
Type 2260 | Enhanced Sound Analysis Software BZ 7206 version 2.1  
and  
AO 0440 | BNC – triaxial LEMO Cable (1.5 m)

### FOR HAND-ARM VIBRATION MEASUREMENTS: In addition to the basic requirements

Type 4506 | Miniature Triaxial Accelerometer  
AO 0526 | 4-pin Microtech to 3 × BNC Cable (5 m)  
or  
Type 4392 | Monoaxial Hand-arm Transducer Set (includes Type 4374 L Monoaxial Accelerometer and handle/hand adaptors)  
Type 2647 B | Charge to DeltaTron® Converter  
AO 1382 | Microdot Cable (1.2 m)  
JP 0145 | Microdot to BNC Connector

### FOR WHOLE-BODY VIBRATION MEASUREMENTS: In addition to the basic requirements

EE 0388 | Seat Pad Triaxial Accelerometer (including 3 m cable)  
AO 0526 | 4-pin Microtech to 3×BNC Cable (5 m)  
or  
Type 4322 | Triaxial Seat Accelerometer (including DIN-microdot Cable WL 0547)  
3×Type 2647 B | Charge to DeltaTron® Converter  
3×AO 1382 | Microdot Cable (1.2 m)  
3×JP 0145 | Microdot to BNC Connector

## Also Required for Type 2238 Systems

### BASIC REQUIREMENTS: (excluding transducer)

Type 2238 D† | Class 1 Integrating Sound Level Meter with BZ 7123 Frequency Analysis Software and Filter Set  
JP 0145 | Microdot to BNC Connector  
AO 1382 | Microdot Cable (1.2 m)  
WA 0302-A | ½" Microphone Adaptor, 12 pF

### FOR HAND-ARM VIBRATION INVESTIGATION: In addition to the basic requirements

Type 4506 | Miniature Triaxial Accelerometer  
AO 0526 | 4-pin Microtech to 3 × BNC Cable (5 m)  
or  
Type 4392 | Monoaxial Hand-arm Transducer Set (includes Type 4374 L Monoaxial Accelerometer and handle/hand adaptors)  
Type 2647 B | Charge to DeltaTron® Converter  
AO 1382 | Microdot Cable (1.2 m)  
JP 0145 | Microdot to BNC Connector

### FOR WHOLE-BODY VIBRATION MEASUREMENTS: In addition to the basic requirements

EE 0388 | Seat Pad Triaxial Accelerometer (including 3 m cable)  
AO 0526 | 4-pin Microtech to 3×BNC Cable (5 m)  
or  
Type 4322 | Triaxial Seat Accelerometer (including DIN-microdot Cable WL 0547)  
3×Type 2647 B | Charge to DeltaTron® Converter  
3×AO 1382 | Microdot Cable (1.2 m)  
3×JP 0145 | Microdot to BNC Connector

## Optional Accessories

Type 4294 | Calibration Exciter  
Type 7815 | Noise Explorer™ – data viewing software  
Type 7825 | Protector™ – data viewing and calculation software  
AO 1442 | PC or Serial Printer Interface Cable  
ZG 0386 | Mains Power Supply (EU)  
ZG 0387 | Mains Power Supply (UK)  
ZG 0388 | Mains Power Supply (US)  
WC 0013 | Modified Accelerometer Mounting Clip  
DB 3585 | Handle Adaptor  
UA 1474 | Accelerometer Mounting Clips – pack of 100 plastic clips that can be easily drilled/filed for custom mounting  
UA 1219 | Accessories for Accelerometers – a kit containing handy adaptors, mechanical parts and beeswax

\* If measurements conforming to ISO 5349 or below 16 Hz are not critical, then 2260 Investigator™ with BZ 7210 v. 1.0 installed will suffice. For an upgrade of BZ 7210 ver. 1.0 to BZ 7210 ver. 2.0, see your Brüel & Kjær representative.

† Owners of Type 2238 without BZ 7123 Frequency Analysis Software and Filter Set can have these installed by Brüel & Kjær.

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