

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).

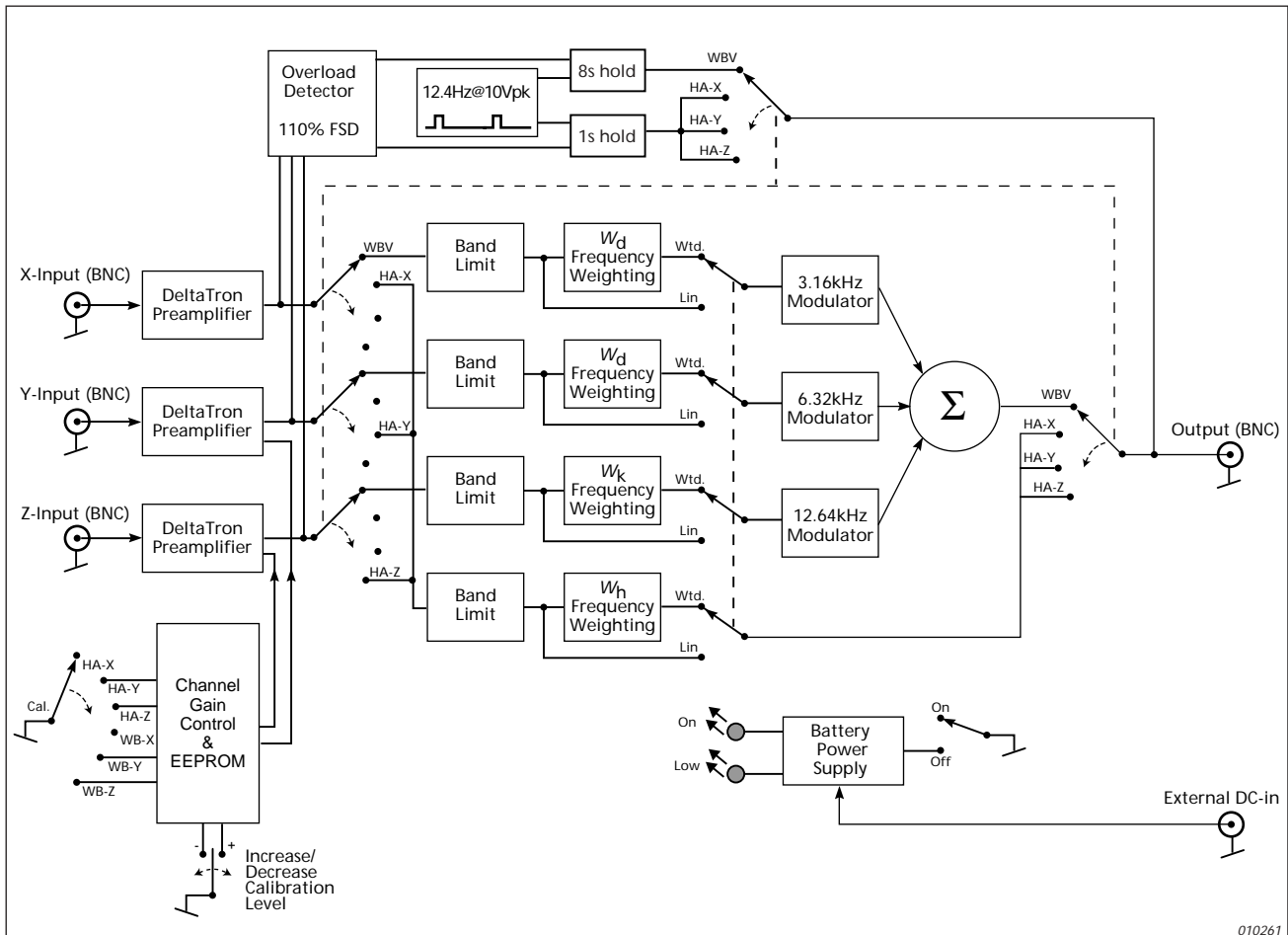
WBV signals are modulated to convert the baseband vibration information into double-sideband a.m. signals with carrier frequencies of 3.16 kHz, 6.32 kHz and 12.64 kHz (these lie within standard 1/3-octave bands). The outputs of the three modulators are summed together to produce a combined signal containing 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 signals¹, 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.

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

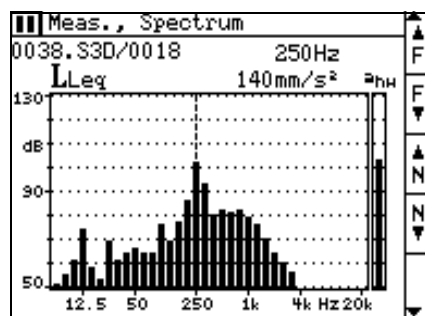
Fig. 1 Schematic diagram of Type 1700



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 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 mm/s^2 . The bar on the extreme right shows the total acceleration value, a_{hw}



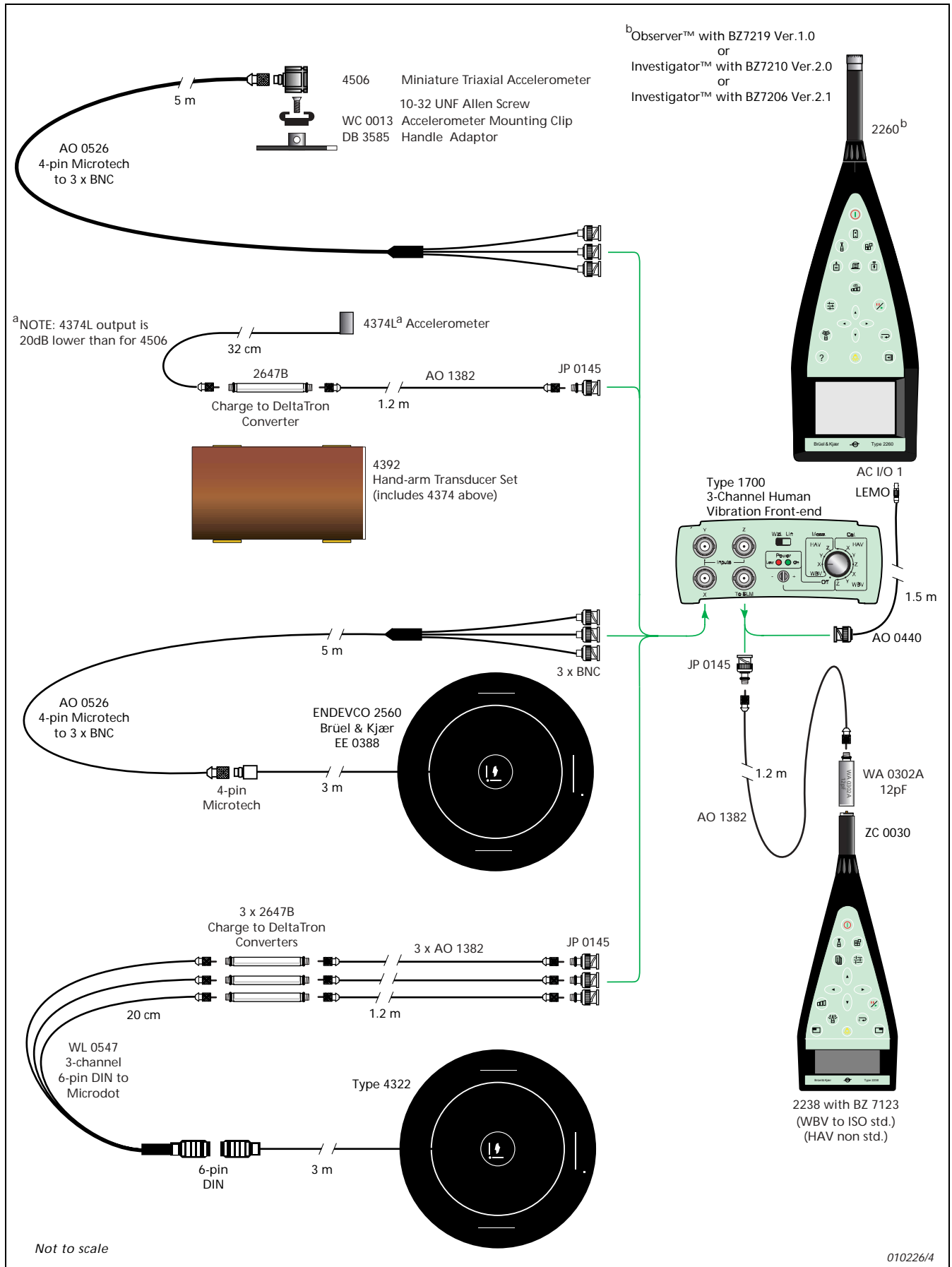
Measurement Results

When using 2260 or 3560 C, the measured acceleration levels can be displayed in 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™



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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^{*}: 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 ± 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 Ω @ 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 μ V (1 Hz to 10 kHz bandwidth), WBV: <30 μ 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 Ω

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 μ V/A/m

Electromagnetic Field (Radiated): <50 μ V @ 10 V/m

Electromagnetic Field (Conducted): <50 μ 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