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.
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 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 1.5V 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\(^1\), 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.

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\(^1\) The modulation products of a HAV signal exceed the available 1/3-octave filter bandwidths
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/s², the sensitivity of the SLM is adjusted, using the SLM's calibration routine, to give a display reading of 140 dB (re 1 µm/s²). 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.

Measurement Results

When using 2260 or 3560 C, the measured acceleration levels can be displayed in m/s² (see Fig. 2), or in dB re 1 µm/s² (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™

AO 0526 4-pin Microtech to 3 x BNC

NOTE: 4374L output is 20dB lower than for 4506

AO 0526 4-pin Microtech to 3 x BNC

ENDEVCO 2560 Bruel & Kjaer EE 0388

3 x AO 0526 4-pin Microtech to 3 x BNC

3 x AO 1382 6-pin DIN to Microdot

Type 4322 6-pin DIN

Type 1700 3-Channel Human Vibration Front-end

Type 1700 3-Channel Human Vibration Front-end

2260b

2238 with BZ 7123 (WAV to ISO std.) (HAV non std.)

WA 0302A 12pF

WL 0547 3-channel 6-pin DIN to Microdot

Not to scale

010226/4
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 monaxial mode with band-limited linear frequency weighting (6.3Hz–12.5kHz, -3dB)
HAV-wtd., X or Y or Z: Hand-arm monaxial mode with Wt frequency weighting complying with ISO5349, ISO/CD 8041
WBV-lin: Whole-body triaxial mode with band-limited linear frequency weighting (0.4Hz–100Hz, -3dB)
WBV-wtd.: Whole-body triaxial mode with Wp, Wd and Wk 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 3560C) or dB re 1µm/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: aHW, aHY, aHZ, aL E.hw
HAV: ahw
WBV with BZ 7213 ver. 1.1.0:
WBV: LeqH, LeqY, LeqZ
HAV:

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

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 1s, for WBV 8s.
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 = 0 dB, Y and Z channels set relative to X-channel, approximately ±2dB in 0.06dB 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: 16kΩ @ 10kHz
Max. Input: 0.78VRMS (1.1 V peak)
Max. Cable Length: 30m
Input Protection: No damage between –6V and +30V peak, or max. 30mA RMS input current, whichever is the greatest
Constant Current Supply (±15%): ±3mA +28V voltage source
Inherent Noise (linear weighting selected): HAV: <10µV (1Hz to 10kHz bandwidth), WBV: <30µV in each 1/3-octave band
Harmonic Distortion and Noise: ±0.1% (1Hz to 10kHz, Vref = Vout (=0.1VRMS))

OUTPUT:
Connector: BNC

Grounding: Single-ended
Output Impedance: 50Ω
Max. Output: 0.71VRMS (1V peak) for Type 1700-A (2260/PULSE™), 1.4VRMS (2V peak) for Type 1700-B (2238)
Dynamic Range: >90dB
Output Protection: ±18VRMS or 50mA, whichever is the greatest

BATTERIES:
Type: 6×LR6/AA-size 1.5V alkaline
Lifetime (at 20°C): Greater than 12 hours with three DeltaTron® channels powered

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

EXTERNAL DC POWER SUPPLY:
Voltage: Regulated or smoothed 10 to 14V, max. ripple 100mV
Power: 3.5V, current: 300mA, inrush current: 1000mA
Socket: ø5.5mm with ø2.1mm pin (positive)

MAINS SUPPLY:
Supported via Mains Adaptor ZG 0386 (EU), ZG 0387 (UK) or New Zealand compliance with EMC Requirements of Australia and NZ compliance with EMC Directive

WARM-UP TIME:
Approximately 60 seconds

WEIGHT AND DIMENSIONS:
1.2kg (2.6lb.) with batteries
45 mm × 110 × 45mm (1.8 × 4.7 × 2.0")

ENVIRONMENTAL SUSCEPTIBILITY:
Magnetic Field: <0.7µA/m
Electromagnetic Field (Radiated): <50µV@10V/m
Electromagnetic Field (Conducted): <50µV@10V 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 IEC60068 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))
Ordering Information

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

Also Required for Type 2260 Systems

**BASIC REQUIREMENTS:** (excluding transducer)

<table>
<thead>
<tr>
<th>Type 2260 Observer™</th>
<th>Modular Precision Sound Analyzer with Sound Analysis Software BZ7219 or Type 2260 Investigator™ Modular Precision Sound Analyzer with Basic Sound Analysis Software BZ7210 version 2.0 or Type 2260 Enhanced Sound Analysis Software BZ7206 version 2.1 and AO 0440 BNC – triaxial LEMO Cable (1.5m)</th>
</tr>
</thead>
</table>

**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 (5m) or
- Type 4392 Monoaxial Hand-arm Transducer Set (includes Type 4374 L Monoaxial Accelerometer and handle/hand adaptors)
- Type 2647B Charge to DeltaTron® Converter
- Microdot Cable (1.2m) and
- JP 0145 Microdot to BNC Connector

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

- EE 0388 Seat Pad Triaxial Accelerometer (including 3m cable)
- AO 0526 4-pin Microtech to 3 × BNC Cable (5m) or
- Type 4322 Triaxial Seat Accelerometer (including DIN-microdot Cable WL0547)
- 3 × Type 2647B Charge to DeltaTron® Converter
- 3 × AO 1382 Microdot Cable (1.2m) and
- 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/ﬁlled for custom mounting
- UA 1219 Accessories for Accelerometers – a kit containing handy adaptors, mechanical parts and beeswax

**Also Required for Type 2238 Systems**

**BASIC REQUIREMENTS:** (excluding transducer)

| Type 2238D† Class 1 Integrating Sound Level Meter with BZ7123 Frequency Analysis Software and Filter Set or Type 2238D† Class 1 Integrating Sound Level Meter with BZ7123 Frequency Analysis Software and Filter Set |
|---------------------|----------------------------------------------------------------------------------------------------|

**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 (5m) or
- Type 4392 Monoaxial Hand-arm Transducer Set (includes Type 4374 L Monoaxial Accelerometer and handle/hand adaptors)
- Type 2647B Charge to DeltaTron® Converter
- AO 1382 Microdot Cable (1.2m) and
- JP 0145 Microdot to BNC Connector

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

- EE 0388 Seat Pad Triaxial Accelerometer (including 3m cable)
- AO 0526 4-pin Microtech to 3 × BNC Cable (5m) or
- Type 4322 Triaxial Seat Accelerometer (including DIN-microdot Cable WL0547)
- 3 × Type 2647B Charge to DeltaTron® Converter
- 3 × AO 1382 Microdot Cable (1.2m) and
- 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/ﬁlled 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 BZ7210 ver. 1.0 installed will suﬃce. For an upgrade of BZ7210 ver. 1.0 to BZ7210 ver. 2.0, see your Brüel & Kjær representative.

† Owners of Type 2238 without BZ7123 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.