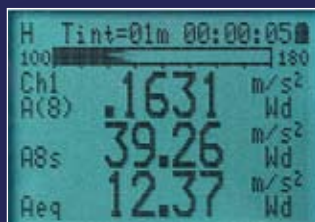


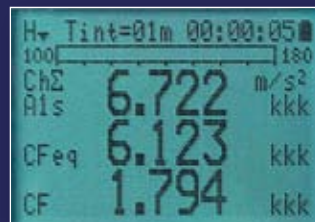


## HD2030

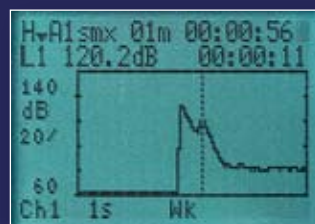
▶ Four channel vibration analyzer



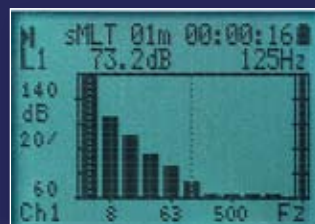
▶ Base screen: single axis measurements



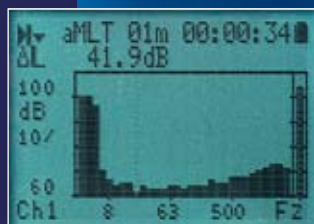
▶ Base screen: vector measurements



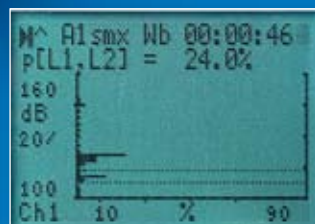
▶ Time profile



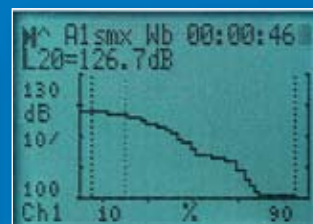
▶ Octave band spectrum



▶ Third octave and spectrum



▶ Statistic analysis: probability distribution



▶ Statistic analysis: graph of percentile levels



### ΗΧΟΠΑΡΕΜΒΑΣΗ

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## [ GB ] Four channel vibration analyzer

**HD2030** is a portable vibration analyzer performing spectral and statistical analysis on four channels simultaneously. The instrument measures all parameters required by current regulations concerning workers protection from vibration related risks and is able to measure vibrations transmitted to both hand-arm and whole body.



### Main features

HD2030 has been designed combining maximum flexibility and easy of use with the possibility to update the instrument according to the evolution of regulations concerning vibrations. The user can directly update the instrument firmware by means of the program Noise & Vibration Studio supplied with the instrument.

The HD2030 satisfies the specifications of standards **ISO 8041:2005**, **ISO 5349-1:2001** (hand-arm vibrations) and **ISO 2631-1,2 and 4 1997** (whole-body vibrations). Octave and third octave filters satisfy class 1 specifications of IEC 61260 standard.

The HD2030 vibration analyzer detects accelerations on four axes through two accelerometers with integrated amplifying electronics (IEPE or equivalent type). Three axes are grouped in the right input, where it is possible to connect three accelerometers or a tri-axial one; the fourth axis is associated to left input. Accelerometers with integrated electronics allow to use standard cables to achieve low impedance and low noise connections between the accelerometer and the instrument, simplifying its use and decreasing the probability to get wrong or altered measurements, because of interferences or electromagnetic disturbances.

The HD2030 analyzes accelerometer signals and makes calculations simultaneously on four axes. The instrument calculates, in parallel for all the measurement channels, weighted acceleration values and octave or third octave spectra; acceleration, velocity or displacement values can be shown for each frequency band. Frequency weightings can be freely chosen according to the specific application.

Together with values of instantaneous and mean acceleration, the analyzer calculates in addition peak levels, vibration dose (VDV), crest factors and performs statistical analysis.

As statistical analyzer HD2030 calculates the probability distribution of a measurement parameter in 1dB classes. Both the probability distribution graph and the percentile levels from L1 up to L99 are available.

The measurement of acceleration on four axes allows, as an example, to measure vibration transmitted to the driver body through the vehicle seat isolating driver movements or to evaluate, during design and production verification, the damping effectiveness of seat suspension and absorbing material in general. In building analysis it is possible to correlate the signal of the hammer used to excite the structure with the signal received by a high sensitivity tri-axial accelerometer.

A flexible data logger function stores multiple profiles and spectra either into the internal 8MB memory or into a memory card (SD up to 2GB). When needed, it's possible to add to profiles the logging of accelerometer signals, directly recording the digital samples. Analysing stored data, it's useful to examine accelerometer signals in order to verify the absence of artefacts like, for example, those generated by DC-shift. Each recording can be documented including a vocal comment. Besides HD2030 can be used like an audio recorder, another possibility to document the measurements.

The "Navigator" program available in the analyzer, allows to examine logged measurements and to hear vocal comments.

For a quick instrument setting the HD2030 can store up to nine setups, customized by the user according to specific applications. The desired setup can be easily identified through the associated title.

Calibration can be performed using either accelerometer calibration data or using a vibration generator. The last 120 performed calibrations are written in a register file and logged in a reserved and protected area of the instrument permanent memory. The interface program Noise & Vibration Studio, included with the instrument, adds automatically the calibration file to the measurements when downloading data into the PC memory.

HD2030 can be completely controlled by a PC, through the RS232 and USB serial interfaces, using a special communication protocol.

### Software

The interface program Noise & Vibration Studio is provided with the instrument and allows to download and visualize data logged in the instrument and to manage setups, sensor configurations and calibration register file.

Instrument settings can be customized by the user and stored with a title in a setup file for later use. In order to easily perform different kind of measurements it is possible to upload up to nine instrument settings, selected from the setup file.

Sensor configurations can be set either manually, filling in the accelerometer data table, or automatically, using the CD provided with the accelerometers supplied by Delta Ohm.

The HD2030 stores calibration information in a reserved area of internal memory. The calibration register file is downloaded to PC memory together with logged data and stored in the same folder.

Several optional analysis modules can be activated by means of license. The program can be automatically updated through the web and includes demonstrative versions of all modules.

### Applications

The HD2030 analyzer executes all measurements required by the European regulations concerning workers protection from mechanical vibration exposition at the workplace (2002/44/EC). The choice to perform hand-arm (HA) or whole body (WB or BV) measurements modifies the frequency range of spectral analysis. For hand-arm measurements the range goes from 3.15Hz up to 3.15kHz (from 4Hz to 2kHz for octave band spectrum), while for whole body measurements the range of central frequencies is shifted downward from 0.32Hz up to 315Hz (from 0.5Hz to 250Hz for octave band spectrum).

The HD2030 is suitable for the evaluation of workers exposure to vibrations and to assess the risk of injury in the following cases:

- vibrations transmitted to hand-arm system through vibrating tools or items subject to vibrations or impacts, vibrations transmitted to whole body

system through the seat of transport vehicles, vibrations transmitted to whole body system by vibrating floors or seats at the workplace,

- vibrations transmitted to whole body system by buildings with vibrations or impacts.

The HD2030 is a vibration analyzer suitable for the following applications:

- Vibration spectral analysis by octave or third octave bands,
- Statistic analysis with percentile calculation from L1 to L99,
- Evaluation of vibration attenuation of anti-vibration gloves, seats and materials, Structural verification of buildings.

#### Technical standards

HD2030 vibration analyzer conforms to the following standards:

- ISO 8041:2005** "Human response to vibration – Measuring instrumentation"
- ISO 5349-1:2001** "Mechanical vibration – Measurement and evaluation of human exposure to hand-transmitted vibration – General requirements"
- ISO 5349-2:2001** "Mechanical vibration – Measurement and evaluation of human exposure to hand-transmitted vibration – Practical guidance for measurement at the workplace"
- ISO 2631-1:1997** "Mechanical vibration and shock – Evaluation of human exposure to whole body vibration – General requirements"
- ISO 2631-2:1989** "Evaluation of human exposure to whole body vibration – Continuous and shock-induced vibrations in buildings (1 to 80 Hz)"
- IEC 61260:1995** "Electro-acoustics – Octave band and fractional-octave band filters"

#### Accelerometer models

The HD2030 can be connected to tri-axial and mono-axial accelerometers with integrated electronics (type IEPE or equivalent). Accelerometers are current powered with a polarization voltage of 25V and a maximum current of 2mA. The available accelerometer models are:

DYTRAN model **3023A2**: miniature tri-axial with nominal sensitivity of 10mV/g and maximum acceleration equal to 500g. This sensor is mainly used for hand-arm measurements.

DYTRAN model **5313M2**: tri-axial with nominal sensitivity of 100mV/g and maximum acceleration equal to 50g. This sensor, inserted in a circular rubber pad, is used for the measurement of vibrations transmitted to the whole body through the seat.

DYTRAN model **3056B2**: mono-axial with nominal sensitivity of 100mV/g and maximum acceleration equal to 50g. This sensor is used for general purpose measurements.

DYTRAN model **3200B5T**: mono-axial with nominal sensitivity of 1mV/g and maximum acceleration equal to 5000g. This sensor is mainly used for the measurement of vibrations transmitted to the hand-arm system when the peak acceleration exceeds the dynamic range of model 3023A2 and for shock measurements.

DYTRAN model **3233A**: tri-axial with nominal sensitivity of 1V/g and maximum acceleration equal to 5g. This sensor is mainly used for the measurement of vibrations in buildings.

#### Accessories

In order to measure vibrations transmitted to the hand-arm system, it's necessary to use adapters coupling the accelerometer to the tool handle. The available accessories are:

**HD2030AC1**: cubic shaped mounting block to be fastened to the handle with a cable tie or a metal clamp as near as possible to the hand position. This adapter is suitable for measurements on light tools, where the weight of the measurement chain has to be minimized. Material: light alloy.

**HD2030AC2**: adapter to be held between the hand and the handle. The accelerometer is placed in lateral position, at the left or the right of the hand. This adapter is suitable for large cylindrical handles. The measurement must be repeated positioning the accelerometer on both hand sides. Material: light alloy.

**HD2030AC3**: adapter to be held between the hand and the handle. The accelerometer is placed in lateral position, at the left or the right of the hand. This adapter is suitable for large cylindrical handles and for accelerometers with integrated screw. The measurement must be repeated positioning the accelerometer on both hand sides. Material: stainless steel

**HD2030AC4**: adapter to be held between the hand and the handle. The accelerometer is placed in central position, between the middle and the ring fingers or between the index and the middle fingers. This adapter is suitable for anatomical handles, not necessarily cylindrical and of small dimensions. Material: light alloy

**HD2030AC5**: Support for measurement on floors and vibrating surfaces in general. An air bubble level is included and the height of two out of the three feets can be adjusted as needed. The support has a cavity on the lower face, where a high sensitivity tri-axial accelerometer, suitable for measurements in buildings, can be fastened. On the upper face there is a tapped hole

(10-32 UNF) for accelerometer mounting. In order to use three mono-axial accelerometers instead of a tri-axial one, a cubic adapter is included to be mounted on the upper face. Material: stainless steel, weight 1.9kg.

The following accessories, needed to keep the accelerometers in contact with various surfaces, are available on request:

- Adhesive metal plate for accelerometer mounting with magnet
- Permanent magnet for accelerometer mounting on metal surfaces
- Adhesive mounting base (glue or wax)
- Insulated mounting base
- Screws with various threading

The following accessories are included with the HD2030 analyzer:

- Wax
- Silicon grease
- USB cable for PC connection
- 1GB SD memory card
- CD with the interface program for PC with Windows operating system "Nose & Vibration Studio" and the HD2030 user manual

Each accelerometer comes with the following accessories:

- Mounting screw
- 2m connecting cable to the HD2030 analyzer (other lengths on request)
- CD with calibration and configuration data and accelerometer manual

#### HD2030 technical specifications

##### Technical standards:

- ISO 8041:2005
- ISO 5349-1:2001 (hand transmitted vibration)
- ISO 2631-1,2,4 1997 (whole body vibration)
- IEC 61260:1995 class 1 (octave and third octave filters)

##### Measurement modes:

- Hand-transmitted vibrations
- Whole-body vibrations
- Building vibrations

##### Measurement parameters:

- RMS, VDV, MTVV, Peak, Max, Min

##### Frequency weightings:

- Fz, Fc, Wh for hand-transmitted vibrations
- Fz, Fa, Wb, Wc, Wd, We, Wj, Wk for whole body vibrations
- Fz, Fm, Wm for building vibrations

##### Octave or third octave band spectral analysis:

The range of central frequencies depends on the chosen application according to the following table:

Application	Central frequency range	
	Octave Band	Third Octave Band
	[Hz]	[Hz]
Hand-Arm	4 ÷ 2000	3.15 ÷ 3150
Whole-Body	0.5 ÷ 250	0.315 ÷ 315
Building Vibrations	0.5 ÷ 250	0.315 ÷ 315

##### Statistic Analysis

The selected measurement parameter is analyzed in 1dB classes. Both the probability and the percentile graphs can be shown.

##### Measurement range

0.1m/s<sup>2</sup> ÷ 7000 m/s<sup>2</sup> with Dytran accelerometer 3023A2 for hand-arm measurements

##### Linearity range

Three ranges of 80dB overlapped by 70dB

##### Digital converter

Four analog to digital converters with a resolution of 25 bits at 8k samples per second

##### Inherent noise level

Less than 30mm/s<sup>2</sup> with Dytran accelerometer 3023A2 for hand-arm measurements and Wh filter

##### Display

Graphic backlit display 128x64 pixels

Screens:

**VLM1**: Three parameters for each measurement axis

**VLM2**: Three parameters of acceleration vector calculated from the three right channel input axes

**VLM3**: Three global parameters for each measurement axis

**VLM4**: Three global parameters of acceleration vector calculated from the three right channel input axes

**PROFILE**: Graphic profile of one parameter for each measurement axis with integration time programmable from 1s to 1 hour

**SPECTRUM:** Octave or third octave spectrum for each measurement axis with calculation of one wideband filter. The graph can show the spectrum of acceleration, velocity or displacement.

**STATISTICS:** the statistical distribution of the parameter chosen in PROFILE

**PERCENTILES:** Percentile level graph of the parameter chosen in PROFILE.

- **Memory**  
8MB Internal FLASH type memory and connector for memory card SD type up to 2GB.
- **Interface**  
Serial RS232 and USB type
- **Input/Output**  
LINE output for the four measurement channels: 2Vpp F.S.  
TRGIN electrically isolated input: instrument trigger used by external devices  
TRGOUT 3V logic output: trigger output used by external devices
- **Power supply**  
Four alkaline batteries AA 1.5V type with 10 hour lifetime  
The instrument can use rechargeable batteries Ni-MH type. **The HD2030 does not perform the function of charger.**
- **Ambient parameters**  
Storage: -25°C ÷ 70°C relative humidity less than 90% without condensation  
Operating: -10°C ÷ 50°C relative humidity less than 90% without condensation
- **Weight and Dimensions**  
95mm X 240mm X 50mm, weight 680gr.

#### Accelerometer technical specifications

##### Model HD3023A2

- **Type:**  
Miniature tri-axial accelerometer with integrated electronics (LIVM™)
- **Sensitivity**  
10mV/g
- **Maximum vibration**  
±600g
- **Frequency response**  
1.5 Hz ÷ 10 kHz (-5% / +15%)
- **Resonant frequency**  
40 kHz
- **Linearity**  
1% F.S.
- **Transverse sensitivity**  
5% max
- **Maximum shock**  
5000g
- **Temperature range**  
-50°C ÷ 120°C
- **Thermal sensitivity**  
0.06%/°C

- **Output bias voltage**  
10VDC
- **Mechanical specifications**  
Weight: 4gr  
Dimensions: (height x width x depth) 12.5mm x 9.15mm x 9.15mm  
Mounting: 10-32 tapped hole in base (screw included)  
Connector: lateral 4 pin SMA type  
Material: titanium alloy  
Isolation: case grounded

##### Model HD5313M2

- **Type:**  
Low profile tri-axial accelerometer, with integrated electronics (LIVM™), contained within a rubber circular pad
- **Sensitivity**  
100mV/g
- **Maximum vibration**  
±50g
- **Frequency response**  
0.5 Hz ÷ 3 kHz (-5% / +5%)
- **Resonant frequency**  
25 kHz
- **Linearity**  
1% F.S.
- **Transverse sensitivity**  
5% max
- **Maximum shock**  
1500g
- **Temperature range**  
-50°C ÷ 70°C
- **Thermal sensitivity**  
0.06%/°C
- **Output bias voltage**  
9VDC ÷ 12VDC
- **Mechanical specifications**  
Weight: 227gr  
Dimensions: (diameter x thickness) 232mm x 12mm  
Cable: 1.5m cable terminated with circular connector  
Material: rubber pad with anodized aluminium central housing  
Isolation case to ground: 10Mohm minimum

##### Model HD3056B2

- **Type:**  
Accelerometer with integrated electronics (LIVM™)
- **Sensitivity**  
100mV/g
- **Maximum vibration**  
±50g
- **Frequency response**  
1 Hz ÷ 10 kHz (-5% / +5%)
- **Resonant frequency**  
32 kHz



Input details



Output details

- **Linearity**  
2% F.S.
- **Transverse sensitivity**  
5% max
- **Maximum shock**  
2000g
- **Temperature range**  
-50°C ÷ 120°C
- **Thermal sensitivity**  
0.12%/°C
- **Output bias voltage**  
9VDC ÷ 12VDC
- **Mechanical specifications**  
Weight: 10gr  
Dimensions: (hex x height) 12.7mm(0.5") x 23.1mm  
Mounting: 10-32 x 3.8mm deep with tapped hole in base (screw included)  
Connector: top mounted micro-coaxial 10-32 UNF-2A  
Material: titanium alloy  
Isolation case to ground: 10Mohm minimum

#### Model HD3200B5T

- **Type:**  
Accelerometer with integrated electronics (LIVM™)
- **Sensitivity**  
1mV/g
- **Maximum vibration**  
±5000g
- **Frequency response**  
0.5 Hz ÷ 40 kHz (-5% / +5%)
- **Resonant frequency**  
130 kHz



Optional tripod

- **Linearity**  
1% F.S.
- **Transverse sensitivity**  
3% max
- **Maximum shock**  
50000g
- **Temperature range**  
-50°C ÷ 120°C
- **Output bias voltage**  
8.5VDC
- **Mechanical specifications**  
Weight: 6gr  
Dimensions: (hex x height) 12.7mm(0.5") x 23.1mm  
Mounting: integrated screw 10-32 UNF-2A  
Connector: top mounted micro-coaxial 10-32 UNF-2A  
Material: stainless steel  
Isolation case to ground: 10Mohm minimum

#### Model HD3233A

- **Type:**  
High sensitivity tri-axial ccelerometer with integrated electronics (LIVM™). It is mainly used for measurements in buildings.
- **Sensitivity**  
1V/g
- **Maximum vibration**  
±5g
- **Frequency response**  
0.4Hz ÷ 3kHz (-10% / +10%)
- **Resonant frequency**  
20kHz
- **Linearity**  
1% F.S.
- **Transverse sensitivity**  
5% max
- **Maximum shock**  
5000g
- **Temperature range**  
-50°C ÷ 120°C
- **Thermal sensitivity**  
0.06%/°C
- **Output bias voltage**  
10VDC
- **Mechanical specifications**  
Weight: 28gr  
Dimensions: (hex x height x depth) 25.4mm x 33mm x 13.2mm  
Mounting: through hole for M4 screw (included)  
Connector: lateral 4 pin SMA type  
Material: titanium alloy  
Isolation case to ground: the body is connected to ground and isolated from mounting surface

#### Order codes of kits and accessories

**HD2030 kit1:** Includes: four channel analyzer HD2030, carrying case, program "Noise & Vibration Studio", USB serial cable (CP22) and 1GB SD memory card (HD2030MC). **Accelerometers, connection cables and accessories have to be specified at the time of placing the order.**

**HD2030AC1:** cubic shaped mounting block to be fastened to the handle, by means of a cable tie or a metal clamp, as near as possible to the hand position. This adapter is suitable for measurements on light tools, where the weight of the measurement chain has to be minimized. Material: light alloy. Includes:

- Hexagon socket head cap screw 10-32 UNF
- 4mm hex key
- 10 cable ties (length x width) 200mm x 4.5mm
- 1 metal clamp with 9mm width

**HD2030AC2:** adapter to be held between the hand and the handle. The accelerometer is placed in lateral position, at the left or the right of the hand. This adapter is suitable for large cylindrical handles. The measurement must be repeated positioning the accelerometer on both hand sides. Material: light alloy. Includes:

- Hexagon socket head cap screw 10-32 UNF
- 4mm hex key
- 10 cable ties (length x width) 200mm x 4.5mm
- 2 flat velcro straps, 24.5mm size

**HD2030AC3:** adapter to be held between the hand and the handle. The accelerometer is placed in lateral position, at the left or the right of the hand. This adapter is suitable for large cylindrical handles and for accelerometers with integrated screw with 10-32 UNF-2A threading. The measurement must be repeated positioning the accelerometer on both hand sides. Material: stainless steel. Includes:

- 10 cable ties (length x width) 200mm x 4.5mm
- 2 flat velcro straps, 24.5mm size

**HD2030AC4:** adapter to be held between the hand and the handle. The accelerometer is placed in central position, between the middle and the ring fingers or between the index and the middle fingers. This adapter is suitable for anatomical handles, not necessarily cylindrical and of small dimensions. Material: light alloy. Includes:

- Hexagon socket head cap screw 10-32 UNF
- 4mm hex key
- 10 cable ties (length x width) 200mm x 4.5mm
- 2 flat velcro straps, 24.5mm size

**HD2030AC5:** Support for measurement on floors and vibrating surfaces in general. An air bubble level is included and the height of two out of the three feet can be adjusted as needed. The support has a cavity on the lower face, where a high sensitivity tri-axial accelerometer, suitable for measurements in buildings, can be fastened. On the upper face there is a tapped hole (10-32 UNF) for accelerometer mounting. In order to use three mono-axial accelerometers instead of a tri-axial one, a cubic adapter is included to be mounted on the upper face. Material: stainless steel, weight 1.9kg. Includes:

- Stainless steel base with air bubble level and three feet. There are a tapped hole on the upper face (10-32 UNF) and a cavity with tapped hole (M4) on the lower face.
- Cubic adapter to be mounted on the upper face using two M4 screws (included). The cube has threaded holes (10-32 UNF) on three orthogonal faces.
- 3mm hex key

**HD2110/CSNM:** serial cable for connection to a PC with COM interface

**CP22:** serial cable for connection to a PC with USB interface.

**HD2030CAB1-3M:** low noise coaxial cable for connection of mono-axial accelerometers (mini-coax SMA 10-32 connector) to the HD2030 analyzer (4 pin push-pull circular connector). Length 3m (other lengths on request). Includes connectors.

**HD2030CAB3-3M:** coaxial cable for connection of tri-axial accelerometers (4 pin SMA connector) to the HD2030 analyzer (4 pin push-pull circular connector). Length 3m (other lengths on request). Includes connectors.

**HD2030CAB13:** coaxial cable for connection of three mono-axial accelerometers to the HD2030 analyzer. Length 400mm, BNC connectors.

**HD2030CAB1B-5M:** coaxial cable for connection of mono-axial accelerometers to the HD2030CAB13 cable. Length 5m (other lengths on request). Includes connectors.

**HD2030CAB1B-10M:** coaxial cable for connection of mono-axial accelerometers to the HD2030CAB13 cable. Length 10m (other lengths on request). Includes connectors.

**HD2030MC:** 1GB SD memory card.

**HD2030AM:** headset with microphone.

**SWD10:** stabilized mains power supply with Vin 100÷240Vac and Vout 12Vdc/1A.

**VTRAP:** tripod.

**HD3023A2:** miniature tri-axial accelerometer for the measurement of hand transmitted vibrations. Sensitivity 10mV/g, range ±500g. Mounting screw HD6200 included.

**HD5313M2:** tri-axial accelerometer contained within a rubber pad for the measurement of whole body transmitted vibrations. Analyzer 1.5m connecting cable included. Sensitivity 100mV/g, range ±50g.

**HD3056B2:** accelerometer for the measurement of whole body transmitted vibrations. Sensitivity 100mV/g, range ±50g. Mounting screw HD6200 included.

**HD3200B5T:** accelerometer for the measurement of hand transmitted vibrations at high shock levels. Sensitivity 1mV/g, range ±5000g. Integrated mounting screw.

**HD3233A:** high sensitivity tri-axial accelerometer for measurements in buildings. Sensitivity 1V/g, range ±5g. Mounting screw M4x20 with washer are included.

Accelerometer accessories available are:

**HD6188:** Silicon grease tube, hydrophobic and electrically insulating.

**HD6273:** Wax tray for accelerometer gluing

**HD6200:** double threaded mounting screw 10-32 UNF-2A. Included with accelerometers HD3023A2 and HD3056B2. Material: beryllium-copper

**HD6202:** double threaded mounting screw 10-32 UNF-2A and M5 X 0.8

**HD6203:** double threaded mounting screw 10-32 UNF-2A and M6 X 1

**HD6239:** vibration probe.

**HD6286:** Adhesive mounting plate for magnets. Used for accelerometer mounting on non-metallic surfaces.

**HD6284:** Insulated magnetic base

**HD6226:** Adhesive mounting base. Tapped hole 10-32 UNF

**HD6245:** Insulated adhesive mounting base, integrated screw 10-32 UNF

**HD6220:** Ground isolation stud, 10-32 UNF-2A tapped hole for accelerometer fastening and 10-32 UNF-2A stud.

## ΗΧΟΠΑΡΕΜΒΑΣΗ □



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Accessories



Accessories