

# **HD2040**

## **TAPPING MACHINE**

### **ENGLISH**

The quality of our instruments is the result of continuous product development. This can lead to differences between the information written in this manual and the instrument you have purchased. We can not entirely rule out errors in the manual, for which we apologize.

The data, figures and descriptions contained in this manual can not be legally asserted. We reserve the right to make changes and corrections without prior notice.

# INDEX

<b>1</b>	<b>INTRODUCTION</b> .....	<b>3</b>
<b>2</b>	<b>DESCRIPTION</b> .....	<b>4</b>
<b>3</b>	<b>GENERAL INFORMATION ABOUT THE MEASURE</b> .....	<b>6</b>
<b>4</b>	<b>INSTALLING THE BATTERY</b> .....	<b>8</b>
<b>5</b>	<b>PREPARATION OF THE MACHINE</b> .....	<b>10</b>
<b>6</b>	<b>OPERATION OF THE MACHINE</b> .....	<b>12</b>
	6.1 POWER SUPPLY .....	12
	6.2 STARTING AND STOPPING THE MOTOR .....	13
<b>7</b>	<b>ENABLE AND DISABLE THE REMOTE CONTROL</b> .....	<b>14</b>
<b>8</b>	<b>MAINTENANCE</b> .....	<b>15</b>
<b>9</b>	<b>TECHNICAL SPECIFICATIONS</b> .....	<b>16</b>
<b>10</b>	<b>STORAGE OF THE MACHINE</b> .....	<b>17</b>
<b>11</b>	<b>SAFETY INSTRUCTIONS</b> .....	<b>17</b>
<b>12</b>	<b>ORDERING CODES</b> .....	<b>18</b>

# 1 INTRODUCTION

The tapping machine **HD 2040** is a normalized impact noise generator for the measurement of sound insulation of floors according to ISO 140-6, ISO 140-7, ISO 140-8, ASTM E492 and E1007.

It has 5 hammers in line driven by a motor controlled by an electronic system, by means of camshaft. The rate of fall of the hammer and the frequency of the impacts are constantly monitored to ensure compliance with the legislation. LED indicators on the front panel indicate the proper functioning of each hammer, detected by an optical sensor.

The hammers are made of stainless steel, hardened and dimensionally stable over time.

The unit is equipped with support feet with height-adjustable rubber base. On the back cover a spirit level gauge is mounted to assist the user to obtain vertical fall direction. The spacer enters the home with light pressure, you pull to remove it. The wheel will be feet below the base to reduce the size of the packing and easy transport of the machine.

The starting and stopping of the machine is via a front panel button or remotely using the supplied remote control. The antenna is screwed to the connector on the top of the unit and it has to be unscrewed it to store the unit in its case. Mains power supply 100 ... 240 VAC or rechargeable lithium-ion battery housed inside the unit. The charger is built; the battery recharges automatically when the machine is connected to the network.

The aluminium frame reduces the weight of the machine and makes it easily transportable.

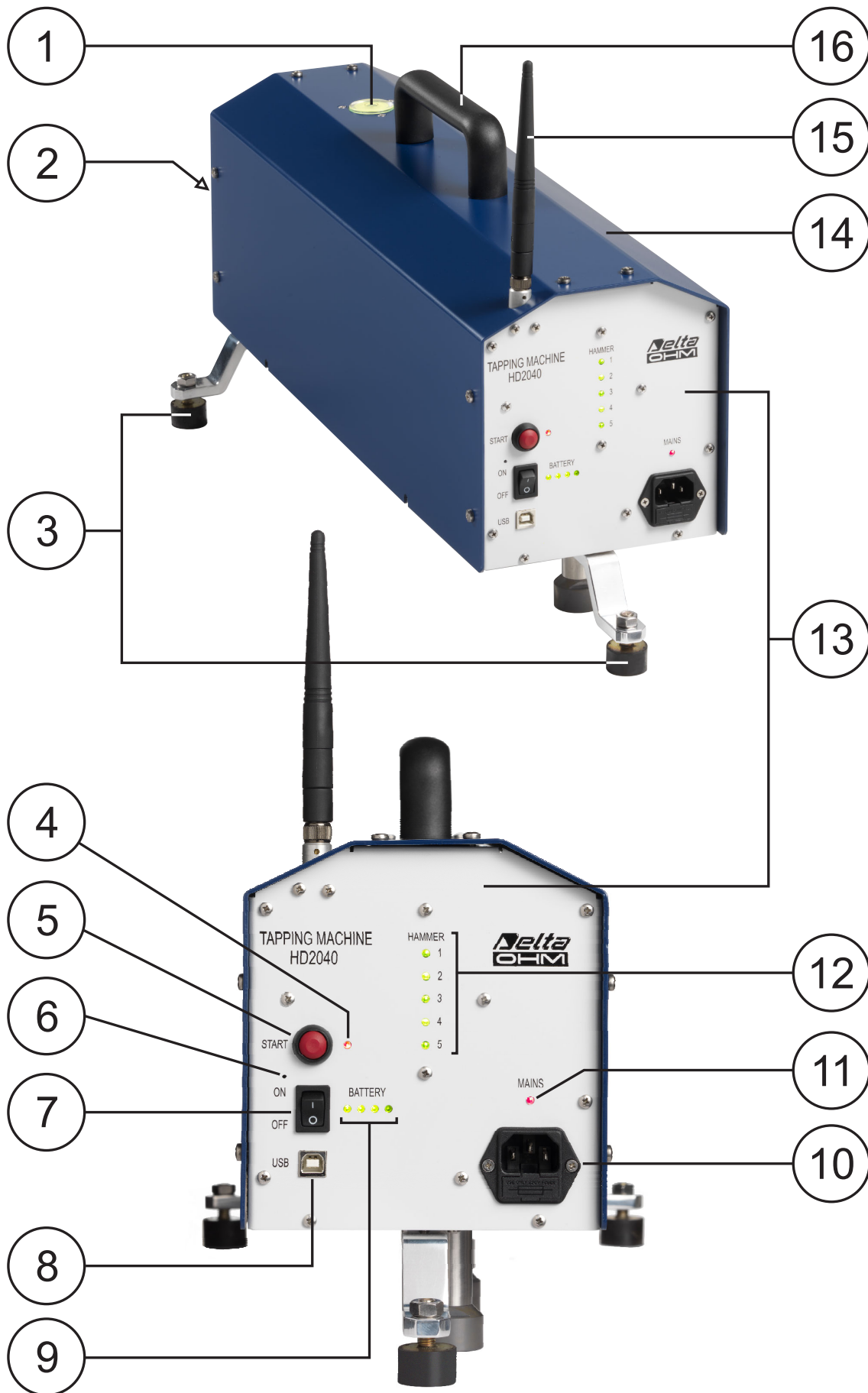
A spirit level on the cover of the machine allows you to position it perfectly horizontal plane.

The inside of the lid of the machine is treated with sound absorbing material.

## REFERENCE STANDARDS:

- ISO 140 – 6 (1998): Acoustics – Measurement of sound insulation in buildings and of building elements - Laboratory measurements of impact sound insulation of floors.
- ISO 140 – 7 (1998): Acoustics – Measurement of sound insulation in buildings and of building elements - Field measurements of impact sound insulation of floors.
- ISO 140 – 8 (1997): Acoustics – Measurement of sound insulation in buildings and of building elements - Laboratory measurements of the reduction of transmitted impact noise by floor coverings on a heavyweight standard floor.
- ASTM E492-09: Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine.
- ASTM E1007-11e1: Standard Test Method for Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures.

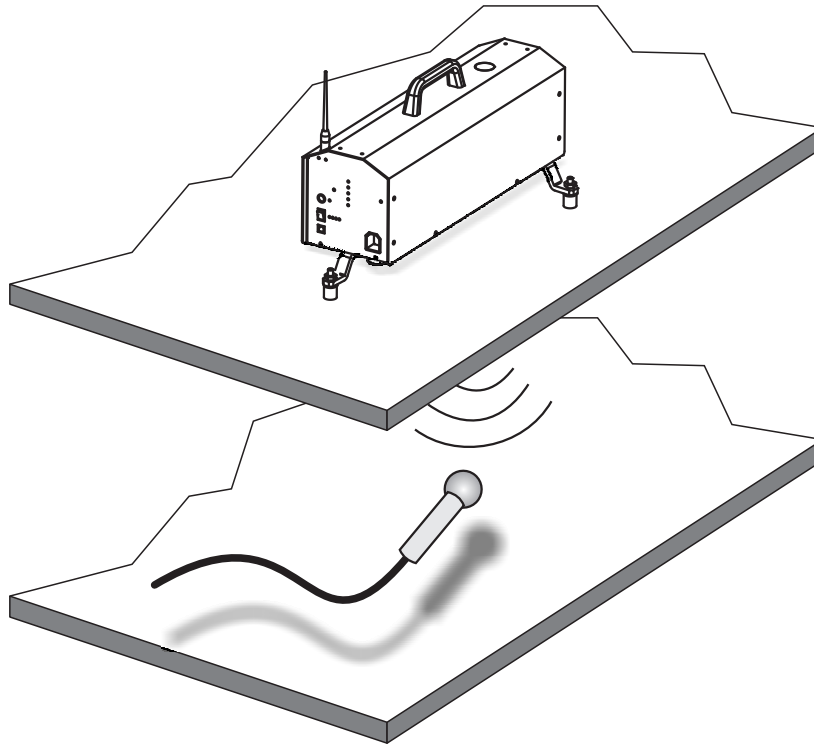
## 2 DESCRIPTION



- 1.** Bubble level for horizontal levelling.
- 2.** Level gauge placed on the rear panel of reference for checking the height of fall of the hammer.  
The level gauge enters its site with a little pressure; pull to remove.
- 3.** Support feet with height-adjustable rubber base.  
The legs can be rotated under the base to reduce the footprint of the machine.
- 4.** LED indicator of the correctness of the motor shaft rotation speed.  
The LED is green if the speed is correct. Otherwise the LED is red.
- 5.** Button to start and stop the unit motor.
- 6.** Access hole to the internal button for enabling and disabling of the transmitter.
- 7.** On/Off switch.  
Turn the power switch to ON to power the unit. Turn the power switch to OFF to switch off unit power.
- 8.** USB type B port for PC connection.  
The use of the port is intended for technical service personnel for maintenance.
- 9.** LED indicators of the status of internal battery charge.  
The indication is multi-level type. All LEDs on indicate that the battery is charged. The rightmost LED flashing indicates that the battery charge is complete. The leftmost LED flashing indicates that the battery is low and needs recharging.  
The LEDs are off when the power switch is OFF. To check the battery charge level is necessary to place the power switch to ON.
- 10.** 100 ... 240 V AC mains inlet, with fuse holder for fuses 5x20 mm.  
Equipped with fuse 3A/250V.
- 11.** LED indicator of the presence of the external power supply.  
The lit LED indicates that the power cord is plugged. The status LED is independent of the position of power switch.
- 12.** LED indicators of the regular falling of the hammers.  
A LED is green when the falling of the corresponding hammer is regular. Otherwise the LED is red.
- 13.** Front panel.
- 14.** Anodized and painted aluminium cover.  
The cover is removable for battery installation and maintenance of the unit.
- 15.** Remote control antenna.
- 16.** Carrying handle.

### 3 GENERAL INFORMATION ABOUT THE MEASURE

The sound insulation of floors is measured by operating the machine on the test floor and measuring the level of noise in the underlying.



The method of measurement is defined by ISO 140-6, ISO 140-7, ISO 140-8, ASTM E492 and ASTM E1007. Here are some basics called for proper implementation of the measure of sound insulation.

During the measurement, position the machine by observing the following rules:

- The machine must be positioned at least in 4 different points on the test surface. If the surface is anisotropic (for example, ribbed slabs), it may take more positions.
- The hammer should be at a distance of at least 0.5 m from the edges of the test surface.
- The line of hammers should be oriented at 45 ° to the axis of the beams.
- If the test surface is smooth and elastic, stabilize the machine to ensure a hammer drop height of 40 mm.

In the receiver environment must be provided at least 4 microphone stations evenly distributed in the environment, two of which must correspond to the position of the tapping machine in the emitting environment. You can use multiple fixed microphones or one microphone moved from one location to another. Place the microphones so that:

- The distance between each station and the upper floor excited by the tapping machine is at least 1 m.
- The distance between each station and the walls of the environment is at least 0.5 m.
- The distance between different microphone positions is at least 0.7 m.
- The distance between each station and the operator is at least 3 m.

In the receiving environment, take a measure of the level of background noise when the unit is not in the tapping action. The sound pressure level in the receiving room when the machine is in action should be greater than 10 dB compared to the level of background noise. Otherwise, to the measurement of sound pressure level with the machine in action must be applied the appropriate corrections defined by regulations.

The isolation of a structure is assessed by the *level of impact noise normalized with respect to the sound absorption*:

$$L'_n = L_i + 10 \times \log \frac{A}{A_0} \text{ [dB]}$$

or by the *level of impact noise normalized with respect to the reverberation time*:

$$L'_{nT} = L_i + 10 \times \log \frac{T_{60}}{T_0} \text{ [dB]}$$

where:

**L<sub>i</sub>** = average level of sound pressure measured at several points of the receiving environment when on the surface under test the impact noise generator is in action.

**A** = equivalent area of sound absorption of the receiving environment, in m<sup>2</sup>.

**A<sub>0</sub>** = reference acoustic absorption equivalent area, equal to 10 m<sup>2</sup>.

**T<sub>60</sub>** = reverberation time in the receiving environment, in seconds.

**T<sub>0</sub>** = reference reverberation time, equal to 0.5 s.

The equivalent area of sound absorption of the receiving environment is calculated using by the Sabine formula:

$$A = 0.16 \times \frac{V}{T_{60}} \text{ [m}^2\text{]}$$

where:

**V** = receiving environment volume, in m<sup>3</sup>.

The measurement of sound pressure levels  $L_i$  is conducted by third octave bands in the frequency range from 100 Hz to 3.15 kHz. The measurement result is a curve that shows the trend of the level  $L'_n$  as a function of noise frequency.

Briefly, the isolation is represented by the *evaluation index of the tapping level*  $L'_{n,w}$ , obtained by comparing the reference curve defined in ISO 717-2 with the curve of the  $L'_n$  values calculated at the various measurement frequencies.

Unlike the values  $L'_n$ , which allow more detailed spectral analysis of sound insulation provided by the test surface, the  $L'_{n,w}$  index provides an overall indication which does not contain information on the frequency behavior of the surface.

#### MEASURES IN PLACE AND IN LABORATORY

The superscript in the symbols  $L'_n$  and  $L'_{n,w}$  characterizes measurements in place, in which the noise is also transmitted from the side walls or other elements bordering the floor. Symbols without superscript  $L_n$  and  $L_{n,w}$  are used to indicate measurements in the laboratory, in which the noise is transmitted only from the test surface. The noise level in place is generally higher than that measured in the laboratory, due to the side transmission:

$$L'_{n,w} = L_{n,w} + K.$$

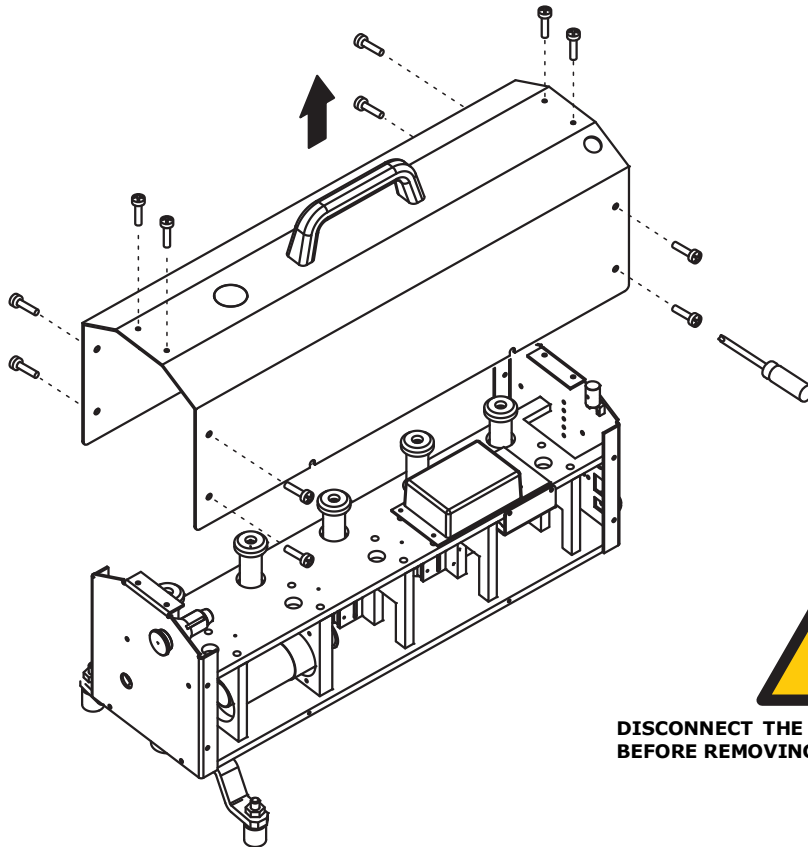
There are tables that show the value of the correction factor K as a function of surface mass (mass per unit area) of the floor and walls.

## 4 INSTALLING THE BATTERY

For security reasons, the machine is delivered without the rechargeable lithium-ion battery installed.

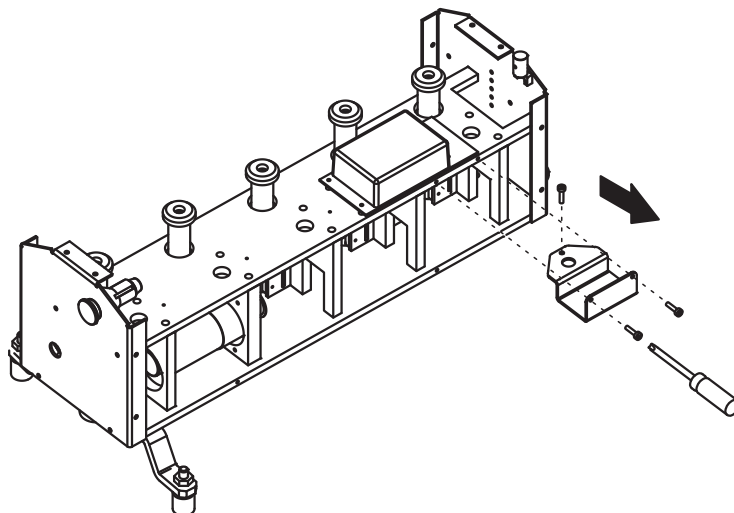
Before you start using the unit you have to install the battery supplied. Install as shown below:

1. Make sure the power switch is OFF and **the power cable is disconnected**.
2. Unscrew the 12 screws that secure the cover to the base of the unit and remove the cover.



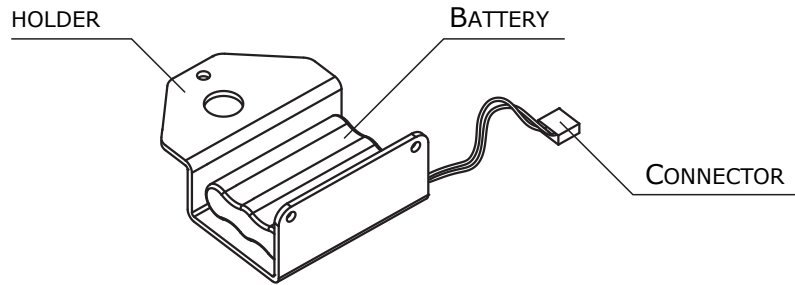
**DISCONNECT THE POWER SUPPLY CABLE  
BEFORE REMOVING THE COVER**

3. Unscrew the 3 screws that secure the battery holder to the structure of the unit and remove the holder.

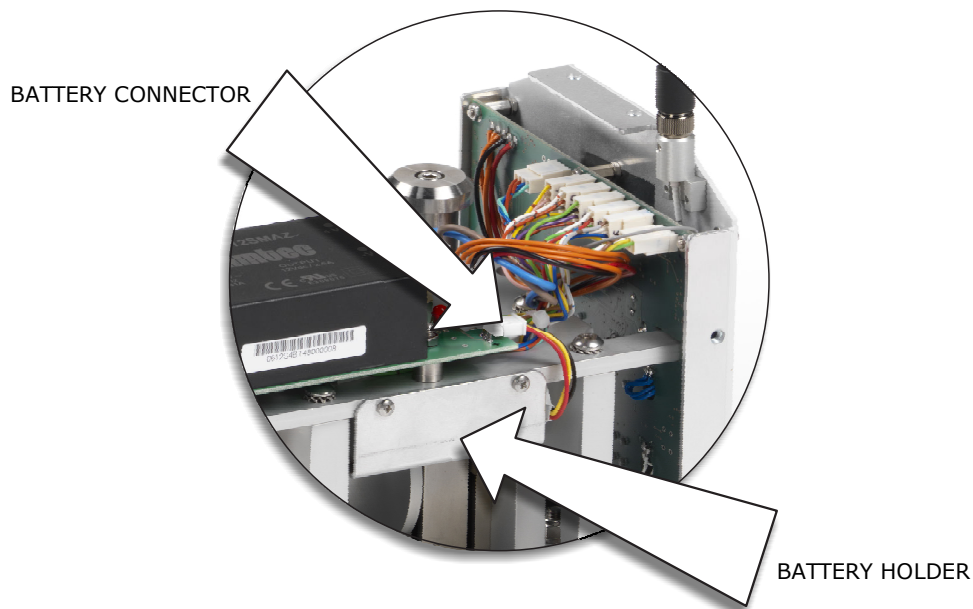




4. Insert the battery into the holder, making sure that the cable connecting the battery comes out towards the front panel of the machine.



5. Attach the battery holder to the unit structure.
6. Connect the battery to the circuit board, observing the correct polarity. The connector has a polarizing key that prevents the possibility to insert the plug incorrectly.



7. Replace the cover of the machine and secure the base with the 12 screws. The cover must be oriented so that the hole for the antenna is towards the front panel of the unit and the spirit level towards the rear panel.
8. Connect the power cable to the unit and to the mains to start charging the battery. Leave the battery charging for at least 8 hours before using it for the first time. The battery charges automatically when you plug the power cable to the mains (MAINS LED on), regardless of the position of the power switch.

**Note**

When you install a new battery, the indicator of the charge level on the front panel may be inaccurate until the first full charge is finished. After the first full charge, the level will start to be shown correctly.

## 5 PREPARATION OF THE MACHINE

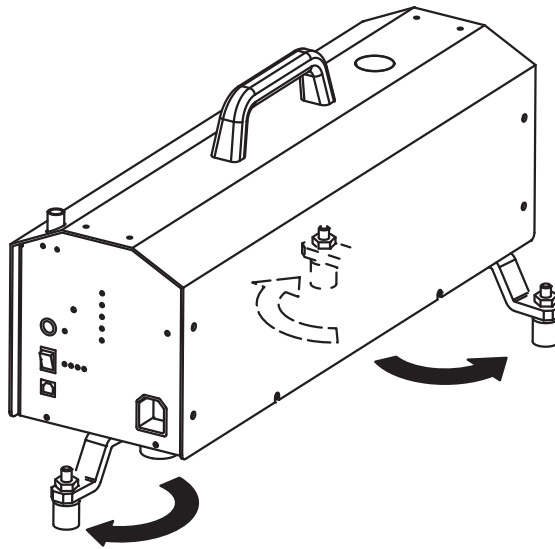


### ATTENTION:

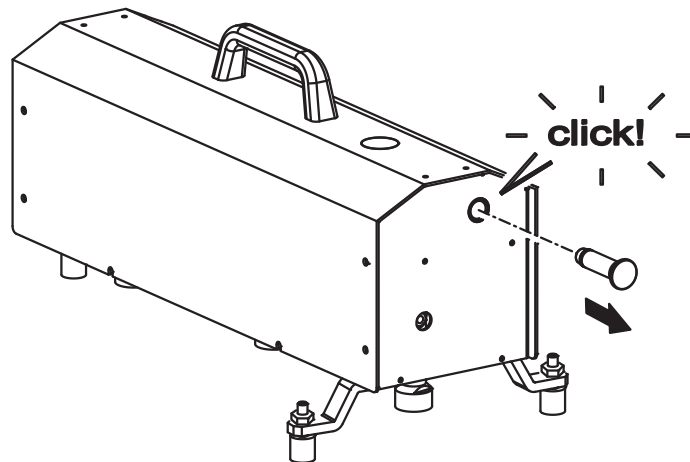
THE UNIT HAS MOVING MECHANICAL PARTS, SO MAKE SURE THAT THE POWER SWITCH IS SET TO OFF AND THAT THE POWER CABLE IS UNPLUGGED BEFORE PERFORMING THE OPERATIONS DESCRIBED IN THIS CHAPTER.

**The tapping machine is supplied with the hammers locked in up position. Remove the cover of the machine and unlock the hammers by removing the plastic tie-wraps around the hammers.**

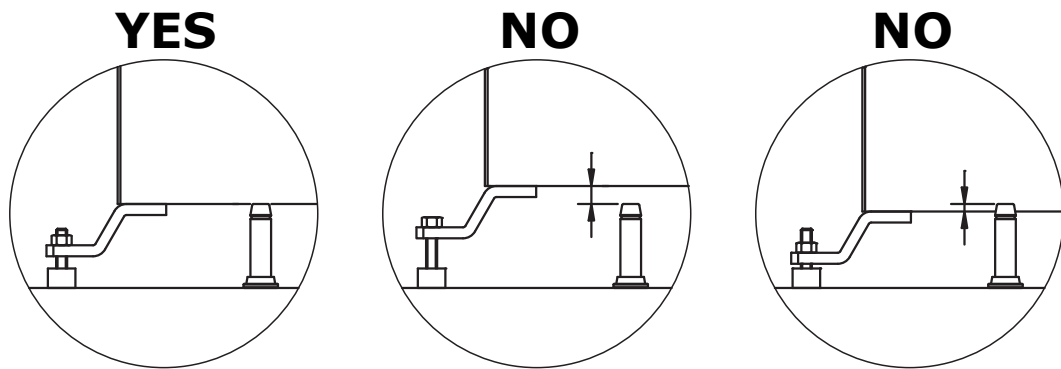
The tapping machine is supplied with the feet retracted in the transport position. To prepare the machine for normal operation it is necessary to rotate the three feet in the working position.



The tapping machine is delivered with the feet already adjusted to grant the correct fall height of the hammers. If necessary, it is possible to verify and adjust the fall height of the hammers by using the rod mounted on the backside of the machine. Pull the gauge out to release it from its site.

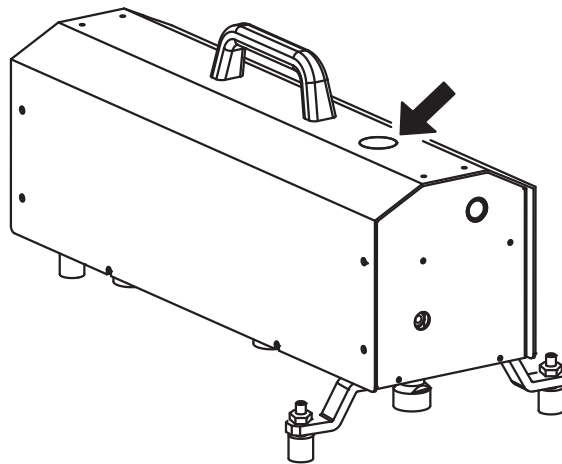


Put the machine on a flat, horizontal surface. Place the gauge between the surface and the bottom of the machine, so that the gauge is along the line of the hammers. The fall height is correct if the distance between the surface and the bottom of the machine corresponds to the height of the gauge.



If adjustments are needed, proceed as follows:

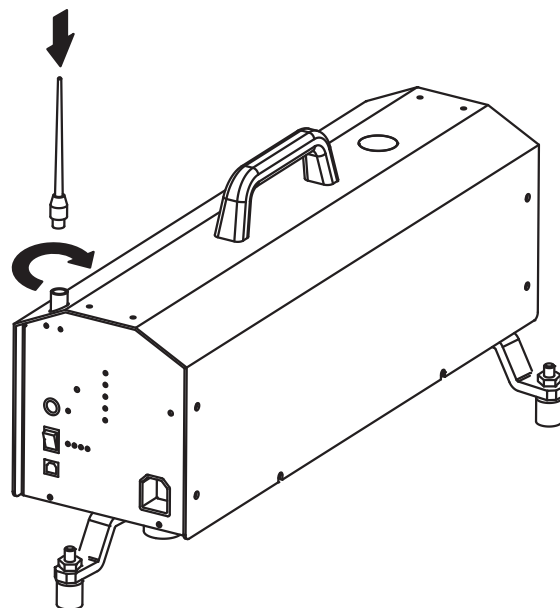
1. Unlock the feet by using the supplied 13 mm wrench.
2. Place the gauge along the line of the hammers, as close as possible to the foot to be checked.
3. Screw or unscrew the feet to adjust the height, checking with the spirit level that the machine is on an horizontal plane.



4. Lock the position of the feet by fixing the nuts.

After use, place the gauge back in its place with a slight pressure.

If you want to use the supplied remote control, mount the antenna on the connector on the top of the machine near the front panel.



## 6 OPERATION OF THE MACHINE

### 6.1 POWER SUPPLY

The machine operates with 100...240 Vac by mains or powered by lithium-ion battery 7.2 V / 2900 mAh housed inside the machine.

**CAUTION: The machine is shipped without the battery installed and with the hammers locked. Before starting the machine, install the battery and unlock the hammers.**

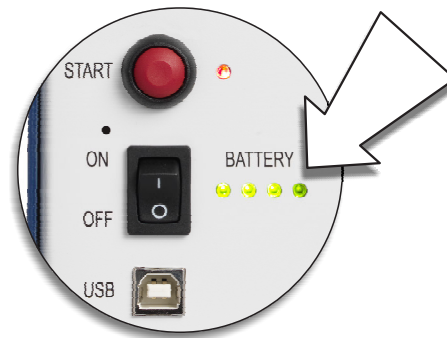
The machine always works with mains power supply if the power cable is connected. MAINS LED is lit when the mains supply is present, regardless of the position of power switch.

To turn on the machine, set the power switch to ON.

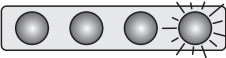
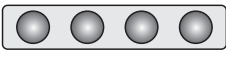
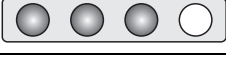



*Note:* The motor **does not** start automatically when you turn on the machine, the motor control is manual via the START button or the remote control.

If you plan to use the machine in places where there is no mains, be sure to fully charge the battery before use. The first time you charge the battery, let it charge for at least 8 hours. After the first charge, the battery completely discharged requires a charging time of about 4 hours (if the motor is not running).

The battery charges automatically if the power cable is connected to the mains (MAINS LED on), regardless of the position of power switch. The LEDs indicating battery charge level however are turned off if the power switch is set to OFF. To check the charge level of the battery, turn the machine on by setting the power switch to ON. The level is indicated by four LEDs to the right of the switch.



The following table shows the level of battery charge indicated by LEDs.

Indication	Level of battery charge
 Rightmost LED flashing	Fully charged
 4 LEDs	Greater than 75%
 3 LEDs on	Between 50 and e 75%
 2 LEDs on	Between 25 and 50%
 1 LED on	Lower than 25%
 Leftmost LED flashing	It is necessary to recharge the battery

It is possible to keep the power cable connected to the mains even if the battery is fully charged, without danger of damage.

The autonomy of the fully charged battery is about 80 minutes.

## 6.2 STARTING AND STOPPING THE MOTOR



### WARNING:

THE MACHINE HAS MOVING MECHANICAL PARTS, MAKE SURE NOT TO CAUSE DAMAGES TO PEOPLE OR THINGS DURING THE OPERATION OF THE MOTOR. DO NOT MOVE THE MACHINE WHEN THE HAMMERS ARE WORKING.

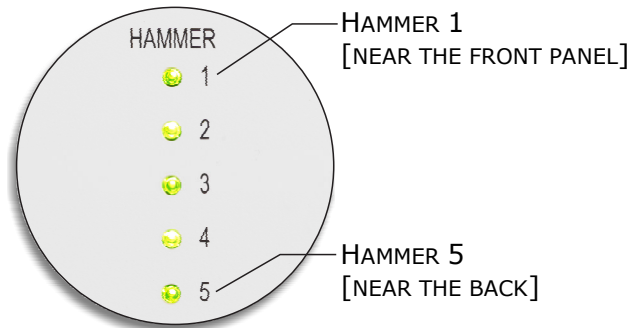
After turning on the machine, in order to start the movement of the hammers press the START button on the front panel or the remote control button.



The LED to the right of the button indicates the correctness of the motor shaft rotation speed. The LED is green if the speed is correct. Otherwise the LED is red.

The impact sequence of hammers is 1-3-5-2-4. The hammer number 1 is located next to the front, the hammer number 5 is located near the rear panel.

The regularity of the falling of the hammers is reported by the HAMMER LEDs on top of the front panel. There is one LED for each hammer.



The HAMMER LED for one hammer is green if the falling of the hammer is regular. If the falling of a hammer is not regular, the LED turns red.

To stop the movement of the hammer, press again the START button on the front panel or the remote control button. The LED to the right of the START button and the HAMMER LEDs are off when the hammers are at standstill.

### NOTES FOR THE USE OF REMOTE CONTROL:

- If you use the remote control, make sure that the antenna is properly inserted into the connector located on top of the machine.
- The transmitter must be enabled to work with the machine. The supplied remote control is already enabled. To enable additional remote controls or disable the supplied remote control, see chapter 7.
- The range of the transmitter is about 300 m in open field. Any obstructions between the transmitter and the machine may limit the maximum distance of the remote control.

## 7 ENABLE AND DISABLE THE REMOTE CONTROL

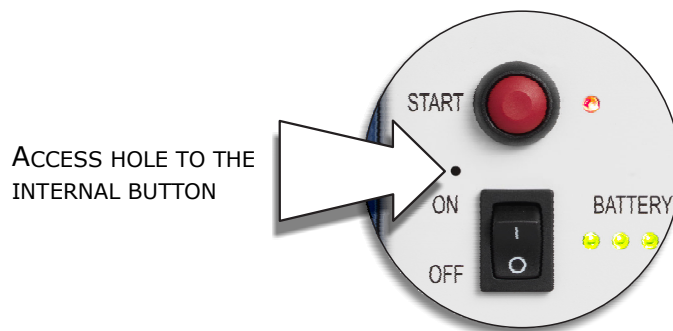
The remote controls have an identification code that is transmitted to the machine when you send a command. Only if the code is recognized by the machine, the command to start or stop the motor is executed. This allows you to use multiple remote controls for different machines without any interference between the various machines.

The supplied remote control is already enabled to work with the machine.

If you require additional remote controls subsequent to the delivery of the machine, it is necessary to enable them, to be recognized by the machine.

In order to enable an additional transmitter, proceed as follows:

1. Turn on the machine by setting the power switch to ON.
2. By using a pointed object, press and hold the internal button located on the front panel of the machine, between the power switch and START button.



3. Press and release the button on the remote control.



When the remote control button is released, the remote control LED emits two green flashes to indicate that the transmission is successful.

4. Release the internal button of the machine.
5. Press the button on the remote control to verify that the operation was performed correctly.

To disable a remote control, even the one supplied, follow the same procedure.

Please pay attention to the fact that the procedure for enabling and disabling is the same. Therefore, if after enabling or disabling a remote control the procedure is repeated, the remote control is disabled or enabled respectively again.

You can enable up to 18 remote controls for the same machine.

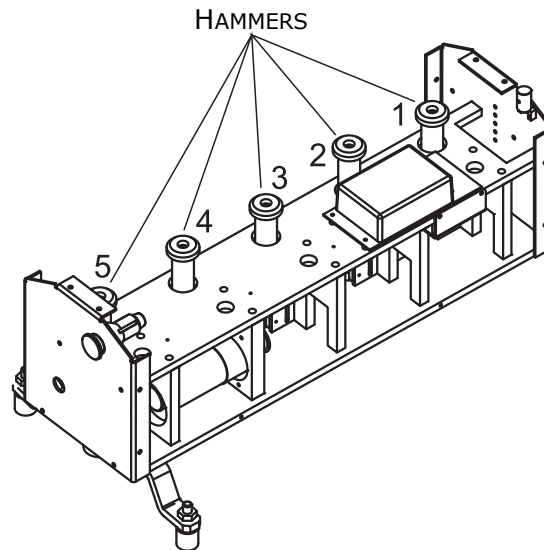
## 8 MAINTENANCE



**WARNING:**

**MAKE SURE THAT THE POWER SWITCH IS SET TO OFF AND THE POWER CABLE IS UNPLUGGED BEFORE ANY MAINTENANCE OF THE MACHINE.**

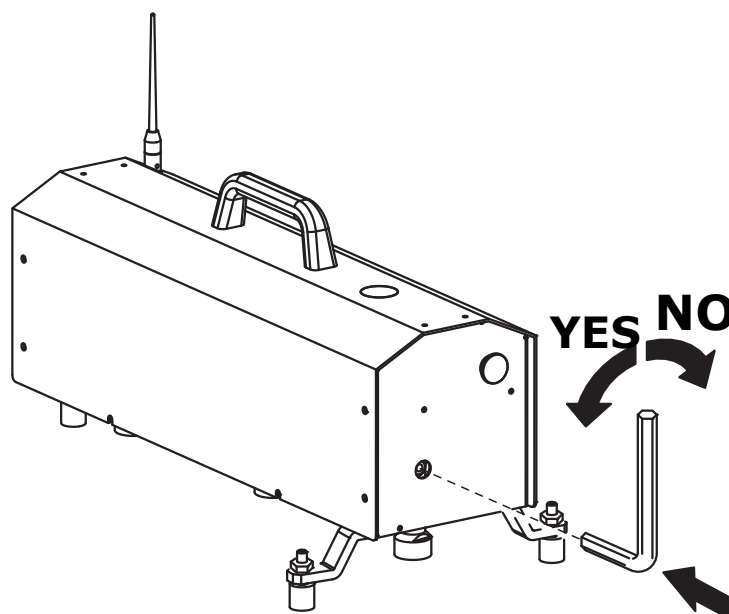
If the LED indicators of the proper functioning of the hammers signal anomalies in the fall speed or impact interval, clean and lubricate the hammers. To access the hammers, remove the cover by unscrewing the 12 screws that secure the base of the machine.



If the problem persists, contact an authorized service center for maintenance and calibration of the machine.

It is advisable to check the proper functioning of the machine at an accredited calibration laboratory at least every two years.

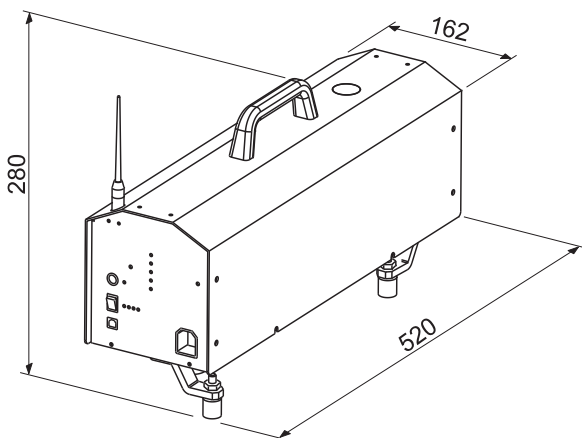
You can manually check the correct movement of the hammers. Insert a 5 mm hex wrench at the end of the motor shaft on the rear panel, then rotate the shaft **COUNTER-CLOCKWISE**.



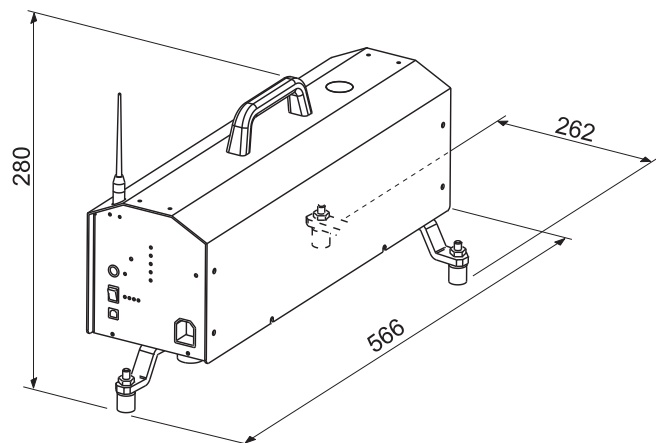
**WARNING: To AVOID ANY DAMAGE, TURN OFF THE MACHINE BEFORE MANUALLY TURNING THE SHAFT.**

## 9 TECHNICAL SPECIFICATIONS

<b>Number of hammers</b>	5 in line
<b>Weight of the hammers</b>	500 ± 12g each
<b>Fall height</b>	40 mm
<b>Tapping interval</b>	100 ± 20 ms
<b>Average tapping interval</b>	100 ± 5 ms
<b>Interval between the impact and the lifting of the hammer</b>	< 80 ms
<b>Distance among the hammers</b>	100 ± 3 mm
<b>Head of the hammers</b>	Diameter 30 ± 0.2 mm, spherical impact surface with radius of curvature 500 ± 100 mm
<b>Tapping direction</b>	Perpendicular to impact surface within ± 0.5°
<b>Support feet</b>	3 height-adjustable feet with rubber pads.
<b>Service serial output</b>	USB with type B connector
<b>Remote control</b>	By remote control (frequency 869.525 MHz, power 6 mW)
<b>Power supply</b>	100...240Vac, 50÷60Hz Lithium Ion rechargeable battery, rated voltage 7.2V, rated capacity 2900 mAh
<b>Power consumption</b>	< 30 W
<b>Fuse</b>	3A / 250V Time-delay fuse
<b>Battery autonomy</b>	About 80 min of continuous operation
<b>Working Temperature and Humidity</b>	-10...+50 °C, 0 ... 90 %RH no condensation
<b>Weight</b>	11 kg the machine complete with battery pack and remote control 5.4 kg the carrying case
<b>Structure of the machine</b>	Anodized and painted aluminum
<b>Dimensions (L x W x H)</b>	520 x 162 x 280 mm with cover with handle and retracted feet 566 x 262 x 280 mm with cover with handle and extended feet (excluding the antenna for the remote control)



**With retracted feet**



**With extended feet**



## 10 STORAGE OF THE MACHINE

Storage conditions of the machine:

- Temperature: -30...+70 °C.
- Humidity: less than 90 %RH no condensation.
- Do not store the machine where:
  - the presence of humidity is high;
  - the machine is exposed to direct sunlight;
  - the machine is exposed to a source of high temperature;
  - strong vibrations are present;
  - there is steam, salt and/or corrosive gas.

During storage, rotate the feet inward below the base of the machine to reduce the size.

## 11 SAFETY INSTRUCTIONS

### General Safety Instructions

This machine has been manufactured and tested in compliance with safety standards EN61010-1 relating to electronic measuring instruments and left the factory in perfect technical condition of safety.

The regular functioning and operational safety of the machine can only be guaranteed if all normal safety measures are observed as well as those specific described in this operating manual.

The regular functioning and operational safety of the machine can only be guaranteed under the climatic conditions specified in the manual.

Do not use the machine in places where they are present:

- Quick environment temperature changes that could cause condensation.
- Corrosive or flammable gases.
- Direct vibrations or shocks.
- High intensity electromagnetic fields or static electricity.

Do not carry the machine when the hammers are in motion.

**Do not remove the cover of the machine before you set the power switch to OFF and unplug the power cable.**

In case of mains power supply, ensure that there is the system ground and the cable is in good condition.

If the machine was transported from a cold to a warm place or vice versa, the formation of condensation can disturb its operation. In this case wait for the temperature of the machine to reach room temperature before putting it into service.

During transport or when the machine is not used, remove the antenna so to avoid any damage.

### Obligations of the user.

The user of the machine must ensure that the following laws and guidelines regarding the treatment of hazardous materials are followed:

- EU guidelines for safety at work
- national laws for the safety at work
- accident prevention regulations

## 12 ORDERING CODES

**HD2040** Machine for the generation of impact noise in accordance with ISO 140-6 and 140-7, ASTM E492 and E1007. Complete with rechargeable lithium ion battery, built-in battery charger, remote control, 13 mm wrench, instruction manual.  
**Optional carrying case.**

### ACCESSORIES

**HD2040-R** Additional remote control. Frequency 869.525 MHz Power 6 mW.

**HD2040-A** Additional antenna for the remote control.

**HD2040-V** Carrying case.

**HD2040-B** Spare rechargeable lithium-ion battery pack. Nominal voltage 7.2 V. Rated capacity 2900 mAh.

**DELTA OHM metrology laboratories LAT N° 124 are accredited by ACCREDIA for Temperature, Humidity, Pressure, Photometry / Radiometry, Acoustics and Air Velocity. They can supply calibration certificates for the accredited quantities.**



## **Dichiarazione di conformità UE** *EU declaration of conformity*

**Prodotto:** Macchina di calpestio HD2040  
*Product: Tapping machine HD2040*

**Accessori:** Remote control  
*Accessories: Remote control*

**Fabbricante:**  
*Manufacturer:*  
Delta Ohm S.r.l. a socio unico  
via G. Marconi 5  
35030 Caselle di Selvazzano (PD)  
ITALY

**La presente dichiarazione di conformità è rilasciata sotto la responsabilità esclusiva del fabbricante.**

*This declaration of conformity is issued under the sole responsibility of the manufacturer.*

**L'oggetto della dichiarazione di cui sopra è conforme alla pertinente normativa di armonizzazione dell'Unione:**

*The object of the declaration described above is in conformity with the relevant Union harmonisation legislation:*

Low Voltage Directive 2014/35/EU  
Electromagnetic Compatibility Directive 2014/30/EU  
RoHS Directive 2011/65/EU

**Pertinenti norme armonizzate utilizzate:**

*Relevant harmonised standards used:*

Safety EN 61010-1:2010  
EMC EN 61326-1:2013  
RoHS EN 50581:2012

**Firmato a nome e per conto di:**

*Signed for and on behalf of:*  
Delta Ohm S.r.l. a socio unico

Caselle di Selvazzano (PD) – 2016-04-20

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Luisa Masut – CEO

# GUARANTEE



## TERMS OF GUARANTEE

All DELTA OHM instruments are subject to accurate testing, and are guaranteed for 24 months from the date of purchase. DELTA OHM will repair or replace free of charge the parts that, within the warranty period, shall be deemed non efficient according to its own judgement. Complete replacement is excluded and no damage claims are accepted. The DELTA OHM guarantee only covers instrument repair. The guarantee is void in case of incidental breakage during transport, negligence, misuse, connection to a different voltage than that required for the appliance by the operator. Finally, a product repaired or tampered by unauthorized third parties is excluded from the guarantee. The instrument shall be returned FREE OF SHIPMENT CHARGES to your dealer. The jurisdiction of Padua applies in any dispute.



The electrical and electronic equipment marked with this symbol cannot be disposed of in public landfills. According to the Directive 2011/65/EU, the european users of electrical and electronic equipment can return it to the dealer or manufacturer upon purchase of a new one. The illegal disposal of electrical and electronic equipment is punished with an administrative fine.

This guarantee must be sent together with the instrument to our service centre.  
IMPORTANT: Guarantee is valid only if coupon has been correctly filled in all details.

**Instrument Code: HD2040**

Serial Number \_\_\_\_\_

## RENEWALS

Date \_\_\_\_\_

Date \_\_\_\_\_

Inspector \_\_\_\_\_

Inspector \_\_\_\_\_

Date \_\_\_\_\_

Date \_\_\_\_\_

Inspector \_\_\_\_\_

Inspector \_\_\_\_\_

Date \_\_\_\_\_

Date \_\_\_\_\_

Inspector \_\_\_\_\_

Inspector \_\_\_\_\_

