PHYWE	Cobra SMARTexperiment - Mathematical Pendulum	12972-00

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Operating instructions

CE The unit complies with the applicable EC-guidelines

Fig. 1: 12972-00 Cobra SMARTexperiment – Mathematical Pendulum

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1 SAFETY PRECAUTIONS

Caution!

- Carefully read these operating instructions completely before operating this instrument. This is necessary to avoid damage to it, as well as for user-safety.
- Use the unit only for its intended purpose
- Only use the instrument for the purpose for which it was designed.
- Do not open the unit.
- Protect the instrument from dust, moisture and vapours. Use a slightly moist lint-free cloth to clean the instrument. Do not use aggressive cleaning agents or solvents.

2 PURPOSE AND CHARACTERISTICS

With the Cobra SMARTexperiment "Mathematical Pendulum", the mathematical pendulum - the period of oscillation of the harmonic oscillation depends on the length of the pendulum but not on the attached mass - can be demonstrated with a simple set-up. - can be illustrated.

3 FUNCTIONAL AND OPERATING ELEMENTS

3.1 Cobra SMARTsense Photogate

3.1.1 Operating elements

The sensor has a power button and two LEDs to indicate the Bluetooth status and the battery charge level.

Function of the power button

To switch the sensor on and off, the power button must be pressed for longer than 3s.

Functions of the Bluetooth LED

Flashes red every 2s	Not connected
Flashes green every 2s	Connected to terminal
Flashes green every 4s	Measurement recording in progress

Functions of the charging LED

Flashes red every 2s	Weak battery
Red luminous	Charging active
Glowing green	Charging process completed

3.1.2 USB interface

The USB Type-C interface is used to charge the battery that is permanently installed in the sensor.

3.1.3 Connection interface A⇌B

The cable supplied for connecting sensors "A" and "B" is plugged into the socket.

3.2 Assembly

3.2.1 Screw the Cobra SMARTsense Photogate sensor onto the stand.

Fig. 2 Sensor and stand

Fig. 3 Sensor mounted

3.2.2 Push 2 rods (one with internal thread and one with external thread) into the uprights. To do this, open the yellow clamps (see fig. 4). After the rods have been pushed in, press the clamps down. Check the firm connection between upright and pole.

Fig.4 Mounting the stand

3.2.3 Push a rod with an internal thread from above into the opening of a stand so that the thread is at the upper end. Then tighten the knurled screw (Fig. 5 [1]) so that the rod is firmly locked in place.

Fig.5 Mounted rod

3.2.4 Now extend the assembled rod by screwing on the remaining rod (with external thread).

Fig.6 Extended rod

3.2.5 Fit the thread holder (fig. 7 [2]) to the upper end of the rod using the knurled screw (fig. 7 [1]).

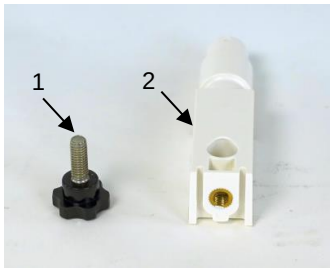

Fig. 7 Thread holder

Fig.8 Mounted bracket

3.2.6 Now push the scale onto the thread holder from the front and fix it with the help of the plastic screw.

Fig. 7 Scale

Fig.8 Mounted scale

3.2.7 Mount the thread using the thread attachment (Fig.9 [1]). Attach the thread attachment to the upper end of the rod and pass the thread through the slot of the thread holder so that the tube (Fig.9 [2]) hits the thread holder.

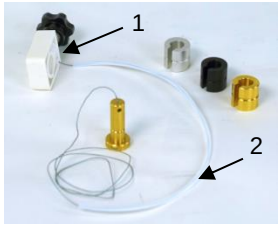

Fig. 9 Thread holder

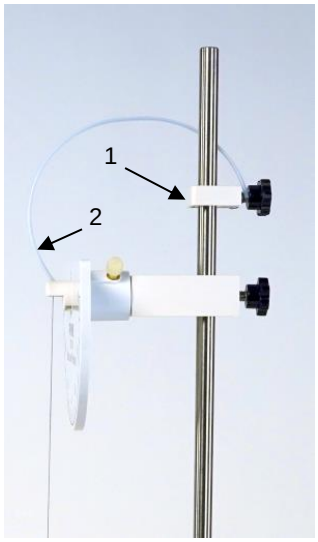

Fig. 10 Mounted bracket

3.2.8 Place the sensor between the rods of the stand and position it so that the thread is in the middle of the light barrier. If necessary, shorten the pendulum thread by pulling the thread out of the tube at the top and winding it around the knurled screw (Fig.11 [1]) of the thread attachment.

Fig. 11 Ready-assembled experimental set-up

4 NOTES ON OPERATION

This device fulfils all of the technical requirements that are compiled in current EC guidelines. The characteristics of this product qualify it for the CE mark.

The individual connecting leads are each not to be longer than 2 m.

The instrument can be so influenced by electrostatic charges and other electromagnetic phenomena (HF, bursts, indirect lightning discharges) that it no longer works within the given specifications. Carry out the following measures to reduce or eliminate the effect of such disturbance: Ensure potential equalization at the PC (especially with Laptops). Use screening. Do not operate high frequency emitters (e.g. radio equipment or mobile radiotelephones) in the immediate vicinity. When a total failure of the instrument occurs, unplug it and plug it back in again for a reset.

5 HANDLING

5.1 Experimental setup

5.1.1 Changing the pendulum mass

The scope of delivery of the experiment includes 3 different masses which can be pushed directly onto the pendulum foot.

Fig. 12 Pendulum weights

5.1.2 Changing the pendulum length

Loosen the knurled screw of the pendulum holder (Fig. 13 [2]) and move the holder along the rod. Shorten the thread by pulling it out of the tube and wrapping it around the knurled screw (Fig. 13 [1]).

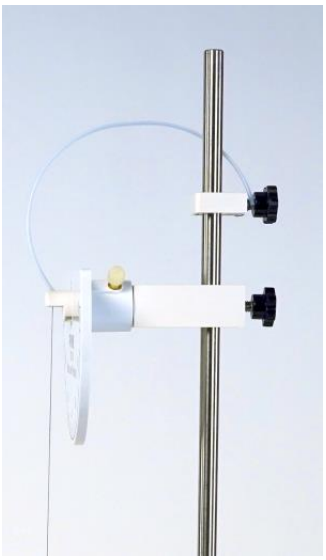

Fig. 13 Height adjustment

5.2 Charging the Photogate Sensor

Use a USB-C cable to connect the sensor to a computer or USB charger (not included).

During the charging process, the battery charge LED lights up red. When the charging process is complete, the battery charge LED lights up green. The charging time for a completely discharged battery is 3 hours maximum.

Disconnect the charger at the latest four hours after the completion of the charging process. Otherwise, the service life of the battery may be negatively affected.

5.2 Start-up

Switch on the sensor by pressing the power button for more than 3s. Now the Bluetooth LED flashes red. Start the software and select the sensor.

If the sensor is to be used via the USB interface, it does not need to be switched on. The sensor is connected directly to the end device using the supplied USB cable.

There is a 9-digit code on the back of the sensor (Fig.14). The last 4 digits of the code are displayed as the sensor name in the software (Fig.15). This enables the precise assignment of the sensors within the software.

Fig. 14

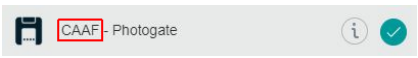

Fig. 15

Selection of the sensor via the Bluetooth interface

Make sure that the Bluetooth interface is activated on the terminal device (PC/Tablet/Smartphone) and that the software is allowed to access the interface.

After the sensor has been selected in the software, the LED flashes green to indicate that the connection has been established correctly. After the sensor has been coupled with the software, the sensor is no longer visible to other users in the software, and therefore can no longer be selected.

If the sensor is switched on and not connected, it switches off automatically after 5 minutes.

Selection of the sensor via the USB interface

For this purpose the sensor must be plugged into the USB port of the end device. It is not necessary to switch on the sensor. The sensor is automatically recognized and displayed. It can be selected and connected directly.

6 TECHNICAL DATA

Operating temperature range: 5 - 40°C

Rel. humidity < 80%

Sensor:

Measuring range	0…∞ s
Resolution	10 µs
Wavelength	infrared
Max. Data rate	1000 Hz
Battery capacity	1000 mAh
Max. Radio range (free field)	30 m
Fork width	50 mm
Dimensions (LxWxH)	150x200x610 mm
Mass:	1,75 kg

7 SCOPE OF DELIVERY

The scope of delivery includes:

- 1x Cobra SMARTsense Photogate
- 2x USB connection cable type C 07935-00
- Set of weights (aluminium, brass, plastic)
- 4x rods
- 1x Tripod foot, divisible 02001-00
- 1x stand for Photogate sensor
- 1x thread holder with attachment and thread
- 1x scale
- Div. screws

8 ACCESSORIES

The following accessories are available:

- USB-charger 07934-99
- USB connecting cable type C 07935-00
- USB-Bluetooth-Adapter 07936-00
- Software measureLAB 14580-61
- Free measureApp available from supplier portals

iOS	Android	Windows

9 CONFORMITY

PHYWE Systeme GmbH & Co.KG hereby declares that the radio system type 12972-00 complies with the 2014/53/EU directive. The complete text of the EC Declaration of Conformity is available at the following Internet address:

www.phywe.com/en/ec-declaration

10 DISPOSAL

The packaging mainly consists of environmentally-friendly materials that should be returned to the local recycling stations.

Do not dispose of this product with normal household waste. If this unit needs to be disposed of, please return it to the address that is stated below for proper disposal

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