PHYWE excellence in science

Cobra SMARTexperiment - Archimedes' principle

12971-00

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Fig. 1: 12971-00 Cobra SMARTexperiment - Archimedes' principle

Operating instructions

CE The unit complies with the applicable EC-guidelines

TABLE OF CONTENTS

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 "Archimedes' Principle", Archimedes' Principle -The static buoyancy of a body in a medium is as great as the weight force of the medium displaced by the body - can be illustrated with a simple set-up.

3 FUNCTIONAL AND OPERATING ELEMENTS

3.1 Cobra SMARTsense Force & Acceleration

3.1.1 Operating elements
The sensor has an on-button and two LEDs for indicating the Bluetooth and battery charge status.

On-button
Press the on-button for more than 3 seconds to switch the sensor on and off

Bluetooth-LED

Flashing red every 2 seconds	Not connected
Flashing green every 2 seconds	Connected to the terminal device
Flashing green every 4 seconds	Running measurement

Battery charge LED

Flashing red every 2 seconds	Low battery
Illuminated red	Active charging process
Illuminated red	Charging process completed

3.1.2 Functional elements
The cantilever beam is located inside the housing. The supplied hook for carrying the load can be screwed into the bottom of the sensor and secured with the knurled nut.

3.1.3 USB port
The battery, which is permanently installed in the sensor, is charged via the type C USB port. Furthermore, communication with a computer takes place via this interface.

3.2 Assembly

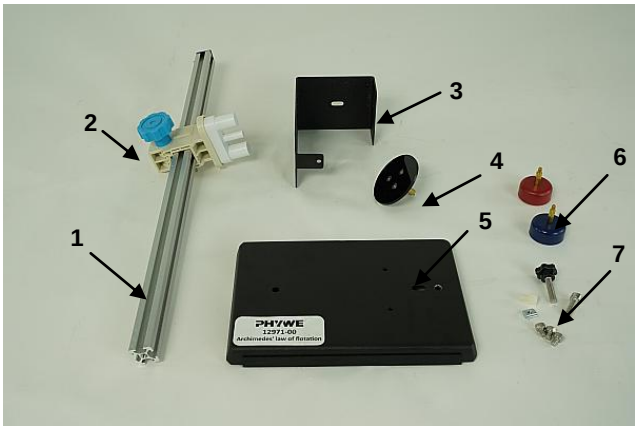


Fig. 1

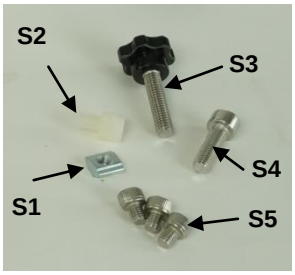


Fig. 2

3.2.1 Push the threaded plate (S1) into the support rail (1). Use a short Allen screw (S5) to loosely fix the table angle (3) to the support rail so that the height can be adjusted.

Fig. 3: Table angle connected with support legs

3.2.2 Screw the support rail (1) onto the base plate from below using the long Allen screw (S4).

3.2.3 Screw the table angle (3) onto the base plate (5) from above using the two short Allen screws (S5).

Fig. 4+5 Table angle with support rail and base plate

3.2.4 Attach a SMARTsense Force & Acceleration Sensor to the height adjuster (2) using the knurled screw (7).

Fig. 6 Mounted sensor

3.2.5 Screw the weight plate (4) onto the second SMARTsense Force & Acceleration Sensor.

Fig. 7 Sensor with hook and weight plate

3.2.6 Screw the second sensor to the table bracket (3) using the plastic or wing screw (S2).

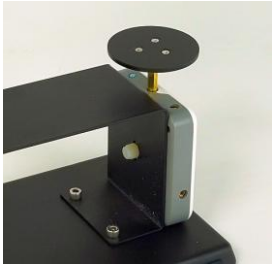


Fig. 8 Mounted sensor

Fig.9 Unit construction

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 Put the outlet extension on the outlet of the large container and place it on the table angle (3). Place a small container on the weight plate (4).

Fig. 10 Container with drain

5.1.2 Attach the magnets to the float and the force sensor.

Fig. 11+12 Float and sensor with magnet

Fig. 13 Complete experimental setup

5.1.3 Use the thumb screw on the height adjuster to adjust it to a certain height.

Fig. 14 Height adjuster with wing screw

5.1.4 If smaller vessels are used to immerse the float, the scissor lift table included in the scope of delivery can be used.

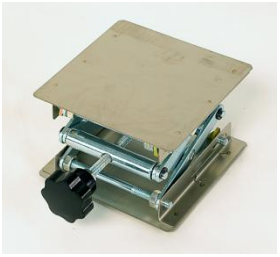


Fig. 15 Scissor lift table

To do this, place the scissor lift table on the table angle (3) and then adjust the corresponding height on the lift table by turning the knurled screw.

5.1.5 Now fill the large beaker with sufficient liquid and carry out the experiment.

5.1 Charging the Force & Acceleration 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.16). The last 4 digits of the code are displayed as the sensor name in the software (Fig.17). This enables the precise assignment of the sensors within the software.

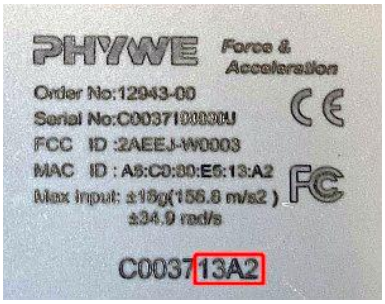


Fig. 16

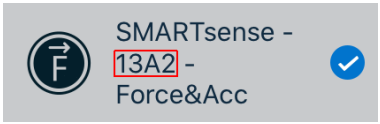


Fig. 17

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.

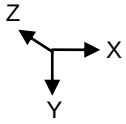
After the sensor has been selected in the software, the LED flashes green to indicate that the connection has been established correctly. After the sensor has been coupled with the software, the sensor is no longer visible to other users in the software, and therefore can no longer be selected.

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.

Force sensor:
The force signal is determined by means of strain gauges on a bending beam. The force is applied along the main axis of the sensor.

Acceleration:
Acceleration values are measured on 3 axes.
The symbol on the front of the sensor shows the assignment of the axes in positive directions.



Gyroscope:
The gyroscope measures the rate of rotation of the sensor.
The printed 3-axis symbol represents the axes of rotation.

6 TECHNICAL DATA

Operating temperature range: 5 - 40°C
Rel. humidity < 80%

Sensor

Force:	
Measuring range	±50 N
Resolution	30mN
Acceleration:	
Measuring range	± 16 g
Resolution	0,01 g
Gyroscope:	
Measuring range	34,9 rad/s
Resolution	0,01 rad/s
Accuracy*	± 1 %
Max. date rate	1000 Hz
Battery capacity	250 mAh
Max. wireless range (open field)	30 m
Dimensions (length x width x height)	150x200x500 mm
Weight	2,15 kg

*referred to the full-scale value

7 SCOPE OF DELIVERY

The scope of delivery includes:

- 2x Cobra SMARTsense Force & Acceleration 12943-00
- 2x USB connection cable type C 07935-00
- Set of floats (stainless steel, brass, wood)
- 3x magnetic connector
- 1x base plate
- 1x height adjuster
- 1x support rail
- 1x table angle
- 1x weight plate
- 3x mug
- 1x outlet extension
- 1x scissor lift table
- 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 12971-00 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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