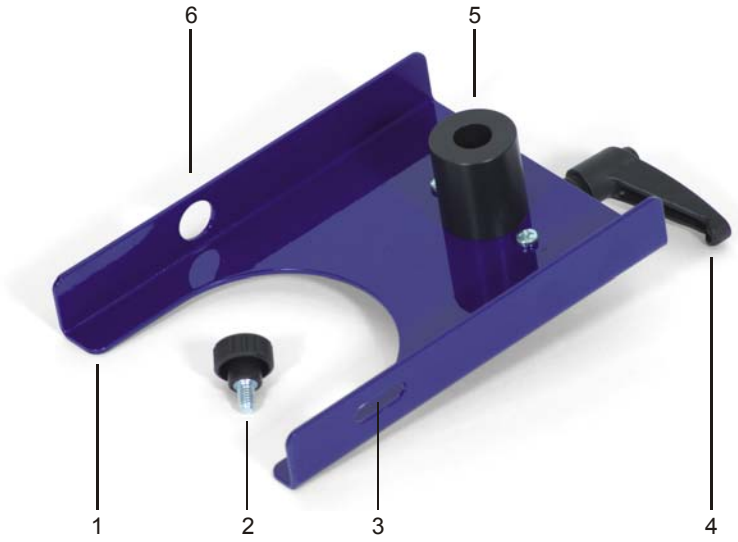
# Light Barrier Holder 1018448

## Instruction manual

12/14 UD




1 Light barrier holder
2 Knurled screw
3 Slot for knurled screw
4 Securing lever
5 Spacer with hole for stand rod
6 Hole for connecting lead

### 1. Safety instructions

Safe operation of the light barrier holder is guaranteed as long as the equipment is used as specified. Safety cannot be assured, however, if the light barrier holder is used incorrectly or carelessly.

### 2. Technical data

| | |
|---|---|
| Dimensions: | 165x125x55 mm approx. |
| Weight: | 400 g approx. |

### 3. Description

The light barrier holder consists of a metal profile which accommodates light barrier 1000563. It is equipped with a spacer with hole in the centre for a stand rod (diameter 12 mm), a securing lever with an external thread for attaching the holder to the stand rod, a knurled screw for fastening the light barrier itself into the holder, a slotted hole for the knurled screw and a hole for the lead connecting the light.

The light barrier holder is intended to secure the light barrier 1000563 to the free-fall apparatus 1000738 at a well defined height. Measuring the time the light from the barrier is obscured by a falling ball of known diameter (16 mm) allows for measurement of the instantaneous velocity of the ball at a specific height. The average velocity of the falling ball can be measured with the help of the start attachment and a single light barrier or by the use of two light barriers.

Note: The length of the spacer is chosen such that the height of its top edge, as read from the scale on the stand rod, corresponds to the distance between the sensor of the light barrier and the landing plate of the free-fall apparatus.

### 4. Operation

- Position light barrier 1000563 in the light barrier holder and secure it in place with the knurled screw.
- Take the start fitting of the free-fall apparatus off the stand rod. Slide the light barrier holder with the light barrier attached down onto the rod from the top and secure it at the correct height by means of the securing lever.

- Feed the plug of the connecting lead for the light barrier through the hole provided in the holder and connect the barrier to the digital counter 1003123 (230 V) or 1003122 (115 V).

Note: As alternatives to digital counters 1003123 or 1003122, it is also possible to user counters 1001033 (230 V) or 1001032 (115 V). However, the duration of the time when the light barrier is obscured cannot be measured using these counters, meaning that it is not possible to measure the instantaneous velocity of the ball.

## 5. Sample experiment

**Instantaneous and average velocities of a falling ball**

Required equipment:

| | |
|---|---|
| 1 Free-fall apparatus | 1000738 |
| 2 Light barriers | 1000563 |
| 2 Light barrier holders | 1018448 |
| 1 Digital counter (@230 V) | 1003123 |
| or | |
| 1 Digital counter (@115 V) | 1003122 |
| 1 Set of 3 safety experiment leads for free-fall apparatus | 1002848 |

- Set up the experiment as described in step 4 and shown in Fig. 1.
- Align the two light barriers in their holders in such a way that the ball falls roughly through the centre of the opening between the light barriers and the holders.
- Set up the digital counter to measure the time the light barriers are obscured.
- Initiate free-fall with the help of the start fitting and measure the times $\Delta t_{1,2}$ during which the two light barriers are obscured.
- Calculate the instantaneous velocities of the falling ball:

$$v_{1,2} = \frac{16\ \text{mm}}{\Delta t_{1,2}}$$

Fig. 1: Experiment set-up for measuring instantaneous velocity.

- Now modify the experiment set-as shown in Fig. 2, i.e. with the start fitting and the light barrier at the bottom connected to the microsecond counter and the top light barrier unconnected.

Fig. 2: Experiment set-up for measuring average velocity.

- Set up the digital counter in such a way that measurement of the time starts when the free-fall is initiated by means of the start fitting and stops when the ball passes the light barrier at the bottom.
- Initiate free fall and measure the fall time $\Delta t$.
- Determine the distance $\Delta s$ between the start fitting and the light barrier at the bottom (take into account the note under step 3).
- Calculate the average velocity:

$$v = \frac{\Delta s}{\Delta t}$$

Note: As an alternative to starting the measurement with the help of the start fitting, the measurement can also be triggered by connecting the top light barrier to the microsecond counter. The average velocity $v'$ can then be calculated from the time $\Delta t'$ and the distance $\Delta s'$ between the two light barriers (take into account the note under step 3).