

## Operating Instructions

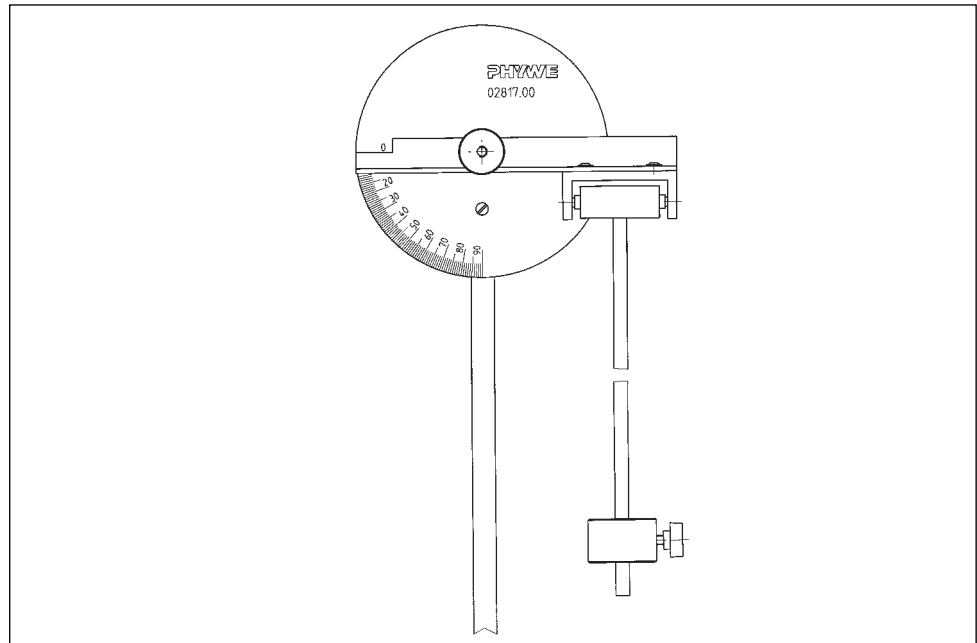


Fig. 1: Variable „g“ pendulum

### 1 PURPOSE AND DESCRIPTION

The pendulum is so constructed that its plane of swing can be turned continuously from the normal vertical position to the horizontal position. The angle  $\Phi$  by which the plane of swing differs from the normal vertical position can be read off on a scale. In this way, the contribution of the decisive component for the time of swing, the acceleration of gravity  $g$ , can be continually reduced, down to the value zero ( $\Phi = 90^\circ$ ). In this way, the effect of a reduction in the acceleration of gravity on the time of swing of a pendulum can be demonstrated. Instead of the well known formula for the time of a complete back and forth swing (period of oscillation)  $T$  of a pendulum of length  $l$

$$T = 2\pi \sqrt{\frac{l}{g}}$$

we must use here the generalized relationship

$$T(\Phi) = 2\pi \sqrt{\frac{l}{g \cdot \cos\Phi}}$$

A round, stainless steel support rod of 50 cm length is supplied with the pendulum. It must be held in a support base with adjustable feet, e.g. the tripod 02002.55.

### 2 HANDLING DURING THE EXPERIMENT

The time of swing  $T$  must be measured as a function of the angle of inclination. When  $\Phi = 0$ , move the pendulum, held in the tripod, as far down the holding rod as possible to attain the best possible stability of the set-up.

Use the levelling ring of the tripod to carefully adjust the pendulum. The value  $\Phi$  read on the angle scale must correspond with the inclination of the plane of swing to the vertical. The following procedure has been found to work well:

- Point one leg of the tripod in the direction of the rest position of the pendulum, and adjust the levelling ring of the foot of this leg so that the foot is as short as possible. Adjust the other two feet so that they are roughly in the middle of their adjustment range.
- Loosen the milled screw at the centre of the angle scale. Swing the rod of the pendulum up and fix it at  $\Phi = 90^\circ$  by retightening the milled screw.
- Adjust the levelling rings of the two tripod feet which were set to the middle of their range to bring the rest position of the pendulum to the middle of the swing.
- Slowly screw out the levelling ring on the third foot so that the pendulum swings slower and slower; should the rest position shift, compensate for this by adjustment of the other two feet.
- The procedure is finished when the pendulum is at rest in practically any position.

After this preparation, do not shift the tripod about on the table. Now stepwise reduce the angle of inclination  $\Phi$  and measure the corresponding time of swing, e.g. with a stopwatch. It is, however, quicker and easier to use a light barrier and an electronic timer (see the „List of Equipment“ and Fig. 2).

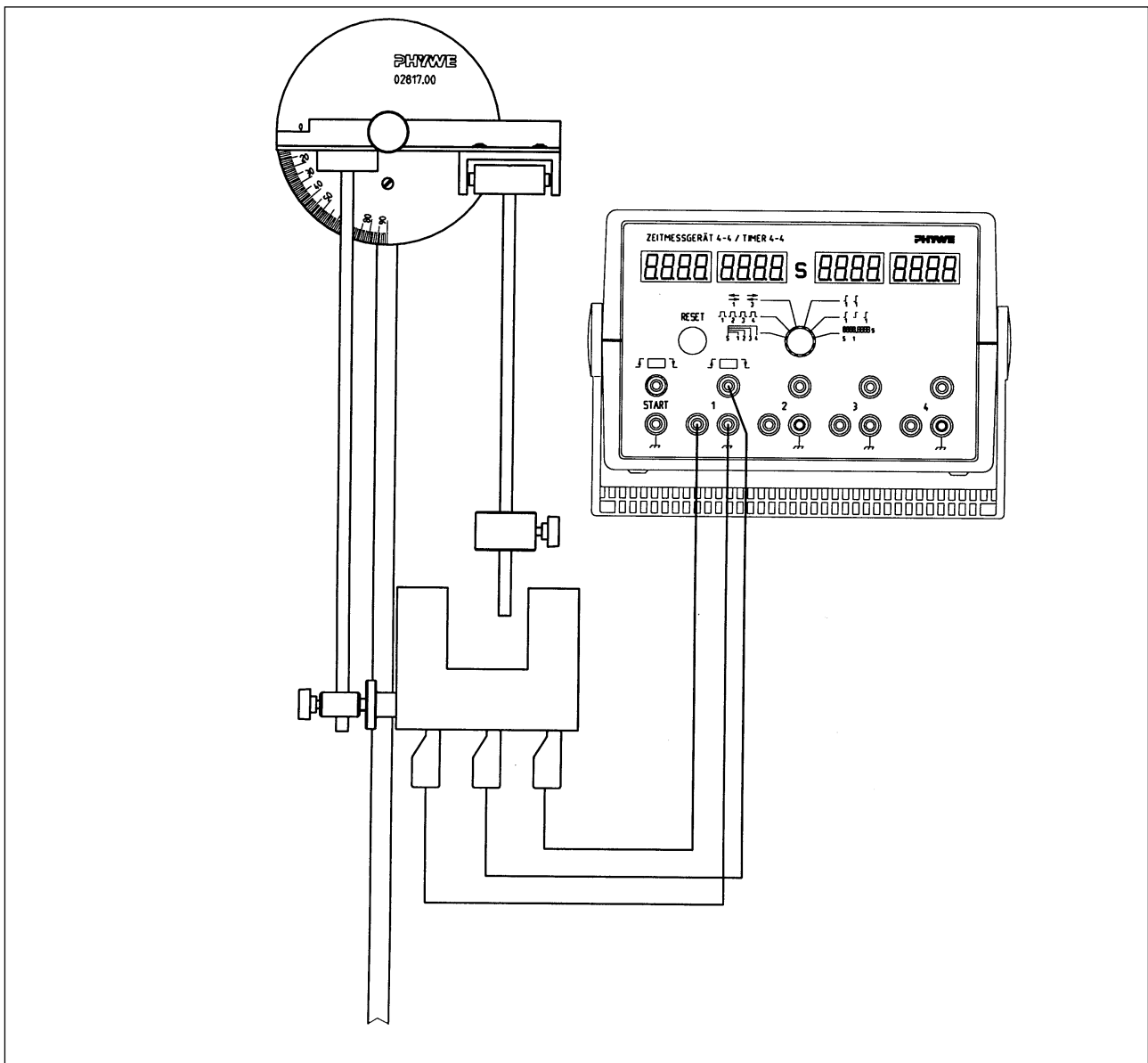


Fig. 2: Experimental set-up for the measurement of the time of swing with light barrier and timer.

### 3 LIST OF EQUIPMENT

The following accessories are recommended for use with the variable „g“ pendulum 02817.00:

Tripod base -PASS-	02002.55
Holder for fork-type light barrier	02817.10
Light barrier, compact	11207.20
Timer	13605.99
Connecting cord, 500 mm, red	07361.01
Connecting cord, 500 mm, yellow	07361.02
Connecting cord, 500 mm, green	07361.04

### 4 LITERATURE

University Laboratory Experiments, Physics 16502.12