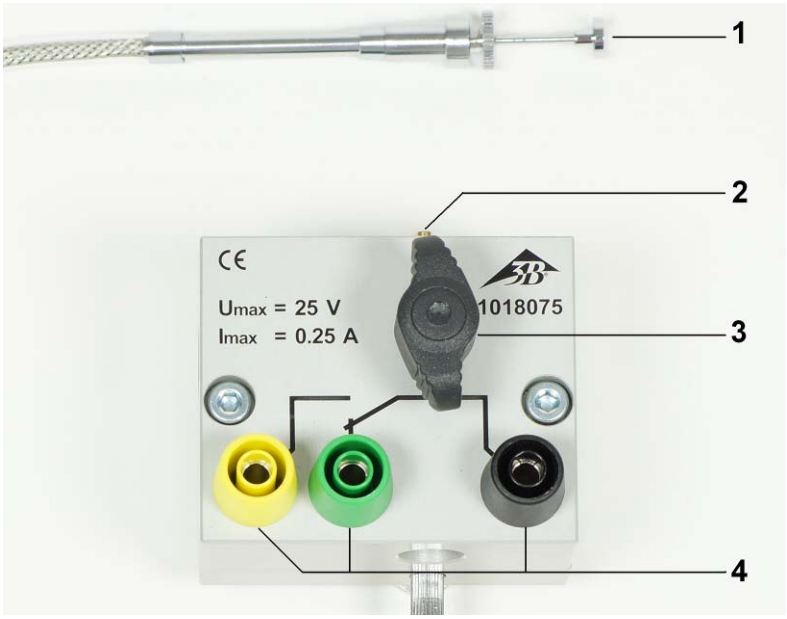
Trigger Mechanism for Maxwell's Wheel 1018075

Instruction manual

01/15 SD/UD



1 Trigger
2 Holding pin
3 Fastening screw
4 4-mm safety sockets (output)

1. Safety instructions

This triggering mechanism conforms to safety regulations for electrical measurement, control and laboratory equipment, as specified in DIN EN 61010 part 1. It is intended for use in dry rooms suitable for electrical equipment.

Safe operation of the multimeter is guaranteed if it is solely used as specified. Safety cannot be guaranteed, however, if the multimeter is used incorrectly or handled without due care and attention.

If it may be deduced that the equipment may no longer be used without risk (e.g. if there is visible damage), it must immediately be taken out of action.

- Use the equipment in dry rooms only.
- Take note that the maximum voltage and current for the trigger are 25 V and 0.25 A.

2. Technical data

Connections:	4-mm safety sockets (output)
Attachment:	2 Slots (horizontal/vertical) for stand rods of diameter 10 mm plus fastening screw
Dimensions:	60 x 50 x 45 mm
Weight:	250 g

3. Description

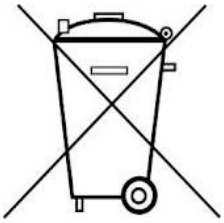
The trigger mechanism is designed for triggering the defined starting of Maxwell's wheel 1000790. It has holes running through it so that it can be slotted either horizontally or vertically onto stand rods of 10-mm diameter and secured in place with a fastening screw. It is equipped with 4-mm safety sockets for connection to the start input of the digital counter.

The trigger maintains Maxwell's wheel in its starting position with the help of a holding pin. In this holding position, the switch setting is as printed on the casing. When the trigger is actu-

ated, the contacts are switched over, allowing the wheel to start moving and simultaneously triggering measurement of time.

4. Storage, cleaning and disposal

- Store the equipment in a clean, dry and dust-free location.
- Do not use aggressive cleaning agents or solvents to clean the equipment.
- Use a soft, damp cloth for cleaning purposes.
- The packaging should be disposed of at local recycling points.
- Should you need to dispose of the equipment itself, never throw it away in normal domestic waste but use containers specifically set aside for electrical waste. Local regulations will apply.



5. Operation/Sample experiment

How the height *h* by which Maxwell's wheel falls depends on the square of the fall time t^2

Required equipment:

1	Maxwell's wheel	1000790
1	H-shaped stand base	1001042
2	Stand rod, 1000 mm	1002936
4	Universal clamp	1002830
1	Stand rod. 280 mm, 10 mm diam.	1012848
1	Trigger mechanism for Maxwell's wheel	1018075
1	Light barrier	1000563
1	Digital counter with interface (@ 230 V)	1003123
or		
1	Digital counter with interface (@ 115 V)	1003122
1	Set of 3 safety experiment leads for free-fall apparatus	1002848
1	Ruler, 1m	1000743
1	Set of pointers for ruler	1006494
1	Stand base, 900 g	1001045

- Set up the experiment as shown in Fig. 1.
- Align the axle of Maxwell's wheel with the thread wound around it horizontally with the help of the two fastening screws.
- Line up the light barrier in such a way that the sensor will be obscured by the actual axle of the wheel and not by one of its end caps, for example. Make sure to avoid any collision between the wheel and the light barrier.
- Connect the light barrier to the mini-DIN8 PHOTO/MIC socket for counter input B.
- Attach the trigger mechanism to the horizontal 280-mm stand rod in such a way that the holding pin is above the middle of the wheel and pointing towards the wheel's axle.
- Connect the red socket of counter input A to the yellow socket of the trigger mechanism with the help of the green 150-cm safety experiment lead. Plug the black and red 75-cm leads together and use them to connect the black socket of counter input A to the black socket of the trigger mechanism.
- Arm the trigger mechanism by pushing it back as far as it will go with your thumb and then gently turning the knurled screw in an anti-clockwise direction with your index finger.
- Carefully wind the thread around the Maxwell's wheel and use the holding pin to fasten it to the armed trigger mechanism.
- When you fasten the wheel in place, make sure you do not knock it out of its rest position with the holding pin. If necessary, you can readjust the horizontal alignment of the wheel.
- Set up the ruler in the heavy stand base as shown in Fig. 1.
- Move the topmost pointer until it points to the position of the wheel's axle.
- Move the topmost pointer until it points to the position of the sensor belonging to the light barrier.
- Press the 'FUNCTION' button on the digital counter to select the 'START A – STOP B' operating mode.
- Set off the trigger by gently pressing it, turning the knurled screw slightly clockwise with your index finger and letting the trigger go.

The wheel is then free to move and at the same moment, the counter starts measuring the time. As soon as the axle breaks the beam of the light barrier, the measurement stops automatically. The fall time is then displayed in either s or ms.

- Read off the fall time t from the counter and the height fallen h, which is the difference between the heights of the pointers along the ruler, and make a note of these values.
- Repeat the measurement for various times and heights of fall, i.e. for different positions of the light barrier and therefore the bottom pointer.
- Plot the height of the fall h as a function of the fall time t^2 (Fig. 2). The following equation predicts that this should be a linear relationship:

$$h(t) = \frac{1}{2} \cdot \frac{g}{1 + \frac{I}{M \cdot r^2}} \cdot t^2$$

g: Acceleration due to gravity
I: Moment of inertia of wheel
M: Mass of wheel
r: Radius of axle

Having matched a straight line to the plot, it is possible to determine from the gradient either I, if g, M and r are known, or g, if $I = 1/2 \cdot M \cdot R^2$ (R: radius of wheel), M and r are known.

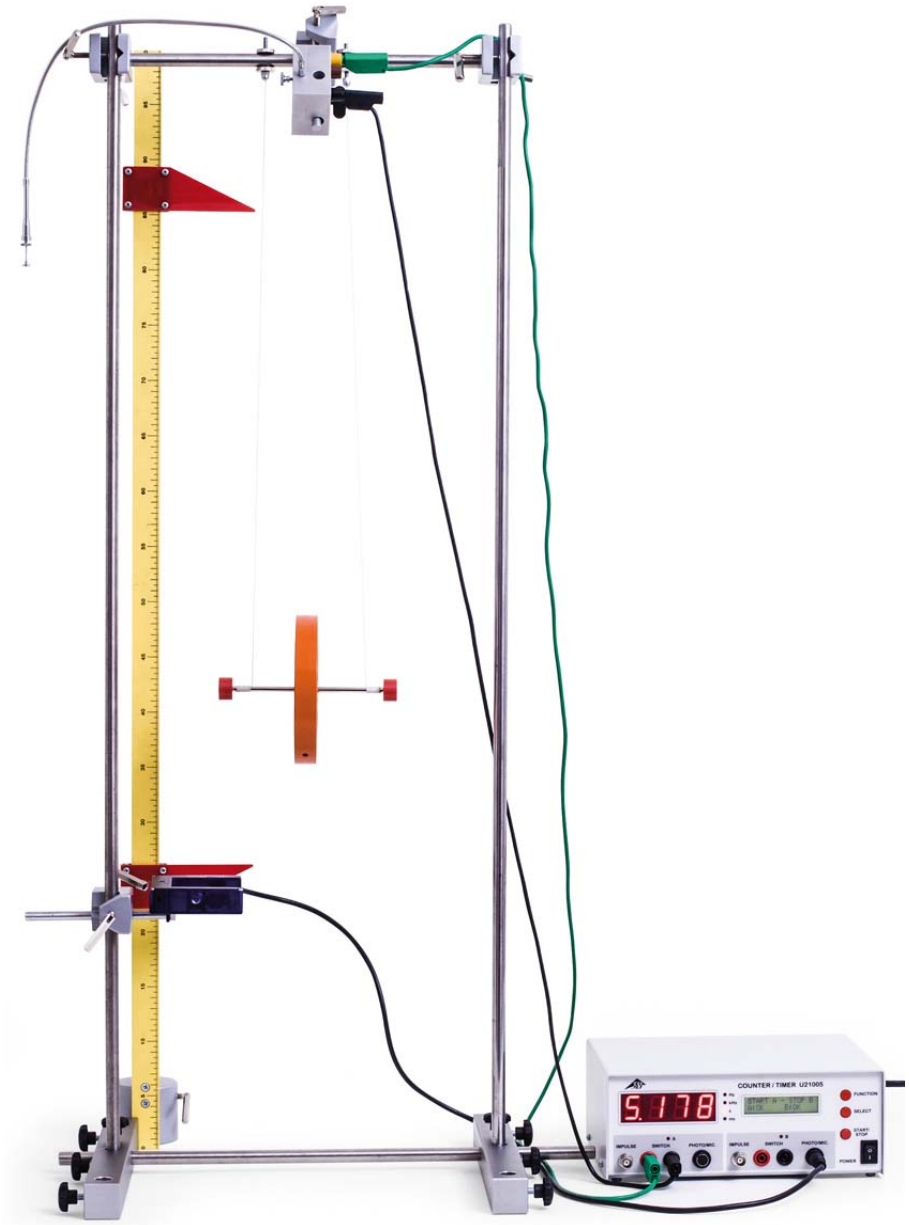


Fig. 1: Experiment set-up.

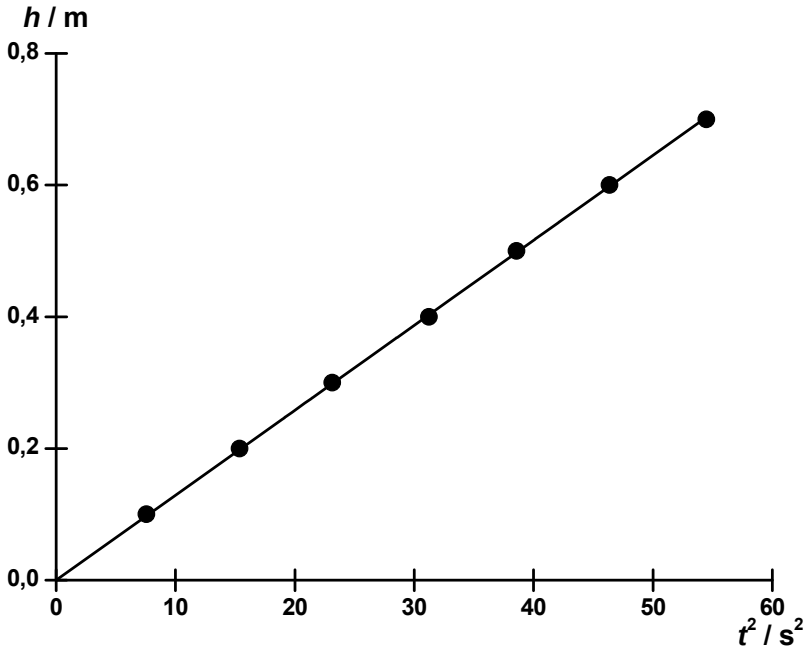


Fig. 2: Graph of h as a function of t^2.