

## Motions

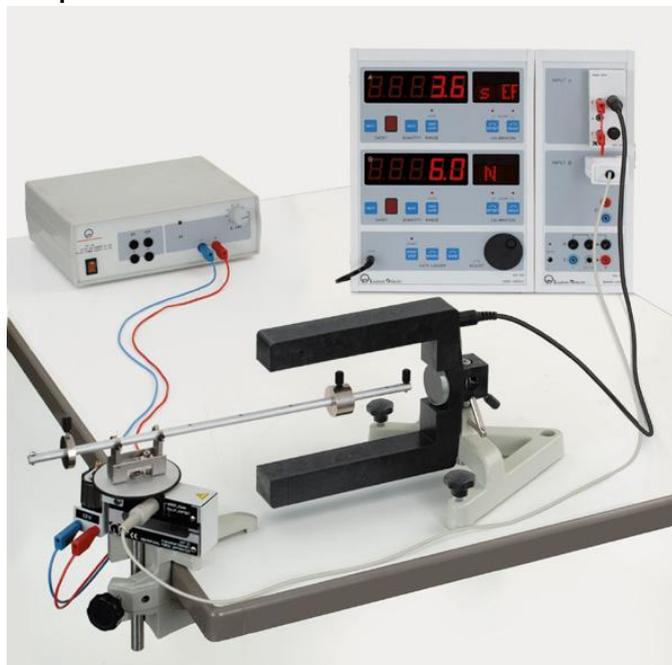
## Circular motion and rotation

## Dependence of centrifugal force on the angular velocity

## Object of the experiment

- Investigating the relation between the centrifugal force and the angular velocity of the test body

## Setup



## Safety notes regarding this experiment:

- The lock screws and locating screws of the test body and the balancing weight have always to be tightened firmly.
- Do not reach into the rotating apparatus with your hands.

## Preparing the centrifugal force apparatus:

- Before the centrifugal force apparatus is used in conjunction with the centrifugal force adapter for the first time, the zero and the gain have to be adjusted as explained in the instruction sheet of the centrifugal force adapter (524 0681).
- If the centrifugal force apparatus S is used, these adjustments are not necessary.

## Preparing the force measurement:

- Put the CASSY-Display into operation with the Sensor-CASSY connected.
- Connect the centrifugal force apparatus with the centrifugal force adapter or the centrifugal force apparatus S to Input B.
- While the centrifugal apparatus is unloaded, press the key OFF-SET (CALIBRATION) until the red LED blinks.
- After adjusting the zero, press the key OFFSET (CALIBRATION) again for confirmation.

## Preparing the measurement of the rotation period:

- Plug the timer box into Input A, and connect the light barrier.
- Connect the inputs E and F of the timer box.
- Set the measuring mode s EF with the key NEXT (QUANTITY).

## Adjusting the balancing weight of the centrifugal force apparatus:

- Before the measurements are started, the balancing weight of the centrifugal force apparatus has to be adjusted so that the centrifugal force  $F = 0$  is displayed if no test body is attached.
- If another centrifugal force  $F$  is measured, the balancing weight has to be shifted step by step to the left and to the right along the rotatable arm.

## Apparatus

1 Centrifugal force apparatus S .....	524 068
1 Fork-type light barrier .....	337 46
1 Timer box .....	524 034
1 Multi-core cable, 6-pole, 1.5 m .....	501 16
1 Sensor-CASSY 2.....	524 013
1 CASSY-Display USB.....	524 020USB
1 AC/DC power supply, 0...12 V .....	521 49
1 Connecting leads, 19 A, 100 cm, red/blue, pair .....	501 46
1 Connecting lead 32 A, 25 cm, black .....	501 23
1 Bench clamp .....	301 06
1 Stand base, V-shape, small.....	300 02
1 Stand rod, 25 cm, 12 mm diam.....	300 41

## Carrying out the experiment

- Remove the lock screw, and position the test body 3 ( $m = 0.1$  kg) on the rotatable arm so that the locating screw bites into the outermost bore of the arm ( $r = 0.25$  m).
- Tighten the locating screw.
- Put the lock screw on, and tighten it.
- Select the voltage at the power supply so that a rotation period  $T$  of approximately 0.7 s is reached.
- Wait until the rotation period is constant.
- Read the centrifugal force  $F$  and the rotation period  $T$  from the CASSY-Display.
- Repeat the measurement with other rotation periods.

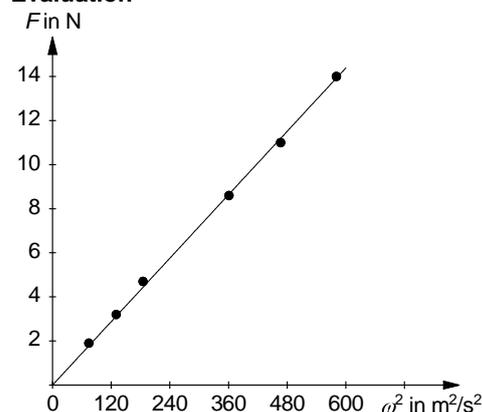
## Measuring example

$m = 0.1$  kg,  $r = 0.25$  m

Rotation period $T$ in s	*angular velocity $\omega$ in m/s	$\omega^2$ in $\text{m}^2/\text{s}^2$	Force $F$ in N
0.73	8.6	73.96	1.9
0.55	11.4	129.96	3.2
0.46	13.6	184.96	4.7
0.33	19.0	361.00	8.6
0.29	21.6	466.56	11.0
0.26	24.1	580.81	14.0

\*The angular velocity is calculated according to  $\omega = 2\pi / T$

## Evaluation



## Motions

*Circular motion and rotation*

## Dependence of centrifugal force on the angular velocity

At a constant distance of a test body from the centre of rotation, the centrifugal force acting on the body is proportional to the square of the angular velocity:  $F \sim \omega^2$ .