Mechanics

Oscillations

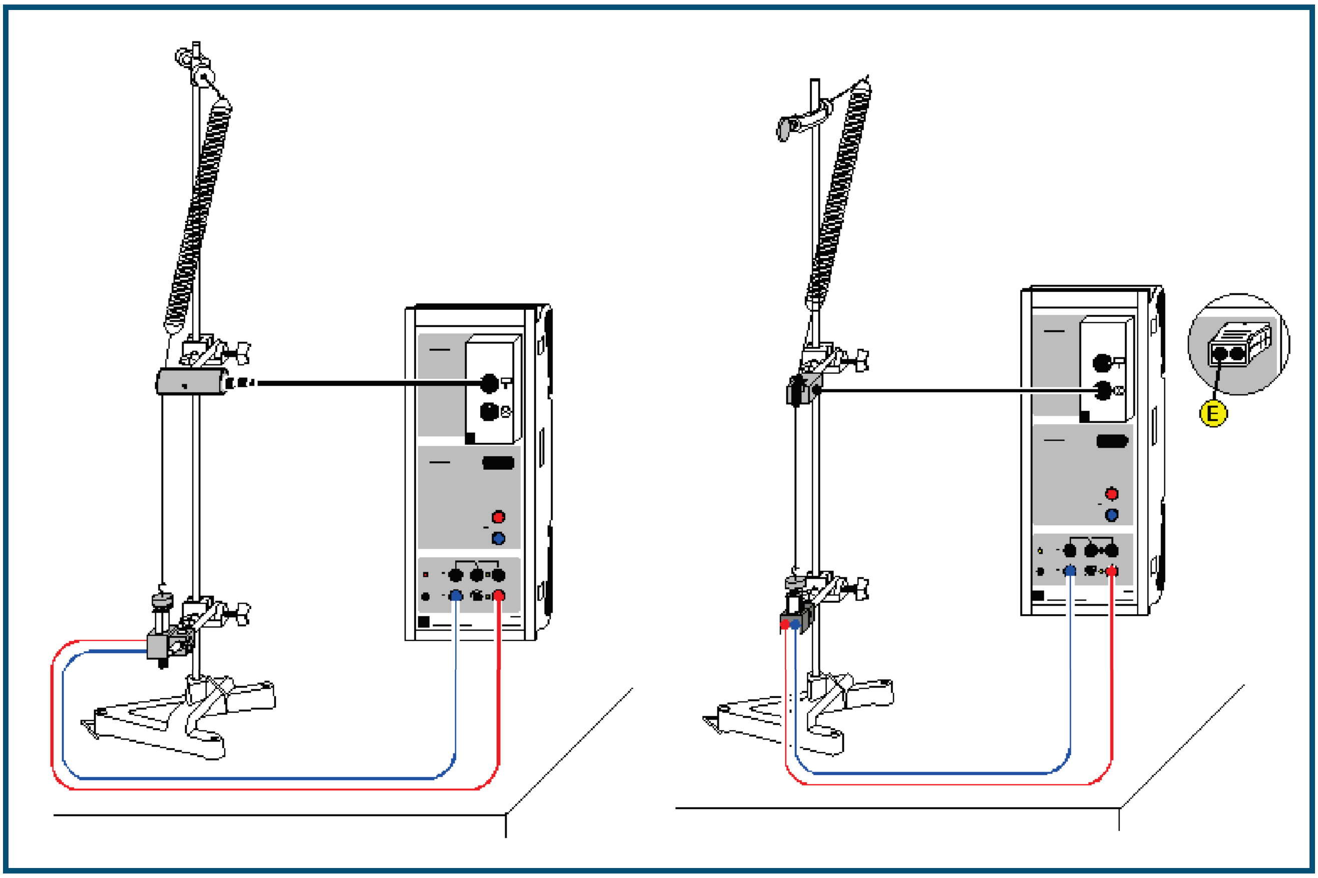
Harmonic oscillations

Oscillations of a spring pendulum - Recording the path, velocity and acceleration with CASSY

Description from CASSY Lab 2

For loading examples and settings, please use the CASSY Lab 2 help.

Harmonic oscillations of a spring pendulum



Experiment description

This experiment records the harmonic oscillations of a spring pendulum as a function of the time t. The evaluation compares the path s, velocity v and acceleration a. These can be displayed either as a function of the time t or as a phase diagram.

Equipment list

1	Sensor-CASSY	524 010 or 524 013
1	CASSY Lab 2	524 220
1	BMW box	524 032
1	Motion sensing element	337 631
	or	
1	Timer S	524 074
1	Combination light barrier	337 462
1	Combination spoked wheel	337 464
1	Multi-core cable, 6-pole	501 16
1	Helical spring, 3 N/m	352 10
1	Set of weights, 50 g	342 61
1	Holding magnet	336 21
1	Stand base, V-shape, 28 cm	300 01
1	Stand rod, 25 cm	300 41
1	Stand rod, 150 cm	300 46
2	Leybold multiclamps	301 01
1	Clamp with hook	301 08
1	Fishing line, 10 m	from 309 48ET2
1	Pair of cables, 100 cm, red and blue	501 46
1	PC with Windows XP/Vista/7	

Experiment setup (see drawing)

Lay the string of the spring pendulum over the deflection pulley of the motion sensing element so that the oscillation of the pendulum is transmitted to the sensor without slip; connect the sensor to the top socket of the BMW box. The holding magnet enables a defined measurement start by holding the pendulum weight in the bottom reversing point of the oscillation before the start of measurement recording.

This experiment can be expanded to investigate air friction (e.g. with a piece of cardboard on the weight) or the effect of a change in the pendulum mass.

Carrying out the experiment

- Load settings
- If necessary, change the time interval in the Measuring Parameters (**Window → Show Measuring Parameters**). A shorter interval enables more measured values and smoother s(t) and v(s) diagram, while a longer interval generates fewer measured values and less scattering in a(t).
- You may need to invert the sign of path measurement (**s** ↔ **-s** in Settings sA1).
- Define the zero point in the equilibrium position of the pendulum (→ **0** ← in Settings sA1)
- Deflect the pendulum approx. 10 cm and hold it there with the holding magnet.
- Start the measurement with and stop it with when the experiment is finished.
- Always check that the path zero point is at the equilibrium position before repeating the experiment.

Evaluation

In addition to the path display, this example also contains an overview display with s(t), v(t) and a(t) and a phase diagram v(s). The various diagrams can be selected by clicking on them.

The phase relations and the damping are easy to see.

Remark

The recorded curve forms depend greatly on the selected time interval. The time interval is necessarily a compromise between a rich sequence of measured values, clearly apparent s(t) minima (shorter interval) and low inaccuracy in the v(t) and a(t) diagram (longer interval).