3B SCIENTIFIC® PHYSICS

...going one step further

Ultrasonic Motion Sensor U11361

Instruction manual

06/09 Hh

1. Safety instructions

When in operation, the ultrasonic motion sensor customarily generates individually audible packets of pulses (bursts) which repeat with variable frequency. When operated in this way the equipment is guaranteed to be safe.

- In the case of a fault (visible damage to the equipment, unusual sounding bursts) the equipment should immediately be turned off.

2. Scope of delivery

1 Ultrasonic motion sensor U11361

1 Stand rod, 120 mm long

1 Stand rod, 60 mm long

1 miniDIN 8-pin connector lead, 1 m long

1 Instruction manual for U11361

3. Description

Sensor box for measuring movements in one dimension e.g. on an air track or in free fall.

For use in conjunction with a 3B NET*log*™ (U11300) unit for making manual measurements or connected to a computer running 3B NET*lab*™ (U11310) for acquisition of measured data.

The sensor is detected automatically by the 3B NET*log*™ unit.

4. Function

The motion sensor utilises a gold-foil ultrasonic transducer and transmits packets consisting of 16 ultrasonic pulses (bursts). The ultrasonic sensor will detect the echo of such signals from a (moving) object ("target") after a minimal acoustic lag of about 1 ms – corresponding to a distance to the object of about 15 cm. The exact distance to the object is calculated from the time between the transmission of a signal and detection of its echo, along with the speed of sound in air, which is temperature dependent. For larger distances between sensor and object, the ultrasonic transducer automatically adapts the repeat frequency so that it is about 40 Hz for short distances and approximately 5 Hz for distances up to 10 m.

5. Technical data

Measuring range:	0.15 m –10 m approx.
Resolution:	< 5 mm
Accuracy:	± 1 %
Sensor type:	Electrostatic 50 kHz - transducer
Angle of sensor wedge opening:	15° @ - 6 dB
Burst repeat frequency:	40 Hz to 5 Hz, automatically adapted according to the distance from the object

5. Operation

- Screw the stand rod into the M6 nut provided.
- Plug the miniDIN cable into the miniDIN socket and connect up the 3B NET*log*™ unit.
- Attach the motion sensor mechanically to the experiment set-up, e.g. in front of an air track, under a free-falling body or in the path of a vibrating pendulum bob.
- Turn on the 3B NET*log*™ unit and wait for it to detect the sensor.
- Carry out measurements and evaluate them.

6. Applications

Position, speed and acceleration of moving objects.

Movements in the range of the sensor.

Detecting simple harmonic motion of a weight on a spring.

Measuring the period of an oscillating body.

Objects moving up and down.

The bouncing of a ball.

7. Sample experiment

Uniform acceleration followed by change of direction

Required equipment:

1 3B NET*log*™ unit	U11300
1 3B NET*lab*™ program	U11310
1 Ultrasonic motion sensor	U11361
1 Universal clamp	U13255
1 Air track, 1.6 m	U40405
1 Glider 450 g, blue	U40422
1 Air-flow generator	U15425
1 Conical reflector	U40462

- Set up the experiment as shown in Fig. 1. Also take note of the instructions for the air track.
- Attach the motion sensor using a universal clamp to the rubber-band launcher on the air-inlet side of the air track, see detailed photograph, Fig. 2.
- Attach the stopper with the pulley to the other end of the air track. Make sure that the stopper's spring buffer is facing along the track.
- Lower the track by adjusting the height of its feet so that the rider moves under its own weight towards the right-hand end of the track.
- Connect the sensor by means of its miniDIN connector lead to analog input A or B on the 3B NET*log*™ unit.
- Wait for the 3B NET*log*™ unit to detect the sensor.
- Attach a conical reflector U40462 to the glider U40422 and turn on the air track.
- Start measuring, starting with the rider moving away from the air inlet end of the track.
- Open the experiment template for "speed measurement on an air track" in 3B NET*lab*™, which includes all the necessary settings for evaluating the measurements.
- Carry out the experiment and evaluate the results. See Fig. 3.

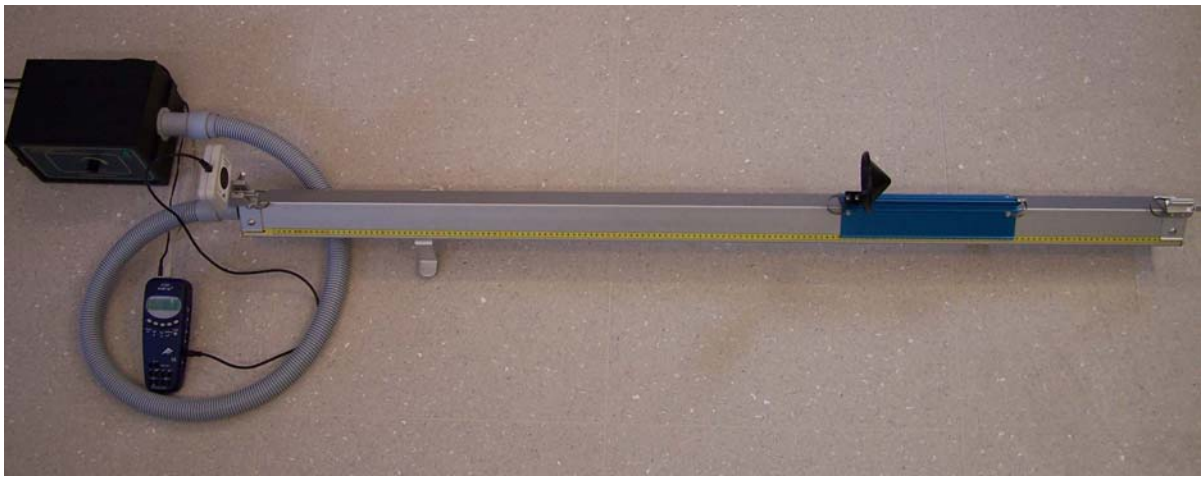

Fig. 1: Experiment set-up for measuring speed on an air track

Fig. 2: Detailed view of how the sensor box is attached to the air track

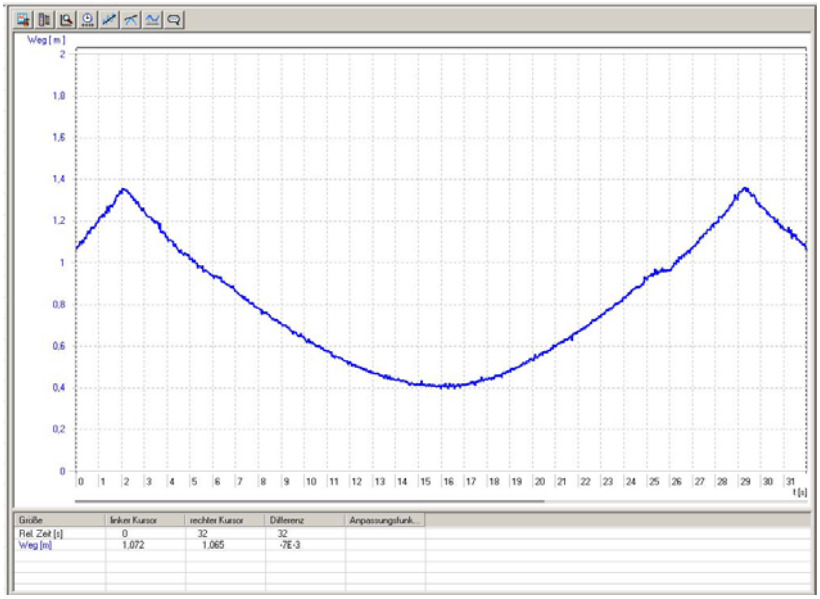

Fig. 3: Recording of a curve showing part of the motion of a glider accelerating uniformly, then changing direction