

Kundt's Tube E 1017339

Instruction manual

09/16 ALF



1. Notes

The tube consists of fragile plastic and there is a risk of it getting broken.

- Avoid excessive stress, such as collisions or impacts on mechanical components.
- Never allow the tube to get hotter than 50°C.
- Use speakers with a maximum voltage of 6 Vrms. Do not apply any DC voltage across the speaker.
- Only the specially designed pulse box K (1017341) should be used to supply the electrical pulses.

2. Description

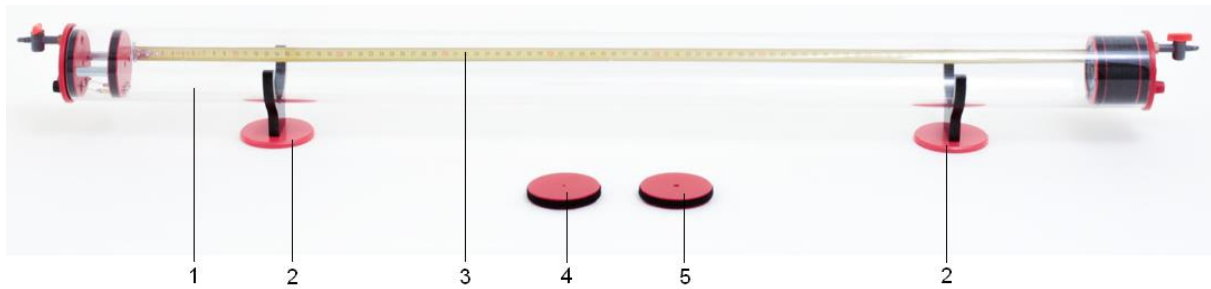
Kundt's tube is used in conjunction with additional accessories for the qualitative and quantitative investigation of sound waves in air or other gases, using the tube either closed or open. In particular, it is used to measure the wavelength and the speed

of sound. It also allows the properties of standing waves to be investigated as a function of temperature.

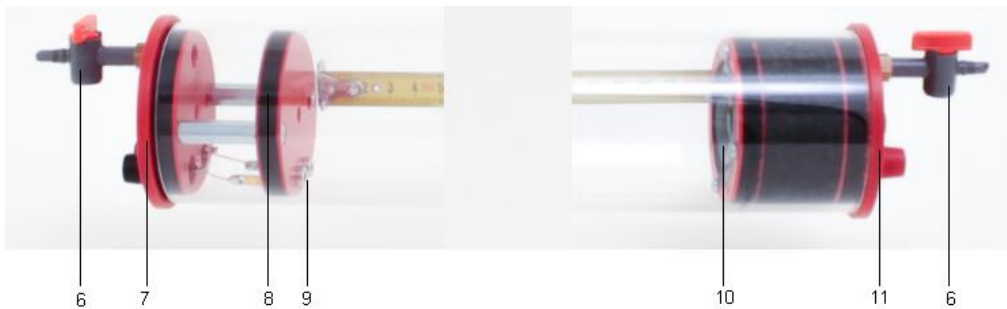
The Kundt's tube equipment set consists of a transparent acrylic tube with a movable scale and two removable end caps with built-in hose nozzles for filling the tube with various gases. The column of air is excited by means of a built-in speaker, which can be driven using a function generator or pulse box K (1017341).

More accurate measurements can be made using the capillary disc in front of the speaker, because standing waves remain largely unaffected by the "soft" speaker membrane. Measurements of the time it takes sound to propagate (with the help of the pulse box) are carried out without the capillary disc.

In order to vary the length of the column of air, the sensor disc can be screwed to the end of the long microphone probe.



- | | |
|-----------------|------------------|
| 1 Sound tube | 4 Capillary disc |
| 2 Feet | 5 Sensor disc |
| 3 Movable scale | |



- | | |
|---|--|
| 6 Hose connector with stop cock | 9 Pair of sockets for connecting heating rod K |
| 7 End cap with sockets for connecting heating rod | 10 Speaker |
| 8 Guide for microphone probes | 11 End cap with sockets for connecting speaker |

3. Equipment included

- 1 Sound tube
- 1 End cap with two holes and a guide for microphone probes, 4-mm safety sockets, hose nozzle and sockets for connecting heating rod
- 1 End cap with speaker, hose nozzle and 4-mm safety sockets
- 1 Movable scale
- 2 Feet
- 1 Capillary disc
- 1 Sensor disc
- 1 Instruction manual

5. Technical data

- Sound tube**
- | | |
|------------------|------------|
| Length: | 1000 mm |
| Diameter: | 70 mm |
| Scale: | 950 mm |
| Hose connectors: | 5 mm diam. |
- Speaker**
- | | |
|------------------|---------------------|
| Frequency range: | 20 to 5000 Hz |
| Power output: | 2 W |
| Impedance: | 50 Ω |
| Connectors: | 4-mm safety sockets |
| Weight: | 1.25 kg approx. |

4. Accessories

Microphone probe, long	1017342
Microphone probe, short	4008308
Pulse box K	1017341
Heating rod K	1017340
Microphone box (230 V, 50/60 Hz) or	1014520
Microphone box (115 V, 50/60 Hz)	1014521

6. Operation

- Insert the caps into the ends of the tube, applying some glycerine or soap to the sealing gaskets if necessary to make insertion easier.
- Set up the sound tube on the supplied feet.
- Attach the movable scale to the mountings on the feet.
- Connect a function generator or pulse box to

the pair of sockets for driving the speaker. Take note of the maximum power rating for the speaker (max. 6 Vrms)

- Insert the microphone probe needed for the experiment in question through the holes in the guide.
- When experimenting with so-called technical gases, fill the tube via the hose nozzles. The setting of the cocks needs to be in accordance with the density of gas.
- In order to heat the column of air, insert heating rod K (1017340) into the appropriate sockets in the cap and connect it to a DC power supply. The temperature must never exceed 50°C.

7. Example experiments

7.1 Determination of speed of sound by measuring the time it takes for a sound pulse to cover a given distance in air and in other gases

Additionally required:

1 Pulse box K	1017341
1 Microphone probe, long	1017342
1 Microphone probe, short	4008308
1 Microphone box (230 V)	1014520
or	
1 Microphone box (115 V)	1014521
1 Microsecond counter (230 V)	1017333
or	
1 Microsecond counter (115 V)	1017334
2 HF patch cords, BNC/4-mm plugs	1002748
1 Pair of safety experiment leads	1002849

A variety of technical gases, if required

- Place the microphone probes in the Kundt's tube and set up the apparatus. (see Fig. 1)
- Connect the long microphone probe to the Channel A input of the microphone box and connect the short one to the input for Channel B.
- Use a BNC/4-mm adapter cable to connect the output of Channel A to the Start input of the microsecond counter (plug red 4-mm plug into green socket, black 4-mm plug into black ground socket).
- Connect the output of Channel B to the Stop input of the microsecond counter (plug red 4-mm plug into red socket, black 4-mm plug into black ground socket from the side).
- Connect the pulse box to the speaker.

- Set both outputs to trigger mode and set the gain for both channels to a medium value.
- Connect the microsecond counter and microphone box to their power supplies and plug them into the mains.
- Trigger a click pulse from the pulse box and read off from the counter the time it takes for the sound to propagate from the long microphone probe to the short one.

Use the distance between the two microphones and the time measured to calculate the speed of sound in the tube at room temperature.

7.2 Determine the speed of sound by measuring the time it takes for a sound pulse to cover a given distance as a function of temperature

Additionally required:

1 Pulse box K	1017341
1 Microphone probe, long	1017342
1 Microphone probe, short	4008308
1 Microphone box (230 V)	1014520
or	
1 Microphone box (115 V)	1014521
1 Microsecond counter (230 V)	1017333
or	
1 Microsecond counter (115 V)	1017334
1 Heating rod K	1017340
1 DC power supply 20 V, 5 A (230 V)	1003312
or	
1 DC power supply 20 V, 5 A (115 V)	1003311
1 Digital Quick-Response pocket thermometer	1002803
1 K-Type NiCr-Ni Immersion Sensor	1002804
2 HF patch cords, BNC/4-mm plugs	1002748
2 Pairs of safety experiment leads	1002849

7.3 Quantitative investigations of standing waves in closed and open tubes – Determination of the speed of sound from wavelength and frequency

Additionally required:

1 Microphone probe, long	1017342
1 Microphone box (230 V)	1014520
or	
1 Microphone box (115 V)	1014521
1 Function generator FG100 (230 V)	1009957
or	
1 Function generator FG 100 (115 V)	1009956
1 Multimeter ESCOLA 2	1006811
1 Pair of safety experiment leads	1002849
1 HF patch cords, BNC/4-mm plugs	1002748

7.4 Frequency analysis of standing waves in a closed tube

Additionally required:

1 Microphone probe, long	1017342
1 Microphone box (230 V)	1014520
or	
1 Microphone box (115 V)	1014521
1 Function generator FG 100 (230 V)	1009957
or	
1 Function generator FG 100 (115 V)	1009956
1 USB oscilloscope 2x50 MHz	1017264
1 HF-Patch cord	1002746
1 HF patch cords, BNC/4-mm plugs	1002748
1 Pair of safety experiment leads	1002849

8. Storage, cleaning and disposal

- Keep the equipment in a clean, dry and dust-free place.
- Do not clean the unit with volatile solvents or abrasive cleaners.
- Use a soft, damp cloth to clean it.
- 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. Local regulations for the disposal of electrical equipment will apply.

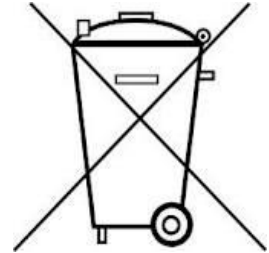


Fig. 1 Determination of speed of sound by measuring the time it takes for a sound pulse to cover a given distance

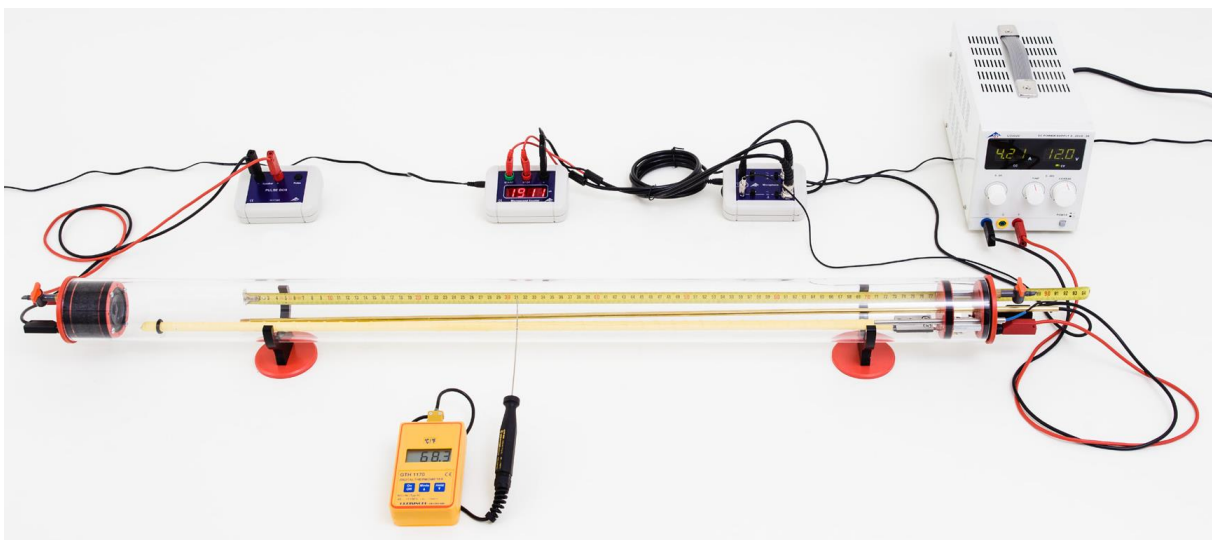


Fig.2 Determine the speed of sound by measuring the time it takes for a sound pulse to cover a given distance as a function of temperature

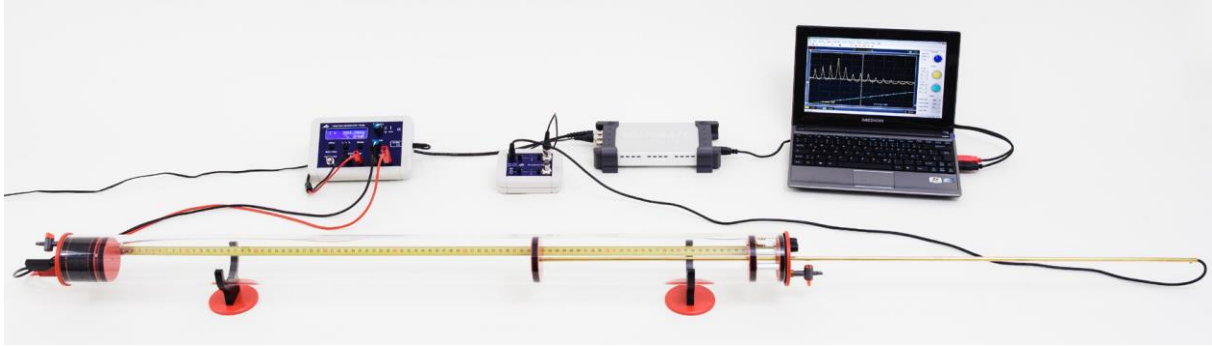


Fig. 3 Frequency analysis of standing waves in a closed tube

