Lehr– und Didaktiksysteme
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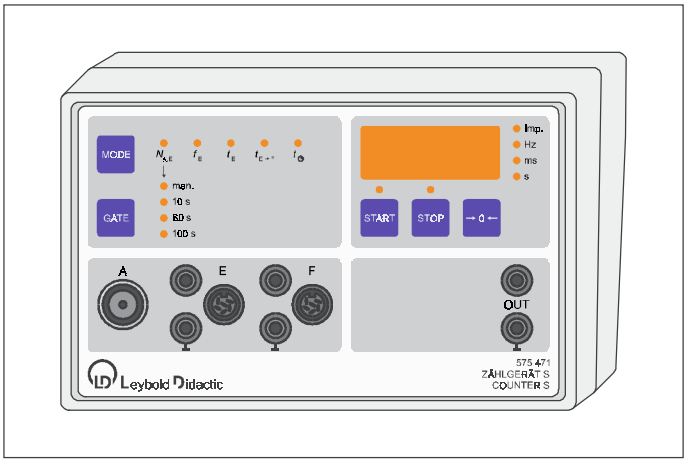


Instruction sheet 575 471

Counter S (575 471)

1 Description

The counter S is a measuring instrument for counting counter tube pulses, pulse rates or other electrical signals as well as for measuring time and frequency. It is equipped with a 5-digit digital display, a counter tube input with internal voltage supply (500 V–), a built-in loudspeaker for acoustical pulse indication, and two pairs of 4-mm sockets and two light barrier inputs (6-pole) for frequency and time measurements.

2 Scope of supply

1 counter S

1 plug-in unit 230 V / 12 V (562 791)
or
1 plug-in unit 115 V / 12 V (562 792)

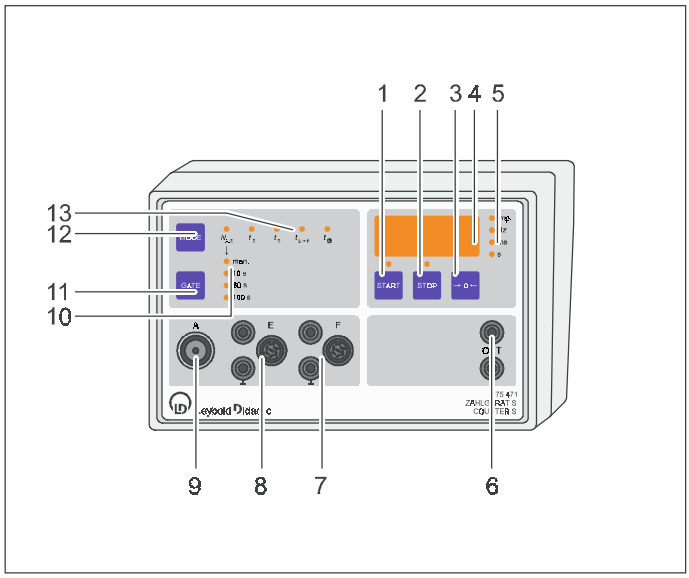
Safety notes

- Only low-voltage pulses may be applied to the inputs E and F!
- Do not apply voltage to the output OUT!

3 Technical data

Display of measured values:	5-digit
Height of digits:	10 mm
Time base:	quartz control
Gate times for counter tube:	fixed 10 s, 60 s, 100 s; adjustable up to 9999 s
Connections:	
Input A:	coaxial socket, counter tube voltage 500 V (at the middle conductor of the socket):
Inputs E, F:	DC coupling, pulses up to 30 V, pair of 4-mm sockets, 6-pole DIN socket
Output:	TTL compatible, pair of 4-mm sockets
Voltage supply:	hollow socket for plug-in unit, on the back of the housing
Measuring ranges:	
Events:	0 ... 99999 pulses
Frequency:	0 ... 99999 Hz,
Time:	0 ... 99.999 ms, 0 ... 99999 s
General data:	
Dimensions:	20.7 cm × 13 cm × 4.5 cm
Weight:	0.4 kg

4 Components



1 Pushbutton START
2 Pushbutton STOP
3 Pushbutton → 0 ←
4 Display of measured value
5 Display of unit
6 Output OUT
7 Input F
8 Input E
9 Input A
10 Display of gate time
11 Pushbutton GATE
12 Pushbutton MODE
13 Display of operation mode

Pushbutton MODE:

Setting of the operation mode $N_{A,E}$, f_E, t_E, $t_{E\to F}$ or $t_{\circlearrowleft}$

$N_{A,E}$: Counting of pulses at the inputs A and E

f_E: Frequency measurement at the input E

t_E: Time measurement at the input E

$t_{E\to F}$: Measurement of the time delay between inputs E and F

$t_{\circlearrowleft}$ Manual time measurement (stop clock)

Pushbutton GATE:

Gate time selection for pulse counting, fixed values of 10 s, 60 s and 100 s, or manual adjustment.

By pressing GATE + MODE, gate times are freely adjustable (MODE upwards, GATE downwards)

Pushbutton START:

Start of a measurement (apart from frequency measurement, all measurements have to be started manually)

Pushbutton STOP:

(Premature) stop of a measurement

Pushbutton → 0 ←:

Reset display

Input A:

Coaxial socket with internal voltage supply (500 V at the middle conductor) for end-window counters (e.g. 559 01)

Inputs E, F:

Pair of 4-mm sockets, lower socket grounded, pulse input for pulses up to 30 V.

6-pole DIN socket, connection of light barriers (337 46 or 337 462)

Output OUT

Pulse output, TTL, lower socket grounded

5 Use

5.1 Pulse counting (operation mode $N_{A,E}$):

Either (cf. 6.2.1-3)

- Connect a function generator (e. g. 522 62), multi-purpose microphone (586 26) or another signal source to the input E (pair of sockets) paying attention to the polarity.

or (cf. 6.2.4)

- Connect the forked light barrier (337 46) or the combination light barrier (337 462) to the input E (6-pole socket).

or (cf. 6.1.1)

- Connect the end-window counter (e.g. 559 01) to the input A (coaxial socket).

- Select the operation mode $N_{A,E}$ with the button MODE.

  The current operation mode is indicated by LEDs.

Either

- Select a fixed gate time with the button GATE.

or, in order to set a freely selected gate time,

- Press the button GATE and before releasing it the button MODE; release both buttons, and increase the displayed gate time with GATE, or decrease it with MODE.

  The default value is 0 s (no gate time).

- Start pulse counting with START.

  When the gate time is over, the measurement is stopped automatically. By pressing STOP, the measurement can be stopped manually.

  While pulses from the end-window counter are counted, an acoustical signal is to be heard for every pulse from the counter.

5.2 Frequency measurement (operation mode f_E):

Either (cf. 6.2.1-3)

- Connect a function generator (e. g. 522 62), multi-purpose microphone (586 26) or another signal source to the input E (pair of sockets) paying attention to the polarity.

or (cf. 6.2.4)

- Connect the forked light barrier (337 46) or the combination light barrier (337 462) to the input E (6-pole socket).

- Select the operation mode f_E with the button MODE.

  The current operation mode is indicated by LEDs.

  The gate time has a constant value of 1 s, and the frequency measurement starts automatically. It can be stopped manually by pressing the button STOP.

5.3 Time measurement (operation mode t_E):

(cf. 6.3.1):

- Connect the forked light barrier (337 46) or the combination light barrier (337 462) to the input E and/or F (6-pole socket).

  The signal source must not bounce (no switches or the like) as the time for each pair of edges (dark period or light period) is recorded.

- Select the operation mode t_E with the button MODE.

  The current operation mode is indicated by LEDs.

- Start the time measurement with the button START.
- If desired, stop the time measurement manually with the button STOP.

5.4 Measurement of the time delay (operation mode $t_{E\rightarrow F}$):

Either (cf. 6.4.1-2)

- Connect two forked light barriers (337 46) or combination light barriers (337 462) to the inputs E and F (6-pole sockets).

or (cf. 6.4.3-4)

- Connect a switch, multi-purpose microphone (586 26) etc. to the inputs E and F (pairs of sockets) paying attention to the polarity.

- Select the operation mode $t_{E\rightarrow F}$ with the button MODE.

  The current operation mode is indicated by LEDs.

- Start the measurement of the time delay with the button START.

  The time measurement is started by the first pulse edge at the input E and stopped by the first pulse edge at the input F. All other pulse edges are disregarded. In contrast to time measurement in the operation mode t_E, therefore bouncing signal sources (e.g. for measuring the propagation time of sound) can also be used.

5.5 Manual stop clock (operation mode $t_⏱$):

- Select the operation mode $t_⏱$ with the button MODE.

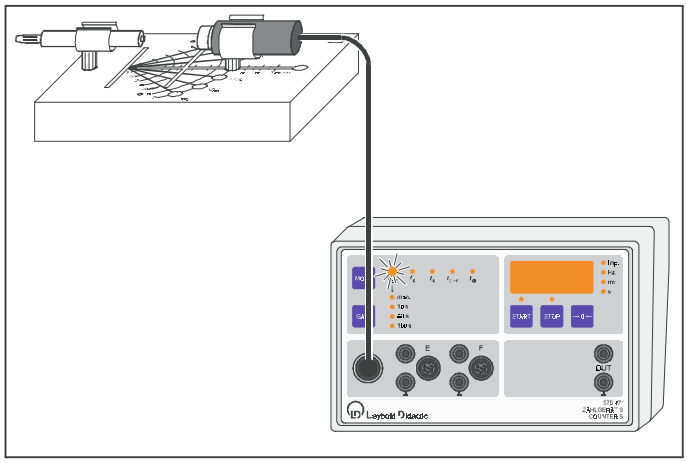
  The current operation mode is indicated by LEDs.

- Start the time measurement with the button START and stop it with the button STOP.
- Before making a new time measurement, reset the display to zero with the pushbutton → 0 ←.

6 Experiment examples

6.1 Pulse counting

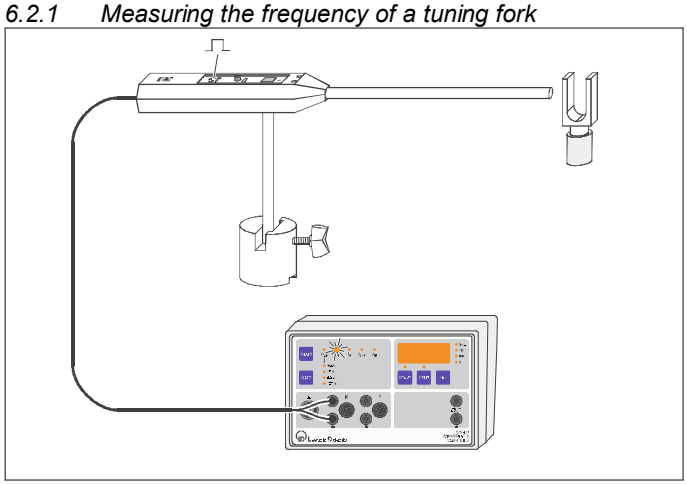
6.1.1 Counting pulses from a counter tube



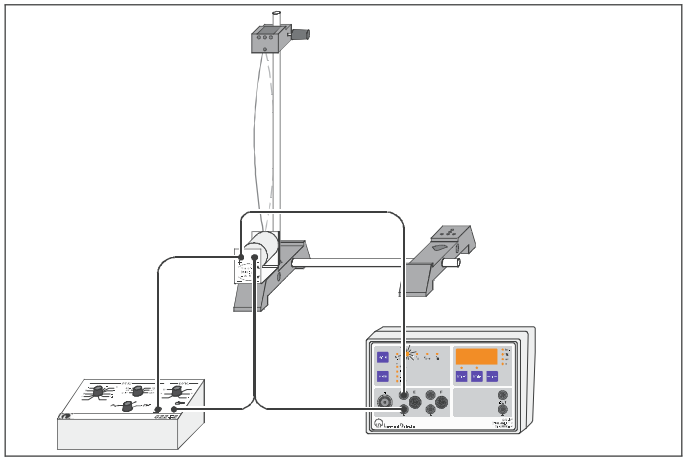
The pulses are triggered by radioactive radiation in an end-window counter. An arbitrary gate time can be selected.

6.2 Fequency measurement

6.2.1 Measuring the frequency of a tuning fork

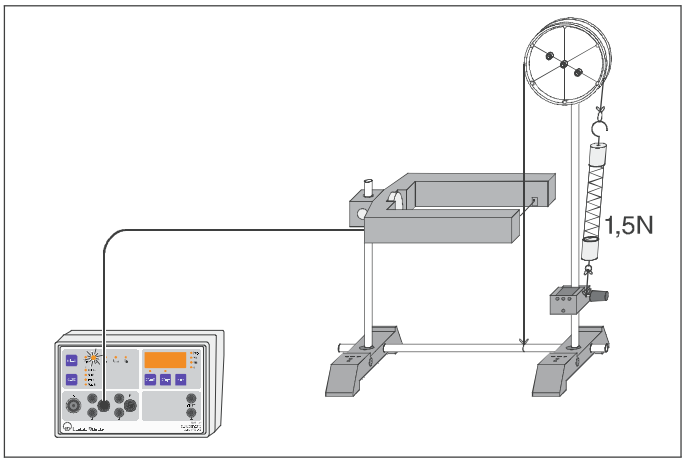


6.2.2 Determining the frequencies exciting standing waves



Generating standing waves on a rubber string (or on a helical spring) with a motor and a tacho-generator, which is driven by the function generator.

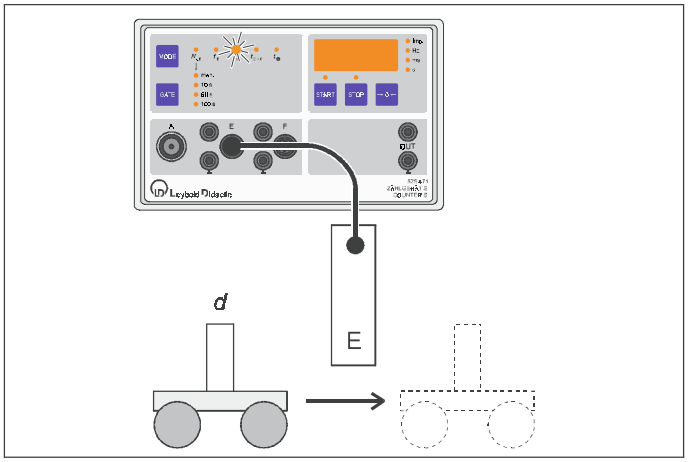
6.2.3 Determining the natural frequencies f of a rubber string



Counting the number $n = 2\ f$ of light barrier interruptions per second caused by the oscillating string.

6.3 Time measurement

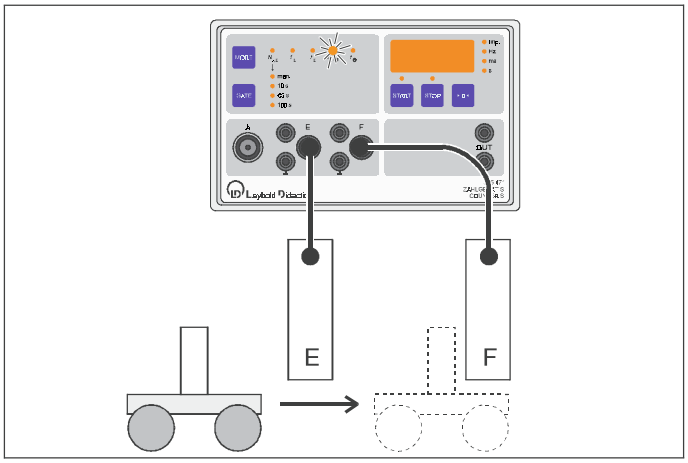
6.3.1 Measuring time and determining velocities



Measuring the interruption time of the light barrier E and calculating the average velocity during the interruption from the width of the interrupter flag according to v=d/t.

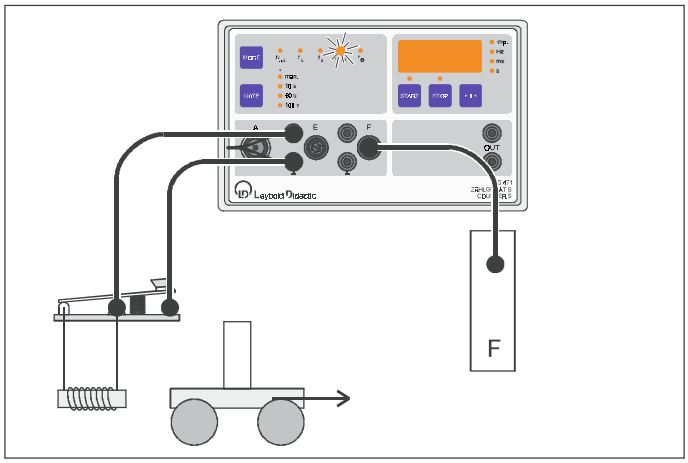
6.4 Measuring time delay

6.4.1 Measuring time delay with two light barriers



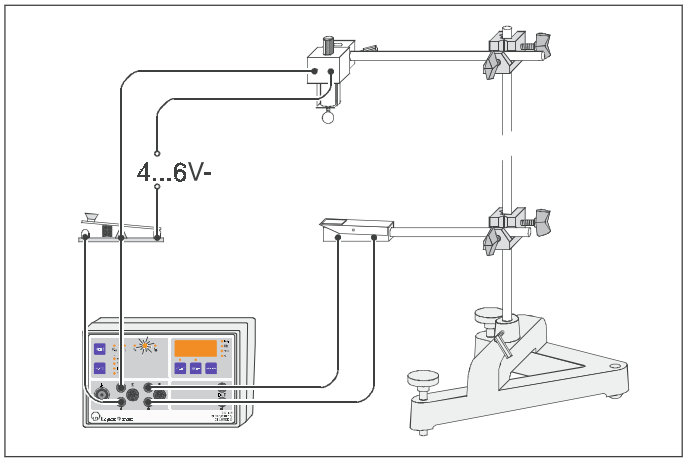
Measuring the time interval beween the interruptions of the light barrier E and the light barrier F.

6.4.2 Measuring time delay with a holding magnet and a light barrier



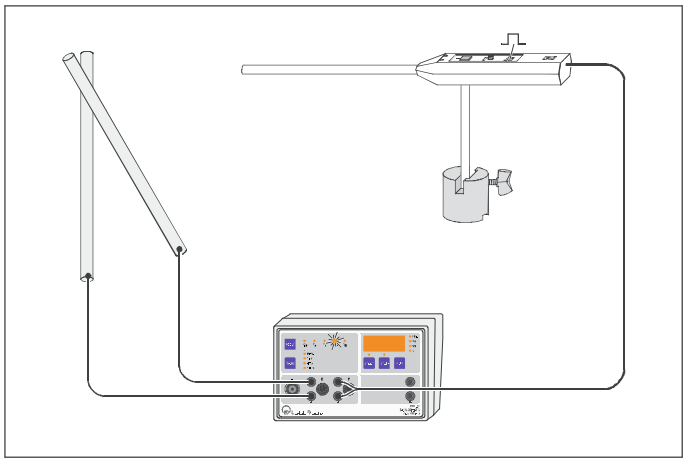
Measuring the time from the start of the motion (interruption of a circuit involving the holding magnet) until the trolley reaches the light barrier.

6.4.3 Measuring the time delay in free fall



Measuring the time from the start of the motion (interruption of a circuit involving the holding magnet) until a contact is made (the experiment body reaches the contact plate).

6.4.4 Measuring the sound propagation time



Measuring the propagation time between the sound generation (by slamming together the two stand rods) and the sound detection by the multi-purpose microphone.