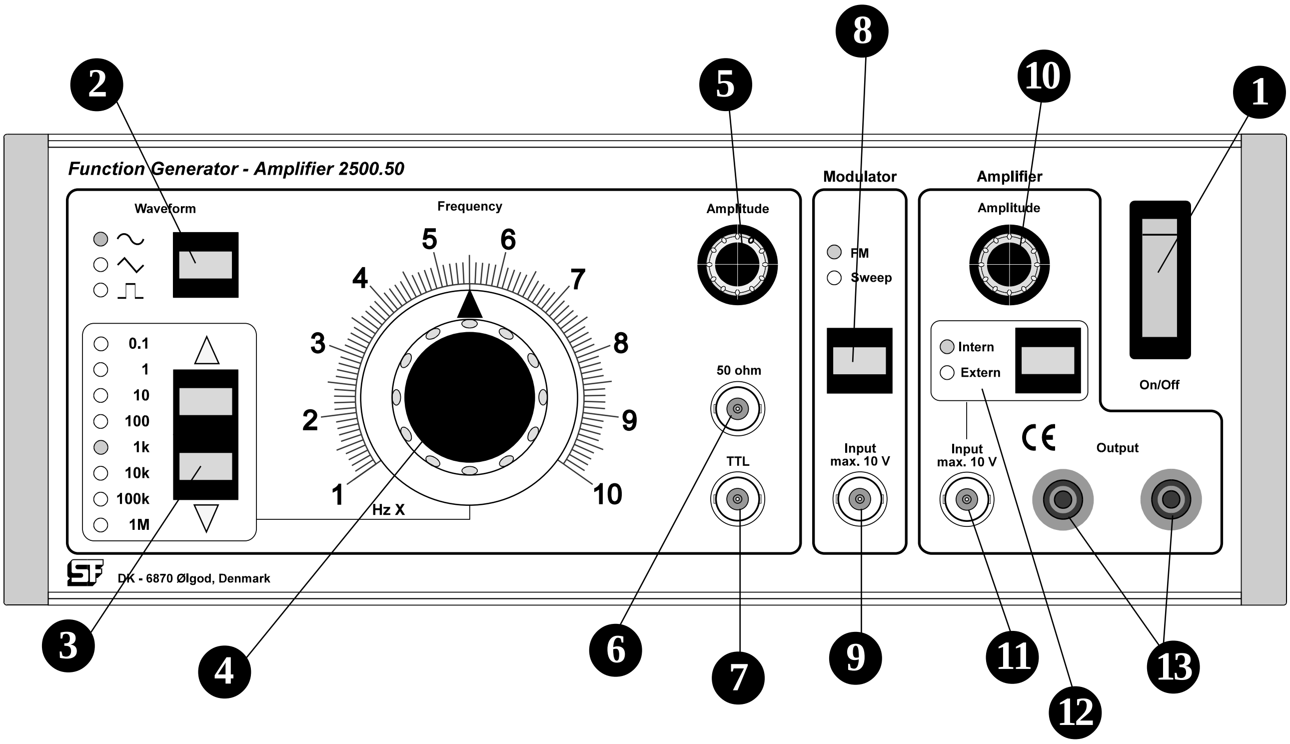
# Users manual for Tone Generator no. 2500.50

15.08.97 Ae 2500.50




**The apparatus is divided into following three sections:**

Function generator, modulator and amplifier.

The function generator can be utilized for producing an AC voltage with a variable frequency. The desired frequency can manually be choosen by the selector buttons (Arrow up/Arrow down) and fine adjusted by the frequency adjust button.

The built-in modulator secures that the function generator´s frequency can be controlled by an external AC or DC voltage. Through this e.g. a frequency modulated signal is obtained, which e.g. is useable to demonstrate the nature of FM radio waves. Containing both loudspeakers and vibrators, which demand a relatively high power output, the generator is equipped with a seperate power amplifier. Placing the amplifier separately serves to the non-amplified signal can be picked out before the power amplifier, avoiding distortion, which any amplifier may cause. Additionally, the amplifier can be used completely independent from the function generator as a separate power amplifier.

**Operation levers:**

Pos.1: Power switch with light indicator, (LED).

**Function generator**

Pos.2: Adjusting button to set the wave form of the output signal. Switching on the generator the wave form of the sine wave will then automatically be chosen. Activating this button the option will then switch into a triangle signal. Any activations of this button will change the wave form. A LED will light up to show the choosen Wave form.

Pos. 3: Decade selector. Switching on the generator the multiplication factor is autmatically set to 100. Pressing one of the buttons, "Arrow up" or "Arrow down" then the frequency range will change. A LED will light up to show the choosen frequency range.

Pos. 4: Frequency selector. This function, however, is inactive when the selector Pos. 8 is set in the "Sweep" position.

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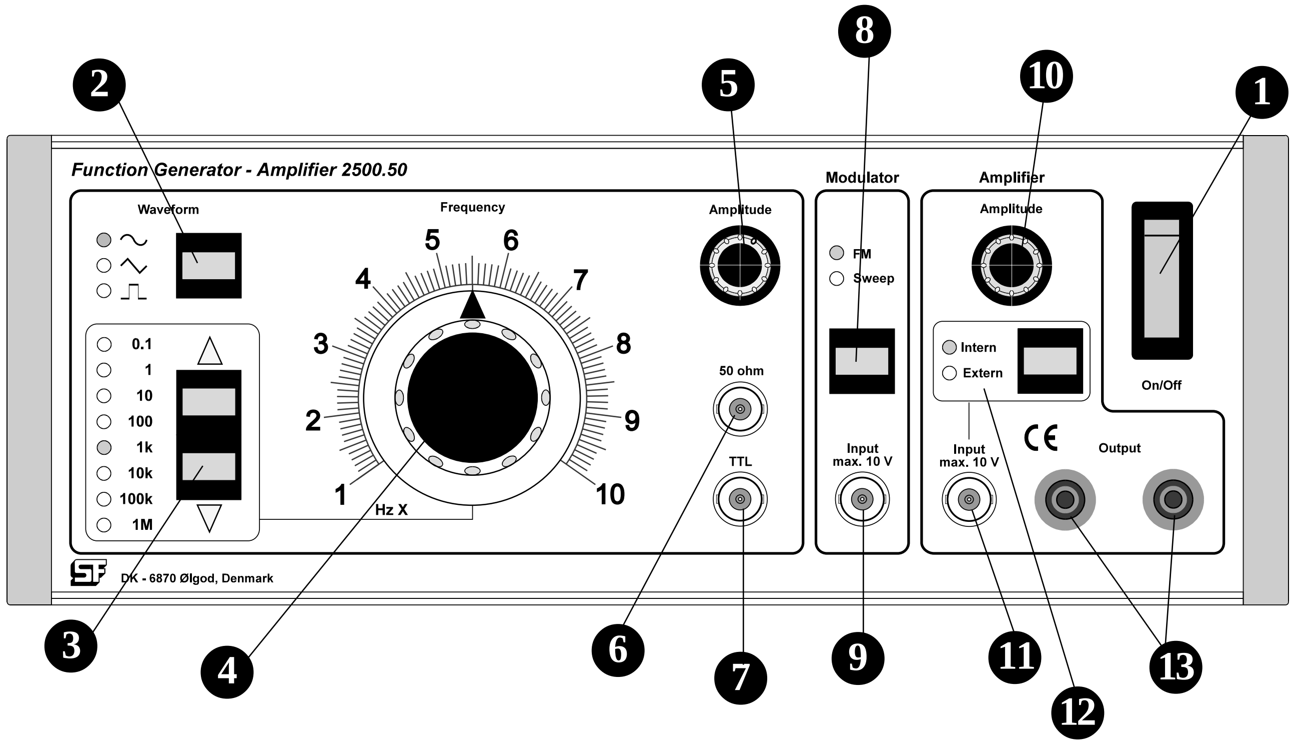



Pos. 5: Control button for adjusting the output signals´amplitude.

Pos. 6: BNC terminal for output signals. Short circuit protected.

Pos. 7: BNC terminal for output signals, (TTL-level). Short circuit protected.

**Modulator:**

Pos. 8: Selector for choise of the input signal.
A LED will light up to show the choosen.

Pos. 9: BNC terminal for input signals.

**Amplifier**

Pos. 10: Control button for setting the amplified signals´ amplitude.

Pos. 11: BNC terminal for input on the power amplifier.

Pos. 12: Selector for internal or external signal application to the amplifier.
A LED will light up to show the choosen.

Pos. 13: Banana terminals for output from the power amplifier. The output is short circuit protected.

**Operation:**

Setting the function generator without modulation: The selector Pos. 8 must be in position "FM". The output frequency is set via Pos. 3 "Hx x" and Pos. 4 "Frequency". The output signal wave form is choosen with Pos. 2 "Waveform" and the amplitude is set with Pos. 5 "Amplitude". The desired output signal can now be drawn from the terminals Pos. 6 "50 OHM" or Pos. 7 "TTL".

**Amplification of the signal of the function generator:**

Set the lever Pos. 12 into position "Intern". Adjust the amplitude of the internal signal by pressing the lever Pos. 5 "Amplitude" and with Pos. 10 Amplitude the size of the output signal from the power amplifier is set. The output signals is drawn from the terminals Pos. 13.

**Amplification of an internal signal:**

The signal is led through the terminal Pos. 11. The amplitude of the output signal is adjusted by lever Pos. 10. The output signal is drawn from the terminal Pos. 13.

**FM modulation:**

The modulation signal is led into the terminal Pos. 9. The selector Pos. 8 is set into position "FM". In this position the modulation part only registrates variations. A power voltage of 1 volt results in a frequency increase of approx. 10%, 2 volt results in a frequency increase of approx. 20% etc. up to 5 volt giving a frequency increase of 50%. Activating negative voltage, (same principle as for possitive voltage), the frequency simply will be reduced, i.e. providing 1 volt results in a frequency reduction of approx. 10 %.

**Sweep modulation:**

The selector Pos. 8 i set into position "Sweep". The frequency selector Pos. 4 is now inactive. The modulation signal is led into the terminal Pos. 9. The output signal on terminal Pos. 6 or terminal Pos. 7 can be directly drawn out or led through the amplifier and drawn out on terminal Pos. 13.
The table shown below shows the approximate output frequencies as function of the input voltage and position of the decade selector.

| Power voltage | Pos. 3 decade selector | Output frequency |
|---|---|---|
| 0 V | 1 | 0 Hz |
| 0 V | 10 | 0 Hz |
| 0 V | 100 | 0 Hz |
| 0 V | 1 K | 0 Hz |
| 0 V | 10 K | 0 Hz |
| 0 V | 100 K | 0 Hz |
| 0 V | 1 M | 0 Hz |
| 1 V | 1 | 2 Hz |
| 1 V | 10 | 20 Hz |
| 1 V | 100 | 200 Hz |
| 1 V | 1 K | 2 KHz |
| 1 V | 10 K | 20 KHz |
| 1 V | 100 K | 20 KHz |
| 1 V | 1 M | 2 MHz |
| 5 V | 1 | 10 Hz |
| 5 V | 10 | 100 Hz |
| 5 V | 100 | 1 KHz |
| 5 V | 1 K | 10 KHz |
| 5 V | 10 K | 100 KHz |
| 5 V | 100 K | 1 MHz |
| 5 V | 1 M | 10 MHz |

**Tecnical specification:**

Power voltage:
230 volt AC +6/-10% - 50/60 Hz.

Power consumption:
5 W at idling. 80 W at full power.

Fuse:
500 mAT

Dimensions:
297 x 225 x 118 mm.

Weight:
4,0 kg. excl. power chord.

**SIGNAL:**

Frequency range: 0,1 to 10 MHz i
8 divisions.

Output signals:
sine, triangle and rectangular.

Output voltage, all wave forms:
5,5 volt $_{pp}$, symmetrical at 0 volt.

Output impedance, 50 OHM and TTL:
50 OHM.

Distortion, sine:
less than 1,3%.

**MODULATION**

Input impedance: 47 OHM.

Input voltage, FM:
± 0 to 5 volt.

Input voltage, sweep:
± 10 volt $_{pp}$

Sweep:
DC to 10 KHz

**AMPLIFIER:**

Frequency range:
DC to 50 kHz at - 3 dB.

Output power:
10 watt RMS at 4 OHM.

Output level:
± 10 volt $_{pp}$

Signal/noice level:
> 92 dB

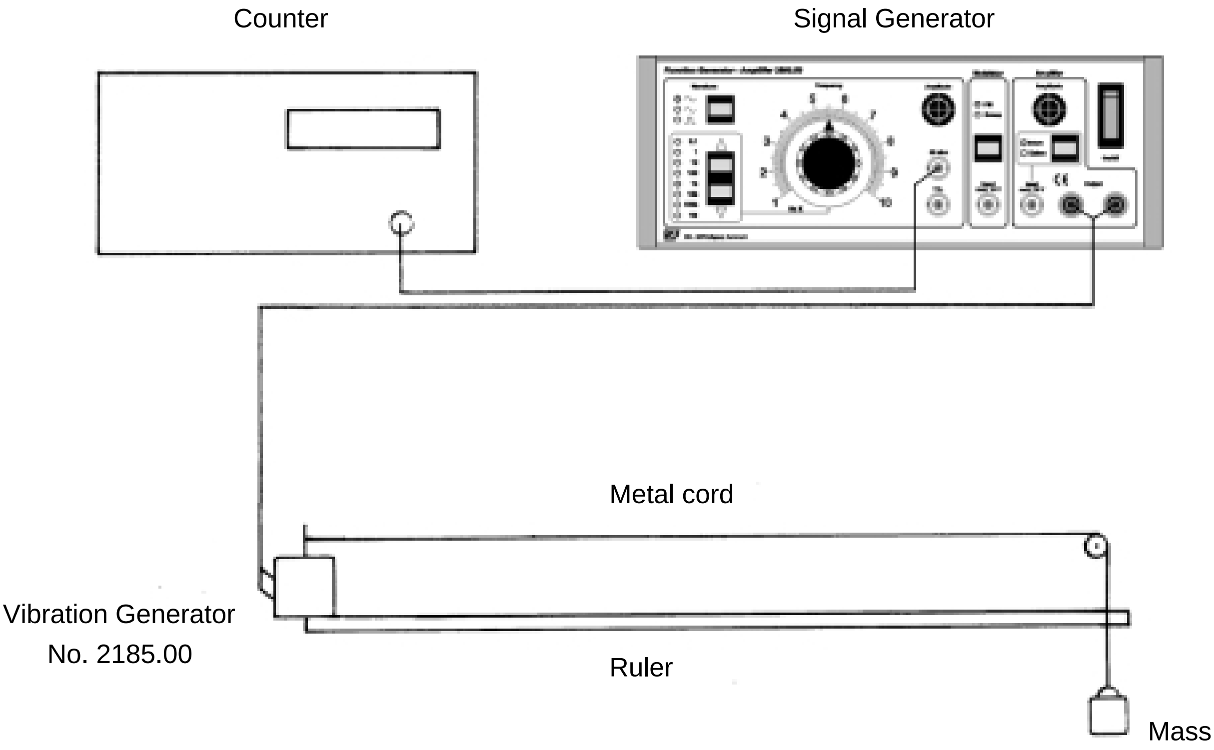
Input impedance:
10 K ohm

Amplication factor, max.:
10 gg.

**Experiment notes:**

**The velocity of propagation:**

Adjust the frequency selector (pos. 3) to a position resulting in standing waves.
Read the frequency on the scale and measure the wavelength with the ruler.
The velocity of progagation may be calculated using the following equation:
Velocity of progagation = wavelength x frequency.

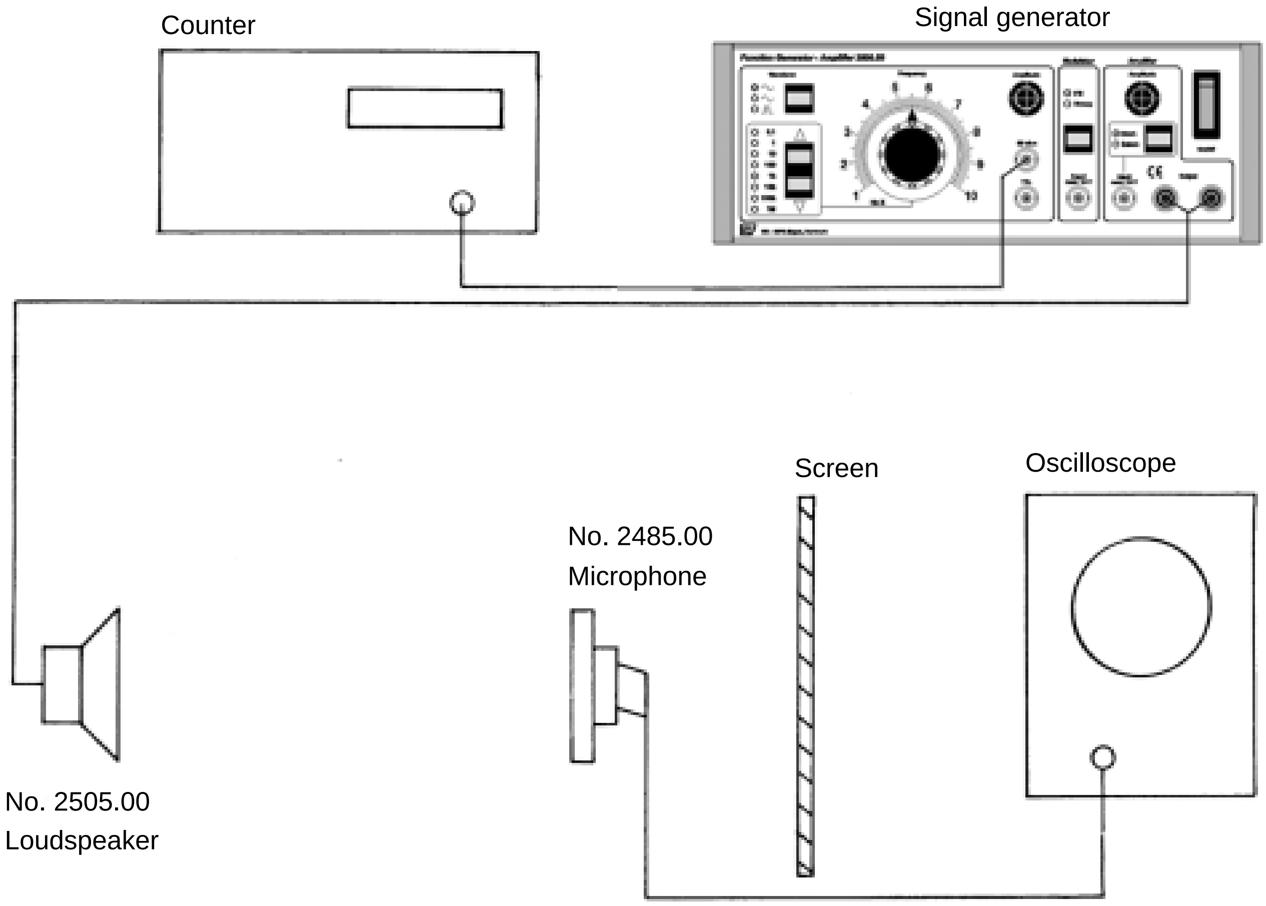



By repeating the experiment several times with different frequencies, it can be demonstrated that the velocity of propagation is independant og the frequency.

Try:
a) Using cords of different materials.
b) Using cords of different masses (cross dimensions).
c) Using a tighter cord (increasing the mass).

**The interference of sound waves:**

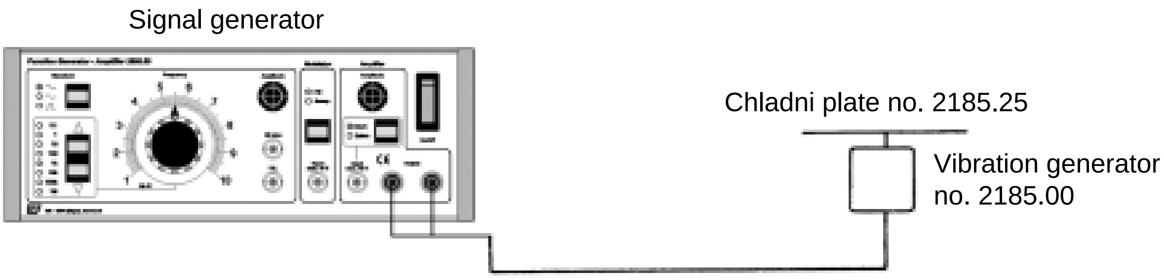
Adjust the frequency to 1500 Hz. The distance from the screen to the loudspeaker should be approx. 1 m. The experiment may be carried out at different frequencies and distances, however please notice that the distance between the loudspeaker and the screen ought to be an uneven number of quarter wavelenghts.




Vaiations in the sound intensity (variations in the height of the curves on the oscilloscope) may be observed by placing the microphone various places between the loudspeaker and the screen. Thus demonstrating that the sound is reflected by the screen ind interferes with the forthcoming wave, resulting in standing waves. A graphic illustration of the results may also be drawn. The experiment may be extended by using screen of different materials e.g. mineralfibre, etc.

**Nodal Line Patterns:**

Sprinkle some sand or salt on the Chladni plate. The Chladni plate is vibrated by the Vibration Generator. At certain frequencies nodal lines will appear and the sand will amass at the nodal points, thus giving a clear impression of the standing waves induced to the Chladni plate.




E.g: