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# Low frequency amplifier

13625.90... 99

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**Operating instructions**

CE The unit complies with the corresponding EC guidelines.

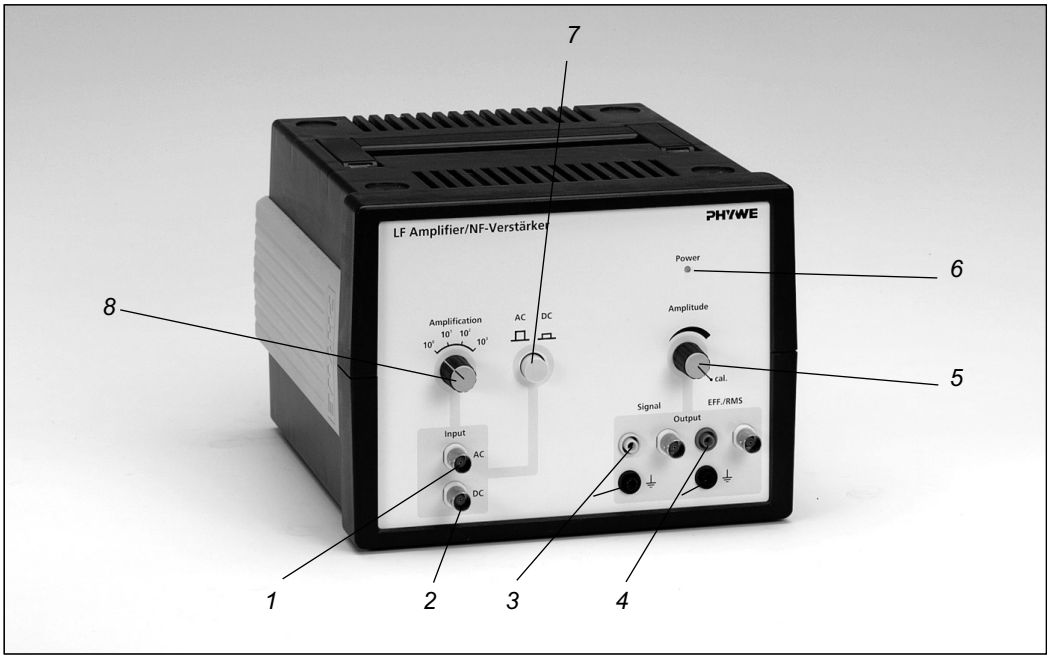


Fig. 1: Low frequency amplifier 13625.93.

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## 1 SAFETY PRECAUTIONS

- Carefully read these operating instructions completely before operating this instrument. This is necessary to avoid damage to it, as well as for user-safety.
- Check that your mains supply voltage corresponds to that given on the type plate fixed to the instrument.
- Install the instrument so that the on/off switch and the mains connecting plug are easily accessible.
- Do not cover the ventilation slots.
- Take care that no liquids or objects enter in through the ventilation slots.
- Only use the instrument in dry rooms in which there is no risk of explosion.
- Do not start up this instrument in case of visible signs of damage to it or to the line cord.
- Only use the instrument for the purpose for which it was designed.

## 2 PURPOSE AND DESCRIPTION

The low frequency amplifier is a versatile unit with the following applications:

– *AC voltage power amplifier* up to $U_{eff}$ = 10 V with a maximum output up to 15 W. Voltage amplification can be adjusted within a range of 0.1… 1000 for a maximum output voltage of 10 V.

– *DC voltage power amplifier* up to 10 V; maximum output values ±10 V/2 A (20 W). The instrument can be used among others to amplify voltages coming from the DA conversion outputs of the COBRA computer interface. The adjustment of voltage amplification is carried out in the same way as in the case of alternate voltages.

– *AC voltage measuring amplifier* up to $U_{eff}$ = 10 V with amplification factors 1, 10, 100 and 1000 (output voltage 10 V). An alternative voltage is supplied at the RMS output, which corresponds to the effective value of the input voltage multiplied by the selected amplification factor.

– *DC voltage measuring amplifier* up to ±10 V with the same amplification factors as for AC voltage; maximum output voltage is ±10 V.

## 3 FUNCTIONAL AND OPERATING ELEMENTS

All control and handling elements are situated on the front panel of the unit, except for the main switch and plug socket:

*1 Alternating voltage input*
BNC socket for input of the alternating voltage to be amplified up to ≥ 10 V; the input only is activated when key (*7)* is not depressed.

*2 Direct voltage input*
BNC socket for input of the direct voltage to be amplified up to ±10 V; the input only is activated when key (*7)* is depressed.

*3 Power output*
to take an amplified alternating or direct voltage; a pair of 4 mm safety plug sockets and a BNC socket in parallel are available for this purpose; maximum output voltage is 10 V.

*4 Measurement output*
to take a direct voltage $U_A$, which always is within a range 0 $U_A \geq$ 10 V; a pair of 4 mm safety plug sockets and a BNC socket in parallel are available.
In the operating mode „Alternating voltage“ (key *7* not depressed), $U_A$ corresponds to the effective value of alternating voltage applied to input (*1)*, multiplied by the amplification factor selected with (*5)* and (*8)*.
In operating mode „direct voltage“ (key *7* depressed), $U_A$ corresponds to the absolute value of direct voltage applied to input (*2)* multiplied by the amplification factor selected with (*5)* and (*8)*.

*5 Amplification setting button*
for continuous setting of the voltage amplification factor; in position „CAL“ (right hand stop), the factor corresponds exactly to the value set with multipoint switch (*8)*. This adjustment button allows to reduce output voltage approximately by a factor of 10.

*6 Unit on control light*
the LED lights up when power is switched on.

*7 „Operating mode“ key*
to select direct voltage (key depressed) or alternating voltage (key not depressed).

*8 „Amplification“ multipoint switch*
to select amplification steps 1, 10, 100 and 1000; set values apply when setting knob (*5*) is in position „CAL“.

## 4 HANDLING

**Caution:** the unit may only be used to amplify direct or alternating voltages up to 10 V at the utmost (overload protection cf. sections 4.3 and 4.4).

### 4.1 Start-up

The unit is connected to the grid by means of the supplied mains cable, which is plugged into the corresponding socket at the back of the unit. A fuse holder is integrated in the upper part of the connecting plug. This only can be opened, e.g. using a screw-driver, when the plug has been pulled out. Spare fine fuse link 5 mm x 20 mm, cf. identification plate.
The low frequency amplifier is switched on by means of the main power switch situated at the back of the housing. It is then immediately ready for use.

### 4.2 Use as a power amplifier

According to the required frequency range, the voltage to be amplified is given into the unit over a BNC cable, either at input AC (*1*) or at input DC (*1*). If input AC is used, key (*7)* must not be depressed, if input DC is used, key (*7)* must be depressed. Voltages up to 10 V may be amplified. In the AC operating mode, this value relates to the effective value of a sinusoidal input signal.
The amplified signal is taken from power output (*3*), either over the pair of 4 mm sockets or over the parallel BNC socket. Amplification can be varied by means of multipoint switch (*8)* and adjusting knob (*5*). In this case, it must be made sure that output voltage is not higher than 10 V, as otherwise distortions may occur. Effective value output (*4)* is simultaneously available to determine the effective value of input voltage; as the amplification factor must be known for this, adjusting knob (*5)* should be set to position „CAL“.

### 4.3 Use as a measuring amplifier

The voltage to be amplified is input in the same way as described in the preceding section for use as a power amplifier. The amplified signal is taken from the effective value output (*4*), either from the pair of 4 mm sockets or from the parallel BNC socket. Amplification can be set with multipoint switch (*8)*, adjusting knob (*5)* being set to position „CAL“. Input voltage $U_E$ can be calculated from the direct voltage measured at the output according to

$$U_E = \frac{U_A}{V}$$

where *V* is the amplification factor set with (*8)*. If input AC (*1*) is used, $U_E$ is the input voltage effective value. If input DC (*2*) is used, then $U_E$ is the momentary value of the applied direct voltage.
It must be taken into account that the maximum value of output voltage is 10 V; when this value is reached, amplification should be reduced, as otherwise measurement errors may occur.

### 4.4 Overload capacity

**Caution:** both inputs can be overloaded up to a peak voltage of 100 V. Higher voltages must absolutely be avoided for safety reasons and could cause destruction of the unit.
Both outputs are short-circuit proof, power output (*3*) is

protected by a thermal overload protection which switches off the unit in case of overheating. After such a shutdown, a few minutes must elapse before the unit is switched on again by itself. Before this occurs, the cause of the overload should be removed.

## 5 NOTES ON OPERATION

This high-quality instrument fulfils all of the technical requirements that are compiled in current EC guidelines. The characteristics of this product qualify it for the CE mark.

This instrument is only to be put into operation under specialist supervision in a controlled electromagnetic environment in research, educational and training facilities (schools, universities, institutes and laboratories).
This means that in such an environment, no mobile phones etc. are to be used in the immediate vicinity. The individual connecting leads are each not to be longer than 2 m.

The instrument can be so influenced by electrostatic charges and other electromagnetic phenomena that it no longer functions within the given technical specifications. The following measures reduce or do away with disturbances:
Avoid fitted carpets; ensure potential equalization; carry out experiments on a conductive, earthed surface, use screened cables, do not operate high-frequency emitters (radios, mobile phones) in the immediate vicinity.

## 6 TECHNICAL SPECIFICATIONS

| | |
|---|---|
| Inputs | |
| DC voltage | – 10 V ... + 10 V |
| AC voltage ($U_{eff}$) | 0…10 V |
| Overload protection | 100 V |
| DC Impedance | 100 kΩ |
| AC impedance | 50 kΩ |
| Amplification factors | 0.1 ... 1 |
| continuously adjustable | 1 ... 10 |
| | 10 ... 100 |
| | 100 ... 1000 |
| Error if (*5)* is in position „CAL“ | < 1.5 % |
| Signal output | |
| DC output voltage max. | ±10 V, 2 A |
| AC output voltage ($U_{eff}$) max. | 10 V |
| Nominal moving load | 8 Ω |
| Overload protection | short-circuit proof |
| Thermal protection | shut-down in case of overload |
| Effective value output | |
| Output voltage | ±10 V |
| Interior resistance | 1 kΩ |
| Error | < 1.5% |
| AC frequency response | |
| Amplification 1 | 3.5 Hz ... 200 kHz |
| Amplification 10 | 3.5 Hz ... 120 kHz |
| Amplification 100 | 3.5 Hz ... 100 kHz |
| Amplification 1000 | 3.5 Hz ... 75 kHz |
| DC frequency response | 0... 6 Hz |
| Noise voltage | |
| Amplification 1/10/100/1000 | <1/1.2/7/50 mV |
| Distortion factor (typical) | < 0.5% |
| Connecting voltage (+6%/-10%) | see type plate |
| Mains frequency | 50/60 Hz |
| Power consumption | 55 VA |
| Mains fuse (5 mm x 20 mm) | see type plate |
| Housing dimensions (mm) | 230 x 236 x 168 (W, D, H) |
| Weight | approx. 4.5 kg |

## 7 NOTES ON THE GUARANTEE

We guarantee the instrument supplied by us for a period of 24 months within the EU, or for 12 months outside of the EU. Excepted from the guarantee are damages that result from disregarding the Operating Instructions, from improper handling of the instrument or from natural wear.
The manufacturer can only be held responsible for the function and technical safety characteristics of the instrument, when maintenance, repairs and alterations to the instrument are only carried out by the manufacturer or by personnel who have been explicitly authorized by him to do so.

## 8 WASTE DISPOSAL

The packaging consists predominately of environmentally compatible materials that can be passed on for disposal by the local recycling service.

Should you no longer require this product, do not dispose of it with the household refuse. Please return it to the address below for proper waste disposal.

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