Difference amplifier

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Operating Instructions

CE The unit complies with the corresponding EC guidelines.

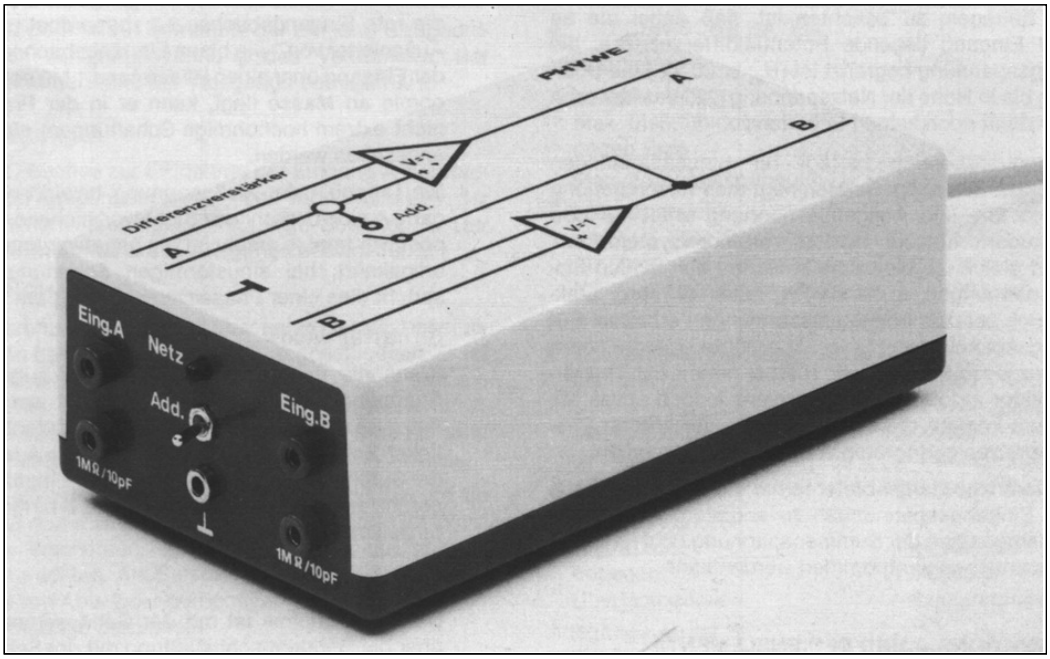

Fig. 1 Difference Amplifier 11444.93.

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.
- 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.
- Only use the instrument for the purpose for which it was designed.

2 PURPOSE AND CHARACTERISTICS

The Difference Amplifier is, as a rule, used in combination with an oscilloscope to simultaneously measure two voltages, potential-free and phase-correct. Normally, only voltages having a common reference point, which is either earthed or can be earthed by connection to the oscilloscope, can be simultaneously oscilloscoped. This disadvantage is eliminated by connecting the difference amplifier in series, so that the range of applications of the oscilloscope is greatly increased.

The difference amplifier has two identical high-resistance amplifying systems, which work independently of each other and are not earthed. Each amplifying system has an amplification factor of 1. In the allowable working range, the potentials of the measuring points can be a maximum of ±15 V against the earth point of the connection, it must be additionally observed that the maximum input voltage is limited ($U_{ss} \leq 20$ V). An overload up to the height of the mains voltage (230 V) does not cause damage to the instrument.

The maximum frequency range is dependent on the height of the input voltage. For sinus voltages with maximum permissible amplitude, the upper frequency limit is 15 kHz. Up to this frequency limit, the phase reversal between the input and output voltage is below 10°. As this is almost the same for both amplifying systems, however, the phase difference between the input voltages remains practically the same for the output voltages. For input voltages of $U_{ss} \leq 2$ V the upper frequency limit increases to 100 kHz.

With increasing frequency, however, the amplification factor decreases somewhat, and the input and output side phase differences can also differ slightly from each other.

The difference amplifier offers in addition the possibility of adding the two input voltages, whereby on the output side, alongside the sum voltage, one of the individual voltages can still be taken.

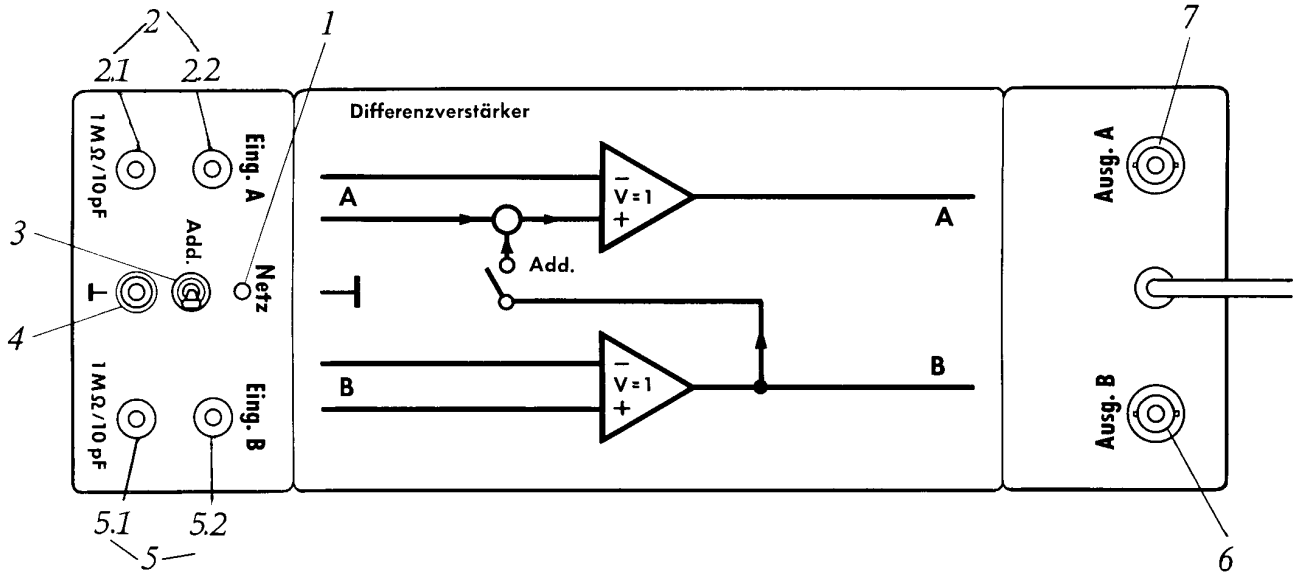

Fig. 2: Front and side view of the Difference Amplifier 11444.93.

3 FUNCTIONAL AND OPERATING ELEMENTS

Fig. 2 shows the following parts and operating elements:

1 *Mains control light*

2 *Input A:*
4 mm pair of sockets for putting on the measurement voltage, which is to be taken from output A. The inner conductor of the BNC output socket 7 is assigned to the red input socket 2.2, the outer conductor of 7 is assigned to the blue input socket 2.1.
The input lies over a 1 MΩ resistance of mass, so that it can be seen as earth-free for not too high-resistance connections.
A reversal of polarity of the measurement voltage causes a reversal of the sign at output A; with sinusoidal voltages this corresponds to a phase shift of 180°.

3 *Switch „Add.“:*
When the switch is positioned to the right, the voltages fed to inputs A and B are also led individually to the corresponding outputs. When it is switched to the left, the sum $U_A + U_B$ is on output A and the individual voltage U_B on output B. Please note, when voltage addition is made, the voltage limit also applies to the sum voltage.

4 *Mass socket ⊥:*
The 4 mm socket is connected with the housing mass and, via the instrument connecting cable, to the protective earthing of the AC mains.

5 *Input B:*
is identical to input A.

6 *Output B:*
BNC socket for drawing the output voltage assigned to input B.

7 *Output B:*
BNC socket for drawing the output voltage assigned to input A, as well as the sum voltage $U_A + U_B$ when required.

4 HANDLING

The difference amplifier is ready for immediate use as soon as it is connected to the AC mains.
When making connections, pay attention to the correct polarity, so that the voltages on the inputs A and B have the right sign. An example for a series circuit of correctly poled connections at the amplifier input is given in Fig. 3.
The feed voltage of the measuring connection is to be chosen so that the limiting values for the voltages picked up as well as for the potential against earth are observed. Should, for example, distortions appear in the oscillogram, then the feed voltage must be reduced and possibly the input sensitivity of the oscilloscope increased.

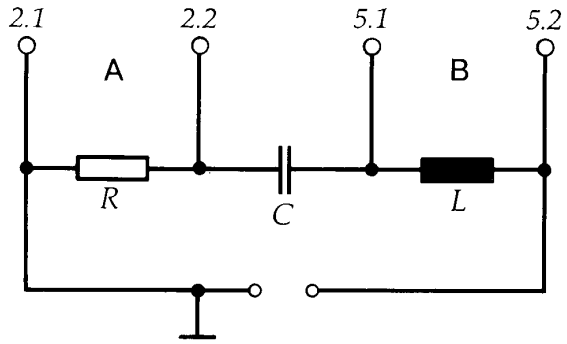

Fig. 3: Example.

5 NOTES ON OPERATION

This high-quality instrument fulfills 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 TECHNISCHE DATEN (typical for 25°C)

Operating temperature range	5...40°C
Relative humidity	< 80%
Amplification	1 ±3%
Input voltage	$U_E \leq 20\ V_{ss}$
Potential against earth	≤ ±15 V
Frequency range for sinusoidal voltages	
for $U_E \leq 20\ V_{ss}$	0 to 15 kHz
for $U_E \leq 6\ V_{ss}$	0 to 70 kHz
for $U_E \leq 2\ V_{ss}$	0 to100 kHz
Distortion factor	≤ 0.5%
Synchrony suppression	
to 2 kHz	≥ 60 dB (= factor of 1000)
to 15 kHz	≥ 40 dB (= factor of 100)
Offset (input open)	≤ 100 mV
Inputs A and B	1 MΩ // 10 pF; mains voltage proof
Outputs A and B	short-circuit proof
Internal resistance	100 Ω
External resistance	≥ 10 kΩ

Mains supply

Protection class	I
Connecting voltage (+6%/-10%)	see type plate
Mains frequency	50/60 Hz
Power consumption	3.5 VA
Housing dimensions (mm)	190 x 110 x 70
Weight	approx. 0.6 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. This guarantee does not cover natural wear nor damage resulting from improper handling.
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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