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Operating instructions

 The unit complies with the corresponding EU guidelines.

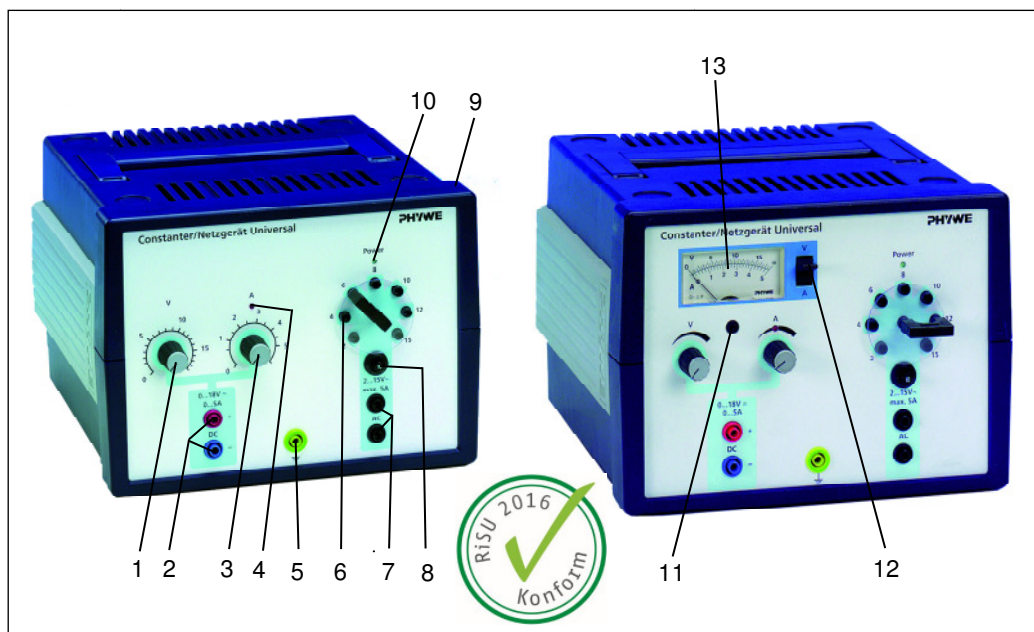


Fig. 1: Power supply, universal 13504-93.

Fig. 2: Power supply, universal, with analog display 13503-93.

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1 SAEFTY PRECAUTIONS



Caution!

- 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.
- Protect the instrument from dust, moisture and vapours. Only clean it in voltage-free state with a slightly moistened, lint-free cloth. Aggressive cleaning agents and solvents are unsuitable.
- Do not extract the 4 mm plugs from the sockets during operation, because there is a danger of burns due to the formation of arcs and the output sockets can be damaged
- Only use the instrument in dry rooms in which there is no risk of explosion.
- Do not start up this instrument should there be visible signs of damage to it or to the line cord.
- Only use the instrument for the purpose for which it was designed.
- Do not open the unit.
- Prior to connecting the mains power, ensure that the protective earth conductor of the power supply unit is properly connected to the protective earth conductor of the mains power network. Ensure that the mains socket into which the mains power plug is plugged is equipped with a protective earth conductor. Do not eliminate the protection by using an extension cord without a protective earth conductor.
- Only use the mains power cable that is supplied with the unit or an equivalent cable.

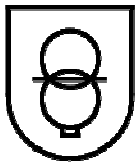
2 PURPOSE AND CHARACTERISTICS

Both universal power supplies are versatile, high performance power supply units with characteristics which make them almost ideal power sources for schools, laboratories and workshops. The power supplies deliver a variable, regulated d.c. voltage of 0...18 V with a selectable current limit of 0.05...5 A and an independent stepped-down AC voltage 2...15 V AC/max. 5 A. The 13503-93 power supply is also equipped with a voltmeter/ammeter.

The output voltages are electrically isolated from the mains, fully floating and lie in the protective low voltage range.

The power supplies are enclosed in impact resistant plastic cases. A carrying handle which can be folded out is set into the case cover plate. The same part set into the baseplate of the unit can be folded out towards the rear to hold the unit in a sloped position. Four rubber feet ensure stability. The power supply units can be stacked on top of other units of the same design during storage (not in operation). The rubber feet provide increased security against slipping when stacked because they locate in cup-shaped indentations in the unit underneath.

3 EXPLANATION OF THE SYMBOLS



Safety isolating transformer, short-circuit-proof due to special safety measures

4 FUNCTIONAL AND OPERATING ELEMENTS

The following functional and operating elements are to be found on the front plate of the instrument (see Figs 1 and 2):

1 Adjusting knob "Direct voltage"

for stepless setting of the electronically controlled (stabilized) direct voltage from 0 to 18 V. When the current intensity withdrawn is smaller than the limiting value for the current set with adjusting knob (3), i.e. when display (4) does not light up, then the set voltage is subject to control.

2 Output, 0...18 V/5 A

Pair of 4 mm sockets for withdrawal of the direct voltage set with adjusting knob (1) (positive terminal is red, negative terminal is blue). The output voltage is ungrounded and floating.

3 Adjusting knob "Current limitation"

for stepless setting of a maximum current intensity of approx. 50 mA to 5 A. Constant current mode requires that the load resistance is smaller than the quotient of the voltage set with adjusting knob (5) and the limiting value for the current set with (3).

4 Display "Constant current mode"

lights up when the limiting value for the current set with adjusting knob (3) is reached. In this case, the voltage is no longer controlled, but depends on the load resistance.

5 Socket ⊥

With connection to the line made, this is connected to the earthed earth lead.

6 Socket ring

for selection of the voltage step for the alternating voltage withdrawable at output (7). The selection is made by plugging a special short-circuiting plug into the central socket and the appropriate socket in the ring.

7 Output, 2...15 V~/max. 5 A

Pair of 4 mm sockets for withdrawal of an alternating voltage; the selection of the size of the voltage is made by means of socket ring (6). This output is galvanically separated from the mains, ungrounded and protected by an overload circuit breaker.

8 Overload circuit breaker

with thermal triggering for protection of alternating voltage output (7).

9 On/off switch and fuse holder (at the back of the instrument)

The fuse holder (Fig. 3) in the upper part of the device connector at the back can be accessed once the mains power connecting cable has been removed. It can then be pried out with the aid of a screwdriver.



Fig. 3: Fuse holder

Only mains fuses with the fuse rating stated under "Fuse" on the type plate are permissible.

Do not change the fuse unless the unit has been disconnected from the mains power supply and is absolutely voltage-free. Bypassing the fuse holder or mending the fuse is not permissible.

Prior to replacing a fuse, ensure that the cause of tripping has been eliminated.

Remove the defective fuse from the fuse holder and insert a new one with the correct rating. Then, push the holder back in. Ensure that you can hear it lock into place. If the fuse trips again after the unit has been switched on, do not use a higher fuse rating. This problem indicates a major defect and the unit must be sent to our service department for repair.

10 Operation indicator lamp

indicates that the unit is ready to operate.

The controls 11...13 are only present on the 13503-93 Power Supply:

11 Zero adjustment

for the pointer of moving-coil measuring instrument (10).

12 Measure and selection switch

for selection of the display of either direct current or direct voltage.

13 Voltmeter or ammeter

for the analog display of either direct voltage or of direct current at output (2) as required.

5 HANDLING



Caution!

The power supplies are not to be stapled with other instruments because of their high performance and the resulting heat development. An inclined position is recommended, particularly when high direct currents are withdrawn (swing out the inclining feet).

To connect the instrument to the AC mains, plug the 1.5 m long mains lead that is supplied with the instrument into the mains connector at the back of the instrument. The rectangular fuse holder integrated between the switch and the mains connector can only be opened using a screwdriver or similar after the mains lead has been unplugged from the instrument.

The high current intensity provided by the instrument can cause considerable damage to it when it is connected to an incorrect circuit. It is therefore recommended, to avoid unnecessary risks, that the behavior of the circuit be first tested with the instrument set to a low limiting value for the current. When the red current limitation LED (4) lights up even at a very small voltage, this can be an indication of a short circuit. Interruption in the load must fundamentally only occur at 0 V reduced outlet voltage. Pulling the 4 mm plugs from the sockets during operation of the instrument is to be avoided under all circumstances, as there is then a danger of burning because of arc formation and of damage to the output sockets.

The safety output sockets accept both conventional 4 mm plugs and safety connecting cables (e.g. 07337-01).

5.1 Alternating voltage part

The voltage that is to be withdrawn at output (7) can be set stepwise at socket ring (6) by appropriately plugging the cap- tive, special short-circuiting plug into the socket ring.

Important! Do not tap voltage from two sockets of the ring! Should this be done, then the overload protection would not be in the circuit and the transformer could be destroyed by the overload.

The output voltages are dependent on the load and on the line voltage. The voltage values relate to a load at half of the rated current, i.e. 2.5 A.

When overloading of the alternate voltage output has triggered overload circuit breaker (8), this can be pressed back in again after the few seconds required for the bimetal to cool.

The cause of the fault should have been eliminated in the meantime.

5.2 Direct voltage part

5.2.1 The characteristic of the output voltage and current intensity.

Two quantities can be set for direct voltage output (2); a voltage value U (with adjusting knob 1) and a current intensity value I (with adjusting knob 3). The actual values of the output voltage U and current intensity I are functions of U and I and of the (ohmic) external resistance R_a . The characteristic form of this dependence is determined by the internal circuit for voltage control and for current limitation.

From the set values of U and I , a critical value $R = U/I$ is calculated according to Ohm's Law. Voltage and current intensity behave differently, according to whether the external resistance R_a is greater or smaller than R .

5.3 Operation as stabilized voltage supply

Before switching the instrument on, set adjusting knob 1 (U) to a minimal value and adjusting knob 3 (I) to maximum current intensity. Switch the instrument on and set the required voltage value. When the accuracy of the built-in voltmeter is not sufficient, connect an external voltmeter. It can be recognized that the voltage control is functioning from the fact that the current limitation display (4) does not light up.

5.4 Operation as stabilized constant current source

Before switching the instrument on, set adjusting knob 3 (I) to the minimum value (left stop) and adjusting knob 1 to maximum voltage. Switch the instrument on and set the required current intensity value with (3). When the accuracy of the built-in ammeter is not sufficient, connect an external measuring instrument. Constant current mode can be recognized by the lighting up of red LED (4). Should the LED go out then the load resistance is too large to permit the wanted limiting current value at the set limiting voltage value. As the output voltage is dependent on the operating temperature of the instrument, when only to a limited extent, a certain temperature drift occurs because the internally generated Joule's heat. The highest operating temperatures occur when a high current is withdrawn from the instrument at a voltage of between 5 V and 6 V.

The direct current part is not only short-circuit-proof but also – within certain limits! – external voltage proof; in particular, the direct voltage outputs of two power supplies can be connected together in series or parallel (at any settings of adjusting knobs (3) and (1) without any harm to them.



Important!

The power supply is to be exclusively used for supplying suitable experimental set-ups and instruments. The user carries the responsibility for the operational reliability of the set-up to which the instrument is connected. When it is connected to incorrect circuitry, even the relatively low performance provided by the instrument could cause considerable damage (fire hazard!). To avoid unnecessary risks, we therefore recommend that the setup which it is to supply be carefully checked prior to switching the power supply on. The connection of AC and DC outputs in parallel is not permitted. This could result in the destruction of the DC output.

6 NOTES ON OPERATION



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



Due to the safe isolation and the safety isolating transformer in accordance with DIN EN 61558-2-6 (as per BG/GUV-SI 8040 "Sicher experimentieren mit elektrischer Energie in Schulen" (Safe experimentation with electrical energy at schools) and SI 8070 "Richtlinien für Sicherheit im Unterricht" (RiSU) (Regulations for safety at school)), this power supply unit is particularly suitable for student experiments and for all age levels ("compliant with the regulations for safety at schools").

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 no mobile phones etc. are to be used in the near vicinity. The individual connecting leads must not be longer than 2 m.

The Instrument can be influenced by electromagnetic charges and other electromagnetic phenomena in such way, that it works no longer within the given specifications. The following measures reduce or prevent disturbing influences: Avoid carpeted floor ensure potential equalization, perform the experiments on conductive and grounded surfaces, use screenings and screened cables and do not work with high frequency emitters (radios, mobile phones etc.) in the immediate vicinity. After a total blackout, carry out a "Reset" (new start) of the complete system.

7 TECHNICAL SPECIFICATIONS

(typical for 25 °C)

Operating temperature range	5...40 °C*
Relative humidity	<80 %

Mains supply

Protection class	I
Connecting voltage (+6 %/-10 %)	see type plate
Mains frequency	50/60 Hz
Power consumption	295 VA
Mains fuse (5 mm x 20 mm)	see type plate

Alternating voltage part

Output voltages	$U = 2, 4, 6, 8, 10, 12, 15 \text{ V}$
Rated current	$I = 5 \text{ A}$
Short circuit protection	overload circuit breaker

Direct voltage part

Output voltage	regulated
Adjustment range	$U = 0.05...18 \text{ V}$
Deviation from desired value at 230 V +6%/-10%	$\Delta U \leq \pm 10 \text{ mV}$
Ripple	$\leq 5 \text{ mV}$
Internal resistance	$R_i \leq 20 \text{ m}\Omega$

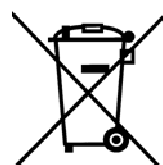
Current limit, continuously adjustable	$I = 0.05...5 \text{ A}$
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Housing dimensions (mm)	230 x 236 x 168 (W, D, H)
Weight	approx. 7.9 kg

*With maximum power output and a high ambient temperature, the back of the unit may heat up. Therefore, continuous operation should be avoided in this state.

8 WASTE DISPOSAL

The packaging mainly consists of environmentally-friendly materials that should be returned to the local recycling stations.



Do not dispose of this product with normal household waste. If this unit needs to be disposed of, please return it to the address that is stated below for proper disposal.

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