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Triple Power Supply HM8040-3

Manual
English





DECLARATION OF CONFORMITY

Manufacturer: HAMEG Instruments GmbH
Industriestraße 6
D-63533 Mainhausen

The HAMEG Instruments GmbH herewith declares conformity of the product

Product name: Tripple Power Supply

Type: HM8040-3

with: HM8001-2

Options: -

with applicable regulations:

EMC Directive 89/336/EEC amended by 91/263/EWG, 92/31/EEC

Low-Voltage Equipment Directive 73/23/EEC amended by 93/68/EEC

Harmonized standards applied:

Safety:

EN 61010-1: 1993 / IEC (CEI) 1010-1: 1990 A 1:
1992 / VDE 0411: 1994
Overvoltage category II
Degree of pollution: 2

Electromagnetic compatibility:
EN 61326-1/A1

Radiation: Table 4, class B.
Immunity: Table A1

EN 61000-3-2/A14
Harmonic current emissions: Klasse D

EN 61000-3-3
Voltage fluctuations and flicker

Date: 14.01.2004

Signature

G. Hübenett
Product Manager

General information regarding the CE marking

HAMEG instruments fulfill the regulations of the EMC directive. The conformity test made by HAMEG is based on the actual generic and product standards. In cases where different limit values are applicable, HAMEG applies the strictest standard. For emission the limits for residential, commercial and light industry are applied. Regarding the immunity (susceptibility) the limits for industrial environment have been used.

The measuring and data lines of the instrument have much influence on emission and immunity and therefore on meeting the acceptance limits. For different applications the lines and/or cables used may be different. For measurement operation the following hints and conditions regarding emission and immunity should be observed:

1. Data cables

For the connection between instruments resp. their interfaces and external devices, (computer, printer etc.) sufficiently screened cables must be used.

Maximum cable length of data lines must not exceed 3 m. The manual may specify shorter lengths. If several interface connectors are provided only one of them may be used at any time.

Basically interconnections must have a double screening. For IEEE-bus purposes the double screened cable HZ72 from HAMEG is suitable.

2. Signal cables

Basically test leads for signal interconnection between test point and instrument should be as short as possible. Without instruction in the manual for a shorter length, signal lines must be less than 3 meters long.

Signal lines must be screened (coaxial cable - RG58/U). A proper ground connection is required. In combination with signal generators double screened cables (RG223/U, RG214/U) must be used.

3. Influence on measuring instruments.

In the presence of strong high frequency electric or magnetic fields, even with careful setup of the measuring equipment an influence can not be excluded.

This will not cause damage or put the instrument out of operation. Small deviations of the measuring value (reading) exceeding the instrument's specifications may result from such conditions in some cases.

HAMEG Instruments GmbH

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English

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Triple Power Supply HM8040-3



2x 0-20V / 0,5A – 1x 5V / 1A

3-digit switchable displays for current and voltage

Display resolution 0.1V/1mA

Adjustable current limiting

Linear inline regulator

Low residual ripple and low noise

Pushbutton for activating/deactivating all outputs

Electronic fuse

Mainframe HM8001-2 required for operation

Mainframe
HM8001-2



Silicone test lead
HZ10



Triple Power Supply HM8040-3

Valid at 23 degrees °C after a 30 minute warm-up period.

Outputs

2 x 0-20V and 5V Single pushbutton control of all outputs, linear regulators with overheating protection. Floating outputs for parallel/serial operation, current limit and electronic fuse

20 V Output

Setting range: 2 x 0 – 20V, continuously variable

Residual ripple: <1 mV_{rms}

Output current: max. 0.5A

Current limit /electronic fuse:
0 – 0.5A continuously variable

Dynamic behaviour:

Load change 10% - 90% of full load

Recovery time: 200 µs

Dyn. transient deviation: typ. 2 mV

Dyn. output impedance: 3,75 mΩ

Load change at 50% basic load and ±10% of full load

Recovery time: 150 µs

Dyn. transient deviation: 400 µV

Dyn. output impedance: 4 mΩ

5V Output

Range: 5V ±0.5V
screw-driver adjustment

Ripple and noise: ≤ 1 mV_{rms}

Output current: max. 1 A continuous,
short-circuit-proof

Combined displays of 20V outputs

7-segment LED: 2 x 3-digit displays,
each switchable for voltage and
current (V, mA)

Resolution: 0.1 V / 1 mA

Display accuracy: ±1 digit voltage
±4 digit current

LED: current limit indication

Maximum limits

Reverse voltage: 25 V, each output

Reverse current: 500 mA, each output

Voltage to ground: 100 V, each terminal

Temperature control: If the inside temperature
exceeds 75...80°C, the
HM8040-3 will be turned off.

Miscellaneous

Safety class: Safety class I (EN61010-1)

Power supply (from mainframe):

1 x 8V / 1 A

2 x 24V / 530 mA

1 x 5V / 400 mA

1 x 18V_{AC} / 100 mA

Σ = 40 W

Current output of 2 HM8040-3

with HM8001-2: sum of all channels <2 A

Operating temperature: 0 °C to +40 °C

Storage temperature: -20 °C to +70 °C

Max. relative humidity: <80% (without condensation)

Dimensions (W x H x D): 135 x 68 x 228 mm

Weight: approx. 1.07 kg

Included in delivery: HM8040-3 Triple Power Supply, Manual

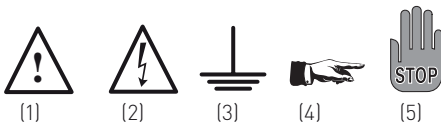
Optional accessories: HZ10 Silicon-insulated cable

Important hints

Unpacking

Be sure to check whether the contents are complete. Then inspect the instrument carefully for any mechanical damage and loose parts floating around inside. In case of transport damage please notify the sender immediately. Do not operate a damaged instrument.

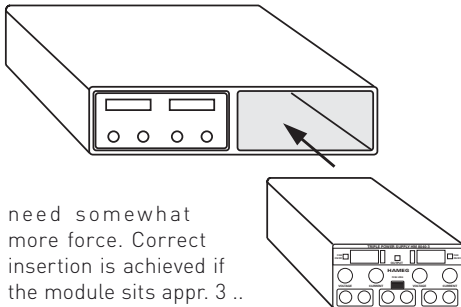
Symbols used



- Symbol 1: Attention, please consult manual
 Symbol 2: Danger! High voltage!
 Symbol 3: Ground connection
 Symbol 4: Important note
 Symbol 5: Stop! Possible instrument damage!

Installation

The instrument may be installed either right or left in the HM8001-2. Just shove it into the mainframe until the backside connector engages which may



need somewhat more force. Correct insertion is achieved if the module sits appr. 3 .. 4 mm inside the frame of the HM8001-2.

Transport

Conserve the packing material in case you may need it later for shipping the instrument. Any transport damages caused by unsuitable packing will void the warranty.

Storage

Storage requires a dry enclosed environment. If the instrument was subjected to extreme temperatures during transport it should be acclimatized at least for 2 hrs prior to turning it on.

Safety instructions

This instrument was designed and built according to VDE0411 part 1 safety standards valid for electrical measuring, control and laboratory equipment. It fulfills thus automatically the international standards EN 61010-1 and IEC 61010-1.

In order to protect this safety status and to ensure safe operation the user is requested to observe all safety instructions in this manual carefully. In fulfillment of safety class I all parts of this module are connected to the mains safety ground (protective earth) if properly installed in the mainframe. The module and its mainframe may only be connected to a mains outlet with a safety ground conductor or to an isolation transformer. In case of doubt whether a mains outlet carries a safety ground conductor this has to be tested according to the instructions in DIN VDE0100 part 610.



Danger! High Voltage!
It is prohibited to disconnect the safety ground either inside or outside of the instrument!

The line voltage selector of the mainframe must be set to the correct mains voltage. Opening of either the module or the mainframe is restricted to qualified personnel!
 Prior to opening the instrument must be switched off and disconnected completely.
 In any of the following cases the module resp. the mainframe has to be switched off immediately and locked away in order to prevent any further use:

- Apparent damage of the instrument.
- Damaged cable(s).
- Damaged fuse holder.
- Loose parts inside.
- No function.
- After longtime storage under unfavourable conditions like in the open or in moist atmosphere.
- After being subjected to hard transport.



Exceeding 42 V
By series connecting all outputs the 42 V limit can be exceeded which means that touching live parts may incur danger of life! It is assumed that only qualified and extensively instructed personnel are allowed to operate this instrument and/or the loads connected to it.

Correct operation

HAMEG modules are destined to be operated normally in the mainframe HM8001-2. If they are used in other systems it must be ensured that they are operated with the correct supply voltages (see specification). All applicable safety rules are to be observed.

The instruments are destined for operation in clean and dry rooms. Operation is precluded in dusty or moist atmosphere, if there is danger of explosion, and if aggressive chemicals are present.

The operating temperature range is 0 ... + 40 degrees C, the storage and transport temperature range -20 ... +70 degrees C. In case of suspected condensation a 2 h acclimatizing period has to be awaited before the instrument may be operated.

Safety regulations require that the mainframe be only operated from mains outlets with a safety ground connector or via an isolation transformer of safety class 2. No special orientation of the instrument is prescribed, however, sufficient air circulation must be ensured. Continuous operation will require a horizontal or slightly tilted (front feet extended) position.



The ventilation holes must not be obstructed!



Please note: Because of electromagnetic reasons, it is not permitted to use two moduls of type HM8040-3 in the same mainframe.

Warranty and Repair

HAMEG instruments are subjected to a strict quality control. Prior to leaving the factory, each instrument is burnt-in for 10 hours. By intermittent

operation during this period almost all defects are detected. Following the burn-in, each instrument is tested for function and quality, the specifications are checked in all operating modes; the test gear is calibrated to national standards.

The warranty standards applicable are those of the country in which the instrument was sold. Reclamations should be directed to the dealer.

Only valid in EU countries

In order to speed reclamations customers in EU countries may also contact HAMEG directly. Also, after the warranty expired, the HAMEG service will be at your disposal for any repairs.

Return material authorization (RMA):

Prior to returning an instrument to HAMEG ask for a RMA number either by internet (<http://www.hameg.com>) or fax. If you do not have an original shipping carton, you may obtain one by calling the HAMEG sales dept (+49-6182-800-300) or by sending an email to vertrieb@hameg.com.

Maintenance

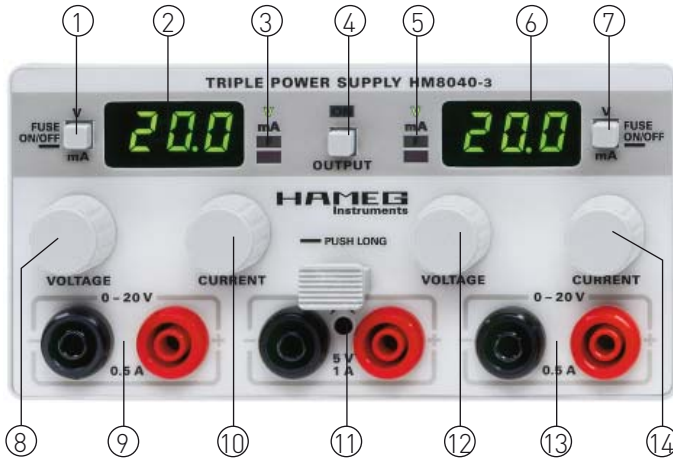
This instrument needs no special maintenance if properly used. A moist cloth will clean it. Use a soft detergent (water plus 1 % detergent) for the removal of persistent dirt. Remove grease with benzine (petrol ether). Displays and display windows may only be cleaned with a moist cloth.



Use no alcohol, solvents or abrasives! Under no circumstances any fluid must enter the instrument. Other than the specified cleaning materials may affect plastic or lacquered surfaces.

Overtemperature protection

If an internal temperature of 75 ... 80 degrees C is exceeded the outputs and the displays will be turned off. This will be indicated by 3 blinking dashes in the left and right displays. As soon as the displays return to the normal display of the values set the instrument will again be ready to operate. The outputs will remain disabled until the pushbutton OUTPUT ④ is depressed.



Operating controls

④ OUTPUT

Turns outputs on/off

⑪ 5 V 1 A

5 V output, adjustable within $\pm 10\%$ of 5 V with a screwdriver. Max. 1 A, short-circuit proof.

20 V output on the left

① V / mA / Fuse

Selection of voltage or current display V/mA
Selection of current limiting or electronic fuse function

② Display

3 digit display (7segment LED)

- ③ V LED voltage display selected
- mA LED current display selected
- F LED of electronic fuse activated
- I_{max} LED indication of current limit reached

⑧ VOLTAGE

Adjustment of voltage 0 .. 20 V

⑨ 0 – 20 V

Safety terminals for left 20 V output

⑩ CURRENT

Adjustment of current limit $I_{max} = 0 .. 0.5$ A

20 V output on the right

⑦ V / mA / Fuse

Selection of voltage or current display V/mA
Selection of current limiting or electronic fuse function

⑥ Display

3 digit display (7segment LED)

- ⑤ V LED voltage display selected
- mA LED current display selected
- F LED of electronic fuse activated
- I_{max} LED indication of current limit reached

⑫ VOLTAGE

Adjustment of voltage 0 .. 20 V

⑬ 0 – 20V

Safety terminals of right 20 V output

⑭ CURRENT

Adjustment of current limit $I_{max} = 0 .. 0.5$ A

Basics of power supplies

Linear regulators

Linear regulators offer a very constant output voltage even if the mains or the load may vary considerably. The remaining ripple will be very low with any good instrument, about 1 mV_{rms} or less and may be neglected. Also, linear regulators are free from EMI as generated by SMPS.

A conventional mains transformer isolates the instrument from the mains. A rectifier provides an unregulated dc voltage buffered by capacitors which also serve as energy storage elements. A transistor in series with the output is controlled by a regulation loop which compares (a fraction of) the output voltage with a highly stable reference voltage. This analog loop is very fast and will restore the output voltage quickly to its desired value whenever the input voltage or the load vary.

Parallel and series operation

Supplies must be specified for these operating modes which is the case with all HAMEG supplies. The output voltages to be combined are normally independent of each other. The outputs of one or more supplies can then be connected in series or parallel.

Series operation

As you see (Fig. 2) the voltages are added. The total voltage generated thus may exceed the 42V safety limit. In such case touching live parts may create

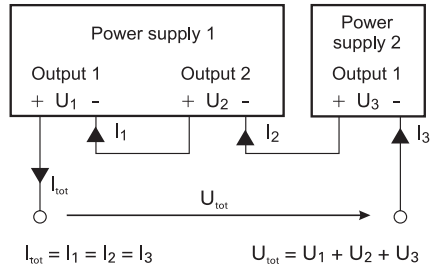


Fig. 2: Serial operation

danger of life! It is assumed that only qualified and extensively instructed personnel is allowed to operate such power supplies and their loads. All outputs carry the same current, hence the current limit adjustments of all supplies should be set to the same value. If in any of the series connected power supplies the current limit will be reached this supply will enter the current limiting mode, so the total output voltage will decrease and become unregulated!

Parallel operation

In order to increase the total available current the outputs of supplies can be paralleled. The output voltages of the supplies involved are adjusted as accurately as possible to the same value. In this mode it is possible that one or more supplies enter the current limit mode. The output voltage remains in regulation as long as still at least supply is in the voltage control mode. It is recommended but not absolutely necessary to fine adjust the voltages such that the individual current contributions remain nearly equal. Of course, the maximum available output current is the sum of the individual supplies' maximum currents.

Danger! – High voltage

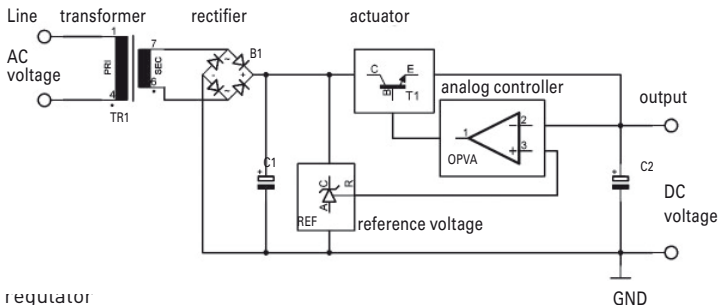


Fig. 1: Linear regulator

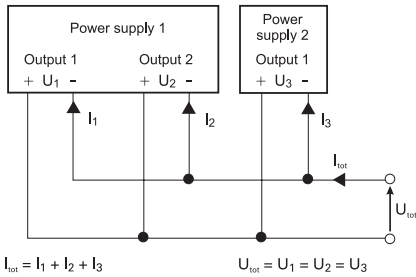


Fig. 3: Parallel operation

Example:

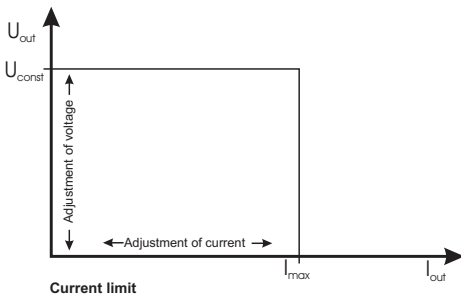
A load draws 0.7 A at 12 V. Each output of the HM8040-3 is specified for 0.5 A. In order to supply the 0.7 A both outputs have to be set to 12 V. Then the respective output safety terminals have to be connected in parallel (black to black, red to red). The load is connected to one of the supplies. By depressing OUTPUT ④ the outputs are activated. As a rule one output will supply appr. 500 mA in current limit mode, the other the balance of 200mA in voltage control mode.



If you parallel power supplies made by HAMEG and those of other manufacturers please make sure that the individual current contributions of the supplies involved are as equal as possible. HAMEG supplies are designed for series and parallel operation. If supplies of other manufacturers are used in a parallel connection which are not overload protected damage may occur if the individual currents are unequal.

Current limiting

means that a maximum current can be set. This



is e.g. useful in order to protect a sensitive test circuit. In case of an inadvertent short in the test circuit the current will be limited to the value set which will in most cases prevent damage.

The picture shows that the output voltage V_{out} remains stable, while the current I increases until the current limit selected will be reached. At this moment the instrument will change from constant voltage regulation to constant current regulation. Any further load increase will cause the current to remain stable while the voltage decreases ultimately to zero.

Electronic fuse

This feature provides a still better protection of sensitive loads, especially of such loads which require more than one voltage: if one current limit is reached all output voltages will be disconnected immediately. In order to turn these back on the pushbutton OUTPUT ④ must be depressed.

Concept of the HM8040-3

The triple power supply HM8040-3 features 3 independent output voltages. In addition to supplying 3 voltages the 0 ... 20 V outputs may be connected in series or parallel.



Exceeding 42 V

If all outputs are series connected the sum can exceed 42 V. In this case touching of live parts may cause danger of life! It is assumed that only qualified and extensively instructed personnel is allowed to operate these supplies and their loads.

In series connection the maximum current is 0.5A. By paralleling the outputs a maximum of 1A is possible. The maximum voltage remains 20V. Please note that the specifications (e.g. impedance, noise, regulation) listed for individual use of the outputs may change if series or parallel connected.

Output power

As the HM8040-3 is fed from the mainframe supplies in the HM8001-2 its maximum output power is limited to 25W. Sufficient ventilation is necessary.



The operation of two HM8040-3 in the HM8001-2 is only permitted if the sum of all output currents (these are 6) remains ≤ 2 A.

Overtemperature protection

If the internal temperature exceeds 75 .. 80 degrees C all outputs and displays will be deactivated. This will be indicated by 3 blinking dashes in the left and right displays.

As soon as the displays will light up again and display the values set the instrument will be ready for operation. In order to turn the outputs back on the pushbutton OUTPUT ④ has to be depressed.

Switching the outputs on/off

It is a feature of all HAMEG power supplies that the outputs can be turned on and off by pushing a button. The power supply remains turned on so that all voltages and currents may be set prior to turning the outputs on.

Introduction to the operation

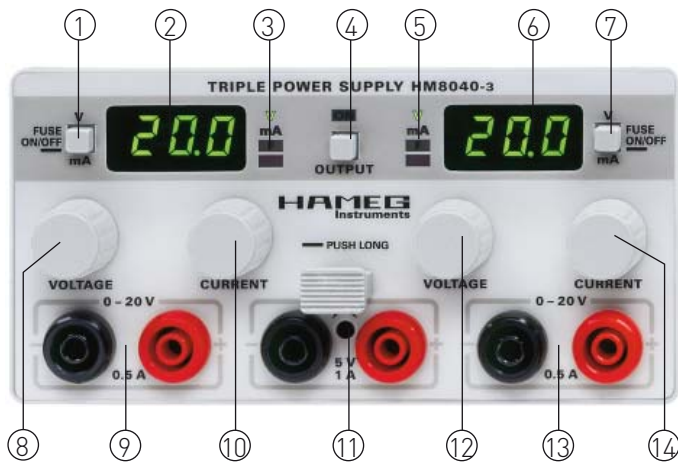
First time operation

Before turning the instrument on please observe the following:

- The mains voltage selector at mainframe HM8001-2 is set to the correct voltage.
- The correct fuses for the voltage selected are installed in the fuseholder
- Connection to a mains outlet with protective earth or to a class 2 isolation transformer
- No visible damage to the instrument
- No damage to the line cord
- No loose parts inside the instrument

Turning the instrument on

After turning the instrument on the outputs will always remain disconnected in order to protect the loads. First the desired voltages should be set, then the desired maximum currents, then the outputs may be activated by pressing OUTPUT ④. After turn-on the instrument will select the current limit mode (electronic fuse deactivated). If the fuse mode is selected after turn-on this mode will be lost after turn-off.



Controls and displays

① ⑦ V / mA / Fuse

- a) Short operation: switches displays back and forth between voltage (V) and current (mA)
- b) Long operation: switches back and forth between "current limiting" and "electronic fuse"

③ ⑤ V / mA / F (4 x LED)

V

The voltage at the safety terminals is displayed with a resolution of 0.1 V

mA

The output current is displayed with a resolution of 1 mA

F

If the electronic fuse was activated this LED will light up.

I_{max}

If current limit is reached, the lower LED lights up.

Current limiting

After turn-on the instrument will be in the current limit mode. The knobs CURRENT ⑩ ⑭ allow to set the maximum output currents for the left and right 20 V outputs independently of each other. If the current limit in one output is reached the current will remain at the value I_{max} without af-

fecting any other output. If the current limit set of the remaining output should be reached, this output will also change over to constant current I_{max} operation. In order to set a current limit the output concerned has to be shorted first, then the limit adjusted which is indicated by the associated LED ③ or ⑤ lighting up. After removal of the short the LED will extinguish.

Electronic fuse

Before selecting this mode the maximum currents of the 2 outputs have to be set according to the procedure outlined above. The pushbutton V/mA/Fuse ① ⑦ has to be pushed long. After the LED "F" ③ ⑤ lights up the electronic fuse mode is active. If any of the current limits set is reached all outputs will be turned off completely. In order to leave the electronic fuse mode press the pushbutton ① ⑦ long again.

Example:

The left output may be in the "current limit" mode while the right output may be in the "electronic fuse mode". If I_{max} is reached in the left output current will continue to flow there. If the current limit is reached in the right output, however, all outputs will be turned off.



The current limits can be adjusted using the rotary controls CURRENT ⑩ ⑭ between 0 – 500 mA. In the CCW position of these controls 0A the current will be indeed zero, so the output capacitances will be discharged slowly to 0 Volt.

In the “current limit” mode the appropriate LED (I_{max}) ③ ⑤ will light in the CCW position and as explained the output voltage will slowly decrease to zero. In the “electronic fuse” mode all outputs will be disabled immediately after pressing OUTPUT ④ if any of the CURRENT controls is set CCW.

②⑥ Displays

7segment 3 digit displays of either voltage or current. Each display associates with the terminals underneath. The displays show continuously the voltages resp. currents of the two 20V outputs, also while these are switched off. This allows presetting the output levels prior to activating them which we do recommend. Selection of voltage or current is done using the pushbuttons V/mA/ Fuse ① ⑦. The voltages are displayed with a resolution of 0.1 V, the currents with 1 mA.

④ Output

Pushbutton for turning all outputs ON/OFF. The displays remain unaffected always on. Activation of the outputs is indicated by the LED “ON”.

④⑬ 0 .. 20 V

Outputs 0 .. 20 V. Safety terminals for 4 mm safety plugs. The outputs can withstand shorts of unlimited duration.

⑧⑫ Voltage

Knobs for output voltage adjustment

⑩⑭ Current

Knobs for maximum output current adjustment, pertinent only for the 20 V outputs. The range is 0 .. 500 mA.

If the control is fully CCW the outputs will be disabled immediately if the mode “electronic fuse” was selected. In “current limit” mode the LED I_{max} will light up, and the voltage will decrease slowly to 0 Volt.

⑪ 5V/1A

5 V output with safety terminals for 4 mm safety plugs. Short-circuit proof. The voltage may be changed from 4.5 V to 5.5 V using a screwdriver.



Overtemperature protection!

If the internal temperature exceeds 75 .. 80 degrees C the outputs and the displays will be switched off which is indicated by 3 blinking dashes showing in the left and right displays. As soon as the displays light up and show the values set again the instrument is ready for operation. In order to turn the outputs back on the pushbutton OUTPUT ④ has to be depressed.