HAMEG Instruments
A Rohde&Schwarz Company

Power supply HM7042-5

Manuel / English

Triple Power Supply
HM7042-5

HZ42 19" Rackmount kit 2RU

Silicone test cable HZ10

2x 0–32 V/0–2 A 1x 0–5,5 V/0–5 A

High-performance and inexpensive laboratory power supply

Floating, overload and short-circuit proof outputs

Separate voltage and current displays for each output:
4 digits at Channel I+III; 3 digits at Channel II

Display resolution:
10 mV/1 mA at Channel I+III; 10 mV/10 mA at Channel II

Protection of sensitive loads by current limit or electronic fuse.

Pushbutton for activating/deactivating all outputs

Low residual ripple, high output power, very good regulation

Parallel (up to 9 A) and Series (up to 69.5 V) operation

Temperature-controlled fan

Triple Power Supply HM7042-5

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

Outputs	
2 x 0 – 32 V and 0..5.5 V	ON/OFF pushbutton control, SMPS followed by a linear regulator, floating outputs for parallel/serial operation, current limit and electronic fuse.

Channel I + III (32 V)	
Range:	2 x 0 – 32 V, continuously adjustable 2 knobs (coarse/fine)
Ripple:	≤ 100 μV_{rms} (3 Hz – 300 kHz)
Current:	max. 2 A
Current limit/electronic fuse:	0 – 2 A, continuously adjustable (knob)
Recovery time (10 % - 90 % load variation)	
	80 µs within ±1 mV of nominal value
	30 µs within ±10 mV of nominal value
	00 µs within ±100 mV of nominal value
Max. transient deviation:	typ. 75 mV
Recovery time (50 % basic load, 10 % load variation)	
	30 µs within ±1 mV of nominal value
	05 µs within ±10 mV of nominal value
	00 µs within ±100 mV of nominal value
Max. transient deviation:	typ. 17 mV
Display	
7-segment LED:	32.00 V (4 digit) / 2.000 A (4 digit)
Resolution:	0.01 V / 1 mA
Display accuracy:	±3 digit voltage / ±4 digit current
LED:	indicates current limit

Channel II (5.5 V)	
Range:	0 – 5.5 V, continuously adjustable (knobs)
Ripple:	≤ 100 μV_{rms} (3 Hz – 300 kHz)
Current:	max. 5 A
Current limit / electronic fuse:	0 – 5 A, continuously adjustable (knob)
Recovery time (10 % - 90 % load variation):	
	80 µs within ±1 mV of nominal value
	10 µs within ±100 mV of nominal value
Max. transient deviation:	typ. 170 mV
Recovery time (50 % basic load, 10 % load variation):	
	30 µs within ±1 mV of nominal value
	15 µs within ±10 mV of nominal value
	00 µs within ±100 mV of nominal value
Max. transient deviation:	typ. 60 mV
Display	
7-segment LED:	5.50 V (3 digit) / 5.00 A (3 digit)
Resolution:	0.01 V/10 mA
Display accuracy:	±3 digit voltage / ±1 digit current
LED:	indicates current limit

Outputs	
2 x 0..32 V and 0..5.5 V	ON/OFF pushbutton control. SMPS followed by a linear regulator. All outputs floating allowing parallel and series operation. Current limit each output, electronic fuse.
Max. voltage applicable to output terminals (ON/OFF):	
CH I + CH III:	33 V
CH II:	6 V
Reverse voltage:	max. 0.4 V
Reverse current:	max. 5 A
Voltage to earth:	max. 150 V

Channel I + III (32 V)	
Range:	2 x 0 – 32 V, continuously adjustable
Safety class:	Safety class I (EN61140)
Mains supply:	115/230 V ± 10 %, 50/60 Hz
Ripple:	<100 µV Hz – 300 kHz)
Current:	230 V: 2 x 2.5 A slow blow 5 x 20 mm
Current limit, electronic fuse:	0 – 2 A, continuously adjustable (knob)
Storage temperature:	-20 °C to +70 °C
Max. relative humidity:	< 80% (without condensation)
Dimensions (W x H x D):	285 x 75 x 365 mm
Weight:	approx. 7.4 kg
Recovery time (10 to 90 % load variation):	
80 µs	within ±1mV of nominal value
30 µs	within ±10mV of nominal value
00 µs	within ±100mV of nominal value
max. transient deviation:	typ. 75 mV
50% basic load (10% load variation):	
30 µs	within ±1mV of nominal value
05 µs	within ±10mV of nominal value
00 µs	within ±100mV of nominal value
max. transient deviation:	typ. 17 mV

Accessories supplied: Operator's Manual and power cable
Optional accessories: HZ10S/R Silicone test lead
HZ42 19" Rackmount Kit 2RU

Included in delivery: HM7042-5 Power Supply, Manual, line cord
Optional accessories: HZ10 Silicon-insulated cable
HZ42 19" rackmount kit

Important hints

(1) (2) (3) (4) (5)

Symbols

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!

Unpacking

Please check for completeness of parts while unpacking. Also check for any mechanical damage or loose parts. In case of transport damage inform the supplier immediately and do not operate the instrument.

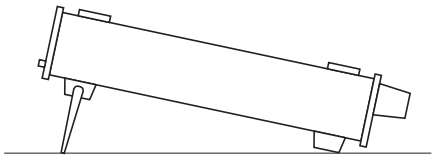
Positioning

Two positions are possible: According to picture 1 the front feet are used to lift the instrument so its front points slightly upward. (Appr. 10 degrees)

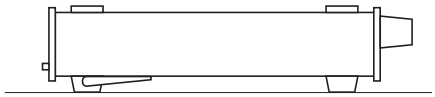
If the feet are not used (picture 2) the instrument can be combined with many other HAMEG instruments.

In case several instruments are stacked (picture 3) the feet rest in the recesses of the instrument below so the instru-ments can not be inadvertently moved. Please do not stack more than 3 instruments. A higher stack will become unstable, also heat dissipation may be impaired.

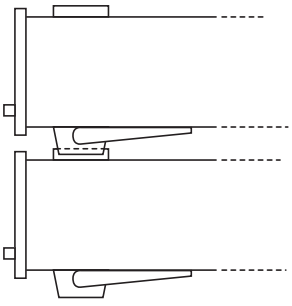
picture 1



picture 2



picture 3



Transport

Please keep the carton in case the instrument may require later shipment for repair. Losses and damages during transport as a result of improper packaging are excluded from warranty!

Storage

Dry indoors storage is required. After exposure to extreme temperatures 2 h should held off on turning the instrument on.

Safety instructions

The instrument conforms to VDE 0411/1 safety standards applicable to measuring instruments and left the factory in proper condition according to this standard. Hence it conforms also to the European standard EN 61010-1 resp. to the international standard IEC 61010-1. Please observe all warnings in this manual in order to preserve safety and guarantee operation without any danger to the operator. According to safety class 1 requirements all parts of the housing and the chassis are connected to the safety ground terminal of the power connector. For safety reasons the instrument must only be operated from 3 terminal power connectors or via isolation transformers. In case of doubt the power connector should be checked according to DIN VDE 0100/610.

Do not disconnect the safety ground either inside or outside of the instrument!

- The line voltage of the instrument must correspond to the line voltage used.
- Opening of the instrument is allowed only to qualified personnel
- Prior to opening the instrument must be disconnected from the line and all other inputs/outputs.

In any of the following cases the instrument must be taken out of service and locked away from unauthorized use:

- Visible damages
- Damage to the power cord
- Damage to the fuse holder
- Loose parts
- No operation
- After longterm storage in an inappropriate environment , e.g. open air or high humidity.
- Excessive transport stress

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.

Proper operating conditions

The instruments are destined for use in dry clean rooms. Operation in an environment with high dust content, high humidity, danger of explosion or chemical vapors is prohibited. Operating temperature is 0 ... +40 degrees C. Storage or transport limits are –10 ... +70 degrees C. In case of condensation 2 hours are to be allowed for drying prior to operation. For safety reasons

operation is only allowed from 3 terminal connectors with a safety ground connection or via isolation transformers of class 2. The instrument may be used in any position, however, sufficient ventilation must be assured as convection cooling is used. For continuous operation prefer a horizontal or slightly upward position using the feet.

Do not cover either the holes of the case nor the cooling fins.

Specifications with tolerances are valid after a 30 minute warm-up period and at 23 degrees C. Specifications without tolerances are typical values of an average instrument.

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

The instrument does not require any maintenance. Dirt may be removed by a soft moist cloth, if necessary adding a mild detergent. (Water and 1 %.) Grease may be removed with benzine (petrol ether). Displays and windows may only be cleaned with a moist cloth.

Do not use alcohol, solvents or paste. Under no circumstances any fluid should be allowed to get into the instrument. If other cleaning fluids are used damage to the lacquered or plastic surfaces is possible.

Mains voltage

A main voltage of 115V and 230V can be chosen. Please check whether the mains voltage used corresponds with the voltage indicated by the mains voltage selector on the rear panel. If not, the voltage has to be changed. In this case the line fuse has to be changed, too.

Please note:
After changing the main voltage, the line fuse has to be changed. Otherwise the instrument may be destroyed.

Changing the line fuse

The fuses are accessible from the outside and contained in the line voltage connector housing. Before changing a fuse disconnect the instrument from the line, the line cord must be removed. Check fuse holder and line cord for any damages. Use a suitable screw driver of appr. 2 mm to depress the plastic fuse holder releases on both sides, the housing is marked where the screw driver should be applied. After its release the fuse holder will come out by itself pushed forward by springs. The fuses can then be exchanged, please take care not to bend the contact springs. Reinsertion of the fuse holder is only possible in one position and by pressing against the springs until the locks engage.

It is forbidden to repair defective fuses or to bridge them by any means. Any damage caused this way will void the warranty.

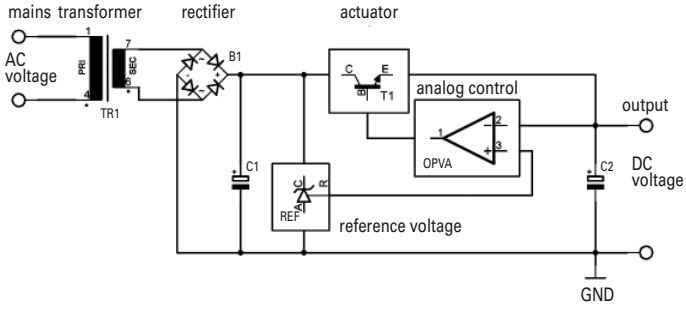
Types of fuses:
Size 5 x 20 mm; 250V~,
IEC 60127-2/5
EN 60127-2/5

Line voltage	Correct fuse type
230 V	2 x 2,5 A slow blow
115 V	2 x 5 A slow blow

Basics of power supplies

Linear power supplies

Linear regulated power supplies excel by their highly constant output voltage, low ripple and fast regulation, even under high line and load transients. Good power supplies feature a ripple of less than 1 mV_{rms} which is mostly neglegible. Further they are free from EMI emission in contrast to SMPS.
A conventional mains transformer isolates the line from the secondary which is rectified and supplies an unregulated voltage to a series pass transistor. Capacitors at the input and output of the regulator serve as buffers and decrease the ripple. A high precision reference voltage is fed to one input of an amplifier, the second input is connected mostly to a fraction of the output voltage, the output of this amplifier controls the series pass transistor. This analog amplifier is generally quite fast and is able to keep the output voltage within tight limits.

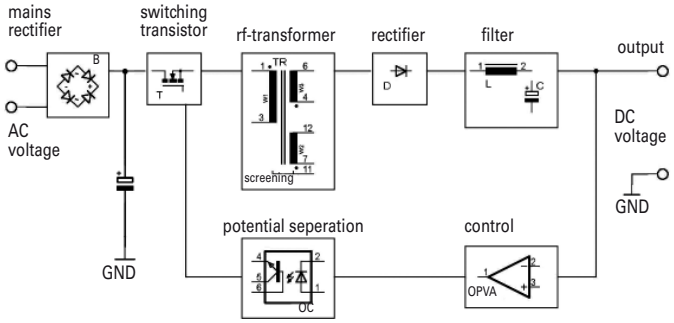


Switched-mode power supplies (SMPS)

SMPS operate with very much higher efficiencies than linear regulated power supplies. The DC voltage to be converted is chopped at a high frequency rate thus requiring only comparatively tiny and light ferrite chokes or transformers with low losses, also, the switching transistor is switched fully on and off hence switching losses are low. In principle regulation of the output voltage is achieved by changing the duty cycle of the switch driving waveform.

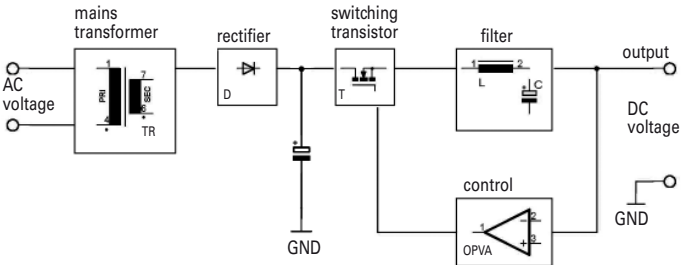
1st Off-line SMPS

The line voltage is rectified, the buffer capacitor required is of fairly small capacitance value because the energy stored is proportional to the voltage squared (E = 1/2 x C x U_2).

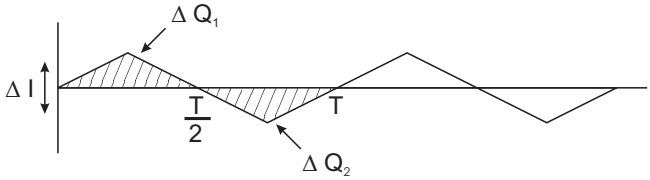


2nd Secondary SMPS

These still require a 50 or 60 Hz mains transformer, the secondary output voltage is rectified, smoothed and then chopped. The capacitance values needed here for filtering the 100 resp. 120 Hz ripple are higher due to the lower voltage.
All SMPS feature a very much higher efficiency from appr. 70 up to over 95 % compared to any linear supply. They are lighter, smaller. The capacitors on the output(s) of a SMPS may be quite



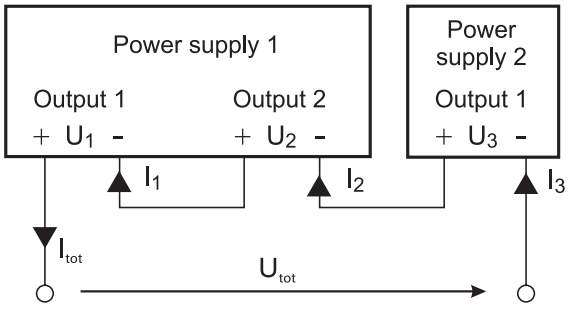
small due to the high frequency, but the choice depends also on other factors like energy required for buffering or ac ripple from the load (e.g. motors). In principle the size of the major components decreases with increasing operating frequency, however, the efficiency drops apppreciably above appr. 250 kHz as the losses in all components rise sharply.



Parallel and series operation

It is mandatory that the power supplies used are definitely specified for these operating modes. This is the case with all HAMEG supplies. As a rule, the output voltages to be combined are independent of each other, hence, it is allowed to connect the outputs of one supply with those of another or more.

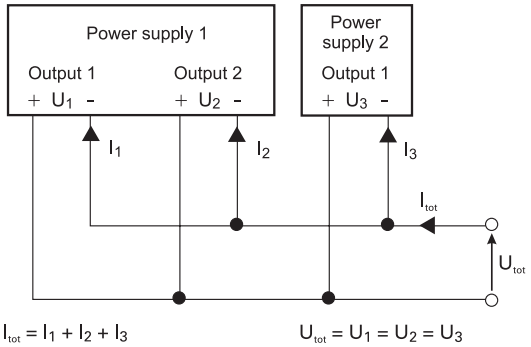
Series operation



$I_{tot} = I_1 = I_2 = I_3$ $\quad U_{tot} = U_1 + U_2 + U_3$

In this mode the output voltages add, the output current is the same for all supplies. As the sum of all voltages may well surpass the 42 V limit touching of live parts may be fatal! Only qualified and well instructed personnel is allowed to operate such installations.
The current limit of the outputs in series should be adjusted to the same value. If one output reaches the current limit the total voltage will break down.

Parallel operation



$I_{tot} = I_1 + I_2 + I_3$ $\quad U_{tot} = U_1 = U_2 = U_3$

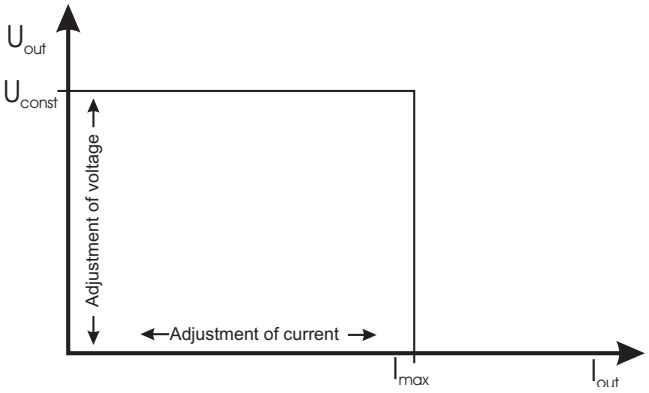
In order to increase the total available current the outputs of supplies can be paralleled. The output voltages of the supplies involved are adjusted as accurately as possible to the same value. In this mode it is possible that one or more supplies enter the current limit mode. The output voltage remains in regulation as long as still at least one 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.

Example:
A load requires 12 V at 2.7 A. Each 32 V output of the HM7042-5 can deliver 2 A. First set both supplies to 12 V. Then connect both black and both red safety connectors respectively in parallel. The load is connected to one of the supplies. With the pushbutton OUTPUT ⑧ the voltage will be turned on. It is normal that one output will current limit at 2 A while the other will contribute the balance of 0.7 A in voltage regulation.

In case you should parallel power supplies of other manufacturers with HAMEG supplies make sure all are specified for this mode of operation. If one supply of those connected in parallel should have insufficient overload protection it may be destroyed. HAMEG supplies are specified for series and parallel operation.

Current limit

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

In order to provide a still better protection than current limiting offers the HM7042-5 features an electronic fuse. As soon as I_{max} is reached all outputs will be immediately simultaneously disabled.
They may be turned on again by depressing OUPUT ⑧.

Concept of the HM7042-5

In this instrument the advantages of a SMPS, especially high efficiency, and those of a linear regulator, e.g. high quality regulation, are combined. A high power DC/DC converter is used as a preregulator for the following linear regulators, this reduces the high losses typical of purely linear regulation. The HM 7042-5 has 3 independent and isolated voltage sources. In addition to the standard mode of operation as a triple output supply all outputs may be series or parallel connected.

Exceeding the safety voltage level of 42 V!

If all outputs are series connected the maximum output voltage can exceed 42 V. In such case touching of live parts may be fatal! Only qualified and well instructed personnel is allowed to use such installations!

In series conncetion the maximum available current is limited to 2 A. Paralleling the two 32 V outputs will yield 4 A at a maximum of 32 V. Please note that series as well as parallel conncetion may influence some specifications valid such as output impedance, noise, regulation.

Output power of the HM7042-5

The maximum combined output power is 155.5 W. The HM7042-5 has a temperature-controlled fan the rpm of which will increase with rising temperature. This will ensure sufficient cooling under all normal operating conditions.

Switching the display on/off

All Hameg supplies feature a pushbutton which turns the outputs ON/OFF while the supply remains functioning. This allows to preset all voltages to their respective desired values prior to turning the outputs on by depressing OUTPUT ⑧.

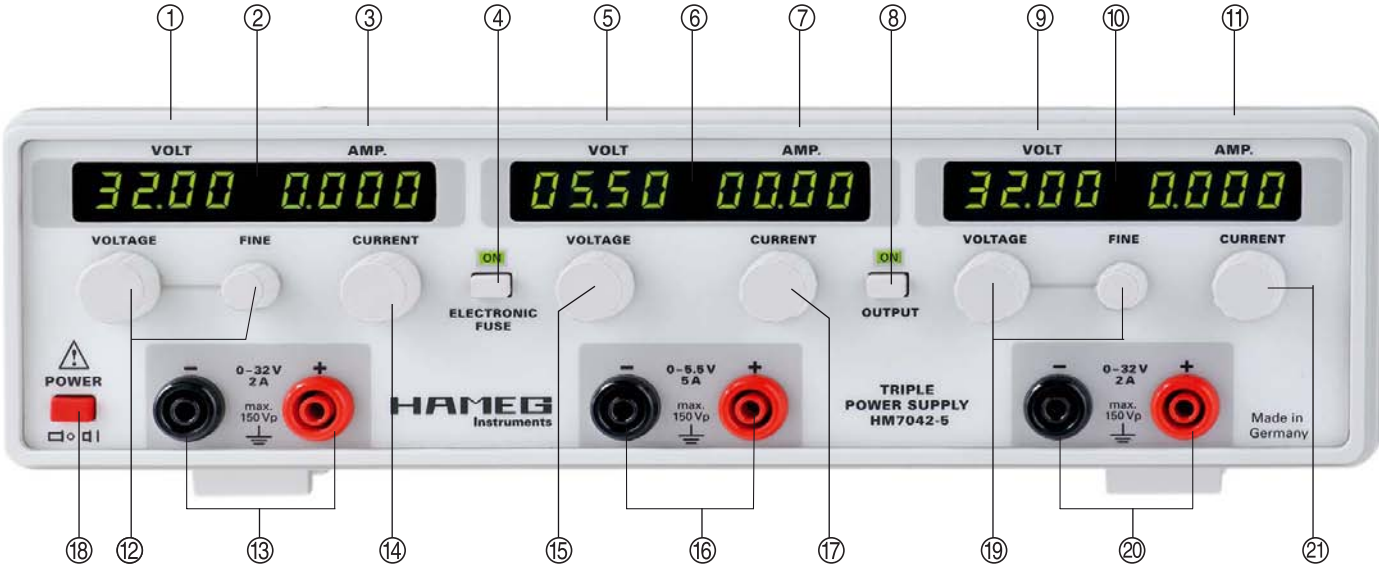
Introduction to the operation

First time operation
Please observe especially the following notes:

- The line voltage indicated on the rear panel corresponds to the available line voltage, also, the correct fuses for this line voltage are installed. The fuses are contained in the line voltage connector housing.
- The connection to the mains is either by plugging into a socket with safety ground terminal or via an isolation transformer of protection class II.
- No visible damage to the instrument.
- No visible damage to the line cord.
- No loose parts floating around in the instrument.

Turning on the HM7042-5

After turning on all outputs will remain disabled, protecting the loads. Prior to pressing OUPUT ⑧ all output voltages should be set to their desired values. Also, after turn-on the instrument will be in the operating mode "Current limit".
The maximum current available can be set by CURRENT ⑭ ⑰ ㉑. The mode "Electronic fuse" may be selected after turn-on, but after each turn-off-on cycle "Current limit" will be set.



Operating controls and displays

0 – 32 V / 2 A

Output voltage, adjustable 0 – 32 V. Safety terminals for 4 mm plugs. The outputs are short circuit-proof with no time limit.

① ⑨ VOLT
4 digit displays (7 segment LEDs), of the actual values of all voltages, the resolution is 10 mV. The display are always operative, even when the outputs are disabled allowing presetting of all output voltages before the loads are connected to them. We recommend to follow always the procedure of setting the output voltages first and then turn the outputs on.

② ⑩ LED
These LEDs will light up if current limit is reached.

③ ⑪ AMP.
4 digit displays (7 segment LEDs) of the actual output currents, resolution 1 mA. We recommend to set the output current (I_{max}) before setting the output voltage and then turn on the outputs.

⑫ ⑲ VOLTAGE/FINE
Rotary controls for the coarse/fine adjustment of the 0 – 32 V outputs.

⑬ ⑳ 0 – 32V / 2A
Outputs, 4 mm safety connectors

⑭ ㉑ CURRENT
Rotary controls for setting the maximum currents of the 0 – 32 V outputs. If a control is turned CCW to 0 A all outputs will be turned off immediately if the function "electronic fuse" was activated. In case "Current limit" was selected the LEDs Á É will light up, the voltage will drop to zero.

0 – 5.5 V / 5 A

This output voltage can be adjusted 0 – 5.5 V. 4 mm safety connectors. This output is short-circuit proof without a time limit.

⑤ VOLT
3 digit displays (7 segment LEDs) of the actual output voltage, resolution 10 mV. This display will show the output voltage even if the output was switched off. We recommend to follow always the procedure of setting the output voltage first and then turn the output on.

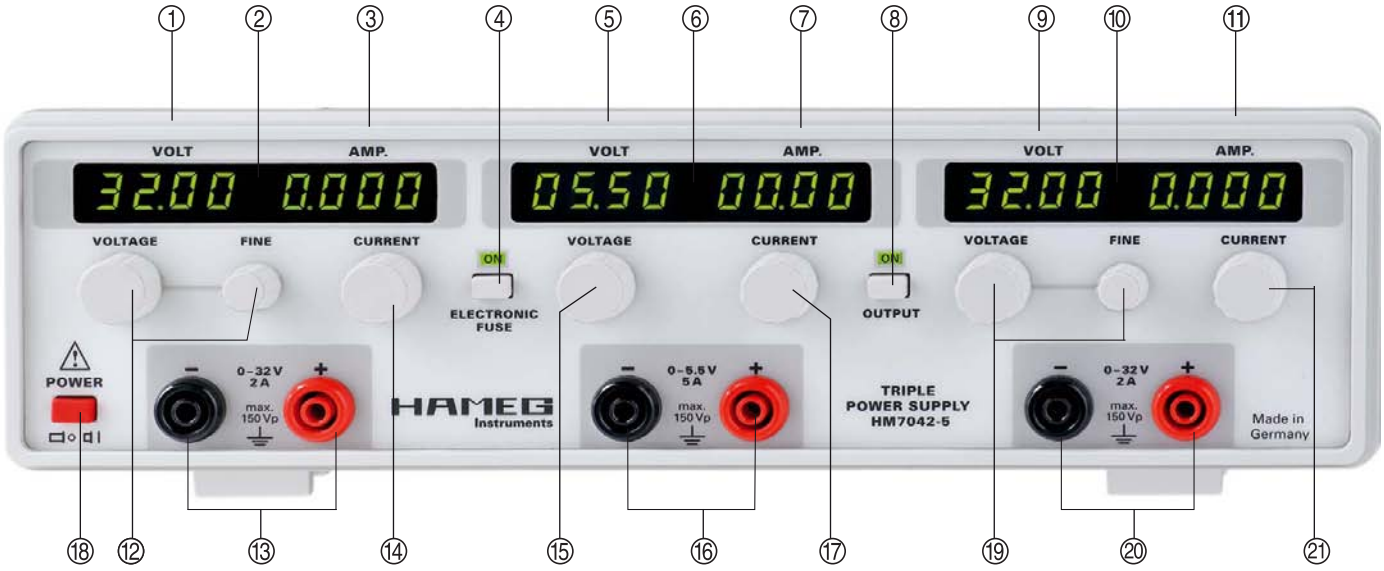
⑥ LED
If the current limit I_{max} is reached this LED will light up.

⑦ AMP.
3 digit displays (7 segment LEDs) of actual output currents, resolution 10 mA. We recommend to set the output current I_{max} prior to turning on the output voltages.

⑮ VOLTAGE
Rotary control for setting the 0 – 5.5 V

⑯ 0 – 5.5V / 5A
Output, 4 mm safety connectors.

⑰ CURRENT
Rotary control for setting the maximum output current 0 – 5 A. If the control is turned CCW to 0 A all outpts will be turned



Operating controls

Front panel

① ⑤ ⑨ **VOLT** ③ ⑦ ⑪ **AMP.** ② ⑥ ⑩ **LED**	Voltage display Current display Current limit indicator
④ **ELECTRONIC FUSE**	Selector of functions electronic fuse/current limit LED will light if electronic fuse function enabled
⑧ **OUTPUT**	Switching ON/OFF of all channels LED indicates status on
⑫ ⑲ **VOLTAGE/FINE**	Fine/coarse adjustment of output voltage 0...32V
⑮ **VOLTAGE**	Adjustment of output voltage 0...5.5V
⑭ ⑰ ㉑ **CURRENT**	Adjustment of current limit I_{max} of both current limit and electronic fuse threshold
⑬ ⑳ **0 – 32V / 2A**	Safety terminals of the 32-V-outputs
⑯ **0 – 5.5V / 5A**	Safety terminals of the 5-V-output
⑱ **Power button**	

Rear panel

㉒ **Voltage selector**	Choice of mains voltage (115V/230V)
㉓ **Power receptacle**	with line fuse

off immediately if the mode "electronic fuse" was selected. In "current limit" mode the LED ⑥ will light up, the voltage will drop to zero.

④ ELECTRONIC FUSE
This pushbutton will activate the electronic fuse mode, indicated by LED [ON].

Current limiting
After turn-on of the power supply it will always start in the "Current limit" mode.
Using the CURRENT ⑭ ⑰ ㉑ controls the maximum output current I_{max} can be set for each output separately. Onset of current limiting in one channel will not influence the others.
In order to adjust I_{max} the appropriate output has to be short-circuited first, then I_{max} can be set, the associated LED ② ⑥ or ⑩ will light up and indicate the current limit mode.

Electronic fuse (Fuse)
Prior to selection of this mode the current limits have to be set using the CURRENT ⑭ ⑰ ㉑ controls. As outlined each output has to be short-circuited first before adjusting the appropriate CURRENT control. After setting I_{max}, the short has to be removed. Then Electronic Fuse ④ is depressed, the LED [ON] will light up indicating that the HM7042-5 is in the Electronic Fuse mode. In this mode all outputs will be immediately deactivated if the I_{max} of one channel is reached. In order to leave this mode press Electronic Fuse ④ again.

The current limits can be set using the controls CURRENT ⑭ ⑰ ㉑ 0 – 2 A / 0 – 5 A. If a control is set CCW to 0 A indeed the current will be zero, so the output capacitances will be discharged slowly to 0 V. In "Current Limit" mode the CCW position of a control will cause the associated LED ② ⑥ ⑩ to light up, the output voltage will decrease slowly. In the "Electronic Fuse" mode the CCW position of any CURRENT control will result in immediate switching off of all channels after depressing OUPUT ⑧.

⑧ OUTPUT
Pushbutton for turning all 3 channels simultaneously ON/OFF, indicated by the LED [ON]. The voltage displays will remain unaffected.

⑱ Mains switch