

**Specifications HM7042-3 ..... 7**

**Operating Manual ..... 8**

    General information ..... 8

    Symbols as Marked on Equipment ..... 8

    Safety ..... 8

    Operating conditions ..... 9

    Warranty ..... 9

    Maintenance ..... 10

    Line Voltage ..... 10

    Changing fuses ..... 11

**HM7042-3 Function controls ..... 12**

**Tips for use ..... 13**

    Operating modes ..... 13

    Current limit ..... 14

    Increase of output voltage and output current ..... 14

    Security note ..... 14

    Output power of the HM7042-3 ..... 15

    Thermal overload protection ..... 15

**Functional test ..... 16**

    Instruments required ..... 16

    1) Voltage check ..... 16

    2) Current check ..... 17

    3) Check of maximum current limit ..... 17

    4) Check of current display ..... 17

    6) Check of internal resistance of 2,7V - 5,5V source ..... 18

    7) Check of ripple (0V - 32V sources) ..... 18

## **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 severer 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. Without a special instruction in the manual for a reduced cable length, the maximum cable length of a dataline must be less than 3 meters long. If an interface has several connectors only one connector must have a connection to a cable.

Basically interconnections must have a double screening. For IEEE-bus purposes the double screened cables HZ72S and HZ72L from HAMEG are 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.**

Under the presence of strong high frequency electric or magnetic fields, even with careful setup of the measuring equipment an influence of such signals is unavoidable. This will not cause damage or put the instrument out of operation. Small deviations of the measuring value (reading) exceeding the instruments specifications may result from such conditions in individual cases.

**HAMEG GmbH**

KONFORMITÄTSERKLÄRUNG  
DECLARATION OF CONFORMITY  
DECLARATION DE CONFORMITE



**HAMEG**<sup>®</sup>  
Instruments

Name und Adresse des Herstellers  
Manufacturer's name and address  
Nom et adresse du fabricant

HAMEG GmbH  
Kelsterbacherstraße 15-19  
D - 60528 Frankfurt

HAMEG S.a.r.l.  
5, av de la République  
F - 94800 Villejuif

Die HAMEG GmbH / HAMEG S.a.r.l. bescheinigt die Konformität für das Produkt  
The HAMEG GmbH / HAMEG S.a.r.l. herewith declares conformity of the product  
HAMEG GmbH / HAMEG S.a.r.l. déclare la conformité du produit

Bezeichnung / Product name / Designation: **Labornetzgerät/Power Supply/Alimentation**

Typ / Type / Type: **HM7042-3**

mit / with / avec: -

Optionen / Options / Options: -

mit den folgenden Bestimmungen / with applicable regulations / avec les directives suivantes

EMV Richtlinie 89/336/EWG ergänzt durch 91/263/EWG, 92/31/EWG  
EMC Directive 89/336/EEC amended by 91/263/EWG, 92/31/EEC  
Directive EMC 89/336/CEE amendée par 91/263/EWG, 92/31/CEE

Niederspannungsrichtlinie 73/23/EWG ergänzt durch 93/68/EWG  
Low-Voltage Equipment Directive 73/23/EEC amended by 93/68/EEC  
Directive des équipements basse tension 73/23/CEE amendée par 93/68/CEE

Angewendete harmonisierte Normen / Harmonized standards applied / Normes harmonisées utilisées

Sicherheit / Safety / Sécurité

EN 61010-1: 1993 / IEC (CEI) 1010-1: 1990 A 1: 1992 / VDE 0411: 1994  
EN 61010-1/A2: 1995 / IEC 1010-1/A2: 1995 / VDE 0411 Teil1/A1:1996-05  
Überspannungskategorie / Overvoltage category / Catégorie de surtension: II  
Verschmutzungsgrad / Degree of pollution / Degré de pollution: 2

Elektromagnetische Verträglichkeit / Electromagnetic compatibility / Compatibilité électromagnétique

EN 50082-2: 1995 / VDE 0839 T82-2  
ENV 50140: 1993 / IEC (CEI) 1004-4-3: 1995 / VDE 0847 T3  
ENV 50141: 1993 / IEC (CEI) 1000-4-6 / VDE 0843 / 6  
EN 61000-4-2: 1995 / IEC (CEI) 1000-4-2: 1995 / VDE 0847 T4-2: Prüfschärfe / Level / Niveau = 2

EN 61000-4-4: 1995 / IEC (CEI) 1000-4-4: 1995 / VDE 0847 T4-4: Prüfschärfe / Level / Niveau = 3

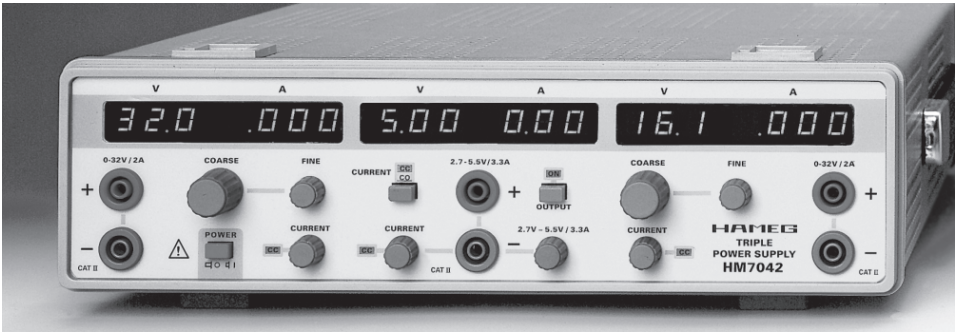
EN 50081-1: 1992 / EN 55011: 1991 / CISPR11: 1991 / VDE0875 T11: 1992

Gruppe / group / groupe = 1, Klasse / Class / Classe = B

Datum /Date /Date  
16.12.1998

Unterschrift / Signature / Signatur

E. Baumgartner  
Technical Manager  
Directeur Technique



## Triple Power Supply HM7042-3

- 2x0 - 32V / 2A and 1x2.7- 5.5V / 5A
- Floating Outputs
- Digital Displays for Voltage and Current
- Adjustable Current Limiter
- Parallel and Serial Operation
- Output Power up to 146 W
- Thermic protection
- Temperatur controlled fan

The **HM7042-3** Triple Power Supply is a compactsize instrument developed for current and voltage supply requirements in the laboratory field. This new designed instrument combines high efficiency with low ripple and noise. A high performance DC/DC converter is used as a pre regulator followed by a linear voltage regulator. With this technic a high output power - **up to 146 W** could be achived by small cabinet dimensions. There are a total of **three independent floating** voltages wich allow **serial** or **parallel** operation.

Two outputs are continously variable from **0 - 32V** and have a maximum current of **2A**. In addition to the two voltages, the **HM7042-3** has a third output, variable between **2.7V** and **5.5V** by a maximum current of **5A**. This feature is very interesting for the supply of low-voltage CMOS or TTL components. Current limiting are continuously variable for all the three outputs. Based on the load the change-over from voltage control to current control is performed automatically and is indicated via LEDs. The Voltage is displayed with **3 ½** and the current with **3** digits.

The **HM7042-3** possesses every safety feature necessary to ensure problem-free operation. For safe and practical operation, and protection of sensitive or symmetrical curcuits, all outputs can be switched On/Off simultaneously with a pushbutton. The built-in fan is temperature-controlled and starts operating after the inside temperature reached 40°C. Due to its high quality standard the **HM7042-3** is stackable with other **HAMEG** instruments, will always be a cost-effective alternative which rivals other, more expensive units.

# Specifications HM7042-3

(Reference Temperature: 23°C ± 1°C)

## Voltages 2x0-32V

<b>Range:</b>	continuously variable 0-32V via coarse and fine voltage output controls
<b>Resolution of display</b>	100mV
<b>Output current</b>	2x 0 - 2 A
<b>Setting range of current limit.</b>	continuously variable 2x0.02 - 2A
<b>Resolution of display</b>	(range 0-1999mA) 1mA (range≤2.0A) 10mA
<b>Minimum output</b>	10mV

## Voltages 2.7V - 5.5V

<b>Range:</b>	2.7 - 5.5V(±0.1v)
<b>Resolution of display</b>	10mV
<b>Output current</b>	0 - 5A
<b>Setting range of current limit.</b>	0.05 - 5A
<b>Resolution of display</b>	10mA

## General Information

<b>Internal resistance:</b>	(static) typ. 7mΩ (dynamic) typ. 200mΩ
<b>Stability:</b>	≤2.5mV at line voltage variations of up to 10%
<b>Recovery time:</b>	≤80μs
<b>Load regulation:</b>	(Outp.Voltage>2.5V) ≤0.05%
<b>Temperature coefficient:</b>	≤0.1%/°C
<b>Ripple and noise:</b>	≤1mV (fo: 100 kHz)

All outputs are **floating**. Can float up to ±100V of ground. Series connection of all outputs possible. Outputs are switchable from the front panel.  
Built-in overheating protection and fan is supplied.

<b>Operating modes:</b>	constant voltage (CV) constant current (CC) overload controll
-------------------------	---

## Display

Six 3-digit 7-segment LED-displays with separate indication for V and mA;  
LED Current limit indicator

## Miscellaneous

<b>Line voltage:</b>	115/230V AC ±10%, 50/60Hz
<b>Power consumption:</b>	approx. 250 Watt at full load
<b>Min./Max. ambient temperature:</b>	0°C...+40°C
<b>Protective system:</b>	Safety class I (IEC 1010-1)
<b>Weight:</b>	approx. 6kg, color: techno-brown
<b>Cabinet:</b>	<b>W</b> 285, <b>H</b> 75, <b>D</b> 365 mm

# Operating Manual

## General information

The operator should carefully read the following instructions to avoid any operating errors and to be fully acquainted with the instrument when later in use. After unpacking the instrument, check for any mechanical damage or loose parts inside. Should there be any transportation damage, inform the supplier immediately and do not put the instrument into operation.

## Symbols as Marked on Equipment



ATTENTION refer to manual.



DANGER High voltage.



Protective ground (earth) terminal.

## Safety

This instrument has been designed and tested in accordance with IEC Publication 1010-1, Safety requirements for electrical equipment for measurement, control, and laboratory use. It corresponds as well to the the CENELEC regulations EN 61010-1. All case and chassis parts are connected to the safety earth conductor. Corresponding to Safety Class 1 regulations (three-conductor AC power cable). Without an isolating transformer, the instruments power cable must be plugged into an approved three-contact electrical outlet, which meets International Electrotechnical Commission (IEC) safety standards.



### ***Warning!***

***Any interruption of the protective conductor inside or outside the instrument or disconnection of the protective earth terminal is likely to make the instrument dangerous. Intentional interruption is prohibited.***

The instrument must be disconnected and secured against unintentional operation if there is any suggestion that safe operation is not possible. This may occur:

- if the instrument has visible damage,
- if the instrument has loose parts.

- if the instrument does not function,
- after long storage under unfavourable circumstances (e.g. outdoors or in moist environments),
- after excessive transportation conditions (e.g. in poor packaging).

When removing or replacing the metal case, the instrument must be completely disconnected from the mains supply. If any measurement or calibration procedures are unavoidable on the opened-up instrument, these must only be carried out by qualified personnel acquainted with the danger involved.

## Operating conditions

The ambient temperature range during operation should be between +10°C and +40°C and should not exceed -40°C or +70°C during transport or storage. The operational position is optional, however, the ventilation holes - on the right and left side - has to be kept free.

## Warranty

Before being shipped, each instrument must pass a 24 hour quality control test. Provided the instrument has not undergone any modifications Hameg warrants that all products of its own manufacture conform to Hameg specifications and are free from defects in material and workmanship when used under normal operating conditions and with the service conditions for which they were furnished. The obligation of HAMEG hereunder shall expire **two (2) years** after delivery and is limited to repairing, or at its option, replacing without charge, any such product which in Hamegs sole opinion proves to be defective with the scope of this warranty.

This is Hamegs sole warranty with respect to the products delivered hereunder. No statement, representation, agreement or understanding, oral or written, made by an agent, distributor, representative or employee of, which is not contained in this warranty will be binding upon Hameg, unless made in writing and executed by an authorized Hameg employee. Hameg makes no other warranty of any kind whatsoever, expressed or implied, and all implied warranties of merchantability and fitness for a particular use which exceed the aforestated obligation are hereby disclaimed by Hameg. Hameg is not liable to buyer, in contract or in tort, for any special, indirect, incidental or consequential damages, express losses or delays however caused.

In case of any complaint, attach a tag to the instrument with a description of the fault observed. Please supply name and department, address and telephone number to ensure rapid service.

The instrument should be returned in its original packaging for maximum protection. We regret that transportation damage due to poor packaging is not covered by this warranty.

## **Maintenance**

The most important characteristics of the instruments should be periodically checked according to the instructions provided in the sections "Operational check and "Alignment procedure". To obtain the normal operating temperature, the instrument should be turned on at least 30 minutes before starting the test. The specified alignment procedure should be strictly observed.

For cleaning use a brush or wet a soft cotton cloth with cleaning solution. For the displays use only water.

Do not spray cleaner in the instrument or onto the displays.

Do not use cleaning solutions containing fluoride, acids or alkalis

When removing the case detach mains/line cord and any other connected cables from the instrument. Remove all screws on rear panel and, holding case firmly in place, pull chassis forward out of case. When later replacing the case, care should be taken to ensure that it properly fits under the edges of the front and rear frames.

When reclosing the instrument, care should be taken that the case fits correctly with the front and rear panel.

## **Line Voltage**

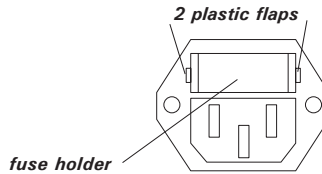
Before connecting the instrument, check that the instrument is set to the correct mains/line voltage. All instruments shipped to West European countries are preset to 230V~. For switching over to 115V~ use the mains/line selector switch on the rear side of the instrument.



## Changing fuses

### ***Procedure***

1. Disconnect mains cable. Mains connector and fuse holder form a union and are located on the back of instrument.
2. Push the 2 plastic flaps of the fuse holder toward each other using a small screwdriver.
3. The fuse holder can now be taken out of the socket.
4. Take out fuses of the fuse holder and insert new fuses.
5. Only use original fuses as shown in the table below and insert them into fuse holder.
6. Insert fuse holder into socket.



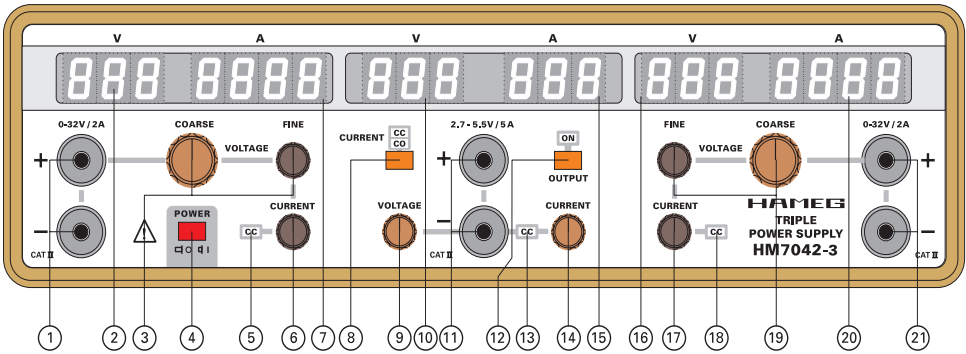
***The use of "repaired" fuses or shorting the fuse holder terminals is not permitted. Damages caused by such actions are not covered by the warranty.***



***Fuse type:  
Size (5x20) mm; 250 VAC, C;  
Slow blow (T)***

***Mains voltage 115V ±10% Fuse rating T 4A  
Mains voltage 230V ±10% Fuse rating T 2A***

## HM7042-3 Function controls



### (4) Power

Mains switch

### (2)/(10)/(16) Voltage Display (7-segment LED)

Resolution for 0 - 32V Outputs is 100 mV . For 2.7 - 5.5 V is 10 mV.

### (7)/(15)/(20) Current Display (7-segment LED)

Resolution for 0 - 32V output 1mA;  
above 2A 10mA. For 2.7 - 5.5 V 10mA.

If the selected current limit is reached, the **constant current LEDs (5)/(13) or (18)** will show a red light "CC" This indicates that the power supply is working as a constant current source at the moment. For each output is such a LED present. The transition from constant voltage mode to constant current mode and back is done automatically, indicated by the LED's "CC" on front panel. (on or off)

### (3)/(21) Output 0V - 32V

Contact safe sockets for 4-mm banana pins. Short circuit protection. (The output can be shorted infinitely.)

### (3)/(19) Coarse / Fine

Rotary knobs for coarse and fine adjustment of output voltages for left (1) and right (21) outputs. Range for coarse is **0 - 32V**, for fine about **0 - 1,4V**.

### (11) Output (2.7V - 5.5V)

Contact safe sockets for 4-mm banana pins. Short circuit protection. (The output can be shorted infinitely.)

### **(9) Voltage (2.7V - 5.5V)**

Potentiometer for adjustment of output voltage 2.7 -5.7V (Middle output)

### **(6)/(14)/(17) Current Limits**

Potentiometers for continuous adjustment of current limits of the power supply .

The range is **0 - 2A** for the outputs 0 -32V. For the 2.7 - 5.5V output **0 - 5A**

If constant current mode is **activated LED (5)/(13)/(18)** is illuminated **red**. In this case the output voltage cannot be increased with the **"coarse"** and **"fine"** controls **(3)/(19)** resp. **(9)**. A constant current is provided at the banana sockets **(1)/(11)/(21)**. The value depends on settings of the potentiometers **(6)/(14)/(17)**.

### **(8) Current**

Control button to change operation mode:

**"CC"** = Constant Current operation

**"CO"** = Current is off

### **(12) Output**

Pushbuttons for switching off all 3 output voltages **(1)/(11)/(21)**. Only when **button (12) is activated** (LED is illuminated) are the output voltages connected to the banana sockets.

## **Tips for use**

The output power of the **HM7042-3** is not activated by switching on the instrument. This is for protection of the load, connected to the output. The pushbutton **(12)** "output" should therefore not in the "on" position before all correct setting of voltages are made. Pushbutton **(12)** should be not activated until all settings are made. This pushbutton is useful also for disconnecting the source from the load for any reason. The digital displays **(3)/(10)/(16)** of the **HM7042-3** always shows the actual values of voltage and current of the **3 outputs** . The voltage display is active also when the outputs are disabled, thus permits voltage adjustment prior to connecting any load.

## **Operating modes**

The **HM7042-3** features constant voltage or constant current mode and switch of. The transition between the constant voltage

or constant current modes is automatic. Constant current mode is indicated by a illuminated LED **(5)/(13)/(18)** in the respective display. As long as this LED's are on, the power supply is operating in constant current mode (CC = constant current).

## Current limit

The **HM7042-3** has 3 individual current limits, one for each output voltage. For the **each 0V - 32V** sources the **current limit** can be adjusted **continuously** between **0A and 2A** with the Potentiometers **(6)/(17)**.

The current limit for the **2,7V - 5,5V** source with Potentiometer **(14)**. Continuously 0 -5A

## Increase of output voltage and output current

The **HM7042-3** features 3 supply voltages which are galvanically separated. This enables the user to use the serial and parallel connection of the sources as well as simple operation of three independent sources.



### **Security note**

***The HM7042-3 may exceed the safe low-voltage of 42V in serial operation. This might lead to danger when touching voltage-carrying areas. It is therefore strongly recommended that the HM7042-3 is operated only by qualified personnel acquainted with the dangers involved.***

The maximum output current of the **HM7042-3** is limited to **2A**, if it is used in serial operation.

**Up to** can be obtained by **parallel connection**.

**Not counting the 5.5V source (11)**, the following combinations of current and voltage are possible:



**2 x 0-32V / 2A**

**1 x 0-64V / 1A *Attention! Dangerous voltage level!***

**1 x 0-32V / 4A**

If also using the 5V source, the combinations include also **1 x 2,7-5,5V / 7,3A** and **1 x 69,5V / 2A**.

**Careful operation is required by parallel connection of the 5.5V source with one 32V output.**

By series or parallel connection, some specifications like internal resistance, load regulation and noise of the **HM7042-3** may change.

## Output power of the HM7042-3

The **HM7042-3** is capable of delivering an output power of up to 145 Watts.

By series and parallel connection, the maximum output power does not change. Due to combination of the sources, especially when operating with low voltages and high currents, a high power dissipation and bad cooling may cause a shutdown of the unit.

The **HM7042-3** features a temperature controlled fan. At rising temperature the fan will rotate at higher speed, thus maintaining good heat transfer. For all normal operating conditions the cooling is adequate.

## Thermal overload protection

All outputs of the **HM7042-3** are short-circuit protected. The triple power supply contains two types of thermal overload protection functions.

- 1) A bi-metal in the power transformer interrupts mains voltage. The output sockets **(1)/(11)** and **(21)** are no longer powered. All functions are off. After reaching lower temperature, the unit will switch itself on again (remove shorts!).
- 2) An electronic fuse is integrated in to the **HM7042-3**, which at extrem high temperatures (e.g. caused by shorts on the sockets **(11)**) will disconnect the sources from the output. This mode is indicated by the flashing **LED (12)** on the front panel. The display **(2)/(10)/(16)** will show the previously selected values for voltage.



### **Attention!**

**In this case the unit can only put back in operation with the mains switch (4).**

**This is possible, after a the temperature is below 40°C.**

## Functional test

The **HM7042-3** should regularly be tested to assure proper functioning. The following test checks out the unit's performance and supplies suggestions for adjusting specific values.



***The adjustment below will only be meaningful if the below indicated or equivalent instruments are used.***

Prior to the functional test or adjustment, the instrument has to reach its operating temperature: It should be operated at least 30 minutes before beginning any tests. All specifications in the data sheet apply to an operating temperature of  $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ .

Before opening the unit, carefully read the sections : "security", "warranty" and "service". For the link between measuring instrument and tested unit, shielded cables should be used to avoid external error sources or interference by external factors.

## Instruments required

- 1 digital multimeters (e. g. HM8011-3 or equivalent)
  - resolution voltage  $\leq 100\text{mV}$
  - current  $\leq 1\text{mA}$
- 1 oscilloscope (e. g. HM303 or equivalent.)
- 1 resistor  $2\text{K}\Omega$  1 %

### 1) Voltage check

- 1.1) The maximal output voltage at **(1)/(21)** may vary between **32V** and **33V**.
- 1.2) The minimal output voltage at **(1)/(21)** may vary between **0mV** and **25mV**.  
The load resistance for these measurements is **2K $\Omega$** .
- 1.3) The output voltage of **2.7V** to **5.5V (11)** may not vary more than  **$\pm 0,1\text{V}$**  for currents up to **5A**.
- 1.4) Check of "VOLTS" display.  
The deviation of the display may be  $\pm 1$  digit, therefore a voltmeter with a resolution  $\leq 100\text{mV}$  must be used.

## 2) Current check

- 2.1) The maximum output current must exceed **2A** . Connect the multimeter to the output **(1)/(21)** to measure the current.
- 2.2) Check of current limit (minimum value)  
The current limit must be adjustable to a minimum value of below **10mA**. Adhere to the following test procedure:
- Make a short across sockets **(21)**.
  - Turn potentiometer **(17)** extreme counterclockwise.
  - Rotary knobs **(19)** "coarse" and "fine" must be set to the extreme clockwise position.
  - Push button **(8)** activate "**CC**" (LED shows green)
  - Activate Push button **(12)** "**CC**" (LED is "ON") LED "**CC**" **(18)** appears red.
  - Current value on display (20) must be  $\leq 20\text{mA}$ .  
The same procedure applies likewise to the other **0V - 32V** supply.

## 3) Check of maximum current limit

The maximum output current has to reach the value of **2A** for the 0 - 32V supply.

For the 2.7-5.5V supply 5A. Adhere to the following test procedure:

- Make a short across sockets **(21)**.
- turn potentiometer **(17)** to the extreme clockwise position.
- set rotary knobs **(19)** ("coarse" to counterclockwise and "fine" to clockwise extreme).
- Push button **(8)** activate "**CC**" modes.(LED show green light).
- Push button **(12)** (LED is "ON" ) and LED "**CC**" **(18)** shows red.
- Current displayed on **(20)** must be in excess of  $\leq 2\text{A}$ .  
The same procedure applies likewise to the other **0V - 32V** supply.

## 4) Check of current display

The deviation between an external multimeter (e.g. **HM8011-3**) and the internal display may not exceed  $\pm 2$  digit, in the range from **20mA** to **2A**. Adhere to the following test procedure:

- a) Set mode "CC" using **(8)** ( LED "CC" appears green )
  - b) Set current with **(17)** to 20mA.(Counterclockwise)
  - c) Connect multimeter to the output socket **(21)**.
  - d) The maximum difference between internal display and multimeter may not exceed  $\pm 2$  mA ( $\pm 2$  digits).
  - e) Set a current of **2.05A** using **(17)** and **(19)**.
  - f) Connect multimeter to the output socket **(21)**.
  - g) The display of the **HM7042-3** and the multimeter may not differ more than  $\pm 20\text{mA}$  ( $\pm 2$  digit)
- The same procedure applies likewise to the other **0V - 32V** supply.

### 5) Check of internal resistance of 0 - 32 V supply

The change in output voltage due to a load change may not vary more than 4mV if the load current changes **500mA**.

- a) Connect multimeter to the output socket **(21)**.
- b) Set a current of **100mA** using **(17)** and take note of that value.
- c) Also connect a voltmeter to the output socket**(21)**., and note the measured voltage. =  $U_{out1}$
- d) Increase the current by **500mA**, and take note of that value.
- e) Read voltage on output **(15)** with the voltmeter, and take note of that value. =  $U_{out2}$
- f)  $\Delta U_{out} = U_{out2} - U_{out1} \leq 4\text{mV}$

The same procedure applies likewise to the other **0V - 32V** supply.

### 6) Check of internal resistance of 2,7V - 5,5V source

The change in output voltage due to a load change may not vary more than **7mV** if the load current changes **1000mA**. Measuring procedure is similar to 5), but use an external variable load to set a current.

### 7) Check of ripple (0V - 32V sources)

$U_{pp}$  = Peak-peak of output ripple  
 $U_{rms}$  = RMS value of output ripple

The RMS value of the output ripple of **(1)/(21)** must be inferior to **1mV**, measured over a bandwidth of **100KHz**. This condition must be satisfied for output currents up to **2000mA**.



- a) Connect a load resistance and an oscilloscope (or a multimeter reading true RMS) to the output **(1)/(21)**.
- b) Using **(17)/(19)**, vary the current between **20mA** and **2000mA**.
- c) Check for **U<sub>rms</sub> ≤ 1mV**

