R&S®HMC804x
Power Supply
User Manual

5800451102

Test & Measurement

Benutzerhandbuch / User Manual

Version 04

ROHDE&SCHWARZ

CE

DECLARATION OF CONFORMITY

Manufacturer:
ROHDE & SCHWARZ GmbH & Co. KG · Mühldorfstr. 15 · D-81671 Munich

The ROHDE & SCHWARZ GmbH & Co. KG herewith declares conformity of the product:

Product name:	Programmable 1/2/3 channel Power Supply
Type:	R&S®HMC8041, R&S®HMC8042, R&S®HMC8043
with Options:	HOC740

complies with the provisions of the Directive of the Council of the European Union on the approximation of the laws of the Member States

- relating to electrical equipment for use within defined voltage limits (2006/95/EC) [LVD]
- relating to electromagnetic compatibility (2004/108/EC) [EMCD]
- relating to restriction of the use of hazardous substances in electrical and electronic equipment (2011/65/EC) [RoHS].

Conformity with LVD and EMCD is proven by compliance with the following standards:

EN 61010-1:2011
EN 61326-1:2013
EN 61326-2-1:2013
EN 55011:2009 + A1:2010
EN 61000-3-2:2006 +A1:2009 + A2:2009
EN 61000-3-3:2013

For the assessment of electromagnetic compatibility, the limits of radio interference for Class B equipment as well as the immunity to interference for operation in industry have been used as a basis.

Date: 12.02.2015

Signature:

General Information Regarding the CE Marking

ROHDE & SCHWARZ measuring instruments comply with regulations of the EMC Directive. ROHDE & SCHWARZ is basing the conformity assessment on prevailing generic and product standards. In cases with potentially different thresholds, ROHDE & SCHWARZ instruments apply more rigorous test conditions. Thresholds for business and commercial sectors as well as small business are applicable for interference emission (class 1B). As to the interference immunity, the standard thresholds for the industrial sector apply. Measurement and data lines connected to the measuring instrument significantly affect compliance with specified thresholds. Depending on the respective application, utilized lines may differ. In regards to interference emission and immunity during measurements, it is critical that the following terms and conditions are observed:

1. Data Cables

It is imperative to only use properly shielded cables when connecting measuring instruments and interfaces to external devices (printers, computers, etc.). Unless the manual prescribes an even shorter maximum cable length, data cables (input/output, signal/control) may not exceed a length of 3m and may not be used outside of buildings. If the instrument interface includes multiple ports for interface cables, only one cable at a time may be connected. Generally, interconnections require double-shielded connecting cables.

2. Signal Cables

In general, measuring cables for the transmission of signals between measuring point and measuring instrument should be kept as short as possible. Unless the manual prescribes an even shorter maximum cable length, signal cables (input/output, signal/control) may not exceed a length of 1m and may not be used outside of buildings. In general, all signal cables must be used as shielded conductors (coaxial cable- RG58/U). It is important to ensure proper ground connection. Signal generators require the use of double-shielded coaxial cables (RG223/U, RG214/U).

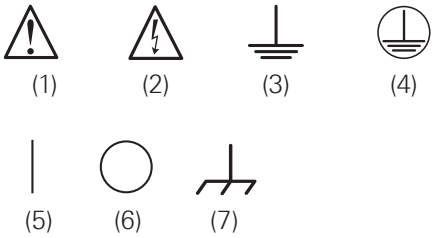
3. Impact on Instruments

If strong high-frequency electric and magnetic fields are present, it may occur despite diligent measurement setup that unwanted signal units are injected into the instrument via connected cables and lines. This does not result in destruction or shutdown of ROHDE & SCHWARZ instruments. In individual cases, external circumstances may cause minor variations in the display and measuring values beyond the selected specifications.

Content

1 Important Notes

1.1 Symbols



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

(5) (6) (7)

Symbol 1: Caution, general danger zone – Refer to product documentation
Symbol 2: Risk of electric shock
Symbol 3: Ground
Symbol 4: PE terminal
Symbol 5: ON (supply voltage)
Symbol 6: OFF (supply voltage)
Symbol 7: Ground terminal

1.2 Unpacking

While unpacking, check the package contents for completeness (measuring instrument, power cable, product CD, possibly optional accessories). After unpacking, check the instrument for mechanical damage occurred during transport and for loose parts inside. In case of transport damage, please inform the supplier immediately. The instrument must not be operated in this case.

1.3 Setting Up the Instrument

As shown in the illustrations, small hinges on the bottom stands can be folded out to set up the instrument in a slightly inclined position. Please make sure that the stands are completely folded out to ensure a stable position.

The instrument must be positioned in a manner that allows the user to disconnect the unit from the mains at any time and without restrictions.

Fig. 1.1: Operating positions

1.4 Safety

This instrument was built in compliance with DIN EN 61010-1 (VDE 0411 part 1), safety regulations for electrical measuring instruments, control units and laboratory equipment. It has been tested and shipped from the plant in safe condition. It is in compliance with the regulations of the European standard EN 61010-1 and the international standard IEC 61010-1. To maintain this condition and to ensure safe operation, the user must observe all instructions and warnings given in this operating manual. Casing, chassis and all measuring ports are connected to a protective earth conductor. The instrument is designed in compliance with the regulations of protection class I.

For safety reasons, the instrument may only be operated with authorized safety sockets. The power cord must be plugged in before signal circuits may be connected. Never use the product if the power cable is damaged. Check regularly if the power cables are in perfect condition. Choose suitable protective measures and installation types to ensure that the power cord cannot be damaged and that no harm is caused by tripping hazards or from electric shock, for instance.

It is prohibited to disconnect the earthed protective connection inside or outside the instrument!

If it is assumed that a safe operation is no longer possible, the instrument must be shut down and secured against any unintended operation.

Safe operation can no longer be assumed:

- If the measuring instrument shows visible damage
- If the measuring instrument includes loose parts
- If the measuring instrument no longer functions properly
- After an extended period of storage under unfavorable conditions (e.g. outdoors or in damp rooms)
- After rough handling during transport (e.g. packaging that does not meet the minimum requirements by post office, railway or forwarding agency).

Exceeding the Low Voltage Protection!
For the series connection of all output voltages, it is possible to exceed the low voltage protection of 42 V. Please note that in this case any contact with live components is life-threatening. It is assumed that only qualified and trained personnel service the power supplies and the connected loads.

Prior to switching on the product, it must be ensured that the nominal voltage setting on the product matches the nominal voltage of the AC supply network. If it is necessary to set a different voltage, the power fuse of the product may have to be changed accordingly.

1.5 Intended Operation

The measuring instrument is intended only for use by personnel familiar with the potential risks of measuring electrical quantities. For safety reasons, the measuring instrument may only be connected to properly installed safety socket outlets. Separating the grounds is prohibited. The power plug must be inserted before signal circuits may be connected.

Use the measuring instrument only with original ROHDE & SCHWARZ measuring equipment, measuring cables and power cord. Never use inadequately measured power cords. Before each measurement, measuring cables must be inspected for damage and replaced if necessary. Damaged or worn components can damage the instrument or cause injury.

The product may be operated only under the operating conditions and in the positions specified by the manufacturer, without the product's ventilation being obstructed. If the manufacturer's specifications are not observed, this can result in electric shock, fire and/or serious personal injury, and in some cases, death. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed.

The measuring instrument is designed for use in the following sectors: Industry, residential, business and commercial areas and small businesses.

The measuring instrument is designed for indoor use only. Before each measurement, you need to verify at a known source if the measuring instrument functions properly.

To disconnect from the mains, the low-heat device socket on the back panel has to be unplugged.

1.6 Ambient Conditions

The allowed operating temperature ranges from +0°C to +40°C (pollution category 2). The maximum relative humidity (without condensation) is at 80%. During storage and transport, the temperature must be between -40°C and +70°C. In case of condensation during transportation or storage, the instrument will require approximately two hours to dry and reach the appropriate temperature prior to operation. The measuring instrument is designed for use in a clean and dry indoor environment. Do not operate with high dust and humidity levels, if danger of explosion exists or with aggressive chemical agents. Any operating position may be used; however adequate air circulation must be maintained. For continuous operation, a horizontal or inclined position (integrated stand) is preferable.

When one or more R&S®HMC804x instruments are installed in a 19" rack, it is important to ensure that sufficient space is available for adequate cooling (see figure below). Required minimum distance: 1 RU

The maximum operating altitude for the instrument is 2000 m. Specifications with tolerance data apply after a warm up period of at least 30 minutes at a temperature of 23°C (tolerance ±2°C). Specifications without tolerance data are average values.

The heat produced inside the R&S®HMC804x is guided to the exterior via temperature-controlled fan. Each channel has its own temperature sensor which checks the heat generation in the instrument and controls the fan speed. However, it is necessary to ensure that there is sufficient space on both instrument sides for the heat exchange. If the temperature inside the instrument still increases to more than ~80°C, a channel-specific overheat protection intervenes. Affected outputs will automatically be switched off.

Do not obstruct the ventilation holes!

1.7 Maintenance

Clean the outer case of the measuring instrument at regular intervals, using a soft, lint-free dust cloth.

The display may only be cleaned with water or an appropriate glass cleaner (not with alcohol or other cleaning agents). Follow this step by rubbing the display down with a dry, clean and lint-free cloth. Do not allow cleaning fluid to enter the instrument. The use of other cleaning agents may damage the labeling or plastic and lacquered surfaces.

Before cleaning the measuring instrument, please make sure that it has been switched off and disconnected from all power supplies (e.g. AC supply network or battery).

No parts of the instruments may be cleaned with chemical cleaning agents (such as alcohol, acetone or cellulose thinner)!

1.8 Warranty and Repair

ROHDE & SCHWARZ instruments are subject to strict quality controls. Prior to leaving the manufacturing site, each instrument undergoes a 10-hour burn-in test. This is followed by extensive functional quality testing to examine all operating modes and to guarantee compliance with the specified technical data. The testing is performed with testing equipment that is calibrated to national standards. The statutory warranty provisions shall be governed by the laws of the country in which the R&S® product was purchased. In case of any complaints, please contact your supplier.

The product may only be opened by authorized and qualified personnel. Prior to working on the product or before the product is opened, it must be disconnected from the AC supply network. Otherwise, personnel will be exposed to the risk of an electric shock.

Any adjustments, replacements of parts, maintenance and repair may be carried out only by authorized ROHDE & SCHWARZ technical personnel. Only original parts may be used for replacing parts relevant to safety (e.g. power switches, power transformers, fuses). A safety test must always be performed after parts relevant to safety have been replaced (visual inspection, PE conductor test, insulation resistance measurement, leakage current measurement, functional test). This helps ensure the continued safety of the product.

1.9 Measurement Categories

This instrument is designed for measurements on circuits that are only indirectly connected to the low voltage mains or not connected at all. The instrument is not intended for measurements within the measurement categories II, III or IV; the maximum potential against earth generated by the user must not exceed 250 V_{DC} (peak value) in this application. The following information refers solely to user safety. Other aspects, such as the maximum voltage, are described in the technical data and must also be observed.

The measurement categories refer to transients that are superimposed on the mains voltage. Transients are short, very fast (steep) current and voltage variations which may occur periodically and non-periodically. The level of potential transients increases as the distance to the source of the low voltage installation decreases.

- **Measurement CAT IV**: Measurements at the source of the low voltage installations (e.g. meters)
- **Measurement CAT III**: Measurements in building installations (e.g. power distribution installations, power switches, firmly installed sockets, firmly installed engines etc.).
- **Measurement CAT II**: Measurements on circuits electronically directly connected to the mains (e.g. household appliances, power tools, etc.)
- **0** (instruments without measured measurement category): Other circuits that are not connected directly to the mains.

1.10 Mains Voltage

The instrument applies 50 Hz / 60 Hz mains voltages ranging from 100 V to 240 V (tolerance ±10%) . Mains voltage switching is not intended. The input line fuse is accessible externally. Power socket and fuse holder form a single unit. You need to first disconnect the power cord from the connector before you can safely replace the fuse (as long as the fuse holder is undamaged). Next the fuse holder must be pried out using a screwdriver. The starting point is a slot next to the contacts. Then the fuse can be forced out of its mounting and must be replaced by an identical fuse (please find information about the fuse type below). The fuse holder will be inserted against the spring pressure until it locks into place. The use of mended fuses or to short circuit the fuse holder is prohibited. Resulting damage are not covered by the warranty.

If the instrument is to remain unattended for a longer time period, it must be switched off at the mains switch for safety reasons.

Fuse type: **T3,15L250V** (size 5 x 20 mm)

Fig. 1.2: Back panel R&S®HMC804x with connectors

1.10 Limits

Fig. 1.3: Connectors on the front panel of the instrument

The R&S®HMC804x is equipped with a protective overload feature. The protective overload feature prevents damage to the instrument and is intended to protect against a possible electrical shock. The maximum values for the instrument must not be exceeded. The protection limits are listed on the front panel of the R&S®HMC804x to ensure the safe operation of the instrument. These protection limits must be adhered to:

Max. output voltage	32 V_{DC}
Max. output current	3 A / 5 A / 10 A (max.100 W)
Max. voltage against earth	250 V_{DC}
Max. counter-electromotive force (CEMF)	33 V_{DC}
Reverse polarity voltage	0.4 V_{DC}
Max. current for reverse polarity voltage	3 A
Power supply	100 V_{AC} to 240 V_{AC} ±10%
Frequency	50 Hz / 60 Hz
Max. power consumption	200 W

1.11 Batteries and Rechargeable Batteries/Cells

If the information regarding batteries and rechargeable batteries/cells is not observed either at all or to the extent necessary, product users may be exposed to the risk of explosions, fire and/or serious personal injury, and, in some cases, death. Batteries and rechargeable batteries with alkaline electrolytes (e.g. lithium cells) must be handled in accordance with the EN 62133 standard.

1. Cells must not be disassembled, opened or crushed.

2. Cells and batteries may not be exposed to heat or fire. Storage in direct sunlight must be avoided. Keep cells and batteries clean and dry. Clean soiled connectors using a dry, clean cloth.

3. Cells or batteries must not be short-circuited. Cells or batteries must not be stored in a box or in a drawer where they can short-circuit each other, or where they can be short-circuited by other conductive materials. Cells and batteries must not be removed from their original packaging until they are ready to be used.

4. Keep cells and batteries out of reach of children. Seek medical assistance immediately if a cell or battery was swallowed.

5. Cells and batteries must not be exposed to any mechanical shocks that are stronger than permitted.

6. If a cell develops a leak, the fluid must not be allowed to come into contact with the skin or eyes. If contact occurs, wash the affected area with plenty of water and seek medical assistance.

7. Improperly replacing or charging cells or batteries can cause explosions. Replace cells or batteries only with the matching type in order to ensure the safety of the product.

8. Cells and batteries must be recycled and kept separate from residual waste. Cells and batteries must be recycled and kept separate from residual waste. Rechargeable batteries and normal batteries that contain lead, mercury or cadmium are hazardous waste. Observe the national regulations regarding waste disposal and recycling.

1.12 Product Disposal

Fig. 1.4: Product labeling in accordance with EN 50419

The Electrical and Electronic Equipment Act implements the following EG directives:

- 2002/96/EG (WEEE) for electrical and electronic equipment waste and
- 2002/95/EG to restrict the use of certain hazardous substances iin electronic equipment (RoHS directive).

Once its lifetime has ended, this product should be disposed of separately from your household waste. The disposal at municipal collection sites for electronic equipment is also not permitted. As mandated for all manufacturers by the Electrical and Electronic Equipment Act (ElektroG), ROHDE & SCHWARZ assumes full responsibility for the ecological disposal or the recycling at the end-of-life of their products.

Please contact your local service partner to dispose of the product.

2 Description of the Operating Elements

Front panel of R&S®HMC8043

1 Display - Color display (320 x 240 pixel)
2 Interactive soft menu keys – All relevant functions are directly accessible
3 Function keys – To be used as numeric keypad in SHIFT function
CH1 - Settings for channel 1
CH2 - Settings for channel 2
CH3 - Settings for channel 3
CH1 ON/OFF - Activating / Deactivating channel 1
CH2 ON/OFF - Activating / Deactivating channel 2
CH3 ON/OFF - Activating / Deactivating channel 3
ARB - EasyArb function
ADV - Advanced functions (e.g. OVP, OPP, Fuse etc.)
MEAS - Logging function / power display
MASTER ON/OFF - Selected channels may be switched ON or OFF
TRACK - Activating the tracking function
TRIG - Manual trigger
4 SAVE/RECALL – Loading/storing of instrument settings
5 SETUP – Access to basic instrument settings
6 HELP – Integrated help display
7 SHIFT – Shift key to activate the numeric keypad
8 Universal knob with arrow keys – Setting desired values (edit keys)
9 POWER – On/Off for standby mode
10 USB connector – USB connector to save parameters
11 CH1 (4 mm safety sockets) -
Outputs channel 1; 0 V to 32 V / 3 A (33 W max.)
12 CH2 (4 mm safety sockets) -
Outputs channel 2; 0 V to 32 V / 3 A (33 W max.)
13 CH3 (4mm safety sockets) -
Outputs channel 3; 0 V to 32 V / 3 A (33 W max.)

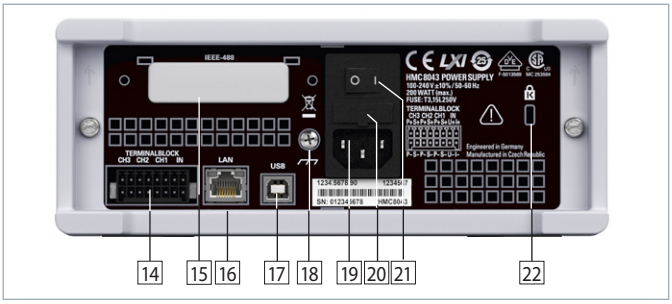


Fig. 2.2: Back panel of R&S®HMC8043

Back Panel of R&S®HMC8043

14 Terminal block - connections for all channels (voltage/ current interface, trigger, sense) for easy integration into 19'' rack systems
15 IEEE-488 (GPIB) interface (option) – Factory-installed only
16 Ethernet (LAN) interface
17 USB interface
18 Ground terminal
19 Low-heat device socket with power switch
20 Fuse
21 Power switch
22 Kensington lock

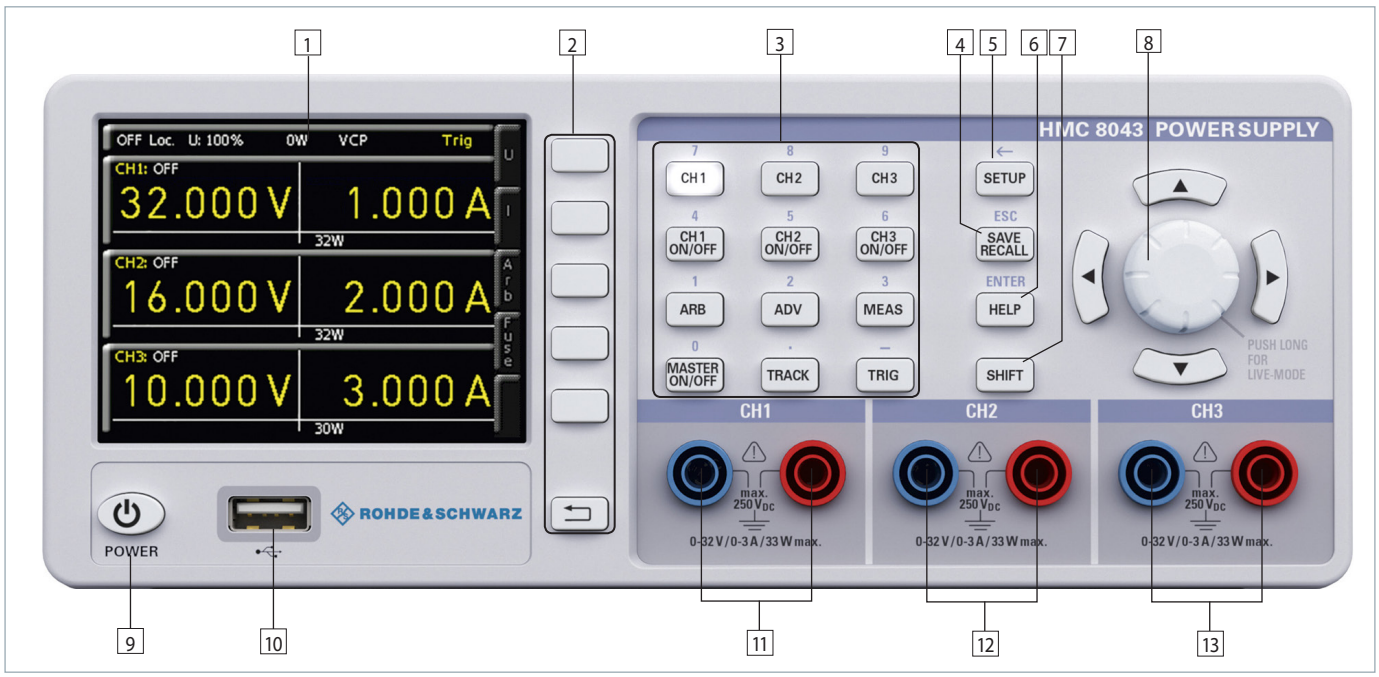


Fig. 2.1: Front panel of the R&S®HMC8043

Front panel of R&S®HMC8042

(for R&S®HMC8042, channel 3 is omitted)

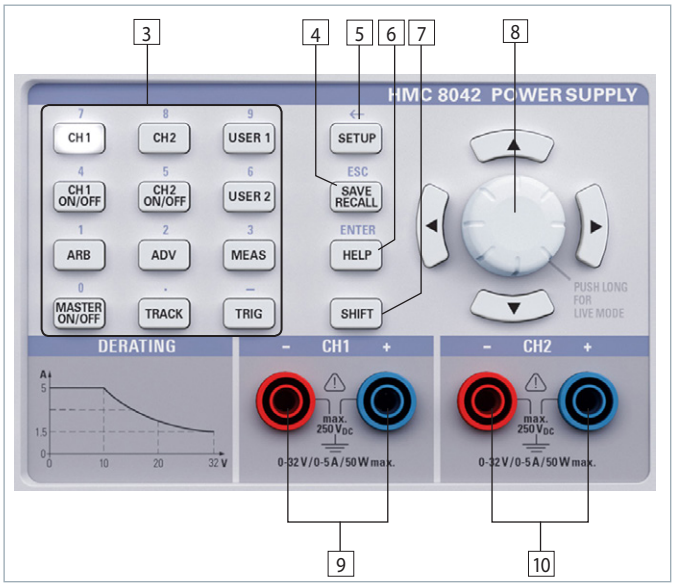


Fig. 2.3: User panel R&S®HMC8042 (2 channel instrument)

Front panel of R&S®HMC8041

(for R&S®HMC8041, channel 2 and channel 3 are omitted)

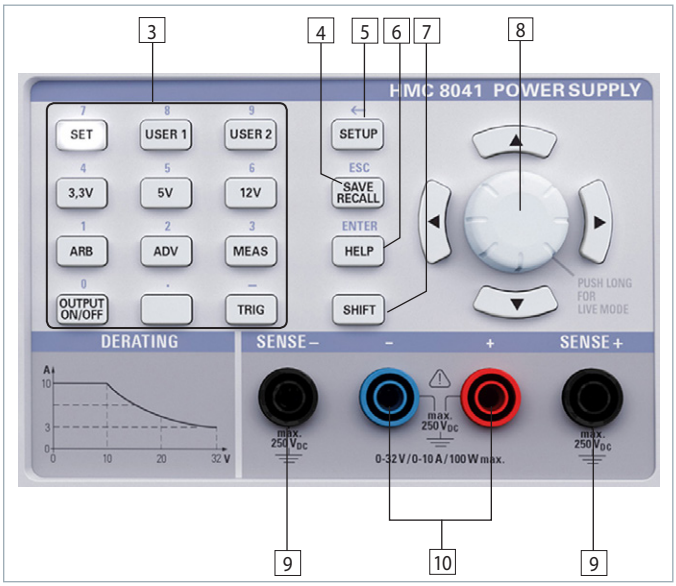


Fig. 2.4: User panel R&S®HMC8041 (1 channel instrument)

1 Display - Color display (320 x 240 pixel)
2 Interactive soft menu keys – All relevant functions are directly accessible
3 Function keys – To be used as numeric keypad in SHIFT function
CH1 - Settings for channel 1
CH2 - Settings for channel 2
USER 1 - Loading/storing of user-defined settings
CH1 ON/OFF - Activating / Deactivating channel 1
CH2 ON/OFF - Activating / Deactivating channel 2
USER 2 - Loading/storing of user-defined settings
ARB - EasyArb function
ADV - Advanced functions (e.g. OVP, OPP, Fuse etc.)
MEAS - Logging function / power display
MASTER ON/OFF - Selected channels may be switched on or off
TRACK - Activating the tracking function
TRIG - Manual trigger
4 SAVE/RECALL – Loading/storing of instrument settings
5 SETUP – Access to basic instrument settings
6 HELP – Integrated help display
7 SHIFT – Shift key to activate the numeric keypad
8 Universal knob with arrow keys – Setting desired values (edit keys)
9 CH1 (4 mm safety sockets) - Outputs channel 1; 0 V to 32 V / 5 A (50 W max.)
10 CH2 (4 mm safety sockets) - Outputs channel 2; 0 V to 32 V / 5 A (50 W max.)

Back Panel of R&S®HMC8042

Refer to back panel of R&S®HMC8043

1 Display - Color display (320 x 240 pixel)
2 Interactive soft menu keys – All relevant functions are directly accessible
3 Function keys – To be used as numeric keypad in SHIFT function
SET - Channel settings
USER 1 - Loading/storing of user-defined settings
USER 2 - Loading/storing of user-defined settings
3.3 V - Voltage setting to 3.3 V
5 V - Voltage setting to 5 V
12 V - Voltage setting to 12 V
ARB - EasyArb function
ADV - Advanced functions (e.g. OVP, OPP, Fuse etc.)
MEAS - Logging function / power display
MASTER ON/OFF - Selected channels may be switched on or off
TRIG - Manual trigger
4 SAVE/RECALL – Loading/storing of instrument settings
5 SETUP – Access to basic instrument settings
6 HELP – Integrated help display
7 SHIFT – Shift key to activate the numeric keypad
8 Universal knob with arrow keys – Setting desired values (edit keys)
9 SENSE + / - (4 mm safety sockets) - Compensating the line resistances
10 CH1 (4 mm safety sockets) - Outputs channel 0 V to 32 V / 10 A (100 W max.)

Back Panel of R&S®HMC8041

Refer to back panel of R&S®HMC8043.

3 Brief Description

The following chapter introduces the most important R&S®HMC804x functions and features.

3.1 Operating the Instrument

Prior to operating the instrument for the first time, please be sure to observe the safety instructions mentioned previously!

After connecting power cord und switching on the power switch on the instrument back panel the R&S®HMC804x can be switched on via POWER ON key on the instrument front panel. When switching the instrument on, the R&S®HMC804x power supply will use the same operating mode that was in use at the time the unit was last switched off. All instrument settings (nominal values) are stored in a nonvolatile memory and will be retrieved when switching the instrument on again. By default, the output signals (MASTER ON/OFF key) are switched off at the beginning of operations. This is intended to prevent a connected load from being serviced unintentionally when switching the instrument on. The intent is also to avoid destruction caused by an exceedingly high voltage or power (due to previously stored instrument settings).

3.2 Selecting the Parameters

Each function and operating mode of the power supply can be selected with the keys on the front panel of the instrument. Use the respective function or channel keys to select basic functions such as voltage, current or Arbitrary settings. Advanced functions are managed by use of soft menu keys to the right of the display. Pressing the SHIFT key activates the numeric keypad.

3.3 Selecting the Channels

To select a channel, press the corresponding channel option key CH1, CH2 or CH3. If you press a channel option key, the channel LEDs are illuminated. Subsequent settings refer to the selected channels. You should always first select the required output voltage and the maximum required power before activating the channels by pressing the CH1 ON/OFF, CH2 ON/OFF or CH3 ON/OFF key. Press the MASTER ON/OFF key to activate the previously selected channels. If the MASTER ON/OFF has been activated, the LED is illuminated.

3.4 Selecting the Output Voltage

To select the output voltage, press the corresponding channel option key (CH1, CH2 or CH3) and the soft menu key VOLTAGE. If the corresponding channel has been activated, the LED is illuminated. If the soft menu key VOLTAGE or CURRENT have been activated, the LEDs for the arrow keys and the SHIFT key will also be illuminated. The nominal value for the output voltage can be selected via know and the numeric keypad. If you wish to select the channel voltage via knob, the VOLTAGE key must be activated so you can select the desired decimal point via arrow keys. The nominal value of the output voltage is increased by turning the knob to the right, and it is decreased by turning it to the left. The same applies to the value selection of the current.

Depending on the instrument type, up to 3 galvanically isolated and hence combinable channels are available. The R&S®HMC8043 has three identical channels with a continuous voltage range of 0 V to 32 V. All instrument types (R&S®HMC8041, R&S®HMC8042, R&S®HMC8043) provide a total operating performance of max. 100 W.

All power supplies feature galvanically isolated, floating overload and short-circuit proof outputs and may be connected in series or in parallel, thus making higher currents and voltages available.

3.5 Tracking-Function

The tracking function allows you to interlink multiple channels. It is possible to change both the voltage and the current limit for the individual channels simultaneously.
To access the Tracking Mode, press the TRACK key. Then you can select the individual channels. If you change the voltage value by using the soft menu key U and the knob, the voltage values of the interlinked channels will be changed by the identical amount. The same applies to the current in relation to the soft menu key I. During tracking, the R&S®HMC804x power supply retains the previously selected voltage and current difference between the channels until a channel has reached the minimum or maximum value of the voltage or current. If the TRACK key has been activated, the LED is illuminated in white. This key remains activated until it is pressed again.

3.6 Fuse Setting

To protect a connected, sensitive load even better, the R&S®HMC804x power supply includes an electronic fuse. The ADV menu and the soft menu key FUSE allow the selection or deletion of fuses. If the electronic fuse has been activated for one or more channels, FUSE will be shown in the display for each selected channel.

The LINK (Fuse Linking) function allows you to logically interlink channels with their electronic fuses. If the current for a channel exceeds the value Imax and if the electronic fuse for this channel has been activated, all channels interlinked with this channel will be switched off. In addition, you can use the soft menu key DELAY to set a fuse delay. For instance, this prevents the fuse to be triggered in case of a capacitive load when switching the instrument on.

3.7 EasyArb Editor

The R&S®HMC804x allows you to generate freely programmable waveforms which can be reproduced within the limits set by the instrument for voltage and current for the respective channel. The arbitrary function can be configured and executed via control panel or external interface.

Press the ARB key to access the Arbitrary menu. Use the soft menu key EDIT to edit the parameters for the freely programmable waveform. The base data for voltage, current and time (duration per point) are required for this purpose. The appropriate base data allow you to generate waveforms, such as a step function or a saw tooth.

The soft menu ACTIVATE allows you to activate the arbitrary function for each channel.

3.8 Storing Data

The R&S®HMC804x power supply can store two different types of data:

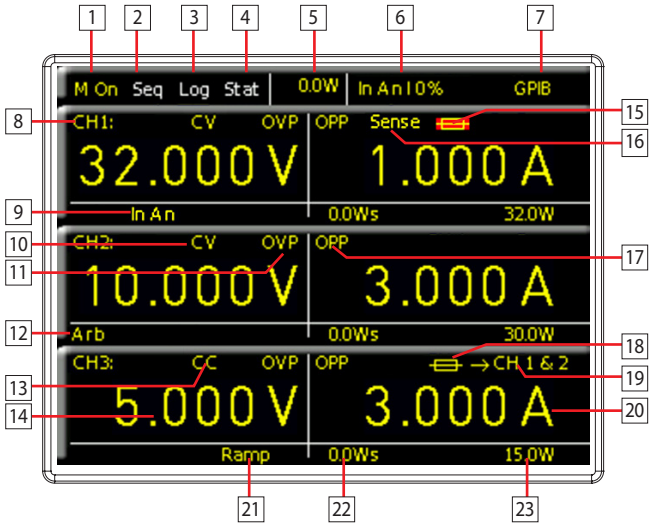
- Instrument settings
- Screenshots

Out of these data types, screen displays can only be stored on a USB stick. Instrument settings can be stored on a USB stick or internally in the instrument to non-volatile storage media.

Press the SAVE/RECALL key to open the menu to save and recall. The soft menu “Device Settings” allows you to load or store instrument settings. Select the submenu SAVE to store the current instrument settings. Select the storage location and the file name, then press the soft menu key SAVE to save the current instrument settings. This file may be reloaded at a later time. The menu item DEFAULT SETTINGS in the main menu also allows you to load the factory default settings.

4 Selecting the Parameters

4.1 Description of the Display



1 Master output (ON/OFF)
2 Sequencing
3 Logging
4 Statistics
5 Total power consumption
6 In An U 0% Analog In
In Trig Rise Trigger In
7 Type of interface: GPIB / USB TMC / USB VCP / LAN
8 Name of channel
9 Analog In (channel)
10 Constant voltage (CV)
11 Overvoltage protection (OPP)
12 EasyArb
13 Constant current (CC)
14 Display of voltage
15 Fuse tripped
16 Sense detection
17 Overload protection (OPP)
18 Electronic fuse set
19 Fuse linking
20 Display of current
21 EasyRamp
22 Energy meter
23 Channel power

The display values of the R&S®HMC8041 differs from the R&S®HMC8042 and R&S®HMC8043. Two different values will be displayed. The upper display value (SET) is the previous adjusted Value for current and voltage. The lower

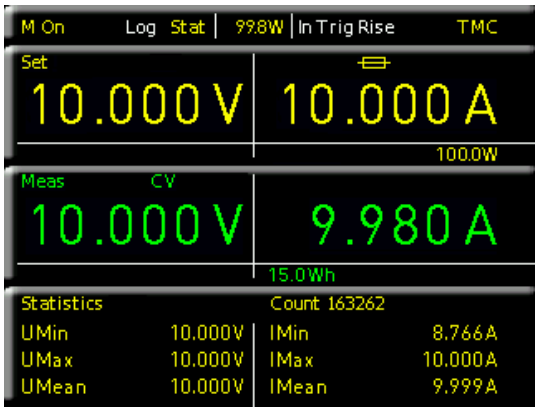


Fig. 4.1 Display values R&S®HMC8041

display value (MEAS) is the measured current and voltage value.

4.2 Selecting the parameters

Each function and operating mode of the power supply can be selected with the keys on the front panel of the instrument. Use the respective function key to select the measurement function. An active measurement function is highlighted by an illuminated white LED. Subsequent settings refer to the selected measurement function.
To set the signal parameters, three options are available:

- Numeric keypad
- Knob
- Arrow keys

Use the soft menu keys to select the respective menu item.

4.2.1 Numeric Keypad

Fig. 4.2: Numeric keypad with function keys

The easiest way to enter a value precisely and promptly is to use the numeric keypad with numeric keys (0...9) and the decimal point key. Pressing the SHIFT key activates the numeric keypad. If the corresponding channel has been selected (CH1, CH2 or CH3) and the soft menu key VOLTAGE or CURRENT has been pressed to enter the parameter, you can use the activated SHIFT key to enter the value via keypad. After entering the voltage or current value, press the corresponding unit to confirm the entry (soft menu key). Before confirming the parameter unit, you can delete any value that has been entered incorrectly by pressing the key ← (SHIFT + SETUP key). The ESC key allows you to cancel the operation to enter parameters. This will close the editing window. If no values have been entered, the instrument will automatically switch back after 20 seconds without data entry (see chapter 8.3.7 Key Fallback Time). Press the ENTER key (SHIFT + HELP key) to confirm characters in text edit mode.

The R&S®HMC8041 and R&S®HMC8042 also offer the option to set predefined voltages by continuously pressing the corresponding key for the output (e.g. 3.3 V). Custom settings can be assigned to the USER1 and USER2 keys. This requires you to press the corresponding key for an extended period. This will store both current and voltage value as well as channel specific settings (such as FUSE, OVP etc.). Briefly pressing the USER1 or USER2 key will load the settings. To avoid destruction of an externally connected circuit due to operating errors, the output will be deactivated before changing the output voltage. This must be reactivated manually.

4.2.2 Knob with Arrow Keys

You can also use the knob to enter the parameter values. The input will be modified gradually, and the respective input parameter will be set instantly. The nominal value is increased by turning the knob to the right, and it is decreased by turning it to the left. Dimensionless values, such as while setting the display, are changed via knob. You can select the desired decimal point via arrow keys.

For instance, if the display shows a voltage of 10.028 V (cursor on the 3rd digit from the right), it is possible to press the knob to set the digits to the right of the cursor to 0 (10.000 V).

4.3 Soft Menu Keys

The soft menu keys on the upper right of the screen allow you to use the shown menu field in the display. Use the numeric keypad or the knob to set the respective selected parameter. If a menu field has been selected via soft menu keys, this function will be marked in yellow and will be activated to set the parameter and function. If a specific setting makes an instrument setting unavailable, the respective soft menu key will be deactivated and the label will be displayed in gray. With the lowest soft menu key  a menu can be closed or a lower menu level can be returned.

4.4 Display of Measurement Values

The R&S®HMC804x power supply has a TFT color display. Depending on the instrument type, up to 3 channels will be shown on the display. The figure in chapter 4.1 shows an overview of the screen layout of the power supply with possible function displays and descriptions.

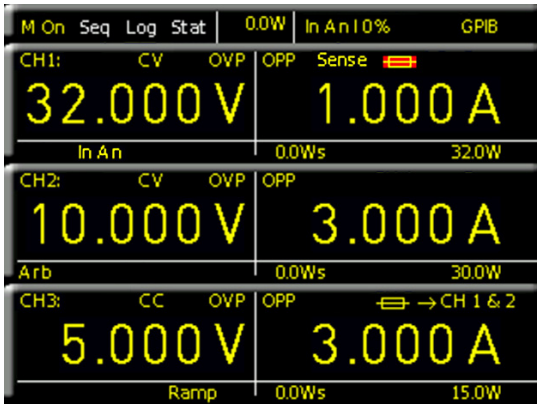


Fig. 4.3 Value display R&S®HMC8043

4.5 Adjustable Maximum Values

Depending on the instrument type different maximum values are adjustable at the power supply:

- **R&S®HMC8041:**
  For the R&S®HMC8041, CH1 continuously provides 0 V to 32 V / 10 A (100 W max.).
- **R&S®HMC8042:**
  For the R&S®HMC8042, CH1 and CH2 continuously provide 0 V to 32 V / 5 A (50 W max. per channel).
- **R&S®HMC8043:**
  For the R&S®HMC8043, CH1, CH2 and CH3 continuously provide 0 V to 32 V / 3 A (33 W max. per channel).

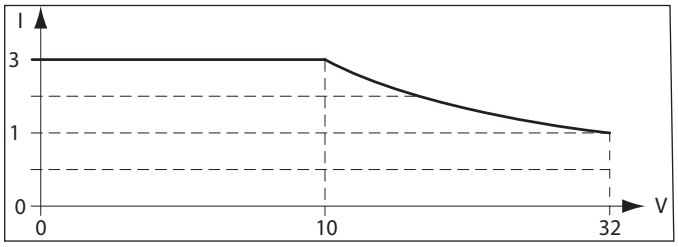


Fig. 4.4: R&S®HMC8043 power hyperbola

4.6 Activating the Channels

After entering the parameters (current/ voltage) of the respective channel, select the corresponding channel via CH1 ON/OFF, CH2 ON/OFF or CH3 ON/OFF key and press the MASTER ON/OFF key to create it at the output. This allows you to conveniently select the desired output parameters up front and subsequently connect to the load via the MASTER ON/OFF key. The respective channel or signal output is active when the key LED is illuminated. Depending on the mode, the display of the respective activated channel also switches to green (CV - constant voltage operating mode) or red (CC - constant current operating mode). If the MASTER ON/OFF is disabled, the display values will be displayed in yellow.

4.7 LIVE Mode

In addition to the already mentioned settings options in the channel short menu, the LIVE mode is also available. The LIVE mode allows you to select the current and voltage values for the respective channel directly on the display. Press the knob for an extended period to activate the LIVE mode. The instrument automatically switches to the voltage input field for channel 1 (CH1). All remaining fields will be grayed out. The values are selected exclusively via knob. Depending on how fast or how slow you turn the knob, the input value will change in large or small increments. Use the arrow keys to select each entry field. Once all settings have been selected, you can exit the LIVE mode by pressing the lowest soft menu key or by pressing the universal knob.

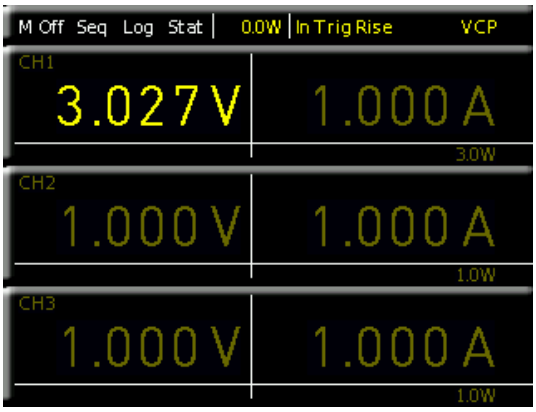


Fig. 4.5 LIVE Mode

5 Instrument Functions

5.1 Constant Voltage (CV) / Constant Current (CC) Operating Mode

The R&S®HMC804x includes two operating modes (CV/CC) and can function as constant voltage source (CV - constant voltage mode) or as constant current source (CC - constant current mode). Depending on the connected load, the instrument switches automatically between constant voltage and constant current mode. After switching on the power the instrument will always be in the constant voltage operating mode. The maximum current I_{MAX} corresponds to the setting on the CURRENT key.

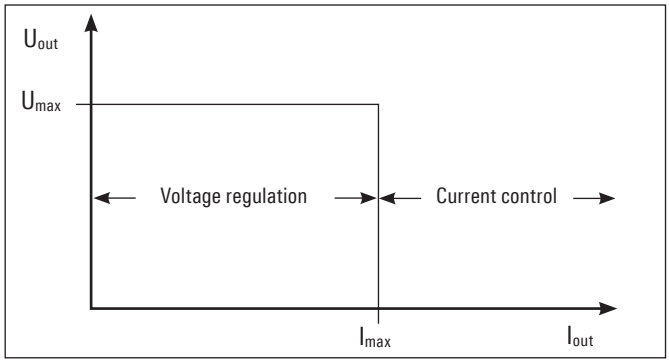


Fig. 5.1: Current limit

After pressing the channel option key, use the soft menu key CURRENT to select the current value via knob, arrow keys or numeric keypad. The current is selected individually for each channel. Once the setting has been completed, press the unit key again.Otherwise, the instrument will automatically switch back after 20 seconds, without the changes taking effect (see chapter 8.3.7 Key Fallback Time).

As the diagram shows, it remains true that $U_{OUT} = U_{MAX}$ will remain stable as long as the output current $I_{OUT} < I_{MAX}$ (voltage regulation). If the selected current value I_{MAX} is exceeded, the current control (Constant Current operating mode) is applied. This means that despite an increased load, the value I_{MAX} can no longer increase. Instead, the voltage U_{OUT} will decrease the nominal value of U_{MAX}. However, the current flow remains limited to I_{MAX}. If the channel and the MASTER ON/OFF key are activated and the selected channel is modified, depending on the operating mode, the display color for the activated channel will switch from green (CV - constant voltage mode) to red (CC - constant current mode).

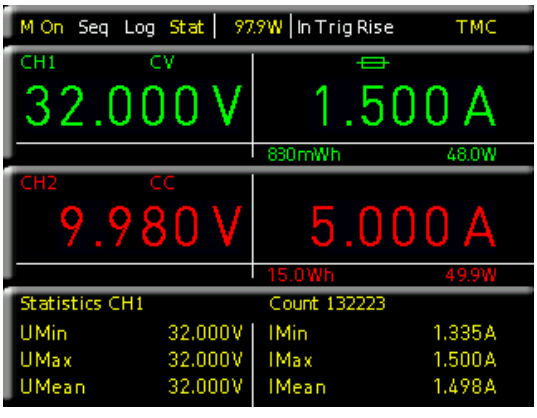


Fig. 5.2: Display values CV/CC R&S®HMC8042

5.2 Fuse

A current limit indicates that only a specific maximum current I_{max} can flow. Prior to operating an experimental circuit, this maximum value will be selected at the power supply; and if the fuse is triggered, the corresponding channel will be deactivated. The intent is to prevent damage to the experimental circuit in case an error occurs (e.g. a short circuit).

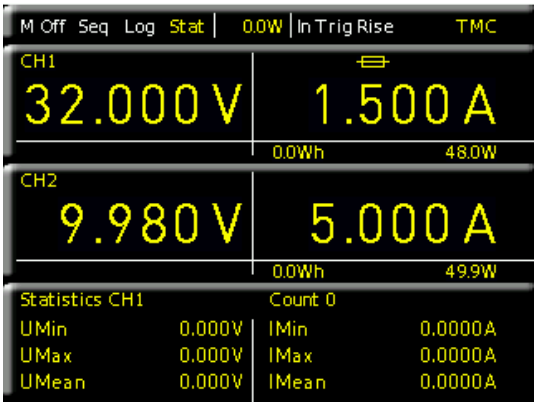


Fig. 5.3: Fuse display CH1

To protect a connected, sensitive load even better, the R&S®HMC804x includes an electronic fuse. The setting for the electronic fuses can be selected via ADV key and soft menu key FUSE. Additionally, the channel option key CH1 / CH2 / CH3 and the soft menu key FUSE allow the selection or deletion of fuses. With the soft menu key CHANNEL the respective channel can be selected. The soft menu key ACTIVATE allows you to activate or deactivate the fuses for the respective channels. If the electronic fuse has been activated for one or more channels, the display will show a fuse icon. If the electronic fuse has been tripped, the fuse icon on the display is flashing red.

5.2.1 Fuse Link

The soft menu key LINKED TO allows you to logically interlink channels with their electronic fuses. Pressing the soft menu key CHANNEL allows you to select or deselect individual channels. An activated link will be displayed with an arrow and the respective interlinked channel. If the current for a channel exceeds the value I_{MAX} and if the electronic fuse for this channel has been activated via FUSE key (see "Setting the Current Limit"), all channels interlinked with this channel will be switched off. The tripped channel will be displayed with a red flashing fuse icon. The fuse of the interlinked channel which has also tripped will be displayed with a red fuse icon. If the electronic fuse is tripped,

the interlinked channels are switched off; however, the MASTER ON/OFF key remains active. At any given time, the outputs can be reactivated via corresponding channel option key. In case of any excess current, it will immediately be switched off again.

Fig. 5.4: Fuse Linking example

Fig. 5.2 shows that exceeding the current limit at CH1 leads to automatically having CH2 and CH3 switched off.

5.2.2 Fuse Delay

The DELAY function allows you to select a fuse delay by 10ms to 10s. This is intended to ignore the current peaks that occur, depending on the load, when the instrument is switched on so the fuse is not triggered (e.g. in case of a capacitive load). This refers exclusively to a fuse trigger delay at the measured channel, not a trigger delay between individual channels. The fuse delay can be changed via knob or numeric keypad. Select the delay for each channel individually by using the respective soft menu key. With the soft menu key CHANNEL the respective channel can be selected.

The fuse delay function is only available when the channel is activated (MASTER ON). This function is not activated in the regular function mode.

5.3 Over Voltage Protection (OVP)

The OVP is individually adjustable for each channel (soft menu key CHANNEL). The over voltage protection is preset at the factory to 32.050 V; however, this may be reduced with the soft menu key LEVEL to match the requirements of the respective application.

You can choose from two different OVP options:

- **Measured** (MEAS): In the MEAS mode, OVP will switch off if the measured value exceeds the set limit.
- **Protected** (PROT): In the PROT mode, the instrument output will not be switched off in case the set limit is exceeded. In addition, the measured value will be monitored (see MEASURED operating mode).

With the soft menu key ACTIVATE the OVP of the respective channel will be activated (ON) or disabled (OFF). If the voltage exceeds the preset value U_{MAX}, the respective channel will be switched off to protect the load. If the over voltage protection is tripped, OVP will flash in the display.

5.4 Overload Protection (OPP)

The overload protection is individually adjustable for each channel (soft menu key CHANNEL). Depending on the instrument type the overload protection is preset at the factory to the maximum power value P_{MAX} (per channel); however, this may be reduced to match the requirements of the respective application. With the soft menu key ACTIVATE the OPP of the respective channel will be activated (ON) or disabled (OFF). If the power exceeds the preset value Pmax, the respective channel will be switched off to protect the load. If the overload protection is tripped, OPP will flash in the display.

5.5 Tracking Function

The TRACK function is only available with R&S®HMC8042 and R&S®HMC8043.

The tracking function allows you to interlink multiple channels. It is possible to change both the voltage and the current limit up to the maximum value for the individual channels simultaneously.

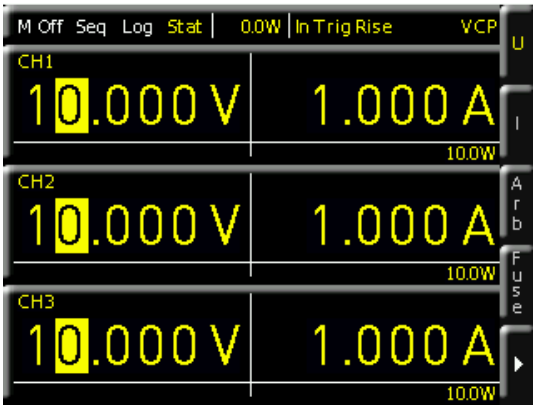


Fig. 5.5: TRACK function

To access the tracking mode, press the TRACK key. After activating the TRACK function (TRACK LED is illuminated) you can select the individual channels via CH1, CH2 and CH3 key. If e.g. the soft menu key U is activated, you can change the voltage of one of these channels via knob or arrow keys, the voltages of the interlinked channels will be changed by the identical amount. The same applies to the current and the usage of the soft menu key I. During tracking, the R&S®HMC804x power supply retains the previously selected voltage and current difference between the channels until a channel has reached the minimum or maximum value of the voltage or current.

The TRACK function can only be used in the local operating mode (frontal operation). The TRACK function may not be used via remote operating mode (SCPI commands) since according to the SCPI standards, each channel is considered an "instrument" and has to be activated separately.

If the TRACK key is activated, the key LED will be illuminated. Once the setting has been completed, press the TRACK key again. Otherwise, the instrument will automatically switch back after 20 seconds, without the changes taking effect (see chapter 8.3.7 Key Fallback Time).

5.6 EasyArb Editor

Press the ARB KEY to access the arbitrary menu. The R&S®HMC804x allows you to generate freely programmable waveforms which can be reproduced within the limits set by the instrument for voltage and current for the respective channel. The arbitrary function can be configured and executed via control panel or external interface. For all practical purposes, each channel has its own arbitrary memory. This means that an arbitrary waveform is generated and that the arbitrary waveform of the respective channel is then started. Use the menu item EDIT to open the EasyArb editor. The parameters for the freely programmable waveform can be edited. The respective channel will be selected via the soft menu key CHANNEL.

Fig. 5.6: EasyArb editor

The base data for voltage, current and time (duration per point) are required for this purpose. The appropriate base data allow you to generate any of the common waveforms (step function, saw tooth, sine, etc.). It is possible to repeat a maximum of 512 arbitrary points (IDX of 0...512). The repetition rate is at a maximum of 65535 repetitions. If the repetition rate (soft menu key REPETITION) is set to "0", the arbitrary function will be repeated infinitely until the waveform will be disabled via soft menu key ACTIVATE OFF. If the arbitrary waveform is disabled, the respective channel will be also disabled. You can select the values via knob or the numeric keypad (SHIFT key). If you select the values via numeric keypad, the values will be confirmed by pushing the knob. Use the arrow key to select the individual columns. Additionally, you have the option to interpolate between the generated points (INTP = Y) or not (INTP = N).

The arbitrary function can not be used with sequencing simultaneously.

Use END BEHAV. on page 2|2 of the EasyArb editor menu to define the arbitrary endpoint behavior, when ARB function is finished. The following menu items are available:

- **OFF** (default setting): In OFF mode the instrument deactivates the respective channel automatically, if the ARB function is finished.
- **HOLD**: In HOLD mode the last defined arbitrary point will be held, if the ARB function is finished; the respective instrument channel will be not disabled.

To generate the arbitrary function, use the soft menu key ACTIVATE (ON/OFF) in the ARB menu or the short menu of the respective channel via soft menu key E.ARB. Once the respective channel (CH1 ON/OFF, CH2 ON/OFF, CH3 ON/OFF) and the output (MASTER ON/OFF) has been activated, the arbitrary waveform will be generated at the output.

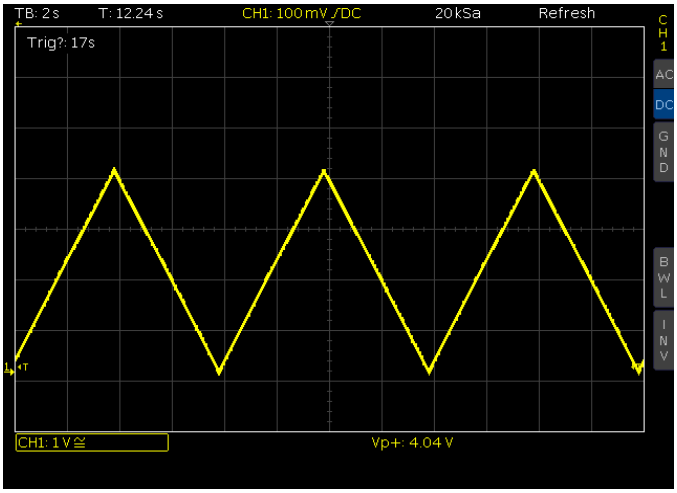


Fig. 5.7: Arbitrary waveform example

With the soft menu key TRIGGERED the manual trigger can be activated (ON) or disabled (OFF). Two different trigger modes are available via soft menu key TRIG. MODE:

- **SINGLE:** By pushing the TRIG key each single arbitrary point will be generated at the output one after another.
- **RUN:** By pushing the TRIG key the whole arbitrary waveform will be generated at the output.

Use SAVE on page 2|2 of the EasyArb editor menu to save the generated waveforms internally or externally on a USB stick which can then be reloaded via LOAD. Via soft menu COPY the defined arbitrary points can be copied to another instrument channel (not available with R&S®HMC8041). The soft menu key CLEAR ALL allows

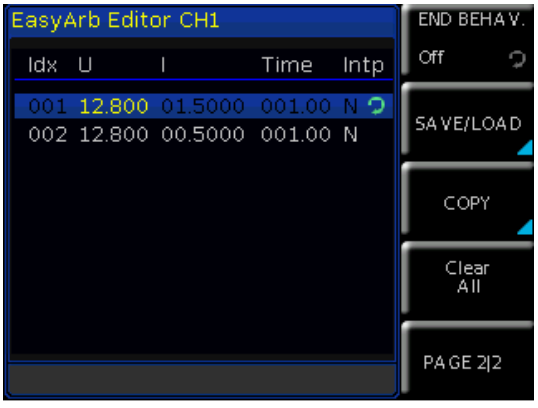


Fig. 5.8: EasyArb Editor page 2|2

you to delete any previously made arbitrary settings of the respective channel.

5.6.1 Data Format Example for an Arbitrary File

#Device;R&S®HMC8043
#Device Name;ABC
#Format;ARB
#Date;2014-09-03
#Rep;0
#EP;4
#Version;01.003-02.401-03.701
#Serial No.;020600484
Idx;U;I;Time;Interp
001;10.500;00.4000;001.00;0
002;13.000;00.4000;001.00;0
003;09.500;00.4000;001.00;0
004;11.000;00.4000;001.00;0

5.6.2 Example of an Arbitrary Waveform (in this case: R&S®HMC8043)

HMC8043

Duration (s)	Voltage (V)	Current (A)	Interpolation
1,00	0,000	1,0000	☑
1,00	1,000	1,0000	☑
1,00	2,000	1,0000	☑
1,00	3,000	1,0000	☑
1,00	4,000	1,0000	☑
1,00	5,000	1,0000	☑
1,00	0,000	1,0000	☑

Fig. 5.9: Arbitrary-editor example (excerpt) HMExplorer software

Alternatively, you can also use the arbitrary software module of the HMExplorer software to create an arbitrary waveform. This allows you to create each point of a waveform by use of the editor. You can add or delete individual points by using the "+" or "–" function. With the function INTERPOLATION the defined arbitrary points can be output interpolated. Once all arbitrary points have been created, the created signal can be transferred to the instrument via interface by using the menu item TRANSFER. The menu TRANSFER opens and allows you to select the respective R&S®HMC channel and the repetitions.

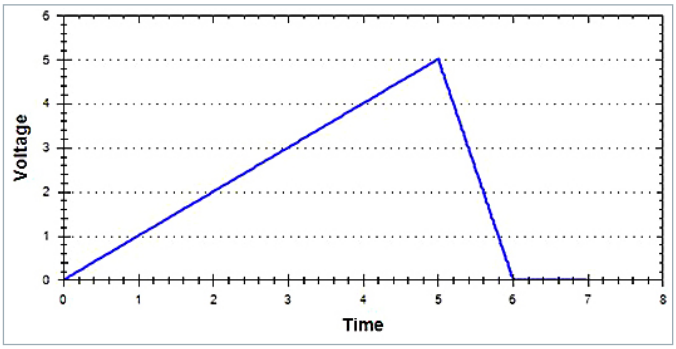


Fig. 5.10: Arbitrary example HMExplorer software

Additionally, you can activate the output to issue the signal directly at the output and to view it on an oscilloscope, for instance (see fig. 5.11).

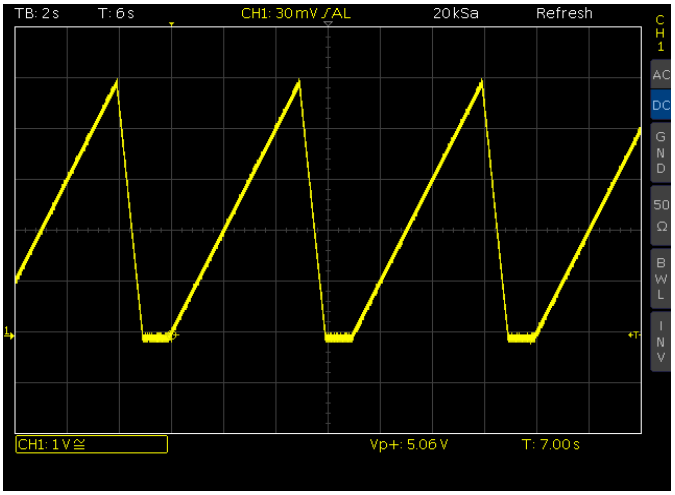


Fig. 5.11: Output arbitrary example on an oscilloscope

For more information about the arbitrary software module, please see the manual of the HMExplorer software.

6 Advanced Operating Functions

6.1 Terminal Connector

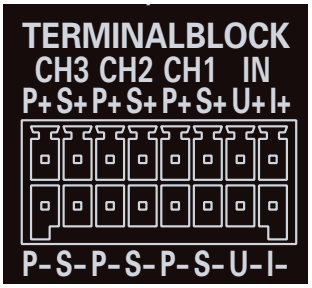


Fig. 6.1: Terminal block with connector assignment

The terminal connector on the back panel of the instrument allows you to execute the voltages / currents of all channels (including SENSE). The 16-pole terminal block includes the following connectors for each channel:

- **P+** (corresponds to + socket on the front panel)
- **P-** (corresponds to - socket on the front panel)
- **S+** and **S-** (SENSE connectors)
- **U+**, **U-**, **I+**, **I-** (voltage/current interface) + **Trigger**

To connect lines, you can use e.g. a plug-in terminal block connector. This allows for the easy integration into 19`` rack systems (please refer to fig. 6.2). The SENSE lines (only available on the back panel for the R&S®HMC8042 and R&S®HMC8043) allow you to compensate voltage drops on the supply lines to the load so that the actual selected voltage is applied to the load. The instrument automatically detects when the SENSE lines are connected and it regulates the output voltage directly at the load. If the SENSE lines are connected via S+ and S-, the display shows SENSE. The maximum compensation value of the lead resistances is 1V.

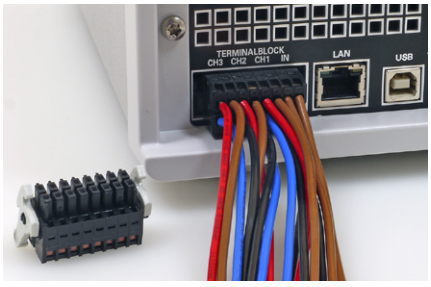


Fig. 6.2: Example plug-in terminal block connector

6.1.1 19“ Rack Mount Kit

To install a 19“ rack, you can use the rack mount set R&S®HZC95. When one or more R&S®HMC804x instruments are installed in a 19“ rack, it is important to ensure that sufficient space is available for adequate cooling (see example for rack mount fig. 6.3).

The installation in 19“ racks requires a minimum distance of 1 RU between the rack frames. When using 1 RU blank covers, it is recommended to choose perforated blank covers.

Fig. 6.3: Example for 19“ rack mount

6.2 Analog In

On the back panel of the instrument, you can find the connectors for analog control signals (please refer to chapter 6.1 terminal connector). The R&S®HMC804x enables you to optionally control the output voltages of the power supply by means of a voltage signal (0 V to 10 V) or current signal (4 mA to 20 mA). Do not connect both sig-nals simultaneously because there is no galvanic isolation between voltage input and current loop. You must exclusively use one mode or the other. The Analog In menu will be opened via soft menu key ANALOG IN. With the soft menu key CHANNEL the respective channel will be chosen, the soft menu key ACT.CH activates the Analog In function for the selected channel. Additionally, the Analog In function can be activated or disabled via the channel short menu (ANALOG IN ON/OFF). Use the soft menu key MODE to differentiate between two different setting modes:

- **LIN:**
  Use the LIN mode to proportionally control the voltage that is set at the front panel of the instrument.
- **STEP:**
  If the threshold is exceeded, the STEP setting issues the voltage of the selected output that is set at the front panel of the instrument. Otherwise 0 V will be issued.

The Analog In function can not be used with sequencing, Easy-Ramp or arbitrary function simultaneously.

The threshold for the STEP mode can be adjusted via soft menu key THRESHOLD. Use the soft menu key INPUT to differentiate between voltage (U) or current signal (I). You can use any combination and configuration for the outputs on which the interface is intended to operate.

6.2.1 Analog In - Example

Fig. 6.4 shows an Analog In example in the operating mode LIN which proportionally controls the voltage set at the front panel of the instrument. An external power supply unit is used as the source. The connection is

established via plug-in terminal block connector which will be connected with the external source. A voltage signal (U+ / U-) is used in this example..

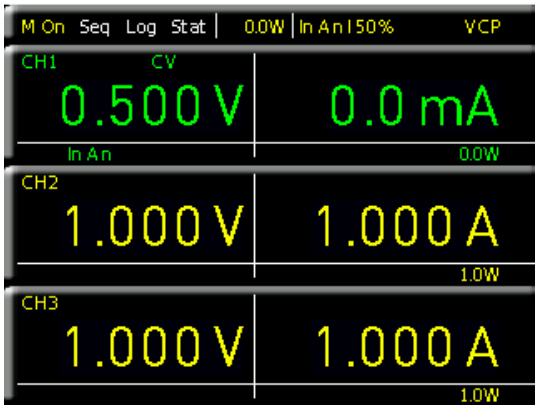


Fig. 6.4: Analog In example

Select a voltage of 5 V at the external source. Set the voltage value for CH1 to 1 Volt. If you activate the Analog In function for CH1 via channel short menu or ADV menu (In An display) below the channel, the voltage value for CH1 will be set to 50% of the previously selected voltage value. In this example, it would correspond to 500 mV. If you increase the voltage for the external source to a maximum of 10 V, the voltage value for CH1 will be set to 100% of the previously selected voltage value. In this example, it would correspond to 1 Volt. Accordingly, the output voltage for CH1 is controlled by means of a current signal. This procedure requires the connectors I+ / I-. If you increase the current value for the external source to 20 mA, the voltage value for CH1 will be set to 100% of the previously selected voltage value. In this example, it would correspond to 1 Volt.

Analog IN and the external trigger function may not be used simultaneously (same socket at the back panel of the instrument).

6.3 Sequencing

The R&S®HMC804x power supply includes a sequencing function that can be adjusted via a menu. Sequencing enables the user to automatically connect available channels consecutively with adjustable time offsets when an output is switched on (MASTER ON/OFF). It is also possible for all channels to be simultaneously switched on or off. The time offset between each channel can be adjusted via soft menu key DELAY from 1ms to 10 s. The sequencing function will be activated and deactivated individually for each channel. Additionally, the sequencing function can be activated by means of a manual trigger. The following sequencing start options are available:

- **Starting sequencing with MASTER ON:**
  Select the corresponding channels in the Sequencing menu (ACT.CH1, ACT.CH2, ACT.CH3), activate the sequencing via soft menu key ACTIVATE and then activate the channels via channel key CH1 ON/OFF, CH2 ON/OFF or CH3 ON/OFF (LED is illuminated). Press the MASTER ON/OFF key to start the selected sequence.

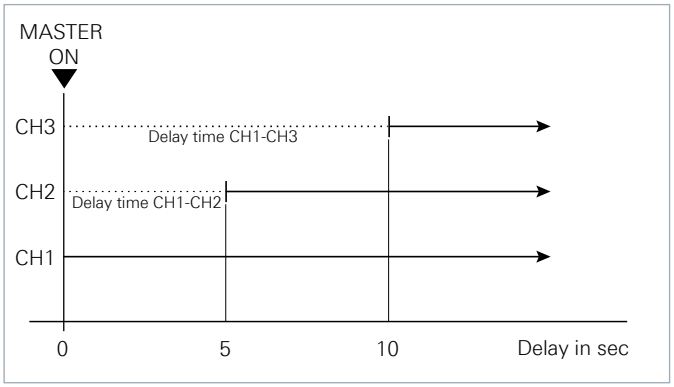


Fig. 6.5: Example for Sequencing

Sequencing can not be used with the arbitrary function simultaneously.

- **Starting sequencing via channel key:**
  Select the corresponding channels in the Sequencing menu (ACT.CH1, ACT.CH2, ACT.CH3), activate the sequencing via soft menu key ACTIVATE and then deactivate the channels via channel key CH1 ON/OFF, CH2 ON/OFF or CH3 ON/OFF. To start the selected sequence when the MASTER ON/OFF key is activated (LED is illuminated), press the channel key of one of the channels included in the sequencing (CH1 ON/OFF, CH2 ON/OFF or CH3 ON/OFF).
- **Starting sequencing via trigger:**
  Select the corresponding channels in the Sequencing menu (ACT.CH1, ACT.CH2, ACT.CH3), activate the sequencing via soft menu key ACTIVATE, then deactivate the channels via channel key CH1 ON/OFF, CH2 ON/OFF or CH3 ON/OFF, and activate the trigger via soft menu key TRIGGERED (ON). To start the selected sequence when the MASTER ON/OFF key is activated (LED is illuminated), press the blinking TRIG key or the channel key CH1 ON/OFF, CH2 ON/OFF or CH3 ON/OFF.

The squencing will be activated by pushing the channel key CH1 ON/OFF, CH2 ON/OFF resp. CH3 ON/OFF, if the channel is within the defined sequence and is activated in the sequencing menu.

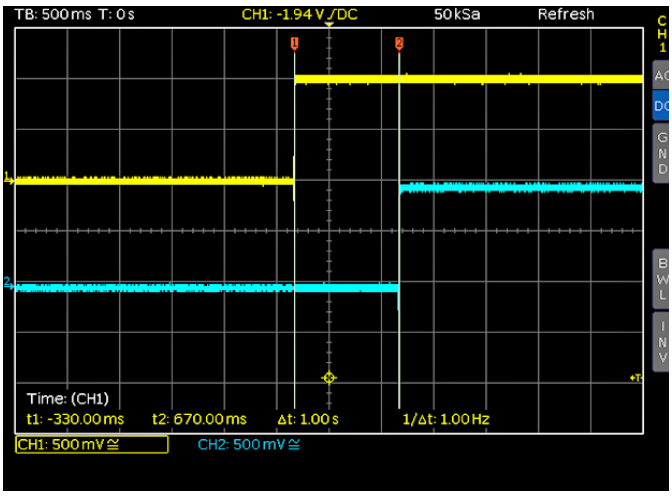


Fig. 6.6: Delay between CH1 and CH2

6.4 External Trigger

You can create an external trigger signal (TTL) to the voltage interface on the back panel of the instrument to start an arbitrary function, for instance, to activate and deactivate sequencing or to activate data logging.

6.5 EasyRamp

EasyRamp can not be used with Analog In and arbitrary function simultaneously.

The power supply includes a EasyRamp function allowing the user to simulate a startup curve. After switching on the channels (MASTER ON), the increase in output voltage and output current will be approximately linear to the set voltage and current value. Use the soft menu key TIME to select the time value during which the voltage and current values are intended to increase. You can modify the time value via knob in 10 ms increments or via numeric keypad. You may enter any time value between 10 ms and 10 s. The soft menu key ACTIVATE enables you to activate (ON) or deactivate (OFF) each channel separately. The start time (TIME) is also selected individually for each channel. Once you have activated one or multiple channels and you use the MASTER ON/OFF key after activating the channels (CH1 ON/OFF, CH2 ON/OFF, CH3 ON/OFF), the increase in voltage and current values will be shown in the display.

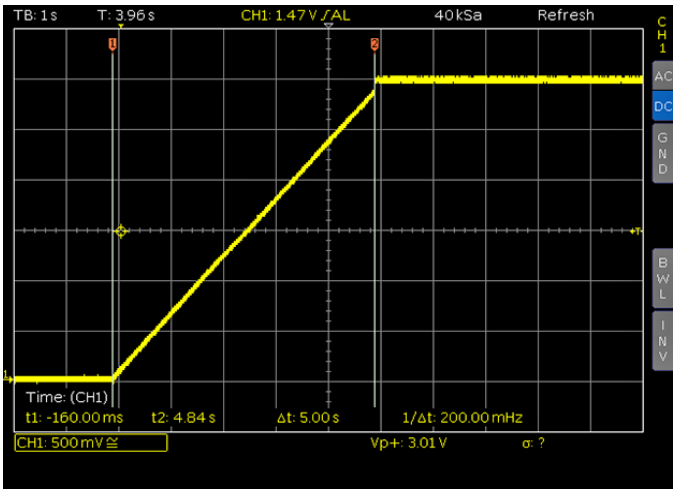


Fig. 6.7: EasyRamp example

6.6 Parallel and Serial Mode

It is assumed that only qualified and trained personnel service the power supplies and the connected consumers.

To increase output voltage and currents, it is possible to operate the channels in serial or parallel mode. These operating modes require that power supplies are suitable for the parallel and/or serial mode. In general, the output voltages to be combined are independent. The outputs for one or multiple power supplies can be interconnected for this purpose.

A serial connection may cause dangerous voltages.

6.6.1 Serial Mode

This type of interconnection adds the individual output voltages. The same current flows through all outputs. The current limits for the outputs wired in series should be set to the identical value. If one of the outputs exceeds the current limit, the total voltage will naturally collapse. It is advisable to set both voltages to a similar value to distribute the loads evenly (not absolutely necessary). If a (low resistance) load is connected, it is essential to activate more than one channel. This could damage the instrument (especially protective diodes). Therefore, it is necessary to always have both channels or no channel at all switched on.

If the instrument switches to constant current operating mode (CC) during a serial connection, the voltage display becomes inaccurate.

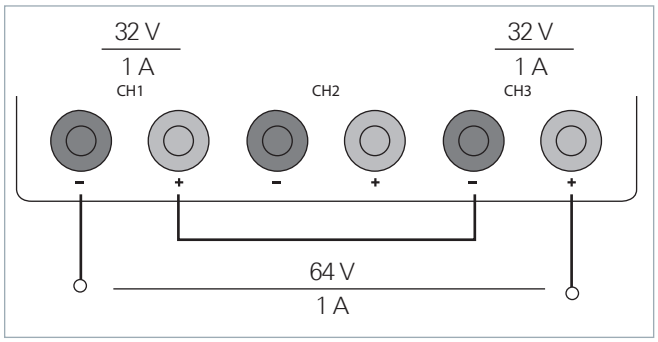


Fig. 6.8: Example for serial mode

6.6.2 Parallel Mode

If it is necessary to increase the total current, the power supply outputs must be wired in parallel. The output voltages for the individual outputs should be set to the same voltage value as precisely as possible. For slight voltage differences, it is common in this operating mode to first charge a voltage output up to the current limit; the other voltage output provides the remaining current. The maximum total current is the sum of the individual currents of all sources connected in parallel. For power supplies that are connected in parallel, It is possible that compensating currents flow within the power supplies. The use of power supplies by other manufacturers, which are potentially not overload proof, can cause destruction of these units as currents may be distributed unevenly.

By increasing the voltage slightly, the load distribution can be manipulated. If the voltage for a channel is to be increased by 50mV, for instance (by a set of identical cables), the current will initially be provided by this channel.

Generally, a higher current will first be supplied from the channel with the higher output voltage. Once this channel reaches its power limit, the remaining current will be made available by the channel that is connected in parallel. In this scenario, it is unpredictable which channel will supply the higher current because it is also possible for channels with identical voltage values to display a low voltage difference. If you distribute the load to multiple channels, it is

recommended to set the current limit of the channel that is to supply the main current to a fraction of the current. This approach handles the semiconductor with care and improves the heat dissipation, as the power loss is distributed more evenly.

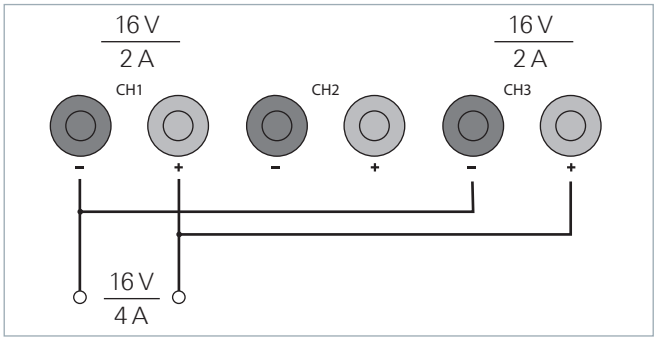


Fig. 6.9: Example for parallel mode

6.7 Multi-Quadrant Operation

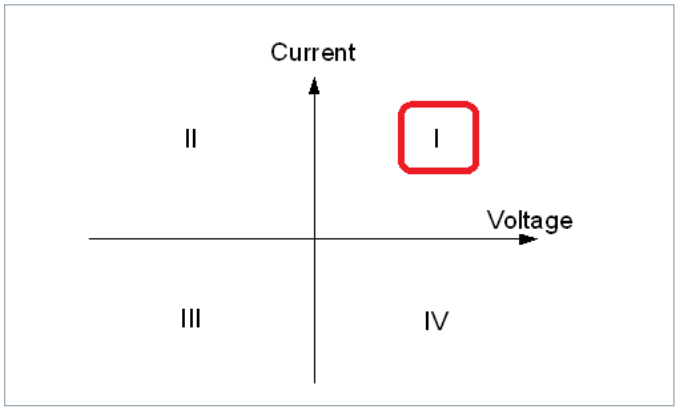


Fig. 6.10: Power supply quadrants diagram

In general, operating in multi-quadrant mode requires a multi-quadrant power supply. The R&S®HMC804x is only a 1-quadrant power supply which is able to provide positive voltage or positive current (quadrant I). However, a negative voltage can be generated by means of a special connection of two channels (common GND). Fig. 6.11 shows a connection example for a R&S®HMC8043, the connection for the R&S®HMC8042 is identical. This type of connection can generally reach a range between -32V and +32V. This does not refer to a negative display on the screen, but rather to a connection with an identical voltage range. However, a negative current (current sink) is not possible.

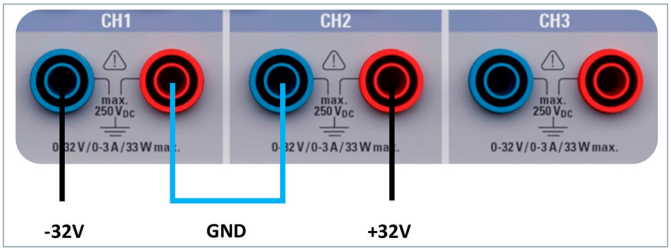


Fig. 6.11: R&S®HMC8043 connection

A negative voltage range can only be generated by means of a special connection of two channels. A negative voltage range can not be generated by one channel.

6.8 Statistic

Fig. 6.12: Statistic menu R&S®HMC8043

The R&S®HMC804x includes an internal statistic function which is able to determine statistic values (Min/Max, Mean, Count) for current and voltage for each channel. Open the Statistic menu via MEAS key and soft menu STATS. Use the soft menu key STATS to activate (ON) or deactivate (OFF) statistic values. Use the soft menu key CLEAR to reset statistic values and to determine new values. The R&S®HMC8043 does not allow the simultaneous display of the statistic and the channel values. In this case, the statistic runs in the background and has to be accessed via MEAS menu. The R&S®HMC8042 and R&S®HMC8041 allow for the statistic to be displayed below the channel values. The statistic values can only be determined individually for each channel.

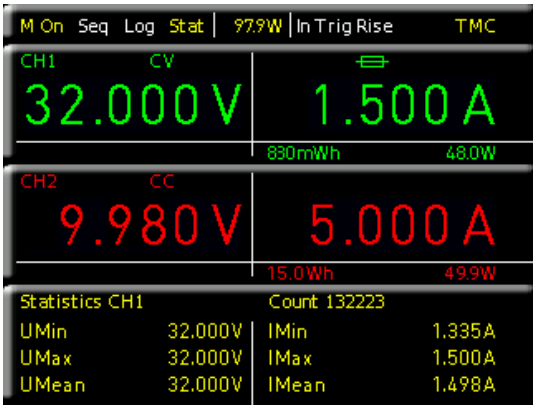


Fig. 6.13: Statistic example R&S®HMC8042

6.9 Energy Meter

The ENERGY function enables you to show the energy released at the output in Ws in the display. Use the soft menu key ACTIVATE to connect this COUNTER individually for each channel (CHANNEL) or use the soft menu key CLEAR to reset it. The soft menu key HOLD enables you to freeze the current released energy values in the display. Press the soft menu key HOLD again to deactivate the function.

7 Data Logging

The soft menu LOGGING allows you to start the capture of measurement values and to select various settings. Use the soft menu key LOGGING to activate (On) or deactivate (Off) the capture and the storage of measurement values. Use the soft menu STORAGE to select the storage location (Internal / USB stick), the file name (File Name) and the file format (CSV / TXT). The soft menu key INTERVAL and the knob allow you to select a measurement interval. The measurement interval describes the time between the recorded measurements. For instance, if the function INTERVAL is set to 2, all 2 s will be included in the measurements.

The soft menu MODE offers three different logging modes. Select the function "U" if you intend to perform an infinite data capture. The limiting factor in this context is the size of the internal storage (512 kB max.) or of the connected USB stick (4 GB max., FAT/FAT32 formatted). If the function "N" is activated, the soft menu key COUNT and the knob enable you to set the number of measurement values to be captured. For instance, if you set an interval of 2s and a count of 5, 5 measurement values will be captured in intervals of 2 s. If the function "T" is activated, the soft menu key TIME and the knob enable you to set the duration of the capture of the measurement values.

External USB hard disc drives (or USB extension) will be not supported. Only FAT/FAT32 formatted USB sticks can be used with the R&S®HMC804x.

7.1 Date Format Example for a Logging File

```
#Device;R&S®HMC8043
#Device Name;Device under test HM
#Format;LOG
#Date;2000 - 01 - 01
#Version;00.014-02.301-03.651
#Serial No.;NO SERIAL NUMBER

#Mode;Unlimited
#Logging Interval[s];1.000
#Specified Logging Count;-----
#Specified Logging Time[s];-----
#Sequence;Off

#CH1 Voltage Target[V];25.050
#CH1 Current Target[A];0.130
#CH1 Sequence Delay[s];-----
#CH1 EasyArb;Off
#CH1 OVP;Off
#CH1 OPP;Off
#CH1 Ramp;Off
#CH1 Analog in;Off

#CH2 Voltage Target[V];16.000
#CH2 Current Target[A];2.000
#CH2 Sequence Delay[s];-----
#CH2 EasyArb;Off
#CH2 OVP;Off
#CH2 OPP;Off
#CH2 Ramp;Off
#CH2 Analog in;Off

#CH3 Voltage Target[V];24.050
#CH3 Current Target[A];1.030
#CH3 Sequence Delay[s];-----
#CH3 EasyArb;Off
#CH3 OVP;Off
#CH3 OPP;Off
#CH3 Ramp;Off
#CH3 Analog in;Off

#Start Time;01:20:15
#Stop Time;01:20:18

#Actual Count; 3

U1[V];I1[A];U2[V];I2[A];U3[V];I3[A];Timestamp
0.000;0.0000;0.000;0.0000;0.000;0.0000;01:20:16:136
0.000;0.0000;0.000;0.0000;0.000;0.0000;01:20:17:135
0.000;0.0000;0.000;0.0000;0.000;0.0000;01:20:18:134
```

8 Documentation, Storage and Recall

The power supply R&S®HMC804x enables users to store all screenshots and user settings. Instrument settings may be saved internally. This data can also be stored on a connected USB stick. Screenshots may only be stored on a USB stick. You can access the main menu to store and load functions by pressing the SAVE/RECALL key.

8.1 Instrument Settings

Use the soft menu DEVICE SETTINGS to save current instrument settings and to load previously saved settings.

Press the soft menu key SAVE to open the SAVE menu. You can use the soft menu key STORAGE to select a possible location (Internal or Front) where you would like to save the instrument settings. Selecting the respective storage location and confirming the selection via soft menu key ACCEPT opens the file system manager. The FILE NAME can be changed or adjusted to the corres-ponding setting (SET is the default label). You can use the soft menu key COMMENT to enter a comment which will be displayed in the file manager footer once a file has been selected. Instrument settings are saved in the HDS format (binary). The format may not be changed. The option SAVE allows you to store the settings.

Instrument settings from a previous firmware version cannot be loaded with a new firmware version.

To reload stored preference files, press the respective soft menu key to open the soft menu LOAD. This opens the file manager where you can use the knob to select the respective file. Once the storage location and the respective settings file has been selected, you can load the file by pressing the soft menu key LOAD. To remove files that are no longer required you can use the knob to select the respective settings file and remove it by pressing the soft menu key REMOVE FILE. If a USB stick is connected, you can also change or delete directories.

The menu item DEFAULT SETTINGS also allows you to load the factory default settings.

8.2 Screenshot

The most important format to store information for documentation purposes is the screenshot. A screenshot is an image file which shows the current screen content at the time that storage takes place. Screenshots may only be stored to a USB stick. If a USB stick is connected, you can also change, create or delete directories. Press ACCEPT to confirm the location of the target directory. The FILE NAME can be changed or adjusted to the corresponding setting (SCR is the default label).

The file format of a graphics file determines the color depth and the type of compression. The quality of the various formats is identical for the multimeter graphics.

You can choose from the following file formats in the soft menu “Format”:

- **BMP** = Windows Bitmap Format
- **PNG** = Portable Network Graphic

Use the soft menu key COLOR MODE and the knob to select between GRAYSCALE, COLOR and INVERTED. If GRAYSCALE is selected, the colors are converted to gray scales when the data is stored, if COLOR is selected, the data is stored as it displays in the screen, and if INVERTED is activated, data will be stored in color with a white background. If you press the SAVE key, the current screen will be saved immediately to the selected storage location with the selected name and format.

Pressing and holding the HELP key allows you to save a screenshot to a connected USB stick.

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9 General Settings

Important general settings, such as basic settings or interface settings may be selected via SETUP key. Press the ⮌ key to move up one level.

9.1 Update (Instrument Firmware)

The instrument firmware is packed in a ZIP file. After downloading the ZIP file, unpack the data to the base directory of a USB stick. Then connect the USB stick with the USB port of the power supply and press the SETUP key. Use the soft menu key UPDATE to open the Update menu displaying version number, date and build information of the currently installed firmware.

Pressing the soft menu key FIRMWARE to update the instrument firmware will result in a search for the corresponding file on the USB stick. The information for the new firmware to be installed will then be displayed on the stick below the row labeled NEW:. The version number will be displayed in red in case the existing firmware on the instrument is identical to the latest version; otherwise the version number will be shown in green. Only if this is the case, press the soft menu EXECUTE to start the update.

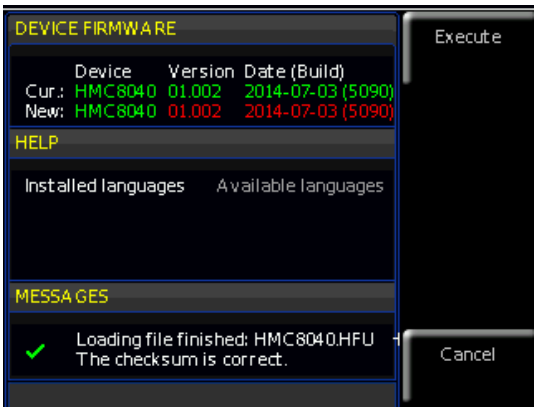

Fig. 9.1: Firmware update menu

9.2 Interface Setting

The soft menu INTERFACE enables you to select the settings for:

- **VCP** (virtual COM Port)
- **USB** (TMC)
- **Ethernet** (IP address, sub-net mask etc.) and
- **IEEE-488 GPIB** interface (GPIB address)

Select the respective interface for the communication via respective soft menu key. Set the required interface parameters via soft menu item PARAMETER. For more information about interface use, please see chapter 10.

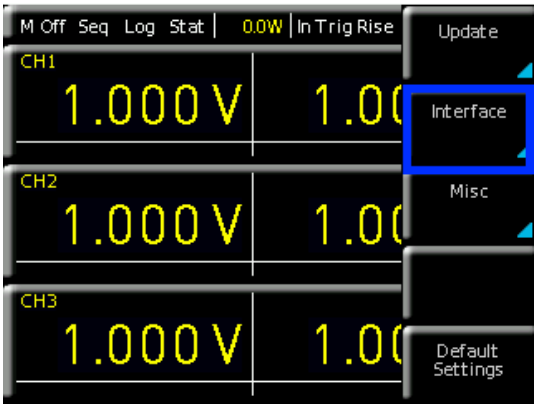

Fig. 9.2: Setup menu

9.3 General Settings (Misc)

9.3.1 Device Infos

This soft menu key allows you to retrieve instrument information such as serial number, software version etc. Additionally, the still available internal memory will be displayed.

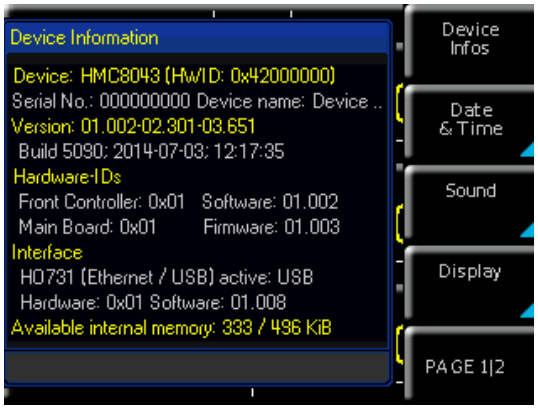

Fig. 9.3: Device information

9.3.2 Date & Time

The soft menu key DATE & TIME allows you to set the time and date and add a date and time stamp to printouts and saved data records. The user can reset the date and time. Date and time can be set via knob. The respective soft menu item is activated when it is marked in yellow. Press SAVE to accept the date and time parameters.

9.3.3 Sound

The power supply offers the option to issue a signal in the event of an error (or simply as a control measure). This signal can be activated (ON) or deactivated (OFF) via soft menu key ERROR BEEP or CTRL BEEP. The respective soft menu item is activated when it is marked in yellow.

9.3.4 Display

The soft menu DISPLAY and the soft menu key BACKLIGHT allow you to set the screen intensity via knob from 10% to 100%. The soft menu key CONTRAST enables you to select the contrast, and the BRIGHTNESS key allows you to select the screen brightness from 10% to 100%. The respective soft menu item is activated when it is marked in yellow.

9.3.5 Key Brightness (KEY)

The soft menu key KEY BRIGHT allows you to set the key brightness via knob from 0% to 100%. The soft menu key FALLB. TIMES allows you to set the so called Key Fallback Time to 5 s, 10 s or 20 s by pressing the soft menu key KEY. If the key fallback time is set, the open settings window will be closed automatically after the adjusted key fallback time. In addition, it is possible to switch off the automatic switching back (OFF). The respective soft menu item is activated when it is marked in yellow.

9.3.6 Device Name

In this menu, you can select an instrument name. Pressing the soft menu key DEVICE NAME opens a keypad. Use the knob to select the letters. You can confirm each letter via ENTER key (SHIFT). Press the soft menu key ACCEPT to confirm the entered instrument name.

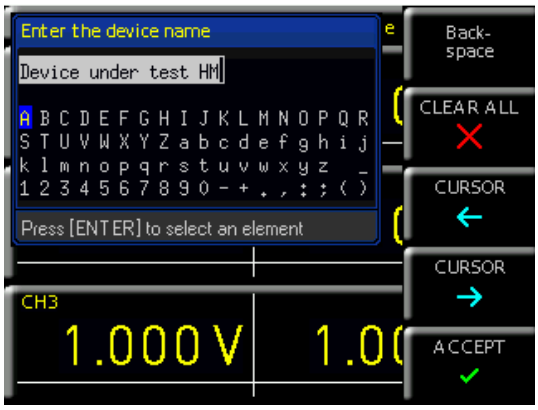

Fig. 9.4: Enter the device name

9.3.7 CSV

Use the soft menu CSV to define the format of the CSV file. The decimal separator (DEC.SEP.) and the line separator (FIELD DELIM.) can be definedund.

10 Remote Control

By default, the R&S®HMC804x includes an Ethernet and a USB interface.

To enable communication, the selected interface and the respective settings in the instrument must be identical to the selections for the PC.

In addition to a LAN interface, the R&S®HMC804x includes a USB device port. For this interface, the user can select if the instrument is accessed via virtual COM port (VCP) or via USB TMC class. The R&S®HMC804x is optionally available ex factory with an integrated GPIB interface (R&S®HMC804x-G). The GPIB interface has its own interface slot on the rear panel.

Fig. 10.1: Rear panel

10.1 USB VCP

All currently available USB VCP drivers have been fully tested and released for Windows XP™, VISTA™, Windows 7™, Windows 8™ and Windows 10™ (32 + 64 Bit).

The traditional version of the VCP (virtual COM port) allows the user to communicate with the R&S®HMC using any terminal program via SCPI commands once the corresponding Windows drivers have been installed.
The actual USB-VCP driver can be downloaded from the ROHDE & SCHWARZ homepage for free. If a connection between PC and the instrument has been established and no R&S®HMC USB-VCP driver is installed, the operating system answers with “Found New Hardware”. In addition, the “Found New Hardware Wizard” is displayed. Only in this case the USB-VCP driver must be installed. Further

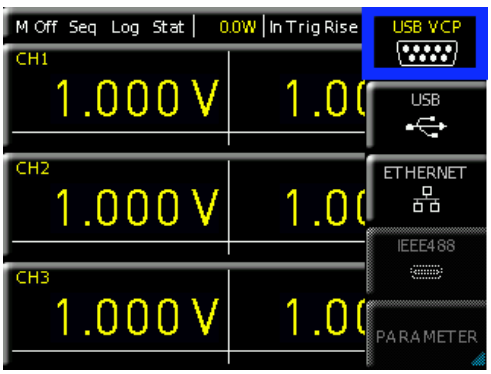

Fig. 10.2: USB-VCP settings

information about the USB VCP driver installation you can find in the installation guide internal of the driver file.

The following requirement for USB-VCP driver installation are necessary:

1. **R&S®HMC804x with an activated USB-VCP interface.**
2. **A PC with operating system Windows XP™, VISTA™, Windows 7™, Windows 8™ or Windows 10™ (32 or 64Bit).**
3. **Administrator rights are necessary for the installation of the driver. If an error message regarding spelling errors appears, the rights to install the driver are not given. In this case, please contact your IT department to obtain the necessary rights.**

In addition, you may use the free software “HMExplorer”. This Windows application offers R&S®HMC804x instruments a terminal function and the option to create screenshots and arbitrary waveforms.

10.2 USB TMC

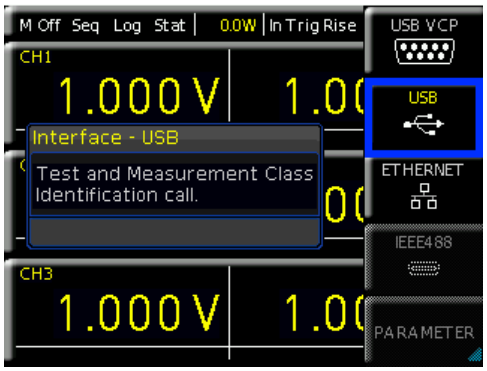

Fig. 10.3: Interface menu

A modern alternative to the virtual COM port (VCP) is the control via USB TMC class. TMC stands for “Test & Measurement Class” which indicates that the connected measurement instrument can be recognized without special Windows drivers if VISA drivers are installed and that it can be used directly in corresponding environments. The GPIB interface serves as model to the structure of the TMC design. A major benefit of the USB TMC class is that by sampling specific registers the user can determine if commands have been terminated and if they have been processed correctly. However, the communication via VCP requires analysis and polling mechanisms within the controlling software which may significantly strain the interface of the measurement instruments. The TMC status registers solve this problem with the USB TMC in the same manner as is the case with the GPIB interface for the hardware, namely via corresponding control lines.

The HMExplorer software does not support the communication via USB TMC.

10.2.1 USB TMC Configuration

The R&S®HMC804x power supplies require a generic USB instrument driver to be operated in USB-TMC mode. The USB Test & Measurement class (USB-TMC) is a protocol that enables GPIB-like communication via USB interfaces and a separate instrument class of the USB specification.

The USB-TMC protocol supports service requests, trigger and other GPIB-specific commands. The driver is included in the NI-VISA package (Virtual Instrument Software Architecture) and can be downloaded at http://www.ni.com/downloads/ni-drivers/.

You need to first install the NI-VISA drivers on your Windows system. Please download the most recent version of the NI-VISA driver package. Extract the previously downloaded driver package and follow the installation instructions. Below please find an example for NI-VISA 5.4.1:

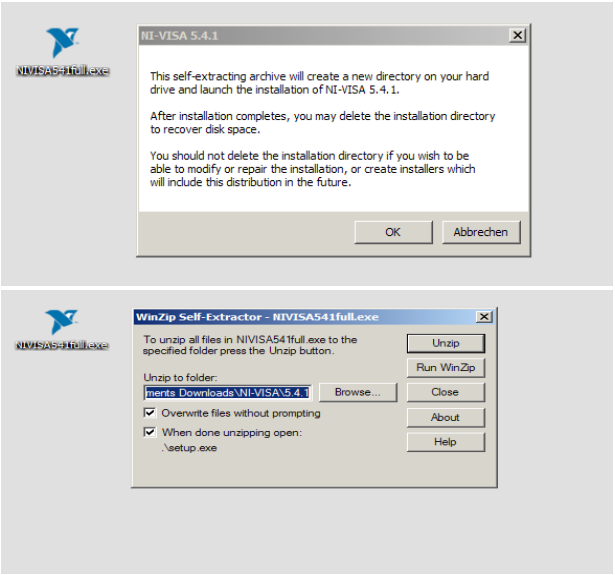

Fig. 10.4: NI-VISA 5.4.1

Select "Next“ to start the installation and follow the installation instructions.

Fig. 10.5: NI-VISA installation instructions

In this step, please select "NI-VISA xxx --> Leave this feature and its subfeatures installed locally“ (Fig. 10.6).

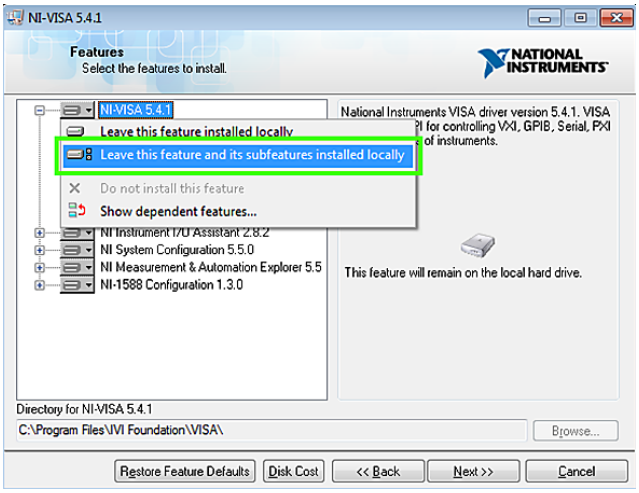

Fig. 10.6: NI-VISA feature installation locally

Now that you have successfully installed the NI-VISA drivers, you can switch your HMC804x power supply to the USB-TMC interface. Select the SETUP menu of your R&S®HMC804x, and choose INTERFACE.

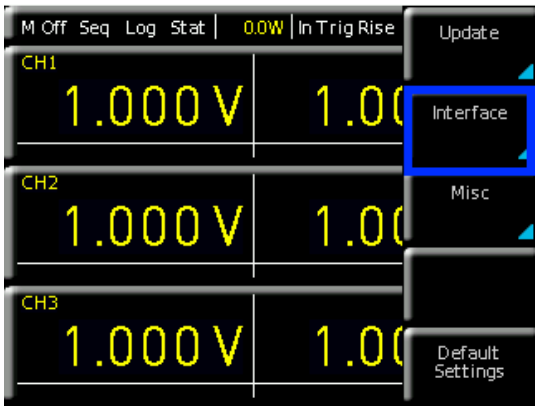

Fig. 10.7: Setup menu

Use the soft key to select "USB". The following message will be displayed.

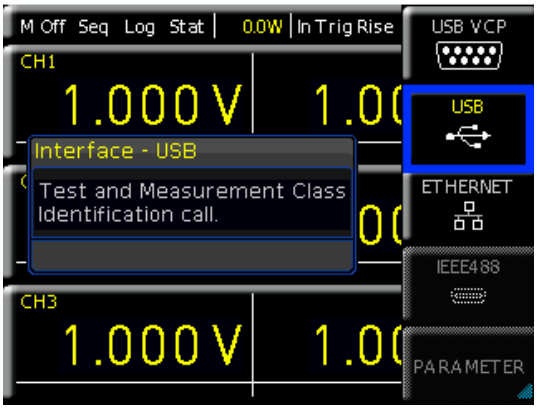

Fig. 10.8: Interface menu

The main view will now display "TMC" as selected interface type.

Fig. 10.9: TMC display

Finally, use a USB interface cable (type A – B) to connect the power supply with your Windows PC. On the first use, the operating system issues the following message: "Found New Hardware". Once the installation has been successfully completed, the following message will be displayed: "Device Setup" - "USB Test and Measurement Device (IVI), ready to use".

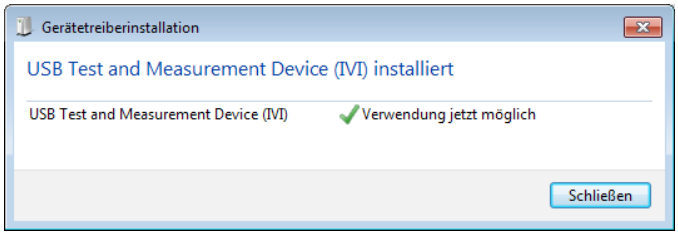

Fig. 10.10: Instrument driver installation

Once you open the Windows Device Manager, the following entry will be displayed: "USB Test and Measurement Devices --> USB Test and Measurement Device (IVI)"

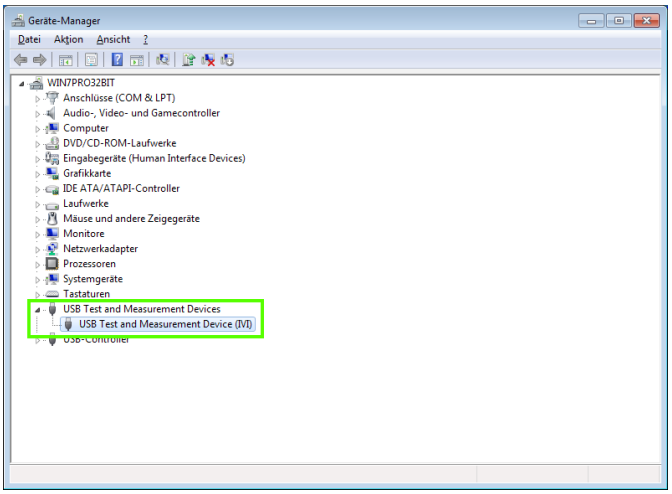

Fig. 10.11: Device manager

10.3 Ethernet

For the direct connection with a host (PC) or indirect connection over a SWITCH, a doubly protected network cable (e.g. CAT.5, CAT.5e, CAT.5+, CAT.6 or CAT.7) is required, equipped with an Ethernet plug type the RJ-45 at each end. Either an uncrossed or a crossed network cable (cross over cable) can be used.

10.3.1 IP networks (IP – Internet protocol)

In order that two or several network elements (e.g. measuring instruments, host/PC's, …) can communicate over a network with one another, some fundamental connections have to be considered, so that data communication is error free and unimpaired.

For each element in a network an IP address has to be assigned, so that they can exchange data among themselves. IP addresses are represented (with the IP version 4) as four decimal numbers separated by points (e.g. 192.168.15.1). Each decimal number is represented by a binary number of 8 bits. IP addresses are divided into public and private address ranges. Public IP addresses will be able to route by the Internet and an Internet service Provider (ISP) can to be made available. Public IP addresses can be reached directly over the Internet to directly exchange internet data. Private IP addresses are not routed by the Internet and are reserved for private networks. Network elements with private IP addresses cannot be reached directly over the Internet so no data can be directly exchanged over the Internet. To allow network elements with a private IP address to exchange data over the Internet, they require a router for IP address conversion (English NAT; Network address translation), before connection to the Internet. The attached elements can then data exchange over this router, which possesses a private IP address (LAN IP address) and also a public IP address (WAN IP address), via the Internet.

If network elements exchange data only over a local network (without connection with the Internet), appropriate use private IP addresses. Select in addition e.g. a private IP address for the instrument and a private IP address for the host (PC), with which you would like to control the instrument. If you might connect your private network with the Internet later via a router, the private IP addresses used in your local network can be maintained. Since within each IP address range the first IP address is used as network IP address and the last IP address is used as Broadcast IP address, in each case two IP addresses have to be taken off from the "number of possible host addresses" (see table 1: Private IP address ranges).

Apart from the organization of IP addresses into public and private address ranges, IP addresses are also divided into classes (Class: A, B, C, D, E). Within the classes A, B, and C are also include the private IP of address ranges described before. The categorisation from IP addresses is for the assignment of public IP address ranges of importance and essentially depends on the size of a local network (maximum number of hosts in the network), which is to be connected with the Internet (see table 2: Classes of IP addresses). IP addresses can fix (statically) or variable (dynamically) to be assigned. If IP addresses in a network are assigned fix, an IP address must be preset manually with each network element. If IP addresses in a network are assigned to the attached network elements automatically (dynamically), a DHCP server (English DHCP becomes; Dynamic Host Configuration Protocol) is required for the dispatching of IP addresses. With a DHCP server an IP address range for the automatic dispatching of IP addresses can be preset. A DHCP server is usually already integrated in a router (DSL router, ISDN router, Modem router, WLAN router, …) integrated. If a network element (e.g. an instrument) is connected by a network cable directly with a host (PC), the IP addresses cannot be assigned to the instrument and the host (PC) automatically, since no network with DHCP server is present here. They have to be preset therefore at the instrument and at the host (PC) manually.

IP addresses are divided by using subnet mask into a network quota and into a host quota, so similarly e.g. a telephone number is divided in pre selection (land and local area network number) and call number (user number). Subnet mask have the same form as IP addresses. They are represented with four decimal numbers separated by points (e.g. 255.255.255.0). As is the case for the IP addresses here each decimal number represents a binary number of 8 bits. The separation between network quota and host quota is determined by the subnet mask within an IP address (e.g. the IP address 192.168.10.10 by the subnet mask 255.255.255.0 is divided into a network quota 192.168.10.0 and a host quota of 0.0.0.10). The allocation takes place via the transformation of the IP address and the subnet mask in binary form and afterwards a bit by bit

adress range	subnetz mask	CIDR way of writing	number of possible host adresses
10.0.0.0 –10.255.255.255	255.0.0.0	10.0.0.0/8	$2^{24} - 2 = 16.777.214$
172.16.0.0 –172.31.255.255	255.240.0.0	172.16.0.0/12	$2^{20} - 2 = 1.048.574$
192.168.0.0 –192.168.255.255	255.255.0.0 255.255.255.0	192.168.0.0/16 192.168.0.0/24	$2^{16} - 2 = 65.534$ $2^{8} - 2 = 254$

Table 10.1: Private IP adress ranges

class	adress range	net quota	host quota	max. number of networks	max. number of hosts
A	0.0.0.1 - 127.255.255.255	8 Bit	24 Bit	126	16.777.214
B	128.0.0.1 - 191.255.255.255	16 Bit	16 Bit	16.384	65.534
C	192.0.0.1 - 223.255.255.255	24 Bit	8 Bit	2.097.151	254
D	224.0.0.1 - 239.255.255.255	Reserved for multicast applications			
E	240.0.0.1 - 255.255.255.255	Reserved for special applications			

Table 10.2: Classes of IP adresses

one logical AND operation between IP address and subnet mask. The result is the network quota of the IP address. The host quota of the IP address takes place via the bit by bit logical NAND operation between IP address and subnet mask. By the variable allocation of IP addresses in network quota and host quota via subnet masks, one can specify IP address ranges individually for large and small networks. Thus one can operate large and small IP networks and connect if necessary to the Internet via a router. In smaller local networks the subnet mask 255.255.255.0 is mostly used. Network quota (the first 3 numbers) and host quota (the last number) are simple here without much mathematical expenditure to determine and it can with these subnet mask up to 254 network elements (e.g. measuring instruments, hosts/PC's...) in a network be operated at the same time.

Often also a standard gateway is present in a network. In most local networks is this gateway with the router to the Internet (DSL router, ISDN router etc.) is identical. Using this (gateway -) router a connection can be manufactured with another network. Thus also network elements, which are not in the same (local) network, can be reached and/or network elements from the local network are able to exchange data with network elements from other networks. For a network-spreading data exchange the IP address of the standard gateway must also be preset. In local networks, mostly the first IP address within a network for this (gateway -) router is used. Mostly routers in a local network to be used as gateway have an IP address with a „1" in the last place of the IP address (e.g. 192.168.10.1).

10.3.2 Ethernet settings

PC and instrument have to be connected to the same network. Otherwise a remote connection is not possible.

In addition to the USB interface, the interface card includes an Ethernet interface. Select Ethernet as interface and press the soft menu key PARAMETER to then determine the settings for the necessary parameters directly within the R&S®HMC804x . You can specify all parameters and assign a fixed IP address. You can also assign a dynamic IP address with the activated DHCP function. Please contact your IT management to configure the settings properly.

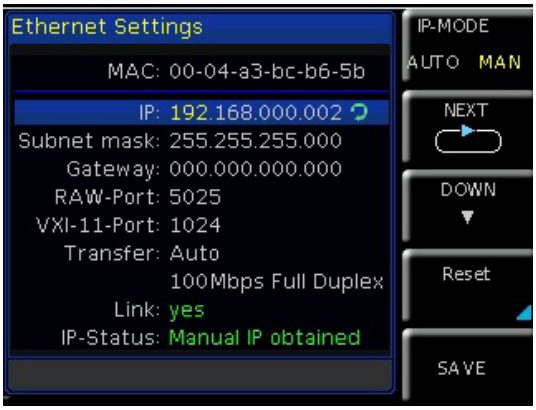

Fig. 10.12: Ethernet settings

If the device has an IP address, it can be accessed via web browser at this IP since the Ethernet interface includes an integrated web server. Enter the IP address in the browser's address bar (http://xxx.xxx.xxx.xxx). This will open a window including the instrument type and the serial number.

If DHCP is used and the system cannot assign an IP address to the R&S®HMC804x (for instance, if no Ethernet cable is connected or the network does not support DHCP), it may take up to three minutes until a timeout allows the interface to be configured again.

10.3.3 LXI

LAN eXtensions for Instrumentation (LXI) is an instrumentation platform for measuring instruments and test systems that is based on standard Ethernet technology. LXI is Operation in a Network intended to be the LAN-based successor to GPIB, combining the advantages of Ethernet with the simplicity and familiarity of GPIB.

The R&S®HMC804x is LXI certified and supports the version 1.4 (LXI Core 2011). Advanced functions are not supported. IVI (Interchangeable Virtual Instrument) instrument drivers are a central component for the LXI certification. So called IVI.net drivers are made available that are based on the .NET framework 4 by Microsoft. LabView and LabWindows/CVI drivers, created on the basis of LabWindows/CVI 2012, are also available.

10.3.4 Webserver

The Ethernet interface offers a web server, which can be used with a web browser (e.g. Internet Explorer). The following functions are supported by the Webserver:

- Display of the device information

Fig. 10.13: Display of the device information

- Display of the Ethernet settings

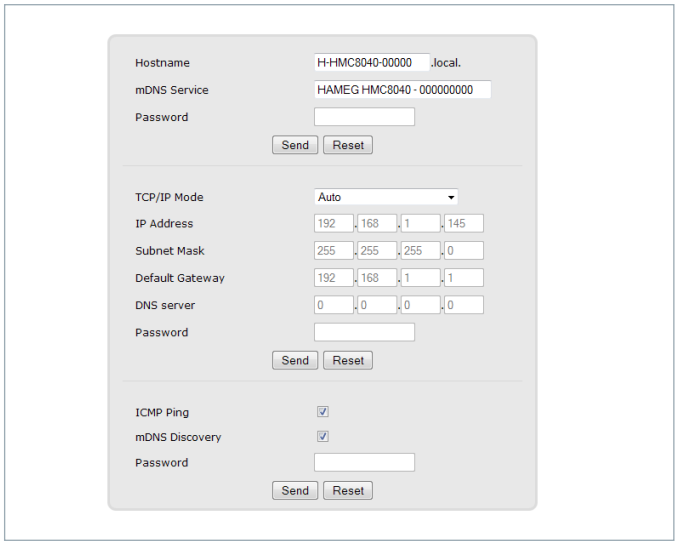

Fig. 10.14: Ethernet settings

- Password setting (security)

Fig. 10.15: Password setting

The Ethernet password can only be reset via HMC Ethernet menu (Ethernet --> Parameter --> Reset). The web browser function „Reset“ only resets the web browser parameter entry.

10.4 IEEE-488.2 / GPIB

In addition to the GPIB functions which are available via USB TMC class, the R&S®HMC804x is optionally available with an integrated GPIB interface (R&S®HMC804x-G). This solution is particularly attractive for customers who already have an existing GPIB environment. With minimum efforts, an old instrument can be replaced by a R&S®HMC804x model.

The optional IEEE-488 interface (GPIB) can only be factory-fitted as it is necessary for this purpose to open the instrument and break the guarantee seal.

Configure the settings in the R&S®HMC804x for all necessary parameters after you select IEEE488 as interface and press the soft menu key PARAMETER.

11 Technical Data

R&S®HMC8043
R&S®HMC8042
R&S®HMC8041

1/2/3 channel power supply

from firmware version 01.104

Electrical Specifications	
Total power output	100 W
Maximum power per channel	
R&S®HMC8043 R&S®HMC8042 R&S®HMC8041	33 W 50 W 100 W
Voltage output	
all models	0 V to 32 V
Current output	
R&S®HMC8043 R&S®HMC8042 R&S®HMC8041	max 3 A max 5 A max 10 A
Number of outputs	
R&S®HMC8043 R&S®HMC8042 R&S®HMC8041	3 2 1
Line & load regulation (SENSE connected)	
Constant voltage mode	
R&S®HMC8043	<0.02% + 3 mV
R&S®HMC8042 R&S®HMC8041	<0.03% + 5 mV
Constant current mode	
R&S®HMC8043	<0.03% + 200 µA
R&S®HMC8042 R&S®HMC8041	<0.03% + 300 µA
Voltage ripple 20 Hz to 20 MHz (front connector) (V=16 V, I=Imax*0.5)	
R&S®HMC8043 R&S®HMC8042	450 μV_{rms} / 4 mV_{pp}
R&S®HMC8041	1 mV_{rms} / 5 mV_{pp}
Current ripple 20 Hz to 20 Mhz (V=16 V, I=Imax*0.5)	
all models	typ. <1 mA_{rms}
Response time with SENSE compensation (10% to 90% load change)	1 ms (±20 mV)
Max SENSE compensation	1 V
Programming accuracy (23° C ±5° C)	
Voltage	
all models	<0.05% + 2 mV
Current	
R&S®HMC8043	<0.05% + 2 mA typ. <0.05% + 1 mA (I <100 mA)
R&S®HMC8042	<0.1% + 5 mA typ. <0.05% + 2 mA (I <100 mA)
R&S®HMC8041	<0.2% +10 mA typ. <0.2% + 4 mA (I <100 mA)
Readback accuracy (23° C ±5° C)	
Voltage	
all models	<0.05% + 2 mV
Current	
R&S®HMC8043	<0.05% + 2 mA typ. <0.05% + 1 mA (I <100 mA)
R&S®HMC8042	<0.05% + 4 mA typ. <0.1% + 2 mA (I <100 mA)
R&S®HMC8041	<0.15% + 10 mA typ. <0.2% + 4 mA (I <100 mA)
Resolution	
Voltage	
all models	1 mV
Current	
R&S®HMC8043 R&S®HMC8042	0.1 mA (I <1 A) 1 mA (I >1 A)
R&S®HMC8041	0.5 mA (I <1 A) 1 mA (I >1 A)
Voltage to earth	250 VDC
Reverse voltage	max. 33 V
Inverse voltage	max. 0.4 V
Max. current allowed in case of inverse voltage	3 A
Supplemental characteristics	
Front connectors	4 mm saftey sockets
Rear connectors	Wago male connector (713-1428/037-000), 8 x 2-pole, pin spacing 3.5 mm / 0.138 in
Temperature coefficient ±(% of output + offset) (per K)	voltage: <0.02 % + 3 mV current: <0.02 % + 3 mA
Output voltage overshoot during turn-off of AC power with activated channel output	100 mV
Over temperature protection	Yes
Voltage programming speed (within 1 % of total excursion)	
Positive voltage change	
no load	10 ms + µC-time
with resistive load	10 ms + µC-time
Negative voltage change	
no load	500 ms + µC-time
with resistive load	10 ms + µC-time
Command processing time	<30 ms
Over Voltage Protection	Yes
Over Power Protection	Yes
Energy Meter	Yes
EasyRamp	Yes
EasyRamp time	10 ms to 10 s
Electronic Fuse	
Fuse trip time	<10 ms
Fuse linking	<100 µs + trip time of linked channel
Fuse delay	10 ms to 10 s
Analog Interface	
Shunt resistance (4 mA to 20 mA)	250 Ohm
Input resistance 0 V to 10 V	>10 kOhm
Acquisition rate V/I interface	10 Sa/s
Response time V/I interface	<150 ms
Resolution	14 bit

Trigger Input	
Trigger response time	<1 ms
Min. trigger interval	10 ms
Trigger level	TTL
Edge direction	rising, falling
Arbitrary (EasyARB)	
Parameter	Voltage, current, time, interpolation mode (y/n)
Number of Points	max. 512
Dwell time	10 ms to 600 s
Repetition rate	continous or burst mode with 1 to 255 repetitions
Trigger	manually, interface, trigger input
Logging	
Sampling rate	1000 Sa/s, 100 Sa/s, 10 Sa/s, 1 to 3600 Sa/s
Resolution	
R&S®HMC8043	1 mV / 0.1 mA (<100 Sa/s) 10 mV / 1 mA (1000 Sa/s)
R&S®HMC8042 / R&S®HMC8041	1 mV / 1 mA (<100 Sa/s); 10 mV / 10 mA (1000 Sa/s)
Memory	Internal or external memory (USB memory sticks)
Maximum number of points	limited by memory
Output Sequencing	
Synchronicity	<100 µs
Delay per channel	1 ms to 60 s
Remote Interfaces	
Connectors	USB-TMC, USB-CDC (Virtual COM), LAN (LXI), GPIB (optional)
Miscellaneous	
Input power option	100 VAC to 240 VAC (±10 %) 50/60 Hz
Maximum input power	200 W
Fuse	T3, 15L 250 V
Operating temperature	0 °C to +40 °C
Storage temperature	-20 °C to +70 °C
Humidity	5 % to 80 %
Display	3.5" / QVGA
Dimensions (H x W x D)	88 x 222 x 280 mm
Rack mount capability (half 19")	Yes
Weight	2.6 kg

The specifications are based on a 30 min warm-up period.

Accessories included:
Line cord, operating manual

Recommended accessories:

R&S®HZC95	19" rackmount kit, 2HE
R&S®HZ10S	5 x silicon test lead (black)
R&S®HZ10R	5 x silicon test lead (red)
R&S®HZ10B	5 x silicon test lead (blue)
R&S®HZ72	IEEE-488 (GPIB) interface cable, 2 m

12 Appendix

12.1 List of Figures

12.2 Glossary