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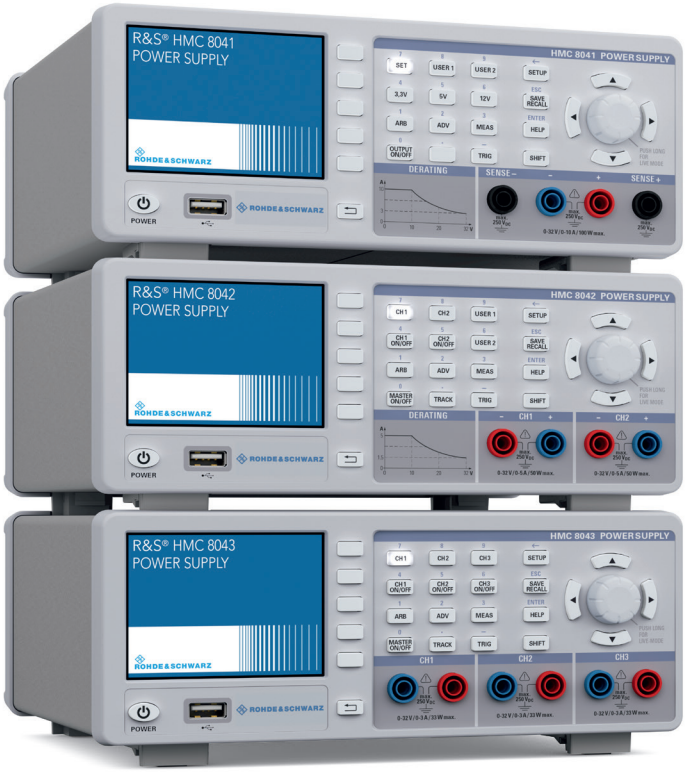
Power Supply All-Rounder for Lab and Test Field



Generally, lab power supplies are considered rather unremarkable instruments. They fulfill a practical purpose while we hardly pay them any attention. However, the new instrument series by Rohde & Schwarz with its various functions deserves a closer look. This can also be said about its price/performance ratio. The editorial department of "Elektronik" magazine took a close look at these lab power supplies.

Power supplies for the lab are often overshadowed by the modern high speed processor and communications technology. Users expect their hassle and error-free operation with guaranteed electrical safety over the years. They are expected to be easy to operate and to issue alerts in case of an input error. All in all, we simply want them to do their job, no questions asked. Yet without these power supplies, equipped with cutting edge processor technology, it would be impossible to accomplish any work at all, be it in high-tech development laboratories, manufacturing plants or test fields. All this merits a closer look at our new lab power supplies series. The series includes up-to-date and practice-oriented data sheet parameters, as well as an impressive variety of effortless features. Despite this large array of features, the instruments offer a price performance ratio that remains unmatched in this category: The lab power supplies of the HMC804x series are available at a price of less than EUR 1,000, and are offered with either one, two or three output channels. They were developed by HAMEG, a manufacturer of measurement technology who has been known to operate under the umbrella of Rohde & Schwarz for nearly a decade.

Designed for industrial applications

The instrument series includes the HMC8041 (one output channel), the HMC8042 (two channels) and the HMC8043 (three channels). Each model is equipped with a maximum total output power of 100 W. For instance, the three-channel instrument provides a continuous voltage range of 0 V to 32 V at a maximum current of 3 A (alphanumerically precisely adjustable to mV or mA). The two-channel instrument provides a maximum of 5 A, and the one-channel version a maximum of 10 A.

As to be expected, the two- and three-channel power supplies also include a familiar lab power supply feature, i.e. the option to operate multiple outputs in a series or parallel. This function enables the user to add the voltages (in serial mode) or to multiply the potential currents to be drawn. For that purpose, the instrument features outputs that are galvanically isolated, floating (up to 250 V_{DC} against earth), overload and short-circuit proof.

In addition, instruments always include two operating modes: They can work as constant voltage source (CV, Constant Voltage, adjustment accuracy < 0.05 % + 2 mV) or as constant current source (CC, Constant Current, adjustment accuracy < 0.05 % + 2 mA). All important parameters are shown on the 3.5-inch QVGA display which continues to be easily legible even in unfavorable light conditions.

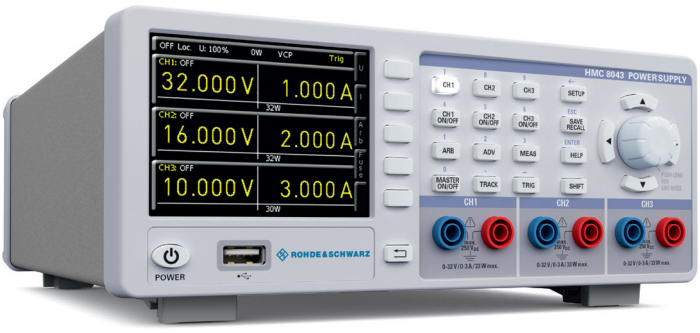


Image 2: R&S®HMC8043 three channel model

450 μV_{eff} and 4 mV_{PP} for a bandwidth of 20 Hz to 20 MHz are listed as voltage/ripple values in the data sheet. Please also note the control period at the output for a load step from 10 % to 90 %: It amounts to 1 ms (±20 mV).
During the practical lab use of the instrument, its simple and intuitive operation on the front panel via function keys and soft menus (image 2) on the right hand side of the screen immediately stands out. The ease-of-use, which was already confirmed during initial testing, even made it unnecessary to refer to a manual. In addition, the power supplies can also be controlled via PC software. In any case, it is highly recommended to read the manual as it provides the user with an in-depth overview of the diverse instrument options which will be summarized below.
In general, the instruments are very suitable for the use in the industrial production, such as in product lines or in test facilities. For instance, linear switching regulators that have been readjusted guarantee high efficiency. This also contributes to a very low heat generation when the instrument is operated at full power. The half 19-inch format enables users to use two three-channel instruments to integrate six power supply channels with two rack units in a 19-inch rack. Despite the switching design, instruments still generate heat; therefore, users must ensure one rack unit of free space above the instruments during the installation in the rack.
It almost goes without saying that the instruments also include a fan which only runs when necessary and operates very quietly on the lab bench, as tests have confirmed.

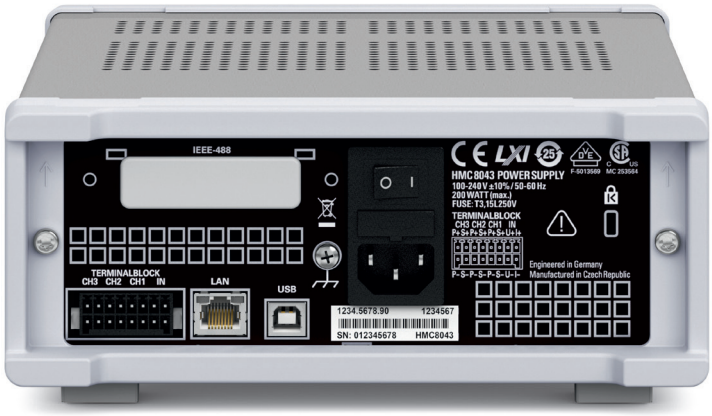


Image 3: Rear view of the IEEE-488 (GPIB) version

Users may access the SENSE lines on the front for the one-channel instrument; the two- and three-channel instrument includes these on the back panel (image 3). The two SENSE lines 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.

Any output combination (including "Tracking")

The tracking function is very practice-oriented as it enables the user to select output parameters to interlink multiple channels. This is useful, for instance, when the supply for multiple separate circuits also needs to be operated separately. It is possible to change both the voltage and the current limit for the individual channels simultaneously.
Another interesting operating mode is "sequencing": It allows the user to define the delay sequence in which channels are switched on. The switch-on delay can be selected in 1 ms increments between 1 ms and 10 s.
The EasyRamp function is another feature that can come in handy for the output voltage allowing the user to simulate a startup curve. After switching on the channels via MASTER ON key, the increase in output voltage will be approximately linear to the set voltage. The duration of this voltage increase can be regulated in 10 ms increments via knob on the front panel or via numeric keypad; you can set time parameters between 10 ms to 10 s.

Safety - a key factor

The new power supplies feature multiple safety levels to protect both the connected loads as well as the instruments from damage. In the first place, the electronic fuse provides protection: The ADV menu ("Advanced") and the soft menu key FUSE allow the selection or deletion of fuses. If the current for a channel exceeds the value I_{max} and if the electronic fuse for this channel has been activated, all channels interlinked with the function "Fuselink" will be switched off. However, channels that are not linked with the secured channel will continue to be activated (e.g. the supply voltage for a fan which will continue to run while all other channels are switched off). Other safety features that will be activated within 10 ms are the OVP (Over Voltage Protection) and the OPP (Over Power Protection).

ARB function: Generating voltage sequences

The new power supplies allow 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. You can configure and run the arbitrary function via control panel as well as via external interface (by means of the HMExplorer software which can be downloaded free of charge) (image 4). Importing and exporting data for the arbitrary function can also be performed via CSV file or SCPI command.

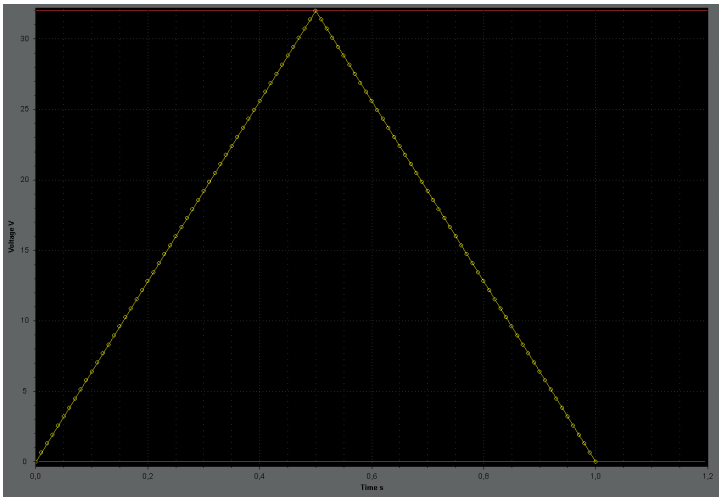


Image 4: Graphical editor of HMExplorer software

Use the menu item EDIT (ARB key) to edit the parameters for the freely programmable waveform. The base data for voltage, current and time (duration per point between 10 ms and 10 min) are required for this purpose (image 5). The appropriate base data allows you to generate any of the common waveforms which allows for the linear connection of individual points (e.g. saw tooth, step etc.). It is possible to repeat a maximum of 512 specified points. The repetition rate is at a maximum of 255 repetitions – you will also notice more complex current and voltage sequences, to test the function of circuits for deviating AC supply sequences, for instance. This function is often required in the automotive sector.

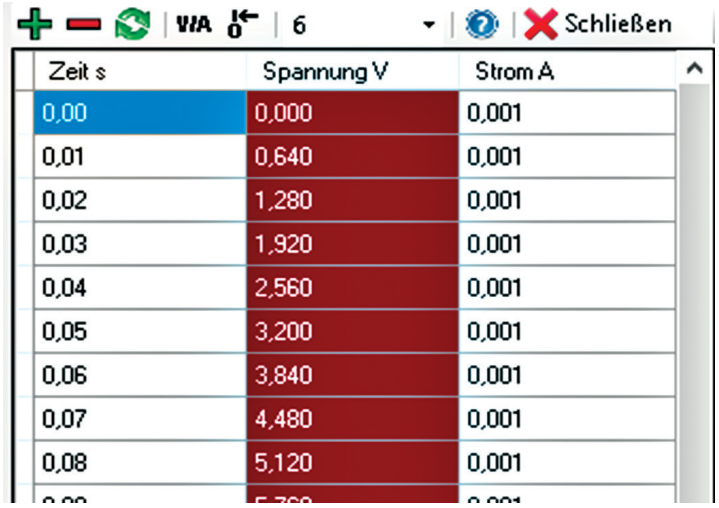


Image 5: Text editor in HMExplorer Software

Software support for various interfaces

The LXI compliant instruments include a LAN interface (e.g. to operate in LXI networks based on the regular Ethernet), a USB interface and, depending on the instrument model, a GPIB interface. For the USB interface, the user can select if the instrument is accessed via virtual COM port (VCP) or via USB TMC class. The traditional version of the VCP allows the user to communicate with the HMC using any terminal program via SCPI commands once the corresponding Windows drivers have been installed. In addition, you may use the free software "HMExplorer". This Windows application offers instruments a terminal function, the option to create screenshots and to read-out the measured data from the instrument.

Additional interfaces for external control and event triggering

You can find an analog interface on the backpanel of the instrument. It includes analog control inputs for 0 V to 10 V, and for the traditional current interface 4 mA to 20 mA, to set the voltage. You can choose the linear mode or a threshold to select the settings via soft menu key. You can set the threshold in 100-mV increments between 0 and 10 V. If the threshold is exceeded, the set voltage for the respective channel is applied to the output, otherwise the voltage will be 0 V.
The trigger input control is particularly noteworthy. For instance, the trigger input is able to trigger the next ARB step: In that case, the output signal is no longer time-triggered but rather event-triggered. Suppose you are working with a testing process which may require a different amount of time depending on the circumstances: A strictly time-triggered arbitrary signal requires the power supply to be programmed so that it is guaranteed that the voltage change does not occur before the test step has been completed. The trigger options of the new instruments enable a testing system to signal when a step has been completed, for instance, and it can literally request the instrument to supply the next test voltage. Data logging can also be triggered. These operating modes are primarily usable for test sites or test system configurations.

Logs all relevant data - including the power supplied

Other power supplies do not include a data logging or energy measurement option, let along in this price category.
In logging mode, the soft menu includes three different modes to record voltage, current and time values. Select the function "U" for endless data logging. The limiting factor in this context is the size of the internal storage or the connected USB stick. The number of the measuring points that can be stored internally is variable and partially depends on memory allocation by stored ARB signals and instrument settings that are stored locally.

If the function “N” is activated, the user can set the number of measurement values to be captured via soft menu key or knob. For instance, if you set an interval of 2 s and a count of 5, five measurement values will be captured in increments of 2 s (minimum interval: 1 ms, resolution 10 mV or 1 mA). If the function “T” is activated, the soft menu key “Time” and the knob enable you to set the capture duration of the measurement values.
As circuit engineers are increasingly sensitive towards the energy consumption of their developed device, the operating mode “Energy Meter” is particularly useful as it is not included in other power supplies of this quality and price category. It enables the display of energy released at the output in Ws.
The following conclusions may be drawn from the conducted tests: For the laboratory environment, the test field and the production, the new power supply series are very practice-oriented instruments which include an impressively comprehensive variety of functions in this price category (less than EUR 1,000).

Wolfgang Hascher

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