

R&S® NGA100 POWER SUPPLY SERIES

Linear. Accurate. Affordable.



Data Sheet
Version 01.00

ROHDE & SCHWARZ

Make ideas real



MODEL OVERVIEW



R&S® NGA101

- ▶ One output
- ▶ Max. 40 W total output power
- ▶ Max. 35 V or max. 6 A per output



R&S® NGA102

- ▶ Two outputs
- ▶ Max. 80 W total output power
- ▶ Max. 35 V or max. 6 A per output
- ▶ Max. 70 V in serial or max. 12 A in parallel mode



R&S® NGA141

- ▶ One output
- ▶ Max. 40 W total output power
- ▶ Max. 100 V or max. 2 A per output



R&S® NGA142

- ▶ Two outputs
- ▶ Max. 80 W total output power
- ▶ Max. 100 V or max. 2 A per output
- ▶ Max. 200 V in serial or max. 4 A in parallel mode

AT A GLANCE

The R&S®NGA100 power supplies are linear, compact and easy to use. All models have excellent readback accuracy with a low-current range for demanding measurements.

Features such as data logging, arbitrary waveforms, built-in statistics and remote sensing make the instruments ideal for various bench applications. Equipped with a number of different remote interfaces, including USB and Ethernet, the R&S®NGA100 power supplies are also great for automated tests.

The channel fusion feature extends voltage and current range. Get up to 200 V with the R&S®NGA142 in serial mode and up to 12 A with the R&S®NGA102 in parallel mode.

Advanced protection functions keep devices connected and power supplies safe.

BENEFITS

Thoughtfully engineered

- ▶ Linear design
- ▶ High readback accuracy
- ▶ Built-in statistics
- ▶ Independent channels
- ▶ FlexPower
- ▶ Color coding
- ▶ Safety binding posts
- ▶ Rackmountable

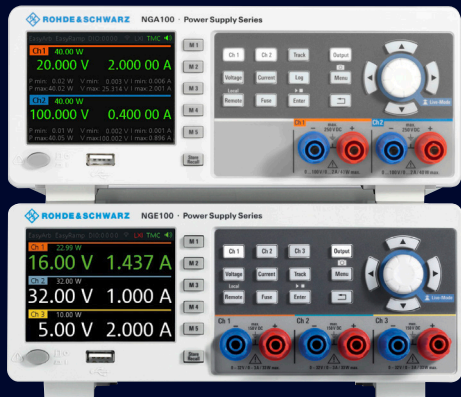
Full-featured

- ▶ EasyRamp
- ▶ EasyArb
- ▶ Data logging
- ▶ Low-current measurement range
- ▶ Channel fusion
- ▶ Tracking
- ▶ Remote sensing
- ▶ Save/recall device settings
- ▶ Protection functions

Well-connected

- ▶ USB interface
- ▶ Ethernet interface
- ▶ Wireless LAN (WLAN)
- ▶ Digital trigger I/O

DIFFERENT POWER SUPPLY CLASSES



R&S®NGA142 two-channel power supply and
R&S®NGE100B three-channel power supply

Basic power supplies

- ▶ Affordable, quiet and stable
- ▶ For manual operation and simple computer-controlled operation
- ▶ Used in education, on the bench and in system racks



Performance power supplies

- ▶ When speed, accuracy and advanced programming features are vital to test performance
- ▶ Features such as DUT protection, fast programming times and downloadable V and I sequences
- ▶ Used in labs and ATE applications



R&S®HMP4040 four-channel and
R&S®NGP814 four-channel power supply

Specialty power supplies

- ▶ Tailored to specific applications
- ▶ Unique features such as
 - Emulation of unique battery characteristics
 - Electronic loads to accurately sink current and dissipate power in a controlled manner
- ▶ Used in labs and ATE environments



R&S®NGU401 single-channel SMU
R&S®NGM202 two-channel power supply

THOUGHTFULLY ENGINEERED

Linear design

Advanced electronic circuitry is often complex and sensitive to the supply line interference. The linear design of the output stages allows the R&S®NGA100 power supplies to operate with minimum residual ripple and noise. Supplying extremely stable output voltage and current is crucial when developing sensitive components.

High readback accuracy

The R&S®NGA100 power supply series has outstanding programming and readback accuracy to accurately measure and replicate a device's actual power consumption, even at low voltage and current levels. These built-in measurements reduce the need for external multimeters and simplify the setup.

Built-in statistics

The integrated statistics show the min. and max. values for power, voltage and current.

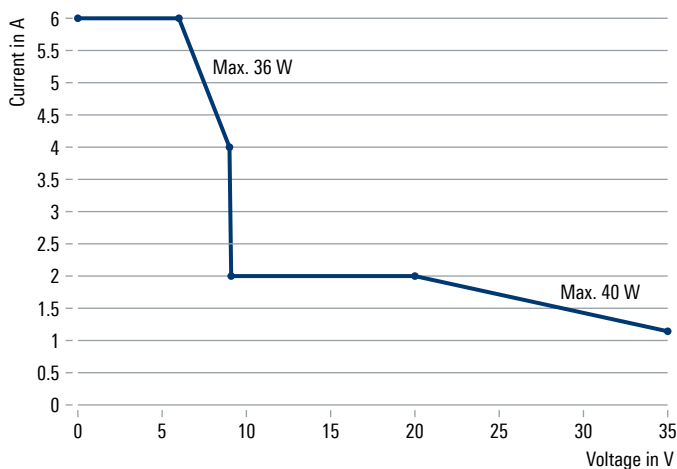
Independent channels (R&S®NGA102 and R&S®NGA142)

The two channels have completely separate circuitry and are not connected to the chassis ground, making it easy to combine channels for bipolar circuitries that might need +12 V/–12 V. Both channels are electrically equivalent, with the same voltage, current and power. The two channels act as separate power supplies and can be operated individually or simultaneously.

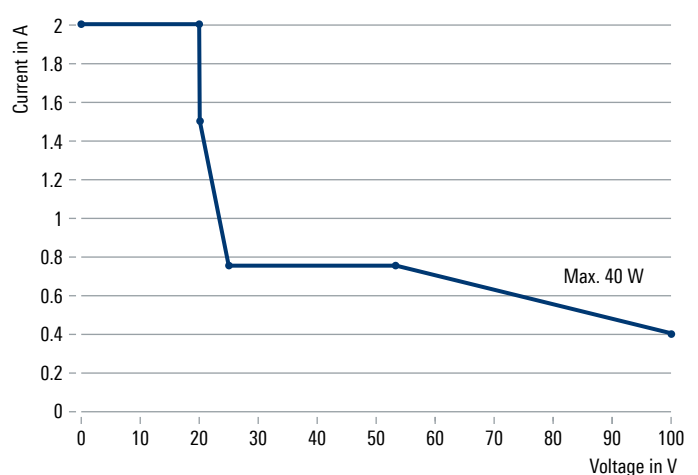
FlexPower

The R&S®NGA100 series operates with maximum power at various operating points and covers far more applications than single range power supplies. All possible voltage and current combinations are shown in the corresponding FlexPower curves.

R&S®NGA101/R&S®NGA102 FlexPower curve per output



R&S®NGA141/R&S®NGA142 FlexPower curve per output

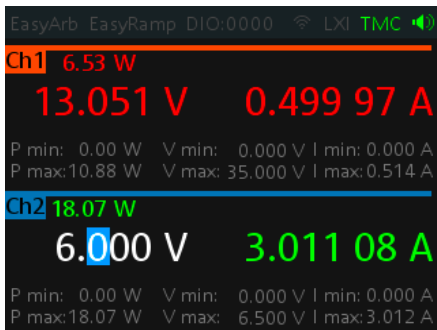


Color coding

All operating conditions can be clearly seen on the 3.5" display, including the status of any protective functions. Voltage and current values are easy to read, even from a distance. Colors indicate the different operating states:

- ▶ Active output in constant voltage mode is in green.
- ▶ Active output in constant current mode is in red.
- ▶ Inactive output is in white. Whenever a channel is in setting mode, a blue background marks the number being set.

Color coding at the binding posts and on the display help prevent connection errors.



Safety binding posts

The R&S®NGA100 output power supply connectors can use both 4 mm safety banana plugs and stripped cables without needing an adapter.



Rackmountable

A compatible rackmount kit and rear output connectors ensure easy integration into test systems. Each rackmount frame can hold up to two R&S®NGA100 power supplies.

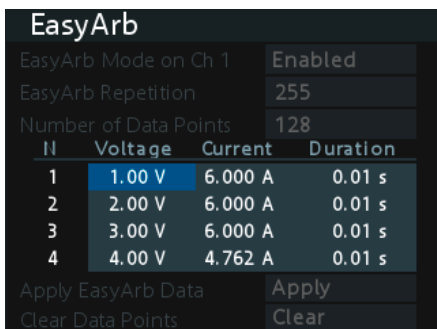
FULL-FEATURED

EasyRamp

To control inrush currents, some test setups require continuously rising supply voltage instead of rapid jumps. The EasyRamp function increases the output voltage continuously over timeframes of 10 ms to 10 s.

EasyArb

Voltage and current must be varied during a test sequence to stimulate different device states. Arbitrary waveform sequences can be programmed either manually, via the user interface or via the external interfaces.



Data logging

Logging data is key to long-term monitoring, reviewing test setups and repeating test conditions when analyzing power behavior or optimizing power consumption.

R&S®NGA100 power supplies simultaneously log voltage and current measurements over time on all outputs at a sampling rate of 10 samples per second. The timestamped data can be easily exported as a .csv file for reports and documentation. Pressing Log starts data acquisition, pressing Log again stops acquisition.

Low-current measurement range

IoT devices can have multiple sleep modes where current consumption is very low. To accurately determine these operating states, R&S®NGA100 power supplies have a low-current measurement range. Currents below 200 mA are measured with a resolution of 1 μ A and an accuracy of $\pm(0.15\% + 25 \mu$ A).

Channel fusion (R&S®NGA102 and R&S®NGA142)

The two output channels operate in series or parallel for higher voltage or current. After activating serial or parallel channel fusion, the device will start to act like a one-channel power supply with double voltage or current capability. In serial mode the outputs are connected internally, while the parallel mode requires external wiring.

The function enables even more applications to be covered by a single instrument.



Serial mode



Parallel mode

Tracking (R&S®NGA102 and R&S®NGA142)

Symmetrically adjusts voltage or current on both outputs simultaneously.

Remote sensing

Improve your voltage regulations with remote sensing, by regulating the output voltage directly at the DUT input terminals instead of the power supply's output terminals.

Four-wire remote sensing compensates for voltage drops in supply leads, especially in high current applications. The R&S®NGA100 power supplies provide sense connections for each output on the rear.

Save/recall device settings

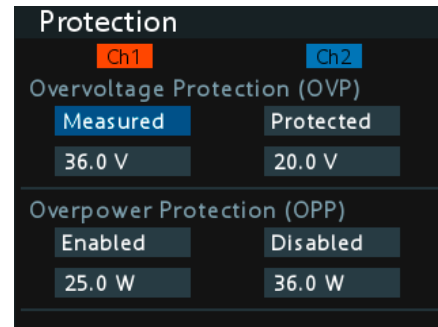
Easily store and recall up to five common instrument settings with five memory keys on the front panel.

Protection functions

Each channel enables settings for:

- ▶ Maximum current (electronic fuse, overcurrent protection, OCP)
- ▶ Maximum voltage (overvoltage protection, OVP)
- ▶ Maximum power (overpower protection, OPP)

When the limit is reached, the output automatically switches off and a message (FUSE, OVP or OPP) appears. On two-channel devices (R&S®NGA102 and R&S®NGA142), overcurrent protection can be linked to the other channel (FuseLink function). Here, the channel exceeding maximum current and the linked channel are switched off. Delay times can also be set for electronic fuses, preventing outputs from switching off because of short current spikes. The R&S®NGA100 power supplies also come with internal overtemperature protection to switch off the affected output when thermal overload is pending.



WELL-CONNECTED

USB interface (virtual COM port and TMC class)

External PCs can control R&S®NGA100 power supplies via the USB interface. The USB port can also save log data files and screenshots to a USB drive.

Ethernet interface with integrated web server

Remotely control all instrument parameters with the Ethernet interface. Choose between a fixed IP address or use the DHCP function to allocate dynamic IP addresses. The integrated web server offers easy instrument control directly via the browser.

Ethernet	
MAC Address	16:90:27:4e:ef:83
Status	Disconnected
IP Mode	DHCP & Auto-IP
IP Address	169 . 254 . 9 . 20
Subnet Mask	255 . 255 . 0 . 0
Default Gateway	169 . 254 . 9 . 20
Reset LXI	Reset

Wireless LAN (WLAN)

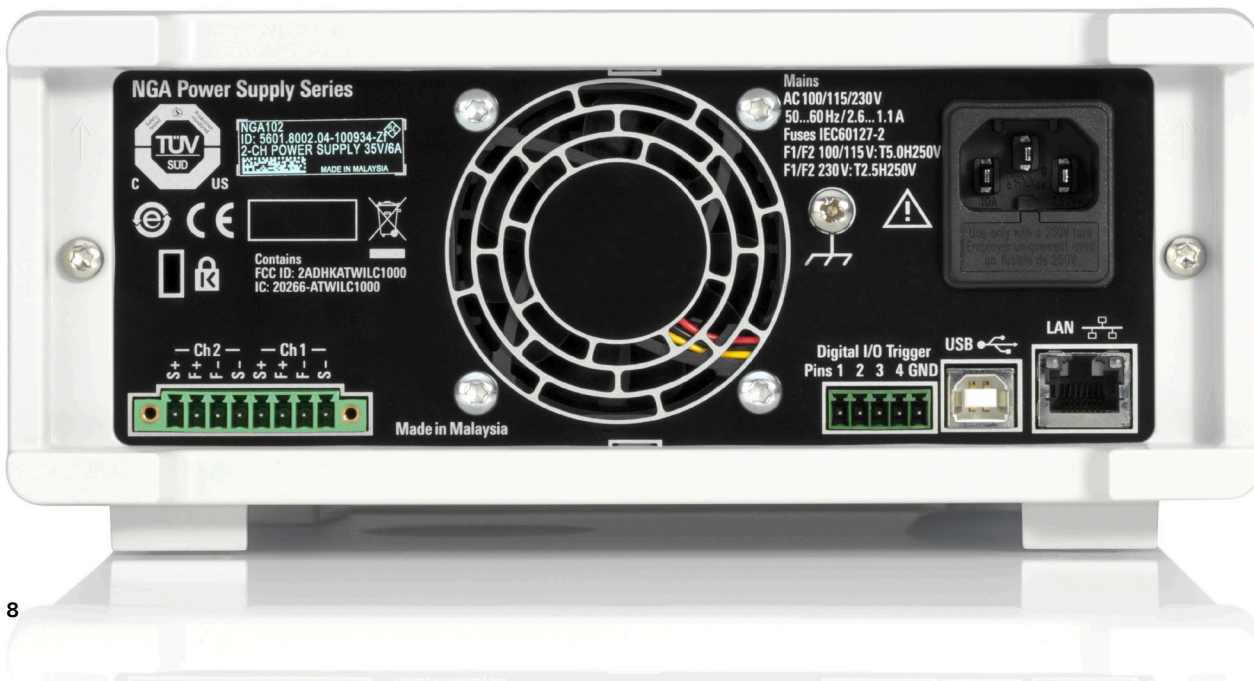
Alternatively, R&S®NGA100 power supplies can be remotely controlled via the optional wireless LAN interface (R&S®NGA-K102). Activated by a keycode, the wireless LAN module supports the client mode to automatically connect the instrument to a network.

WLAN	
MAC Address	f8:f0:05:f1:56:e3
Module	Enabled
Status	Connected
SSID	.S@DAS_SPEKTRUM
Password	●●●●●●●●
Connect	Disconnect
IP Address	192 . 168 . 50 . 13
Subnet Mask	255 . 255 . 252 . 0
Gateway	192 . 168 . 48 . 1

Digital trigger I/O

Digital input triggers can automatically control the main instrument functions. The instrument events can also control the remote interface via output triggers. The optional 4-bit digital in/out interface enables easy trigger system setup. The R&S®NGA-K103 option is required to activate this function.

Digital IO			
Master Enable	Disabled		
DIO 1	DIO 2	DIO 3	DIO 4
Direction	Trigger In		
Channel	Ch 1		
Response	Start EasyArb		
Trigger	Pulse		
Logic	Active High		
Status	Enabled		



SPECIFICATIONS

Definitions

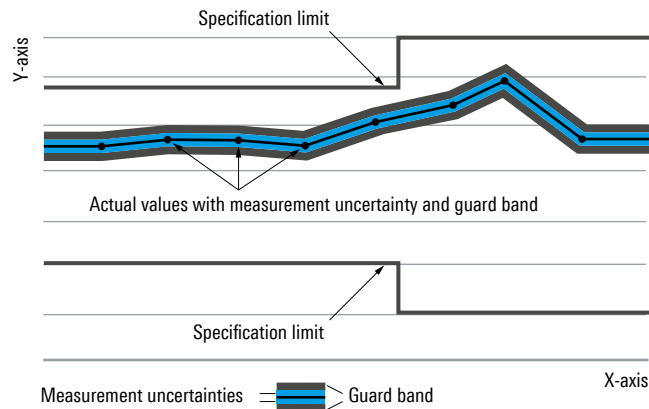
General

Product data applies under the following conditions:

- ▶ Three hours storage at ambient temperature followed by 30 minutes warm-up operation
- ▶ All data is valid at +23 °C (-3 °C/+7 °C) after 30 minutes warm-up time.
- ▶ Specified environmental conditions met
- ▶ Recommended calibration interval adhered to
- ▶ All internal automatic adjustments performed, if applicable

Specifications with limits

Represent warranted product performance by means of a range of values for the specified parameter. These specifications are marked with limiting symbols such as $<$, \leq , $>$, \geq , \pm , or descriptions such as maximum, limit of, minimum. Compliance is ensured by testing or is derived from the design. Test limits are narrowed by guard bands to take into account measurement uncertainties, drift and aging, if applicable.



Specifications without limits

Represent warranted product performance for the specified parameter. These specifications are not specially marked and represent values with no or negligible deviations from the given value (for example, dimensions or resolution of a setting parameter). Compliance is ensured by design.

Typical data (typ.)

Characterizes product performance by means of representative information for the given parameter. When marked with $<$, $>$ or as a range, it represents the performance met by approximately 80% of the instruments at production time. Otherwise, it represents the mean value.

Nominal values (nom.)

Characterize product performance by means of a representative value for the given parameter (for example, nominal impedance). In contrast to typical data, a statistical evaluation does not take place and the parameter is not tested during production.

Measured values (meas.)

Characterize expected product performance by means of measurement results gained from individual samples.

Uncertainties

Represent limits of measurement uncertainty for a given measurand. Uncertainty is defined with a coverage factor of 2 and has been calculated in line with the rules of the Guide to the Expression of Uncertainty in Measurement (GUM), taking into account environmental conditions, aging, wear and tear.

Device settings and GUI parameters are indicated as follows: "parameter: value".

Typical data as well as nominal and measured values are not warranted by Rohde&Schwarz.

In line with the 3GPP/3GPP2 standard, chip rates are specified in million chips per second (Mcps), whereas bit rates and symbol rates are specified in billion bits per second (Gbps), million bits per second (Mbps), thousand bits per second (kbps), million symbols per second (Msps) or thousand symbols per second (ksps), and sample rates are specified in million samples per second (Msample/s). Gbps, Mcps, Mbps, Msps, kbps, ksps and Msample/s are not SI units.

SPECIFICATIONS

All data is valid at +23°C (-3°C/+7°C) after 30 minutes warm-up time.

Electrical specifications		
Outputs	The channel outputs are galvanically isolated and not connected to ground.	
Number of output channels	R&S®NGA101, R&S®NGA141	1
	R&S®NGA102, R&S®NGA142	2
Maximum total output power	R&S®NGA101, R&S®NGA141	40 W
	R&S®NGA102, R&S®NGA142	80 W
Maximum output power per channel		40 W
Output voltage per channel	R&S®NGA101, R&S®NGA102	0 V to 35 V
	R&S®NGA141, R&S®NGA142	0 V to 100 V
Maximum output current per channel	R&S®NGA101, R&S®NGA102	6 A
	R&S®NGA141, R&S®NGA142	2 A
Voltage ripple and noise	20 Hz to 20 MHz	
	R&S®NGA101, R&S®NGA102	< 0.5 mV (RMS), < 10 mV (peak-to-peak) (meas.)
	R&S®NGA141, R&S®NGA142	< 1.5 mV (RMS), < 20 mV (peak-to-peak) (meas.)
Current ripple and noise	20 Hz to 20 MHz	< 500 µA (RMS) (meas.)
Load regulation	load change: 10% to 90%	
Voltage	±(% of output + offset)	
	R&S®NGA101, R&S®NGA102	< 0.01% + 5 mV
	R&S®NGA141, R&S®NGA142	< 0.01% + 10 mV
Current	±(% of output + offset)	
Load recovery time	10% to 90% load change to within 0.2% of rated voltage	
	R&S®NGA101, R&S®NGA102	< 100 µs (meas.)
	R&S®NGA141, R&S®NGA142	< 50 µs (meas.)
Rise time	10% to 90% of rated output voltage, resistive load	
	R&S®NGA101, R&S®NGA102	< 50 ms
	R&S®NGA141, R&S®NGA142	< 100 ms
Fall time	90% to 10% of rated output voltage, resistive load	full load: < 10 ms, no load: < 50 ms
Programming resolution		
Voltage		1 mV
Current		1 mA
Programming accuracy		
Voltage	±(% of output + offset)	
	R&S®NGA101, R&S®NGA102	< 0.05% + 5 mV
	R&S®NGA141, R&S®NGA142	< 0.05% + 20 mV
Current	±(% of output + offset)	
		< 0.05% + 500 µA

Output measurements		
Measurement functions		voltage, current, power
Readback resolution		
Voltage		1 mV
Current		100 μ A
Low-current measurement range	\leq 200 mA output current	1 μ A
Readback accuracy		
Voltage	\pm (% of output + offset)	
	R&S [®] NGA101, R&S [®] NGA102	< 0.02% + 5 mV
	R&S [®] NGA141, R&S [®] NGA142	< 0.02% + 10 mV
Current	\pm (% of output + offset)	< 0.03% + 500 μ A
Low-current measurement range	R&S [®] NGA101, R&S [®] NGA102	< 0.15% + 40 μ A
	R&S [®] NGA141, R&S [®] NGA142	< 0.15% + 25 μ A
Temperature coefficient (per °C)		
	+5°C to +20°C and +30°C to +40°C	
Voltage	\pm (% of output + offset)	< 0.0075% + 0.75 mV
Current	\pm (% of output + offset)	< 0.015% + 3 mA
Low-current measurement range		< 0.023% + 5 μ A
Remote sensing		
Maximum sense compensation	R&S [®] NGA101, R&S [®] NGA102	0.5 V (meas.)
	R&S [®] NGA141, R&S [®] NGA142	1.0 V (meas.)

Ratings		
Maximum voltage to ground		250 V DC
Maximum counter voltage	voltage with the same polarity connected to the outputs	
	R&S [®] NGA101, R&S [®] NGA102	36 V
	R&S [®] NGA141, R&S [®] NGA142	102 V
Maximum reverse voltage	voltage with opposite polarity connected to the outputs	0.4 V
Maximum reverse current	for 5 min max.	6 A

Remote control		
Command processing time		< 100 ms (typ.)

Protection functions		
Overvoltage protection		
		adjustable for each channel
Programming resolution	R&S [®] NGA101, R&S [®] NGA102	1 mV
	R&S [®] NGA141, R&S [®] NGA142	10 mV
Overpower protection		
		adjustable for each channel
Overcurrent protection (electronic fuse)		
		adjustable for each channel
Programming resolution		1 mA
Response time	$(I_{load} > I_{resp} \times 2)$ at $I_{load} \geq 2$ A	< 1 ms
Fuse linking (FuseLink function)	R&S [®] NGA102, R&S [®] NGA142	yes
Response time for linked channels		< 5 ms
Fuse delay time	adjustable for each channel	10 ms to 10 s (10 ms increments)
Overtemperature protection		
	independent for each channel	yes

Special functions		
Output ramp function		EasyRamp
EasyRamp time		10 ms to 10 s (10 ms increments)
Arbitrary function		EasyArb
Parameters	CH1 only	voltage, current, time
Maximum number of points		128
Dwell time		10 ms to 600 s (10 ms increments)
Repetition		continuous or burst mode with 1 to 255 repetitions
Trigger		manually, by remote control or via optional trigger input
Trigger and control interfaces		digital I/O
Trigger response time	R&S®NGA-K103	< 100 ms
Maximum voltage (IN/OUT)		5 V
Input level		TTL
Maximum drain current (OUT)		5 mA
Data logging		
Maximum acquisition rate		10 sample/s
Memory depth		external USB drive
Voltage resolution		see readback resolution
Voltage accuracy		see readback accuracy
Current resolution		see readback resolution
Current accuracy		see readback accuracy
Channel fusion		
Maximum voltage in serial mode	R&S®NGA102	70 V
	R&S®NGA142	200 V
Maximum current in parallel mode	R&S®NGA102	12 A
	R&S®NGA142	4 A
Restricted functions		<ul style="list-style-type: none"> ▶ EasyRamp ▶ EasyArb ▶ Low-current measurement range ▶ Remote sensing ▶ Digital I/O
Display and interfaces		
Display		3.5"/QVGA
Front panel connections		4 mm safety binding posts
Rear panel connections		8-pin connector block (outputs, remote sensing)
Remote control interfaces	standard	USB-TMC, USB-CDC (virtual COM)
		LAN
	R&S®NGA-K102	WLAN

General data		
Environmental conditions		
Temperature	operating temperature range	+5°C to +40°C
	storage temperature range	-20°C to +70°C
Humidity	noncondensing	5% to 95%
Power rating		
Mains nominal voltage		100 V/115 V/230 V (±10%)
Mains frequency		50 Hz to 60 Hz
Maximum power consumption		230 W
Main fuses	100 V/115 V AC power source	5 A, 250 V IEC 60127-2/5 T
	230 V AC power source	2.5 A, 250 V IEC 60127-2/5 T
Product conformity		
Electromagnetic compatibility	EU: in line with Radio Equipment Directive 2014/53/EU	applied standards: ▶ ETSI EN300328 V2.2.2 ▶ EN61326-1 ▶ EN61326-2-1 ▶ EN55011 (Class A) ▶ EN55032 (Class A) ▶ ETSI EN301489-1 V2.1.1 ▶ ETSI EN301489-17 V3.1.1
	Korea	KC mark
Electrical safety	USA, Canada	FCC47 CFR Part 15B, ICES-003 Issue 6
	EU: in line with Low Voltage Directive 2014/35/EU	applied harmonized standard: EN61010-1
	USA, Canada	UL61010-1, CAN/CSA-C22.2 No. 61010-1
WLAN approvals	Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom	CE
	Singapore	IMDA standards DB102020
RoHS	USA, Canada	FCC, IC
	in line with EU Directive 2011/65/EU	EN50581
Mechanical resistance		
Vibration	sinusoidal	5 Hz to 55 Hz, 0.3 mm (peak-to-peak), 55 Hz to 150 Hz, 0.5 g const., in line with EN60068-2-6
	random	8 Hz to 500 Hz, acceleration: 1.2 g (RMS), in line with EN60068-2-64
Shock		40 g shock spectrum, in line with MIL-STD-810E, method 516.4, procedure I
Mechanical data		
Dimensions	W × H × D	222 mm × 97 mm × 448 mm (8.74 in × 3.82 in × 17.64 in)
Weight	R&S®NGA101	6.6 kg (14.5 lb)
	R&S®NGA141	6.9 kg (15.2 lb)
	R&S®NGA102	7.0 kg (15.4 lb)
	R&S®NGA142	7.3 kg (16.1 lb)
Rack installation	R&S®HZN96, space for two instruments	19", 2 HU
Recommended calibration interval	operation 40 h/week over entire range of specified environmental conditions	1 year

ORDERING INFORMATION

Designation	Type	Order No.
Base unit		
One-channel power supply, 35 V/6 A	R&S°NGA101	5601.8002.02
One-channel power supply, 100 V/2 A	R&S°NGA141	5601.8002.03
Two-channel power supply, 35 V/6 A	R&S°NGA102	5601.8002.04
Two-channel power supply, 100 V/2 A	R&S°NGA142	5601.8002.05
Accessories supplied		
Set of power cables, terminal blocks, quick start guide		
Options		
Wireless LAN remote control	R&S°NGA-K102	5601.8419.03
Digital trigger I/O	R&S°NGA-K103	5601.8425.03
System components		
19" rack adapter, 2 HU	R&S°HZN96	3638.7813.02

Warranty		
Base unit		3 years
All other items ¹⁾		1 year
Options		
Extended warranty, one year	R&S°WE1	
Extended warranty, two years	R&S°WE2	
Extended warranty with calibration coverage, one year	R&S°CW1	Please contact your local Rohde & Schwarz sales office.
Extended warranty with calibration coverage, two years	R&S°CW2	
Extended warranty with accredited calibration coverage, one year	R&S°AW1	
Extended warranty with accredited calibration coverage, two years	R&S°AW2	

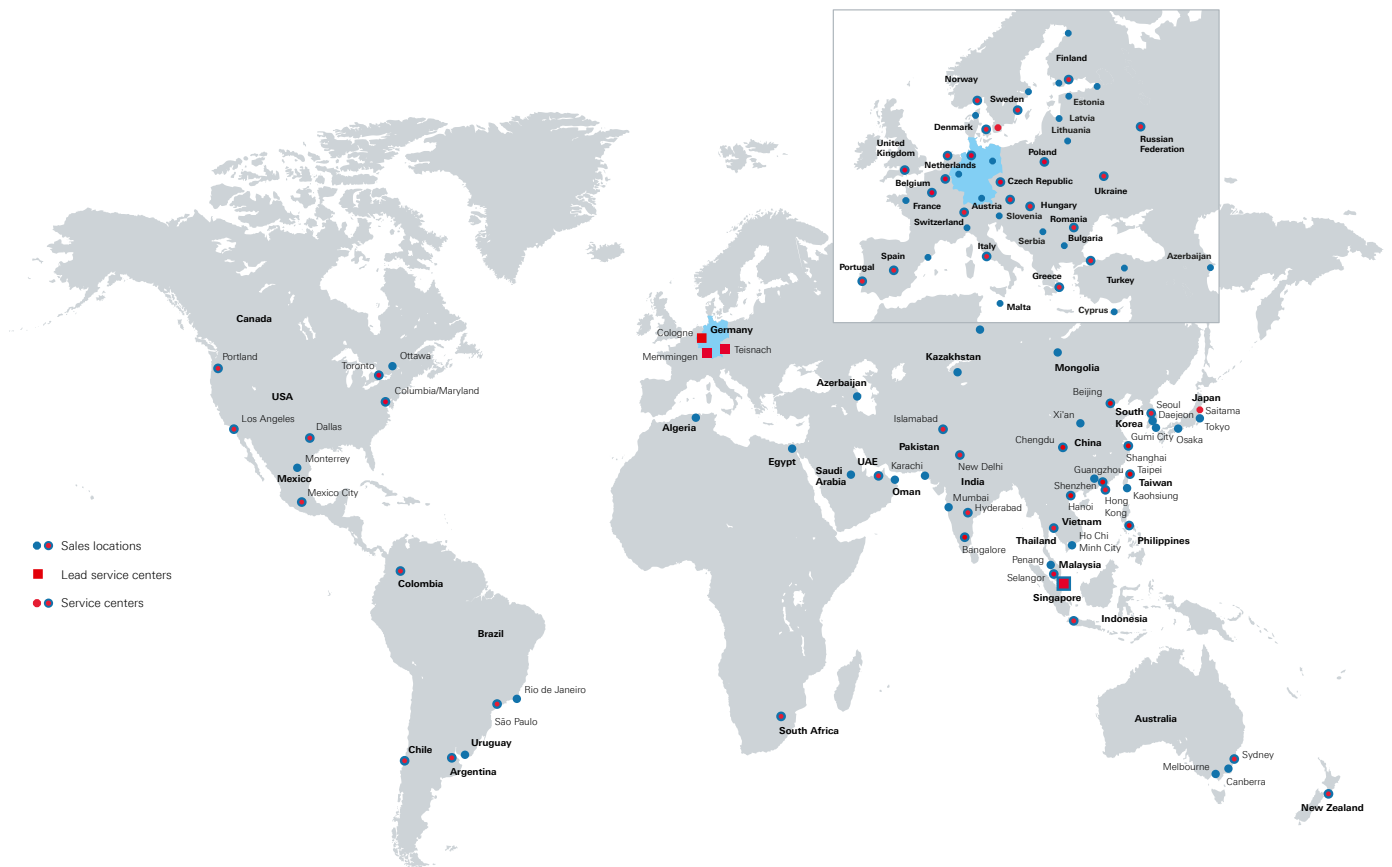
¹⁾ For options that are installed, the remaining base unit warranty applies if longer than 1 year. Exception: all batteries have a 1 year warranty.

FROM PRESALES TO SERVICE. AT YOUR DOORSTEP.

The Rohde & Schwarz network in over 70 countries ensures optimum on-site support by highly qualified experts.

User risks are reduced to a minimum at all project stages:

- ▶ Solution finding/purchase
- ▶ Technical startup/application development/integration
- ▶ Training
- ▶ Operation/calibration/repair



Service that adds value

- ▶ Worldwide
- ▶ Local and personalized
- ▶ Customized and flexible
- ▶ Uncompromising quality
- ▶ Long-term dependability

Rohde & Schwarz

The Rohde & Schwarz electronics group offers innovative solutions in the following business fields: test and measurement, broadcast and media, secure communications, cybersecurity, monitoring and network testing. Founded more than 80 years ago, the independent company which is headquartered in Munich, Germany, has an extensive sales and service network with locations in more than 70 countries.

www.rohde-schwarz.com

Sustainable product design

- ▶ Environmental compatibility and eco-footprint
- ▶ Energy efficiency and low emissions
- ▶ Longevity and optimized total cost of ownership

Certified Quality Management

ISO 9001

Certified Environmental Management

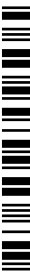
ISO 14001

Rohde & Schwarz training

www.training.rohde-schwarz.com

Rohde & Schwarz customer support

www.rohde-schwarz.com/support



X-ON Electronics

Largest Supplier of Electrical and Electronic Components

Click to view similar products for [Benchtop Power Supplies](#) category:

Click to view products by [Rohde & Schwarz](#) manufacturer:

Other Similar products are found below :

[NL200](#) [PR20](#) [ZUPNC403](#) [ZUP/W](#) [ZUPNC402](#) [TL89F2](#) [TL89K1](#) [TL89T1](#) [1332A-NIST](#) [ACC-GENH/RM](#) [P 6300](#) [SPE3102](#) [SPE3103](#)
[SPE6103](#) [P 5995](#) [CPX200DP](#) [AX-3003P](#) [AX-6003P](#) [AX-8450A](#) [TPM-3003](#) [HMP2020](#) [HMP2030](#) [HMP4040](#) [1350](#) [UT804](#) [1410](#) [XLNRC](#)
[1513](#) [1514](#) [1550](#) [1651A](#) [1652](#) [1665](#) [1666](#) [1667](#) [1693](#) [1694](#) [1698](#) [MX100TP](#) [1739](#) [1762](#) [1788](#) [TPM-3005](#) [1902B](#) [9174B](#) [GDM-8245](#)
[GDM-8255A](#) [GDM-8341](#) [PSP-603](#) [PSW 160-7.2](#)