G5.RSS Programmable Regenerative DC Source Sink Series

The G5.RSS series is bidirectional regenerative and can operate in CV, CC, CP, or CR control modes with simulation of internal resistance in CV or internal conductance in CC mode. It is universally applicable and therefore suitable for all industrial and scientific applications in laboratories as well as on test benches and production lines. The modular and finely graded G5.RSS series is characterized by highly dynamic response times, adjustable filter time constants, and a wide current-voltage range with an auto-ranging factor 3. Optional software, programming, and communication interfaces as well as extended safety functions allow the G5.RSS power supplies to be optimally adapted to special customer application requirements.

Device Types

Voltage V	Power kW	Current A	Height U	Order Code
*0...80	9	-338...338	4	G5.RSS.9.80.338
*0...80	18	-676...676	4	G5.RSS.18.80.676
*0...80	27	-1014...1014	7	G5.RSS.27.80.1014
*0...80	36	-1352...1352	7	G5.RSS.36.80.1352
*0...80	45	-1690...1690	10	G5.RSS.45.80.1690
*0...80	54	-2028...2028	10	G5.RSS.54.80.2028
0...160	18	-338...338	4	G5.RSS.18.160.338
0...160	36	-676...676	7	G5.RSS.36.160.676
0...160	54	-1014...1014	10	G5.RSS.54.160.1014
0...240	27	-338...338	7	G5.RSS.27.240.338
0...240	54	-676...676	10	G5.RSS.54.240.676
0...320	36	-338...338	7	G5.RSS.36.320.338
0...500	9	-54...54	4	G5.RSS.9.500.54
0...500	18	-108...108	4	G5.RSS.18.500.108
0...500	27	-162...162	7	G5.RSS.27.500.162
0...500	36	-216...216	7	G5.RSS.36.500.216
0...500	45	-270...270	10	G5.RSS.45.500.270
0...500	54	-324...324	10	G5.RSS.54.500.324
0...1000	18	-54...54	4	G5.RSS.18.1000.54
0...1000	36	-108...108	7	G5.RSS.36.1000.108
0...1000	54	-162...162	10	G5.RSS.54.1000.162
0...1500	27	-54...54	7	G5.RSS.27.1500.54
0...1500	54	-108...108	10	G5.RSS.54.1500.108

*also as 60 V SELV version for single or parallel operation available, order code example: G5.RSS.9.**60**.338
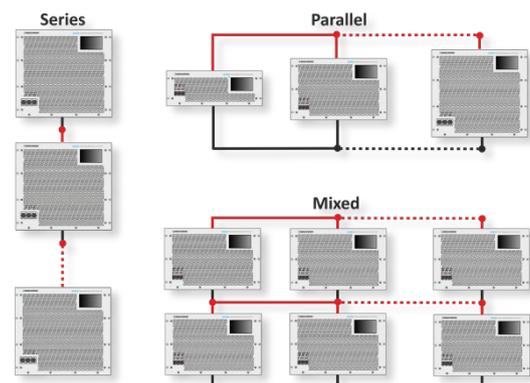
Modular and Easily Scalable Systems

Figure 1: Modular concept for easy power and voltage increase by parallel, series, and mixed operation. The parallel configuration allows even the operation of devices with different output power, e.g., 18, 36, and 54 kW modules, in one system

The output of an individual power supply is in the range from 0...9 kW to 0...2000+ kW, up to 3000 VDC. The advantageous modularity of REGATRON power supply solutions allows the system to be easily adapted to ever-changing test requirements. It is possible to reconfigure between parallel, series, and mixed operation.

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Moreover, the system can be expanded with additional power supply units or may be split into smaller units. Whether for single devices or powerful multi-device multi-unit systems, REGATRON also offers turnkey cabinet solutions or project-specific system integration according to customer specifications.

Therefore, the purchase of a REGATRON power supply is a solid investment for the future.

Applications and Features

The high accuracy and dynamics of the G5.RSS series, as well as the ability to easily change between different multi-unit configurations, make this series the ideal power supply solution for bidirectional R+D tasks and test bench applications such as testing of power conversion systems (PCS) or testing of converters for energy storage systems (ESS).

Various features such as switchable filter time constants and adjustable controller settings as well as the integrated powerful 8-channel digital scope assist the user to quickly and easily achieve optimal system behavior for a special application requirement.

Simplified and safe operation can be provided by pre-programmed overvoltage protection and digital fuses with immediate and I2t triggering. Different protection levels for different DUTs can be either programmed by the user's automation test system via various interfaces or activated manually by digital input signals or even more conveniently wired to different switch positions.

The G5.RSS series also offers the possibility to store, edit, and recall any device configuration on board the power supply.

Dynamics

Maximum speed or minimum overshoot? Figure 2 shows the dynamic parameters of the G5.RSS series can be easily adapted to a specific task.
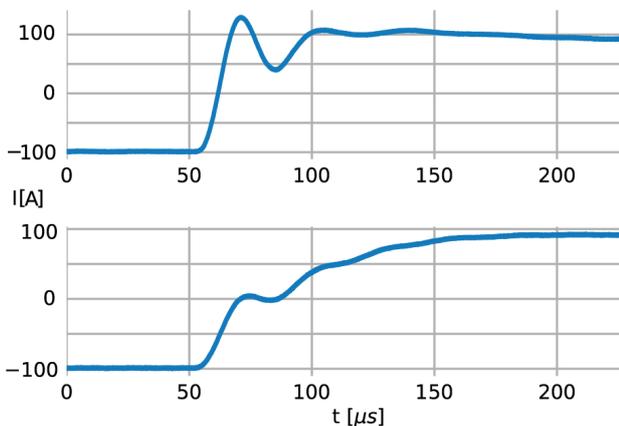

Figure 2: Parameterization example of a 36 kW, 1000 V, 108 A device: Set-value step current -97…97 A@333VDC in <50 µs with overshoot (top), in <200 µs w/o overshoot (bottom). This dynamic behavior is characteristic for all G5 devices.

General Dynamic Data

rise time set-value step	voltage 0…90% current -90…90%	150…220 µs 35…70 µs
response time load step	CV, recovery within 0.5% set value	50…290 µs

G5.RSS Series as P-HIL Power Amplifier

Power-hardware-in-the-loop (P-HIL) simulation integrates physical hardware and software models in a closed-loop, offering versatile opportunities to investigate the behavior of complex systems at different parameter settings.

A typical PHIL setup includes a fast real-time computer driving a power amplifier. The G5.RSS series is best suited for this purpose due to its high dynamics and a fast analog port. Time analog-in to power output is typically 90 µs.

Accuracy

The G5.RSS series has an exceptional voltage accuracy of 0.01…0.02% FS. The current accuracy is in the range of 0.03…0.09% FS depending on the model. There is even an additional high-resolution current measurement range from -10 to 10% FS with an accuracy of better than 0.005% FS.

Control Modes

CV   constant voltage
CC   constant current
CP   constant power
CR   constant resistance
Ri   internal resistance simulation in CV
Gi   internal conductance simulation in CC

Interfaces

Ethernet and USB

To connect with:
- G5.Control, the operating and maintenance software
- API .NET programming, e.g., by LabView, Python, Matlab
- WebAPI (REST) interface via the optional HMI or RCU

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I/O port

The I/O interface features analog and digital signals used for set and actual values or operating states. Integrated into the user's control system it is possible to set dynamically changing limits, to use enable signals, or trigger in- or outputs. The possibility to activate up to 4 user-defined parameter sets using digital inputs means that the system can be adapted to different EUTs. For example, predefined digital fuses and voltage limits can be set.

Grid Connection

The wide-band AC input accepts all common AC grid systems and has an active power factor correction.

AC Grid	380…480 VAC ±10% at 50/60 Hz
PF	0.99
Efficiency	94…95%, depending on model

Options

Software and Controls

Time-Based Function Generator (TFE)

The TFE time-based function generator allows programming either through G5.Control operating software, HMI touch display, or various interfaces.

- Time-dependent functions U = f(t), I = f(t), P = f(t): sine, triangle, or square as well as user-defined data points. Import and export through csv files supported
- Ramp function for amplitude and offset changes
- Small signal modulation up to 10 kHz

Sweep functionality for TFE

As an add-on to the TFE time-based function generator, the sweep mode allows for continuous or stepwise sweeping of the amplitude and the frequency of a programmed function. Both the amplitude and the frequency may be swept linearly or exponentially.

This sweep function together with the high modulation bandwidth of 10 kHz makes devices well suited to electrochemical impedance spectroscopy (EIS) of batteries, fuel cells, and electrolyzers.

Application Area Programming (AAP)

The AAP application area programming feature allows to set the DC output voltage or current or power as a function of any of the input values I_{DC}, U_{DC}, or P_{DC}. The functional relationship is given by a user-defined curve whose values are managed by CSV import/export. In this way, a wide variety of nonlinear electrical two-pole

networks can be defined, e.g., photovoltaic arrays or fuel cell curves. As an example, Figure 3 shows the typical fuel cell characteristics with a voltage/current dependence. Embedded calculation on board the G5.RSS assures real-time simulation.
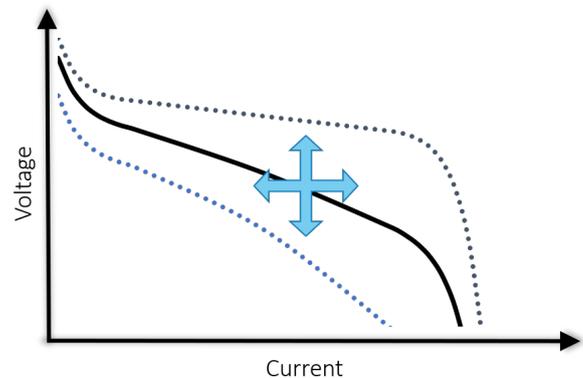

Figure 3: AAP curve with fuel cell characteristic U = f(I).

HMI / RCU

The HMI built into the front panel allows comprehensive and convenient operation of the power supply via touch display or the WebAPI (REST) interface.

With the remote control unit (RCU) it is possible to control the device or system from a distant location in the same manner as with the HMI.

Figure 4: Intuitive control by HMI touch display. Everything you need at a glance.

CAN Interface

The CAN multi-protocol (CANmp) interface has a 1 kHz data rate, a 16-bit resolution, and is adaptable to any proprietary CAN bus. In addition, it supports dbc file handling.

EtherCAT Interface

The EtherCAT slave interface (ECAT) supports configuration by ESI file and communicates in a 1 kHz cycle. It transmits the entire process data in the same cycle, i.e. commands, actual states, and actual values. Acyclic communication via mailbox for device configuration is also possible.

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SCPI Interface

SCPI, Standard Commands for Programmable Instruments, are ASCII strings, which are sent to the device over TCP/IP using the LAN socket. They can perform set operations or query operations.

User Safety

- Integrated safety relay (ISR) for increased emergency stop reliability, supporting performance level PL c / PL e according to EN ISO 13849
- Discharging of the AC filter (XCD), is mandatory when using the device with a plug connection. XCD ensures a discharge time of the AC filter <1 s as required by EN 62477-1
- Based on the 80 V models, also a 60 V SELV version is available
- Various terminal protection covers

The different protective covers are designed for integration into 19" rack systems or for use as a tabletop device. The cover for cabinet integration provides protection against accidental contact, whereas the cover for the tabletop version requires touch-proof protection in accordance with standard EN 62477-1.

Voltage V	Power kW	DC-cover acc. contact	DC-cover touch-proof	AC-cover touch-proof	Tabletop use allowed	Order Code
60...160	≤18	●		○	✓	G5.PAC.DCAC.1
60...320	≥27	●	—	—	—	—
500...1000	≤18	—	●	○	✓	G5.PAC.AC.1
500...1500	≥27	—	●	○	✓	G5.PAC.AC.2

●   included
○   optional, mandatory for tabletop use

Environmental Conditions

- Front-panel-mounted air filter (AirFilter), recommended for use in dusty environments and with IP20 cabinets
- Higher degree of protection up to IP54 available on cabinet level
- Liquid cooling of the G5 devices at system level as shown in Figure 6. The Regatron solution allows to take the entire dissipated heat of the power supply out of the test bench and reuse it as process heat in the facility if possible

Rack-Integrated System Solutions

- Mobile rack solutions on castors up to 162 kW
- IP54 protection for air or liquid-cooled systems
- Third-party product integration and numerous safety options
- Insulation monitoring: remote activation of the insulation measurement, actual insulation value, and warning/error status are provided by the CANmp interface or by optional display
- Easy reconfiguration between parallel, series, and mixed operation

Figure 5: REGATRON's rack-integrated turn-key system solutions for various power levels e.g. 72 kW (left) and 162 kW (right). Various types of AC/DC connectors and cables allow for comfortable handling.

Figure 6: REGATRON's liquid-cooled system solutions up to IP54 with various power levels e.g. 54...162 kW (left) and 216...324 kW (right). The remote control unit RCU, indicator lights, emergency stop button, and main switch allow the user to operate the system on the enclosure's front door.

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Important Features of the G5.RSS Series

Technology

- Technologically advanced, fast-switching, compact 19-inch power supplies
- High control dynamics in the 100…200 µs range – even at higher power levels up to 2000+ kW
- Exceptional accuracy and an additional high-resolution current measurement range
- Wide current-voltage range with an auto-ranging factor 3
- CV, CC, CP, CR, and Ri/Gi-Sim control modes
- Regenerative and highly efficient, resulting in a significant reduction of energy consumption and heat dissipation

System Control and Options

- Operating software for extended analysis, parameterization options, and calibration
- Powerful application programming interfaces (APIs)

System Capability

- Modular and easily scalable systems
- Parallel, series, and mixed operation with a digital high-speed bus
- Simple multi-unit configuration supported by the operating software
- Easy rack mounting
- Liquid cooled systems in IP54 available
- Optional safety features such as 2-channel safety interface and insulation monitoring
- Turn-key cabinet solutions or project-specific system integration according to customer specification

This product is developed, produced and tested according to ISO 9001 by REGATRON.

For detailed technical information, contact REGATRON or your local sales partner.

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REGATRON DC & AC Power Supplies: Modular · Precisely Engineered · Technologically Advanced

50+ years of innovation since 1969