G5.UNV Universal Regenerative DC Source Sink Series

The G5.UNV series is bidirectional regenerative and can operate in CV, CC, CP, CR, and Ri-Sim control modes. It is universally applicable and therefore suitable for all industrial and scientific applications in laboratories and on test benches. The modular and finely graded G5.UNV series is characterized by highly dynamic response times, adjustable filter time constants, and a wide current-voltage range with an auto-ranging factor 3. The power supplies of the G5.UNV series are equipped with the function and software modules for the simulation of energy storage devices and solar arrays as well as for the testing and evaluation of batteries and fuel cells. The engineer therefore has a power supply available that easily covers a wide range of applications.

Device Types

Voltage V	Power kW	Current A	Height U	Order Code
0...500	18	-108...108	4	G5.UNV.18.500.108
0...500	27	-162...162	7	G5.UNV.27.500.162
0...500	36	-216...216	7	G5.UNV.36.500.216
0...500	54	-324...324	10	G5.UNV.54.500.324
0...1000	18	-54...54	4	G5.UNV.18.1000.54
0...1000	36	-108...108	7	G5.UNV.36.1000.108
0...1000	54	-162...162	10	G5.UNV.54.1000.162
0...1500	27	-54...54	7	G5.UNV.27.1500.54
0...1500	54	-108...108	10	G5.UNV.54.1500.108

Modular and Easy Scalable Systems

The output of an individual power supply is in the range from 0...18 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. Not only is it possible to reconfigure between parallel, series, and mixed operation, but also to expand the system with additional power supply units or to split it into smaller units.

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

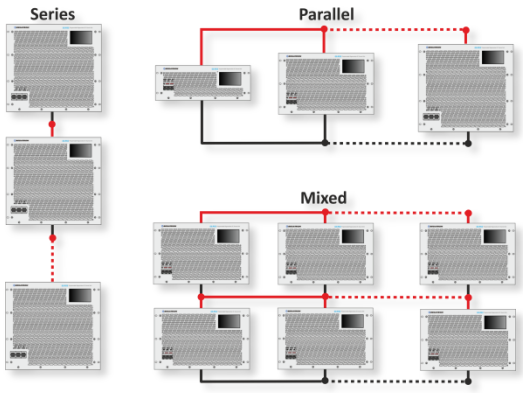

Figure 1: Modular concept for easy power and voltage increase by parallel, series, and mixed operation. The parallel configuration allows even an operation of different power levels, e.g., 18, 36, and 54 kW modules, in one system.

Whether for single devices or powerful multi-device master-slave systems, REGATRON also offers turnkey cabinet solutions or project specific system integration according to customer specifications.

Applications and Features

The G5.UNV series is the fully equipped all-rounder! It contains all necessary function and software modules for the simulation of energy storage devices and solar arrays as well as for the testing and evaluation of batteries and fuel cells.

Various excellent 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 customer application. The G5.UNV series also offers the possibility to store, edit, and recall any device configuration on board the power supply.

Time-Based Function Generator

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

- 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
- Sweep function for current ripple modulation 0…10 kHz

Solar Array Simulation

As a PV simulator the G5.UNV series features especially low capacitance values in the output filter stage, switchable earth leakage resistors, and the versatile application software SASControl. The powerful platform for R+D and testing of PV inverters fully complies with the efficiency measurement procedures for maximum power point tracking (MPPT) in inverters as described in EN 50530. Core of the application software SASControl is a versatile script programming system which allows the easy implementation of individual programming sequences. Report generation of measured data is included.

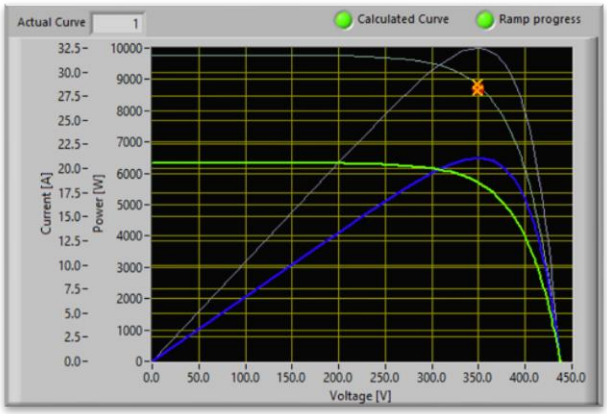

Figure 2: SASControl Live Viewer – always up to date.

Battery Simulation

As a battery simulator the G5.UNV series realistically and dynamically simulates both the electro-chemical and electrical properties of a battery type in charge and discharge mode. Other features include high data resolution and options for meeting high safety standards for operators. The real-time computing process of the application software BatSim perfectly matches the internal timing of the DC power supply. Therefore, an optimum computing rate is achieved leading to very short response times even in cases of steep changes in charge/discharge currents. Each battery type reacts in a specific manner to charge and discharge currents in terms of state of charge, cell voltage, ohmic and parametric losses, and polarization effects. These dependencies are considered by specific mathematical models used in the REGATRON BatSim software/firmware. The operator can fine tune the model with several well-defined parameters to adjust the simulation to a user's requirement.

Models of the following battery types are available for configuration: Li-ion, lead-acid, NiMH, and NiCd.

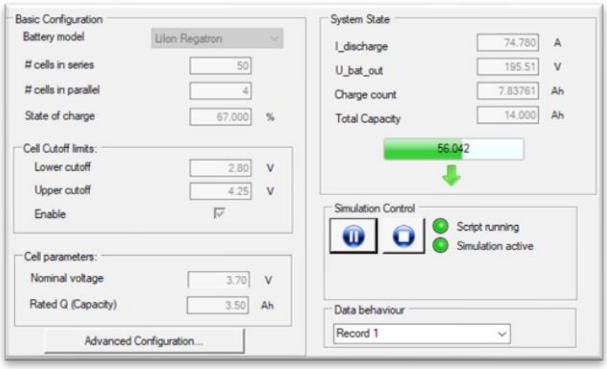

Figure 3: BATSim configuration – a few clicks away from the required battery simulation.

Battery Testing

As a battery tester the G5.UNV series has an exceptional electrical performance that offers several advantages for battery testing applications:

- Accuracy of <0.02% FS
- Additional high-resolution current measurement range from -10 to 10% FS
- Current rise time in the 50…200 µs range
- Parameterizable to avoid overshoot
- Current ripple modulation up to 10 kHz

In addition, the G5.UNV provides important features for user safety, power supply, and battery protection. It avoids:

- Reverse-polarity problems
- Arcing and high inrush current when connecting the battery to the DC terminals even at unmatched voltage levels
- Deep battery discharge at voltage off state (DC port impedance >10 MΩ)

The application software BatControl allows selecting and running so-called BatScripts. These scripts automate the manually given commands to the G5 Battery Tester and allow the running of these commands according to defined schedules.

- Define charge and discharge algorithms
- Run drive cycles (according to own or already defined standards)
- Repeat previously recorded discharge/charge data

Fuel Cell Simulation

For use as fuel cell simulator the G5.UNV series utilizes the integrated AAP function. 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 4 shows the typical fuel cell characteristics with a voltage/current dependence. Embedded calculation on board the G5.UNV assures real-time simulation.

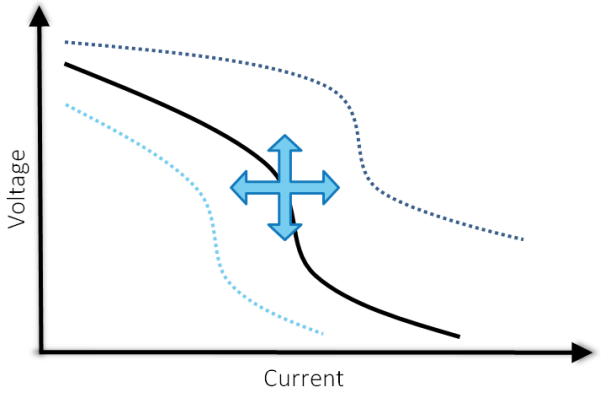

Figure 4: AAP curve with fuel cell characteristic U = f(I).

G5.UNV Series as P-HIL Power Amplifier

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

A typical P-HIL setup includes a fast real-time computer driving a power amplifier. The G5.UNV series is best suited for this purpose due to its high dynamics and a fast analog port. Time analog-in to DSP: <50 µs

Dynamics

Maximum speed or minimum overshoot? Figure 5 shows that the dynamic parameters of the G5.UNV series can be easily adapted to a specific task.

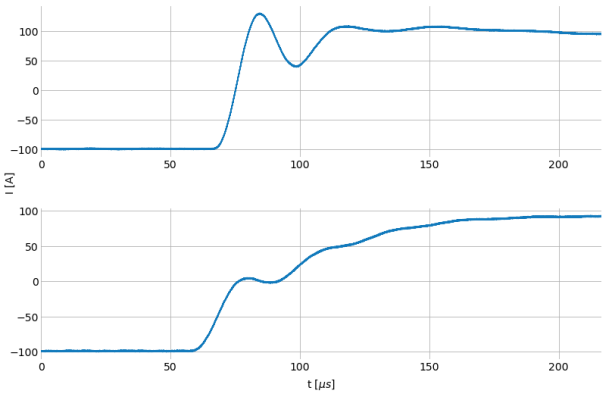

Figure 5: Parameterization example: set-value step currents. -97…97 A@333VDC in <50 µs with overshoot (top), in <200 µs w/o overshoot (bottom).

General Dynamic Data

rise/fall time set-value step	voltage 0…90%	150…200 µs
	current -90…90%	50…100 µs
response time load step	CV, recovery within 0.5% set value	100…150 µs

Accuracy

The G5.UNV series has an exceptional accuracy of <0.02% FS. There is even an additional high-resolution current measurement range from -10 to 10% FS.

Control Modes

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

System Control

G5.Control	operating and maintenance software
TFE	time-based function generator
AAP	application area programming
SASControl	PV simulation software
BatSim	battery simulation software
BatControl	battery testing and cycling software
API	.NET programming, e.g., by LabView, Python, Matlab, or REST interface
I/O port	Analog interface for set and actual values, operating states

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	95...96%

Options

Software and Control

HMI

The HMI built into the front panel allows comprehensive and convenient operation of the power supply via touch display.

Figure 6: 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.

Capacitor Simulation

Capacitor simulation software CapSim for implementation of a RC-equivalent circuit model, eg., Electric Double Layer Capacitors EDLC.

User Safety

- Integrated safety relay (ISR) for increased emergency stop reliability supporting performance level PL c / PL e according to EN ISO 13849
- Discharge of AC filter (XCD), recommended for mobile use of the device. XCD ensures a discharge time of the AC filter <1 s as required by EN 50178
- AC terminal protection cover (PAC.AC), recommended for use as tabletop unit

Environmental Conditions

Front-panel-mounted air filter (AirFilter), recommended for use in dusty environments.Important Features of the G5.UNV Series

Rack-Integrated System Solutions

- Mobile rack solutions up to IP54
- Insulation monitoring: remote activation of the insulation measurement, actual insulation value, and warning/error status are provided by CANmp interface or by optional HMI
- Easy reconfiguration between parallel, series, and mixed operation

REGATRON
programmable power supplies

Figure 7: REGATRON's rack-integrated turn-key system solutions, e.g., 72 kW (left) and 162 kW (right) power levels. Various types of AC/DC connectors and cables allow for comfortable handling. Third-party product integration and numerous safety options are additional features.

Technology

- Technologically advanced, fast switching, compact 19-inch power supplies
- High control dynamics in the 100...200 µs range – even at higher power levels
- Exceptional accuracy of <0.02% FS, additional high-resolution measurement range
- Wide current-voltage range with an auto-ranging factor 3
- CV, CC, CP, CR, and Ri-Sim control modes
- Regenerative and highly efficient, resulting in significant reduction of energy consumption and heat dissipation

System Capability

- Modular and easy scalable systems
- Parallel, series, and mixed operation with a digital high-speed bus
- Simple master-slave configuration with the operating software
- Easy rack mounting
- 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

System Control and Options

- Operating software, extended analysis, parameterization options, and calibration
- Application software with visualization, programming, and data logger
- Powerful application programming interfaces (APIs)

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

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

NEW

DC Generation 5

50+ years of innovation since 1969