

RUG-TC

RUGGED MODULAR DC POWER SUPPLIES



POSITIVE PROBLEM SOLVING **+=**

The RUG-TC is ideal for mobile applications. Each module is designed to withstand a high level of shock and vibration, as well as high humidity.

Originally developed for military vehicles, these DC sources have been used in many vehicle mount projects. This includes surface boat, submarine and rail along with other automotive projects. Applications have varied from powering transmitters and sonar to battery charging. The passive PFC circuit helps ensure that the unit can be operated from weakly regulated diesel generators. Low level protocols [LLP] gives access to the most commonly used hexadecimal memory addresses for given functions.

- + Proven Many Times on Vehicle Mounted Applications**
- + Up to 20G/11ms of Shock Across X-, Y- & Z- Axis**
- + Parallel, Series and Multi-load Operation**
- + Function Generator with V/I Capability**
- + Protected Against Condensation**
- + Access to Low Level Protocols**

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STANDARD MODELS

SELECTION TABLE

Part Number	Max. Power	Voltage Range	Current Range	Efficiency	Internal Resistance
RUG-TC 10-52-ESV	10kW	0 - 52V	0 - 250A	92%	0 - 208mΩ
RUG-TC 10-65-ESV	10kW	0 - 65V	0 - 193A	92%	0 - 337mΩ
RUG-TC 10-100-ESV	10kW	0 - 100V	0 - 125A	92%	0 - 800mΩ
RUG-TC 10-130-ESV	10kW	0 - 130V	0 - 96A	92%	0 - 1354mΩ
RUG-TC 10-200-ESV	10kW	0 - 200V	0 - 63A	92%	0 - 3175mΩ
RUG-TC 10-400-ESV	10kW	0 - 400V	0 - 31A	92%	0 - 12903mΩ
RUG-TC 10-500-ESV	10kW	0 - 500V	0 - 25A	92%	0 - 20000mΩ
RUG-TC 10-600-ESV	10kW	0 - 600V	0 - 20A	92%	0 - 30000mΩ
RUG-TC 10-800-ESV	10kW	0 - 800V	0 - 16A	92%	0 - 32000mΩ
RUG-TC 10-1000-ESV	10kW	0 - 1000V	0 - 13A	92%	0 - 32000mΩ
RUG-TC 16-52-ESV	16kW	0 - 52V	0 - 400A	92%	0 - 130mΩ
RUG-TC 16-65-ESV	16kW	0 - 65V	0 - 308A	92%	0 - 211mΩ
RUG-TC 16-100-ESV	16kW	0 - 100V	0 - 200A	92%	0 - 500mΩ
RUG-TC 16-130-ESV	16kW	0 - 130V	0 - 153A	92%	0 - 850mΩ
RUG-TC 16-200-ESV	16kW	0 - 200V	0 - 100A	92%	0 - 2000mΩ
RUG-TC 16-400-ESV	16kW	0 - 400V	0 - 50A	92%	0 - 8000mΩ
RUG-TC 16-500-ESV	16kW	0 - 500V	0 - 40A	92%	0 - 12500mΩ
RUG-TC 16-600-ESV	16kW	0 - 600V	0 - 32A	92%	0 - 18750mΩ
RUG-TC 16-800-ESV	16kW	0 - 800V	0 - 25A	92%	0 - 32000mΩ
RUG-TC 16-1000-ESV	16kW	0 - 1000V	0 - 20A	92%	0 - 32000mΩ
RUG-TC 20-52-ESV	20kW	0 - 52V	0 - 500A	95%	0 - 104mΩ
RUG-TC 20-65-ESV	20kW	0 - 65V	0 - 385A	95%	0 - 169mΩ
RUG-TC 20-100-ESV	20kW	0 - 100V	0 - 250A	95%	0 - 400mΩ
RUG-TC 20-130-ESV	20kW	0 - 130V	0 - 192A	95%	0 - 677mΩ
RUG-TC 20-200-ESV	20kW	0 - 200V	0 - 125A	95%	0 - 1600mΩ
RUG-TC 20-320-ESV	20kW	0 - 320V	0 - 80A	95%	0 - 4000mΩ
RUG-TC 20-400-ESV	20kW	0 - 400V	0 - 63A	95%	0 - 6349mΩ
RUG-TC 20-500-ESV	20kW	0 - 500V	0 - 50A	95%	0 - 10000mΩ
RUG-TC 20-600-ESV	20kW	0 - 600V	0 - 40A	95%	0 - 15000mΩ
RUG-TC 20-800-ESV	20kW	0 - 800V	0 - 32A	95%	0 - 25000mΩ
RUG-TC 20-1000-ESV	20kW	0 - 1000V	0 - 25A	95%	0 - 32000mΩ
RUG-TC 20-1200-ESV	20kW	0 - 1200V	0 - 20A	95%	0 - 32000mΩ
RUG-TC 32-52-ESV	32kW	0 - 52V	0 - 700A	95%	0 - 74mΩ
RUG-TC 32-65-ESV	32kW	0 - 65V	0 - 600A	95%	0 - 108mΩ
RUG-TC 32-100-ESV	32kW	0 - 100V	0 - 400A	95%	0 - 250mΩ
RUG-TC 32-130-ESV	32kW	0 - 130V	0 - 308A	95%	0 - 422mΩ
RUG-TC 32-200-ESV	32kW	0 - 200V	0 - 200A	95%	0 - 1000mΩ
RUG-TC 32-320-ESV	32kW	0 - 320V	0 - 125A	95%	0 - 2560mΩ
RUG-TC 32-400-ESV	32kW	0 - 400V	0 - 100A	95%	0 - 4000mΩ
RUG-TC 32-500-ESV	32kW	0 - 500V	0 - 80A	95%	0 - 6250mΩ
RUG-TC 32-600-ESV	32kW	0 - 600V	0 - 66A	95%	0 - 9091mΩ
RUG-TC 32-800-ESV	32kW	0 - 800V	0 - 50A	95%	0 - 16000mΩ
RUG-TC 32-1000-ESV	32kW	0 - 1000V	0 - 40A	95%	0 - 25000mΩ
RUG-TC 32-1200-ESV	32kW	0 - 1200V	0 - 33A	95%	0 - 32000mΩ

Different output ranges and application/user specific options are possible. Please contact ETPS Ltd. to discuss your requirements.

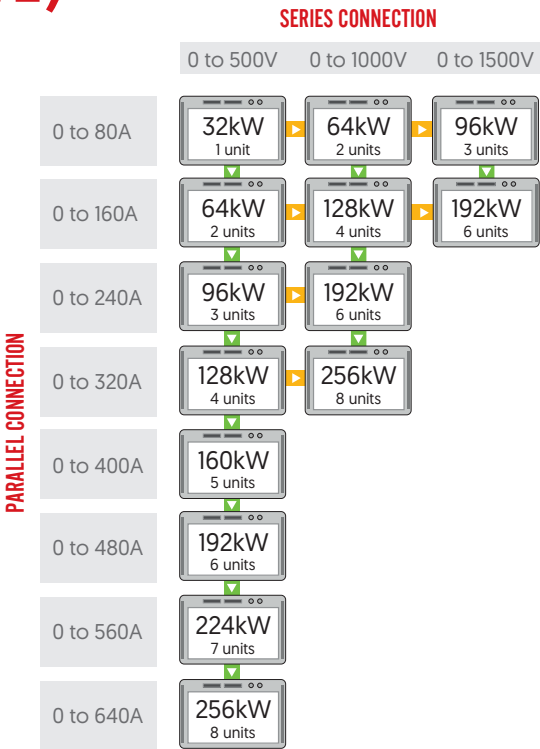
OPTIONS

CODE	DESCRIPTION
FORM FACTOR AND ENCLOSURES	
/LR	Integration into a static enclosure.
/FC	Integration into a flightcase.
INPUT	
/480	Input voltage range of 3 × 432-528Vac, 48-62Hz (for models ≥16kW).
/WR	Wide input of 3 × 360-528Vac, 50/60Hz (only available for 1kV units at 20kW or 32kW).
/FILTER	Input air filter.
OPERATING RANGES AND FEATURES	
/IRXTS	Maximum adjustable internal resistance range extended to 32,000mΩ.
/CANCABLE	Connecting cable for multi-unit operation.
/RMB	Remote Measure Box for higher dynamics in multi-unit operation.
/EMIFILTER	EMI filter for DC output.
INTERFACES AND CONTROL	
/HMI	This provides front panel control and measurement via a menu driven LCD screen. Most users prefer their units to be fitted with HMI. For systems comprised of multiple units or where only remote control is required, cost can be saved by not including front panel controls and display.
/RS232REAR	RS-232 on front and rear panel (time shared mode with RS-232 on front).
/RS422	Differential serial interface (time shared mode with RS-232).
/IEEE	When specified, an integrated IEEE 488.2 interface is built into the rear panel (RS-232 only possible on rear panel). The programming terms employed are compliant with Standard Commands for Programmable Instrumentation (SCPI), making the RUG-TC ideal for system integration.
/CANOPEN	On request an additional serial interface built to the CAN/CANopen standards can be integrated into the rear panel (RS-232 only possible on rear panel).
/CANMP	Integrated CANmp interface (RS-232 only possible on rear panel).
/OPTOLINK	Rear panel integrated fibre optic interface (RS-232 only possible on rear panel).
/USB	Integrated USB interface (RS-232 only possible on rear panel). The graphical user interface (TopControl) can be operated over the USB port. RS-232 and USB cannot be used at the same time.
/ETH	Ethernet interface with listener and talker functions over a LAN (RS232REAR required).
/CAN+USB	Combined CAN and USB interface.
MECHANICAL	
/LCAL	Integrated liquid cooling of the power stage.
/RCU	The RCU provides the HMI functions via cable at a distance of up to 40m. The RCU is available in a compact desktop case or as a 19" rackmount unit.
SAFETY AND PROTECTION	
/ISR	Integrated safety relay for shutdown to EN 13849-1 Cat 2/3
/PACOB	Protection against accidental contact of output current bars.
/RPP	Protection against reverse polarity of the load.
SOFTWARE/SOFT TOOLS	
/TFE	Integrated function generating engine with application area (parametric) programming.
/SASCONTROL	Solar array simulation GUI (includes TFE option).
/BATSIM	GUI simulating battery characteristics with adjustable parameters.
/CAPSIM	GUI simulating the electrical characteristics of capacitors with adjustable parameters.
/BATCONTROL	GUI to implement specific battery/capacitor charge profiles and industry specific drive cycles.

MODULARITY (MASTER/SLAVE)

Up to 64 RUG-TC modules can be arranged in series, parallel or matrix array configurations. Each module is able to operate independently, so that systems can be reconfigured, expanded or broken up as needs dictate. Inbuilt system comms allow users to switch between various set-ups.

The modular approach is useful for companies who regularly need to power different sized devices. Individual modules can be used for energising multiple small devices, then grouped together for larger projects. The diagram shows all the possible combinations with eight 500V modules.



FORM FACTOR AND ENCLOSURES

STANDARD FEATURES

TECHNICAL DATA	
Module Width	Front panel: 483mm Body: {19"} 444mm
10kW and 16kW Module Height	Front panel: 265mm Body: {6U} 262mm With width strengthening struts: 274mm
20kW and 32kW Module Height	Front panel: 399mm Body: {9U} 394mm With width strengthening struts: 409mm
10kW and 16kW Module Depth	With DC bars: 490.5mm Body: 425mm
10kW and 16kW Module Depth	With DC bars: 570mm Body: 525mm
Strengthening Struts (Number)	2 pieces
Strengthening Struts (Number Mounting Holes)	3 pieces /strut
Strengthening Struts (Diameter Mounting Holes)	M8
Weight	10kW Modules: 44kg 16kW Modules: 46kg 20kW Modules: 66kg 32kW Modules: 70kg
Basic Construction	IP20 (up to IP54 when mounted in a cabinet)

Each RUG-TC is built into a 19" rackmounting case as standard. The standard ruggedised build has 2 × mounting bars underneath the unit to securely fix to the horizontal plain. If rack height is limited then a 2mm mounting plate extending at the rear is optionally possible

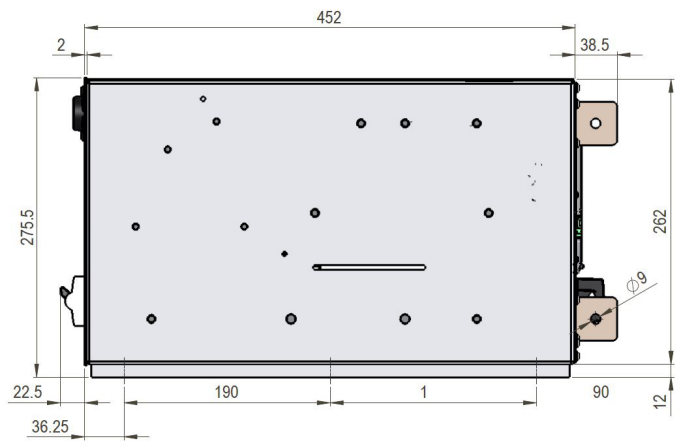
Units can be treated to an integration into a flight case or static enclosure. Common options include mains cables, passive indication of any residual DC voltage, isolation monitoring of DC cables and a panel mounted emergency stop. Switch panels with removable DC links can be fitted for modular systems. This simplifies the reconfiguration between series, parallel or independent use. Simple wheeled cabinets are also available.



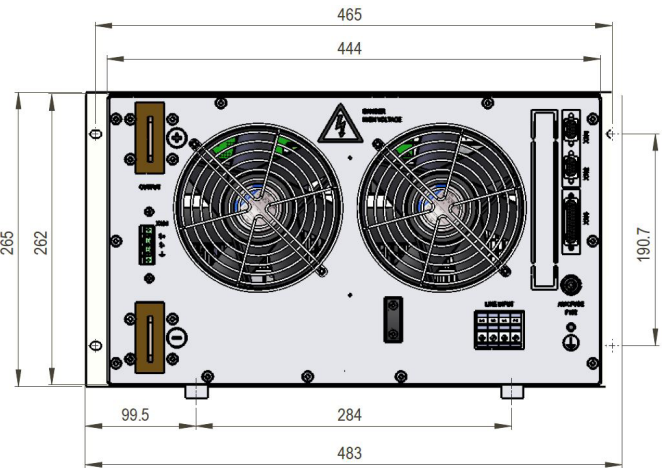
FORM FACTOR AND ENCLOSURES

10kW AND 16kW MODULES

SIDE DIMENSIONS

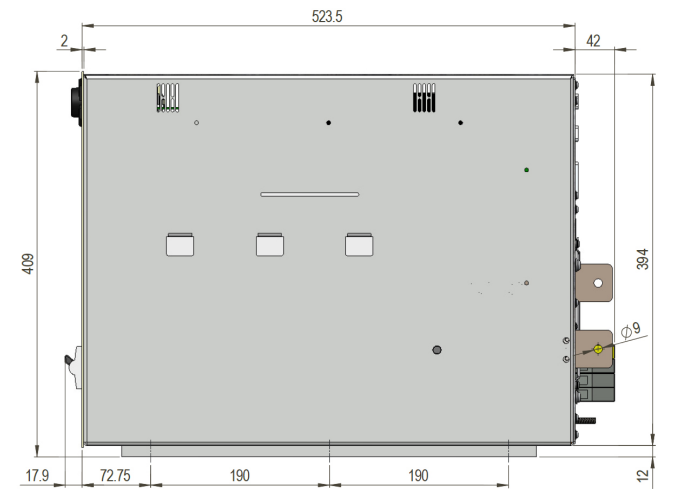


REAR DIMENSIONS

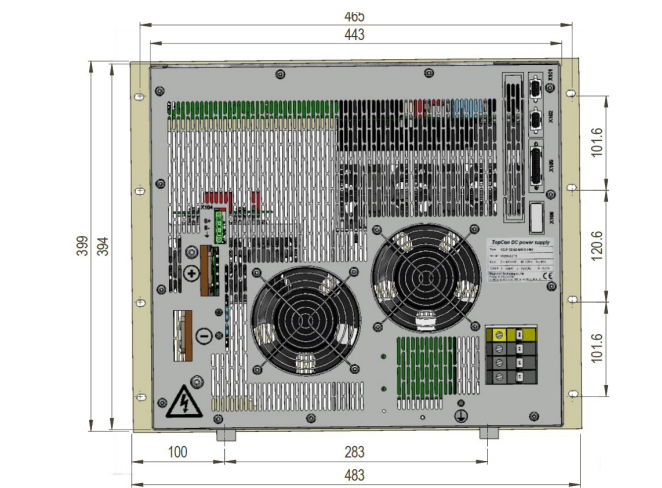


20kW AND 32kW MODULES

SIDE DIMENSIONS



REAR DIMENSIONS



OPTIONS

CODE	DESCRIPTION
/LR	Integration into a static enclosure.
/FC	Integration into a flightcase.

OPERATING RANGES AND FEATURES

STANDARD FEATURES

TECHNICAL DATA	
Remote Sense	$0 - V_{MAX} + 2\%$
Efficiency	Up to 95%
Response time (10-90%)	<2ms
Over Voltage Protection	$0 - 110\% \text{ of } V_{MAX}$
Over Current Protection	$0 - 110\% \text{ of } I_{MAX}$
Output Ripple (300Hz Vrms)	<0.4% [Typical value at nominal ohmic load, line asymmetry < 1 Vrms].
Output Noise (40kHz-1MHz)	<0.1 Vrms [Typical value at nominal ohmic load, line asymmetry < 1 Vrms].
Stability (CV, CC)	$\pm 0.05\%$ [Maximum drift over 8 hours after 30 minute warm-up time, at constant line input, load and temperature conditions].
Temperature Coefficient (CV)	<0.02% of full scale value per°C [Typical change of output values versus ambient temperature, at constant line input and load conditions].
Temperature Coefficient (CC)	<0.03% of full scale value per°C [Typical change of output values versus ambient temperature, at constant line input and load conditions].

HIGHLIGHTED FEATURES



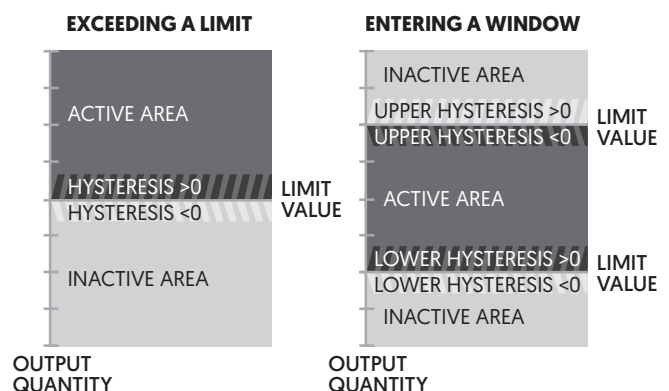
SENSE COMPENSATION

Sense plus terminals are built into the RUG-TC for the connection of sense wire which compensates for voltage drops in the load lines. This has a number of advantages over traditional sense. It is permitted to interrupt the load line during operation (voltage on). The maximum voltage drop compensation is adjustable. The voltage difference between RUG-TC output and sensing point is monitored. If a set limit is exceeded, the RUG-TC unit shuts off. This is particularly useful for applications with long cables often prone to unwanted voltage drops.



VERSATILE LIMIT SETTING (VLS)

The VLS allows the RUG-TC's output relays to be activated automatically when specific output values are met, protecting the DUT from any damaging conditions. Output voltage, current and power values which exceed or fall below a given limit or operating window can be programmed to trigger the relays. Active and inactive areas of operation are defined by a limit value, hysteresis value or a directional designator for the hysteresis.



OPTIONS

CODE	DESCRIPTION
/IRXTS	Maximum adjustable internal resistance range extended to 32,000mΩ
/CANCABLE	Connecting cable for multi-unit operation
/RMB	Remote Measure Box for higher dynamics in multi-unit operation
/EMIFILTER	EMI filter for DC output

STANDARD FEATURES

TECHNICAL DATA	
Operating Modes	Constant Voltage [0 - 100% of V_{MAX}] Constant Current [0 - 100% of I_{MAX}] Constant Power [5 - 100% of P_{MAX}]
Internal Resistance Range	Adjustable $\Omega_{MAX} = [V_{NOM} / I_{NOM}]$
Standard Interfaces	Analogue & RS-232

INPUT

STANDARD FEATURES

TECHNICAL DATA	
Input Voltage	3 × 360 - 440 VAC
Line Frequency	48 - 62Hz
Mains Connection Type	3L + PE (no neutral)
Load Regulation [CV, CC]	<± 0.1%
Line Regulation [CV, CC]	<± 0.1% (Typical value for input voltage variation within 360-440 VAC, at constant load and temperature conditions.

HIGHLIGHTED FEATURE



POWER FACTOR CORRECTION

RUG-TC modules have a Power Factor Correction (PFC) circuit integrated into the input stage as standard. This enhances the overall efficiency of the modules across the output power range when compared to a unit that does not have PFC. The current harmonics of the RUG-TC meet the EN61000-12 regulations for a mains SCE ≥ 120 value. In practice, this means a significant lower peak current value, a decrease of RMS value of the phase current and less perturbations of other equipment running on the same grid.

The inbuilt PFC is also ideal for operating the power supply from a generator. Generators tend to be sensitive against high current peaks, and their voltage controllers may have some stability problems with non-sinusoidal load currents. The PFC feature forms a lowpass filter and therefore, both the repetitive current peaks and also the harmonic content is enhanced. This will help the generator system maintain a stable and reliable output.

OPTIONS

CODE	DESCRIPTION
/480	Input voltage range of 3 × 432-528Vac, 48-62Hz (for models $\geq 16kW$)
/WR	Wide input of 3 × 360-528Vac, 50/60Hz (only available for 1kV units at 20kW or 32kW)
/FILTER	Input air filter

HIGHLIGHTED OPTIONS

+ - CUSTOM DC INPUT

Where users only have access to a DC link, special RUG-TC units have been produced with a DC input. The full functionality of the power supply is still provided. To discuss this option further, please contact ETPS.

⚡ WIDE INPUT RANGE (/WR)

A 360-528Vac wide input range is possible for selected models. This is ideal for systems which may regularly travel to different countries, such as when using the RUG-TC as a battery charger for a global motorsports series.

INTERFACES

STANDARD RS-232 INTERFACE

The RS-232 interface is configured as a Sub-D 9 pin connector (female) and is located on the front panel. This interface can be optionally moved to the rear panel. The graphical user interface, TopControl is operated via RS-232. The software runs on Windows and allows the user to control, measure and configure the power supply.

TECHNICAL DATA

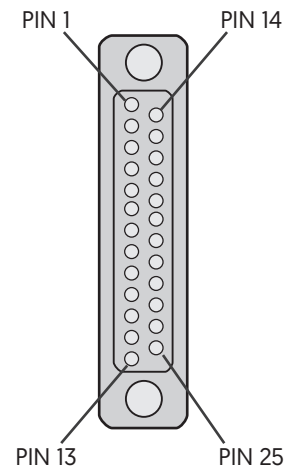
Isolation to Electronics and Earth Configuration	125 Vrms
Baud Rate	38,400 baud
Resolution (Programming & Readback)	0.025% FS (for V & I), 0.1% FS (for P & Ri)

STANDARD ANALOGUE INTERFACE

The control port is configured as a Sub-D 25 female connector and is located on the rear panel. It allows output values to be set and read proportionally using a 0-10Vdc analogue signal. Digital inputs and outputs enable various functions such as the interlock and output ON/OFF. A 10Vdc reference is provided for analogue control. Digital functions are switched via a high/low signal. A 24Vdc supply voltage is provided for these functions. The control port is labelled X105.

TECHNICAL DATA

Isolation to Electronics and Earth	125 Vrms
Unit Ready/Error	Relay Contact
Resolution (Programming & Readback) for V, I, P, Ri	Relay Contact
Actual Voltage Readback 0 - 100%	0 to 10V
Actual Current Readback 0 - 100%	0 to 10V
Resolution [V, I, P, Ri]	0.2% FS
Output Voltage Off/On	0/24VAC/DC
2 Digital Application Inputs	0/24VAC/DC
Interlock Circuit	0/24VDC
Voltage Setting 0 to 100%	0 to 10V
Current Setting 0 to 100%	0 to 0V
Power Setting 0 to 100%	10 to 0V
Internal Resistance Setting	0 to 10V



PIN	SIGNAL	I/O	DESCRIPTION
1	AGND	I	Analogue ground for pins 2–4, 14–16
2	VREF	I	Voltage setpoint input 0–10V
3	IREF	I	Current setpoint input 0–10V
4	IACF	O	Current feedback output 0–10V
5	0 VDC	O	0 VDC I/O ground for pin 25 ¹
6	+10 VDC	O	Analogue reference voltage
7	COM	I	(connected to pin 17) 0VDC DigIn; common ground for pins 8–9, 18–20, 24
8	APP_DIGITALIN_4; CLEAR_ERROR	I	Digital input 0-2V /10-24VDC
9	VOLTAGE_ON	I	Digital input 0-2/10-24VDC
10	OK/ALARM_b ²	O	Relay output 1 normally open
11	OK/ALARM_a ²	O	Relay output 1 common
12	RUN_b ²	O	Relay output 2 normally open
13	RUN_a ²	O	Relay output 2 common
14	PREF	I	Power limit analogue input 0–10V
15	RREF	I	Ri-simulation analogue input 0–10V

PIN	SIGNAL	I/O	DESCRIPTION
16	VACT	O	Voltage feedback output 0–10V
17	COM	I	(connected to pin 7) Common ground to pins 8–9, 18–20, 24
18	APP_DIGITALIN_1	I	Digital input (low) 0-2VDC/(high) 10–28VDC
19	APP_DIGITALIN_2	I	Digital input (low) 0-2VDC/(high) 10–28VDC
20	APP_DIGITALIN_3; ANAOG_REFERENCE_SELECT	I	Digital input (low) 0-2VDC/(high) 10–28VDC Analogue reference select
21	WARN_a ²	O	Relay output 3 normally open
22	WARN_b ²	O	Relay output 3 normally closed
23	WARN_c ²	O	Relay output 3 common
24	INTERLOCK_IN_+	I	Input Interlock +
25	+24 VDC	O	24VDC I/O Aux power output 24 VDC, max. 0.2A

¹ Pin 5 [0 VDC] is used as the reference earth for pin 25 [24 VDC] and is connected internally to the equipotential bonding via a 1 kΩ resistor to earth.

² Maximum switching current: 1 A; maximum switching voltage: 24 V.

STANDARD LOW LEVEL PROTOCOLS

The Low Level Protocols (LLPs) are often ideal for mission critical applications. The LLPs give access to the hexadecimal memory addresses for a given functions such as setting and reading of voltage, current and power limit along with switching output on/off. Second level functionality can also be programmed. This includes adjusting voltage and current slopes and optimising the PID controllers. The user can also program the internal relays for V, I and W. These relays can be used to enable/disable the output depending on user set thresholds or to provide a warning signal. Function sequences, previously stored in the memory, can also be triggered via LLP enabling complex DC waveforms to be implemented.

The LLPs ensures that these power supplies can be used in situation where a Windows or Linux based PC cannot be relied upon. With 5 to 9 Bytes the LLPs provide a protocol with the lowest overheads for high reliability applications where only a PLC may be deemed appropriate.

OPTIONAL INTERFACES

CODE	DESCRIPTION
/HMI	This provides front panel control and measurement via a menu driven LCD screen. Most users prefer their units to be fitted with HMI. For systems comprised of multiple units or where only remote control is required, cost can be saved by not including front panel controls and display.
/RS232REAR	RS-232 on front and rear panel (time shared mode with RS-232 on front).
/RS422	Differential serial interface (time shared mode with RS-232).
/IEEE	When specified, an integrated IEEE 488.2 interface is built into the rear panel (RS-232 only possible on rear panel). The programming terms employed are compliant with Standard Commands for Programmable Instrumentation (SCPI), making the RUG-TC ideal for system integration.
/CANOPEN	On request an additional serial interface built to the CAN/CANopen standards can be integrated into the rear panel (RS-232 only possible on rear panel).
/CANMP	Integrated CANmp interface (RS-232 only possible on rear panel).
/OPTOLINK	Rear panel integrated fibre optic interface (RS-232 only possible on rear panel).
/USB	Integrated USB interface. (RS-232 only possible on rear panel). The graphical user interface, TopControl can be operated over the USB port. RS-232 and USB cannot be used at the same time.
/ETH	Ethernet interface with listener and talker functions over a LAN (RS232REAR required).
/CAN+USB	Combined CAN and USB interface.

HIGHLIGHTED OPTION

CAN MP CAN MULTI-PURPOSE INTERFACE (/CANMP)

CANmp is a high speed digital interface operating at 1kHz. The interface gives users the capability to customise the CAN protocol. Up to 50 messages are user configurable. Along with the CAN ID the data length code, byte order, start bit, data type and signal factor can be adjusted by the user. A DBC file is provided and messages can be easily configured within the standard windows software. Messages can be sent cyclically or upon receipt of a sync or syncID signal.

MECHANICAL

STANDARD FEATURES

USED TESTING STANDARDS	
Mechanical Single Shock Standard	IEC 60068-2-27
Sine Vibration Standard	IEC 60068-2-6
Random Vibration Standard	IEC 60068-2-64
HANDLING MECHANICAL STRENGTHENING, SHOCK (ACCORDING TO IEC 60068-2-27)	
Shock Acceleration	20g/11ms
Shock Number and Vector	± 3 Shocks/axis
Shock Direction	X-, Y- and Z-axis
OPERATIONAL MECHANICAL STRENGTHENING, SHOCK (ACCORDING TO IEC 60068-2-27)	
Shock Acceleration	20g/11ms
Shock Number and Vector	± 3 Shocks/axis
Shock Direction	X-, Y- and Z-axis
OPERATIONAL MECHANICAL STRENGTHENING, SINE VIBRATION (ACCORDING TO IEC 60068-2-6)	
Frequency Range	10Hz – 150Hz
Random Vibration Resistance (Peak)	2g
Average Test Time	30 min./axis
Vibration Direction	X-, Y- and Z-axis
OPERATIONAL MECHANICAL STRENGTHENING, RANDOM VIBRATION (ACCORDING TO IEC 60068-2-64)	
Frequency Range	10Hz – 500Hz
Random Vibration Resistance (RMS)	1.9g
Average Test Time	30 min./axis
Vibration Direction	X-, Y- and Z-axis
ACCELERATION SPECTRAL DENSITY	
10 Hz – 200 Hz	0.01g ² /Hz
500 Hz	0.003g ² /Hz (lin. slope from 200 Hz to 500 Hz)
GENERAL	
Line Input Connections (10kW & 16kW Modules)	Terminal block 4 x 10mm
Line Input Connections (20kW & 32kW Modules)	Terminal block 4 x 25mm
Output Terminals	Nickel-plated copper bars - Length: 40mm, 1 hole 9mm in each bar
Condensation	Condensation during operation does not affect the functionality of the power supply.

OPTIONS

CODE	DESCRIPTION
/LCAL	Integrated liquid cooling of the power stage
/RCU	The RCU provides the HMI functions via cable at a distance of up to 40m. The RCU is available in a compact desktop case or as a 19" rackmount unit.

HIGHLIGHTED OPTIONS



LIQUID COOLING (/LCAL)

Liquid cooling of the RUG-TC's power stage is available for units which may be subject to naturally hot or uncontrolled environments. This enables operation up to 45°C with no performance derating.



REMOTE CONTROL UNIT (/RCU)

The RCU is an external control unit for controlling multi-module systems, which reduces response times when implementing complex changes. The RCU is available as either a desktop unit or a 19" rackmounting module, with or without an emergency stop.

SAFETY & PROTECTION

STANDARD FEATURES

TECHNICAL DATA	
Max. Reactive Load Voltage	≤ 110% Vmax
Mounted In Cabinet	Up to IP 53
Basic Construction	IP 20 (current bars on rear side excluded)
EMC Emission	EN 61000-6-4
EMC Immunity	EN 61000-6-2

OPTIONS

CODE	DESCRIPTION
/ISR	Integrated safety relay for shutdown to EN 13849-1 Cat 2/3
/PACOB	Protection against accidental contact of output current bars
/RPP	Protection against reverse polarity of the load

HIGHLIGHTED OPTIONS

REVERSE POLARITY PROTECTION (/RPP)

When charging an energy storage device, Reverse Polarity Protection [RPP] is recommended for devices without a pre-charge circuit. With the RUG-TC energised but output off, the RPP senses the voltage of the connected energy storage device. A contactor is closed after matching the voltage, to prevent large inrush currents and arcing on start up.

INTEGRATED SAFETY RELAY (/ISR)

For additional safety, a mechanical interlock is available for the mains input of the RUG-TC. The integrated safety relay provides shutdown safety according to EN 13849-1 category 2/3. The ISR is connected to the external safety switch loop. If the external loop is opened, the DC-output of the power supply is powered down immediately.

PROTECTION AGAINST OUTPUT BARS (/PACOB)

A specially produced cover is available which provides protection against accidental contact of output current bars. This safety option can be provided for both the AC and the DC connections.



SOFTWARE/SOFT TOOLS

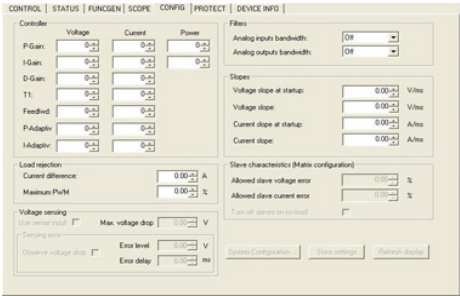
STANDARD TOP CONTROL GUI

All RUG-TC units come with a simple and intuitive TopControl operating GUI as standard. Live values of the power supply are displayed graphically along with any warning and error messages. The software provides a variety of second level parameters, ideal for users who like to optimise their processes. In standard user mode the operator can remotely program set values, enable voltage output as well as the ability to analyse different variables including set and actual values via the integrated scope.

The scope function can simultaneously record up to 8 system variables. Recording can be started manually or by a defined trigger event from any variable of the system. All actual and set values [currents/voltages/power/internal resistance] can be recorded. Other recordable items include system temperatures, intermediate DC circuit, low voltage auxiliary power supplies, error related values and variables from the controller section.

A password protected section is available to the advanced user and service technician. In addition to the standard functions the authorised user is able to:

- + Program linear ramp functions at start up and set value steps during operation
- + Configure multi-unit operation
- + Program the PID controller parameters
- + Program the unit's limit values
- + Calibrate and adjust values as necessary
- + Update the firmware



OPTIONAL SOFTWARE

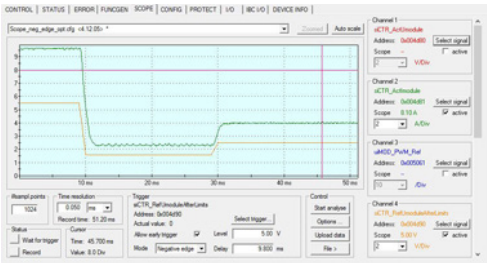
CODE	DESCRIPTION
/TFE	Integrated function generating engine with application area (parametric) programming
/SASCONTROL	Solar array simulation GUI (includes TFE option)
/BATSIM	GUI simulating battery characteristics with adjustable parameters
/CAPSIM	GUI simulating the electrical characteristics of capacitors with adjustable parameters
/BATCONTROL	GUI to implement specific battery/capacitor charge profiles and industry specific drive cycles

HIGHLIGHTED OPTION

FUNCTION GENERATOR (/TFE)

Complex DC waveforms can be implemented through an optional embedded function generator. The highly programmable nature of the function generator allows users to plot out exact waveforms. This is often advantageous when powering a device which requires a very specific operating curve. For example, when providing the DC energy to the coils powering a ship's sonar system, a specific pulse behaviour can be programmed and replicated.

As well as custom shapes, standard square, sawtooth and sine waveforms can be plotted against time. Voltage/current and voltage/power relationships can also be programmed where necessary. Parametric programming is possible, where instead of the time axis, an input variable (V_{IN} , I_{IN} or P_{IN}) can be selected.



APPLICATION GUIS

An application GUI can be used to program hardware to replicate real world behaviour of a power component. This allows specific sections of a circuit to be isolated and tested. Hard to replicate conditions, such as as cranking curve from a cold start, can also be programmed and repeated.

Using a GUI allows a great deal of control, monitoring and reporting to be done remotely. Other advantages include reduced operator errors and preparation time, as well as increased reproducibility and elimination of result variations.

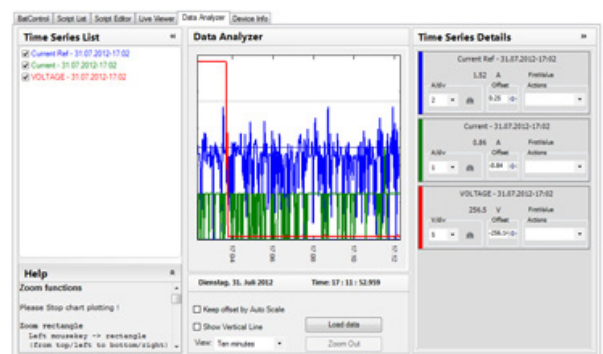
BATTERY EMULATION (/BATSIM)

When testing equipment which is usually battery powered, BatSim provides a convenient method for the RUG-TC to emulate the output of different sized battery stacks. Nearly all relevant electrical characteristics are programmable, including the number of cells, energy capacity, cut off limits, chemistry type and nominal voltage.



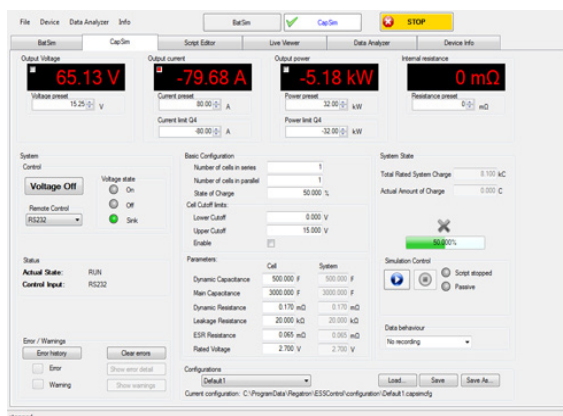
ELECTRIC DRIVE CYCLING (/BATCONTROL)

Drive cycle tests can be implemented using BatControl. Previous data obtained from a test track can be imported and recreated, allowing the RUG-TC to simulate a real world driving test inside a controlled environment. Battery charging profiles can also be implemented through the GUI.



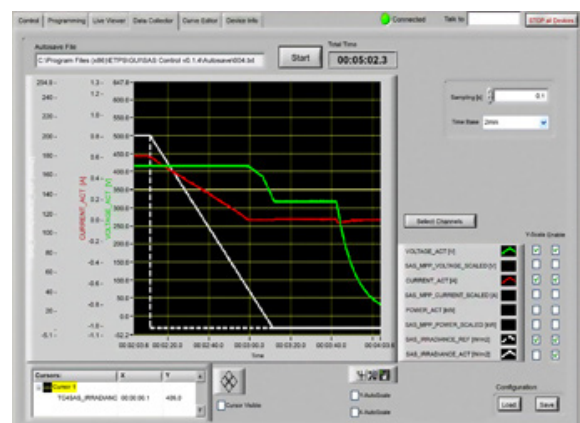
CAPACITOR SIMULATION (/CAPSIM)

The output characteristics of a real capacitor stack can be emulated when CapSim is installed with RUG-TC modules. Number of cells in series/parallel, state of charge, cell cut off limits, dynamic capacitance and resistance are programmable.



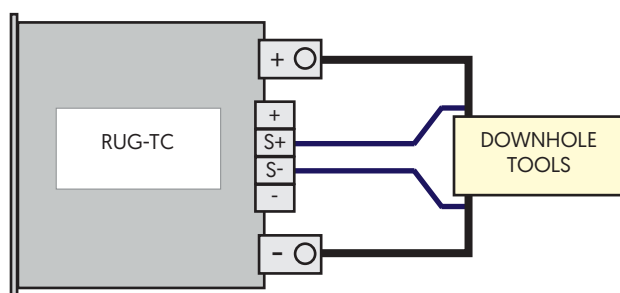
SOLAR ARRAY SIMULATION (/SAS)

When testing PV inverters, SASControl software has all EN 50530 tests pre-installed. The GUI allows users to edit irradiance, temperature and amplitude values. Previous tests have been conducted using over 400,000 individual data points, with more possible.



✂ POWERING DOWNHOLE TOOLS

Applications with long load lines often suffer from unintended voltage drops, such as downhole tools used in hydrocarbon exploration. The RUG-TC's sense plus allows voltage drops to be compensated for throughout the entire length of a load line. This feature is also ideal for powering subsea devices.

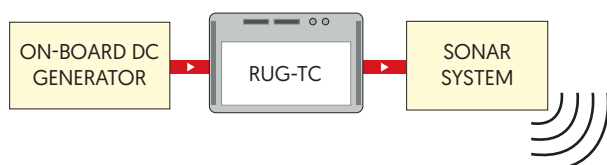


DC/AC POWERING SONAR SYSTEMS

The precise nature of sonar systems requires a highly controlled power supply. A poorly regulated PSU may provide too much energy to the sonar system's transducers, which can cause quenching. This is where the water pressure drops so low that it boils, potentially destroying the transducer. The quenching power limit rises with depth due to increased ambient pressure, so the maximum power output needs to be adjusted accordingly.

A PSU with a poor power factor can have a knock on effect on components and cabling sizing. This is particularly an issue for smaller vessels where space is at a premium. Overall system efficiency is reduced, which means more diesel is needed for the generator to power the sonar system.

The RUG-TC provides the controlled DC energy to coils powering a sonar system. The unit's passive power correction ensures an excellent PFC is maintained.



⚡ POWERING ONBOARD TRANSMITTERS

The RUG-TC can provide the short and precise DC pulses needed to power on-board transmitters in defence vehicles. Military land vehicles require ultra-reliable power supplies for mission critical electrical equipment. Each unit is able to withstand up to 20g of mechanical shock across X, Y and Z axes allowing it to operate across rugged terrains. The PSU operates from temperatures as low as -10°C all the way up to 55°C.



H₂ MOBILE BATTERY CHARGING

The RUG-TC's wide AC input ensures charging is always possible from generators or local grid conditions. A passive Power Factor Correction (PFC) circuit integrated into the input helps a generator maintain a stable and reliable output.

Should you need to cycle packs or discharge them to a safe level for transit, then a heat dissipative discharge section (DDU) is optionally available. The DDU features a front panel which allows users to adjust the minimum threshold voltage. This automatically stops the discharge once a preset level is reached, preventing a damaging deep discharge of the battery pack, which may happen when using unmonitored resistor banks.

A disconnection of the DDU can also be initiated by error monitoring of the fans or DC disconnectors, temperature monitoring and via the fan controller. Users can connect remotely to the front panel of the discharge unit via an Ethernet interface. Current measurement via the front panel and a discharge counter are also optionally available.



Every effort is made to ensure that the information provided within this technical summary is accurate. However, ETPS Ltd must reserve the right to make changes to the published specifications without prior notice. Where certain operating parameters are critical for your application we advise that they be confirmed at the time of order. ETPS Ltd specialises in modifying its proven platforms to suit your needs. Please contact our office if your requirement is non-standard. Please note that your actual unit may differ from those shown.



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Tel: +44 (0) 1246 452909
Sales: 0800 612 95 75
sales@etps.co.uk
www.etps.co.uk

ETPS Ltd
Unit 14, The Bridge
Beresford Way, Chesterfield
S41 9FG



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