

**Programmable Bidirectional Regenerative DC Power Supply**



TC.GSS Series unit with optional Human Machine Interface (HMI)

**Features**

**TC.GSS Series (wide range)**

- TopCon Grid-tie Source Sink technology enables full bidirectional operation
- Compact design with integrated EMI - and Sine filters
- Constant voltage (0 – 100 %), constant current (0 – 100 %) and constant power operation (5 – 100%) with automatic and fast crossover and mode indication. Internal resistance simulation.
- Graduated product line: 65 V<sub>DC</sub>, 130 V<sub>DC</sub>, 400 V<sub>DC</sub>, 500 V<sub>DC</sub>, 600 V<sub>DC</sub>, higher voltages with series connection up to 1500 V<sub>DC</sub>. Power categories of 20 kW and 32 kW are available for each nominal output voltage.
- Optional extras and accessories complete the product line of power supply units.
- Modular concept for easy power increase: Parallel, series, matrix or multiloading master-slave-operation.
- High efficiency at a low cost, resulting from the application of innovative IGBT and transformer technology. Primary switched. Galvanic isolated. Full digital control and regulation.
- A user-friendly PC program, the operating and service software TopControl, enables the user to communicate with the power supply.
- TopControl installation file, LabVIEW® and C/C++ C#/ .NET API (DLL file) are included in the scope of delivery.
- CE conformity
- Swiss made: Developed, manufactured and tested in Switzerland by Regatron AG.

**Technical Data**

**AC lineside ratings**

Line voltage / Line current relationship

	3 x 380 V <sub>AC</sub> ± 10 % / 54 Arms <sup>1) 13)</sup>
	3 x 400 V <sub>AC</sub> ± 10 % / 51 Arms <sup>1)</sup>
	3 x 415 V <sub>AC</sub> ± 10 % / 49 Arms <sup>1)</sup>
	3 x 440 V <sub>AC</sub> ± 10 % / 47 Arms <sup>1)</sup>
	3 x 460 V <sub>AC</sub> ± 10 % / 45 Arms <sup>1)</sup>
	3 x 480 V <sub>AC</sub> ± 10 % / 43 Arms <sup>1)</sup>

Line frequency ..... 48 – 62 Hz  
 Mains connection type ..... 3L + PE (no neutral)  
 Protective conductor current @ 50 Hz ..... < 20 mA <sup>2)</sup>  
 Touch current unweighted ..... < 20 mA <sup>2)</sup>  
 Touch current weighted ..... < 2 mA <sup>2)</sup>  
 Powerfactor Q1/ Q4-mode @ Pnom ..... ≥ 0.99

**DC loadside ratings**

Power range .....	0 kW – ± 32 kW <sup>3)</sup>
Voltage range .....	0 VDC – 65 VDC
Current range.....	0 A – ± 600 A <sup>3)</sup>
Internal resistance range .....	0 mΩ – 110 mΩ <sup>4)</sup>
Switchable output capacitance .....	6 mF / 17.2 mF

**Static accuracy**

Load regulation CV, CC .....	< ± 0.1 % FS <sup>5)</sup>
Line regulation CV, CC .....	< ± 0.1 % FS <sup>6)</sup>

**Transient response time**

Load regulation CV .....	< 1.5 ms <sup>7)</sup>
Set value tracking CV .....	< 1.5 ms <sup>8) 11)</sup>
Set value tracking CC:	
-With quadrant change .....	< 2 ms <sup>8)</sup>
-Without quadrant change.....	< 2 ms <sup>8)</sup>
Efficiency at nominal power Q1/Q4.....	90 %/ 91 % <sup>9)</sup>

**Stability**

Voltage regulation (CV) .....	< ± 0.05 % FS <sup>10)</sup>
Current regulation (CC) .....	< ± 0.05 % FS <sup>10)</sup>

**Ripple Q1 / Q4 Mode**

≤ 300 Hz V <sub>pp</sub> .....	< 0.2 % FS <sup>11)</sup>
≤ 300 Hz V <sub>rms</sub> .....	< 0.05 % FS <sup>11)</sup>

**Noise Q1 / Q4 Mode**

40 kHz – 1 MHz V <sub>pp</sub> .....	< 0.2 V <sup>11)</sup>
40 kHz – 1 MHz V <sub>rms</sub> .....	< 0.05 V <sup>11)</sup>

**Temperature coefficient**

Voltage regulation (CV) .....	< 0.02 % FS / K <sup>12)</sup>
Current regulation (CC) .....	< 0.03 % FS / K <sup>12)</sup>

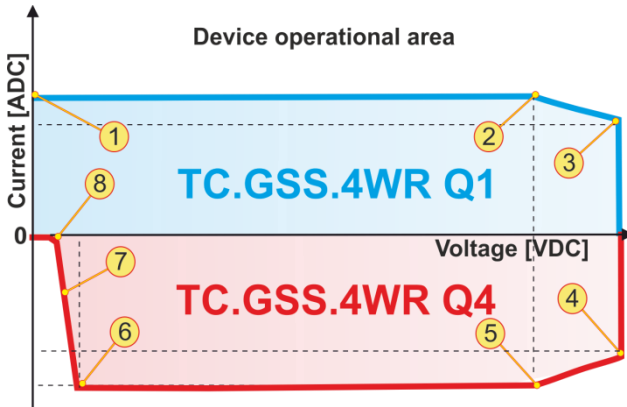
1) At nominal output power and nominal line voltage. Soft-start to limit turn-on surge currents.  
 2) According to IEC60990: Protective conductor current: 50 Hz component @400 VAC/50Hz/P<sub>nom</sub>  
 For weighted touch current: Measured for perception/reaction  
 Protection with earth leakage circuit breaker possible. An additional PE connection is necessary.  
 3) Current according to the given power limit of the corresponding units.  
 (P = V<sub>Load</sub> \* I<sub>Load</sub> ≤ 32 kW; for I<sub>Load</sub> > 492 A --> V<sub>Load</sub> < 65 V).  
 4) The maximum value of the internal resistance is automatically calculated via the DC nominal values  
 (Ri [mΩ] = V<sub>Load</sub> / I<sub>Load</sub> = 65 VDC / 600 A) or limited by the maximum Ri-value: 32000 [mΩ].  
 5) Typical value for 0 – 100 % load variation, at constant line input and temperature conditions.  
 6) Typical value for input voltage variation within 380 VAC ± 10 % – 480 VAC ± 10 %, at constant load and temperature conditions.  
 7) Typical recovery time to within < ± 5 % band of set value for a load step 10 – 90 %, ohmic load, at constant line input and temperature conditions. Transient response time can be slightly affected by multi-unit operation.  
 8) Rise/ fall time for 10%-90% of a set step.  
 9) At 15kHz switching frequency line side inverter.  
 10) Maximum drift over 8 hours after 30 minute warm-up time, at constant line input, load and temperature conditions.  
 11) Typical value at nominal ohmic load, line asymmetry < 1 V<sub>rms</sub>.  
 12) Typical change of output values versus ambient temperature, at constant line input and load conditions  
 13) Information about derating see section Deratings on page 2.

Non-ohmic loads can lead to deviations in the technical data. All product specifications are subject to change without notification.

**Technical Data**

**Operating modes**

Q1 mode ..... source mode  
 Q4 mode ..... regenerative / sink mode  
 Voltage regulation (CV) ..... 0 – 100 % Vnom  
 Current regulation (CC) ..... 0 – ± 100 % Inom  
 Power regulation (CP) ..... ± 5 – ± 100 % Pnom



Q1 and Q4 range of device TC.GSS.32.65.4WR.S.

<b>Quadrant Q1:</b>	<b>Quadrant Q4:</b>
-1- : ..... 0 V / 600 A	-4- : ..... 65 V / -492 A
-2- : ..... 53 V / 600 A	-5- : ..... 53 V / -600 A
-3- : ..... 65 V / 492 A	-6- : ..... 6 V / -600 A
	-7- : ..... 4 V / -300 A
	-8- : ..... 2 V / 0 A

**Remote sensing**

Line voltage drop compensation  
 Terminal on rear side ..... X104

**Deratings**

**Power derating**

Linear power derating < 360 VAC in Q1 mode operation to 30.2 kW / 340 VAC.

**Current derating**

Q1 mode:  
 Max. permanent output source current  
 at 53 VDC / < 35 °C: 600 ADC  
 at 53 VDC / < 40 °C: 540 ADC.  
 Higher current, if CDF < 100 %

**Isolation**

Line to case/logic ..... 1670 VDC 1 s  
 Output to case/logic ..... 2060 VDC 1 s  
 Transformer ..... 4800 VAC  
 Output to case ..... 10.8 MΩ / high impedance (X109 open)  
 per DC bar ..... 35 nF  
 - bar <sup>1)</sup> ..... +680 VDC / -680 VDC  
 + bar <sup>1)</sup> ..... +680 VDC / -680 VDC

**Technical Data**

**Protection**

**Built-in protection**

Overtemperature  
 Overvoltage (programmable) ..... 0 – 110 % Vnom  
 Response time ..... 50 μs – 1600 ms  
 Overcurrent (programmable) ..... 0 – 110 % Inom  
 Response time ..... 50 μs – 1600 ms

Max. reactive load voltage ..... ≤ 110 % Vnom  
 Short circuit protection ..... Cont. short circuit allowed  
 Islanding, grid off, requirements for the connection of micro-generators in public grid according VDE 0126/EN 50438.

**Internal diagnostics**

line input conditions, transformer primary current, temperature conditions, processor idle time, system configuration, system communication, sensor signals, power semiconductor temperatures.

**Type of protection (according EN 60529)**

Basic construction ..... IP 20 (current bars on rear side excluded)  
 Mounted in cabinet ..... Up to IP 54

**Conformity CE-Marking**

**EMC Directive 2014/30/EN**

Generic standards – Emission standard for industrial environments ..... EN 61000-6-4  
 Generic standards – Immunity standard for industrial environments ..... EN 61000-6-2

**Low Voltage Directive 2014/35/EU**

Electronic equipment  
 for use in power installations ..... EN 50178

**RoHS Directive 2011/65/EU**

Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances ..... EN 50581

**Ambient conditions**

**Operation**

Operating temperature ..... 5 – 40 °C  
 Relative air humidity (non-condensing) ..... 0 – 95 %

**Storage**

Storage temperature (with coolant) ..... -18 – 70 °C  
 Relative air humidity (non-condensing) ..... 0 – 95 %

Installation altitude ..... 0 - 2000 m above sea level  
 Operating orientation ..... upside  
 Storage, transport orientation ..... upside

**Utilization category**

Protection class ..... I  
 Overvoltage category ..... III  
 Degree of pollution ..... 2

**Cooling**

Internal liquid to air heat-exchange system using temperature-controlled fans.  
 Coolant ..... Antifrogen® N Clariant

1) Maximum working voltage including DC output voltage.

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**Standard Interfaces**

**RS232**

9 pin D-sub connector, female ..... on front panel  
 Isolation to electronics and earth.....125 Vrms  
 Baud rate..... 38400 baud

**Resolution (programming and readback):**

V, I..... 0.025 % FS  
 P, Ri ..... 0.1 % FS

**I/O Interface X105 (analog / digital)**

25 pin D-sub connector, female ..... on rear panel  
 Isolation to electronics and earth.....125 Vrms

**Control port input functions**

Output voltage off / on ..... 0 / 24 VAC / DC  
 2 digital application inputs ..... 0 / 24 VAC / DC <sup>1)</sup>  
 Interlock circuit ..... 0 / 24 VDC  
 Voltage setting 0 – 100 % ..... 0 V – 10 V  
 Current setting -100% – 100 % ..... -10 V – 10 V <sup>2)</sup>  
 Power setting 0 – 100 % ..... +10 V – 0 V <sup>3)</sup>  
 Int. resistance setting 0% – 100% ..... 0 V – 10 V  
 Input impedance analog inputs ..... 20 kΩ

**Control port output functions**

Unit ready / error ..... Relay contact  
 Output voltage on ..... Relay contact  
 Warnings ..... Relay contact  
 Actual voltage readback 0 – 100 % ..... 0 V – 10 V  
 Actual current readback -100 % – 100 % ..... -10 V – 10 V <sup>2)</sup>

**Resolution (programming and readback):**

V, I, P, Ri ..... 0.2 % FS

**User Software**

**Software TopControl**

The user-friendly operating and service program  
 TopControl is included in the scope of delivery.



- Remote connection via PC interfaces: E.g. RS-232 or USB interface (Option) and further interface options.
- System operation (parallel or serial mode)
- Q1 (source) and Q4 (sink) operation modes.
- TopControl is the user interface software and environment for the additional software option like TFEAAP (FUNGEN) or CANmp.

**Options Unit**

**Displays**

**Human machine interface unit (HMI)**

Integrated control, programming and display unit with graphic LC-Display, select wheel, push buttons and interactive text menus  
 Languages (switchable) ..... English, German

**Display resolution:**

U ..... 4 digits  
 I ..... 3 digits  
 P ..... Kilowatt + 1 decimal digit  
 Ri ..... 1 mΩ

**Remote control unit (RCU)**

Specifications same as HMI, available in 2 versions:  
 Desktop W x H x D ..... 355 x 100 x 290 mm  
 19" Rack-Mount W x H x D ..... 483 x 88 (2 U) x 290 mm

**Interfaces**

**On rear panel**

USB .....  
 ETHERNET .....  
 TC.LXI .....  
 IEEE 488.2 / GPIB / SCPI..... cannot be combined with CANOPEN nor with USB  
 CANmp ..... Fast multi-protocol CAN  
 CANOPEN .....  
 RS232REAR <sup>4)</sup> .....  
 OptoLink ..... fibre optic interface  
 OptoLink / RS232 <sup>5)</sup> ..... fibre optic interface incl. RS232  
 RS422 <sup>5)</sup> .....

**Software**

TFEAAP <sup>1)</sup> ..... TopCon Function Generating Engine  
 Time-based and parametric programming  
 PV curves or user defined curves (csv files)  
 SASControl <sup>1)</sup> ..... SAS application program  
 including TFEAAP  
 BatControl <sup>1)</sup> ..... Battery testing program  
 BatSim <sup>1)</sup> ..... Battery simulation program  
 CapSim <sup>1)</sup> ..... Capacitor simulation program

**Safety**

ISR <sup>4)</sup> ..... 2 channel Integrated Safety Relay  
 VLI ..... Voltage Level Indicator  
 RPP <sup>4)</sup> ..... Reverse Polarity Protection  
 PACOB DC ..... Protection against accidental contact  
 PACOB AC ..... Protection against accidental contact  
 SELV <sup>4)</sup> ..... (Safety Extra Low Voltage)  
 Information technology equipment - Safety -  
 Part 1: General requirements..... IEC 60950-1:2013  
 Requires the option ISR

1) Customer-specific programmable  
 2) 0 – 10 V possible for -100 % ... + 100 %.  
 3) Bipolar power settings -10 V ... + 10 V possible with software configuration change.  
 4) Retrofitting on request  
 5) This option and RS232: time-shared mode required, if use together.

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**Options Unit**

**AIRFILTER**

Front panel airfilter 9 U

**Derating**

When using the Air Filter, a possible derating will start at a lower temperature (approx. 3°C less).

**LC (Liquid Cooling) <sup>1)</sup>**

Integrated liquid cooling system of the power stage with completely integrated liquid to liquid heat-exchange system.

**Internal Heat exchanger**

Material <sup>2)</sup> ..... Stainless steel  
 Inlet/outlet on rear side size ..... G ½"  
 Liquid temperature ..... 15 <sup>3)</sup> – 35 °C  
 Flow ..... ≥ 3 l / min  
 Recommended flow ..... 4 - 6 l / min  
 Pressure max. .... 8 bar  
 Pressure drop.....50 mbar@3 l/min

**Miscellaneous**

NSOV ..... Non-Standard output voltage (if possible)  
 NSOC ..... Non-Standard output current (if possible)  
 NSOP ..... Non-Standard output power (if possible)

**Options System**

**System operation**

**CANCABLE**

Connecting cable for Multi-Unit Systems or RCU  
 Cable length ..... 2, 5, 10, max. 40 m

**TC.MAC (Master Array Controller)**

Required for Multi-Unit Systems with more than 16 power supplies. Controls several subsystems of up to 16 power supplies to reach MW range.

MACInterface ..... Interface for using TC.MAC  
 MACCABLE ..... To connect Subsystem to TC.MAC  
 Cable length ..... 2, 5, 10, max. 40 m

**General Data**

**Weight & Dimension**

Weight .....97 kg  
 Width front panel..... (19") 483 mm  
 Width housing ..... 444 mm  
 Height front panel ..... (9U) 399 mm  
 Height housing ..... 394 mm  
 Depth with output terminals ..... 634 mm  
 Depth housing..... 594 mm

**Terminals**

**AC**

Terminal block ..... 4 x 25 mm<sup>2</sup>

**DC**

Material ..... nickel-plated copper bars  
 Dimensions ..... 40 mm, 1 hole 9 mm Ø in each bar

**Scope of delivery**

RS232 cable ..... 1.8 m  
 Dummy plugs ..... X101 and X105  
 Operating manual ..... English or German  
 Installation disc ..... TopControl  
 DLL files ..... LabVIEW® and C /C++ / C# / .NET API

**Ordering code**

TC.GSS.32.65.4WR.S(.Option)



1 Retrofitting on request  
 2 Ni brazed, ready to use with deionized water  
 3 20 °C ambient temperature and ≤ 70 % relative air humidity

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