

# Quick Start Guide

for the DC Power Supplies of the G5 product family

V03.00

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# 1 Introduction

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The information in this documentation corresponds to the development situation at the time of going to print and is therefore not of a binding nature. REGATRON AG reserves the right to make changes at any time for the purpose of technical progress or product improvement, without stating the reasons. In general we refer to the applicable issue of our "Terms of Delivery".

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## 1.1 Usage of the Document

This User Manual serves as a guide and also as a reference work, describing the device produced by REGATRON AG. Familiarize yourself with the contents of the User Manual to operate the device efficiently. The User Manual must be available at all times to the personnel who are operating the device.

## 1.2 Supplied Documents

The following documents in their actually valid version are supplied together with the delivered device:

Type of Document	Name of Document
<b>CE and UKCA Declaration</b>	<ul style="list-style-type: none"> <li>IN_G5-Certificate-CE-UKCA-Conformity_EN_221207</li> <li>IN_G5-1500V-Certificate-CE-UKCA-Conformity_EN_221207</li> </ul>
<b>User Manual</b>	<ul style="list-style-type: none"> <li>UM_G5-Device_EN_V02.60 (Device Manual)</li> <li>UM_G5-QSG_EN_V02.60 (Quick Start Guide)</li> <li>UM_G5.Control_EN_V02.50 (Software Manual)</li> <li>UM_G5-Incidentlist_EN_Vxx.xx (Service Manual)</li> </ul>
<b>Datasheets</b>	<ul style="list-style-type: none"> <li>DS_G5.XXX.XX.XXX.XXX_EN_2024-05-07 (for the complete range of DC power supplies of the G5 product family)</li> </ul>

## 2 Safety Information

### 2.1 Requirements for the User

Each person using a device is obligated to the legal job safety regulations and must apply the safety and warning notices in the user manual as well as the safety and accident prevention regulations valid for the given environment.

Persons using a device:

- must be skilled workers who are familiar with the risks during measuring electric magnitudes and have the corresponding qualification
- may not be influenced in their reaction capability, e.g. by drugs, alcohol or medicines
- must be informed about the relevant job safety requirements
- must be informed about the responsibilities for maintenance and cleaning of the device
- must have read and understood the General Safety Instructions and the user manual before operating the device
- must use the mandatory safety equipment

ATTENTION:

Improper use can cause injury or damage. Any activities should be performed only by persons who have the required training, knowledge and experience. Skilled personnel are workers who are due to their professional training, knowledge and experience as well as knowledge of relevant regulations able to properly perform the assigned work, to recognize potential hazards and avoid injury or damage.

Each person operating a device must check that the device is in a technically faultless state.

### 2.2 Operator's Responsibilities

An operator is any natural or legal person who uses the device or making the application available. He is responsible for the safety of the user, staff or third parties. The device is used in the commercial sector. Therefore, the operator of the device is subject to legal industrial safety obligations. In addition to the warning and safety instructions in this manual the safety and accident prevention regulations as well as environmental protection rules must be respected.

Particularly, the operator must:

- inform itself of the applicable health and safety regulations
- determine other hazards that may arise from the special working conditions at the site of operation in a risk assessment and minimize the hazards
- implement the necessary rules of conduct for using the electronic load on site in operating instructions
- check regularly throughout the period of use whether the provided user instructions correspond to the current status of the regulations
- adjust the operating instructions, if necessary, to new regulations, standards and operating conditions
- regulate clearly and unambiguously the responsibilities for installation, operation, maintenance and cleaning of the electronic load
- ensure that all employees who are working with the electronic loads have read and understood the user manual and the General Safety Instructions
- provide the required and recommended safety equipment to the employees who are working with the device
- train the employees working with the device at regular intervals how to use the devices and which possible dangers may appear
- ensure that the device is technically proper functioning at any time

## 2.3 Ordinances and Regulations

Follow the mounting and installation instructions during electrical installation!

In particular, in the countries of the European Union the following standard applies:

EN 62477-1 Safety requirements for power electronic converter systems and equipment

If you want to use the electrical power supply in special applications, you must comply with the related standards and health and safety regulations.

Due to the high operating voltage and the high output voltages, an industrial electrical power supply represents a mortal hazard.

To avoid serious injuries or significant damage, only appropriately qualified personnel who are familiar with industrial electrical power supplies are allowed to work on the devices. These individuals must carefully read these operating instructions prior to installation and commissioning and follow the safety instructions.

Electronic devices are in principle not fail-safe. The user is responsible for ensuring that the electrical power supply, mains supplies and loads connected to it are placed in a safe state in the event of a failure of the device.

## 2.4 Intended Use

The intended use for the delivered device depends on the product variant you ordered and received. The intended use of the device is therefore as described in the chapters Scope of Delivery and Description, pages 19 and 27 respectively of the Device Manual and in:

- [Preparing the Installation, page 17](#)

## 2.5 Restrictions of Usage

Operating the devices in a multi-unit-system may result in high output values. A system of devices with a voltage higher than either the device-specific isolation voltage or 1500 VDC is outside of the coverage of the “Low Voltage Directive” 2014/35/EU (LVD).

The scope of delivery is restricted to a usage of the device in a 19” switch cabinet. According to EN 62477-1 standard, for devices with an output voltage lower than 500 V additional protective covers for DC and AC outputs are required, if using the device as a table-top device. These covers are not included in the scope of delivery. They can be ordered separately, see chapter Spare Part List, page 213 of the Device Manual for further information.

If these restrictions are not observed, REGATRON AG cannot be made liable for any consequential harm.

## 2.6 Categorization of the Hazard Areas

The assessment of the effects of hazards from low-voltage systems with a flow of energy for supply and possibly regeneration is divided into various areas, which are described in the following.

### 2.6.1 Personnel Area

The utmost attention is to be paid to the hazards for individuals. There are various risks and hazards, the most important of which are mentioned here.

## 2.6.2 Electric Shock

The system can produce electrical potentials that can be dangerous or even fatal for individuals. During work on the system the following guidelines are to be observed:

### Work in electrically isolated state

This is the recommended way of working, it should be rigorously applied during all connection and wiring work. Follow the rules:

- Electrically isolate.
- Secure against switching back on.
- Discharge and short-circuit capacitors, disconnect and isolate batteries.
- Verify the voltage free status by measurement.
- Connect to earth.
- Report and instruct.

### Work in the vicinity of live parts

In these circumstances an increased hazard potential is to be expected. Minimize the risks by means of:

- Guards
- Covers
- Insulating encapsulation, cladding
- Imposed separation by means of mechanical features, protective grilles
- Supervision, reporting

### Work on live equipment

It is imperative that this form of working is avoided. If it cannot be avoided, careful work preparation is essential. Pay attention to the following:

- The personnel must be specially trained.
- Work in accordance with recognized specialist methods.
- Controlled personal protective equipment must be available (passive protection).
- Organization of the working areas.
- Supervision and preparatory measures (active protection).
- Use appropriate protection against physical contact throughout.
- Set up a suitable emergency stop chain and test it at regular intervals.
- Mark all wires and cables to prevent mistakes.

## 2.6.3 Electrical Heating

G5 power supply systems operate with significant amounts of energy. High currents can cause heating of cables and wires. In particular, during unmonitored endurance tests insulation fires and short-circuits may be caused.

- At particular risk are connectors, switchgear and cable terminals. Check these parts particularly carefully and at regular intervals.
- Use wiring material suitable and stipulated for your application with the related insulation class.
- Monitor your system actively or passively using appropriate sensors or by monitoring parameters.

### 2.6.4 Arcing and Sparking on Opening Contacts

Please note in connection with DC systems that, depending on the inductance, very high-energy electric arcs can occur when opening a current-carrying circuit!

Under certain circumstances, these can lead to burns, eye damage and damage, destruction or fire to system parts. The use of normal mains contactors as isolators in DC circuits is not recommended! Use DC contactors instead. If in doubt, contact their manufacturer. Bear in mind that the protective devices of the REGATRON low-voltage system cannot detect an arc as a fault condition, as this may be desired as a function.

### 2.6.5 Mechanical Injury

As on all electrical installations, mechanical injuries to the head and hands may be caused on removing and fitting covers, wire and cable connections. Always use the correct tool. If necessary protect the head and hands against injuries due to cuts and impacts.

### 2.6.6 Chemical Injury

While handling with cooling liquid, open doors and windows and ensure the room is well ventilated also on the ground level. Avoid work which leads to the formation of aerosols. Use, if necessary the personal safety equipment:

- Use the respiratory protection at short time and existing low concentrations of vapor and aerosols. Use breathing apparatus with independent air supply at long time and high concentrations of vapor and aerosols.
- Use protective gloves which are resistant against acids and solvents and safety gloves to avoid direct skin contact.

## 2.7 Systems and Material Area

### 2.7.1 Fire

G5 power supply systems are manufactured from nonflammable materials exclusively.

In case of fire, electrically isolate the system immediately, on the one hand to interrupt the supply of energy and on the other hand to shut down the fans.

Fight the fire from bottom to top in accordance with the rules in your organization using suitable firefighting equipment (CO<sub>2</sub> fire extinguisher). If possible use fire extinguishers with asphyxiation action to keep the secondary damage low.

### Electromagnetic Fields

Like any electrical system, G5 systems produce electrical and magnetic fields. However, these fields comply fully with the usual standards.

- Note that particularly the EM fields from your wires and equipment connected could nevertheless produce interference on objects in the immediate area.
- Keep data carriers and PC-based measuring environments at an adequate distance from live wires to prevent interference and data loss.
- Protect highly-sensitive sensors and instruments.
- Test effects on communication networks, in particular radio networks.
- Make individuals with electronic implants aware that implants may be affected.



## Noise and Noise Level

The inductive elements as well as the fans on the G5 low voltage system produce a lower or higher noise level dependent on the operating mode. However, even in the immediate vicinity of the cabinet this noise is under the tolerance limit that would make acoustic protection equipment necessary.

The usage of acoustic protection equipment or acoustic insulation measures can be necessary in specific circumstances.

## Mechanical Damage

Incorrect operation of the systems can result in mechanical damage to the downstream equipment and systems. In particular, on the supply of power to drives it is to be ensured, that a load shedding cannot result in excessively high speeds. The monitoring of the maximum speed with intervention in the safety chain is recommended above all.

## Handling Storage Systems containing large Amounts of Energy

Modern energy storage systems are able to absorb large amounts of energy. Therefore, the following applies:

- The cabling should not just comply with the maximum charging and discharging currents to be expected, to some extent significantly higher peak currents are to be expected during switching processes.
- A short circuit or failure can be very serious in the case of storage elements containing large amounts of energy. Due to the high currents serious injuries and serious damage can be caused. The following, incomplete list indicates some of this damage:
  - Burning of wires and connectors
  - Sparking
  - Fires, insulation fires
  - Arcing, welding
  - Electric shocks
- Never short-circuit energy storage systems to discharge them! Always use a suitable discharge resistor of appropriate power rating!
- Visibly secure a discharged energy storage element using a short-circuit bridge.
- Always monitor the maximum storage element voltage, also during practical test operation.
- Use a device that clearly indicates the charge state of the energy storage element, e.g. by monitoring the voltage.

## 2.8 Mains Connection Area

When a G5 power supply device is switched on, there may be an uneven load on the three phases; this uneven load may cause older residual current circuit breakers to trip. Here a modern make of residual current circuit breaker is to be used that will tolerate such asymmetries during the switch-on process. REGATRON recommends using an all-current sensitive RCD circuit breaker type B or B+.

## 2.9 Surrounding Area

G5 power supply devices are generally forced-air cooled (some are water-cooled in addition). Despite the very high efficiency, a power loss occurs in the components that must be dissipated in the form of heat to the surroundings. The energy is dissipated with the aid of forced ventilation to the rear of the G5 device. It is to be ensured that the rooms in which G5 power supply devices operate are cool so that the heat produced can actually be removed. It is to be ensured that there are no undesirable effects (e.g. stirring up of dust or sand, deformation due to the action of heat etc.) due to the flow of air and the heat, which at high load may be powerful.










## 2.10 Area related to Interaction with the Device






Compliance with the design data for the specific device is a prerequisite for malfunction-free operation. Load systems can have significant effects on the power source. The following points are to be noted:

- The maximum voltage specified must not be exceeded.
- Protective measures must be provided against voltage spikes on the load side and their function must be monitored (voltage spikes could damage the filter capacitors and semiconductors in the device).
- Periodic over currents are to be avoided.
- The ripple currents produced on the load side are to be monitored to avoid overloading filter capacitors; in case of doubt ask the manufacturer.
- The device is always to be operated within the permissible temperature range. High temperatures will significantly reduce the service life of various components.

### 2.11 Symbols Description

Throughout this document the following symbols are used, wherever necessary, to indicate and specify hazardous or potentially hazardous situations:

Symbol	Indication
 <b>DANGER</b>	Indicates an immediate hazardous situation which, if not avoided, will result in death or serious injury
 <b>WARNING</b>	Indicates a possible hazardous situation which, if not avoided, could result in death or serious injury.
 <b>WARNING</b>	Indicates a possible hazardous situation due to high voltage, which, if not avoided, could result in death or serious injury.
 <b>CAUTION</b>	Hazardous situation which, if not avoided, could result in minor or moderate injury
<b>NOTICE</b>	Hazardous situation which, if not avoided, could result in damage to the product or other items in its surroundings
	Hazard due to high voltage
	Hazard due to suspended load
	Hazard due to hot surface
	Hazard due to a substance or mixture of substances which cause eczema, allergies or poisoning. Avoid contact with skin!
	Potentially lethal hazard due to a substance or a mixture of substances. Do not touch, do not swallow, do not breathe in!

Symbol	Indication
	<p>Wear a helmet!</p>
	<p>Wear a light breathing protection for low concentrated short-term steams, fumes or aerosols!</p>
	<p>Wear protective gloves!</p>
	<p>Wear safety shoes!</p>
	<p>Properly dispose waste electrical and electronic equipment!</p>

## 2.12 Warning Symbols Used

On the rear side of the G5 device, the following warning symbols are used:

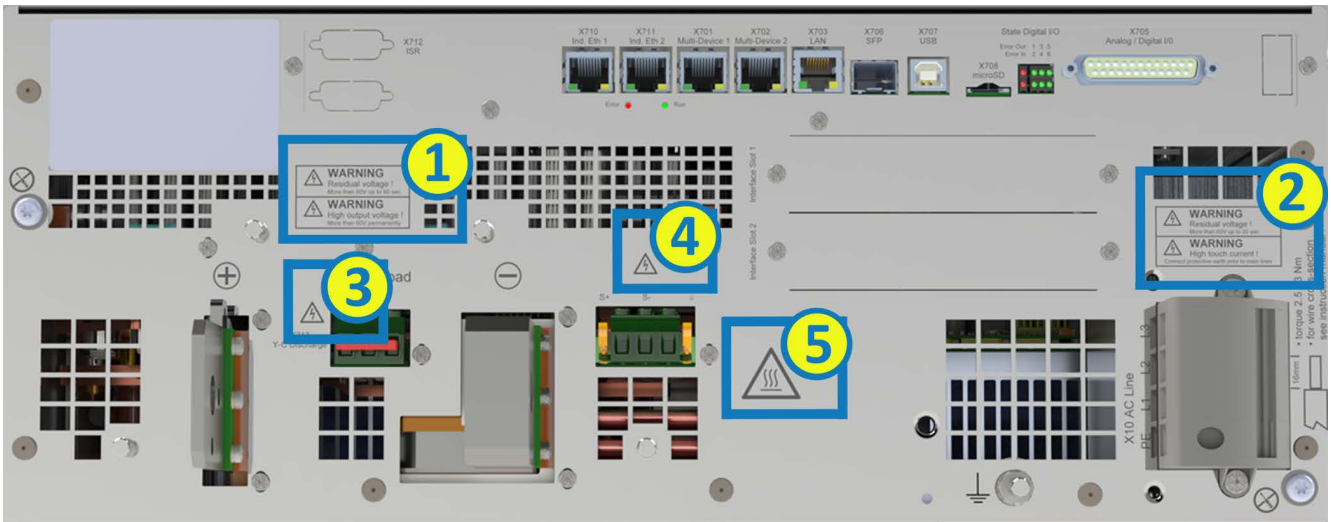







Fig. 1: Exemplary rear side of a 4 U device with warning symbols

Symbol		Indication
1	 <b>WARNING</b>	<b>WARNING Residual voltage!</b> More than 60 V up to 90 sec. <b>WARNING High output voltage!</b> More than 60 V permanently
2	 <b>WARNING</b>	<b>WARNING Residual voltage!</b> More than 60 V up to 20 sec. <b>WARNING High touch current!</b> Connect protective earth prior to main lines
3		Hazard due to high voltage
4		Hazard due to high voltage
5		Hazard due to hot surface

### 3 Transport

**Possible damage!**

Before transporting a G5 device, the following points are to be regarded:

**NOTICE**

- All cables and dummy plugs must be removed.
- Protruding parts such as main switch, controls and fan covers must not be damaged by transport aids (straps, blocks of wood, etc.).
- Due to the weight of the device, a robust trolley, a forklift, or a crane should be used.

The G5 device is equipped with two hoisting slings. These slings can be hooked into the two slots on the bottom of either side. They provide rigging bands both for hooking the device to a crane or a forklift and for carrying it by hand (for the smaller device models).

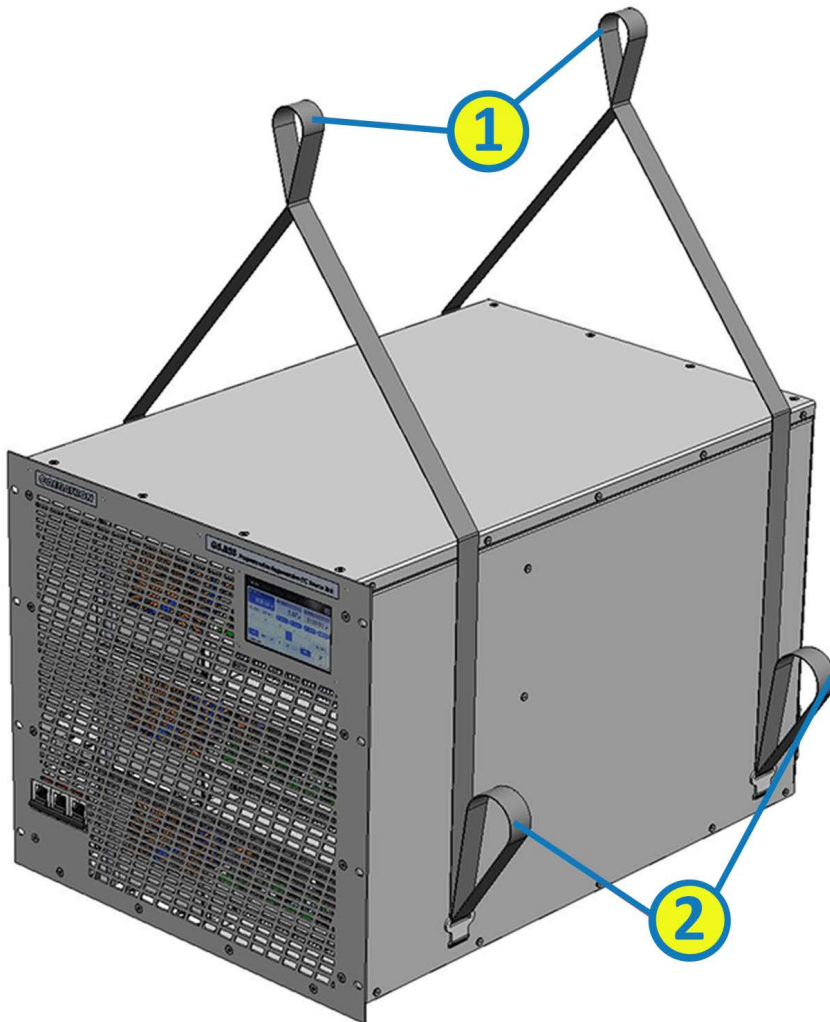
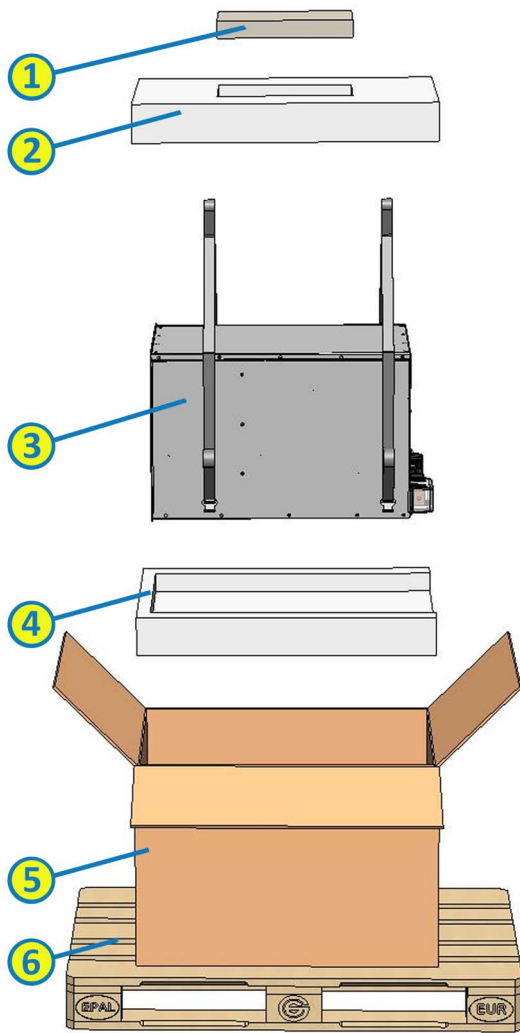


Fig. 2: Hoisting slings for the devices of the G5 family

Usage of the hoisting slings	
1	Hoisting slings with rigging bands for hooking the device to a crane or a forklift
2	Hoisting slings with rigging bands for carrying the device by hand

The G5 device is shipped in a standard packaging as follows:



**Fig. 3: Standard packaging of a G5 device**

Components of the Standard Packaging	
1	Box of accessories
2	Upper cover
3	G5 device (plus hoisting slings)
4	Lower protective support
5	Cardboard box
6	Transport pallet

You can order new shipping packaging from REGATRON Customer Support. Here you can also get additional package protection for the front and the sides, if necessary (e.g. for overseas shipping).

## 4 Site Conditions

**NOTICE** **Electric Surge!**  
The system is designed for use in LPZ1 (Lightning Protection Zone 1).

**NOTICE** **Overheating!**  
Make sure that the warm exhaust air is not drawn back into the system.

The following site conditions have to be kept in terms of installation and environment:

Installation Conditions		
Over voltage category 3 (according to EN 62477-1 or 60664-1)		
<b>Distance at the rear</b> to the nearest wall or large surface area body		<b>&gt; 850 mm (34")</b> For access to the rear, as well as for exhaust of the cooling air. If there is a cabinet door, an escape route of <b>&gt;600 mm (24")</b> width must be provided behind the open door. This is independent of the 850 mm (34") distance.
<b>Distance at the front</b> to the nearest wall or large surface area body		<b>&gt; 850 mm (34")</b> For access to the front, as well as for drawing in the cooling air. If there is a cabinet door, an escape route of <b>&gt; 600 mm (24")</b> width must be provided in front of the open door. This is independent of the 850 mm (34") distance.

Environmental Conditions	
General Conditions	
Maximum altitude	2000 m above sea level
Temperature	-5 °C...+40 °C
Humidity	0...95 %
Moisture conditions of the skin (according to EN 62477-1)	Dry
Vibrations (according to IEC-600068-2-6)	Test Fc
Pollution degree (according to EN62477-1) also for operation	2
Operating Conditions (according to IEC 60721-3-3)	
Climate	3K22
Special climatic conditions	3Z1
Mechanically active substances	3S5
Mechanical	3M11
Biological	3B1



## 5 Preparing the Installation

### Electric shock!

Installation can lead to dangerous situations.

#### Avoidance:

- The electrical installation is to be undertaken by personnel with electrical training
- Never connect or disconnect electrical connections while they are live
- The mains connection on the building side must be switched off and voltage-free
- The system must be electrically isolated and secured against being switched on
- The system, the G5 device is to be connected to, must be galvanically isolated
- Use cables carrying high currents with adequate conductor cross-section area (refer to your national standards and the information on the type plate)
- Your mains voltage must equal the nominal voltage of the system (as given on the type plate)
- The highest permissible unaffected short-circuit current for each input port of the G5 device must be considered, i.e.:  
54 kW device: 10 kA,  
36 kW device: 15 kA,  
18 kW device: 15 kA
- The smallest required uninfluenced short-circuit current to ensure the proper operation of the protection device of the G5 device must be considered, i.e.:  
54 kW device: 1 kA (10x100 A),  
36 kW device: 315 A (5x63 A),  
18 kW device: 160 A (5x32 A)



### Possible damage to the device!

- Due to conductive aggressive substances in the installation location
- Due to a larger amount of moisture in the installation location
- Due to foreign objects within the system

### NOTICE

#### Avoidance:

- If necessary, clean the installation location of aggressive substances or moisture using cloths
- Remove foreign objects such as drilling sward or screws from the system before you fit new devices

Prior to the electrical installation, REGATRON AG recommends to confirm the following aspects:

- The type plate matches the data in the order and delivery documents
- The device nominal data are suitable for the intended application
- The supplied cables/connectors match the intended connections

If you want to use a residual current device, please consider the varying requirements for protection against fire and the protection of individuals. REGATRON recommends the usage of a residual current device sensitive to AC and DC leakage currents. If such a device is to be installed, a Type B or Type B+ must be chosen in order to avoid false tripping or lack of appropriate protection. A type B RCD allows both for processing AC/DC fault currents as also for considerations of HF components up to the kHz range with up-weighted levels for HF.

The G5 device has protection class I according to EN61140.

## 5.1 Mechanical Installation



Wear a helmet when setting up and moving the device!



Wear protective gloves when setting up and moving the device!



Wear safety shoes when setting up and moving the device!

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### Possible damage!

- Due to soiling and foreign bodies at the installation location
- Due to a build-up of heat

### Avoidance:

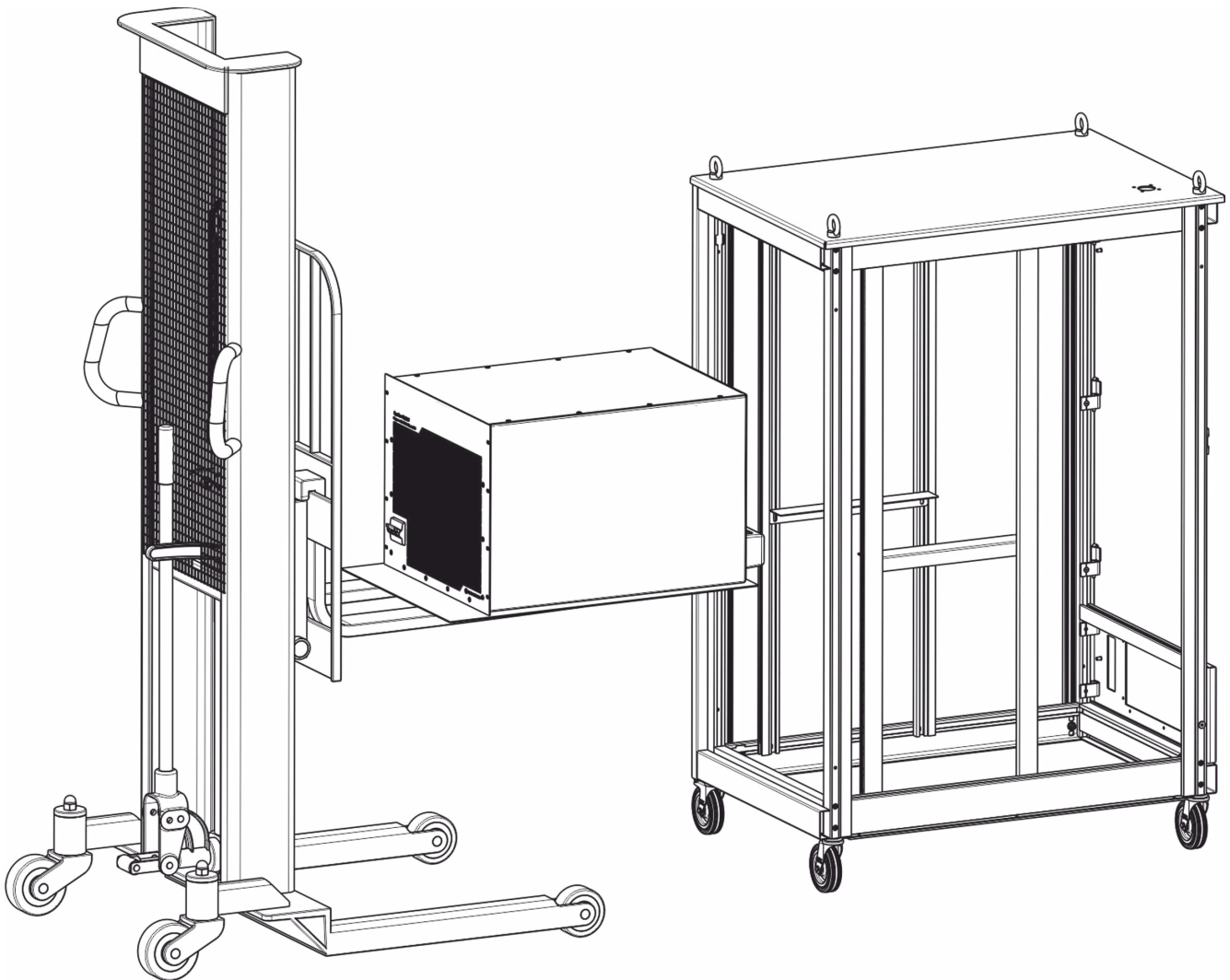
#### NOTICE

- The installation location must be free of conductive and aggressive substances as well as moisture
  - No foreign bodies such as drilling swarf or screws are to be allowed to fall into the system
  - The site conditions must be met
  - The ventilation openings on the front panel and rear wall of the devices must not be covered or sealed
-

Due to the weight of the device the following is to be regarded:

- Rails or shelves must be robust
- The case for a G5 device must be in contact over full installation depth
- At the rear a cross-member must be installed for additional fastening

The G5 device is intended to be installed in a standard 19" switch cabinet with an external air flow. In this case it is to be placed on rails or shelves and fastened at the holes on the left and right edges of the front panel. Usually M6 screws can be used.



**Fig. 4: Case installation with the help of a trolley**

## 5.2 Cable Requirements

The G5 devices comply with the applicable electromagnetic compatibility standards. In order to meet these standards in a system with one or more devices together with a DUT, the electrical installations must be carried out by qualified personnel.

Before the electrical installation, you need to make sure, the connecting cables meet the requirements in terms of electromagnetic compatibility, cable size, and size of mounting holes on cable lugs. The grounding cables must have a specific cross section area. Based on the data of the G5 device (according to the device type plate), the following applies to ensure conformity with the applicable standards:

Electromagnetic Compatibility of Cables
Use large area earthing (suitable for EMI)
Use shielded cables with shields earthed on both ends
Use star topology for the earth connection of several devices and DUTs

Correct Size of Cables and Mounting Holes on Cable Lugs
Diameter of high power cables has to be appropriate
Cable lugs at the connecting cables must have mounting holes with a diameter of d = 9 mm for G5 devices HV series d = 13 mm for G5 devices LV series

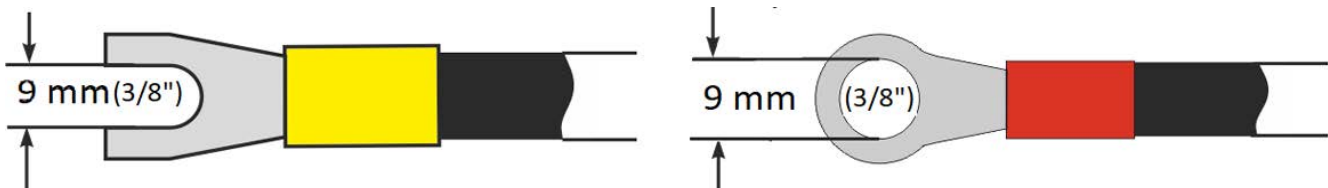


Fig. 5: Diameter d of mounting holes on cable lugs

Cables carrying high currents must have an adequate cable cross-section area. If necessary, refer to your national standards and the information on the type plates in order to determine the correct size of the cables.

Cables for the sense connections should be a single cable with a conductor cross-section area of 0.5 mm<sup>2</sup> (AWG 20) and it should be shielded. It is necessary to use cables insulated against each other and against PE according to the required voltage.

For a fixed connection, grounding cables must have a cross section area equal to that of the external conductor but at least 10 mm<sup>2</sup> (AWG 7). The touch current in the earthing conductors exceeds the limit of 3.5 mA. Therefore the minimum cross-section of the earthing conductor must comply with the local safety regulations for equipment with high current in the earthing conductor.

For a mobile operation, the following applies:

Grounding Cables Cross Section Area for Mobile Operation of the Device	
Phase Conductors	Earthing Conductors
up to 16 mm <sup>2</sup> (AWG 5)	equal to phase conductors
16 mm <sup>2</sup> to 35 mm <sup>2</sup> (AWG 5 to 2)	16 mm <sup>2</sup> (AWG 5)
35 mm <sup>2</sup> and more (>AWG 2)	half of phase conductors

## 6 Configuration

The G5 devices can be configured in many different ways. Apart from the use as a single device, you can also connect a number of devices to a multi-device system. Then you can execute a parallel, serial and matrix configuration in order to reach higher power levels.

**Possible damage to the sense cables!**

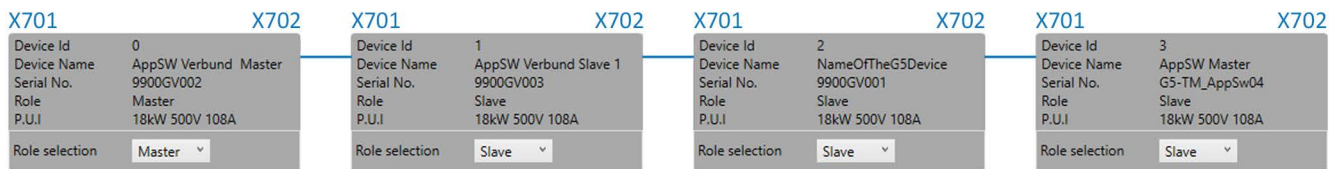
Due to short circuit.

**NOTICE**

**Avoidance:**

Use fuses or circuit breakers (~ 0.5 A) with the appropriate voltage class. These should be placed as close to the DUT as possible.

Each multi-device connection of several individual G5 devices is done by means of the interfaces **X701** and **X702** using multi-device bus cables to build the internal communication between the devices in the configuration.



**Fig. 6: Example: Bus system of a multi-device system of four G5 power supplies**

For all multi-device configurations, the following applies:

- Depending on the actual configuration, the sense voltage has to be measured on different points
- For the multi-device bus cables, the minimum requirement is CAT5. Recommended is type CAT5 SF/UTP
- The roles of individual devices as a master unit or slave unit can be selected by means of the Application Software G5.Control.

**NOTICE**

A multi-device system with a voltage higher than either the device-specific isolation voltage or 1500 VDC is not covered by the “Low Voltage Directive” 2014/35/EU (LVD). In that case, REGATRON cannot be made liable for any consequential harm.

### 6.1 Single Configuration

In a single configuration, the G5 devices are used as individual devices without being connected to others. Here, the G5 device functions as a master device. The electrical output is equal to the values given on the type plate of the device.

When using the sense functionality, the sense measurement of the device is used according to the following scheme:

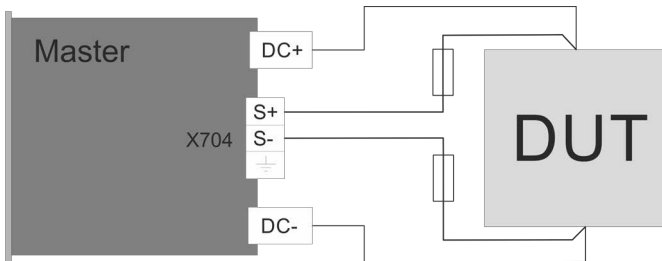


Fig. 7: Sense and load connections on individual devices in a single configuration

### 6.2 Parallel Configuration

In a parallel configuration of multiple G5 devices, the electrical outputs of all devices are connected parallel. The output current of a multi-device system in parallel configuration equals the sum of the output current values of the individual devices. For a parallel configuration, the connected devices must be of the same voltage class.

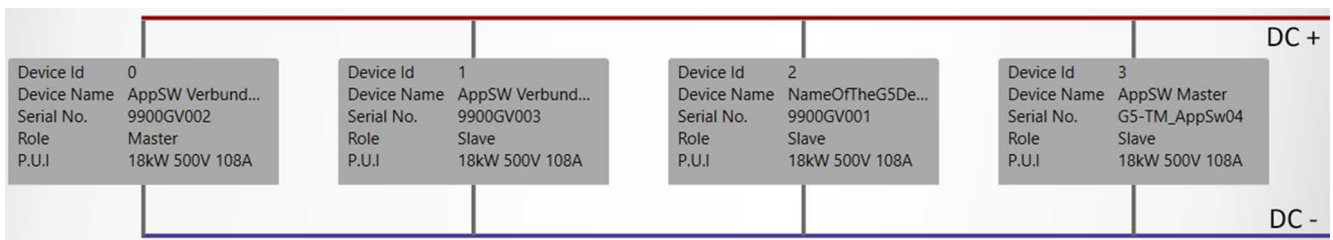


Fig. 8: Example of a parallel configuration of four G5 devices

When using the sense functionality, only the sense measurement of the master device is used according to the following scheme:

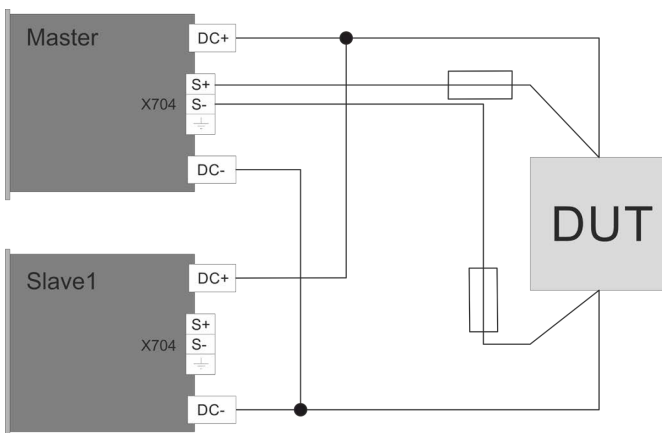


Fig. 9: Sense and load connections on multiple devices in a parallel configuration

## 6.3 Series Configuration

In a series configuration of multiple G5 devices, the electrical outputs of all devices are connected in series. The output voltage of a multi-device system in series configuration equals the sum of the output voltage values of the individual devices. For a series configuration, the connected devices must be of the same voltage and power class.

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**Restrictions for voltage:****NOTICE**

- If the system output voltage exceeds 640 V (for device type LV) or 1500 V (for device type HV), one of the system's midpoints must be connected to ground.
- In any case, the voltage to ground must not exceed 640 V (for device type LV) or 1500 V (for device type HV).

---

**Restrictions for G5.RPP:****NOTICE**

- If at least one but not all devices are equipped with G5.RPP, the total output voltage must not exceed 640 V (for device type LV) or 1500 V (for device type HV), respectively.
- If either none or all devices are equipped with G5.RPP, depending on the device voltages, the following maximum system voltages must not be exceeded:
  - a device voltage of 80 V, 160 V or 320 V results in a max. system voltage of 1280 V
  - a device voltage of 240 V results in a max. system voltage of 960 V
  - a device voltage of 1000 V results in a max. system voltage of 2000 V
  - a device voltage of 500 V or 1500 V results in a max. system voltage of 3000 V

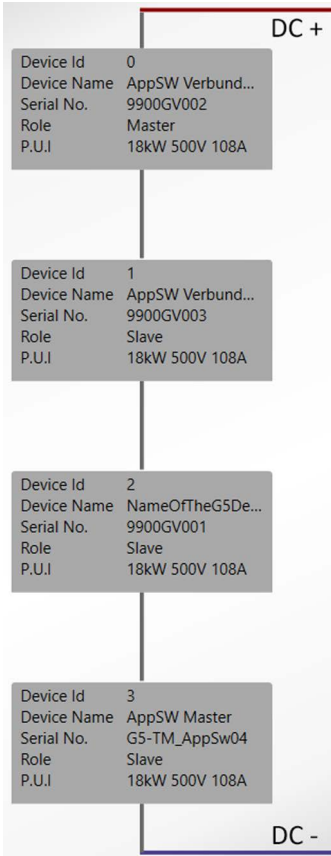


Fig. 10: Example of a series configuration of four G5 devices

When using the sense functionality, the sense measurement of every individual device (master and slaves) are used in series. The measuring mid-points have to be connected to the device mid-points according to the following scheme:

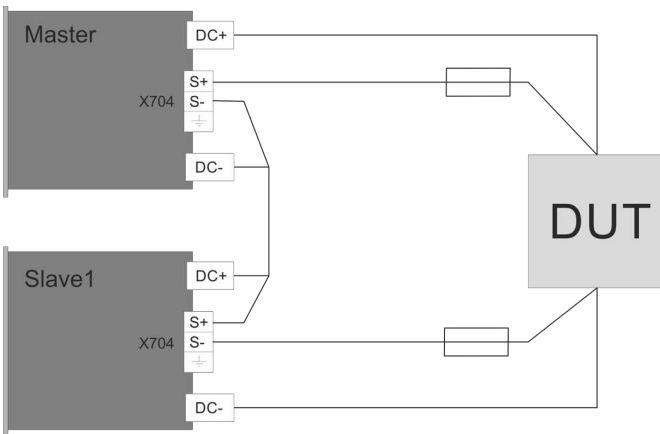


Fig. 11: Sense and load connections on multiple devices in a series configuration



### 6.4 Matrix Configuration

In a matrix configuration of multiple G5 devices, the electrical outputs of some devices are connected in series while others are connected parallel. I.e. it is a mixture of parallel and series configuration.

The output power of a multi-device system in matrix configuration equals the sum of the output power values of the individual devices.

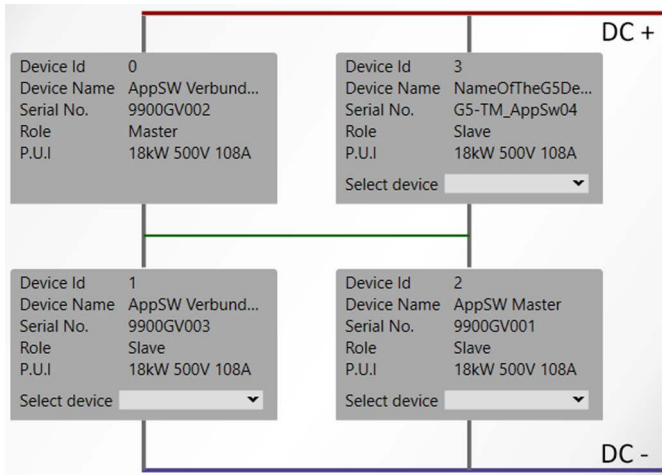


Fig. 12: Example of a matrix configuration of four G5 devices with midpoint connection

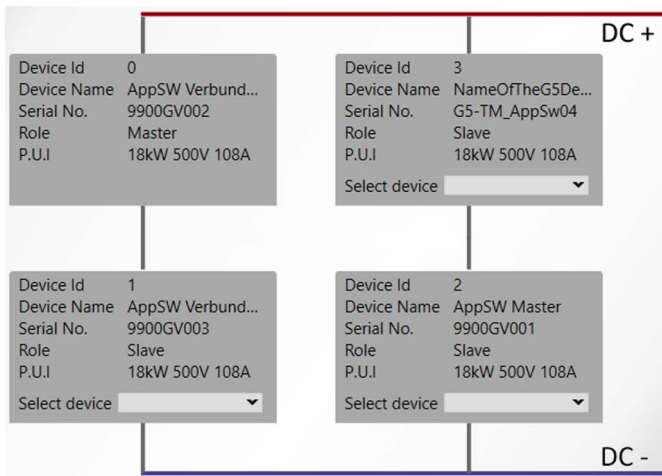
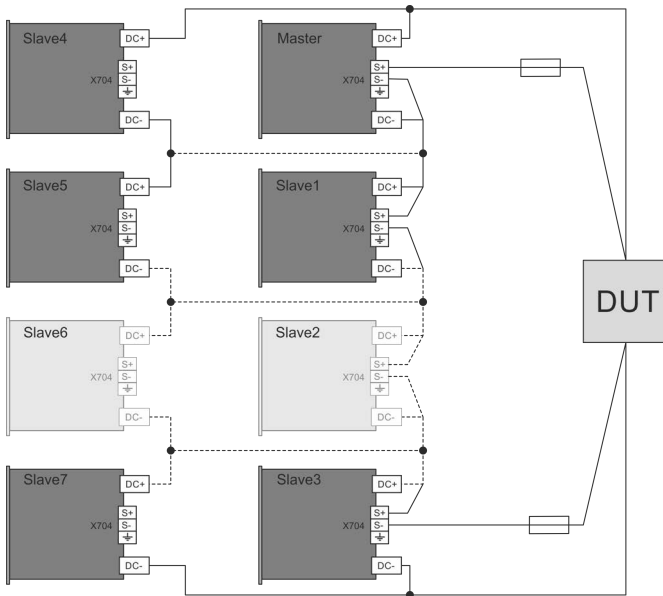


Fig. 13: Example of a matrix configuration of four G5 devices without midpoint connection

When using the sense functionality, the sense measurement must be connected in series. Only the sense measurement of the string with the master device is used. Here, the measuring mid-points must be connected to the device mid-points according to the following scheme:



**Fig. 14: Sense and load connections on multiple devices in a matrix configuration**

## 7 Installation

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### Electric shock!

Due to high voltage!

#### Avoidance:

- The electrical installation is to be undertaken by personnel with electrical training.
- When ever the device has been disconnected from the mains (e.g. via the main switch) or if there is a mains power failure, verify the voltage free status by measurement before working on the system.
- After the installation, check the conductor connections for tight fit and the cables for good strain relief.
- Connection terminals must be protected against touching (e.g. by fitting a suitable housing). If the device is used as a built-in device in a cabinet system, the basic protection of the connection terminals must be provided in the end application. Here, IP20 must apply.
- Without the optional discharge feature G5.XCD, operation with a pluggable AC connection is not permitted!



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### Electric shock!

Due to high voltage!

#### Avoidance:

For secure grounding the device must be connected to a grounding network of type TN. TT- or IT-systems are not permitted.



The installation includes the following tasks to be taken:

- connecting the load side
- mounting the protective DC covers G5.PAC.DC.  
(included per default in the scope of delivery for cabinet integration)
- connecting the line side
- measuring the insulation resistance

## 7.1 Connecting

The connection of the device includes the electrical connections of the load side and the line side as well as the mounting of the protective covers for safety reasons and finally the connection of the sense interface, if necessary.

### 7.1.1 Load Side Connection

---

#### **Possible damage to the device!**

- Due to excessive heating of the DC copper bars
- Due to a one-sided force on the DC copper bars

#### **NOTICE**

##### **Avoidance:**

- Secure clean contacting, i.e. lean and flat cable lugs, clean and greased screws and well tightened screw connection (torque: for device type LV = 60 Nm, for device type HV = 20 Nm)
  - Use two wrenches from both sides, when tightening the screws on the copper bars
- 

There are two ways to connect the load side of the G5 device, depending on the output current it provides.

For devices providing output currents of **up to 1014 A**, do the following:

1. Grease the screws (2), i.e. thread and bearing surface with MoS<sub>2</sub>-based grease, e.g. LM47. The copper bars must not be greased
2. For each pole, attach the cable lugs to the copper bars from either side and put in the screw (2) to hold them in place
3. For each pole, attach the lock nut (1) and tighten the screws (2) with a torque of 60 Nm (for device type LV) or 20 Nm (for device type HV)
4. If you want to use the sense functionality, connect the load to the sense interface **X704** by connecting a shielded twisted pair cable to + and - and the shield to **Pin 3**.
  - ✓ The load side of the G5 device is electrically connected:

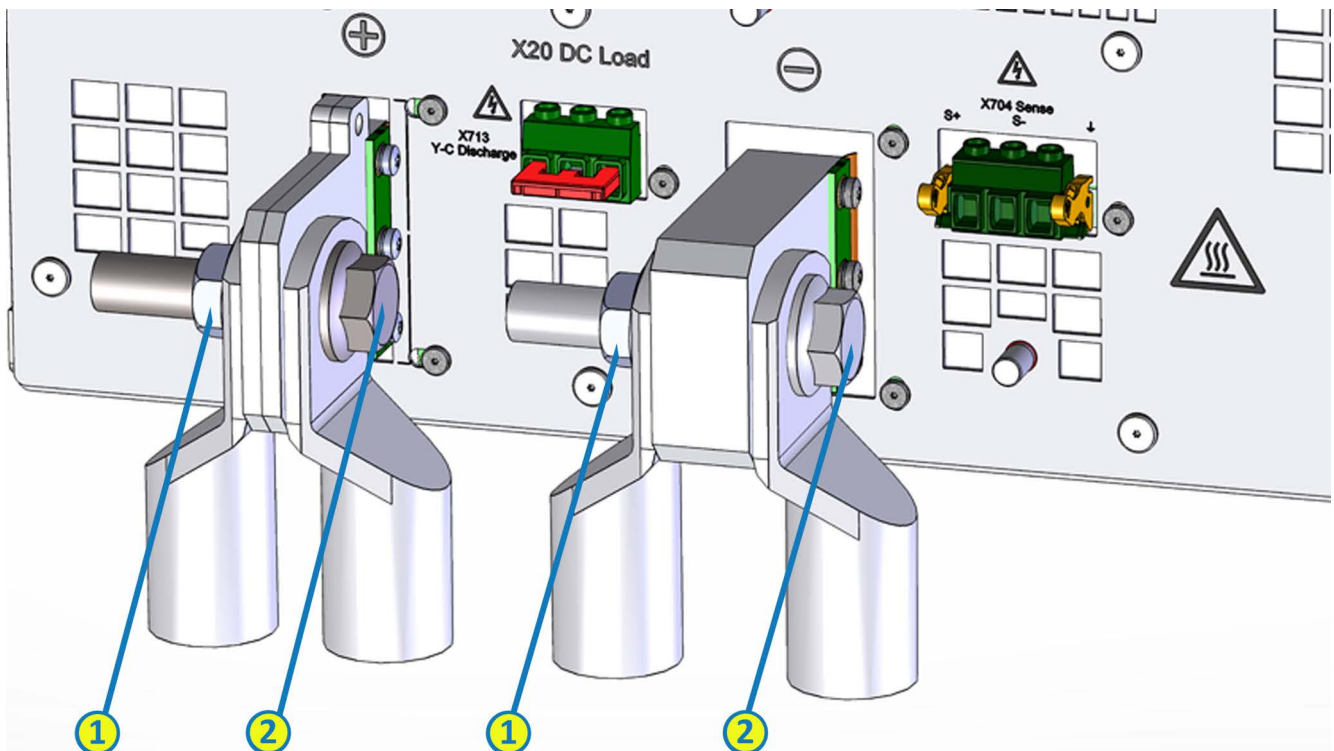


Fig. 15: DC load side connection for devices with an output current of up to 1014 A

For devices providing output currents of **more than to 1014 A**, do the following:

1. Grease the screws (2), i.e. thread and bearing surface with MoS2-based grease, e.g. LM47. The copper bars must not be greased
  2. Install the high current adapters together with the cable lugs
  3. For each pole, attach the cable lugs to the copper bars and the high current adapters from either side and put in the screw (2) to hold them in place
  4. For each pole, attach the lock nut (1) and tighten the screws (2) with a torque of 60 Nm
  5. If you want to use the sense functionality, connect the load to the sense interface **X704** by connecting a shielded twisted pair cable to + and - and the shield to **Pin 3**.
- ✓ The load side of the G5 device is electrically connected with a second pair of cables  
The output current per cable is halved  
Heat generation at the output is reduced:

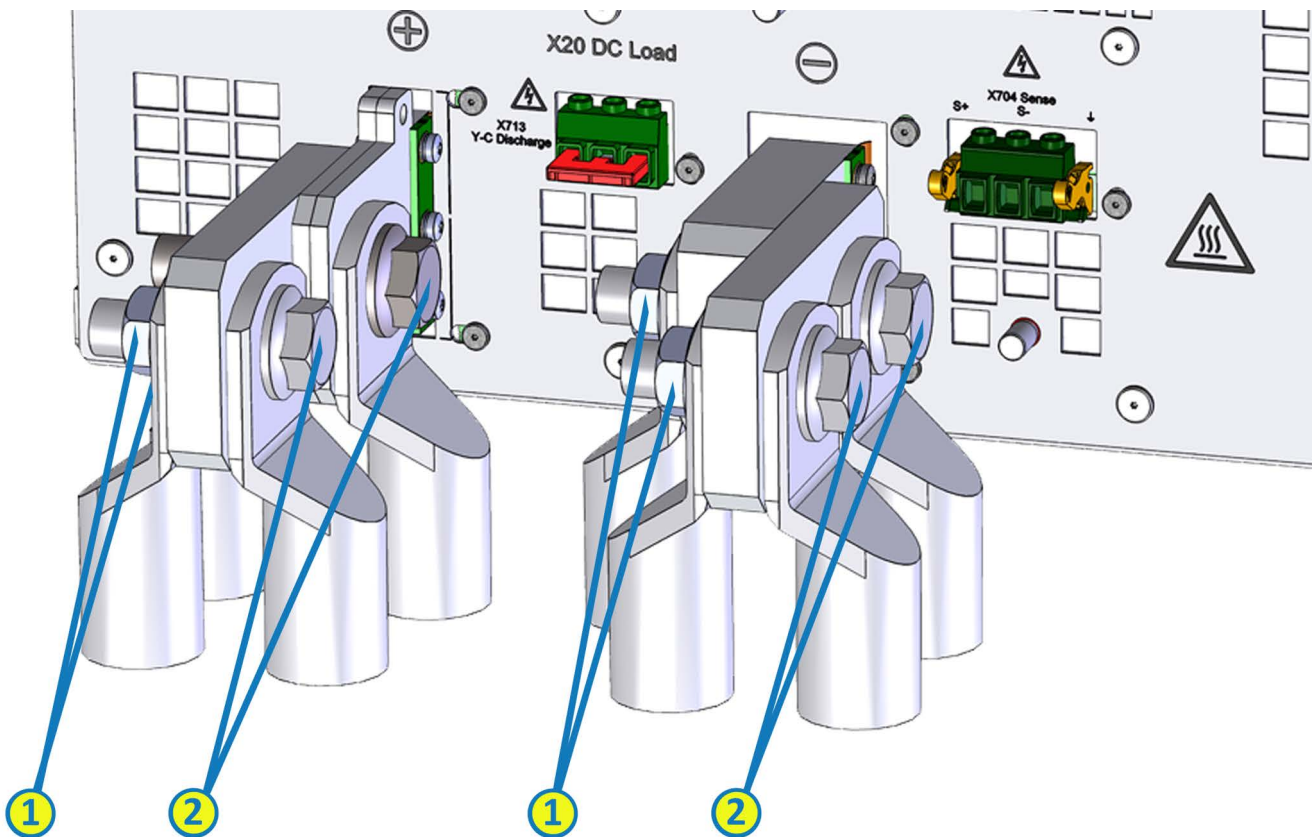


Fig. 16: DC load side connection for devices with an output current of more than 1014 A

### 7.1.2 Mounting Protective DC Covers

**Electric shock!**

Due to contact to live parts!

**Avoidance:**

If necessary, the contact protection must be mounted so that the clearance to live parts is not less than 1.5 mm (load side) or 3 mm (line side). Here, the clearance is tested with a “jointed test finger” according to IEC 60529.

Depending on the output values (voltage and current) of the G5 devices, there are various DC protective covers available:

Part Number	Device Output Values
G5.PAC.DC1	500 V, 1000 V, 1500 V @ all current levels
G5.PAC.DC2	60 V, 80 V, 160 V, 240 V, 320 V @ current level up to 1014 A
G5.PAC.DC3	60 V, 80 V @ current level 1014 A and higher

For mounting **G5.PAC.DC1**, do the following:

1. If necessary, unmount the contact protection by half-turning each of the two locking pins (1)
  2. Break out openings at the intended breakout lines (2) so that you can pass through the DC connection cables
  3. Pass through the DC connection cables
  4. Place the DC contact protection over the load side connection
  5. Fix the DC contact protection by half-turning each of the two locking pins (1)
- ✓ The DC cover G5.PAC.DC1 is mounted as visualized:

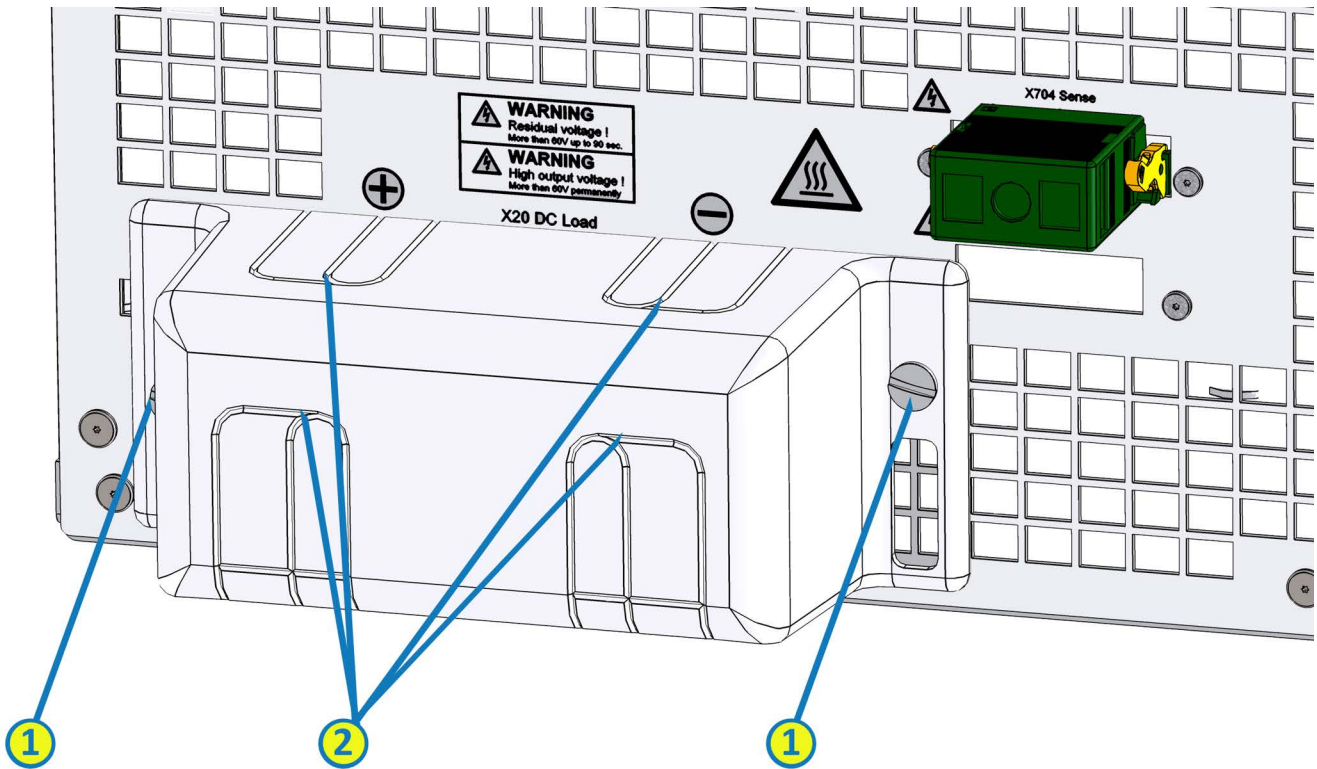


Fig. 17: Mounting DC protective covers for devices with output voltages higher than 500 V



For mounting **G5.PAC.DC2** or **G5.PAC.DC3**, do the following:

1. Connect the two halves of the protection cover with the help of two connecting pins (1)
  2. Place the protection cover onto the frame
  3. Fix the protection cover on the mounting frame with the four fixing screws (2)
- ✓ The DC cover G5.PAC.DC2 or G5.PAC.DC3 is mounted as visualized:

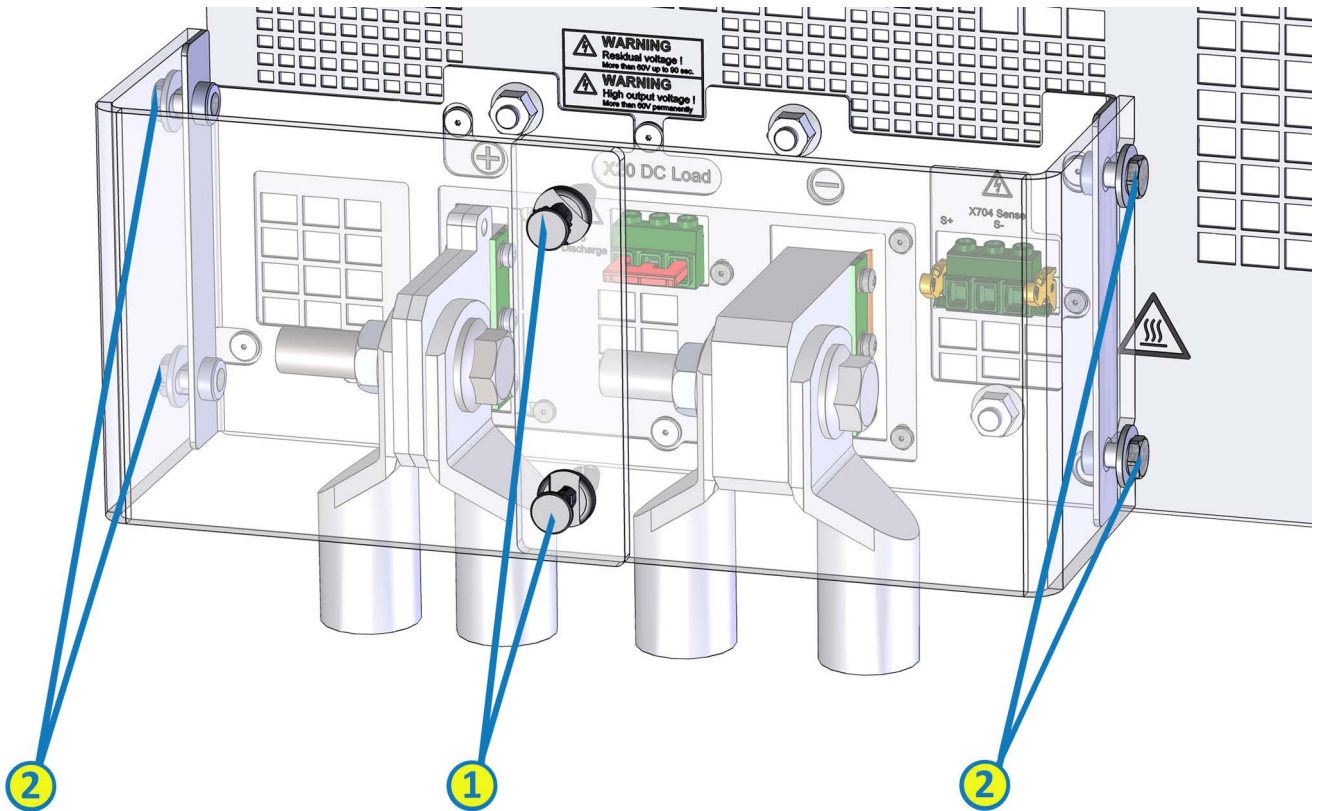


Fig. 18: Mounting DC protective covers for devices with output voltages lower than 500 V

### 7.1.3 Line Side Connection

On the line side the individual cables of the mains connection simply have to be connected to the corresponding poles of the AC cable clamp **X10**. If a protective cover for the line side of the G5 device is used, the strain relief for the AC cable has to be installed before mounting the AC protective cover. The strain relief clamp is premounted on the rear side of the G5 device as follows:

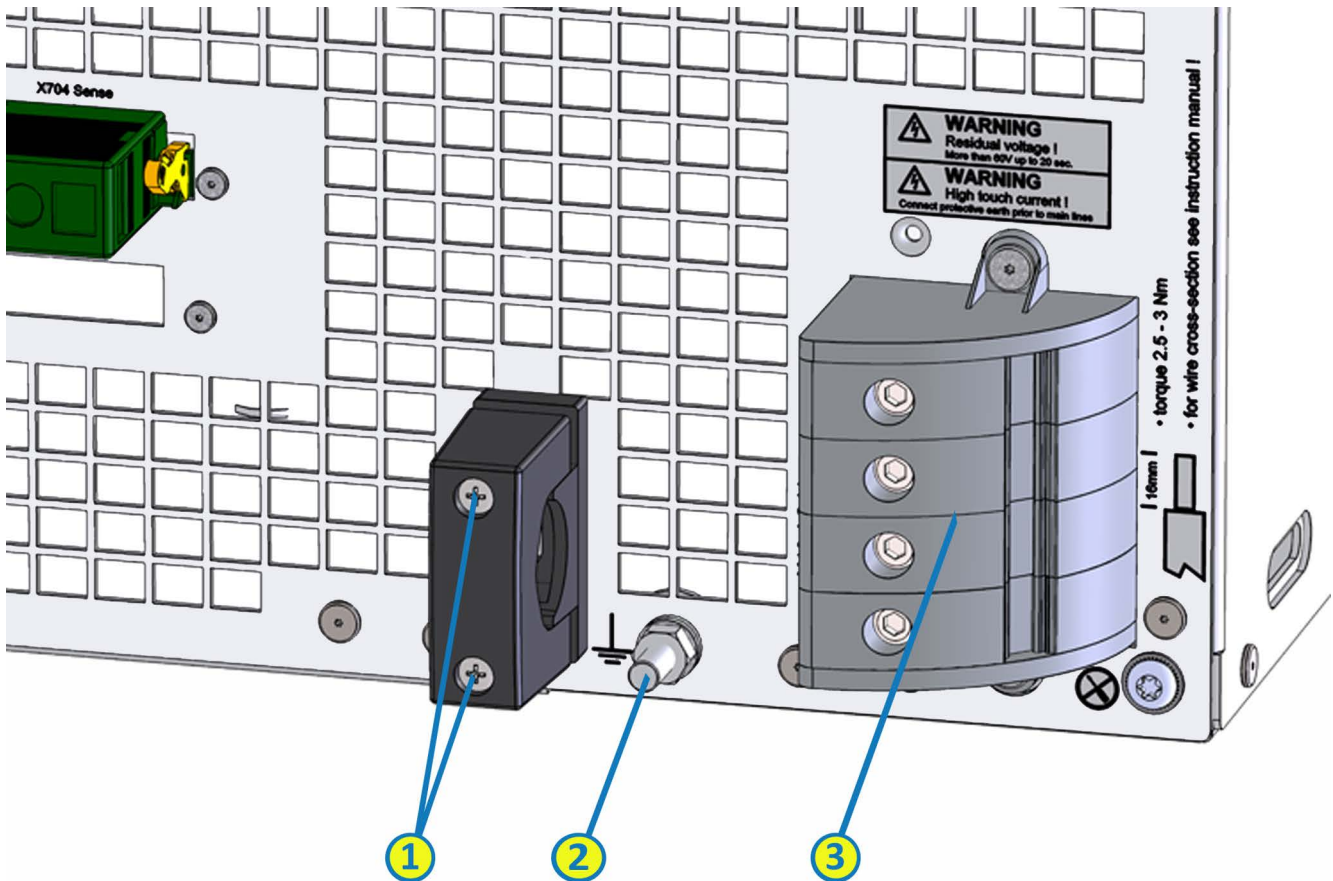


Fig. 19: Line side connection on the rear side of the G5 device

#### Elements for line side connection

1	Strain relief clamp with screws
2	Earthing pin (M6 thread) for additional earth connection
3	AC line side connection (cable clamp) <b>X10</b>

Due to the weight of the AC cables, the installation of the strain relief may require the assistance of a second person. To electrically install the line side of the G5 device with a strain relief clamp, do the following:

1. Open the strain relief clamp wide (1)
2. Connect the additional earth connection to the earthing pin (2) in a way that the connection cable points upwards from the earthing pin (2) and does not block the opening of the strain relief clamp (1) for the AC cables
3. Pass the AC cable through the clamp (1)
4. Connect the AC wires to the AC line side connection (cable clamp) **X10** (3)
5. Close the strain relief clamp (1) so that there is no strain on the cable
  - ✓ The line side is connected electrically with a strain relief clamp.

## 7.2 Measuring the Insulation Resistance

In the course of a new installation or when changing the electrical connection, the insulation resistance has to be measured on the device input. In addition, the insulation resistance has to be measured periodically subject to local safety regulations.

For a correct measurement of the insulation the circuit breaker on the device has to be opened. Depending on the device power the following insulation resistance values should approximately be measured:

- 18 kW: 1.5 M $\Omega$
- 36 kW: 0.75 M $\Omega$
- 54 kW: 0.5 M $\Omega$

The exact measuring result is to be found in the test report.

## 8 Commissioning

### Electric shock!

Commissioning can lead to dangerous situations.



### Avoidance:

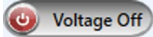
- The commissioning is to be undertaken by personnel with electrical training
- Device and load must be isolated against accidental contact
- No maintenance work must be carried out
- Warning signs must be used and the area must be cordoned off

After having finished the installation of the G5 device you can start the commissioning of the device as follows:

1. Ensure the Application Software G5.Control is installed on the relevant PC
2. Physically connect the PC to the digital interface **X703** LAN or **X707** USB of the G5 device with appropriate cables
  - ✓ The G5 device is physically connected and ready to be started.


### 8.1 Starting

To start the G5 device, do the following:

1. Switch on the main switch on the front side of the device
  - ✓ The device boots and performs a self-test.  
When finished, in the front panel indicator FPI, a green sign saying POWER is illuminated. If any other LED also lights up or flashes, then there is a warning or an error.  
If the G5 device is equipped with the option G5.HMI, then the G5.HMI starts up.
2. Start the Application Software G5.Control
3. Follow the instructions on the screen to establish a connection to the G5 device (for further details see the G5.Control Application Software Manual)
  - ✓ The G5 device is connected to the software and ready to be operated by G5.Control.
4. In the Application Software G5.Control set appropriate values
5. Click on  **Voltage Off** to switch on the DC load side
  - ✓ The G5 device is in state **Voltage On**.  
Energy flows between line side and load side.  
The G5 device can be used for the application cases intended according to the G5.Control Application Software Manual.

## 8.2 Stopping

To stop the G5 device, do the following:

1. Click on  to switch off the DC load side
  - ✓ The G5 device is in state **Voltage Off**.  
No more energy flows between line side and load side.
2. Follow the instructions on the screen to disconnect the G5 device from the Application Software G5.Control
  - ✓ The G5 device is disconnected from the software and can no longer be operated by G5Control.
3. Switch off the main switch on the front side of the device
  - ✓ The front panel indicator FPI extinguishes.  
If the G5 device is equipped with the option G5.HMI, then the G5.HMI extinguishes.  
The G5 device shuts off, but voltage is still present on the mains and heat is still possible on the copper bars.

## 8.3 Grid Troubles

The G5 device has a special safety behavior in case of a grid failure or loss. The G5 device monitors line voltage and frequency of each line (L1...L3) in a 48 kHz cycle. Once a limit violation is detected, the device will switch off and go into error state.

Here, the following limits apply:

- Line frequency deviation: +/- 1 Hz for 100 ms
- Upper limit of line voltage (L-L): 565 Vrms during 2 ms
- Lower limit of line voltage (L-L): 277 Vrms during 2 ms

After a grid failure or loss, the device does not restart automatically. After the limit violation is finished, the error state can be cleared and the device can be restarted manually.

## 9 Disposal



Comply to the WEEE Directive 2012/19/EU and properly dispose waste electrical and electronic equipment!

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When disposing a G5 power supply or any of its electrical accessories, the following points are to be regarded:

- Electrical equipment is too valuable for household waste
- Dispose the waste with due care for the environment
- Concerning the disposal of electrical equipment, comply with national laws

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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Class: Project specific use only