Instruction Manual

psp family *I series gamma*

Bench Case Version

D400 G150/50 WRG-TFKX

Device-No.:246569

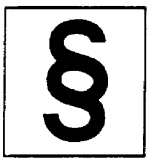
Design may vary

Gewerbepark 10
D-59069 Hamm
Tel.: 02385 / 74-0 Fax: 74-55

www.munk.de
www.rectifier.com

Contents

1 Basic Information



1.1 Intended Use

The power supply described herein has been developed for applications in modern electrochemical process engineering. These power supplies are electrical equipment to be applied in industrial installations. Active loads (e.g. motors, generators, etc.) and reverse voltage sources must not be connected to these power supplies under any circumstances. When installing and operating the device, the relevant safety notes must be observed.

1.2 Improper Handling

The power supply is to be used in the field of application stated in section 1.1 only. It must not be used in private households. The warranty will expire in case of improper handling, and Munk GmbH will not accept liability for any damage to the load.

1.3 Warranty and Liability Clause

Supplies and services of Munk GmbH are performed in accordance with the General Conditions for the Supply of Products and Services of the Electrical and Electronics Industry (Grüne Lieferbedingungen), unless the terms of delivery have been specified otherwise in the contract agreement in writing. Munk GmbH is not liable for defects caused by improper handling and incorrect operation of the power supply. This includes the disregard for protection and safety features and the non-observance of preset device parameters.

1.4 Function of the Power Supply

According to the applied technology, the power supply converts sinusoidal input voltages into direct voltages.

1.5 Manufacturer's Address

Munk GmbH
Gewerbepark 10
59069 Hamm
Germany

Tel.: +49 2385 740
Fax: +49 2385 7455
Mail: info@rectifier.com

1.6 Recycling

The power supply consists at more than 95 % of recyclable materials. Depending on the construction the device contains the following material:

- copper bars, copper windings
- grain-oriented sheet-steel
- clamping iron
- pull rods
- steel
- aluminium

The remaining insulating materials consist of compounds according to DIN EN 60893-2. For separating the individual materials the power supply can be dismantled into its basic components.

2 Important Safety Notes

2.1 Demands on the Operator

This description comprises necessary information on the proper use of the device described therein. It is intended for technically qualified personnel. Qualified personnel are persons being nominated by the person responsible for the plant safety to perform the necessary work and being able to recognize and prevent possible hazardous situations. Prerequisites for this nomination are appropriate training and instruction as well as experience and knowledge of the relevant safety standards, requirements, accident prevention regulations, and operating conditions. (Definition of qualified personnel according to IEC 364).

2.2 Importance of these Instructions

These operating instructions explain the intended use of the device. They contain instructions for installing, connecting, operating and maintaining which must be observed. You will only be able to ensure that the unit will work properly as described in section 1.1 if you follow these instructions.

2.3 Transport and Storage

The equipment will be loaded and transported either as single unit or in several transport units, depending on the design.

The transport units must be screwed together and electrically connected by experts on site. If necessary, the power supply must be stored free from frost in a dry, well-ventilated room and covered during storage. Large temperature deviation has to be avoided.

2.4 Operator's Duties

The operator is obliged to convey the device to the installation site immediately after delivery and to ensure proper installation or storage. Furthermore, he has to ensure that the power supply will not be damaged by incorrect handling and installation. Visible defects must be reported to the forwarding agent in writing within 24 hours.

2.5 Structural Device Modifications

The operator must not modify the power supply in any way without the consent of the manufacturer. This applies to mechanical and electrical modifications such as the installation of components which have not been approved by the manufacturer. Such alterations will void the warranty.

2.6 Danger Notice

The following notes serve the personal safety of the operating staff and the safety of the described product. The power supply may only be used in a technically faultless state and as specified in accordance with the operating instructions on hand. The user must be aware of possible dangers and familiar with applicable safety measures. Faults putting safety at risk must be cleared immediately. The device must not be used until all faults have been cleared.

Hazardous Voltage:

Non-observance may cause death, serious physical injury or damage to property.

- Always disconnect the power supply from all supply voltages before servicing, assembling and disassembling the device and when exchanging fuses.
- Pay attention to the relevant accident prevention and safety regulations applicable in your country.
- Check whether the nominal voltage of the device corresponds to the local mains voltage before commissioning the device.
- Terminals must be protected and designed according to the regulations of the local power utility.
- Protective conductor connections (safety ground connections) must be checked for proper functioning after they have been mounted!

3 Block Diagram

1: AC Supply

2: Control

3: Mains Contactor / Mains Switch (if applicable)

4: Input Filter

5: Mains Rectifier

6: Smoothing

7: High Frequency Chopper

8: High Frequency Transformer

9: Fast Rectifier

10: Filter

11: Set Values

12: Controls

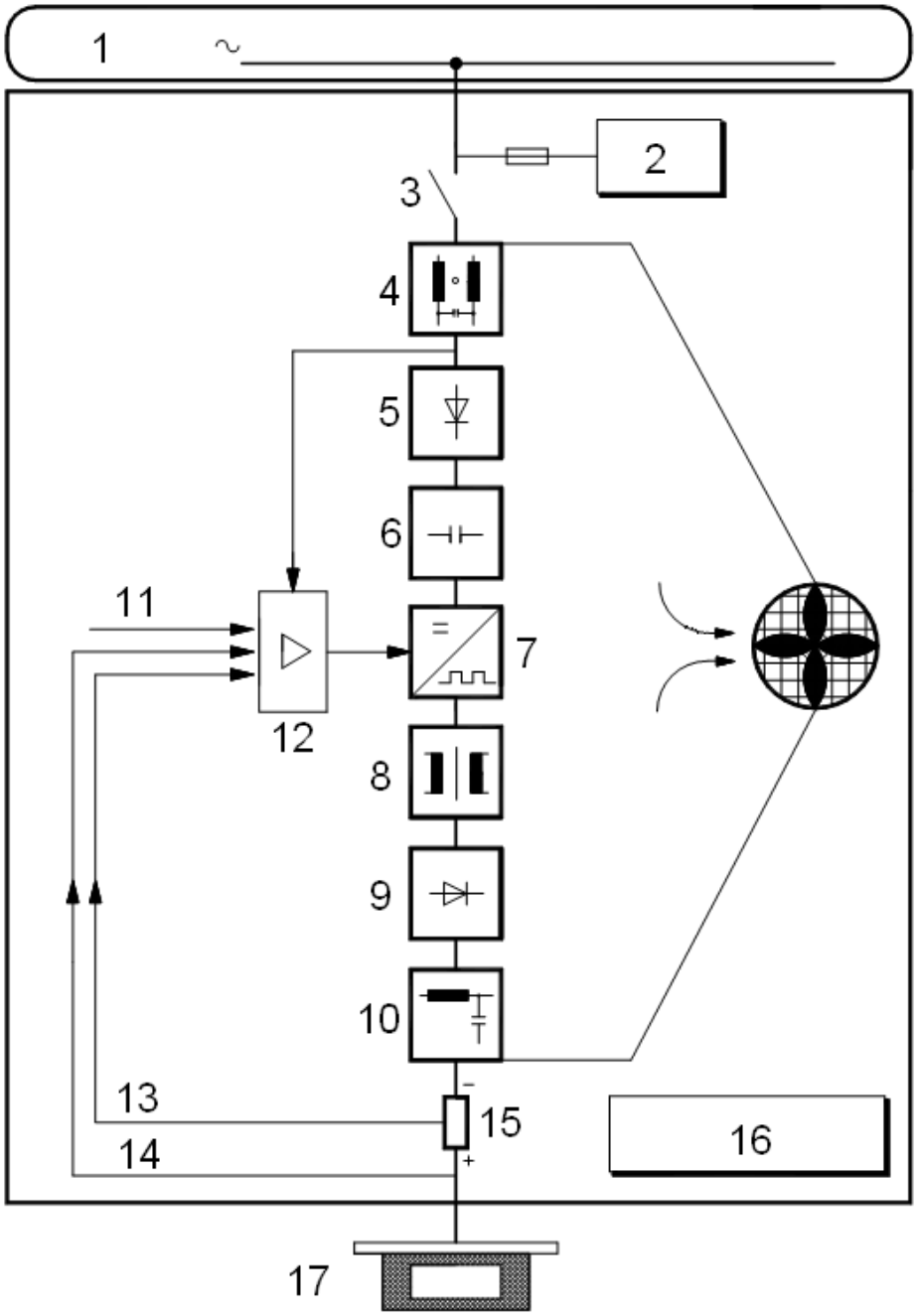
13: Actual Current

14: Actual Voltage

15: Shunt / Current Converter

16: Temperature Monitoring

17: DC-Load



4 Description of psp Family Rectifiers

4.1 Basic Information

Psp family switching-mode power supply rectifiers stand out because of their compact design, high control accuracy, low ripple, low weight, and a high efficiency.

In contrast to other electronic rectifiers, such as thyristor rectifiers, the ripple of psp family power supplies is constant. Thus, psp family rectifiers generate high quality direct currents.

As the operating frequency of the switching mode power supply rectifiers is higher than 20 kHz the wound components, such as main transformer and smoothing filter, as well as the capacitors can be designed much smaller while generating the same output power.

Another outstanding characteristic is the improved dynamic response of the output values which allow set point value deviations at the DC voltage output to be adjusted within milliseconds. These specific control properties render the output variables very stable.

The control accuracy of the internal closed-loop control amounts to just 1% referring to the nominal voltage or current. The current and voltage ripple values of the DC output are below 1 – 3% of the nominal values across the entire control range, if not indicated otherwise in the technical specification.

The power section is installed in an enclosure made from insulating material, thus preventing direct access to live components.

Psp family rectifiers are DC power supplies designed on the basis of switching-mode power supply technology. The internal control electronics facilitate very short adjustment times in case of sudden load variations.

4.2 Switching Mode Power Supply Technology

Switching-mode power supply technology rectifies the mains voltage and supplies it to a DC link consisting of capacitors and connected to a high frequency inverter, which converts the DC link voltage into an AC voltage of a higher frequency. This AC voltage is transferred to the transformer primary circuit, which adjusts the voltage and implements electrical isolation. The secondary voltage of the transformer is rectified and transferred via an output filter to the rectifier output.

4.3 High Current Circuit

The high-current circuit includes the transformer secondary circuit, a high-current rectifier and a smoothing filter.

The high-current rectifier consists of rapid-high-current diodes. The received DC voltage is transferred via the smoothing filter to the rectifier output. The smoothing filter filters the superimposed high-frequency AC voltage of the high-current rectifier. This allows a low-ripple DC voltage to be applied to the rectifier output.

4.4 Closed-Loop Control

Psp family rectifiers, are equipped with current and voltage controllers. Owing to the internal connection the controller limiting the output variable is always the active one. Therefore, you can only preset current and voltage set point values or adjust them using the potentiometers.

The rectifier operates according to a controlled voltage/current characteristic to DIN 41773.

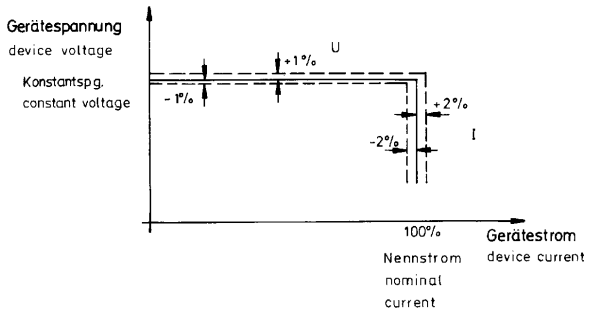


Figure: Diagram of voltage/current characteristic acc. DIN 41733

4.5 Direct Current Output

The DC output is implemented either with polarity terminals, screw terminals or copper bars.

The polarity (+ or -) of the DC output is either marked by colours (i.e. red for the positive and blue for the negative pole) or with the symbols + and -, depending on the design.

The positive pole of the direct current output is usually connected to the anode and the negative pole to the cathode of the electroplating tank.

The load (resistive load or electroplating tank) is connected to the rectifier by an interconnecting cable with a cross section that corresponds to the nominal current of the rectifier output. This interconnecting cable is not included in the delivery with the rectifier.

You can determine the cross section of the interconnecting cable using the table provided in section „current carrying capacity“. However, you can only find the current carrying capacity of the cable you want to use by asking your cable supplier.

Warning: If the cross section you have chosen is too small, the interconnecting cable may become overheated.

If several interconnecting cables are used, the nominal current carrying capacity of the individual conductor must be multiplied by 0.7, unless the regulations applicable in your country require even further capacity reductions.

Both ends of the interconnecting cable must be equipped with cable lugs to ensure high contact stability. Ask your cable supplier for the cable lug and crimping types which have to be used.

Warning: An insufficient or incorrect connection causes overheating – fire risk!

Clean the connecting points at the DC output and load before connecting the cable and check them regularly. Temperature deviations and mechanical motion, such as tank movements, can loosen the interconnecting cable.

Warning: Loose interconnecting cables cause overheating – fire risk!

5 Installation

5.1 Installation Site

The power supply is designed for indoor operation. Humidity and condensation at the installation site must correspond to European conditions, .i.e. a site altitude of 1,000 m (3000 ft.) above sea level must not be exceeded, unless otherwise stated. If the site altitude is exceeded nevertheless, the output must be reduced to guarantee proper operation. If the device is installed in areas with relatively high humidity and changing temperatures, condensation may occur inside the device as soon as the temperature level drops.

The power supply is not suitable for outdoor installation. When choosing the installation site, always consider that free access must be ensured from all sides for maintenance and servicing purposes. Protect the device from dust.

5.2 Electrical Connection

In order to put the device into operation connect it according to the circuit diagrams to all required mains and control lines. The permissible voltages at the input terminals must not be exceeded. Regulations of the local supply companies have to be observed.

Cables for the DC output must have a cross section that corresponds to the nominal direct current of the device. Install the cables in such a way that the cooling air supply for the rectifiers remains unrestricted.

5.3 Air Supply / Cooling System

In order to ensure that the rectifier is sufficiently cooled, neither air intake nor discharge should be impeded. To ensure that the fresh-air supply is sufficient do not cover the lateral air inlet openings. Leave a **minimum** clearance of **20 cm (8")** behind the rectifier to let the exhaust air escape unimpeded and take measures to prevent exhaust air from building up in the area surrounding the rectifier as insufficient air supply may lead to failures and damage the rectifier. The temperature of the supply air must never exceed 40°C (104°F).

Sufficient cooling can only be guaranteed over a long period of time if the cooling air contains only very few dust particles. Aggressive ambient air or dust deposits on the heat sinks may cause insufficient cooling of the rectifier and thus induce operational failures requiring that the manufacturer conducts internal cleaning.

If the maximum ambient temperature has been reached, an impermissibly high temperature may develop inside the power module under unfavorable conditions after disconnection. This impermissibly high temperature does not damage the device but it prevents the output of power. This temperature-induced fault, which may result from heat accumulation after disconnection and which thus occurs subsequently, can be prevented and cleared, respectively, by switching the rectifier into the standby mode. The standby mode should only be switched on for approx. 60 seconds before the actual output of power. The internal fan cooling will then be activated in order to dissipate the heat.

6 Commissioning

6.1 Visual Inspection

Before actually commissioning the device, check the following items:

- **Visually check** whether the devices have been damaged, for instance during transportation, and repair the damages found.
- Check the **ground connections** for a correct connection.
- Check whether the **mains supply** corresponds to the one stated in the Technical Data chapter and to the information given in the cabinet's circuit diagrams.
- Check whether the **screwed connections** at the mains supply, the DC terminal and the terminal strips of the plant control system or remote control unit are tight; retighten them, if necessary.
- Check whether the **load** at each rectifier output is connected with the correct polarity.
- Check for a **short circuit** at the DC outputs and remove this fault immediately.
- Check for the **air in- and outlets**, which must not be covered
- Check whether the entire **air-cooling system** is fully operational.
- Check the interconnecting cable to the load for sufficient cross section, correct installation and correct polarity. **Warning: Fire Risk**

6.2 Switching On

After having considered all items mentioned above and having taken the appropriate measures, you may connect the mains supply in the sub-station.

As these rectifiers are equipped with only a few operating elements, handling **psp family** devices is very easy and does not require any special technical knowledge. After the rectifier has been expertly installed, the device is ready for operation. The rectifier reaches its set point value via a soft start function after you have started the device either by remote control or with the integrated mains switch.

After having switched on the rectifier, you may increase the set point value of the rectifier slowly from 0 to 100 % under energized conditions. Check at the controller whether the actual values correspond to the set point values. Please ensure that a load is connected to the output of each rectifier.

The bench case version of the rectifier consists of two potentiometers (electronic potentiometers for MFD devices) for adjusting the current and voltage setpoints. Turned fully to the left, the set values are set to "zero"; turned full to the right, the nominal values of the rectifier will be set. To receive a signal at the device output you have to select a voltage or current set point above zero.

If you want to control the rectifier in current control mode, you must set the voltage controller to the unit's nominal value or the maximum permissible process voltage. The set point value of the current controller will then be adjusted to the required process current.

If you want to operate the rectifier in voltage control mode, you must set the set point value of the current controller to the unit's nominal value or the maximum permissible short circuit current, depending on the process/product. The set point value of the voltage controller will then be adjusted to the required process voltage.

The output values for current and voltage are displayed on the digital instruments.

Use the optional emergency-off function only in case of emergency.

7 Service and Maintenance

7.1 General Notes on Maintenance

psp family rectifiers normally do not require much maintenance. How often maintenance does need to be carried out depends on local operating conditions.

7.2 Safety Disconnection before Maintaining and Cleaning

Before maintaining, repairing and cleaning the device, make sure you keep to the basic safety rules:

- **Disconnect the device safely and completely from the mains supply and from possibly existing auxiliary supply circuits (external control voltage).**
- **Secure the disconnection from the mains supply against unintentional restarting.**
- **Verify the safe isolation of the rectifier from the supply.**
- **Cover or close off adjacent live parts by means of barriers.**

The fans (if existing) will wear out in the course of time and must then be replaced.

The rectifier should be switched off and allowed to cool down before maintenance begins.

Please check the interconnecting cables to the load and all contact or connecting points at regular intervals **(overheating risk)**.

7.3 Cleaning of the Rectifier

How regularly the rectifier needs to be cleaned depends heavily on its operating conditions. We strongly recommend that the rectifier is not operated close to machines or installations creating a lot of dust. The air ventilation slots should be cleaned regularly to prevent them from being clogged by foreign bodies, although the inside of the rectifier itself should not need cleaning under normal operating conditions as the integrated ventilation system should provide sufficient air flow.

The operator should only ever clean the outside of the unit. Should internal cleaning of the rectifier become necessary - due to heavy contamination inside the device, which may lead to failures - send the rectifier back to the manufacturer for cleaning and testing. The same applies if fluid gets into the rectifier. In this case, immediately disconnect the rectifier from the mains and do not restart it until the manufacturer has checked and cleaned it.

7.4 Storage

The device is equipped with electrolytic capacitors. To prevent from aging the following issues must be observed:

- The storage temperature must not exceed 25°C (75°F)
- The device should be energized at rated voltage with no load every 1-2 years for ca. 30 minutes

8 General Safety Instructions

- Never open the housing as hazardous voltage components are installed inside. You may suffer an **electric shock**!
- None of the components inside the casing requires maintenance. Thus opening the enclosure is unnecessary and strictly prohibited.
- The input values must not exceed the limit values listed in the technical specification as otherwise the unit will be damaged.
- If fluid gets into the rectifier, immediately disconnect it from the power supply to avoid damage.
- Clean the openings of the enclosure and fans or heat sinks from the outside at regular intervals. The cleaning extent depends on the dust emitted in the area around the power supply.
- The protective earth terminal must be connected to the power supply's protective earth conductor (yellow-green wire) to ensure sufficient protection for the operator.
- Erect and connect the rectifier according to the EMC regulations; for example, supply and control lines must be installed separately.
- The local mains voltage must correspond with the operational voltage stated on the rating plate.
- Observe the relevant electrical safety regulations applicable in your country when installing and operating the device.
- Always carry out installation work in off-load conditions, for example, when connecting the output terminals of the device.
- Ensure sufficient protection against electrostatic discharge.
- If the mains feeder and/or the mains plug are obviously damaged, immediately disconnect the unit from the mains.
- **Warning: incorrect installation of the interconnecting cable to the load may cause a fire.** Check the interconnecting cables regularly, and keep the contact points clean.

9 Troubleshooting

9.1 Troubleshooting on the Phone

If you cannot find the fault or the source of it, call **+49 2385 740** and we will put you through to one of our service engineers.

Phone-No.: **+49 2385 / 74-0**
Fax-No.: **+49 2385 / 74-55**
E-Mail: **info@munk.de**
info@rectifier.com

We will be able to help you quickly if you can describe the fault as exactly as possible (error message) and name the rectifier's device number (see **Technical Data)**.

9.2 Periodic Interruptions in Operation

Periodic interruptions in operation and consequent restarts indicate the response of the overheating protection. If this is the case, check whether the cooling air supply is sufficient or whether the rectifier needs to be cleaned.

If the periodic interruptions are caused by the rectifier overheating due to heavy contamination of the cooling components, it is possible to operate the device temporarily with a reduced output power (to finish a running process for instance).

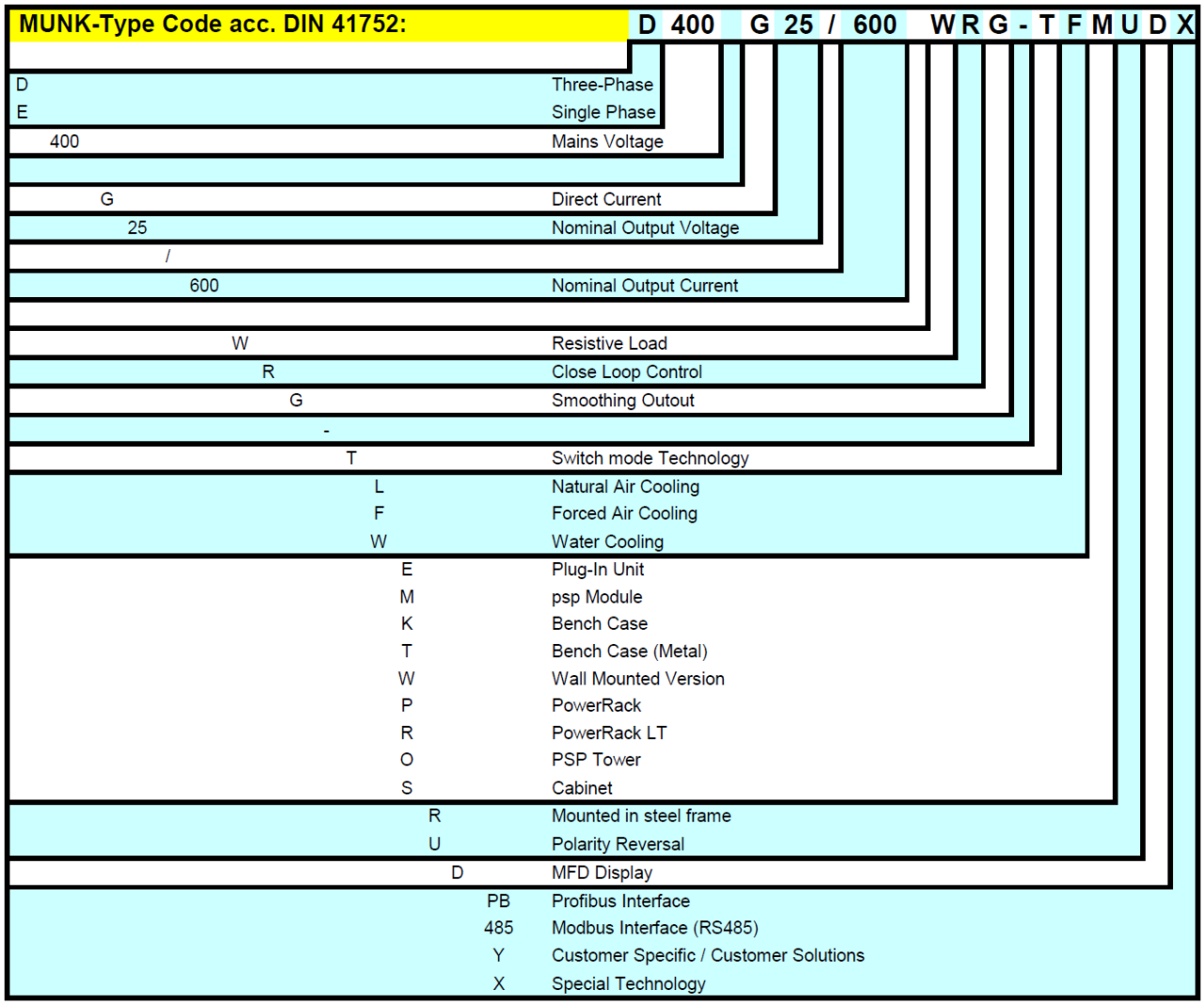
9.3 The Device does not Reach the Set Current

- The device is being operated in voltage-limiting mode; the resistance of the load is too high.

9.4 The Device does not Reach the Set Voltage

- The device is being operated in current-limiting mode; the resistance of the load is too high.

10 Type Code



MUNK-Type Code acc. DIN 41752:	D	400	G	25	/	600	W	R	G	-	T	F	M	U	D	X
D																
E																
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D	Three-Phase
E	Single Phase
400	Mains Voltage
G	Direct Current
25	Nominal Output Voltage
/	
600	Nominal Output Current
W	Resistive Load
R	Close Loop Control
G	Smoothing Outout
-	
T	Switch mode Technology
L	Natural Air Cooling
F	Forced Air Cooling
W	Water Cooling
E	Plug-In Unit
M	psp Module
K	Bench Case
T	Bench Case (Metal)
W	Wall Mounted Version
P	PowerRack
R	PowerRack LT
O	PSP Tower
S	Cabinet
R	Mounted in steel frame
U	Polarity Reversal
D	MFD Display
PB	Profibus Interface
485	Modbus Interface (RS485)
Y	Customer Specific / Customer Solutions
X	Special Technology

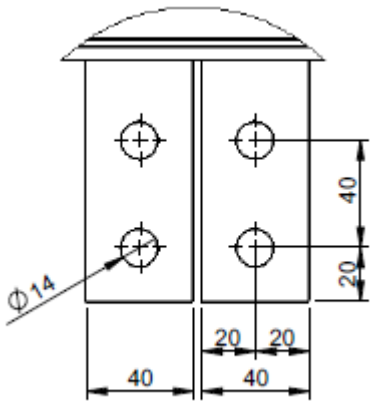
11 Technical Data

11.1 Electrical Data

Mains Voltage	:	3 x 400 ± 10%, 47-63 Hz
Nominal DC Voltage	:	150 V DC
Nominal DC Current	:	50 A DC
Efficiency	:	75% … 90%
Ripple	:	< 3 % referred to nominal values
Adjustment ranges	:	0 … 100 % of Nominal Voltage / Current
Control Accuracy	:	+/- 1% referred to nominal values
Ambient Temperature	:	0 ... 35 °C (30 … 100°F)
Device Type	:	D400 G150/50 WRG-TFKX
Device No.	:	246569

11.2 Dimensions

Dimensions: (W x D x H): 537 mm x 550 mm x 397 mm



Copper output bars:

11.3 Terminal Strip“X02”

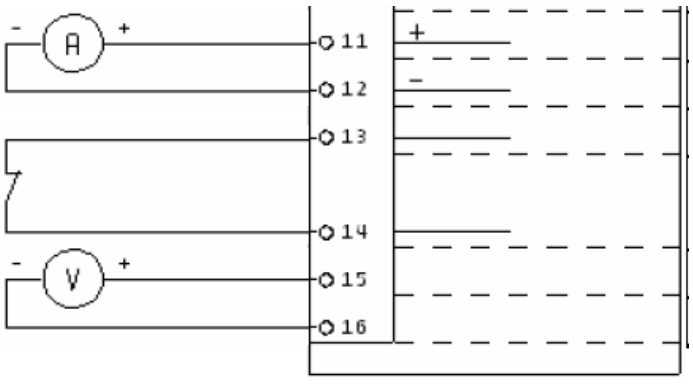
Depending on the rectifier different options for signalling and setting the voltage and current values are available

1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11	Actual Current	0 …10 V DC
12	standardized	GND
13	Pulse Enable	13-14 closed
14		= Output active
15	Actual Voltage	0 …10 V DC
16	standardized	GND

11.4 Connection Examples for “X02“:

11.4.1 Standardized Measuring Values

Level: 0...10V DC



Note: Terminals 13, 14 are for external pulse enabling (bridged, when delivered)

12 Current Carrying Capacities

The values indicated in the table below are recommended values and are taken in simplified terms from the DIN VDE 0298-4 standard, “Application of cables and cords in power installations – Part 4: Recommended current-carrying capacity for sheathed and non-sheathed cables for fixed wirings in buildings and for flexible cables and cords”; or they are extracts from the DIN VDE 0100-430 standard, “Erection of power installations with nominal voltages up to 1000 V; protective measures; protection of cables and cords against overcurrent” and of DIN VDE 0100-520, “Erection of power installations with nominal voltages up to 1000 V – Part 5: Selection and erection of equipment; chapter 52: Wiring systems”.

In borderline cases, the VDE regulations or the regulations applicable in your country must be observed.

Current carrying capacity acc.VDE 0100 part 430 at an ambient temperature of 30 °C (86°F)

cross-section	group 1		group 2		group 3	
	Copper-conduct	Fuse	Copper-conduct	Fuse	Copper-conduct	Fuse
mm²	A	A	A	A	A	A
1,50	16,50	16	16,50	16	21,00	20
2,50	21,00	20	22,00	20	29,00	25
4,00	28,00	25	30,00	25	39,00	35
6,00	36,00	35	38,00	35	51,00	50
10,00	49,00	40	53,00	50	70,00	63
16,00	65,00	63	72,00	63	94,00	80
25,00	85,00	80	94,00	80	125,00	100
35,00	105,00	100	118,00	100	154,00	125
50,00	126,00	125	142,00	125	198,00	160
70,00	160,00	160	181,00	160	205,00	200
95,00	193,00	160	219,00	200	292,00	250
120,00	223,00	200	253,00	250	344,00	315

Group 1 At least one single-core cable runs in a conduit, for example, PVC-insulated single-core non-sheathed cables H 03 V../H 05 V../H07 V.. according to **DIN VDE 0281**, “Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V”.

Group 2 Multi-strand cables, for example, non-metallic sheathed cables, flexible cords, metal-clad cables in open or ventilated ducts.

Group 3 Single-core cables laid in free air, with a minimum distance between the cables corresponding to the cross section of the cable, as well as single-core wiring cables in switching stations, distribution and busbar trunking systems

12.1 Overview of VDE Standards

DIN EN 60204-1 industrial machinery: “Safety of machinery – Electrical equipment of machines –
Part 1: General requirements” (IEC 204-1)

DIN VDE 0891-1 telecommunication and information processing systems: “Use of cables and insulated wires for telecommunication and information processing systems; general directions”

DIN 57891-8 self-supporting telecommunication aerial cables: “Use of cables and insulated wires for telecommunication and information processing systems; special direction for self-supporting telecommunication aerial cables on overhead power lines above 1kV according to DIN 57818/VDE 0818”

DIN VDE 0891-10 ribbon cables (draft standard): “Use of cables and insulated wires for telecommunication and information processing systems; special direction for ribbon cables with round conductors; with a pitch of 1.27 mm according to DIN VDE 0811”