

RECTIFIER

RECT



GUSTAV KLEIN
POWER SUPPLIES - since 1948



FACTORY SCHONGAU (GERMANY)

GUSTAV KLEIN – a company introduces itself

The GUSTAV KLEIN company was founded in Schongau, Germany, in 1948.

In 1969, a subsidiary factory was opened in Austria, at that time our principal export country, located in Inzing to the west of Innsbruck. The GUSTAV KLEIN company has approx. 200 employees in this two factories.

The manufacture of transformers was the beginning of our rapidly expanding product palette, followed by stabilizers and mains voltage controllers for broadcast and television stations of the German federal post.

The first thyristor rectifiers were presented in 1960. And since 1962 used together with thyristor controlled inverters as a UPS – uninterruptible power supply. In 1968 the uninterruptible electronic bypass device for inverters was manufactured.

Switched-mode rectifiers and DC converters were delivered since 1970.

Later, high-current transistors became available on the market, and in 1985 the GUSTAV KLEIN company began to manufacture pulse-width modulated transistor inverters and UPS equipment up to 100 kVA.

New IGBT transistors made it possible to improve the efficiency of our UPS equipment in 1996. Since the year 2000 UPS equipment with microprocessors and IGBT-rectifiers are in our product range.

Today we manufacture not only secured power supplies, but also high power test systems up to 1000 V DC and frequency converters in IGBT technology.



FACTORY INZING (AUSTRIA)

REASONS for choosing GUSTAV KLEIN:

- ▶ **Experience**
More than 250.000 delivered units speak for themselves.
The knowledge of our experienced engineers is also available for YOU.
- ▶ **Confidence and Consistency**
GUSTAV KLEIN is established since 1948 on the market of power supplies. Renowned companies from the Railway, Telecom Power Stations, Chemical and Industry are from the beginning our regular customers.
- ▶ **High Product Reliability**
Decades of practical experience in high security zones of rail networks, electricity power stations, telecommunications networks, hospitals and industrial plants guarantee the highest reliability and quality.
- ▶ **Competence in Consulting and Support**
Starting from your inquiry until After-Sales-Service – YOU will be supported by our experienced engineers.
- ▶ **Competence in Technique**
In-house development in the fields of equipment and microprocessor technology, as well as our own printed-circuit design and our own software programming department, emphasise our continuously innovative activities.
- ▶ **Custom Designed Power Supplies**
Our special competence is to produce complete customized solutions to match YOUR specific requirements.
- ▶ **After-Sales**
We guarantee the supply of spare parts for 15 years and a worldwide service.

Static uninterruptible power supply is for many applications indispensable today. **DC power supplies** are a major part of the uninterruptible power supply.

Statistics show in Germany an average between two and four extended AC mains failures, and more than one hundred short interruptions in the range of milliseconds every year. An independent power supply is more and more important, as these failures are very harmful to critical load.

Safe DC power supplies consist of electronically controlled rectifiers and batteries. Under normal conditions the rectifier is feeding the load and simultaneous charging the battery in float charge. On mains failure the load is supplied by the battery without interruption.

Safe DC power supplies protect from:

- short-duration interruptions
- AC mains failure

In facilities of the telecommunications and in numerous systems of the automation and control technique the growing safety and reliability requirements can only be fulfilled by safe DC power supplies.

Sensitive users include:

- Telecommunication systems
- Railway signaling
- Traffic control installations
- Remote control facilities for electricity supply utilities
- Control equipment for power plants
- Process control equipment and automation in manufacturing plants
- Drives of power circuit breakers

The reliability and lifetime of the system is determined by the rectifier decisively. The rectifiers and operation mode must therefore be designed that all demands regarding battery charge and discharge are fulfilled.

**Our Rectifier-systems
protect your investments
and supply a save power
to your resources
at any time**

Rectifiers are delivered as turnkey systems.

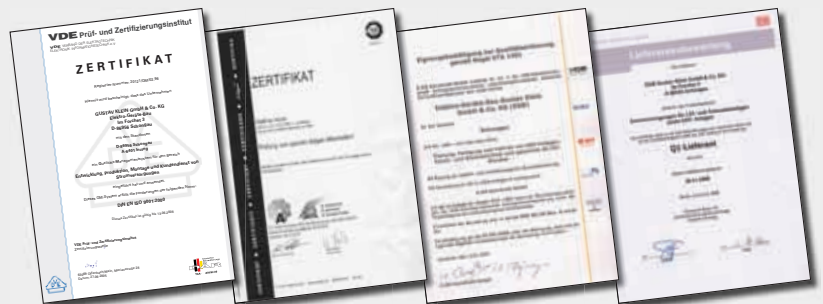
The company GUSTAV KLEIN manufactures rectifiers in thyristor- and, since 1996 in transistor technique (IGBT) with an output power of 2 kW – 500 kW
Output voltages:
24 V, 48 V, 60 V, 110 V, 220 V, 372 V, 700 V

By parallel connection of single devices system powers up to 2000 A can be delivered.

The rectifiers are divided in following main groups according to the required power and application:

- 1. Thyristor rectifier**
Type LGD-IU, L.Nr. 3812
- 2. Transistor rectifier (IGBT)**
Type LGDP-IU, L.Nr. 3864
- 3. Switch mode rectifiers**
Type WGS-U, L.Nr. 5701 and 5713
(see special leaflet)
- 4. Ferromagnetic rectifiers**
Type LGDM-IU, L.Nr. 3373
(see special brochure)

The use by telecommunications, railway, power plants, air traffic control, hospitals and industrial applications is itself evidence of the high quality and reliability of our power supplies.



Extensive certifications

Many years of experience, together with our extensive range of systems, guarantee that we have the comprehensive professional competence to find the technically and economically optimal solution for your problem in accordance with our motto:

**Your Partner
for all aspects of
power supply
equipment**

worldwide

Secure DC power supplies consist of rectifiers and batteries and are designed according to application.

Parallel standby operation

The rectifier must be dimensioned so that load is supplied and the battery is being charged out of the discharged condition simultaneously. At mains failure the battery takes over the load without interruption and any switching operation.

Buffer operation

To cover peak load a part of the energy can be drawn from the battery. This permits a reduction of the rated power of the rectifiers.

Depending on application and the customers requirements, either closed or valve regulated lead acid batteries may be used. For small rated powers, the batteries can be integrated into the rectifier cabinet. At greater powers the battery is housed in a separate cabinet or an open rack. For special applications NiCd batteries are also used.

3 different charging voltages are applied to charge lead acid batteries:

Float charging

For float charging, the battery is charged with 2,23 to 2,27 V/cell, depending upon the type of battery. The float charging voltage is kept below the gassing limit of the battery so that a water loss of the batteries is avoided most largely. The recharging time of discharged batteries is about 10-20 hours at this charging voltage.

Boost charging (fast charging)

Lead-acid batteries are given a boost charge with up to 2,4 V/cell. In contrast to float charging, a discharged battery can be recharged up to the required capacity within a much shorter time. Because of the loss of water, the boost charge should be used only after a longer mains failure and if the charging period should be limited.

Equalizing charge (Forming)

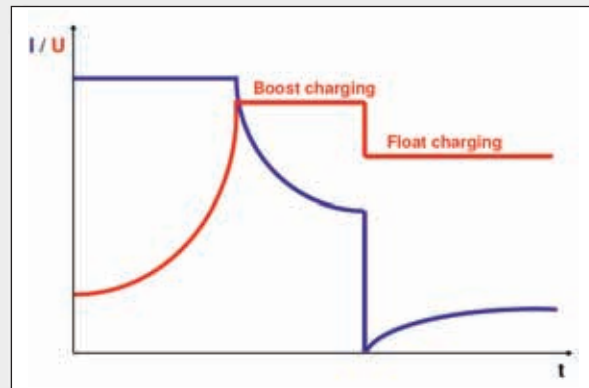
The battery can be charged at 2.65 V/cell before being put into service and as equalization charge. This procedure enables the battery to be safely given a full charge.

Corresponding values apply to NiCd batteries.

Charging characteristics

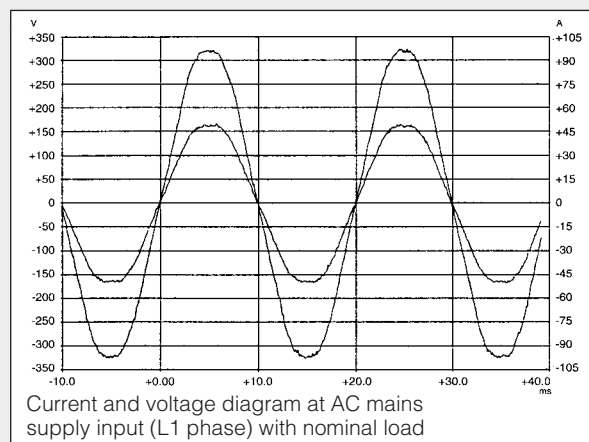
Batteries for DC power supplies are charged in accordance with IU characteristic of DIN 41772. Deeply discharged batteries are first charged with a constant current (I) and then with constant voltage (U) having maintained the fully charged condition.

An automatic charging characteristic control (voltage and/or time-dependent) can be provided (see options).



Special features of the transistor rectifier with IGBT:

- input current absolutely sinusoidal
- no current harmonics
- no reactive input power consumption ($\cos \varphi = 1$)
- input power factor $\lambda = 1$
- operation from standby generator without feedback and power restriction
- no inrush current by soft start
- energy recovery during capacity test
- Electrical isolation
- high dynamic regulation
- high efficiency



Applications

- Charging and direct feeding rectifier
- Energy recovery rectifier
- Net feeding for solar plants
- Peak load covering
- Controlled dc-resistor for battery test with energy recovery

Technical Data



Rectifier Type:		Thyristor LGD-IU, Cat.No. 3812	Transistor LGDP-IU, Cat.No. 3864
Rated Power	kW	2 – 500	
Rectifier Input			
Mains voltage*	V	400/230 ± 10%, 3~, N, PE	
Mains frequency*	Hz	50 or 60 ± 5%	
Rectifier Output			
DC voltage	V	24, 48, 60, 110, 220, 372, 700	60 – 1000
Setting range	% V _{nom}	100 – 200	
Rated current	A	20 – 2000	10 – 1000
Charging characteristics		IU according to DIN 41772 (switchable between 3 characteristics)	
Battery types		Closed or sealed lead-acid or NiCd-batteries	
Constant voltage	V/Cell	2,23 – 2,4 for lead-acid / 1,40 – 1,55 for NiCd-batteries	
Voltage tolerance	%	± 1	
Current limiting	%	can be set at 60 – 105 % of rated current	
Regulation error while current limiting	%	± 2 in voltage range 80 to 100%	
Voltage ripple without battery	% eff.	≤ 5	≤ 2
EMC		EN 62040-2	
Efficiency	%	up to 97 %	up to 96 %
Acoustic noise	dB (A)	50 – 70	
Common Data			
Permissible ambient temperature	°C	0 up to + 40	
Permissible climate		3K3 according to IEC 60721-3-3 (85% relatively humidity, none condensation)	
Permissible operating altitude		1000 m above m.s.l. with rated load	
Protection class*		IP 20 according to EN 60529	
Paint finish*		RAL 7035, structured finish	
Cooling		"AN" convection cooling	"AN" or "AF" forced cooling
Protection		Semiconductor fuse in rectifier unit output	
Transformer		Isolation transformer according to EN 61558	
Rectifier set		fully controlled bridge circuit with thyristor	PWM-Converter with IGBT (PFC)
Instrumentation		Voltmeter and ammeter at output	
Remote signaling		6 potential free contacts	
Indicators on mimic diagram		AC mains supply correct Rectifier operation / fault Battery charging / discharging	

* Other values on request

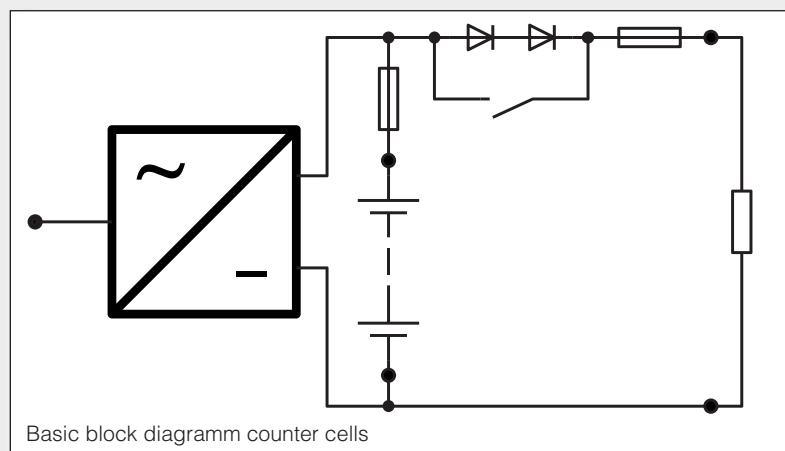
Equipped with

- Phase rotation monitor
- Phase interruption monitor
- Radio interference suppression
- Input contactor
- Isolating transformer
- Automatic softstart
- 3 charging voltages
- Manual control
- Rectifier output fuse
- Overvoltage monitoring latching
- Undervoltage monitoring (current-dependent)
- Floating alarm relay contacts



Options

- Microprocessor control (standard for LGDP-IU)
- Colored Touchscreen display (standard for LGDP-IU)
- 12 pulse rectifier bridge (thyristor rectifier)
- Output filter to reduce ripple
- Paralleling device
- Automatic charging
- Additional instruments
- Fault memory
- Deep discharge supervision
- Battery circuit monitoring
- Higher protection class
- Remote panel
- Special marking of cabinets
- Counter cells
- Cell switching by using main and additional rectifier
- ...



UPS systems	1-phase: 1 – 200 kVA 3-phase: 5 – 500 kVA System performance: – 2000 kVA
Inverter (24 – 1000 V DC, 16 2/3 Hz – 400 Hz)	1-phase: 1,0 – 200 kVA 3-phase: 3 – 500 kVA System performance: – 2000 kVA
Rectifier systems	Thyristor technology (24 – 700 V DC) 5 – 8000 A Switch mode technology (24 – 372 V DC) 5 – 4000 A Transistor technology (60 – 1000 V DC) 5 – 1000 A Ferrous magnetic technology (24 – 220 V DC) 5 – 800 A
DC-voltage converter (24 – 220 V)	System performance: 0,1 – 4 kW – 50 kW
Frequency converter	(16 2/3 Hz – 400 Hz) 1 – 500 kVA
High power test systems (up to 1000 V DC, up to 400 Hz)	5 – 400 kVA
Mains voltage regulator	1 – 1600 kVA
Customer specific systems	

Power supply solutions

Made in
Germany & Austria

Industrial applications
Power stations supply
Stationary railway supply
Frequency converters
Laboratory power supply
Battery simulation
Charge- and discharge units
Industrial UPS
Special UPS for hospitals



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