Operating instructions

Power Safety

Protect 8.31

UPS for industrial applications

Uninterruptible power supply
Protect 8.31 10 - 120 kVA

AEG Power Solutions GmbH, Warstein-Belecke
Department: **PS AE**
Name: **Timmer**
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PERFECT IN FORM AND FUNCTION AEG

AEG Power Solutions GmbH
Emil-Siepmann-Straße 32
59581 Warstein
Germany

☎ +49 2902 763 100
Fax: +49 2902 763 645
e-mail: service.aegpss@aeg.com
Internet: http://www.aegps.com

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1 About these instructions

This chapter describes the structure of the operating instructions. All of the symbols, typography and abbreviations that appear in them are described below.

Every care has been taken in drafting these operating instructions. However, should you notice any errors, please contact the manufacturer immediately.

To ensure that the operating instructions remain up to date, make sure you add any supplements you receive from AEG Power Solutions GmbH to them.

1.1 Target group for these operating instructions

These operating instructions are intended for:

- The operator of the equipment
- Skilled personnel responsible for start-up and operation as well as maintenance and repairs
- Personnel responsible for transporting the equipment to the installation site

1.2 Where to keep the operating instructions

Keep the operating instructions inside the pull-out document compartment. The pull-out document compartment is located on the inside of the left-hand door. The operating instructions must be stored together with the equipment.

Should the equipment change hands, include the operating instructions when handing it over to the new operator.

1.3 Liability and warranty

These operating instructions relate to the technical specifications of the equipment at the time of publication. The contents do not constitute a subject matter of the contract, but serve for information purposes only. Legal claims arising from this contractual relationship shall only be recognised by AEG Power Solutions GmbH subject to the terms agreed under the warranty obligation in the main contract.

Modifications

AEG Power Solutions GmbH reserves the right to make modifications with regard to the content and technical data in these operating instructions without prior notice. AEG Power Solutions GmbH cannot be held liable for any inaccuracies or inapplicable information in these operating instructions, as no obligation to continuously update the data and maintain their validity has been entered into.

The warranty shall be invalidated by:

- Failure to read and follow the operating instructions
- Failure to understand and comply with the safety regulations in these operating instructions
- Unintended use of the equipment
- Lack of the necessary skills and training on the part of the personnel selected to operate the equipment
- Modifications being made to the equipment without the approval of AEG Power Solutions GmbH
- The use of spare parts and replacement parts not approved by AEG Power Solutions GmbH
- Removing or tampering with protection devices
- Noncompliance with specifications when carrying out maintenance work
- Noncompliance with the maintenance schedule

Deliveries

Our goods and services are subject to the general conditions of supply for products of the electrical industry, and our general sales conditions.

Complaints

Claims in connection with supplied goods must be submitted within eight days of receipt, along with the packing slip. Any claims submitted after this point cannot be considered.

1.4 Typographical conventions

1.4.1 Instruction and warning symbols

This section describes the symbols used in the operating instructions.

Symbol	Meaning
	Hazard symbols are triangular and feature a yellow background, black border and corresponding symbol.
	Mandatory signs are round and have a blue background with a white symbol.
	Notes are identified by a red pin. They contain important information about the phases of the equipment's service life.
	Instructions relating to the environment are identified by a wheelie bin. Instructions relating to the environment make reference to mandatory requirements set out by regional or national authorities which are of particular relevance when disposing of materials used during operation, for example.

Table 1 - Instruction and warning symbols in these operating instructions

1.4.2 List of abbreviations

This section tells you about the abbreviations used in these operating instructions.

Abbreviation	Meaning
DOU	Display and operation unit
Equ	Equalising charging
BGV	Regulation set out by Employer's Liability Insurance Association (Germany)
CAN	Controller area network
CNF	Production order number
Tri	Trickle charging
SBS	Static bypass switch
BTD	Battery time of discharge parameter
REC	Rectifier
IEC	International Electrotechnical Commission
Sta	Start-up charging
Cha	Charging
EPS	Emergency power charging
PPE	Personal protective equipment
SNMP	Simple Network Management Protocol
UPS	Uninterruptible power supply
INV	Inverter

Table 2 - List of abbreviations

1.4.3 Typographical elements

This section describes the typographical elements used in these operating instructions.

Typographical element	Meaning
E=mc²	Passages of text which are of particular importance and mathematical formulae are highlighted in bold.
●	This symbol is used for bulleted lists.
➔	This symbol is used for action instructions.
1. **2.** **3.**	Action instructions which have to be followed in a specific sequence are numbered like this.
✓	This symbol is used to indicate the result of an action instruction.
Status messages	Status messages are shown in italics.
→	References to figures, chapters or tables are shown using the symbol on the left.
🖃	This symbol is used to identify postal addresses.
☎	Telephone numbers are shown using the symbol on the left.
©	This is the copyright symbol.

Table 3 - Typographical elements

2 Safety regulations

This chapter introduces you to all aspects relevant to safety. It describes all safety measures, safety devices and residual hazards associated with the equipment. Read it in full and carefully before commencing any work with or on the equipment.

2.1 Intended use

Protect 8.31 uninterruptible power supplies are used to safeguard a continuous power supply to critical electrical loads in the event of faults affecting the mains supply. The Protect series supports a power range from 12 kVA to 120 kVA.

Intended purpose

The equipment may only be used for the purpose of providing an uninterruptible power supply and subject to compliance with the prescribed connection values and setting values.

Any other use or modification is considered unintended. Unintended use can cause serious or fatal personal injury.

Unauthorised repairs, manipulations or changes made to the equipment and its safety devices without the manufacturer's approval are not permitted. The manufacturer cannot be held liable for damage resulting from such repairs, manipulations or changes.

Equipment safety

The equipment will operate reliably and safely subject to compliance with the operating instructions, the operating and equipment specifications and regulations set out by the Employer's Liability Insurance Association.

Residual hazards

When in operation, the equipment poses residual hazards which cannot be countered by design. To restrict such risks, follow the instructions in the section entitled "Residual hazards" (→ chapter 2.8).

Installation site

The equipment may only be installed in areas with restricted access. The ambient conditions must be dry and frost-free.

2.2 Symbols and signal words used

This section describes the symbols and warnings that are important for safety.

2.2.1 Warnings associated with operator actions in these operating instructions

Warnings associated with operator actions provide information about hazards associated with certain activities. To avoid personal injury and damage to property, ensure compliance with all warnings associated with operator actions. They are formulated as follows:

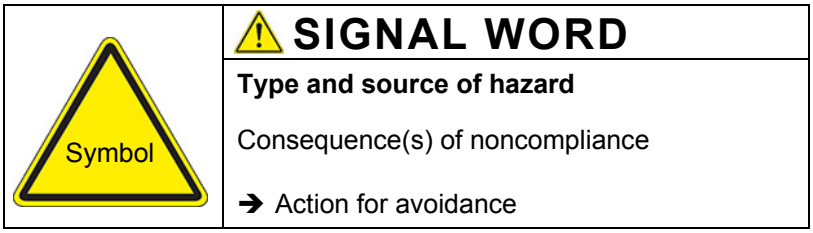


Figure 1 - Warning associated with operator action

2.2.2 Signal words used

The following signals words are used in warnings associated with operator actions.

DANGER	warns of a situation posing an **immediate** hazard which will lead to death or serious injury.
WARNING	warns of a situation posing a **possible** hazard which may lead to death or serious injury.
CAUTION	warns of a situation posing a **possible** hazard which may lead to minor injury.
ATTENTION	warns of **possible** damage to property which could interrupt operation.

2.2.3 Hazard symbols used

The following hazard symbols are used to illustrate hazards in warnings associated with operator actions.

Symbol	Meaning
	General hazard source
	Electrical hazard
	Risk of falling loads
	Flammable material
	Risk posed by corrosive vapours and liquids
	Risk posed by explosive material

Table 4 - Hazard symbols

2.2.4 Mandatory signs for personal protective equipment

The following mandatory signs relate to the use of personal protective equipment. You are required to comply with them.

Symbol	Meaning for transport personnel	Meaning for skilled personnel
		Wear goggles
		Wear a mask
	Wear a safety helmet	Wear an electrician's safety helmet
	Wear protective footwear	Wear insulated boots
		Wear insulating overalls
		Wear a face shield
		Wear insulating gloves with long sleeves
	Wear a hand shield	Wear insulating gloves

Table 5 - Mandatory signs for PPE

2.3 Safety signs and warning notices on the equipment

Safety signs and warning notices provide information about electrical hazards and residual hazards associated with working on and with the equipment. You must comply with them.

2.3.1 Position of safety signs and warning notices

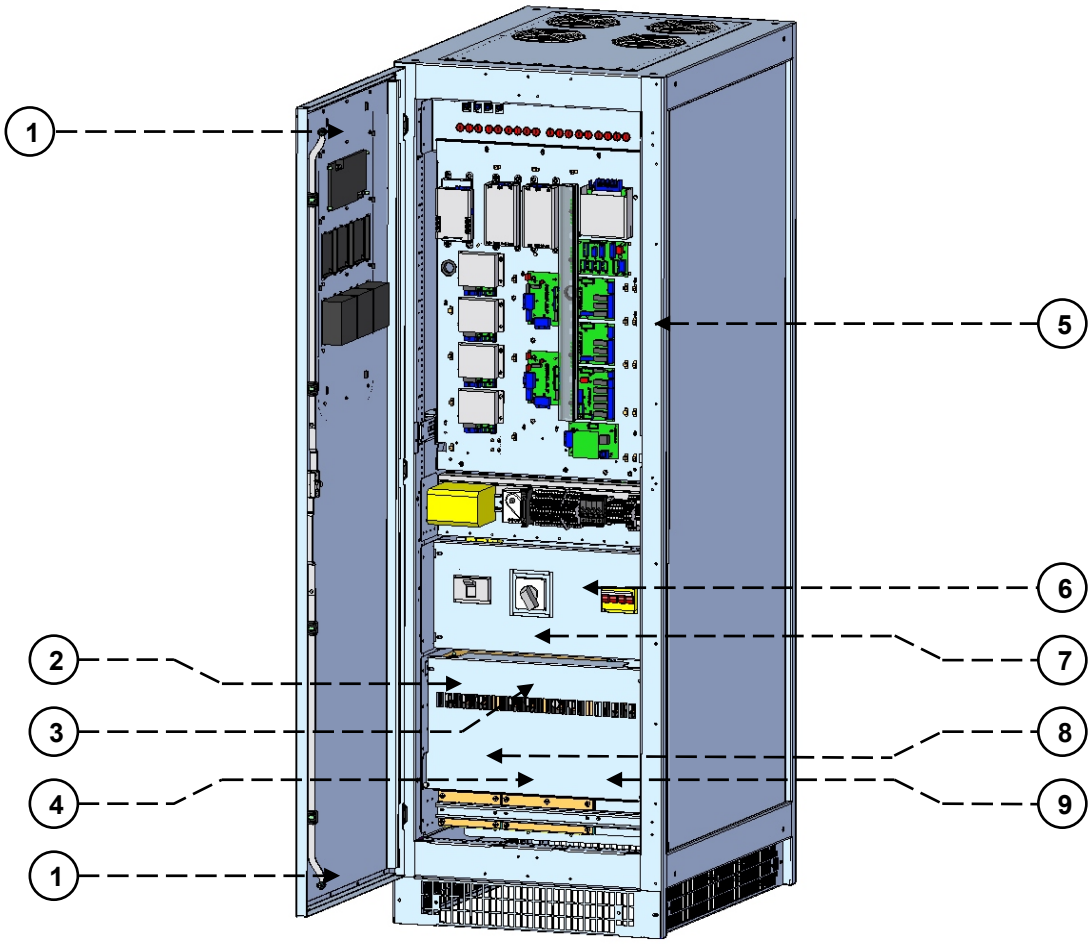


Figure 2 - Position of safety signs and warning notices

2.3.2 Description of safety signs and warning notices

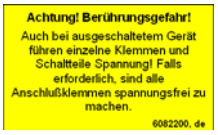
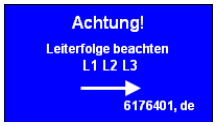
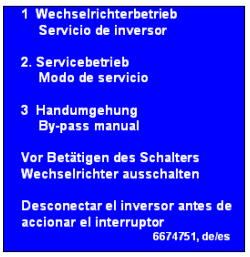
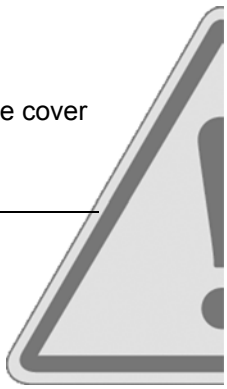
No.	Sign	Sign name	Exact position
1		Shock hazard	Inside of equipment door
2		Phase sequence	Behind protective cover
3		Voltage	Protective cover
4		Mains fuses required	Behind protective cover
5		Disconnect safely	Behind control unit pivot arm
6		Circuit breaker Q29	To the right of Q29
7		Leakage current	Underneath Q29
8		Back feeding protection	Protective cover
9		Neutral conductor	Protective cover

Table 6 - Safety signs and warning notices



2.4 Safety and protection devices for the equipment

This section describes all safety and protection devices. Safety and protection devices protect personnel against hazards which cannot be countered by inherently safe design.

Safety and protection devices must always be in perfect order.

2.4.1 Emergency switching device

The equipment is fitted with an emergency switching device. In the event of critical faults which put personnel and the equipment at risk, the acoustic signal generator sounds and the emergency switching device shuts down the equipment. Furthermore, fault indications appear on the display and operation unit and are forwarded to the control room.

The emergency switching unit can be triggered directly from the control room. This prevents power from being supplied to the load in any operating mode.

Faults must be dealt with as quickly as possible and remedied by skilled personnel.

Shutting down the equipment via the emergency switching unit does not disconnect all poles!

2.4.2 Protective covers

Protective covers are fastened over live parts of the equipment. The protective covers provide protection against accidental contact with live parts. Such protection may only be removed for start-up and for maintenance or repair work.

The covers must be replaced immediately on completion of such work and checked to ensure that they are in perfect working order.

2.4.3 Safety signs and warning notices on the equipment

Safety signs and warning notices are located in the vicinity of danger spots. They provide information about electrical hazards and residual hazards associated with working on and with the equipment.

Safety signs and warning notices must always be in perfect order and clearly legible. You must comply with safety signs and warning notices whenever you are working on or with the equipment.

2.4.4 Lockable equipment door

The equipment door is fitted with a switch cubicle lock to prevent access by unauthorised personnel. The equipment door must be locked at all times.

It may be opened for maintenance and repair work.

When the equipment door is open, the area leading up to it must be made secure.

The equipment door must be locked again once maintenance and repair work is complete.

2.4.5 Guard

The equipment housing acts as a guard, providing protection against unauthorised contact with live parts and electromagnetic beams.

It may be removed for maintenance and repair work.

The area around the equipment must be made secure when the guard is removed.

The guard must be replaced on completion of maintenance and repair work and checked to ensure that it is in perfect working order.

2.5 Obligations on the part of the owner of the equipment

The safety of personnel and the safety, function and availability of the equipment depend upon compliance with the safety instructions. Compliance with the safety instructions is required at all times.

Safety of personnel

- ➔ Personnel must be selected on the basis of skills and training (→ chapter 2.6).
- ➔ Personnel must be made aware of the need for compliance with specifications (→ chapter 2.6).
- ➔ Skilled personnel and transport personnel must be provided with personal protective equipment and taught how to use it.
- ➔ Skilled personnel must receive regular briefings about all safety measures and a record kept of such briefings.
- ➔ Skilled personnel must be made aware of where fire extinguishers are located and how to use them.

Safety of the equipment

- ➔ The equipment must only be operated in perfect working order and in accordance with good electrical engineering practice. If the equipment starts to behave differently, check for faults immediately.
- ➔ All safety signs and warning notices on the equipment must be kept in a complete and clearly legible condition (→ Table 6 - Safety signs and warning notices).
- ➔ Connect the emergency switching unit with the control room via remote signalling.
- ➔ Install a suitable and easily accessible means of back feeding protection (a disconnector) in the fixed cabling.
- ➔ Attach warning notice no. 8 to the external upstream disconnectors for the primary power supply (→ Table 6 - Safety signs and warning notices).
- ➔ Install fire extinguishers in the immediate vicinity of the equipment.
- ➔ Protect the equipment against external influences such as moisture, shavings, and similar.
- ➔ Maintain access to the equipment at all times.

2.6 Requirements of personnel

Skills and training

Only trained and qualified skilled personnel may perform the work described, using tools, equipment and test equipment intended for the purpose and in perfect working order.

Skilled personnel are electricians who, on account of their specialist training, knowledge and experience, along with their knowledge of applicable regulations, are able to assess the work assigned to them and can detect potential hazards.

The transport and storage of the equipment may be assigned to transport personnel. Transport personnel are personnel working specifically in the area of transport who can exhibit the necessary training and knowledge.

Compliance with the safety instructions described is essential for the protection of personnel and the equipment. Skilled personnel and transport personnel must be aware of and follow these safety instructions.

Obligations on the part of skilled personnel

Observe the following safety instructions.

➔ Work on and in electrical equipment is governed by strict rules in order to avoid electrical accidents. The rules are summarised in the five rules of safety. Ensure compliance with the five rules of safety:

1. Disconnect safely
2. Secure the unit against being switched back on
3. Verify that all poles are de-energised
4. Earth and short-circuit the equipment
5. Provide protection in the form of covers or barriers for any neighbouring live parts

➔ Once work is complete, reverse the five safety rules starting at number 5 and working back to number 1.

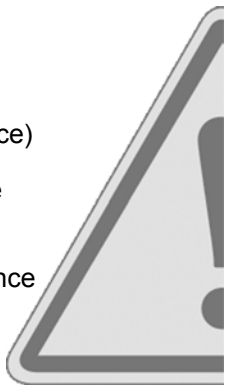
➔ Read the operating instructions. Commit the safety regulations to memory (→ chapter 2).

➔ Ensure compliance with the following regulations:

- BGV A1 (Prevention principles)
- BGV A3 (Electrical systems and equipment)
- BGV A8 (Safety and health protection warnings in the workplace)

➔ Report damage to the equipment and electrical installations to the owner.

➔ Only use spare parts approved by the manufacturer for maintenance and repair work.



➔ Use personal protective equipment (PPA) as intended.

➔ Check that PPE is in perfect order and report any defects you notice to the owner.

➔ Wear a hair net if you have long hair. Do not wear loose clothing or jewellery.

➔ Reinstate protection devices (including covers) on completion of all work on or with the equipment.

➔ Keep the operating instructions in the pull-out document compartment.

Obligations on the part of transport personnel

Observe the following safety instructions during transport.

➔ Read the operating instructions. Commit the safety regulations to memory (→ chapter 2).

➔ Ensure compliance with the following regulations:

- BGV D8 (Hoists, lifting gear and traction gear)
- BGV D27 (Industrial trucks)

➔ Use personal protective equipment (PPA) as intended.

➔ Check that PPE is in perfect order and report any defects you notice to the owner.

➔ Report transport damage to the equipment to the owner.

2.6.1 Safe disconnection of the equipment

This section describes the safe disconnection of the equipment at all poles. In emergencies, hazardous situations and before certain maintenance and repair work is carried out, the equipment must be disconnected safely at all poles.

➔ Disconnect all poles of the equipment safely:

1. Inform the control room: disconnect load power supply
2. Shut down the inverter
3. Open the battery isolator
4. Remove the power supply fuses
5. Disconnect the monitoring equipment cables
6. Check the connection terminals of the equipment and the PE conductors for hazardous voltage

✓ All poles of the equipment are safely disconnected from the power supply.

2.7 Hazardous materials and substances

This section describes the hazardous materials and substances used.

Batteries are toxic

Dangerous gases are released when battery cells are opened. Battery gases are corrosive. Battery electrolyte is extremely toxic and causes serious chemical burns. Noncompliance can lead to death or serious injuries. Follow the safety instructions below.

➔ Ensure that battery spaces are ventilated sufficiently.

➔ Only use batteries that are in perfect working order.

➔ Follow the safety instructions issued by the battery manufacturer.

Batteries are electrical energy sources

Anyone who touches battery contacts is at risk of electric shock. Batteries have a high short-circuit current. Noncompliance with safety instructions can lead to death or serious injuries. When working with batteries, ensure compliance with the following safety instructions.

➔ Remove watches, rings and other metal objects.

➔ Wear rubber gloves and rubber boots.

➔ Use tools with insulated handles.

➔ Never touch batteries with tools or metal parts.

➔ Ensure safe disconnection of the equipment before connecting and disconnecting batteries.

➔ Remove accidental battery earths.

2.8 Residual hazards

This section describes residual hazards. Despite the measures taken to ensure safety and protection, the equipment poses residual hazards which cannot be countered by design.

Observe warnings at all times whilst you are working.

2.8.1 Electrical hazards

DANGER

Contact with voltage!

Risk to life due to electric shock

➔ Use dry insulating material to remove the victim from the live parts.

➔ Seek medical assistance and inform the control room.

➔ Disconnect the equipment safely.

DANGER

Electric shock despite emergency switching device!

Parts of the equipment remain live after the emergency switching device has been activated.

Risk to life due to electric shock

➔ Disconnect the equipment safely.

DANGER

Electric shock caused by inverter!

Parts of the equipment remain live after the inverter has been shut down.

Risk to life due to electric shock

➔ Disconnect the equipment safely.

DANGER

Electric shock caused by back feeding protection!

Once the incoming power supply has been interrupted, the input terminals of the equipment may remain live due to load errors.

Risk to life due to electric shock

➔ Disconnect the equipment safely.

➔ Install back feeding protection (a disconnector) in the load circuit.

DANGER

Electric shock caused by residual voltage!

Batteries conduct a residual voltage following disconnection.

Risk to life due to electric shock

➔ Check the battery poles for hazardous voltages.

➔ Cover the battery poles.

➔ Follow the safety instructions issued by the battery manufacturer.

DANGER

Electric shock caused by leakage currents!

The capacitors generate high leakage currents in the equipment. Conductive parts may be live in the event of connection errors.

Risk to life due to electric shock

➔ Establish a PE conductor connection prior to start-up.

Using residual-current-operated circuit breakers alone is not permitted (→ chapter 2.3, warning notice 7).

ATTENTION

Faults caused by the SBS circuit

An unconnected SBS circuit can cause the equipment to operate asynchronously.

Malfunctions

➔ Connect the neutral conductor terminal X4 to the frame earth.

This warning notice does not apply if the equipment is connected to an IT system (→ chapter 2.3, warning notice 9).

2.8.2 Hazards due to explosions

WARNING

Risk of explosion caused by the use of water to fight fires!

Using water to fight fires can lead to explosions.

Risk to life due to explosions

➔ Use class D fire extinguishers (metal powder/D powder, dry sand, dry salt/ cattle salt, dry cement or cast-iron shavings).

CAUTION

Risk of explosion after prolonged operation!

There is a risk of the electrolytic capacitors failing after 10 years of operation.

Risk of injury due to explosive noise level

Malfunctions

➔ Replace the electrolytic capacitors once they have been in operation for 10 years.

2.8.3 Risks posed by corrosive fluids

⚠ CAUTION

Chemical burns caused by battery electrolyte

Eye or skin contact with battery electrolyte can cause blindness and serious injuries.

➔ In the event of **skin contact**:

1. Rinse the affected area in plenty of water
2. Bandage the affected area with gauze
3. Throw away all clothing affected by the spillage

➔ In the event of **eye contact**, rinse the eyes with an eye wash or plenty of running water.

➔ In the event of **swallowing**:

- Drink as much water or milk as you can
- Try not to vomit

2.8.4 Risks due to loss of control

⚠ ATTENTION

Failure of remote signalling

If remote signalling fails or the signal lines are interrupted, the control room can no longer control the equipment.

Malfunctions

The emergency switching device fails.

➔ Disconnect the equipment safely.

⚠ ATTENTION

Failure of the display and operation unit

If the display and operation unit fails, the skilled personnel will no longer be able to control the equipment.

Malfunctions

➔ Inform the control room.

3 Scope of delivery

Check that the following components are delivered with the equipment:

- Operating instructions
- Brief instructions
- Technical data
- Key for the control cabinet

Optional

Dependent upon the equipment configuration, the following components may or may not be included in the scope of delivery:

- Safety instructions from the battery manufacturer
- Communication interface cable

Available to order

AEG Service can also provide the following documents:

- Spare parts list
- Service book

To place an order, please contact:

AEG Power Solutions GmbH
Emil-Siepmann-Straße 32
59581 Warstein

Germany

☎ +49 2902 763 100
Fax: +49 2902 763 645
e-mail: service.aegpss@aeg.com
Internet: http://www.aegps.com

4 Nameplate

The following information appears on the nameplate:

- Type of equipment
- Equipment power rating
- Nominal values
- Efficiency
- Year of construction
- CNF number
- Unit number

Figure 3 - Nameplate

The nameplate is attached to the inside of the left-hand equipment door.

5 Description of the equipment

This chapter describes the equipment. Gaining a better understanding of the relationship between components will enable you to use the equipment more intelligently, avoid errors and increase your understanding of safety.

If you understand how the equipment works, you can carry out maintenance and repairs more efficiently. You will be able to locate the sources of errors more quickly and reduce downtimes. Last but by no means least, you will feel more comfortable with the technology.

Read this chapter carefully to gain a better understanding of the equipment.

5.1 Performance features of the equipment

Characteristics

The UPS equipment developed by AEG Power Solutions GmbH has been protecting oil and gas infrastructures, electricity plants and other industrial installations for more than 60 years.

Protect 8.31 is the new comprehensive generation of our Protect product range: a true online double-conversion UPS classified as VFI SS 111 in accordance with IEC 62040-3.

Protect 8.31 has been developed with a modular building block architecture for maximum flexibility where adaptation to specific customer requirements is concerned.

As the customer, you define:

- The required mechanical degree of protection
- The input and output voltages
- The individual battery type/the available time
- The scope of documentation and the language
- The components of the equipment

Microcontrollers have been used exclusively for the equipment's control electronics. The primary components of the equipment are distributed in modular assemblies.

Special features

The equipment sets itself apart from the market with the following special features:

- Maximum electrical and mechanical resistance
- Modular design to meet the requirements of individual customers
- High reliability thanks to redundant control
- High efficiency even at low output power
- Compatibility with all types of battery
- Incredibly short lead times
- Full digital control
- First-class communication platform

The equipment is fully compatible with the DC systems and telecommunication systems offered by AEG Power Solutions GmbH.

Optional components

The equipment can be customised to meet specific requirements with the following components.

- Remote signalling
- Explosion-proof battery disconnector housing
- Bypass switch for maintenance work
- Bypass transformer
- Voltage stabiliser
- AC distribution boards
- Battery housing
- Monitoring equipment

For additional information material, please contact AEG Power Solutions GmbH.

5.2 Structure of the equipment

This section describes the parts of the equipment which are relevant for skilled personnel.

5.2.1 Position of parts that are relevant to users

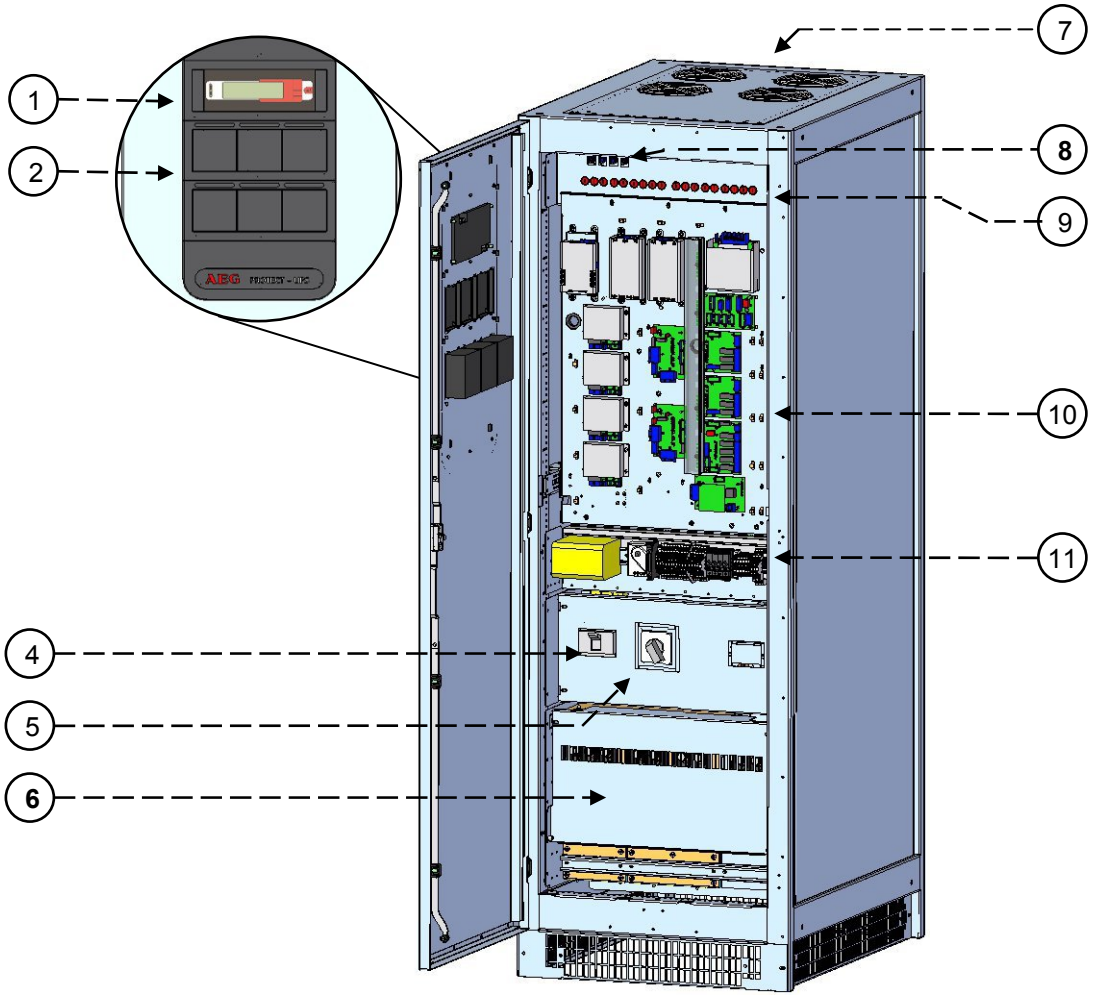


Figure 4 - Position of parts that are relevant to users

5.2.2 Description of parts that are relevant to users

No.	Part relevant to user
1	Display and operation unit (DOU for short; signalling and visualisation of data plus system control and parameterisation → chapter 0)
2	Display instruments (placeholder for additional display instruments for optional components)
4	Load interrupter switch Q1 (connects the rectifier to the input circuit)
5	Manual bypass switch Q29 (switches the load to the SBS circuit without interrupting the power supply; optional component which can also be located outside the system)
6	Connection terminals (terminals for input circuit, SBS circuit, battery circuit and load circuit)
7	Fan (dissipates the exhaust air from the equipment)
8	Fan terminals (for the fan power supply)
9	Internal fuses (fuses for control unit and fans)
10	Control unit pivot arm (space for optional monitoring equipment)
11	Terminal strip X12 (connects the equipment to the control room via remote signalling; can be used to connect other optional components)
	Acoustic signal generator (sounds in the event of critical faults; not visible)
	Battery isolator (disconnects the battery supply from the equipment; located externally)

Table 7 - Description of parts that are relevant to users

5.3 Modular structure

The most important modular components of the equipment are:

- The rectifier
- The inverter
- The static bypass switch (SBS)

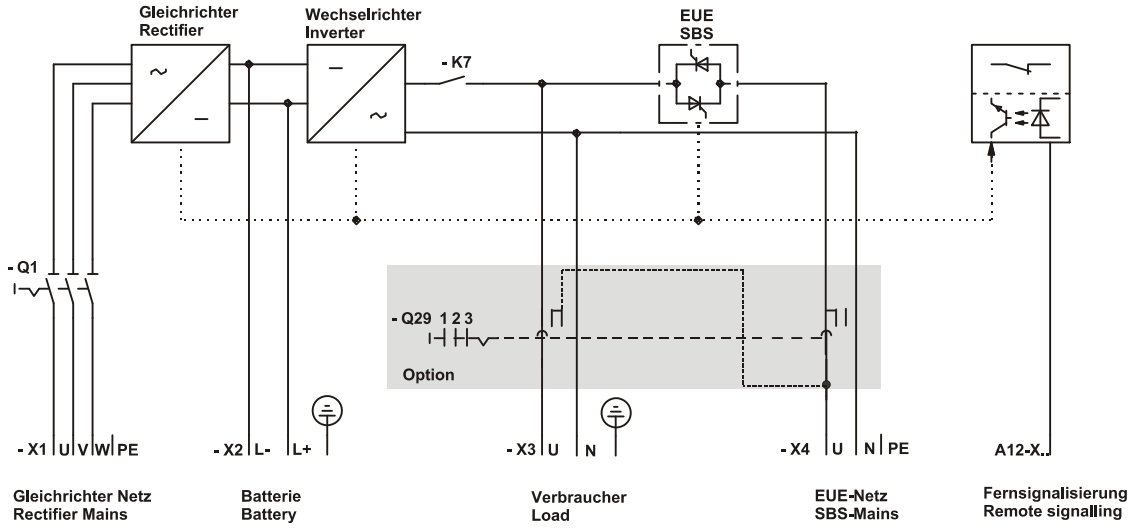


Figure 5 - Connection terminals

Gleichrichter	Rectifier
Wechselrichter	Inverter
Gleichrichter Netz	Rectifier circuit
Batterie	Battery
Verbraucher	Load
EUE-Netz	SBS circuit
Fernisignalisierung	Remote signalling

The **rectifier** converts the 3-phase AC voltage from the mains into a DC voltage internally. The DC voltage supplies power to the inverter and the batteries.

The **inverter** converts the DC voltage from the rectifier into a 1-phase AC voltage. In the event of mains faults, e.g. a power failure, the load is switched over to battery power supply without interruption.

The **static bypass switch** further increases supply reliability. In the event of faults affecting the inverter, the load is switched to power supply from the SBS circuit without interruption.

5.4 Arrangement of the assemblies

The assemblies are logically integrated into and linked with the equipment's overall system. Internal communication takes place via a CAN bus. The parameters of the assemblies can be adapted using the equipment software.

Rectifier with

- Thyristor stack and control unit
- Transformer
- Smoothing device for the batteries
- Interference suppression devices

Static bypass switch (SBS) with

- Thyristor stack and control unit
- Interference suppression devices

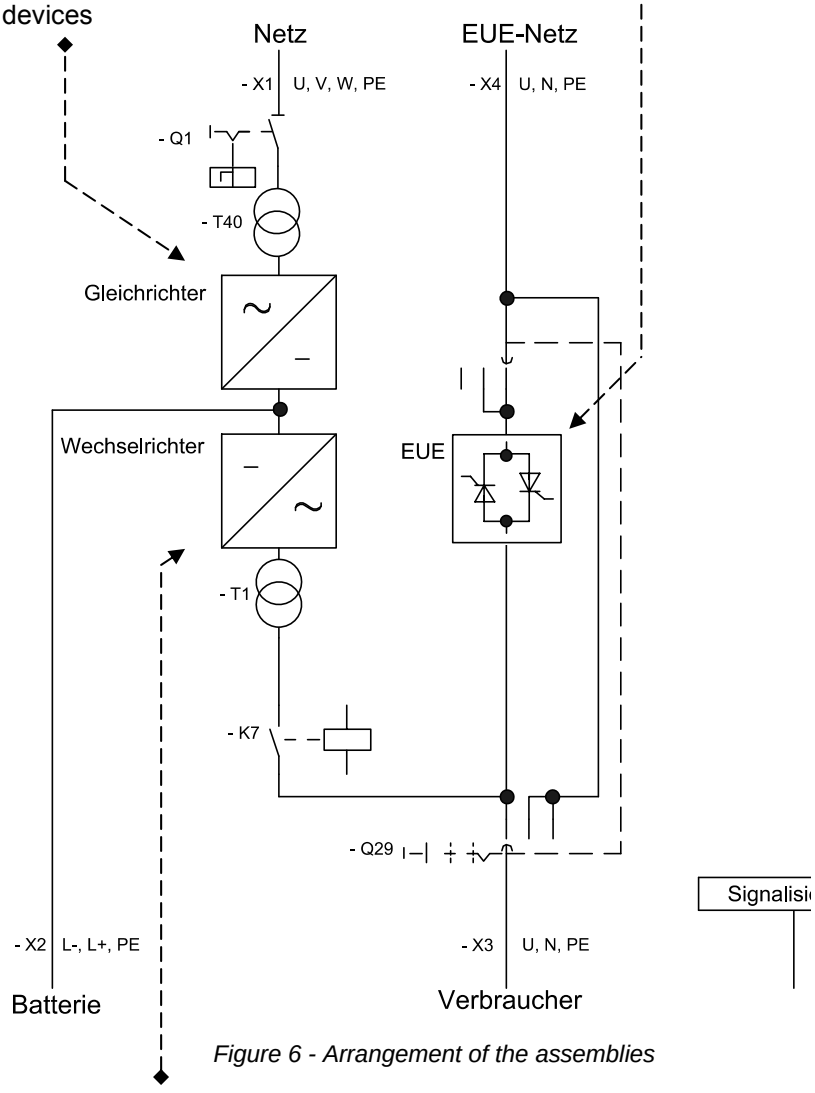


Figure 6 - Arrangement of the assemblies

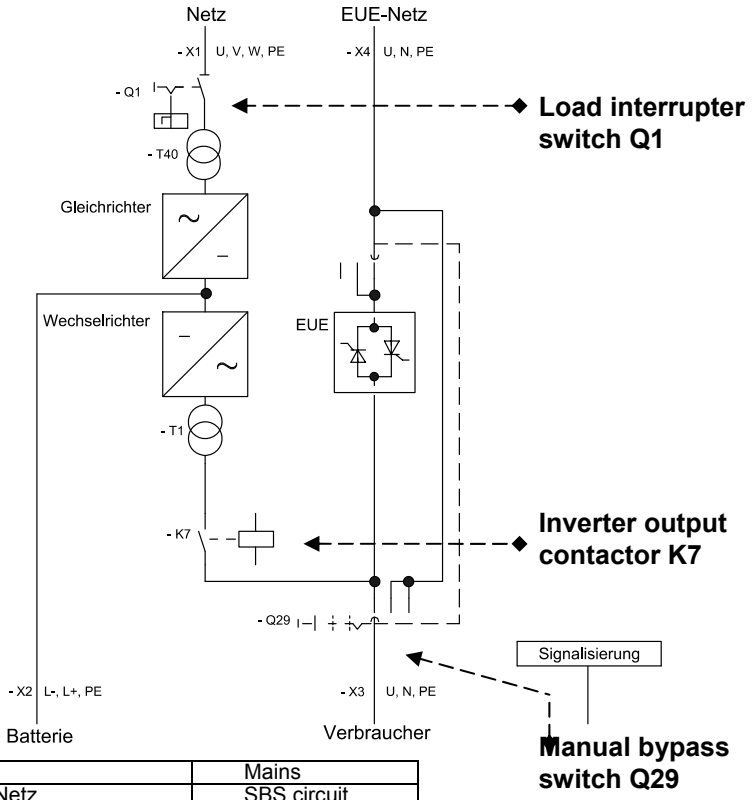
Inverter with

- Inverter stack and control unit
- Interference suppression devices

Netz	Mains
EUE-Netz	SBS circuit
Gleichrichter	Rectifier
Wechselrichter	Inverter
Signalisierung	Signalling
Verbraucher	Load
Batterie	Battery

5.5 Signalling switch

Load interrupter switch Q1 and circuit breaker Q29 are used for manual control of the assemblies.



Netz	Mains
EUE-Netz	SBS circuit
Gleichrichter	Rectifier
Wechselrichter	Inverter
Signalisierung	Signalling
Verbraucher	Load
Batterie	Battery

Figure 7 - Circuit breaker

5.5.1 Load interrupter switch Q1

The load interrupter switch Q1 connects the rectifier to the mains supply.

When the load interrupter switch Q1 is closed (ON position), voltage is supplied to the rectifier. The rectifier charges the batteries and supplies DC voltage to the inverter.

Opening the load interrupter switch Q1 (OFF position) shuts down the rectifier. The batteries are no longer charged and the inverter is no longer supplied with DC voltage.

A fault in the mains supply, e.g. a short circuit, triggers the open-circuit shunt release of the load interrupter switch Q1. The connection between the rectifier and the mains supply is interrupted.

The inverter can be disconnected for maintenance and repair purposes by opening the load interrupter switch Q1 and the battery isolator.

5.5.2 Manual bypass switch Q29

The manual bypass switch Q29 is used to change over between three of the four operating modes. The operating mode is selected by setting the position of the manual bypass switch Q29 accordingly.

The manual bypass switch Q29 is usually located outside the equipment. It can be installed directly in the equipment if required.

Switch position	Name of the switch position	Operating mode
1	Inverter operation	Operation with mains supply available (normal operation)
2	Service mode	Operation with a defective inverter
3	Manual bypass	Operation with manual bypass

Table 8 - Q29 switch positions

When an operating mode is selected, the manual bypass switch Q29 does not take the current status of the assemblies into account. The assemblies must be activated or deactivated manually first.

Switch position 1

The equipment is delivered with the switch set to position 1. This operating mode corresponds to normal operation: power (mains voltage) is supplied to the load via the rectifier and the inverter (→ chapter 0).

Switch position 2

Switch position 2 switches the equipment to "Operation with a defective inverter" operating mode. Power is supplied to the load from the SBS circuit via the static bypass switch (→ chapter 5.7.3).

Before selecting switch position 2, the inverter must be deactivated and the static bypass switch activated.

Switch position 3

Setting the switch to position 3 selects "Operation with manual bypass" operating mode. This mode, which is used primarily for maintenance and repair work, supplies power to the load directly via the SBS circuit (→ chapter 5.7.4).

Before selecting switch position 3, the inverter must be deactivated.

The power supply to the load is not interrupted when the operating modes are changed using the manual bypass switch Q29.

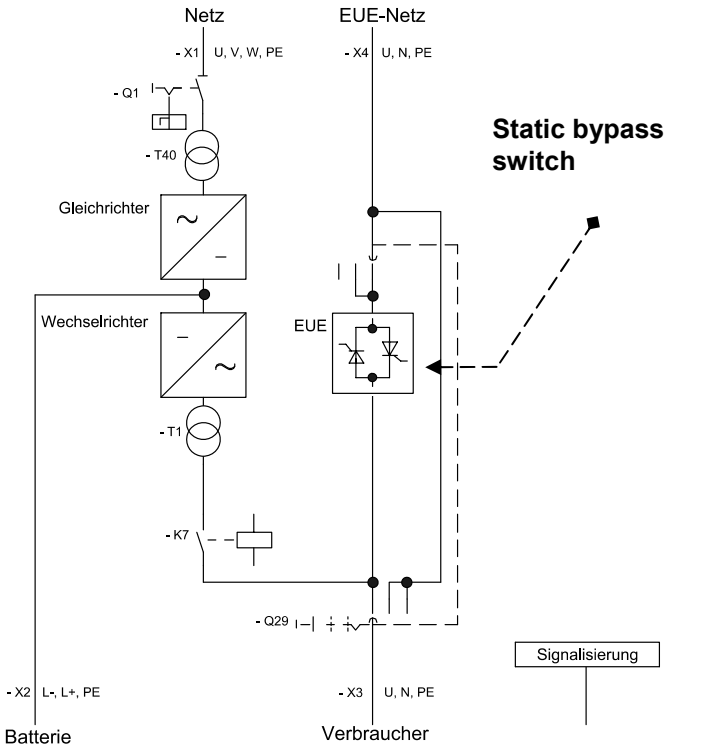
5.5.3 Inverter output contactor K7

The inverter output contactor K7 switches the output voltage of the inverter to the load.

The inverter output contactor K7 adopts its working position as soon as it is actuated, and the output voltage of the inverter is switched to the load.

5.6 How the static bypass switch works

The **static bypass switch** (SBS) further increases supply reliability. In the event of faults affecting the inverter, the load is switched to power supply from the SBS circuit without interruption.



Netz	Mains
EUE-Netz	SBS circu
Gleichrichter	Rectifier
Wechselrichter	Inverter
Signalisierung	Signallin
Verbraucher	Load
Batterie	Battery

Figure 8 - Static bypass switch

The SBS comprises a thyristor contactor and a control unit.

Control unit

The SBS control unit monitors the voltages of the SBS circuit and the load circuit as well as the output voltage of the inverter. It also ensures permanent synchronisation of the output voltages of the inverter and of the SBS circuit.

In the event of an overload or a fault affecting the inverter, the load is switched to power supply from the SBS circuit without interruption. The SBS circuit must be within the tolerance range for operation via the SBS in order for this to happen. The equipment works in "Operation with a defective inverter" operating mode.

Thyristor contactor

In "Operation with a defective inverter" operating mode, power is supplied to the load via the SBS thyristor contactor (→ chapter 5.7.3).

Failure

If the SBS circuit goes out of tolerance, "Operation with a defective inverter" operating mode is blocked.

If the inverter fails also, power can no longer be supplied to the load. The SBS and the inverter must be deactivated and activated manually in order to restore power to the load.

The SBS can be activated and deactivated with circuit breaker Q28 (→ external document: circuit diagram).

The inverter can be deactivated by opening the circuit breaker Q1 and the battery isolator and reactivated in reverse order.

Phase deviation

If the two AC voltages are not synchronised, the message "Phase deviation" is displayed on the display and operation unit.

If the inverter fails during a "phase deviation", e.g. due to a fault in the inverter, the load with a voltage gap is supplied with power by the SBS circuit.

Voltage gap

Supply with a voltage gap can be blocked from within the equipment software for particularly sensitive loads which would otherwise always be damaged by a voltage gap.

As soon as the output voltage of the inverter is within the tolerance range for normal operation, the load is switched back to power supply from the inverter without interruption.

5.7 Equipment operating modes

The equipment can be operated in four modes:

- Operation with mains supply available (normal operation)
- Operation with defective mains supply
- Operation with a defective Inverter
- Operation with manual bypass

5.7.1 Operation with mains supply available (normal operation)

During operation with mains supply available (normal operation), the rectifier and inverter supply mains voltage to the load.

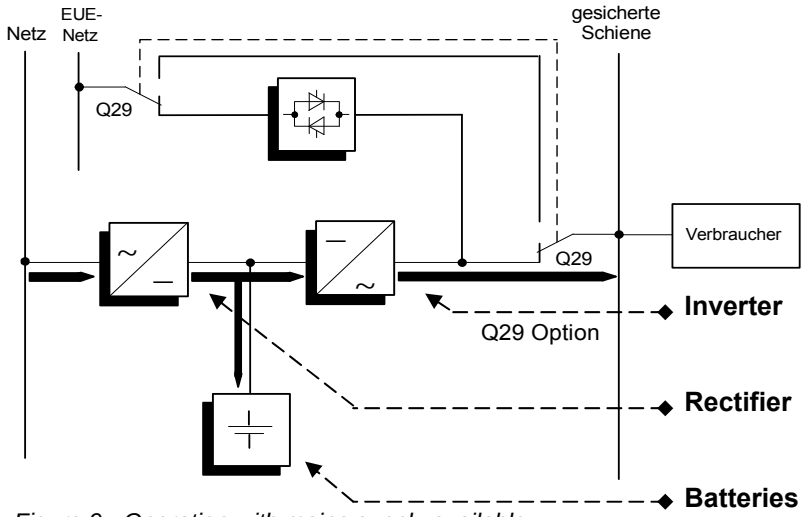


Figure 9 - Operation with mains supply available

Netz	Mains
EUE-Netz	SBS circuit
Nezt	Mains
Gesicherte Schiene	Protected busbar
Q29 option	Q29 option
Verbraucher	Load

The **rectifier** is powered from the mains and converts the AC voltage statically into a stabilised DC voltage. The DC voltage is used to charge the **batteries**. This ensures that the batteries are always fully charged. The **inverter** converts the DC voltage into an AC voltage and supplies power to the connected load.

Batteries

Once the batteries are fully charged, their charge is maintained automatically via trickle charging: the charging current and voltage are continuously adapted to the current battery charge. This ensures maximum battery life at maximum capacity.

5.7.2 Operation with defective mains supply

If the mains supply is defective, the load is supplied with power by the batteries via the inverter.

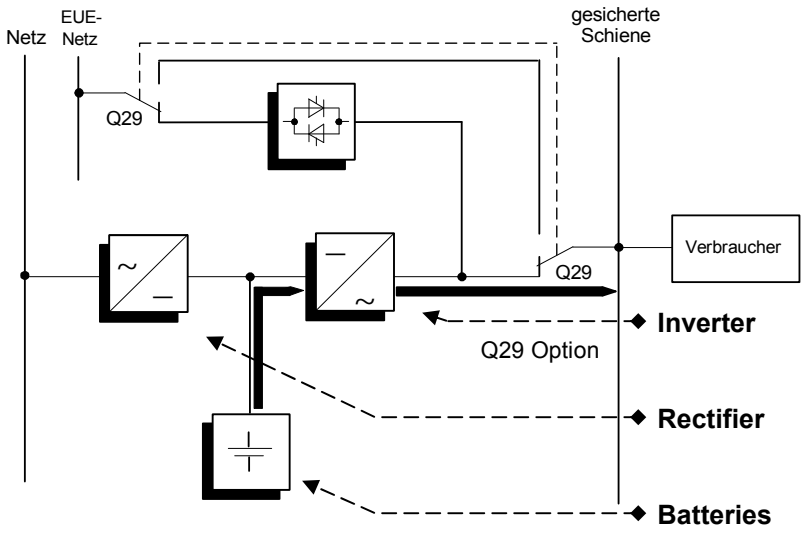


Figure 10 - Operation with defective mains supply

EUE-Netz	SBS circuit
Nezt	Mains
Gesicherte Schiene	Protected busbar
Q29 option	Q29 option
Verbraucher	Load

In the event of faults in the mains supply or if the mains supply fails, the voltage supplied to the **rectifier** will not be sufficient. The rectifier shuts down. In both cases the load is switched to power supply from the **batteries** via the **inverter** without interruption. As long as the battery voltage is in the permissible range, the batteries will supply power to the load.

Rectifier

The rectifier starts up when the voltage and frequency of the mains supply are restored to permissible values. The inverter and the batteries are supplied with power by the rectifier again.

The amount of time for which the batteries are able to supply power depends upon the battery capacity and the power consumption of the load.

5.7.3 Operation with a defective Inverter

In the event of a fault in the inverter, the load is supplied with power by the SBS circuit.

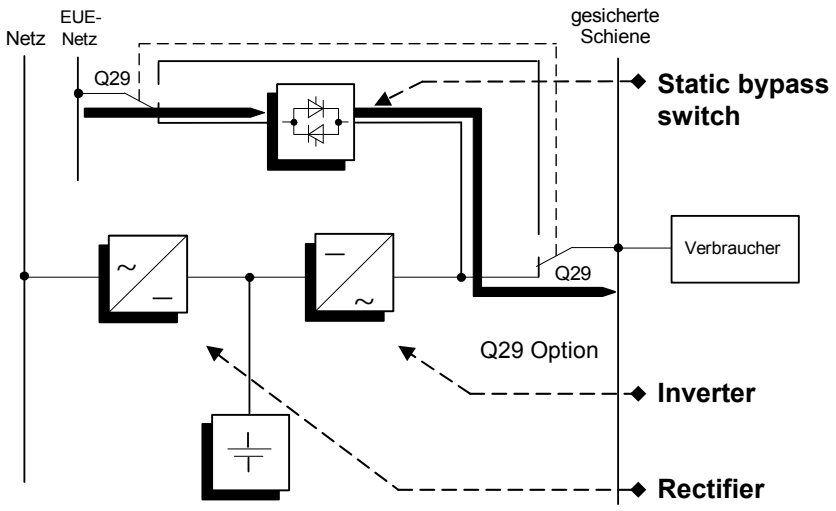


Figure 11 - Operation with a defective inverter

EUE-Netz	SBS circuit
Nezt	Mains
Gesicherte Schiene	Protected busbar
Q29 option	Q29 option
Verbraucher	Load

If the **inverter** is faulty, e.g. due to a malfunction, the rectifier and the inverter shut down. The **static bypass switch** switches the load to the SBS circuit without interruption. Power is supplied to the load from the SBS circuit via the static bypass switch.

Synchronisation unit

The synchronisation unit in the static bypass switch ensures that the phase and frequency of the SBS circuit are permanently synchronised with the last known voltage of the inverter.

Inverter

Once the inverter returns to the permissible values tolerance range, the inverter can be restored as the source of the load power supply.

If the SBS circuit fails in this operating mode, the load power supply will collapse.

5.7.4 Operation with manual bypass

The assemblies can be bypassed during active operation so that maintenance and repair work can be carried out.

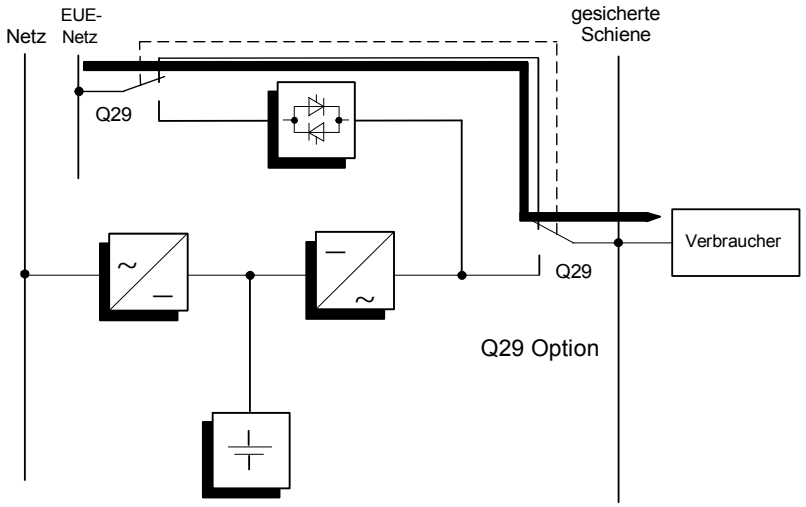


Figure 12 - Operation with manual bypass

EUE-Netz	SBS circuit
Nezt	Mains
Gesicherte Schiene	Protected busbar
Q29 option	Q29 option
Verbraucher	Load

Should maintenance and repair work be required, operation with manual bypass can be activated with the manual bypass switch Q29. The load is supplied with power directly by the SBS circuit. Maintenance and repair work on the assemblies can then be carried out in active operation.

The manual bypass switch Q29 may only be actuated when the inverter is switched off.

If the SBS circuit fails in this operating mode, the load power supply will collapse.

5.8 Batteries

The equipment offers numerous connection options for external components. The batteries are an essential external component and thus a permanent feature of the equipment.

Charging procedure

The batteries are charged in accordance with a CVCC curve to DIN 41772. Battery charging is electronically controlled and monitored. Faults during the charging procedure are detected automatically and charging is interrupted as a result. These measures ensure that the batteries are fully charged as quickly as possible and provide protection against overcharging and other faults.

Battery care

In normal operation, once the batteries are fully charged, their charge is maintained automatically via trickle charging. The charging current and voltage are continuously adapted to the current battery charge. This ensures maximum battery life at maximum capacity.

Rectifier

The rectifier is responsible for battery care and charging. The operating mode of the inverter is selected in order to ensure optimum charging of every battery type. The ideal operating mode is selected via the display and operation unit (DOU). The DOU also provides a means of transferring the battery parameters to the rectifier (→ chapter 8.3).

Rectifier operating modes

The rectifier works in the following operating modes:

Charging: the battery is charged with a constant charging current. When the charging voltage is reached, this value is kept constant with a tolerance of ± 1%. At the same time, the charging current drops. Once the calculated charging time has elapsed, switchover to trickle charging takes place.

Trickle charging: Trickle charging follows charging. It compensates automatic battery discharge, ensuring that the batteries are kept fully charged.

Equalising charging: Equalising charging takes place in accordance with a CVCC curve. The characteristic curve values correspond to the charge values. The charging voltage can be adjusted separately from other characteristic curves. Switching back to trickle charging occurs automatically after 8 hours.

Start-up charging: Equalising charging takes place in accordance with a CVCC curve. The charging current and the charging voltage can be adjusted separately from other characteristic curves. Switching back to trickle charging occurs automatically after 8 hours.

Battery test

The battery tests for the equipment offer a variety of ways to test the function of the batteries. The yellow LED on the DOU flashes to indicate that a battery test is in progress.

Battery tests are started via the DOU. They can be aborted at any time by pressing the function keys. Status messages and measured values relating to battery tests are indicated on the LCD.

The parameters for the battery tests (min. battery voltage, discharge time, discharge current and final discharge voltage) can be changed in the "Service" menu on the DOU.

Before a battery test commences, the date and time of the last battery test are indicated on the DOU LCD. **During** a battery test, the:

- Battery voltage
- Battery current
- Battery test duration
- Battery capacity drawn

are displayed. **After** a battery test, the:

- Battery voltage
- Battery current
- Battery test duration
- Battery capacity drawn at the end of the test

are displayed.

The battery tests are described in detail below.

Some battery tests are optional and thus cannot be run for all items of equipment.

Battery charging circuit test: this battery test checks the batteries by running a current analysis whilst constantly reducing the DC voltage. Line interruptions or defective fuses in the battery circuit are also detected. The test takes just 1 second to complete.

The battery charging circuit test runs automatically at weekly intervals.

Capacity check: this battery test checks the batteries by drawing a constant current. The DC voltage is reduced until the batteries give off the set discharge current. The discharge current must be less than the inverter load. The capacity check aborts the battery test as soon as the inverter load is too small.

The capacity check is terminated as soon as the final discharge voltage or the max. discharge time is reached. Switching back to normal operation occurs automatically once the battery test is complete. The batteries are charged.

Capacity test: this battery test checks the availability of the batteries. It uses the currently connected inverter load for this purpose. The battery test represents operation with defective mains supply; in other words, it simulates the failure of the rectifier (→ chapter 5.7.2).

The DC voltage of the rectifier is reduced. The battery voltage should at this point compensate the reduced DC voltage and supply the full current for the inverter. If the capacity test causes the batteries to fail, the inverter is automatically restored to power supply from the rectifier.

The capacity test is terminated as soon as the final discharge voltage or the max. discharge time is reached. Switching back to normal operation occurs automatically once the battery test is complete. The batteries are charged.

5.9 Interfaces

The equipment supports a variety of communication options. The interfaces are part of the communication system. They provide options for connecting to external components such as IT systems, control rooms, etc.

5.9.1 Remote signalling

Remote signalling is an optional monitoring mechanism via which the equipment is connected to a control room. It can be retrofitted with the expansion boards listed in the table below.

Expansion board	Designation	Characteristics	Connection to terminal strip
A12	Master board		X12
A13	Expansion board 1	Programmable	X12
A14	Expansion board 2	Programmable	X12

Table 9 - Expansion boards for remote signalling

Remote signalling offers additional inputs and outputs for establishing connections with external components.

Inputs

The inputs are connected via optocouplers:

- Inverter remote switch-off

Outputs

The outputs are connected via relay contacts:

- Inverter operation
- Mains operation
- Rectifier fault (REC or REC circuit fault)
- Battery undervoltage
- Collective fault (REC, INV, SBS or battery fault)
- SBS blocked
- Fan fault
- Rectifier circuit failure

The maximum current carrying capacity of the relay contacts is $U_{\sim}$ = 250 V/$I_{\sim}$ = 8 A.

5.9.2 Serial interfaces

Two potential-free serial interfaces are provided for the purpose of connecting the equipment to external IT systems.

Protocol

Both interfaces use the AEG protocol CBSER to communicate with their environment. The second interface is multiprotocol-capable. A licence can be purchased to facilitate operation with additional protocols. A selection of the available protocols can be obtained on request from the manufacturer of this UPS equipment.

The AEG protocol CBSER can be obtained as a detailed protocol description on request.

Expansion board

The serial interfaces take the form of a retrofittable A30 expansion board. The expansion board is designated "Modem UPS". It is retrofitted to the control unit pivot arm (→ chapter 5.10).

5.10 Control unit pivot arm

The control unit pivot arm (→ chapter 5.2 accommodates the monitoring equipment. The monitoring equipment is retrofitted to the control unit pivot arm. The control and signal lines are routed through the cable duct in the centre of the unit.

The figure below illustrates the control unit pivot arm with all monitoring equipment mounted.

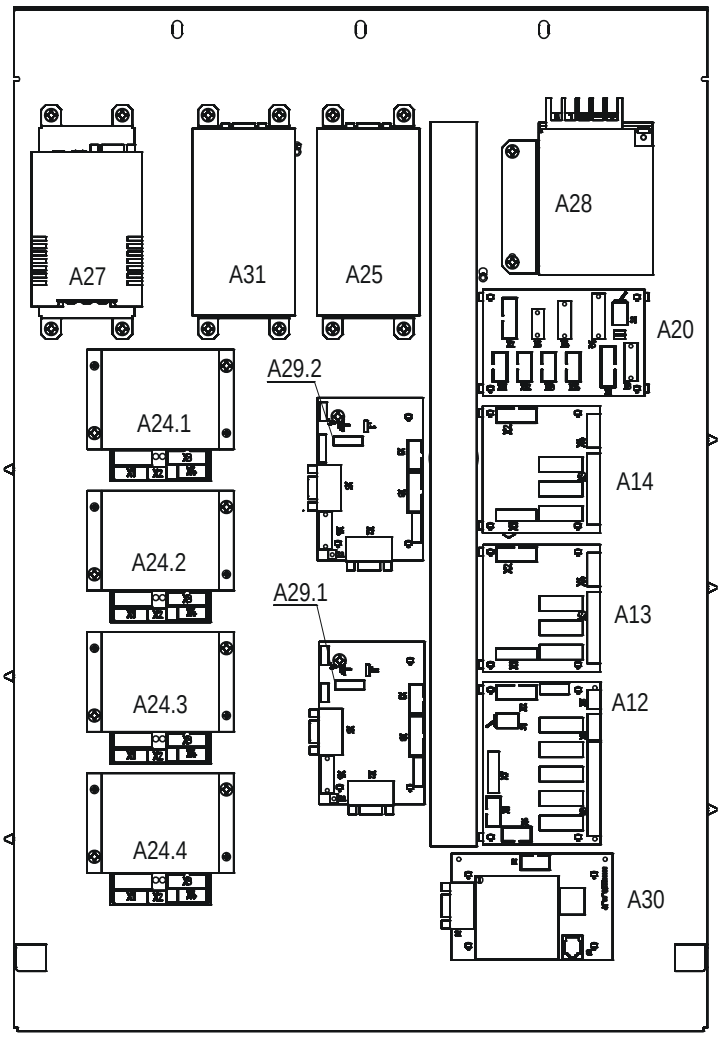


Figure 13 - Control unit pivot arm

A separate technical data sheet describes all monitoring equipment retrofitted to the equipment.

5.10.1 Available monitoring equipment

All currently available monitoring equipment is listed in the table below.

Slot	Designation
A12	Remote signalling master board
A13	Remote signalling expansion board 1
A14	Remote signalling expansion board 2
A20	Parallel operation adapter
A23	Power supply U~ = 24 V
A24.n	BLÜ-PRO battery charging circuit monitoring system
A25	SNMP adapter (RFC1628)
A27	
A28	Power supply
A29.n	
A30	Modem UPS
A31	

Table 10 - Available monitoring equipment

6 Transport

This chapter describes the safety measures during transport, transport personnel and equipment transport.

6.1 Safety during transport

6.1.1 Safety instructions

⚠ WARNING

Risk of accident due to suspended loads!

Possibility of death or very serious injury.

➔ Never stand under suspended loads.

➔ Make sure that nobody stands under suspended loads.

➔ Secure the danger zone.

⚠ WARNING

Risk of accident due to equipment tilting or turning on edges!

Possibility of death or very serious injury.

➔ Be aware of the equipment's centre of gravity.

➔ Never tilt the equipment or turn it on its edges.

⚠ WARNING

Risk of accident due to transport with industrial trucks!

Possibility of death or very serious injury.

➔ Use a crane to transport the equipment.

➔ Only use industrial trucks if it is not possible to use a crane.

6.1.2 Personal protective equipment

Use the following personal protective equipment to avoid injury:

Wear a safety helmet

Wear protective footwear

Wear a hand shield

Check that personal protective equipment is in perfect order and report any defects you notice to the owner.

6.2 Requirements of personnel

Transport personnel are permitted to transport the equipment.

Transport personnel are defined as personnel who have the necessary skills, training and knowledge in the field of transport.

6.3 Transporting the equipment

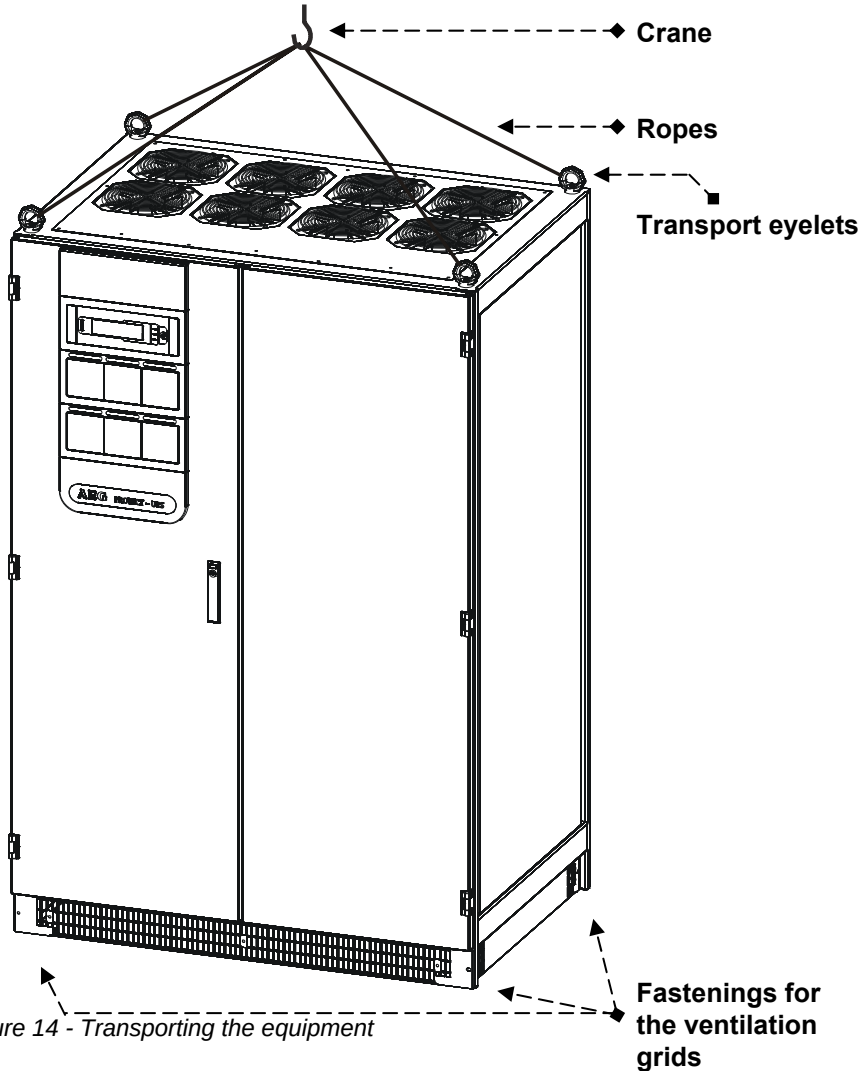


Figure 14 - Transporting the equipment

6.3.1 Selecting a means of transport

Please note the following before commencing transport:

- Use a crane to transport the equipment if possible
- Only use industrial trucks if the ambient conditions mean that it is not possible to use a crane

The equipment can easily tilt or turn on its edges when transported using industrial trucks.

6.3.2 Using a crane to transport the equipment

Preparations

Please note the following before transport:

- Only use ropes which allow an angle of at least 45° between rope and cabinet roof.
- Do not exceed the permissible load-bearing capacity of each rope. The load-bearing capacity must be dimensioned as follows:

  Load-bearing capacity per rope ≥ 0.5 x total weight of equipment

  The total weight of the equipment is specified in the technical data sheet.
- Do not exceed the permissible weight that can be carried by the crane. The total weight of the equipment is specified in the technical data sheet.

Transporting the equipment

➔ To transport the equipment:

1. Screw the transport eyelets into the threaded bores provided on the top of the cabinet.
2. Attach the ropes to the transport eyelets and to the crane.
3. Check that the transport eyelets and ropes are fastened tight.
4. Unscrew the equipment from the pallet.
5. Lift the equipment, move it to the installation site and set it down.
6. Check that the equipment is stable.
7. Remove the ropes and transport eyelets.

✓ Transport of the equipment is now complete.

6.3.3 Using industrial trucks to transport the equipment

Preparations

Please note the following before transport:

- Do not exceed the permissible weight that can be carried by the industrial truck. The total weight of the equipment is specified in the technical data sheet.
- Be aware of the equipment's centre of gravity. The centre of gravity is indicated on the transport packaging.
- Use industrial trucks with lifting arms which are long enough and wide enough.

Transporting the equipment

➔ To transport the equipment:

1. Remove the ventilation grids.
2. Unscrew the equipment from the pallet.
3. Insert the lifting arms between the pallet and the equipment.
4. Lift the equipment, move it to the installation site and set it down.
5. Check that the equipment is stable.
6. Replace the ventilation grids.

✓ Transport of the equipment is now complete.

6.4 Packaging

The packaging protects the equipment during transport by road and rail.

A pallet is screwed to the underside of the equipment. It makes transport easier and protects the equipment whilst on the move.

The housing is protected by corner and edge mouldings. It is wrapped in stretch plastic film. The film provides protection against damage caused by leaks, dust and rain.

Removing the packaging

Proceed as follows:

- Do not remove the moulded parts and stretch plastic film until immediately before start-up. (This is to avoid unnecessary damage to the equipment.)
- Remove any condensation that may have occurred inside and outside the equipment. Condensation is caused by variations in pressure and temperature between where the equipment was manufactured and where it is installed.

Condensation can be volatilised by storing the equipment at the installation site for 48 hours.

- If you intend to store the equipment for this purpose, remove the stretch plastic film and the pallet first.

The stretch plastic film and the moulded parts made from polyethylene foam are chemically inactive and can be disposed of with normal industrial waste or recycled.

7 Installation and start-up

This chapter describes the safety measures for installation and start-up, the requirements to be met by personnel and the installation and start-up procedures.

7.1 Safety during installation and start-up

7.1.1 Safety instructions

⚠ DANGER

Contact with voltage!

Risk to life due to electric shock

➔ Disconnect the equipment safely.

➔ Check that the supply lines are de-energised.

⚠ DANGER

Electric shock caused by leakage currents!

The capacitors generate high leakage currents in the equipment. Conductive parts may be live in the event of connection errors.

Risk to life due to electric shock

➔ Establish a PE conductor connection prior to start-up.

Using residual-current-operated circuit breakers alone is not permitted (→ chapter 2.3, warning notice 7).

⚠ WARNING

Risk of accident due to insufficiently qualified personnel!

Possibility of death or very serious injury.

➔ Work on the equipment may only be carried out by skilled personnel.

ATTENTION

Equipment failure

The equipment may fail if its waste heat is not dissipated.

Malfunctions

➔ Ensure that a sufficiently dimensioned means of dissipating exhaust air from the equipment is provided.

ATTENTION

Equipment failure

If the polarity of the supply lines is reversed, the equipment will fail during start-up.

Malfunctions

➔ Ensure the correct polarity when connecting the supply lines.

7.1.2 Personal protective equipment

Wear the following personal protective equipment to avoid injury:

Wear a safety helmet

Wear protective footwear

Wear a hand shield

Check that personal protective equipment is in perfect order and report any defects you notice to the owner.

7.2 Requirements of personnel

Installation and start-up may only be carried out by skilled personnel.

Skilled personnel are electricians who, on account of their specialist training, knowledge and experience, along with their knowledge of applicable regulations, are able to assess the work assigned to them and can detect potential hazards.

7.3 Installing the equipment

This section describes the mechanical installation of the equipment.

7.3.1 Tightening torques

Note the following tightening torques for all screw connections and clamping screws.

Thread	Tightening torque (mm)
M4	1.2
M5	2.0
M6	3.0
M8	6.0
M10	10.0
M12	15.5
M16	30.0
M20	52.0
M24	80.0

Table 11 - Tightening torques

The tightening torques for floor mounting must be checked where the floor is subject to dynamic force.

7.3.2 Equipment installation site

The equipment installation site must meet certain criteria in order to ensure a long service life and reliable operation. Proceed as follows.

Fire protection requirements

If the equipment is installed in rooms with flammable floors (e.g. textile, wood or PVC) or in computer centres, a floor plate must be fitted between it and the floor.

Ambient conditions

The environment in which the equipment is installed:

- Must be free from conductive dust
- Must be free from acid vapours
- Must have a maximum room temperature of 35°C

Space requirements

The equipment is suitable for installation in confined spaces. The dimensions of the installation site must facilitate unrestricted operation, maintenance and repairs.

The following minimum dimensions must be met:

- At least 1000 mm in front of the unit to ensure an escape route
- 400 mm above the unit so that air can be vented

The waste heat from the equipment must be dissipated in all operating modes.

Floor

The equipment may be installed on the following types of floor:

- On double floors
- Above cable ducts
- On level surfaces

The weight of the equipment must not exceed the maximum floor bearing capacity.

Observe the bending radius of the supply lines. The cable clamp rail is located 185 mm above the floor. With one bend:
bending radius = 10 x diameter of supply line

7.3.3 Attaching the equipment to the floor

Preparations

The equipment is attached to the floor with four fixing bolts. There are four holes in its base frame for the bolts.

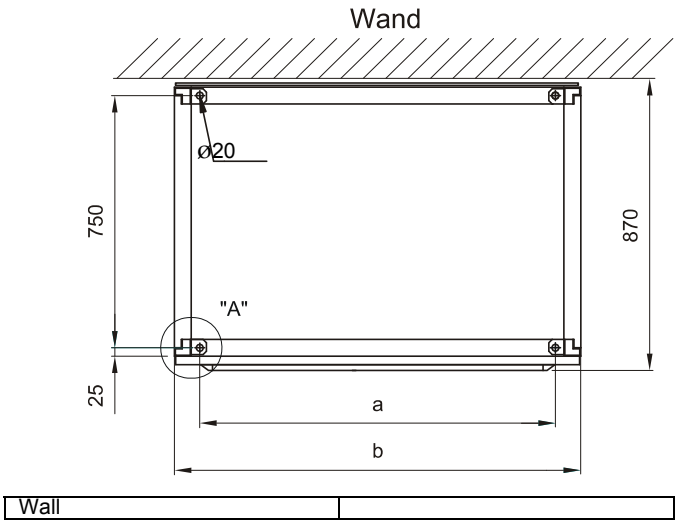


Figure 15 - Floor attachment

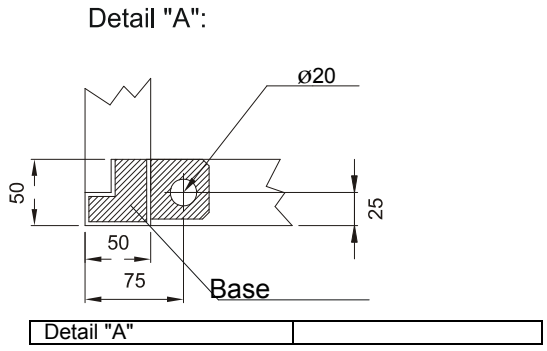


Figure 16 - Floor attachment in detail

The hole spacings are determined by the power rating of the equipment. Please refer to the following table.

Power (kVA)	a (mm)	b (mm)
10	450	600
20	750	900
30/40	750	900
60	1050	1200
80	1350	1500
100/120	1650	1800

Table 12 - Floor attachment

Attaching the equipment to the floor

➔ To attach the equipment to the floor:

1. Check that the floor is even.
2. Use metal wedges to compensate for any unevenness.
3. Select hole spacings in accordance with Table 12 - Floor attachment.
4. Mark hole spacings on the floor.
5. Drill holes for fixing bolts.
6. Align floor plate with holes.
7. Position equipment on floor plate.
8. Align equipment vertically.
9. Screw fixing bolts into holes.

✓ The equipment is now attached to the floor.

7.4 Wiring the equipment

This section describes how the input circuit, SBS circuit, battery circuit and load circuit are connected, as well as the lines for remote signalling.

The circuit diagram illustrates the basic structure of the equipment and shows the connection terminal assignments. Table 13 - Connection terminals lists the assignments between mains and connection terminals.

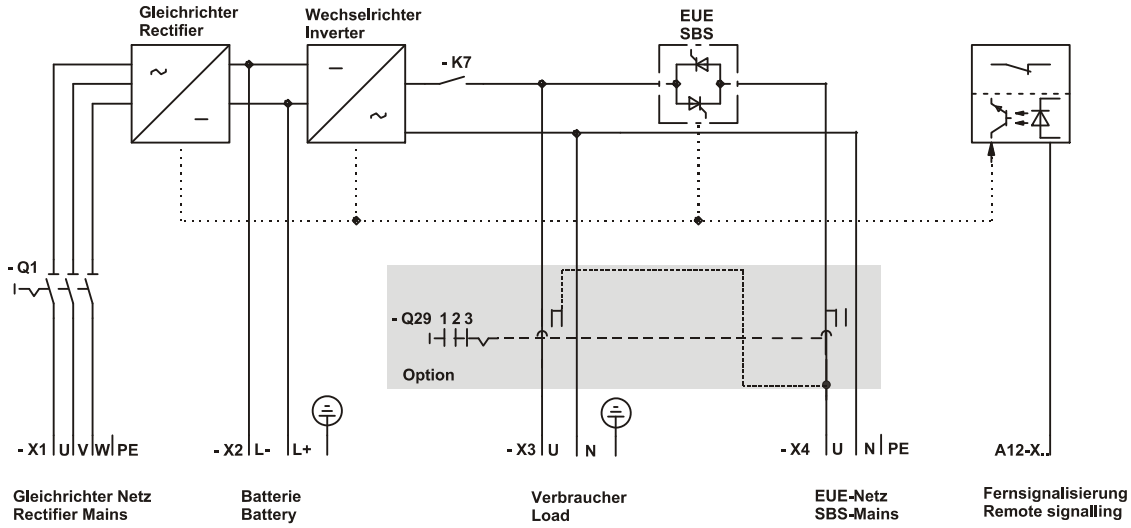


Figure 17 - Connection terminals

Gleichrichter	Rectifier
Wechselrichter	Inverter
Gleichrichter Netz	Rectifier circuit
Batterie	Battery
Verbraucher	Load
EUE-Netz	SBS circuit
Fernisignalisierung	Remote signalling

Connection terminal	Mains	Note
X1	Input circuit	Rectifier circuit
X2	Battery circuit	
X3	Load circuit	
X4	SBS circuit	
X12	Remote signalling	Implemented as terminal strip

Table 13 - Connection terminals

7.4.1 Using overvoltage protection

The equipment is dimensioned for connection to an AC mains, overvoltage category II. If it is to be exposed to higher transient overvoltages, additional protective measures will need to be put in place.

Use a suitable means of external overvoltage protection.

7.4.2 Connecting supply lines

Preparations

Proceed as follows when **installing disconnection devices**:

- In the case of connection to a TN system (normal circumstances) the disconnection devices **must not** interrupt the neutral conductor.
- In the case of connection to an IT system the disconnection devices **must** interrupt the neutral conductor.

Proceed as follows when **tightening clamping screws**:

- Grip the supply line firmly with your left hand
- Tighten the clamping screw with your right hand

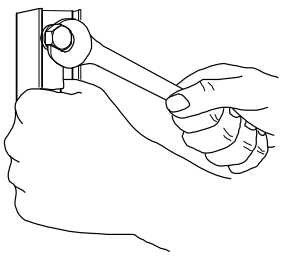


Figure 18 - Clamping screw

This avoids deformation of the supporting rail and protects the base of the connection terminal against torsional forces.

Connecting supply lines

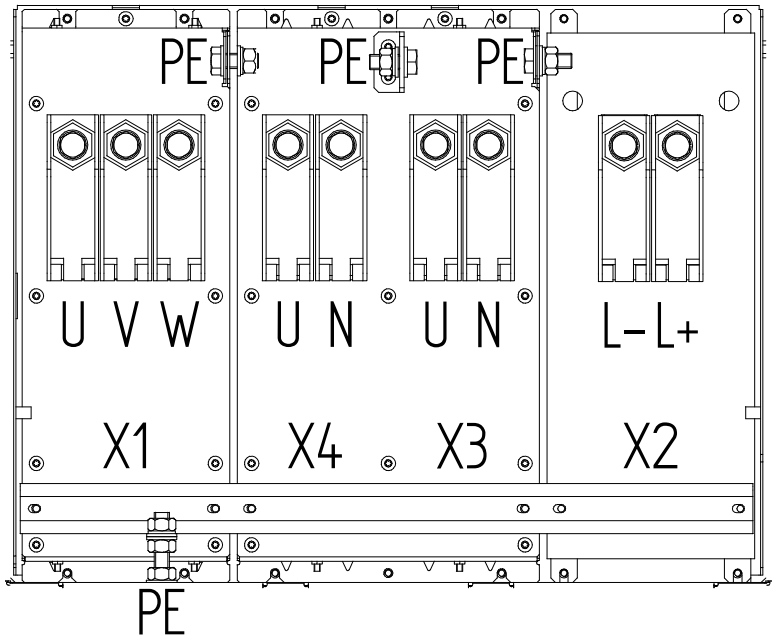


Figure 19 - Connection panel

➔ To connect the supply lines:

1. Remove the protective cover from the connection panel.
2. Insert the supply lines into the equipment from below or behind.

   Supply lines inserted from above must first be routed down next to the equipment.

   Lay a PE conductor to VDE 0100 T540, Table 6.

3. Connect the PE conductor to the PE conductor terminals.

   Also possible as an **option**: Connect the PE conductor to the equipment's earth bar.

4. Use cable lugs to connect the supply lines to the connection terminals.

   The input circuit (X1) and the SBS circuit (X4) can be supplied with power from the same source or from two separate sources.

5. Connect the shield of the battery line to the PE conductor connection.

You only need to do this if you are using a shielded battery line. Shielding the battery line improves the equipment's EMC.

6. Attach the supply lines and PE conductor to the cable clamp rail.
7. Check the polarity of the supply lines.
8. Remove unused cable, tools, etc. from the equipment.
9. Replace the protective cover on the connection panel.

✓ The supply lines are now connected.

7.4.3 Connecting remote signalling

Preparations

Proceed as follows when connecting control and signal lines:

- Remote signalling is fail-safe:
  - In the event of a fault, A12-X3 switches to the two lower numbered connection terminals
  - In the event of a fault, A12-X4 switches to the two higher numbered connection terminals
- A12-X5 has a maximum input voltage of 24 V AC/DC

Connecting remote signalling

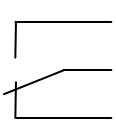
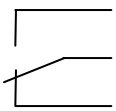
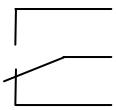
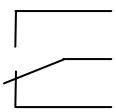
Assign-ment	A12-X3	X12	Meaning
	1	19	Inverter operation
	2	20	
	3	21	
	4	22	Mains operation
	5	23	
	6	24	
	7	25	Rectifier fault
	8	26	
	9	27	
	10	28	Battery undervoltage
	11	29	
	12	30	

Table 14 - Assignment of the connection terminals of A12-X3

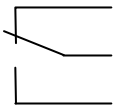
Assign-ment	A12-X4	X12	Meaning
	1	16	Collective fault
	2	17	
	3	18	

Table 15 - Assignment of the connection terminals of A12-X4

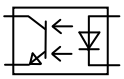
Assign-ment	A12-X5	X12	Meaning
	1 2	52 53	Inverter remote switch-off

Table 16 - Assignment of the connection terminals of A12-X5

➔ To connect the control and signal lines:

1. Lay the control and signal lines in the cable duct in the centre of the unit.
2. Use a 3 mm screwdriver to connect the control and signal lines to terminal strip X12.
3. Connect the shield of the control and signal lines to the PE conductor connection of the control unit pivot arm.

You need to do this if you are using shielded control and signal lines. Shielding the control and signal lines improves the equipment's EMC.

4. Attach the control and signal lines to the cable clamp rail.
5. Check the polarity of the control and signal lines.
6. Remove unused cable, tools, etc. from the equipment.

✓ The control and signal lines are now connected.

7.5 Starting up the equipment

This section describes starting up the equipment. Follow the instructions and comply with the requirements described.

Preparations

Please note the following before start-up:

- If you are using several units in parallel, refer to the additional description of parallel operation.
- Before start-up, check that the default equipment data tallies with the battery data.
- Before start-up, check that the equipment is earthed in accordance with regulations (VDE 0100).
- Make sure that the ventilation grids are never covered during operation.
- Ensure compliance with the start-up requirements set out by the battery manufacturer.

Changes to parameters can be made via the DOU or by AEG Service.

➔ To prepare the equipment for start-up:

1. Open the battery isolator.
2. Set the load interrupter switch Q1 to the "OFF" position.
3. Set the manual bypass switch Q29 to position "3 - Manual bypass".

You only need to do this if a manual bypass switch Q29 is installed in your equipment.

4. Remove the protective cover from the connection panel
5. Connect the mains voltage for the rectifier.
6. Connect the mains voltage for the SBS circuit.
7. Measure the mains voltage at connection terminal X1 (outer conductor/outer conductor): the mains voltage is $U_{\sim}$ = 400 V.
8. Measure the mains voltage at connection terminal X4 (outer conductor/neutral conductor): the mains voltage is $U_{\sim}$ = 230 V.
9. Check the rotating field at connection terminal X1: L1, L2 and L3 clockwise rotation.
10. Disconnect the mains voltage for the SBS circuit.

11. Disconnect the mains voltage for the rectifier.
12. Rectify any problems identified.
13. Replace the protective cover on the connection panel.

✓ You have prepared the equipment for start-up.

Starting up the equipment

You only need to carry out steps **3.** and **8.** if a manual bypass switch Q29 is installed in your equipment.

➔ To start up the equipment:

1. Open the battery isolator.
2. Set the load interrupter switch Q1 to the "OFF" position.
3. Set the manual bypass switch Q29 to position "2 - Service operation".
   The red, yellow and green LEDs light up.
   LCD: "Self-test" is displayed.
4. Connect the mains voltage for the rectifier.
5. Connect the mains voltage for the SBS circuit.
6. Check status: The SBS is starting up,
   the green and yellow LEDs are flashing.
   LCD: "Main menu" is displayed.
7. Wait for status: The SBS is ready,
   the green LED is flashing.
   LCD: "SBS symbol OK" is displayed.
8. Set the manual bypass switch Q29 to position "1 - Inverter operation".
   The green and yellow LEDs flash.
9. Select the DOU display language.
10. Set the load interrupter switch Q1 to the "ON" position.
11. Wait for status: The INV is ready,
    the green LED is flashing.
    LCD: "INV symbol OK" is displayed.
12. Check the battery isolator voltage and polarity.
13. Close the battery isolator.
14. Press the "~I" key on the DOU.
    LCD: "INV symbol" flashes.
15. Wait for status: SBS switches to normal operation,
    green LED lights up.
    LCD: "Energy flow display via INV" is displayed.

✓ You have started up the equipment.

8 Operation

The equipment can be controlled using the operating elements and via remote signalling from a control room.

The operating elements are located on the front of the unit. The display and operation unit is integrated in the door of the control cabinet. The load interrupter switch Q1 and the manual bypass switch Q29 can only be accessed by opening the door of the control cabinet.

8.1 Load interrupter switch Q1

The load interrupter switch Q1 connects the rectifier to the mains supply.

A fault in the mains supply, e.g. a short circuit, triggers the open-circuit shunt release of the load interrupter switch Q1. The connection between the rectifier and the mains supply is interrupted.

The inverter can be disconnected for maintenance and repair purposes by opening the load interrupter switch Q1 and the battery isolator.

8.2 Manual bypass switch Q29

The manual bypass switch Q29 is used to change over between three of the four operating modes.

The manual bypass switch Q29 is usually located outside the equipment. It can be installed directly in the equipment if required.

Switch position	Name of the switch position	Operating mode
1	Inverter operation	Operation with mains supply available (normal operation)
2	Service mode	Operation with a defective Inverter
3	Manual bypass	Operation with manual bypass

Table 17 - Q29 switch positions

When an operating mode is selected, the manual bypass switch Q29 does not take the current status of the assemblies into account. The assemblies must be activated or deactivated manually first.

8.3 Display and operation unit

The display and operation unit (DOU) is used for data signalling and visualisation as well as for equipment control and parameterisation. The DOU is divided into two display elements and two operating elements:

LEDs

Display the current status of the equipment

ENTER key

Confirms control functions and parameters, also used for menu navigation

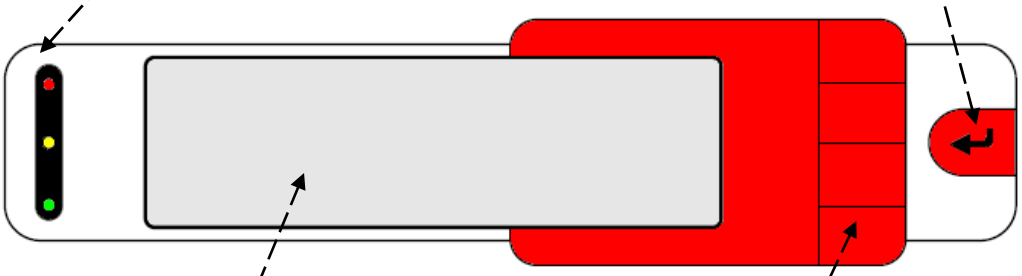


Figure 20 - Display and operation unit

LCD

Displays measured values, status messages and fault indications; along with the current assignment of the function keys on the right-hand side

Function keys

Control the equipment and navigate in menus

The display elements (**LEDs and LCD**) indicate the status of the equipment and measured values. The operating elements (**function keys and the ENTER key**) are used to navigate in menus and control the equipment.

Communication errors are rare when using the DOU. If they do occur, repeat the operation.

8.3.1 LEDs

The three LEDs (green, yellow and red) provide information about the status of the equipment at a glance (→ chapter 9).

8.3.2 LCD

The LCD displays menus, measured values and messages. The function key assignments are displayed on the right-hand side.

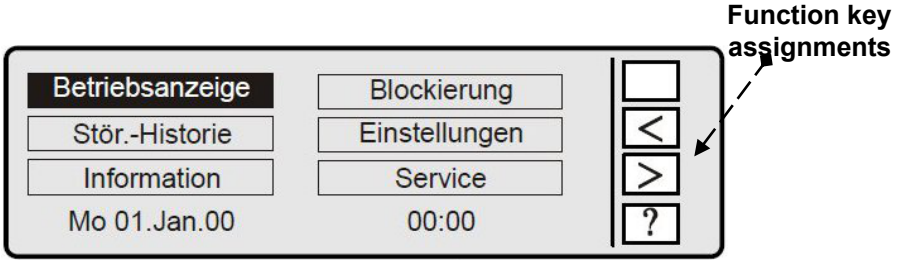


Figure 21 - Function key assignments

8.3.3 Function keys

There are four placeholders for the function keys on the right-hand side of the LCD. Dependent upon which menu you are in, a different function is assigned to each function key. The various functions have fixed symbols. These symbols appear on the function keys.

The symbols and their functions are listed in the table below.

Symbol	Function
	Switch off inverter
	Switch on inverter
	Switch off rectifier
	Switch on rectifier
	Acknowledge acoustic signal generator
	Move cursor up/increase value
	Move cursor down/decrease value
	Move cursor to the right
	Move cursor to the left
	Call status and measured values menu
	Acknowledge fault
	Select module
	Call help menu
	Function key blocked
	Function key without function/placeholder

Table 18 - Function key symbols

8.3.4 ENTER key

You can use the ENTER key to acknowledge control functions and parameters, and to confirm menu selections. Press the ENTER key to exit submenus.

8.4 Menu structure

The DOU menus are illustrated in the tree structure below. The menus are displayed on the LCD.

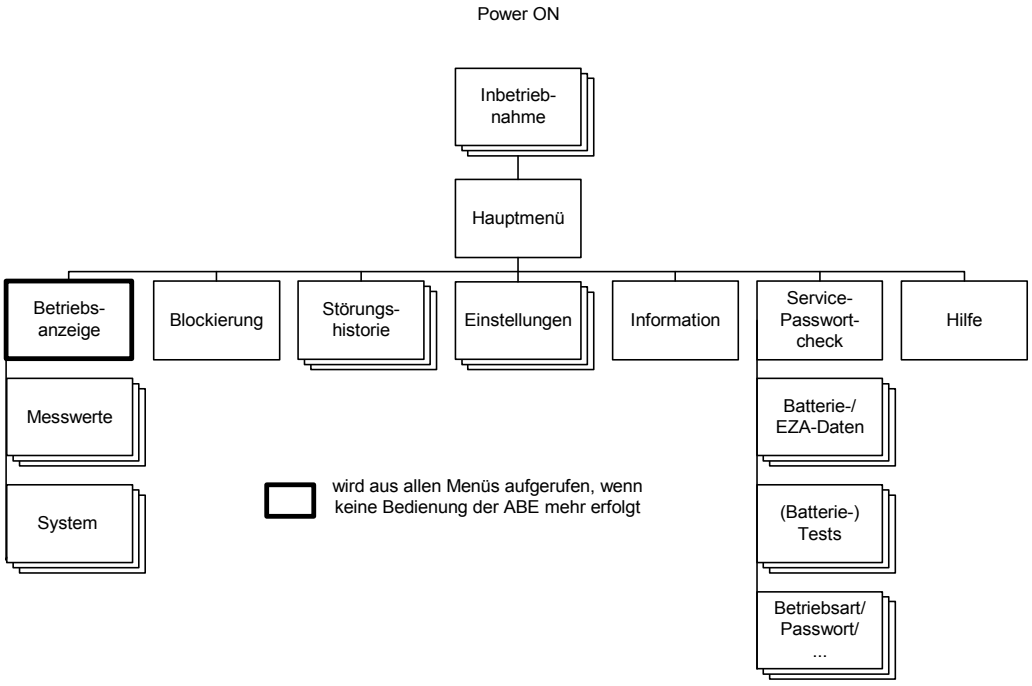


Figure 22 - Menu structure tree

Power ON	Power ON
Inbetriebnahme	Start-up
Hauptmenü	Main menu
Betriebsanzeige	Operating display
Messwerte	Measured values
System	System
Blockierung	Blocking
Störungshistorie	Fault history
Einstellungen	Settings
Information	Information
Service- Passwort- check	Service password check
Hilfe	Help
Batterie-/ EZA-Daten	Battery/ BTD data
(Batterie-) Test	(Battery) Test
Betriebsart/ Password/ …	Operating mode/ password/ etc.

Start-up

The equipment runs a self-test on start-up. On completion of the self-test without errors, the LEDs light up one after the other. The data from the converters is read out during this phase. A progress bar is displayed on the LCD so that you can estimate how long the start-up procedure is going to take.

During **initial start-up** you select the menu language using the function keys. Once you have selected the menu language, a number of other menus are displayed in which you set the parameters for the mains and the batteries.

8.4.1 Main menu

The **main menu** is displayed after start-up.

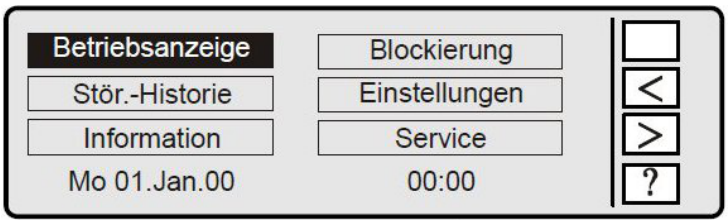


Figure 23 - Main menu

Betriebsanzeige	Operating display
Blockierung	Blocking
Stör.-Historie	Fault history
Information	Information
Einstellungen	Settings
Service	Service

The current selection is displayed inverted (see Figure 23: Operating display). Use the function keys to change the position of the selection. Use the ENTER key to switch to one of the submenus.

You can correct the time and the date in the **Settings**.

8.4.2 Operating display

You can call up the **Operating display** menu from the main menu. The operating display indicates the status of the equipment and the measured values.

The operating display appears automatically if the DOU is idle for a prolonged period.

The **equipment status** displays symbols for the inverter, the rectifier, the batteries and the SBS. The corresponding symbol flashes in the event of a fault affecting one of these components. The energy flow of the components is represented by black bars.

The current capacity utilisation in percent and the standby time in minutes are displayed as **measured values**.

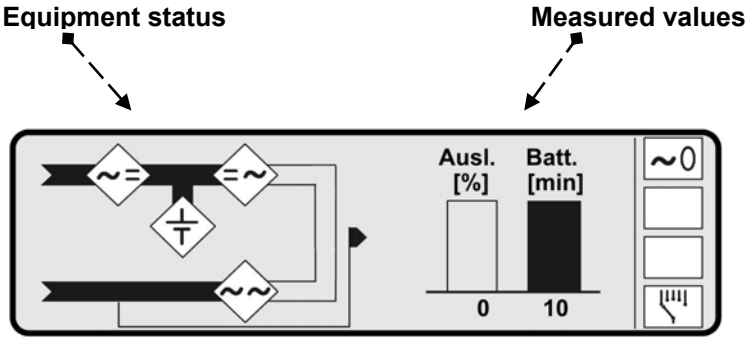


Figure 24 - Operating display menu

Ausl. [%]	CU [%]
Batt. [min]	Batt. [min]

Operation with manual bypass is activated in Figure 24. It is required for maintenance and repair work.

Measured values

To access the **Measured values** menu, press the following function key in the operating display:

 Status and measured values menu

The menu contains status messages and measured values for the:

- Mains
- Batteries
- Loads
- Remote signalling

In the event of a fault, a detailed description of it is displayed here.

System

The **System** submenu contains information about the status of the equipment and the components. In the event of a fault, a detailed description of it is displayed here.

Once a fault has been rectified, it must be acknowledged in the System submenu.

COM interface (optional)

The **COM interface** submenu contains information about the status of the monitoring equipment.

The COM interface menu is only displayed if optional monitoring equipment has been installed.

AUX signals (optional)

The **AUX signals** submenu displays information about the status of general signals.

The AUX signals submenu is only displayed if general signals have been programmed into the remote signalling function.

8.4.3 Blocking

You can call up the **Blocking** menu from the main menu. You block the function keys to prevent unauthorised access in the Blocking menu.

Blocking the function keys prevents:

- Unauthorised attempts to control the equipment
- The acknowledgement of fault indications

Blocked function keys are displayed as follows:

 Function key blocked

Function keys are unblocked by entering a password.

The default password is **1201**. You can change the password in the **Service** menu, **Password** submenu.

8.4.4 Fault history

You can call up the **Fault history** menu from the main menu. In the Fault history menu, you can call up the last 20 fault indications for the:

- Equipment
- Mains
- Batteries

Fault indications are displayed starting from the current date or from a date of your choosing.

8.4.5 Settings

You can call up the **Settings** menu from the main menu. The Settings menu is where you change the:

- LCD contrast
- Language for menus and messages
- Real-time parameters
- Behaviour of the acoustic signal generator for faults and keyboard operations

8.4.6 Information

You can call up the **Information** menu from the main menu. The Information menu displays the following internal equipment information:

- Type of equipment
- Firmware version
- Communication options

Communication options can vary from one unit to another and are dependent upon the optional components selected in each case.

8.4.7 Service

You can call up the **Service** menu from the main menu. You can perform the following actions in the Service menu:

- Set component parameters
- Test batteries
- Log the equipment out of a group in parallel operation
- Change the password

The Service menu can only be opened subject to entering a password. The default password is **1201**. You can change the password in the **Password** submenu.

Rectifier operating mode

You set the rectifier operating mode in the **Rectifier operating mode** submenu. The selected mode changes the way in which the batteries are charged. The current operating mode of the inverter is displayed on the LCD.

The following operating modes are possible:

- Charging
- Trickle charging
- Equalising charging
- Start-up charging

Equalising charging and start-up charging are optional and thus cannot be run for all items of equipment.

Battery test

The batteries are tested against various criteria in the **Battery test** submenu. The yellow LED on the DOU indicates that a battery test is in progress. Status messages and measured values relating to battery tests are indicated on the LCD.

You can change the parameters for the battery test (min. battery voltage, max. discharge time and discharge current) in the **Battery values** submenu.

Before a new battery test gets underway, the last battery test is displayed with date stamp and time stamp.

The following battery tests are available for selection:

- Battery charging circuit test
- Capacity check
- Capacity test

Some battery tests are optional and thus cannot be run for all items of equipment.

Maintenance

You log parallel units out of a group in the **Maintenance** submenu. A unit is logged out of a group for maintenance and repair work; this does not affect the function of the other units in the group.

If you are using several units in parallel, refer to the additional description of parallel operation.

Battery values

You change the default parameters for the batteries in the **Battery values** submenu. It is also where the parameters for the battery tests are changed.

The parameters for the batteries are listed in the data sheets issued by the battery manufacturer. The setting ranges for the parameters vary dependent upon the unit.

All parameters and their setting ranges are listed in the table below.

Parameter	Battery type Pb	Battery type NiCd
(Number of) cells *),)**	90 - 120 ***)	155 - 190 ***)
Cap(acity)	0 – 9999 Ah	
U Tri/cell *), **)	2.13 - 2.32 V/cell	1.33 - 1.50 V/cell
U Cha/cell *), **)	2.23 - 2.43 V/cell	1.37 - 1.70 V/cell
U Equ/cell *), **)	2.23 - 2.58 V/cell	1.37 - 1.75 V/cell
U EPS/cell *)	1.90 - 2.32 V/cell	1.10 - 1.50 V/cell
U Sta/cell *)	1.00 - 2.86 V/cell	0.50 - 1.95 V/cell
I(bat) limit(ation) Tri/Cha/Equ of xxA	1 - 110% v. I_{nom}	
I (bat) limit(ation) Sta of xxA	1 - 110% v. I_{nom}	
(Charging) time Equ/Sta	1 - 1999 min	
Final disch. voltage/cell **)**	1.6 - 2.0 V/cell	0.65 - 1.20 V/cell
Disch. (max. batt. test) time **)**	1 - 1200 min	
Disch. current (%) of xxA **)**	5 - 90% v. I_{nom}	

Table 19 - Setting ranges of the battery parameters

*) The maximum value may deviate from this as there is a maximum DC voltage that must not be exceeded. The maximum value can be parameterised.

**) The minimum value may deviate from this as there is a minimum DC voltage that must not be undershot. The minimum value can be parameterised.

***) The setting range can be parameterised.

****) The parameters are determined by the battery tests.

You can use the table to calculate the following values for a final discharge voltage of approx. 80% of the nominal battery voltage (lead batteries: 1.6 v/cell):

- The discharge powers for two different standby times
- The discharge currents for two different standby times

The standby times are calculated by comparing the battery currents.

Use the following table to calculate the discharge currents.

Discharge currents	Associated discharge times
I_1: 1 - 9999 A	t_1: 1 - 999 min
I_2: 1 - 9999 A	t_2: 1 - 999 min

Table 20 - Discharge currents

The discharge currents and standby times must also comply with the following conditions:

$t_2/I_1 > t_1/I_2$

$t_2 > t_1$

$I_1 > I_2$

BTD values

You set the battery time of discharge parameters in the **BTD values** submenu.

Password

You change the password in the **Password** submenu. The default password is **1201**. Select a 4-digit numerical sequence as the new password.

Keep the password secure. A forgotten password can only be reset by AEG service subject to payment of a fee.

INV voltage

You set the inverter output voltage in the **INV voltage** submenu. The output voltage can be set with a tolerance of ± 3%.

8.4.8 Help

To access the **Help** menu, press the following function key in the operating display:

Call help menu

Dependent upon which menu you are in, a different function is assigned to each function key. The various functions have fixed symbols. These symbols appear on the function keys.

You can look up the meanings of the symbols in the Help menu.

9 Faults

This chapter describes the safety measures, the requirements to be met by personnel and how to troubleshoot faults.

9.1 Safety in the event of faults

9.1.1 Safety instructions

DANGER

Electric shock caused by live parts!

Risk to life due to electric shock

➔ Disconnect the equipment safely.

DANGER

Electric shock caused by residual voltage!

Batteries conduct a residual voltage following disconnection.

Risk to life due to electric shock

➔ Check the battery poles for hazardous voltages.

➔ Cover the battery poles.

➔ Follow the safety instructions issued by the battery manufacturer.

WARNING

Risk of accident due to insufficiently qualified personnel!

Possibility of death or very serious injury.

➔ Work on the equipment may only be carried out by skilled personnel.

ATTENTION

Malfunction caused by Q29

The manual bypass switch Q29 does not take the current status of the assemblies into account during switching procedures.

Malfunctions

➔ Before moving the switch to position 2:

1. Switch off the inverter (→ chapter 5.5.1)
2. Switch on the static bypass switch (→ chapter 5.6)

9.1.2 Personal protective equipment

Wear the following personal protective equipment to avoid injury:

Wear an electrician's safety helmet

Wear insulated boots

Wear insulating gloves with long sleeves

Wear insulating overalls

Wear a face shield

Check that personal protective equipment is in perfect order and report any defects you notice to the owner.

9.2 Requirements of personnel

Only skilled personnel may troubleshoot faults.

Skilled personnel are electricians who, on account of their specialist training, knowledge and experience, along with their knowledge of applicable regulations, are able to assess the work assigned to them and can detect potential hazards.

9.3 Fault messages

Faults during active operation are displayed on the DOU. In the event of critical equipment states, the **acoustic signal generator** will sound.

Fault indications are saved by the **data logger** (optional). The data logger saves the measured data and parameters of the following with every fault indication:

- The rectifier
- The inverter
- The static bypass switch

The data can then be read out for evaluation.

From the time at which the equipment is switched on, the (optional) **self-diagnosis** function monitors:

- The bus system
- The expansion boards
- The sensors

The difference between normal operation and fault scenarios is described in the table.

LED	Acoustic signal generator	Condition
Lights up	**--**	Normal operation: the load is supplied by the inverter.
Flashes	**--**	Fault: the load is supplied via the SBS circuit.
Flashes	**Sounds**	Fault: faults are acknowledged automatically after a short period of time.
Flashes	**Sounds**	Critical fault: the equipment ceases to function. Maintenance/repairs required.

Table 21 - Fault indications

9.4 Fault table

You can use the fault table below to identify the sources of problems. It also provides information about troubleshooting.

Fault	Clarify cause	Rectify fault
Load interrupter switch Q1 open	Earth fault or short circuit on the battery side	● Replace faulty fuses ● Close Q1 (if Q1 opens again: contact AEG Service) ● Carry out equipment maintenance and repairs
REC not working	● Q1 open ● Fuses F20 - F22 are defective ● Fuses F31 - F33 are defective	
SBS not working	● Fault in the SBS circuit ● Fuses F13 - F16 are defective	● Check the SBS circuit ● Replace faulty fuses
INV not working	● INV switched off ● Fuses F26 - F27 are defective ● Fuses F17 - F18 are defective ● INV power supply has failed ● Battery voltage tolerance range exceeded	● Replace faulty fuses ● Check: Q1 open ● X2: Check voltage
Load is de-energised	Defective load fuse (external)	● X3: Check voltage ● Check load fuses (external)
Battery connection is faulty	● Battery isolator open ● Fuses F24 - F25 are defective	● Close the battery isolator ● Replace faulty fuses
Fan not working	● Defective fan fuse ● Loose contact in fan connector ● Fan is defective	● Replace faulty fuses ● Unlock and lock fan connector several times ● Replace fan
Equipment overload	Load consumption too high	● Wait (equipment will switch over to SBS circuit after 1 minute) ● Reduce the load

Table 22 - Fault table

9.5 Troubleshooting

Prerequisites

Fault indications are displayed to you via the DOU:

- The LEDs show the current status of the equipment
- The LCD displays the type of fault

This information enables you to categorise and rectify faults more quickly.

A fault switch-off does not disconnect the equipment all poles!

Troubleshooting

The following function key flashes in the **operating display**:

 Status and measured values menu

➔ Rectify the fault:

1. Press the

    Status and measured values menu function key;

   detailed information about the fault is displayed.

2. Press the

    Acoustic signal generator key;

   the acoustic signal generator is acknowledged.

3. Rectify the fault.
4. Acknowledge the rectified fault in the **System** submenu.

✓ You have rectified the fault.

The DOU background illumination is lit until the fault is acknowledged.

10 Maintenance and repairs

This chapter describes the safety measures, the requirements to be met by personnel and how to carry out maintenance and repairs.

10.1 Safety during maintenance and repairs

10.1.1 Safety instructions

⚠ DANGER

Electric shock caused by live parts!

Risk to life due to electric shock

➔ Disconnect the equipment safely.

⚠ DANGER

Electric shock caused by residual voltage!

Batteries conduct a residual voltage following disconnection.

Risk to life due to electric shock

➔ Check the battery poles for hazardous voltages.

➔ Cover the battery poles.

➔ Follow the safety instructions issued by the battery manufacturer.

⚠ WARNING

Risk of accident due to insufficiently qualified personnel!

Possibility of death or very serious injury.

➔ Work on the equipment may only be carried out by skilled personnel.

CAUTION

Risk of explosion after prolonged operation!

There is a risk of the electrolytic capacitors failing after 10 years of operation.

Risk of injury due to explosive noise level

Malfunctions

➔ Replace the electrolytic capacitors once they have been in operation for 10 years.

ATTENTION

Malfunction caused by Q29

The manual bypass switch Q29 does not take the current status of the assemblies into account during switching procedures.

Malfunctions

➔ Before moving the switch to position 2:

3. Switch off the inverter (→ chapter 5.5.1)
4. Switch on the static bypass switch (→ chapter 5.6)

ATTENTION

Malfunction caused by spare parts

Incorrect or poor quality spare parts invalidate the manufacturer's warranty.

Invalidated warranty.

Malfunctions

➔ Only use spare parts and wear parts approved by the manufacturer.

ATTENTION

Malfunction caused by batteries

The batteries have a reduced standby time whilst a battery test is in progress.

Malfunctions

➔ Think carefully before starting a battery test.

➔ Avoid mains failure.

10.1.2 Personal protective equipment

Wear the following personal protective equipment to avoid injury:

Wear an electrician's safety helmet

Wear insulated boots

Wear insulating gloves with long sleeves

Wear insulating overalls

Wear a face shield

Check that personal protective equipment is in perfect order and report any defects you notice to the owner.

10.2 Requirements of personnel

Maintenance and repairs may only be carried out by skilled personnel.

Skilled personnel are electricians who, on account of their specialist training, knowledge and experience, along with their knowledge of applicable regulations, are able to assess the work assigned to them and can detect potential hazards.

10.3 Maintenance schedule

Many maintenance tasks must be carried out at fixed intervals. The following table lists the maintenance tasks to be carried out and the corresponding maintenance intervals.

Maintenance interval	Maintenance task	Chapter
3 months	**Check condition of battery electrolyte**	10.4.4
3 months	**Check block battery voltage**	10.4.4
3 months	**Check battery voltage**	10.4.4
3 months	**Check electrolyte temperature** (open batteries)	10.4.4
6 months	**Carry out visual inspection**	10.4.2
6 months	**Carry out functional test**	10.4.3
12 months	**Check electrolyte density**(open batteries)	10.4.4
12 months	**Check battery screw connections**	10.4.4
40,000 hours	**Replace fan** *)	10.4.1
10 years	**Replace electrolytic capacitors**	0

Table 23 - Maintenance schedule

*) The maintenance interval for "Replace fan" depends upon the ambient conditions. If large quantities of dust have accumulated, clean the equipment at regular intervals using dry compressed air.

Adapt the maintenance intervals to the prevailing ambient conditions.

Keep a maintenance log recording all maintenance tasks carried out and when.

10.4 Carrying out maintenance and repairs

10.4.1 Fan replacement

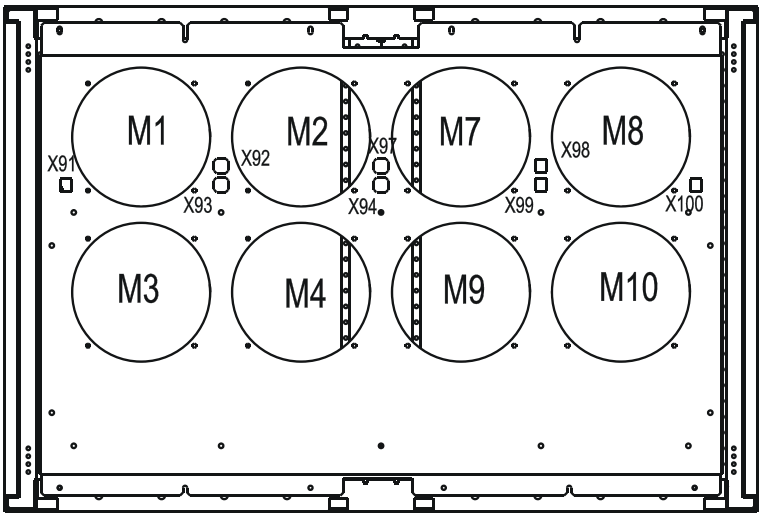


Figure 25 - Fan position

Preparations

Before replacing fans, please note:

- You must follow the safety instructions for changing fans in normal operation (→ chapter 2)

Removing a fan

➔ To remove a fan:

5. Unscrew the fixing bolts on the fan cover
6. Remove the fan cover
7. Unlock the fan connector
8. Unplug the fan connector
9. Remove the fan

✓ You have removed the fan.

Installing a fan

➔ To install a fan:

1. Assemble the fan
2. Fit the fan cover
3. Tighten the fixing bolts to 1.3 Nm
4. Plug in the fan connector

5. Lock the fan connector
6. Check the function of the fan

✓ You have installed the fan.

10.4.2 Carrying out a visual inspection

➔ To inspect the equipment:

1. Disconnect the equipment safely (→ chapter 2.6.1)
2. Check that all screw connections and plug connections are secure
3. Check the equipment for conductive soiling and damage
4. Check safety devices and warning notices for soiling and damage

✓ You have completed the visual inspection of the equipment.

10.4.3 Carrying out a functional test

➔ To check the function of the equipment:

1. Set the manual bypass switch Q29 to position "3 - Manual bypass".
2. Disconnect the equipment safely (→ chapter 2.6.1)
3. Restart the equipment (→ chapter 11.5)
4. Check the LEDs
5. Check rectifier and inverter start-up
6. Check the REC and INV output voltages
7. Check the SBS
8. Check the SBS output voltage
9. Check the battery charging voltage

✓ You have checked the function of the equipment.

10.4.4 Checking batteries

Preparations

Please note the following before checking batteries:

- Ensure compliance with standards DIN 43539 Part 1 and DIN VDE 0108
- Ensure compliance with standard DIN 43530 Part 3 before refilling battery electrolyte
- Automatic test equipment must not be used without the written approval of the battery manufacturer

Checking batteries

Check the batteries in accordance with the manufacturer specifications. Please also note:

- Avoid creepage currents; keep batteries clean and dry
- Only use pure water without additives for cleaning the plastic battery components
- Refill open batteries with distilled water as soon as the battery electrolyte reaches the lower marker

The battery charge is checked automatically every week.

Contact AEG Service if the battery voltage does not comply with specified values and the batteries are charging without errors.

10.4.5 Starting battery tests

Preparations

Please note the following before testing batteries:

- Run the equipment in "Operation with mains supply available" mode (normal operation)
- Check the connection between the batteries and the equipment
- Wait at least 1 minute between battery tests

Some battery tests are optional and thus cannot be run for all items of equipment.

Preparations for the capacity check

Please note the following before starting the battery test:

- Rectifier operating mode: charging or trickle charging
- Battery voltage > 2.2 V/cell (for lead-acid cells)
- Rectifier current < 90% of I_{nom}
- Rectifier current > battery discharge current setpoint +5%

Preparations for the capacity test

Please note the following before starting the battery test:

- Rectifier operating mode: trickle charging

Starting the battery test

➔ Start the battery test from the DOU:

1. Select "Service" in the main menu
2. Select the "Battery test" submenu
3. Select battery charging circuit test, capacity check or capacity test
4. Modify the parameters in the "Battery values" submenu
5. Start the battery test.
   The yellow LED flashes.

✓ You have started a battery test.

The battery charging circuit test runs automatically at weekly intervals.

The batteries may fail during a battery test. If this happens, switchover to "Operation with a defective inverter" occurs. The load is supplied via the SBS circuit.

10.4.6 Replacing fuses

The fuses are entered in the following table.

Fuse	Fuse value	Purpose of the fuse
A92.1-F1	5 A (fast)	Rectifier circuit
A92.1-F2	5 A (fast)	Rectifier circuit
A92.1-F3	5 A (fast)	Rectifier circuit
A92.1-F4	4 A (fast)	Rectifier DC
A92.1-F5	4 A (fast)	Rectifier DC
A92.1-F6	5 A (fast)	Load circuit
A92.1-F7	Free	
A92.1-F8	Free	
A92.1-F9	2 A (fast)	Options
A92.2-F1	5 A (fast)	Load circuit
A92.2-F2	Free	
A92.2-F3	Free	
A92.2-F4	4 A (fast)	Inverter DC
A92.2-F5	4 A (fast)	Inverter DC
A92.2-F6	5 A (fast)	Bypass circuit
A92.2-F7	Free	
A92.2-F8	Free	
A92.2-F9	Free	

Table 24 - Fuses

Inside the equipment, the fuses are identified as follows.

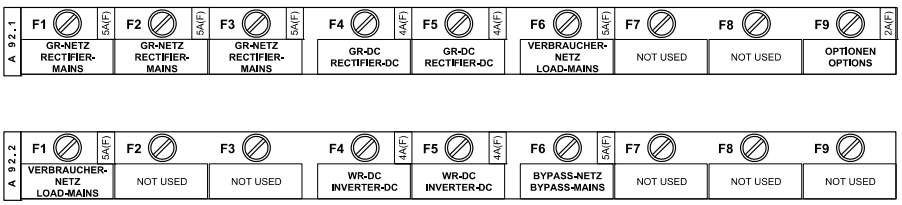


Figure 26 - Position of fuses

GR-Netz Rectifier- Mains	GR-Netz Rectifier circuit
GR-DC Rectifier-DC	GR-DC REC DC
Verbraucher- Netz	Load Netz

Load-Mains	circuit
Not used	Not used
Optionen Options	Optionen Options
WR-DC Inverter-DC	WR-DC INV DC
Bypass-Netz Bypass-Mains	Bypass-Netz Bypass circuit

10.4.7 Replacing electrolytic capacitors

Contact AEG Service if you need to replace electrolytic capacitors.

11 Taking out of service and disposal

This chapter describes the safety measures, the requirements to be met by personnel and how to take the equipment out of service, mothballing, restarting, storage and disposal.

11.1 Safety during taking out of service and disposal

11.1.1 Safety instructions

⚠ DANGER

Electric shock caused by live parts!

Risk to life due to electric shock

➔ Disconnect the equipment safely.

⚠ DANGER

Electric shock caused by residual voltage!

Batteries conduct a residual voltage following disconnection.

Risk to life due to electric shock

➔ Check the battery poles for hazardous voltages.

➔ Cover the battery poles.

➔ Follow the safety instructions issued by the battery manufacturer.

⚠ WARNING

Risk of accident due to insufficiently qualified personnel!

Possibility of death or very serious injury.

➔ Work on the equipment may only be carried out by skilled personnel.

⚠ CAUTION

Chemical burns caused by battery electrolyte

Eye or skin contact with battery electrolyte can cause blindness and serious injuries.

➔ In the event of **skin contact**:

1. Rinse the affected area in plenty of water
2. Bandage the affected area with gauze
3. Throw away all clothing affected by the spillage

➔ In the event of **eye contact**, rinse the eyes with an eye wash or plenty of running water.

➔ In the event of **swallowing**:

- Drink as much water or milk as you can
- Try not to vomit

11.1.2 Personal protective equipment

Wear the following personal protective equipment to avoid injury:

Skilled personnel

Wear an electrician's safety helmet

Wear insulated boots

Wear insulating gloves with long sleeves

Wear insulating overalls

Wear a face shield

Check that personal protective equipment is in perfect order and report any defects you notice to the owner.

Transport personnel

Wear a safety helmet

Wear protective footwear

Wear a hand shield

Check that personal protective equipment is in perfect order and report any defects you notice to the owner.

11.2 Requirements of personnel

Taking out of service, mothballing, restarting and disposal

Taking out of service, mothballing, restarting and disposal may only be carried out by skilled personnel.

Skilled personnel are electricians who, on account of their specialist training, knowledge and experience, along with their knowledge of applicable regulations, are able to assess the work assigned to them and can detect potential hazards.

Storage

Transport personnel are permitted to put the equipment into storage.

Transport personnel are defined as personnel who have the necessary skills, training and knowledge in the field of transport.

11.3 Taking the equipment out of service

Preparations

Please note the following before taking the equipment out of service:

- Make sure that the equipment has been disconnected safety (→ chapter 2.6.1)
- Make sure that the capacitors are discharged

Taking the equipment out of service

➔ To take the equipment out of service:

1. Press the "~0" key on the DOU and acknowledge the message;
   the green LED flashes.
2. Press the "=0" key on the DOU and acknowledge the message;
   The green and yellow LEDs flash.
3. Set the manual bypass switch Q29 to position "2 - Service operation",
   LCD: "Manual bypass symbol" is displayed.

   You only need to do this if a manual bypass switch Q29 is installed in your equipment.

4. Open the battery isolator.
   The red, green and yellow LEDs flash.
5. Set the load interrupter switch Q1 to the "OFF" position.
6. Set the manual bypass switch Q29 to position "3 - Manual bypass".

✓ You have taken the equipment out of service.

If you take the equipment out of service for a prolonged period, the batteries must be fully charged approximately every 3 months. Follow the instructions issued by the battery manufacturer.

11.4 Mothballing the equipment

Preparations

Please note the following before mothballing the equipment:

- Make sure that the equipment has been disconnected safety (→ chapter 2.6.1)
- Make sure that the equipment has been taken out of service (→ chapter 11.3)
- Make sure that the capacitors are discharged

Mothballing the equipment

➔ To mothball the equipment:

1. Remove the protective cover from the connection panel
2. Disconnect the supply lines and PE conductor from the cable clamp rail
3. Disconnect the shield of the battery line from the PE conductor connection
4. Disconnect the supply lines from the connection terminals
5. Disconnect the PE conductor from the PE conductor terminals
6. Remove the supply lines from the equipment
7. Replace the protective cover on the connection panel.

✓ You have mothballed the equipment.

When you mothball the equipment, the batteries must be fully charged approximately every 3 months. Follow the instructions issued by the battery manufacturer.

11.5 Restarting the equipment

Preparations

Please note the following before restarting:

- Check that the equipment and the batteries are in perfect order
- Check that the load interrupter switch Q1 is in the "OFF" position
- Check that the battery isolator is open
- Check that the manual bypass switch Q29 is in position "3 - Manual bypass"

Restarting the equipment

You only need to carry out steps **2.**, **4.** and **6.** if a manual bypass switch Q29 is installed in your equipment.

➔ To restart the equipment:

1. Connect the mains voltage for the rectifier.
2. Connect the mains voltage for the SBS circuit.
3. Set the manual bypass switch Q29 to position "2 - Service operation".
   The red, yellow and green LEDs light up.
   LCD: "Self-test" is displayed.
4. Check status: The SBS is starting up,
   the green and yellow LEDs are flashing.
   LCD: "Main menu" is displayed.
5. Wait for status: The SBS is ready,
   the green LED is flashing.
   LCD: "SBS symbol OK" is displayed.
6. Set the manual bypass switch Q29 to position "1 - Inverter operation".
   The green and yellow LEDs flash.
7. Set the load interrupter switch Q1 to the "ON" position.
8. Wait for status: The INV is ready,
   the green LED is flashing.
   LCD: "INV symbol OK" is displayed.
9. Close the battery isolator.
10. Press the "~I" key on the DOU.
    LCD: "INV symbol" flashes.
11. Wait for status: SBS switches to normal operation,
    green LED lights up.
    LCD: "Energy flow display via INV" is displayed.

✓ You have restarted the equipment.

Putting the equipment intostorage

For safe storage, proceed as follows:

- Select a dry, ventilated room with a stable protective roof as the storage location. The room temperature must be between -35°C and +70°C. The relative air humidity should be ≤ 85%.
- The equipment may only be stored for a maximum period of six months in the original packaging.
- If it has to be stored for longer than six months:
  1. Add normal desiccant
  2. Seal airtight in plastic film
- The documentation issued by the battery manufacturer sets out specific storage conditions for the batteries.

11.6 Disposing of the equipment

This section tells you how to dispose of the individual components of the equipment.

- **Packaging**: Dispose of the stretch plastic film and the moulded parts made from polyethylene foam with normal industrial waste. They are chemically inactive and can be disposed of or recycled.
- **Metal parts**: Take metal parts to a scrap metal dealer. The equipment housing, the lines, the inverter, the rectifier and the transformers can be recycled via normal routes.
- **Electronics components**: Take the electronics components to a recycling company which specialises in disposing of electronics components.
- **Batteries**: Follow the specifications set out by the battery manufacturer for toxic and hazardous substances.

  Batteries must be removed from all parts of the equipment and disposed of in accordance with the regulations for toxic and hazardous substances.
- **Other components**: Dispose of rubber seals and plastic parts with industrial waste. They can be disposed of or recycled.

Electrical and electronics waste must only be disposed of in compliance with local legislation and regulations.

Never dispose of used **batteries or battery material** with refuse. Ensure compliance with local legislation and regulations governing the storage, handling and disposal of batteries and battery material.

12 Appendix

12.1 Spare parts

To ensure high equipment availability, keep a stock of the following spare parts.

Item	Spare part
F1 - F10	Fuse, 2 A, slow-blow
F13 - F22	Fuse, 5 A, fast
F24 - F27	Fuse, 4 A, fast
F28	Fuse, 2 A, fast
F31 - F33	Fuse, 5 A, fast
M1 - M10	Fan
K7	Inverter output contactor
Q1	Load interrupter switch
Q29	Manual bypass switch

Table 25 - Spare parts

Have the unit number of the equipment handy when ordering spare parts.

12.1.1 Exclusion of liability

AEG Power Solutions GmbH will rescind all obligations such as warranty agreements, service contracts, etc. entered into by AEG Power Solutions GmbH or its representatives without prior notice in the event of maintenance and repair work being carried out with anything other than original AEG Power Solutions GmbH spare parts or spare parts purchased from AEG Power Solutions GmbH.

12.1.2 Ordering spare parts

To order spare parts for Protect 8 units, please contact AEG Power Solutions GmbH in Warstein-Belecke, Germany.

To speed up processing of your order, have your CNF number handy.

12.2 Standards and directives

This section lists the legislation, standards, directives and regulations used in drafting the operating instructions and designing and building the equipment.

12.2.1 Drafting of the operating instructions

The operating instructions have been drafted in accordance with:

- European Directive 2006/42/EC
- DIN EN ISO 12100-1:2003 - Safety of machinery
- DIN EN ISO 12100-2:2003 - Safety of machinery
- DIN EN 62040-1:2009 - Uninterruptible power systems
- DIN EN 62079:2001 - Preparation of instructions
- ANSI Z535.6-2006 - Product Safety Information

12.2.2 Equipment design and build

The equipment has been designed and built in accordance with:

- DIN EN 50274 - Low-voltage switchgear and controlgear assemblies
- DIN VDE 0100-410 - Low-voltage electrical installations
- DIN EN 62040-1:2009 - Uninterruptible power systems

The CE marking on the equipment confirms compliance with the EC framework directives:

- 2006/95/EC - Low Voltage Directive
- 2004/108/EC - Electromagnetic Compatibility

12.3 Glossary

EMC

Electromagnetic compatibility describes the capability of a unit to function without restrictions when installed in the vicinity of other units. It is assessed by measuring the interference emitted by each unit and the sensitivity levels of each unit to the interference emitted by others.

EN

Europäische Norm (European standard). In the field of electrical and electronic equipment, these are the European standards issued by CENELEC.

EU directive

A regulation issued by the European Union which the member states are duty-bound to adopt in national law. A distinction is drawn between horizontal directives, which affect all types of product, and vertical directives, which only apply to certain types of product. Currently, the manufacturers of electrical devices have to comply with two important vertical directives which define the requirements to be met by uninterruptible power supplies: 2004/108/EC for EMC and 2006/95/EC relating to issues of safety.

SNMP

The Simple Network Management Protocol is a network protocol which is used for data transfer over Ethernet type computer networks.

12.4 List of figures

12.5 List of tables

12.6 Addresses

Do you have any suggestions for improving these operating instructions?

Do you have any questions on any of the subjects dealt with in these operating instructions?

Our service department is available on the hotline number given below:

✉	AEG Power Solutions GmbH
	Emil-Siepmann-Strasse 32
	59581 Warstein
	Germany
☎	+49 2902 763 100
Fax:	+49 2902 763 645
e-mail:	service.aegpss@aeg.com
Internet:	http://www.aegps.com