



Power supply systems

Protect 5. Inv1/xxx-220-S05 5 kVA – 60 kVA

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Notes on these Operating Instructions

Duty to provide information

These operating instructions must be read carefully by all persons working with or on the inverter prior to installation and initial start-up.

These operating instructions are a composite part of the inverter.

The owner of this unit is obliged to communicate the full content of these operating instructions to all personnel transporting or starting the inverter or performing maintenance or any other work on the unit.

Validity

These operating instructions comply with the current technical specifications of the inverter at the time of publication. The contents do not constitute a subject matter of the contract, but serve for information purposes only.

AEG Power Supply Systems GmbH reserves the right to make modifications with regard to the content and technical data in these operating instructions without prior notice. AEG Power Supply Systems 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.

Warranty

Our goods and services are subject to the general conditions of supply for products of the electrical industry, and our general sales conditions. We reserve the right to alter any specifications given in these operating instructions, especially with regard to technical data, operation, dimensions and weights. Claims in connection with supplied goods must be submitted within one week of receipt, along with the packing slip. Subsequent claims cannot be considered.

AEG Power Supply Systems GmbH will rescind all obligations such as warranty agreements, service contracts, etc. entered into by AEG Power Supply Systems GmbH or its representatives without prior notice if maintenance and repair work is carried out using anything other than original AEG Power Supply Systems GmbH spare parts or spare parts purchased from AEG Power Supply Systems GmbH.

Handling

These operating instructions for the inverter are structured so that all work necessary for start-up, maintenance and repair of the unit can be performed by qualified personnel.

Illustrations are provided to clarify and facilitate certain steps.

If danger to personnel and equipment cannot be ruled out in the case of certain work, it is highlighted accordingly by pictograms explained in Chapter 1, Safety Regulations.

Abbreviations

The following abbreviations are used in these instructions:

DOU = Graphical Display and Operation Unit

SBS = Static Bypass Switch

INV = Inverter

Protect 5. Inv1 = Inverter (INV) + Static Bypass Switch (SBS)

Hotline

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:

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1 Safety Regulations

1.1 Important Instructions and Explanations

The instructions for operation and maintenance, as well as the following safety regulations must be complied with to ensure the safety of personnel as well as the continued availability of the unit. All personnel installing/dismantling, starting up, operating or servicing the units must be familiar with and observe these safety regulations. Only trained and qualified personnel may perform the work described, using tools, equipment, test equipment and materials intended for the purpose and in perfect working condition.

Important instructions are highlighted by "**CAUTION:**", "**ATTENTION:**", "**NOTE:**" and indented text.



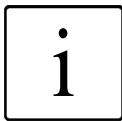
CAUTION:

This symbol identifies all working and operational procedures requiring absolute compliance to avoid any danger to persons.



ATTENTION:

This symbol identifies all working and operational procedures requiring absolute compliance to prevent any damage, irreparable or otherwise, to the inverter or its components.



NOTE:

This symbol identifies technical requirements and additional information requiring the operator's attention.

This document includes brief instructions which describe the function and start-up of the inverter.

These instructions must be glued to the free area on the inside of the unit door.

1.2 Accident Prevention Regulations

Compliance with the accident prevention regulations valid in the respective country of use and the general safety regulations in accordance with IEC 364 is mandatory.

The following must be observed prior to performing any work on the inverter:

- **Disconnect the unit from the power supply.**
- **Secure the unit against reclosing.**
- **Verify that the unit is disconnected from the power supply.**
- **Earth and short-circuit the unit.**
- **Provide protection by covers or barriers for any neighbouring live parts.**

1.3 Danger during Maintenance and Repair Work



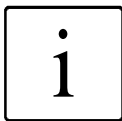
CAUTION:

The voltages applied to the inverter can be fatal. Prior to start-up and/or maintenance work always disconnect the inverter from the power supply and secure the unit against reclosing. The capacitors must be discharged. Free-standing and movable components can protrude into the work area and cause injuries.



ATTENTION:

Considerable damage can be caused to equipment if **unsuitable spare parts** are used during repair work, if work is carried out by unauthorised personnel, or the safety regulations are not observed.



NOTE:

Only trained and qualified personnel may work on or in the vicinity of the inverter (refer to chapter 1.5) while **strictly observing the safety regulations**.

1.4 Fire Protection

Structure of fireproof enclosures (EN 60950)

If uninterruptible power supply units are installed in rooms with inflammable floors (e.g. textile, wood, PVC) or in computer centres, the floor plate must always be installed. The assembler is responsible for proper installation.



CAUTION:

If smoke is detected or a fire breaks out, immediately disconnect the inverter from the power supply and inform the maintenance personnel.

1.5 Qualified Personnel

The inverter may only be transported, installed, connected, started, serviced and operated by qualified personnel who are familiar with the pertinent safety and installation regulations. All work performed must be inspected by responsible experts.

The qualified personnel must be authorised by the responsible safety officer of the installation to perform the work required.

Qualified personnel is defined as personnel

- having completed training and gained experience in the respective field,
- familiar with the pertinent standards, rules and regulations and accident prevention regulations,
- having received instruction on the mode of operation and operating conditions of the inverter,
- capable of recognising and preventing dangers.

Regulations and definitions for qualified personnel can be found in DIN 57105/VDE 0105 Part 1.

1.6 Safety Awareness

The qualified personnel defined in chapter 1.5 are responsible for safety. They must also ensure that only suitably qualified persons are permitted to be in the proximity of the inverter or permitted access to the safety area.

The following points must be observed:

All working procedures which are detrimental to the safety of persons and the operation of the inverter **in any way** are prohibited.

The inverter may only be operated in perfect working condition.

Never remove or render inoperable any safety devices.

All necessary operational measures must be initiated prior to deactivating any safety device in order to perform maintenance, repair or any other work on the unit.

Safety awareness also entails informing colleagues of any unsuitable behaviour and reporting any faults detected to the respective authority or person.

1.7 Application

The inverter may only be used for uninterrupted power supply in the described installation position and operating mode while observing the maximum permissible connection values as specified in these operating instructions. The unit may only be used for this intended purpose. It is not permitted to make any unauthorised modifications to the inverter or to use any spare parts and replacement parts not approved by AEG Power Supply Systems GmbH or to use the inverter for any other purpose.

The person responsible for the installation must ensure that

- the safety instructions and operating instructions are readily available and are complied with,
- the operating conditions and technical data are observed,
- safety devices are used,
- the prescribed maintenance work is performed,
- maintenance personnel is informed without delay or that the inverter is shut down immediately in the event of abnormal voltages or noises, high temperatures, vibrations or any similar effects in order to detect the cause.

These operating instructions contain all information required by qualified personnel for using the inverter. Additional information and explanations for unqualified persons and for the use of the inverter in non-industrial applications are not included in these operating instructions.

The warranty obligations of the manufacturer are only applicable if these operating instructions are observed and complied with.

1.8 Liability

No liability is accepted if the inverter is used for applications not intended by the manufacturer. Any necessary measures for the prevention of injury or damage to equipment are the responsibility of the owner or user. In the event of any claims in connection with the inverter, please contact us quoting:

- Type designation
- Works number
- Reason for claim
- Period of use
- Ambient conditions
- Operating mode

1.9 Directives

The Protect 5. Inv1/xxx units comply with the currently applicable DIN and VDE regulations. VBG4 is met on the basis of compliance with VDE 0106 Part 100.

The requirements of VDE 0100 Part 410, "Functional extra-low voltage with safe isolation", have been complied with where applicable.

The CE sign on the unit confirms compliance with the EC outline directives for 72/23 EEC – Low voltage and for 89/339 EEC – Electromagnetic compatibility if the installation and start-up instructions described in these operating instructions are observed.

2 Technical Data

Please refer to the enclosed technical data sheet for optional and unit-specific setting values.

Type	5 kVA	10 kVA	20 kVA	30 kVA	40 kVA	60 kVA
Rated connection voltage (intermediate circuit voltage)	220 VDC					
Nominal input current of the inverter in A	20	40	80	120	160	234
Output voltage in V, neutral conductor under full load	230 V (optional settings from 220 to 240 V)					
Output current in A	22	43	87	130	174	260
Output frequency in Hz	50 Hz \pm 0.05 (optionally 60 Hz \pm 0.06)					
THD factor in % at rated load	\leq 3 %					
Overload capacity	1.5 x I _{nom} for 1 minute 1.25 x I _{nom} for 10 minutes			I _{short_circuit (max)} = 2,7 x I _{nom}		
Power loss in kW	0,5	0,9	1,4	2,1	2,8	4,2
Dimensions in mm without transport eyelets						
Frame only	Height	1800	1800	1800	1800	1800
	Width	600	600	900	1200	1200
	Depth	800	800	800	800	800
Overall	Height	1810	1810	1810	1810	1810
	Width	600	600	900	1200	1200
	Depth	860	860	860	860	860
Weight in kg	270	270	400	580	580	900

Table 1 Technical data of the inverter

3 General Information

One application of Protect 5. Inv1/xxx systems is to ensure an uninterruptible power supply to computers, IT systems, process control systems and their periphery in production and administration systems.

The Protect 5. Inv1/xxx range covers a power range of 10 kVA to 60 kVA.

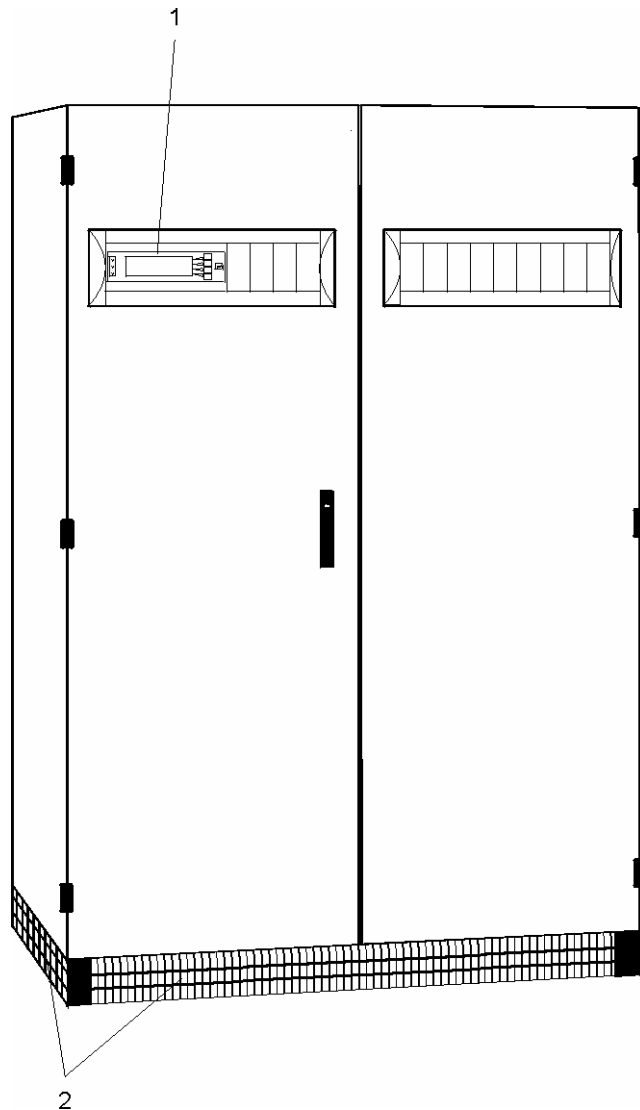


Figure 1 Sample model 60 kVA
(Refer to Chapter 2, Table 1 for dimensions)

- 1 Graphical Display and Operation Unit
- 2 Ventilation grids (4x) for each control cabinet

3.1 Technology

Due to the utilisation of electronic high-performance components, the Protect 5. Inv1/xxx series is suitable for universal applications and has a very high degree of operational reliability as well as optimum efficiency and communication capability with other systems due to integrated interfaces.

The entire control electronics of the inverter is based on the utilisation of state-of-the-art microcomputer assemblies. Logical integration and linking of the various assemblies in the overall system permits specification of the unit properties by unit-related software parameter settings.

The information exchange between the individual modules is carried out using the CAN bus (Controller Area Network). This CAN bus has high interference immunity and is frequently used for industrial applications.

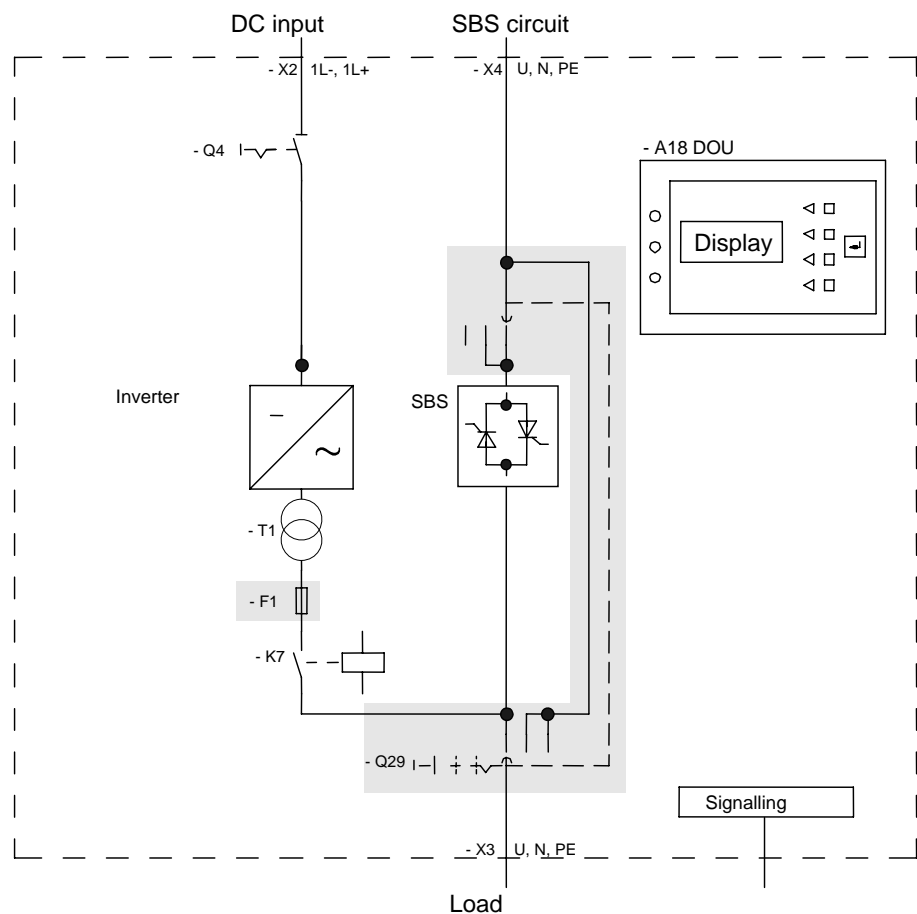


Figure 2 Functional principles of the Protect 5. Inv1/xxx

The main components of the inverter are (Figure 2):**DC supply with:**

- Smoothing device for the batteries or DC busbar
- Interference suppression devices

Inverter section with:

- Inverter stack and control unit
- Interference suppression devices

Static bypass switch (SBS) with:

- Thyristor stack and control unit
- Interference suppression devices

Figure 2 illustrates the functional principle of the uninterruptible power supply unit.

The rectifier (external) supplies the inverter and the battery with DC voltage. The inverter (INV) converts this DC voltage into a 1-phase AC voltage.

The load is powered from the batteries without interruption if mains faults occur (e.g. power failure).

The supply reliability is further increased by the static bypass switch (SBS), which in the event of an INV fault switches the SBS circuit over to the load circuit without any interruption.

3.2 Operating Elements of the Inverter

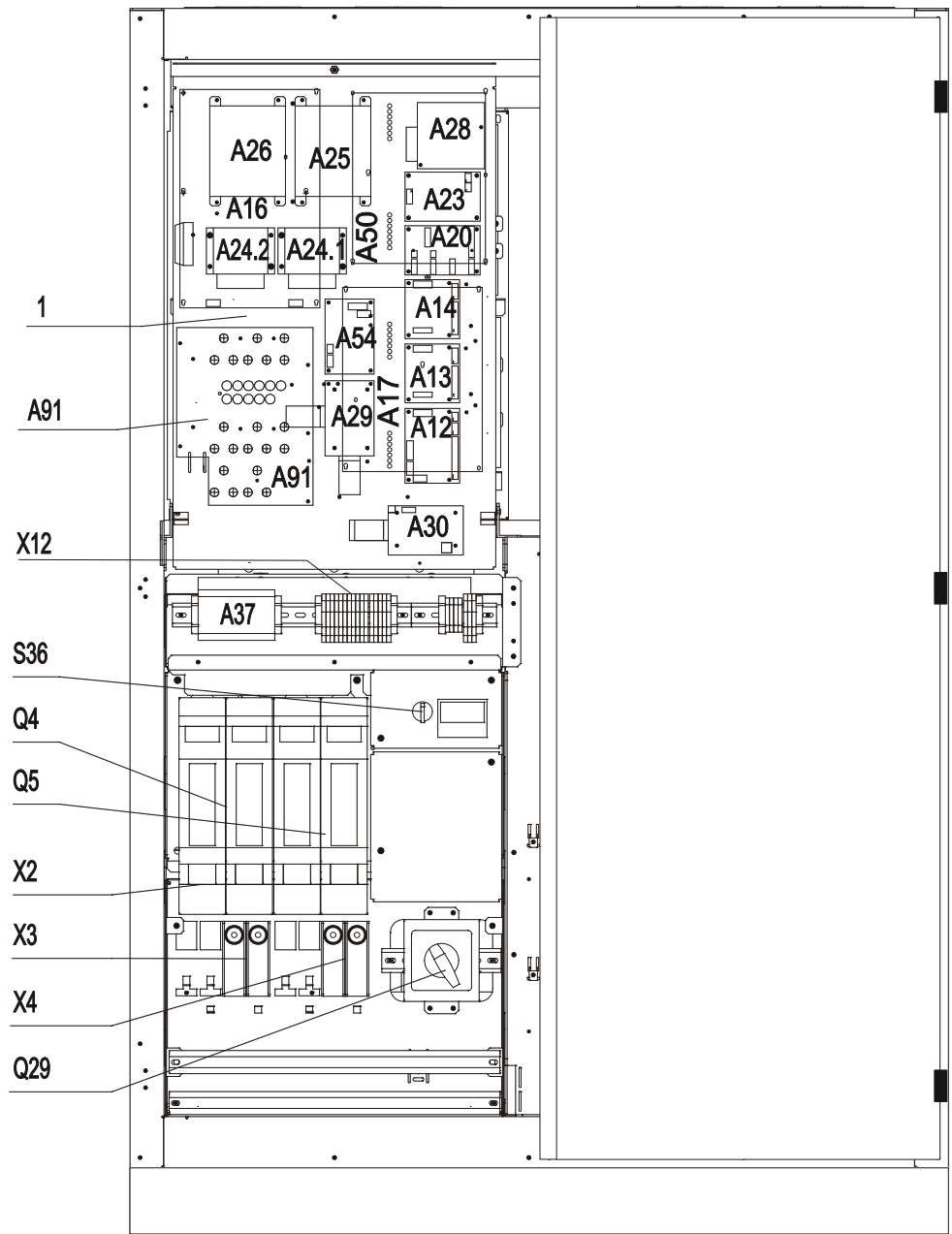


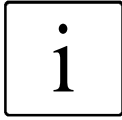
Figure 3 Arrangement of the operating elements, components and individual PCBs with open door

1	PCB's on the control unit pivot plate optional
A91	Internal fuses for control and fans (details see chapter fuses or label inside the cabinet)
X12	Connection Remote signalling
S36	Capacitor charging or discharging
Q4	Circuit breaker DC-Input
Q5	Circuit breaker for second DC-Input (optional)
X2	Connection DC-Input
X3	Connection Load
X4	Connection SBS-mains
Q29	Manual bypass switch

4 Transport, Storage and Installation

4.1 Packing

The units are packed at the works to withstand both rail and road transport. The housing is fixed to the transport pallet using four bolts. The unit is packed in plastic film to prevent any damage to the surface paint and protect the unit against moisture.

**NOTE:**

To prevent damage only remove the protective film from the inverter immediately prior to installation.

The four fixing bolts on the base frame can then be removed using a spanner.

4.2 Crane Transport

**CAUTION:****Do not walk under suspended loads!**

Always wear protective clothing such as a helmet, safety shoes and work gloves!

Transport the unit with due care and observe the safety regulations!

**ATTENTION:**

Only transport the inverter in an **upright position!**

Never **tilt** or **cant** it, avoid displacing the centre of gravity!

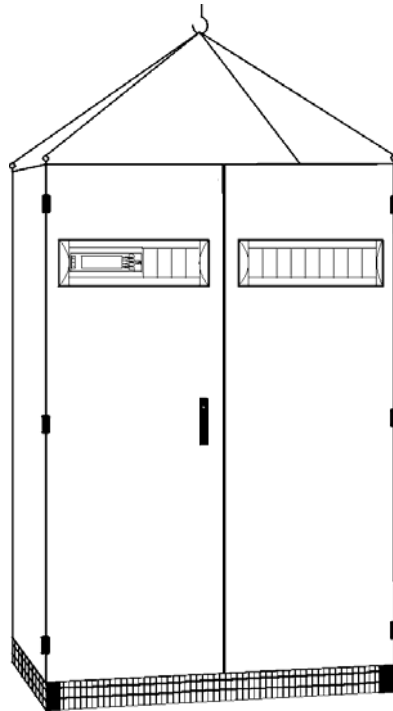


Figure 4 Crane transport

The length of the ropes is calculated so that an angle of 45° is given between the rope and the top edge of the cabinet (DIN 580). The minimum load capacity of each rope must be ≥ 0.5 times the weight of the cabinet (DIN 580). The weight of each inverter can be found in Table 1, Chapter 2. One rope must be used for each transport eyelet.

Proceed as follows to transport the unit by crane (Figure 4):

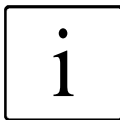
- Insert and tighten the four transport eyelets (not supplied) in the threaded bores provided on top of the cabinet.
- Hook in the four ropes.
- Carefully lift the inverter and transport it to its intended location.
- Lower the inverter carefully without jolting it.
- Remove the ropes and transport eyelets.

4.3 Transporting the Unit using a Forklift or Lowlift Truck



ATTENTION:

Prior to transport with a forklift or lowlift truck, always ensure that the transport devices used for the inverter are designed for the respective weight (refer to Table 1, Chapter 2).



NOTE:

Transport with a forklift or lowlift truck should be avoided whenever possible, especially on construction sites and/or uneven ground.

Always transport by crane when possible!

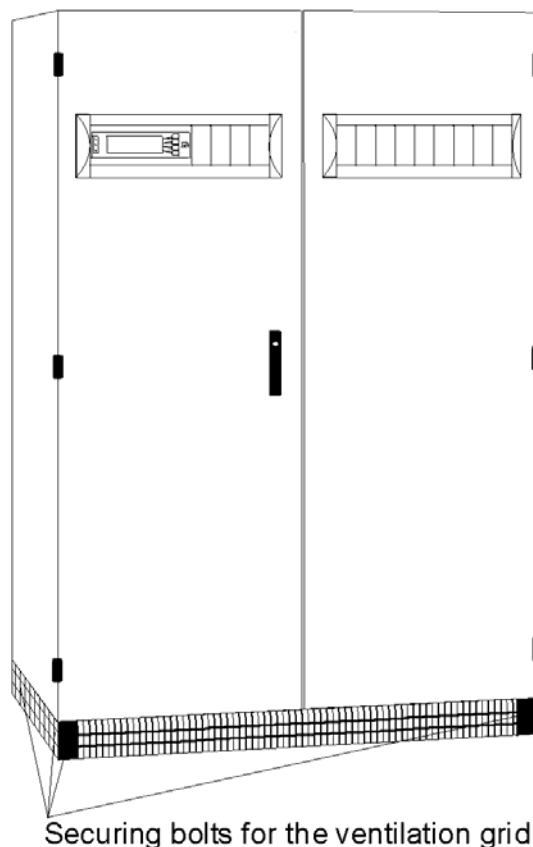


Figure 5 Ventilation grid

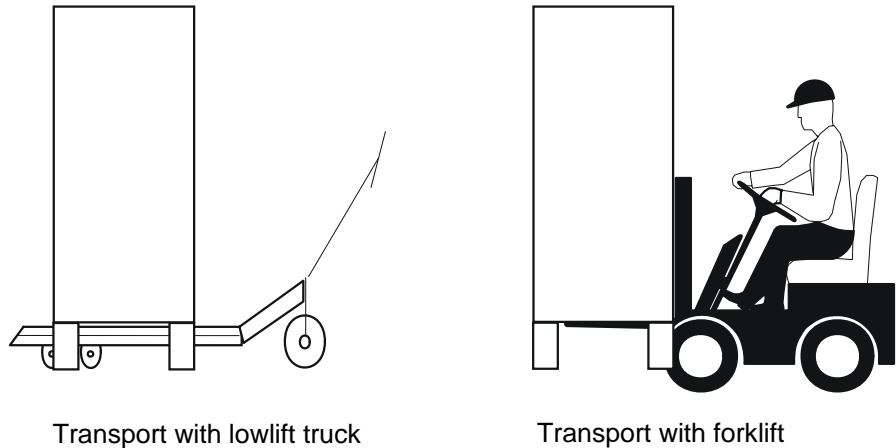


Figure 6 Transport with lowlift and forklift truck



ATTENTION:
Observe the centre of gravity of the unit!

The lifting arms must be:

- - sufficiently long and
- - sufficiently far apart.

Transport the unit as follows:

- Insert the lifting arms between the transport pallet and the inverter.
- Carefully lift the inverter and transport it to its intended location.
- Lower the inverter without jolting it.
- Retract the forklift or lowlift truck.
- Refit the ventilation grids on the inverter using the corresponding fixing bolts.

4.4 Site Requirements

Suitable floor surfaces for installation of the inverter are:

- Double floors
- above cable ducts or
- directly on a level surface.

Ensure that the weight of the units does not exceed the maximum floor bearing capacity (refer to Table 1, Chapter 2).

The site must also meet the following requirements:

- be free of conductive dust,
- be free of corrosive or acid fumes,
- the intake air temperature of the unit must not exceed 35°C, and
- the air vents of the inverter must not be obstructed by any constructional features or other measures.

The units are suitable for installation in confined spaces. Ensure that a min. space of 1000 mm is provided in front of the unit to ensure an escape route, and a space of 400 mm above the unit to guarantee unobstructed air venting.

**ATTENTION:**

The waste heat of the inverter must be dissipated!

The ventilation of the battery compartments must be carried out in accordance with DIN/VDE 0510, Part 2. The following general rule is applicable for ventilation requirements (for lead-acid batteries):

$$Q = 0.05 \times n \times I / 2$$

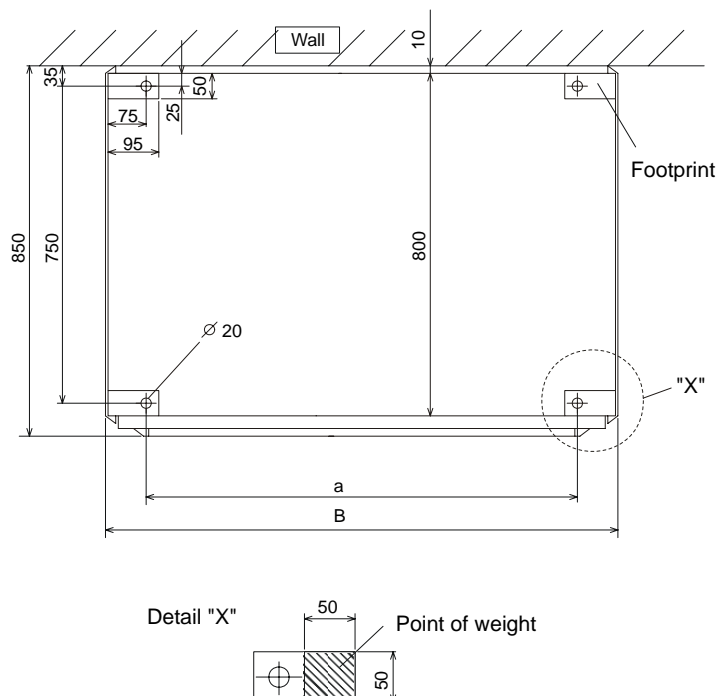
with: Q = air volume in m³/h
 n = number of lead-acid cells
 I = amperage

The ambient temperature in the battery compartment should not exceed 20°C, as the service life of the batteries is otherwise considerably reduced.

4.5 Floor Mounting

Four holes are provided in the base frame of the inverter for the fixing bolts. The spacing and diameter of the bores can be found in the table below.

Before securing the inverter to the floor, ensure that it is vertically aligned, and compensate for any unevenness (e.g. using metal wedges).



Power in kVA	10	20	30/40	60
a in mm	450	750	1050	1050
b in mm	600	900	1200	1200

Figure 7 Dimensions for floor mounting

4.6 Storage

The units may only be stored for a maximum period of six months in the original packaging in dry, ventilated rooms with a permanent roof. The permissible ambient temperature range is between -35°C and $+70^{\circ}\text{C}$ with a relative humidity of $\leq 85\%$.

If the unit is stored for longer than six months, conventional desiccants must be added and the units must be sealed in airtight plastic film.

Please refer to the respective manufacturer's instructions for storage instructions for the batteries.

5 Function

5.1 Operating Modes

Four different operating modes are possible:

- Operation with functioning DC voltage
- Operation with defective inverter
- Operation with manual bypass

5.1.1 Operation with functioning DC Voltage Supply

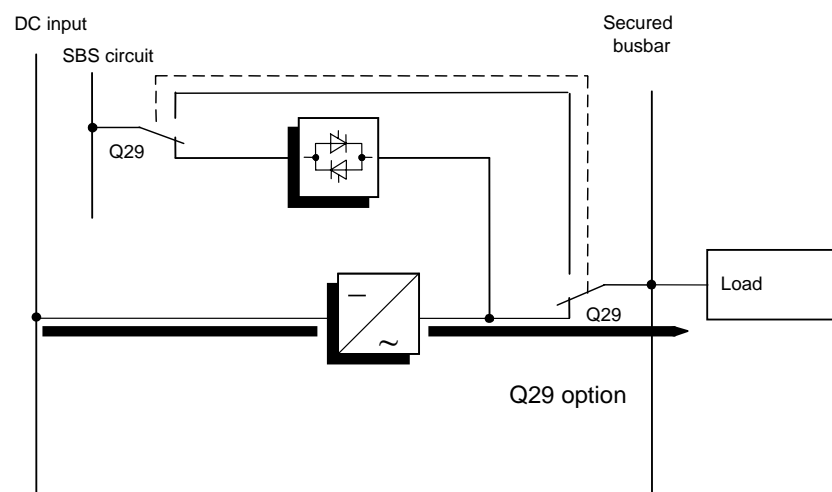


Figure 8 Power circuit with functioning DC voltage (external rectifier and battery)

The inverter converts this secured DC voltage into a stabilised sinusoidal AC voltage and powers the connected loads.

5.1.2 Operation with a Faulty Inverter

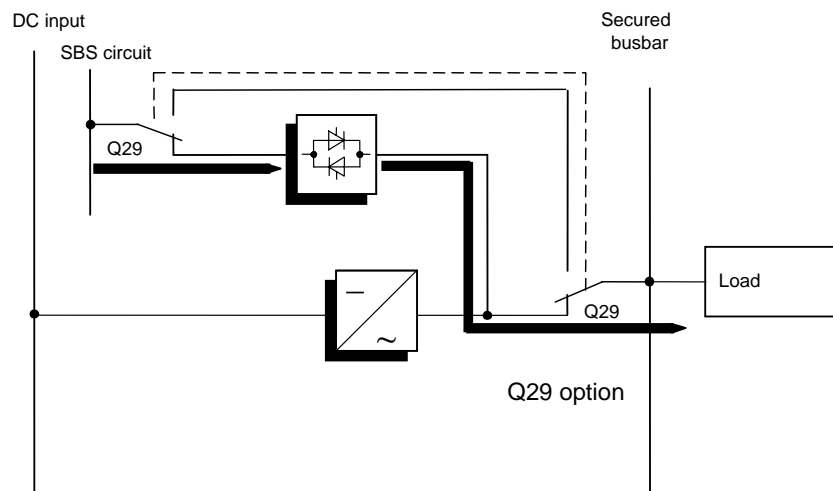


Figure 9 Power circuit with a faulty inverter

If an inverter is defective, power is supplied to the loads by the SBS circuit.

The SBS is an electronic switching device between the load and the mains. The synchronisation unit in the SBS ensures that the frequency and phases of the inverter voltage are synchronised with the mains.

5.1.3 Operation with Manual Bypass

This function is only available with built-in Q29 (optional).

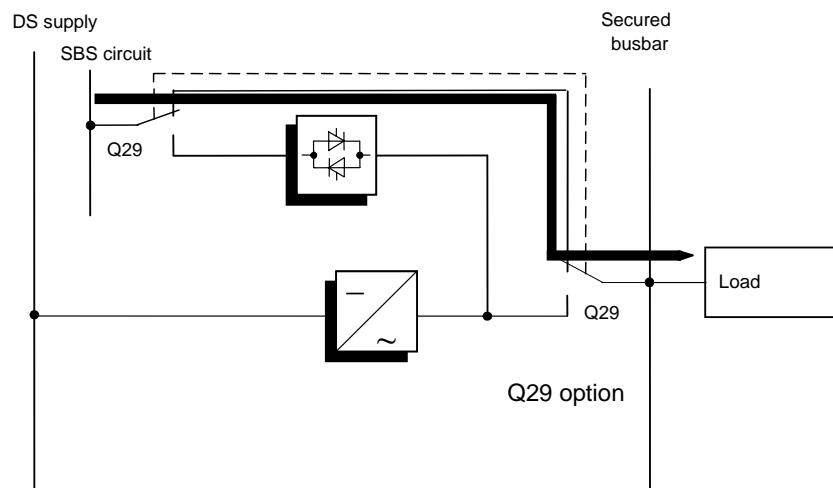


Figure 10 Power circuit with manual bypass

The manual bypass enables maintenance and service personnel to perform work on the inverter without having to switch off the load circuit.



ATTENTION:

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

In the event of a mains supply failure in manual bypass mode, the load supply fails.

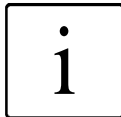
5.2 Function of the Circuit Breakers

Fuse load switch Q4 (Q5 optional):

The fuse load switch Q4 (Figure 2) directly connects the DC voltage after charging the DC link capacitors between the inverter and the DC supply.

Manual bypass switch Q29 (option):

Q29 (Figure 2) permits switchover of the load to the mains input of the SBS without interruption. This switchover is only permitted if the inverter has been switched off and the SBS activated (see also Chapter 5.1.4 Operation with Manual Bypass).



NOTE:

The inverter works setting of Q29 is "1", not activated. This setting is for normal inverter operation.

Inverter output contactor K7:

Inverter output contactor K7 (Figure 2) switches the output voltage of the inverter to the load output.

5.3 Static Bypass Switch (SBS)

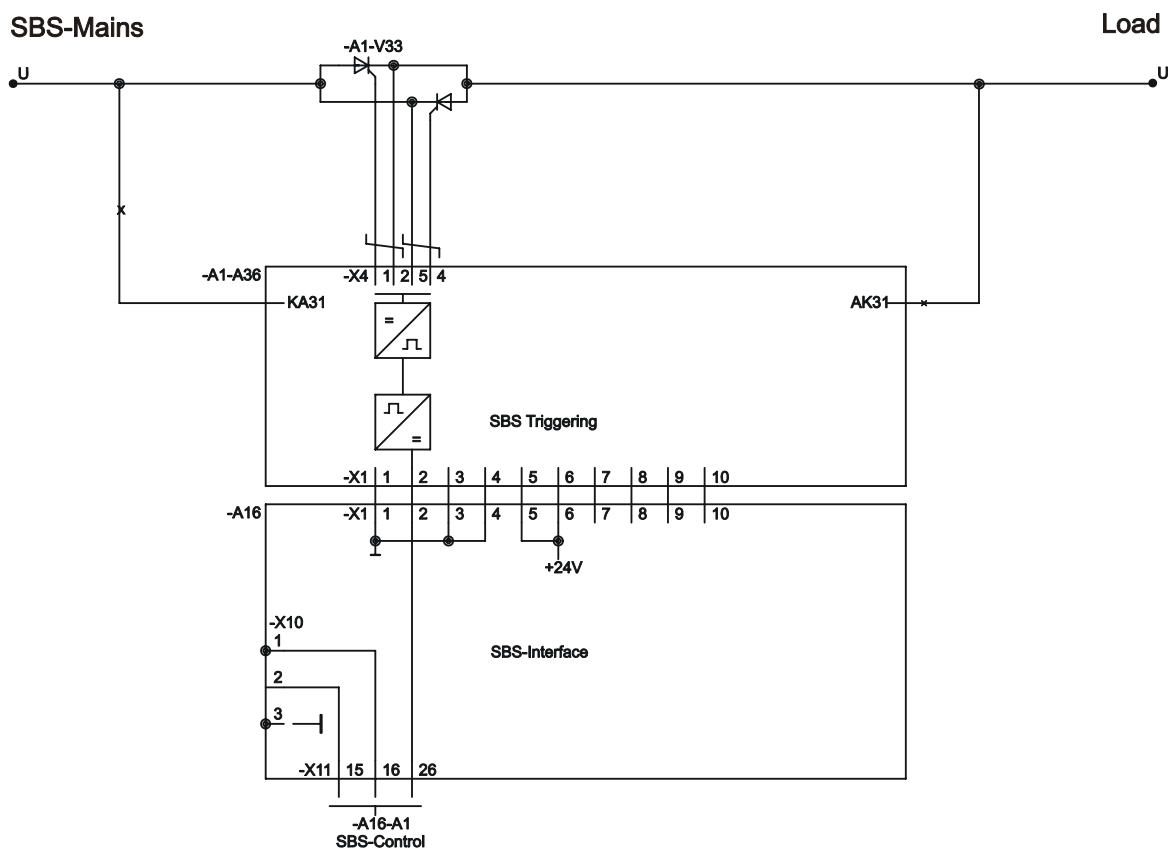
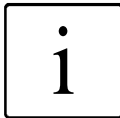


Figure 11 Functional principle of the SBS control unit

The SBS control unit monitors the voltages of the load circuit and, in the event of an overload or inverter fault, initiates switchover of the load to the SBS circuit without interruption. The load circuit is then supplied via the thyristor contactor. As soon as the output voltage of the inverter returns to the permitted tolerance range, the load circuit is automatically switched back to the inverter (INV), also without any interruption.

Switchover from the INV to the SBS circuit and back can also be carried out by the UPS operator by manually switching the INV OFF or ON.

The SBS control unit initiates and monitors synchronisation of the INV voltage with the SBS circuit. If these two circuits are not synchronised, the DOU displays "phase deviation".

**NOTE:**

If during "phase deviation" it is necessary to switch the loads over from the INV to the SBS circuit or if the INV is switched off, switchover to the SBS circuit takes place with a voltage gap. Depending upon customer requirements, the switchover can be blocked if there is a "phase deviation". This operating mode becomes necessary if the connected loads could not withstand such a voltage gap without suffering damage.

The SBS circuit voltage at terminal X4 is monitored by the SBS control unit. If the SBS circuit voltage is not within the permitted tolerance range, the SBS is blocked!

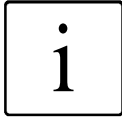
**ATTENTION:**

If the SBS is blocked, there is no switchover to the SBS circuit! This means that if the INV fails or is switched off by the operator, the load circuit is no longer connected to the power supply. The loads must then be manually reconnected by switching the INV back on or activating the SBS

6 Connection

**CAUTION:**

Prior to commencing work, ensure that the connection cables are disconnected from the power supply and that it is not possible to activate the power supply.

**NOTE:**

In order to avoid deformation of the supporting rail and to protect the base of the connection terminal against torsional forces, it is advisable to hold the cable in position when tightening the clamping screw.

The protective measure of earth connection serves to prevent excessive touch voltages on freely accessible metal parts. The inverter is earthed using the earthing bolts (PE) provided on the housing (refer to Table 2, Chapter 6.4).

Prior to start-up ensure that the Inverter is earthed in accordance with valid regulations, e.g. VDE 0100.

6.1 Inputs and Outputs

Figure 12 Connection elements of the inverter

Connection terminals X2 and X4 serve as supply inputs.
The connection to the load is via connection point X3.

6.2 Connection of DC Supply, Load Circuit and SBS Circuit

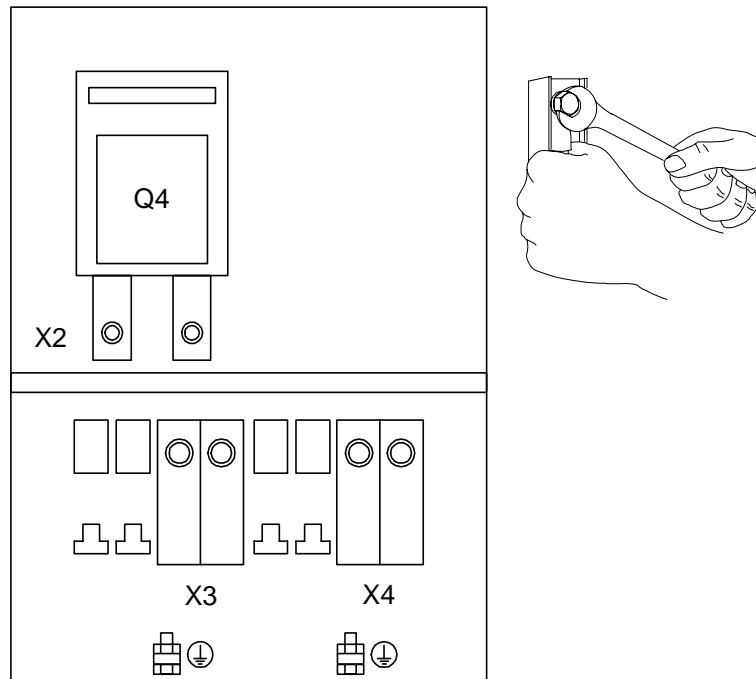


Figure 13 Connection panel of the inverter



ATTENTION:

Ensure correct phase sequence (L1, N) and polarity (+, -) when connecting the cables!

The following general rules apply:

Connection terminal X2 = connection of the DC supply

Terminal X3 = connection of the load circuit

Terminal X4 = connection of the SBS circuit

The connection and earthing terminals are similar in all Protect 5. Inv1/xxx units (refer to Figure 13).

The cables are connected as follows:

- Open the control cabinet door.
- Remove the connection cover from the terminals.
- Insert the cables to be connected into the inverter from below or from the rear.
- Fix the cables to be connected to the respective copper rails by securing the cable lugs (refer to Figure 13) using a spanner.
- **Secure the protective earth conductors (PE)** to the designated unit frames.
- Secure the cables for strain relief on the cable clamp rail.
- Check to ensure that the cables are secured correctly and tighten the fixing bolts if necessary.
- Check the cables for correct polarity and correct phase sequence.
- Remove any cable debris, tools, bolts, etc. from the connection panel.
- Replace the connection cover.

6.3 Connection of the Control and Signal Lines

Refer to Figure 19 for how to connect the control and signal lines for the optional remote signalling PCB.

The cables are connected to the terminals on terminal strip X12: 16-61 (option) using a 3.5 mm screwdriver.

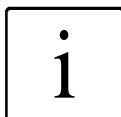
Shielded control and signal lines may have a favourable effect on the EMC. For this purpose, connect the shield of the lines to the terminal unit. Shield terminal blocks (from Phoenix Contact) provided in the unit allow the connection to be made.

6.4 Connection Cross Sections and Fuse Protection

Layout of cross sections in acc. with DIN 0298, Part 4, Table 3				Type rating in kVA					
				5	10	20	30	40	60
Laying type B1/B2									
1	DC input Inverter fusing in A	X2		25	50	100	160	200	315
2	Cross section in mm ² /pole *1	min. max.		10 2x95	10 2x95	35 2x95	70 2x95	95 2x95	2x50 2x95
3	SBS circuit input SBS fusing in A	X4		25	50	100	160	200	300
4	Cross section in mm ² /pole *1	min. max.		4 2x95	10 2x95	35 2x95	70 2x95	95 2x95	2x50 2x95
5	Load output output fusing in A	X3 max.		10	16	25	35	50	63
6	Cross section in mm ² /pole	min. max.		4 2x95	10 2x95	35 2x95	70 2x95	95 2x95	2x50 2x95
7	Remote signalling Cross section of the signal line in mm ² /pole	X12 max.		0.2 - 2.5					

Table 2 Connection cross sections and fuse protection

*1 Laying of the PE conductor in accordance with VDE 0100 T540, Table 6



NOTE:

The cable clamp rail is located 185 mm above the ground.

Observe the bending radius!

(With one bend: radius = 10 x diameter)

7 Start-Up

The start-up procedure is the same for the various inverter versions (10 kVA to 60 kVA).

A voltmeter is required for the following steps.



CAUTION:

When the mains is connected, potentially fatal voltages are applied to the terminals.

Always observe the safety regulations!

Starting the inverter (see also Figure 3)!

7.1 Preparing Start-up of the Inverter (Individual Unit)

Step	Action
1	Remove connection cover.
2	Open and remove fuse load switch Q4 (Q5).
3*	Q29 internal option set to position "3" manual bypass.
4	Connect the SBS circuit.
5	Switch on rectifier voltage for inverter.
6	Measure the DC voltage at terminal X2 (+/-). Check the polarity is correct. The voltage should be approx. 220 V. Measure the mains voltage at terminal X4 (outer conductor/neutral conductor). The voltage should be 230 V.
7	Switch off DC voltage for inverter.
8	Switch off SBS mains voltage.
9	Check the connection terminals are disconnected from the power supply.
10	Eliminate any errors if necessary and repeat the steps.
11	Replace the connection cover.

* Step only required when Q29 is installed

Table 3 Preparing start-up of the inverter

7.2 Starting Up / Restarting the Inverter (Individual Unit)

Step	Action	DOU	
		LED	Display
1	Q4 (Q5) to the "Open" or "OFF" position.		
2*	Q29 (internal option) to position "2" service operation		
3	Connect the power supply for the SBS circuit. The loads are supplied by the SBS.	Yellow / green flashing	Self-test
4	Switch on DC voltage for inverter.	Yellow / green flashing	
5*	Q29 (internal option) to position "1" inverter operation	Yellow / green flashing	
6	When starting up the unit for the first time (commissioning), select the dialog language for the DOU.	Yellow / green flashing	Main menu - operating display
7	Use rotating key S36 and check the measuring display to charge the DC link circuit. Release the rotating key as soon as the pointer moves only slightly.	Yellow / green flashing	
8	Now close Q4 (Q5).	Yellow / green flashing	
9	The DC voltage reaches its final value and the inverter is supplied with power.	Green flashing	DC symbols OK
10	Switch on the inverter using the "I" key on the DOU.	Green flashing	INV symbol flashes
11	Following synchronisation with the SBS circuit, the system is switched over from SBS operation to inverter operation and the loads are supplied with power.	Green ON	Power circuit display via the INV

* Step only required when Q29 is installed

Table 4 Starting up the inverter

8 Operation

8.1 Disconnecting the Inverter (Individual Unit)



ATTENTION:

Only switch off the inverter in an **absolute emergency** by switching off the **SBS circuit** in your distribution!
To restart the system, proceed as described in Chapter 7.

Proceed as described below to disconnect the inverter from the power supply (see also Figure 3).

Step	Action	DOU	
		LED	Display
1	Switch off the INV using the "0" button on the DOU and acknowledge. The SBS circuit is automatically activated.	Green flashing	
2*	Q29 (internal option) set to position "2". Manual bypass is activated.	Green / yellow flashing	Manual bypass symbol
3	Open Q4 (Q5). DC supply circuit is switched off.	Green / yellow flashing	
4	Use switch S36 to discharge the capacitors until the voltage (see display) reaches 0 V.	Green / yellow flashing	
5*	Q29 (internal option) set to position "3". The SBS circuit is switched off.	Green / yellow / red flashing	

* Step only required when Q29 is installed

Table 5 Disconnecting the inverter



CAUTION:

Even if disconnected, the inverter can still be **live** due to **charged capacitors** and connected remote signals.

Check X3 and X4 are disconnected from the power supply and, if necessary, discharge the capacitors with a resistor. Observe the safety instructions!

8.2 Shutting Down the Inverter

If it is necessary to shut down the inverter, the system must be disconnected from the power supply as described in Chapter 8.1.

In addition, the mains supply must be disconnected from the REC circuit and the SBS circuit.



CAUTION:

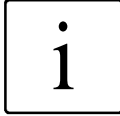
Even when shut down, the inverter can still be **live** due to **charged capacitors**. Discharge the capacitors.

Sicherheitsvorschriften beachten! Observe the safety instructions!

To restart the inverter after shutdown, proceed as described in Chapter 7.

8.3 Emergency Shutdown

Emergency shutdown is available as an option and mainly serves to disconnect the loads from the power supply via an external contact. The exact design of the emergency shutdown depends on customer requirements.



NOTE:

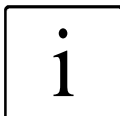
For more information, please refer to the relevant operating instructions.

8.4 Inverter Fuses

The fuses, fuse ratings and protected components can be found in the following table (see also Figure 3, Position 10).

Item	10-60 kVA (value)	Protected components
F1 to F10	0.4 A (fast)	Fans M1 to M10, depending on type
F13	1 x 5 A (fast)	L1 Actual SBS mains voltage
F14 F15 F16	3 x 5 A (fast)	L1 L1 Actual load voltage L1
F17 F18	2 x 5 A (fast)	L1 Actual INV voltage L1
F24 F25	2 x 2 A (fast)	(+) DC intermediate circuit (-) REC control unit supply
F26 F27	2 x 2 A (fast)	(-) DC intermediate circuit (+) INV control unit supply
F28	2 A (fast)	Options

Table 6 Inverter fuses



NOTE:

Fuses are additionally identified by a sticker in the unit.

9 Graphical Display and Operation Unit

9.1 General Information

The graphical **Display and Operation Unit (DOU)** is integrated in the front of the UPS housing. It serves to signal and display UPS unit data and to control and parameterise the UPS system. The DOU consists of a display unit with 3 LEDs, a graphical LCD and an operating panel with 5 keys.

The global unit status can be read from the 3 LEDs. An acoustic signal generator stresses the urgency of critical system statuses.

The graphical LCD shows system statuses and measured values using symbols and plain text. The unit can be controlled and parameterised using menus which are protected by a password.

The DOU is operated using 4 display keys, to which several functions are assigned, and one ENTER key. The currently active key functions are shown on the LCD as symbols.

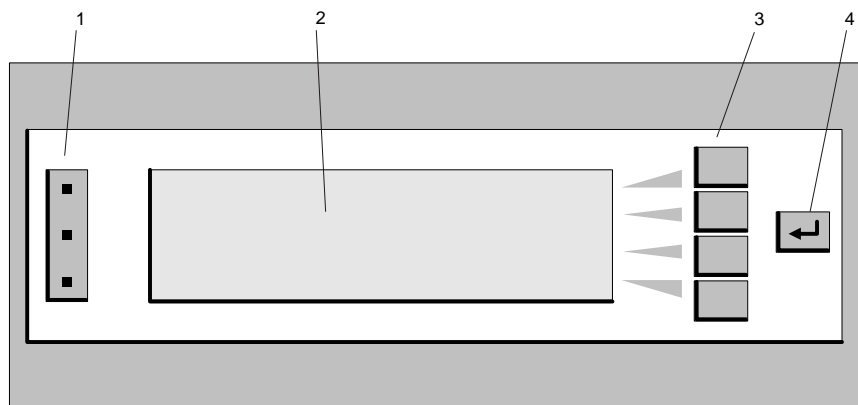


Figure 14 DOU

- 1 LEDs: Red, yellow, green (from top to bottom)
- 2 Graphical display (LCD)
- 3 4 general function keys
- 4 ENTER key

9.1.1 Signalling

LEDs:

- Red, flashing: System fault => Service required
- Yellow, flashing: Self-acknowledging faults/messages, extraordinary system statuses
- Green, flashing: The load is supplied by the bypass circuit
- Green, permanently ON: The load is supplied by the inverter

Acoustic signal generator:

- Signal generator ON: Urgent messages and system faults

9.1.2 Keyboard Operation

You can use the **ENTER key** to **open and close submenus** and to **acknowledge control functions and parameters**.




















The **4 display keys** are assigned to **different functions**. The current key functions are represented as symbols which can be found in a small framed area on the right-hand side of the LCD.

In the "**Operating display**" and in the "**System**" menu, you can switch the **converters on and off** using the general keys. The keyboard symbols in the menu indicate the control function which is currently available. You can only switch off the rectifier in the operating display when the inverter is switched off and while a general control is enabled in the "**System**" menu. If a switch-off procedure has been initiated, you must confirm it in the safety routine, so that the unit cannot be inadvertently switched off. The general control of the power converters can be blocked and protected with a password.

If a **unit fault** occurs, you can refer to the "**System**" menu, where the cause is specified. After eliminating the cause, you must **acknowledge** the fault in the menu. You can then switch the individual power converters back on.

You can **acknowledge the acoustic signal generator using the keyboard**. On the LCD operating display you will find a special acknowledgement key represented by the symbol of a loudspeaker. In all other menus, press any key (even a key without function) to acknowledge. If the number of messages or faults increases, the acknowledgement is cancelled. You can impose a general block both on the acoustic signal generator from notifying you of faults and the clicking sound when you press a key.

Possible keyboard symbols and their function:

	Switch off inverter
	Switch on inverter
	Switch off rectifier
	Switch on rectifier
	Switch off booster
	Switch on booster
	Switch off charger
	Switch on charger
	Acknowledge acoustic signal generator
	Cursor / value / scroll up
	Cursor / value / scroll down
	Cursor right
	Cursor left
	Status / measured value memory
	System is blocked
	Acknowledge fault
	Module selection
	Help menu
	No function

9.2 Start-Up

Following the **power-up reset**, the DOU performs a self-test. Data is loaded from the power converters after the test has been completed successfully. The LEDs light up sequentially during this phase. A start screen appears on the LCD, and a status bar indicates the duration of the start-up process.

When you **start up the DOU for the first time** (commissioning), you must select the menu language using the general keys "<" and ">". The available languages are indicated using their respective country-specific abbreviation (car number plate). The language currently selected is displayed on a black background. You activate the selected language by pressing the ENTER key, and the next menu opens. In order to comply with international requirements, all menus up to the language selection are displayed in English.

When you start up the UPS for the first time (commissioning), depending on the UPS type, the language selection menu is followed by several other menus where you have to set parameters for the UPS circuit and the installed battery. Step-by-step, you are prompted to parameterise the unit and carry out switching operations until the system is in normal operation.

During **subsequent UPS start-ups**, you can initiate the procedure used for the first start-up (commissioning) manually to modify the set parameters. Otherwise, the start-up process is shortened.

9.3 Menu Structure

9.3.1 Menu Tree

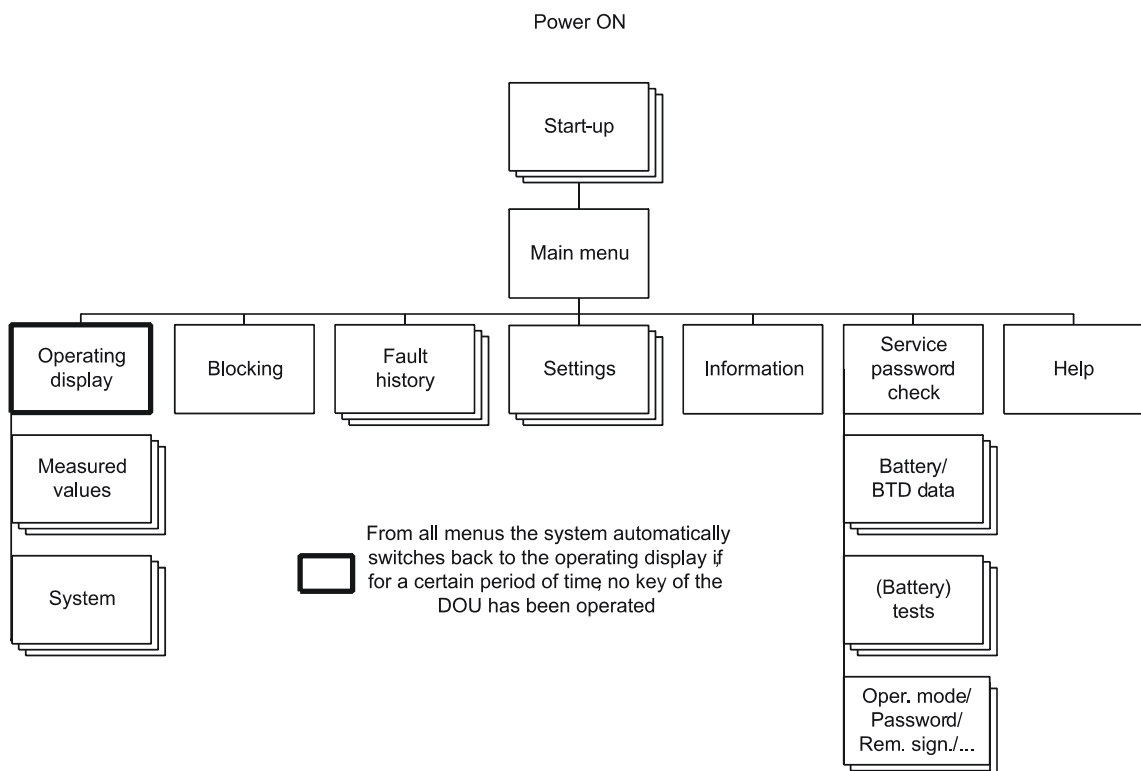


Figure 15 Menu tree

9.3.2 Main Menu

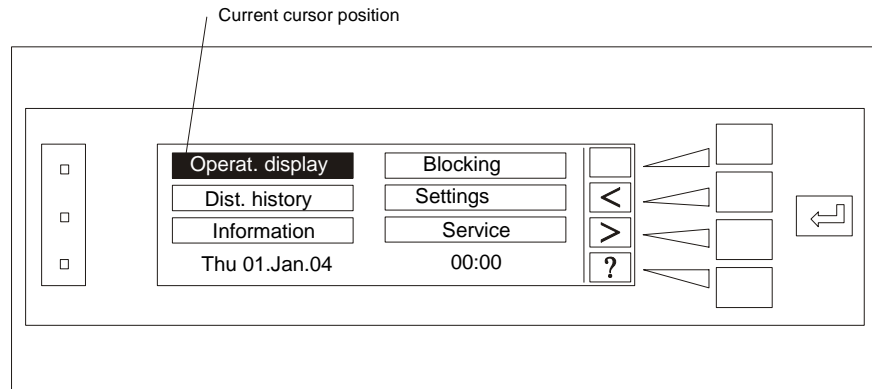


Figure 16 Main menu

After start-up, the **"Main menu"** represents the **highest menu level**, which means that you can open further submenus from here, and you can always return to this level.

The main menu has the typical menu structure.

Additional submenus are displayed on the left-hand side. All selectable submenus are displayed in a frame. A **black background** indicates the **current cursor position**. The bottom line displays the current real time, which can be adjusted using the "Settings" menu. On the right-hand side, the current key function is represented as a symbol which is displayed in a small framed area. You can **move the cursor using the "<" and ">"** keys to select the corresponding submenu. Use the **ENTER key to activate a selected submenu**. Using the **"?" key**, you can call up the **"Help"** menu, which describes the various keyboard symbols.

9.3.3 Operating Display

You can **call up the "Operating display" from the "Main menu"**. If the DOU is **not used for some time**, the system **automatically switches back** to the operating display and the LCD background illumination is switched off. If you have started specific processes, such as a battery test, in a menu, this menu remains active until the process has been completed.

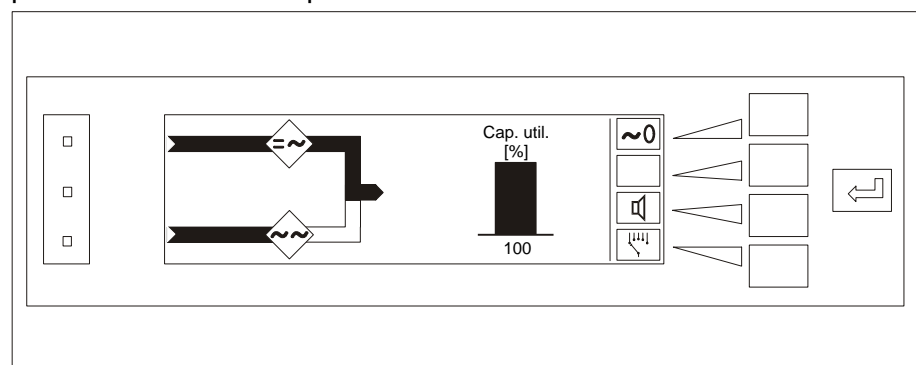


Figure 17 UPS operating display (normal operation)

The "**Operating display**" consists of 3 parts.

On the left-hand side, the **unit status** is shown in a **pictogram**. The individual components of the unit are represented here as symbols. The respective symbol flashes in the event of messages or faults in a component. In addition, the current power circuit is indicated via a bar diagram.

The centre part displays the **most important measured values** of the unit in a digital as well as an analogue format. These values differ, depending on the unit type. In this example, the capacity utilisation of the individual phases (in this case, 3 phases) in percent and the standby time are displayed as the most important measured values of the unit.

The **current display key assignment** is displayed **on the right-hand side**. Here you can switch the power converters on or off depending on the unit status, as long as the operation has not been blocked. You can also acknowledge the acoustic signal generator in this area in the event of messages or faults. Use the bottom key with the measuring device icon to call up menus with detailed information on status and measured values.

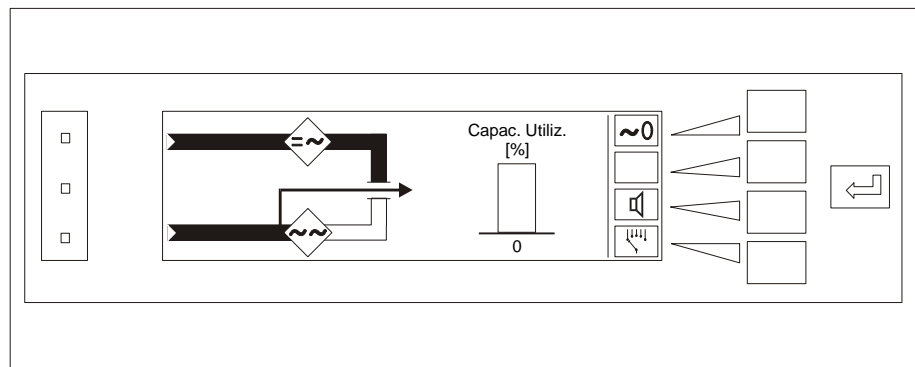


Figure18 Operating display of the UPS with activated manual bypass

Using the **manual bypass switch** (option), you can disconnect the unit from the load. The load is then supplied directly by the mains. This state is shown on the display.

9.3.4 Status/Measured Values

You can access the "**Status/Measured values**" menu from the operating display using the bottom key with the measuring device icon. In this menu, you can select the statuses and measured values of the circuits, the battery, loads or communication options. The "**System**" submenu displays the **status of the UPS** and the individual components. If a **fault** occurs in a **UPS component**, you can **call up a detailed fault description** in a submenu. **After the fault has been rectified**, you must **acknowledge** the fault in this menu.

If **optional communications PCBs** are installed in the unit, the "COM interface" or "Remote signals" submenu displays the status of the individual interfaces. Press the **ENTER key** in the respective submenu to **return** to the "**Selection**" menu.

9.3.5 Blocking

You can **call up** the "**Blocking**" menu **from** the "**Main menu**". After you have entered the current password, you can **block operation** of the control systems (**switching ON/OFF** and **fault acknowledgement**). The password must be entered digit by digit and then acknowledged using the ENTER key.

The **password** set ex works is: **1201**.

In menus where switching operations are normally possible, blocking is indicated by a key.

9.3.6 Fault History

You can **call up** the "**Fault histories**" menu **from** the "**Main menu**". The UPS has an integrated **data logger** that records the fault history of **the circuits, the battery** and **the UPS system**. You can **display** the 20 most recent faults as of the current date or as of a specific date.

9.3.7 Settings

You can **call up** the "**Setting**" menu **from** the "**Main menu**". Here you can **set** the following **parameters**

- **LCD contrast**
- **Language**
- **Real time**
- **Acoustic signal generator** for indicating faults and keyboard operation

in the respective submenus.

9.3.8 Information

You can **call up** the "**Information**" menu **from** the "**Main menu**". Using this menu, you can **call up information** about the unit type, the firmware versions and the available communication options.

9.3.9 Service

You can **call up** the "**Service**" menu **from** the "**Main menu**". After you have entered the current password, you can select submenus where you can set parameters for the UPS and for the battery as well as manipulate the system's operating statuses. The password must be entered digit by digit and then acknowledged using the ENTER key.

The **password** set ex works is: **1201**.

The following **abbreviations** are used in the menus:

Tri	=	Trickle charging
Equ	=	Equalising charging
Cha	=	Charging
EPS	=	Charging with emergency power supply operation
Sta	=	Start-up charging

Menus for changing the operating statuses:

- In the "**Rectifier operating mode**" menu, you can change the charge status of the rectifier (charger). The current charge status is displayed.

- In the "**Battery test**" menu, you can initiate different battery tests, depending on the test implemented. The status and measured values of the battery are displayed during the test.
See Appendix, Battery Tests.
- In the "**Maintenance (with parallel systems)**" menu, you can disconnect units from the complete interconnection of a parallel system for repair or maintenance purposes without causing the remaining units to shut down due to fault.
See separate operating instructions for parallel operation.

Menus for setting parameters:

- In the "**Battery values**" menu, you can set the parameters of your battery for the charging procedure and for tests.
See Appendix, Battery Data.
- In the "**BTD values**" menu, you can set the **B**attery - **T**ime of **D**ischarge parameters of your battery.
See Appendix, Battery Data.
- In the "**Password**" menu, you can set the password for blocking operation and for setting parameters. A range of 0000 to 9999 is possible.

**ATTENTION:**

Keep the password in a safe place! If you have forgotten the password, the DOU must be reset at the customer's expense!

- In the "**Remote signals**" menu (option), you can program up to 3 general signals (IN1-3) for the max. 4 optocoupler inputs of the remote signalling expansion boards, if included. The signal name (IN1-3) cannot be changed. The DOU displays the signal status below the "**Status/Measured values**" menu. An active signal is also indicated via the yellow LED, the acoustic signal generator, and communicated to the connected IT system.

9.3.10 Help

You can call up the "**Help**" menu from the "**Main menu**" using the "?" key. This enables you to **look up the meaning of the keyboard symbols**.

10 Interfaces

10.1 Remote Signalling

The remote signalling PCB consists of a remote signalling master board A12 and an expansion board A13, the contacts of which can optionally be connected to terminal block X12.

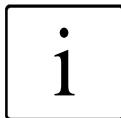
The remote signalling PCBs have the following inputs and outputs:

Inputs (via optocoupler):

- INV remote shutdown

Outputs (via relay contacts):

- Inverter operation
- Mains operation
- DC undervoltage
- Battery undervoltage
- Collective fault
- SBS blocked
- Fan fault
- INV fault

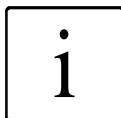


NOTE:

The maximum load for the relay contacts is 250 V / 8°A AC.

Assignment	A12-X3	X12	Meaning	Assignment	A12-X4	X12	Meaning
	1	19	Inverter Operation		1	16	Collective Fault
	2	20			2	17	
	3	21			3	18	
	4	22	Mains Operation				
	5	23					
	6	24					
	7	25	DC-Undervoltage				
	8	26					
	9	27					
	10	28	Battery Undervoltage		1	52	Inverter remote Shut-down
	11	29			2	53	
	12	30					

Figure 19 Terminal assignment of the remote signalling master board A12



NOTE:

The A13 expansion board can be programmed. Also see the technical data sheet for terminal assignment.

The maximum input voltage for terminal X5 is 24 VAC/DC. The maximum switching capacity of the relay contacts is 250 V / 8 A AC.

When a signal is received, the contacts on X3 close on the two contact points with the lower numbers on the connection terminal.

The contacts on X4 close on the two connection terminals with the higher numbers (fail-safe principle).

The control and message lines are routed to the bottom using the cable duct in the centre of the unit.

Standard

Terminal strip X12	From	Designation	Remark
1		L1 load	A37 -> option
2		-	-
3		-	-
4		DC voltage (+)	A38 -> option
5		DC voltage (-)	A38 -> option
6		Neutral conductor	A37 -> option
7, 8, 9	A16-X10:2,3	PE conductor (9) feedback	A37 -> option
10, 11, 12	A50-X8:1,3	PE conductor (12) feedback	A38 -> option
13, 14, 15	Q29	Manual bypass activated (13,14)	Standard A12

Optional

16, 17, 18	A12-X4:1,2,3	Inverter fault	Standard A12
19, 20, 21	A12-X3:1,2,3	INV operation	Standard A12
22, 23, 24	A12-X3:4,5,6	Mains operation	Standard A12
25, 26, 27	A12-X3:7,8,9	DC undervoltage	Standard A12
28, 29, 30	A12-X3:10,11,12	Battery undervoltage	Standard A12
31, 32, 33	A13-X3:1,2,3	Signal – K26	A13
34, 35, 36	A13-X3:4,5,6	Signal – K27	A13
37, 38, 39	A13-X3:7,8,9	Signal – K28	A13
40, 41, 42	A14-X3:1,2,3	Signal – K29	A14 -> option
43, 44, 45	A14-X3:4,5,6	Signal – K30	A14 -> option
46, 47, 48	A14-X3:7,8,9	Signal – K31	A14 -> option
49, 50, 51	A23-X1:1; X1:2	24 VAC (49, 51)	A23 -> OPTION
52, 53, 54	A12-X5:1,2; A13-X4:1	Inverter remote switch-off	Standard A12, A13
55, 56, 57	A13-X4:2; A13-X4:3,4	Signal – OPT2 (54, 55); OPT3 (56, 57)	A13
58, 59, 60	A14-X4:1,2; A14-X4:3	Signal – OPT4 (58, 59); OPT5 (60)	A14 -> option
61, 62, 63	A14-X4:4	Signal – OPT5 (61); NC (62, 63)	A14 -> option

Table 7 Assignment of terminal strip X12

10.2 Serial Interface

Two separate potential-free serial interfaces are provided to establish IT connections.

These are occupied with the AEG protocol CBSER. Optionally, various protocols can be selected for the second interface. These are enabled upon purchase of a licence. A selection of the available protocols can be obtained from your UPS supplier.

The interface is a separate PCB and is located on the outside of the pivot plate next to the remote signalling unit.

For the implementation of special customer software as well as for integration into special bus systems for visualisation using protocol converters, a detailed protocol description is available from AEG Power Supply Systems GmbH.

11 Maintenance and Repairs

11.1 Diagnostic Functions

The comprehensive diagnostic functions implemented in the inverter not only increase its operational reliability considerably, but also reduce the time required for maintenance work and troubleshooting to a minimum.

The inverter is equipped with the following diagnostic functions, some of which are optional:

Self-diagnosis:

This is activated when the system is switched on. Internal auxiliary programs monitor and signal faults, including those from the bus system, the control PCBs or the sensors.

Data logger:

Specified measuring data and parameters from the INV and SBS are stored in the event of a fault. This data is read out and evaluated as required.

11.2 Repairs



CAUTION:

Some repair work, e.g. replacing a fan fuse, can also be performed when the system is in operation and **live**.
Always observe the safety regulations!



ATTENTION:

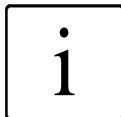
Do not switch the battery under load!

11.2.1 Fault Table

Faults that occur are displayed on the DOU in plain text. Some faults can be located and eliminated quickly using the following table.

Fault	Mögliche UrsachePossible cause	FehlerbehandlungRemedy
SBS does not work.	Fault in the SBS circuit. F13 to F16 faulty.	Check the SBS circuit. Replace the faulty fuses.
INV does not work.	INV is not switched on. F26 and F27 faulty and/or F17 to F18 faulty. Battery voltage outside tolerance range.	Switch on the INV with S1 on DOU. Replace the faulty fuses. Check whether Q4 is in the "ON" position.
No load voltage.	Load fuse faulty.	Measure output voltage at X3. Check external load fuses.
Fan does not work.	Fan fuse faulty. Loose contact in the plug connection. Fan faulty.	Replace the respective fuse in acc. with Table 6, Chapter 8. Unlock and relock the respective fan connector on top of the cabinet several times. Replace the fan in accordance with chapter 9.2.2.
Inverter overload.	Load consumption too high. System automatically switches over to the SBS circuit after one minute.	Reduce the load.

Table 8 Fault table



NOTE:

If the rectifier is faulty and the inverter is switched off, the battery continues to be discharged by the internal power supply for the REC and INV section which is connected to DC voltage (approx. 100 W). The battery must be disconnected by opening the battery isolator to prevent it from becoming fully discharged (exhaustive discharge).

11.2.2 Removing and Installing the Fan



CAUTION:

The fan can be removed and installed when the inverter is switched on.

Always observe the safety regulations!

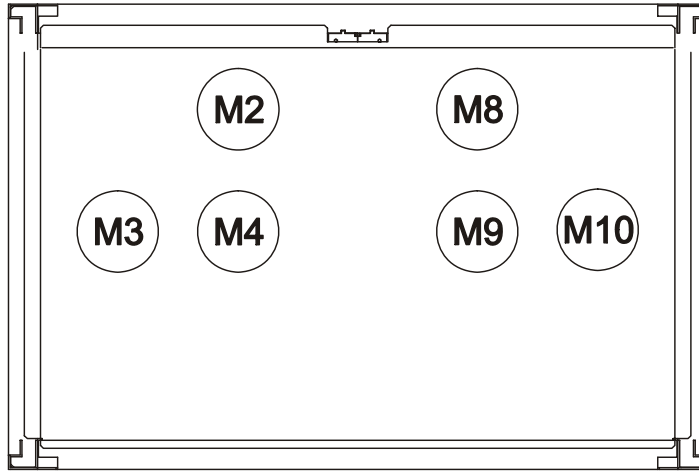


Figure 20 Fan allocation depending on the Protect 5. Inv1/xxx capacity (top view from front)

The defective fan is removed as follows (see Figure 21):

- Remove the corresponding fuse in acc. with Table 6, Chapter 8.
- Unscrew the two fixing bolts on the fan cover grid and remove the grid. Lift the fan until the fan connector is accessible.
- Unlock and disconnect the fan connector.
- Remove the fan.

Installing the fan:

- Fit the fan connector onto the appropriate connector section on the inverter so that both connectors engage in place.
- Insert the fan, refit the fan cover grid and tighten the fixing bolts using a torque spanner, 1.3 Nm.
- Reinsert the respective fuse.
- Check the correct functioning of the fan.
- The fault message disappears.

11.3 Maintenance

The Protect 5. INV1/xxx is made up of state-of-the-art components which are almost non-wearing. We do, however, recommend regular visual checks and functional tests of the unit to maintain its high availability and operational reliability and also to check the battery charge.

It is only possible for the UPS to reach its high degree of availability of approx. 99.99% if any unit fault is eliminated within 24 hours. This must be ensured by providing the necessary service work (e.g. through maintenance contracts).



CAUTION:

Maintenance work must sometimes be performed when the inverter **is connected to the power supply**. Ensure that the work area is cordoned off and always observe the safety instructions!

The following maintenance work must be performed if no other instructions are given by the battery manufacturer:

Task	Interval	Described in
Visual check	6 months	Chapter 11.3.1
Functional Test	6 months	Chapter 11.3.2
Electrolyte level of the batteries	3 months	Chapter 11.3.3
Battery compartment	Annually	Chapter 11.3.3
Fan replacement*	40,000 hours	Chapter 11.2.2

Table 9 Checklist for maintenance work

* Depending on the ambient conditions (observe the instructions of the fan manufacturer)

11.3.1 Visual Checks

When visually inspecting the unit, check whether:

- there is any mechanical damage or whether foreign bodies can be found in the system,
- any conductive dirt or dust has accumulated in the unit,
- accumulation of dust affects heat dissipation.



CAUTION:

The inverter must be disconnected from the power supply in accordance with chapter 8 prior to carrying out the following work.

Always observe the safety regulations!

If large quantities of dust have accumulated, the unit should, as a precaution, be cleaned using dry compressed air, in order to ensure better heat dissipation.

The intervals at which visual checks should be performed are largely determined by the site conditions.

11.3.2 Functional Test

The functional test of the inverter should be performed every six months and include the following tasks:

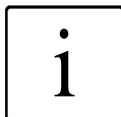
- Activate the manual bypass via Q29 in accordance with Chapter 8
- Disconnect the inverter in accordance with chapter 8 and check the following functions when restarting the system:
- LEDs of the DOU
- Correct start-up of the inverter
- Functioning of the SBS control
- Check the output voltage of the inverter as well as of the SBS.

12 Spare Parts and Customer Service

Despite using non-wearing components, we recommend stocking the spare parts listed in Table 10. This will help to ensure permanent operational availability of your inverter.

Item	Component
F1 to F10	Fuse, 0.4 A, fast
F13 to F18	Fuse, 5 A, fast
F24 to F27	Fuse, 2 A, fast
F28	Fuse, 2 A, fast
M1 to M10	Fans
K7	Contactator
Q4 (Q5)	Fuse load switch
Q29	Uninterruptible changeover switch (option)

Table 10 Spare part stocks



NOTE:

When ordering spare parts, please always supply the designation (item / component) and unit number.

We would like to draw your attention to the fact that spare parts not supplied by us have neither been tested nor approved. Installation of such spare parts can therefore have a detrimental effect on the functional capability and passive safety of the system. We do not accept any liability for any resulting damage.

Our customer service department will be pleased to send you a complete spare parts list for your inverter.

Please contact the following address for help in this matter or if you have any further questions or suggestions:



AEG Power Supply Systems GmbH

Emil-Siepmann-Straße 32
D-59581 Warstein
Germany



++49 (0) 29 02-763-100

FAX: ++49 (0) 29 02-763-645

E-mail: Service-Be.aegpss@aeqsaft.alcatel.de

<http://www.aegpss.de>

13 Annex

The following optional equipment is available for the Protect 5. Inv1/xxx:

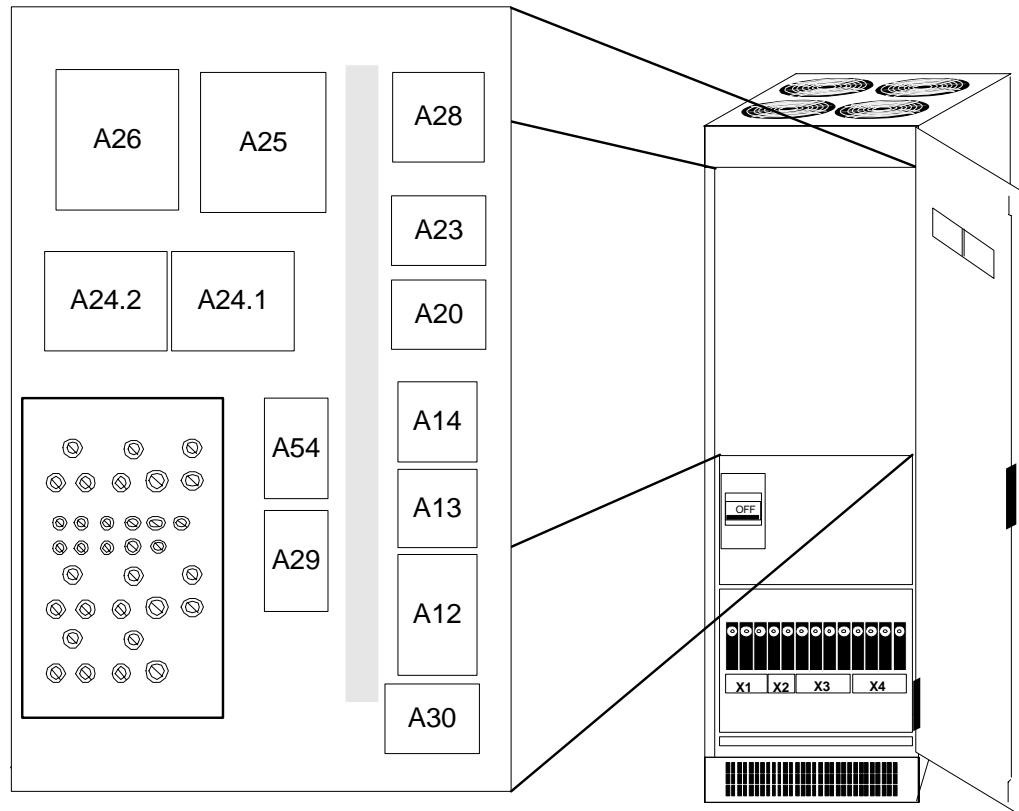


Figure 21 PCBs on the control unit pivot plate (example model 40 kVA) **Standard scope of supply:**

Slot	Designation
A12	Remote signalling master board
A29	CAN COM controller (CCC)

Options:

Slot	Designation
A13	Remote signalling expansion board 1 (see technical data for parameter settings)
A14	Remote signalling expansion board 2 (see technical data for parameter settings)
A20	Parallel operation adapter
A23	Power supply unit 24 VAC
A24	BLÜ-PRO battery charging circuit monitoring
A25	Network adapter/E with SNMP adapter (RFC 1628)
A26	Protocol converter
A28	Power supply unit 12 VDC
A30	Modem device
A54	Measuring amplifier for temperature-dependent charging

Table 11 Legend for Figure 21

Please see the enclosed technical data sheet for the optional printed circuit boards and activated options installed in your unit.

Figure 22 shows all the PCBs included in the scope of supply. These are mounted on the control unit pivot plate behind a cover which can be opened by loosening the fixing bolts.

When **closing** this pivot plate, ensure that no cables are **pinched**.

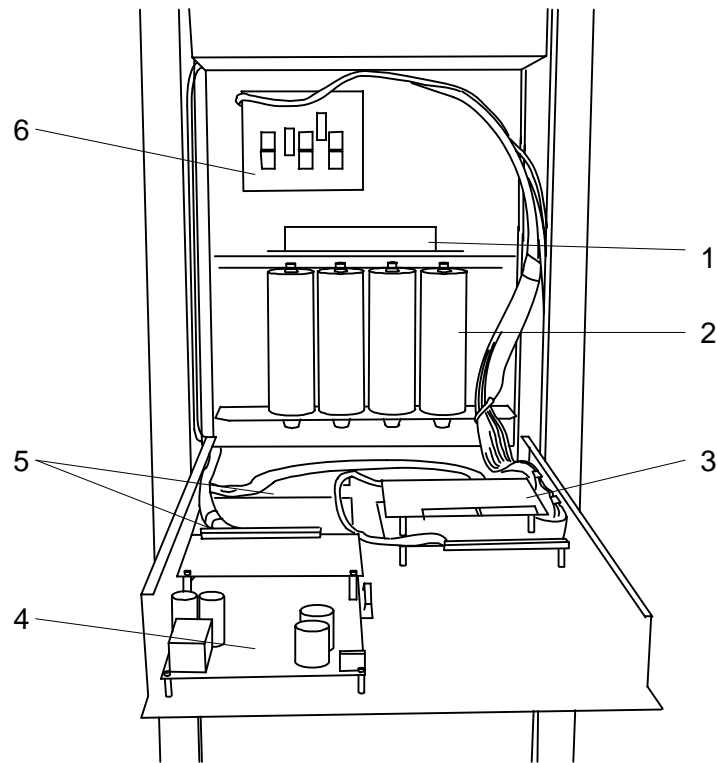


Figure 22 PCBs in the control unit pivot plate

Item	Slot	Designation
1	A1-A1	Inverter triggering
2	C42	Capacitor (number depending on capacity)
3	A17 A17-A1	Inverter interface Inverter control
4	A16 A16-A1	SBS interface SBS control
5	A91	Fuse protection and fan monitoring (front)
6	A1-A36	SBS triggering

Table 12 Legend for Figure 22