AMKASYN
Central inverter

Version: 2017/04
Part no.:   203346
Translation of the "Original Dokumentation"

AMK

Imprint

Name: PDK_203346_ZWR_en

Version:

Version: 2017/04	
Changes	**Letter symbol**
• Safety alert symbols changed to DIN EN ISO 7010	STL

Previous version: 2016/36

Product version:

Product AMK part no.	Firmware Version (AMK part no.)	Hardware Version (AMK part no.)
S 44-F0B	KE-E10 4.00 2012/17 (204105)	(E1032)
S 44-FTB	A5D 4.05 2011/43 (203921) (only S xx-xx**B**)	(E952)
S 44-W0B		(E1033)
S 44-WTB		(E1034)
S 50-FTB		(E954)
S 50-WTB		(E990)
S 60-F0B		(E1035)
S 60-W0B		(E956)
S 88-W00		(E957)
S 88-W0B		(E978)
S 88-WT0		(E958)
S 88-WTB		(E979)
S 100-WT0		(E959)
S 100-WTB		(E975)
S 120-W00		(E960)
S 120-W0B		(E976)
S 240-W00		(E1044)
S 240-W0B		(E980)

Service: Phone: +49 7021/50 05-190, Fax -193

For fast and reliable troubleshooting, you can help us by informing our Customer Service about the following:

- Type plate data for each unit
- Software version
- Device configuration and application
- Type of fault/problem and suspected cause
- Diagnostic messages (error messages)

E-mail: service@amk-antriebe.de

Internet address: www.amk-group.com

Content

1 About this documentation

1.1 Keeping this document

This document must permanently be available and readable at the place where the product is in use. If the product is used at another place or changed the owner, the document must be passed on.

1.2 Target group

Any person who is entitled and intends to carry out one of the following works must read, understand, and observe this document.

1.3 Purpose

This document is addressed to any person who handles the product. It gives information about the following topics:

1.4 Display conventions

Display	Meaning
	This symbol points to parts of the text to which particular attention should be paid!
0x	0x followed by a hexadecimal number, e. g. 0x500A
'Names'	e. g.: Calling up the function 'delete PLC program'
	Parameter names, e. g.: ID2 'SERCOS cycle time'
	Variable names, e. g.: The variable 'udAccel' contains the acceleration value.
	Diagnostic message, e. g.: 1042 'Mains phase fault'
	Safety parameters, e. g.: Prm67 'SMS safe maximum speed'
'Text'	Menu items and buttons in a software or on a controller, e. g.:
	Click the **'OK'** button in the **'Options'** menu to call up the 'Delete PLC program' function
>xxx<	Placeholder, variables, e. g. IP address of the controller: >192.168.0.1<
See 'chapter name' on page x	Executable cross-reference in electronic output media

1.5 Appendant documents

Certificates

Name	Title

Device descriptions

AMK part-no.	Title
28932	Servo drives KE/KW
200043	Liquid-cooled cold plate KW-CP
202975	Controllers A-series
204227	Central inverter - connectbox

Functional documentations

AMK part-no.	Title
202234	Software description AIPEX PRO
203704	Parameter description

2 For your safety

2.1 Basic notes

- At electrical drive systems, hazards are present in principle that can result in death or fatal injuries:
  - Electrical hazard (e. g. electric shock due to touch on electrical connections)
  - Mechanical hazard (e. g. crush, retract due to the rotation of the motor shaft)
  - Thermal hazard (e. g. burns due to touch on hot surfaces)
- These hazards are present while starting up and operating the unit, and also during servicing or maintenance work.
- Safety instructions in the documentation and on the product warn about the hazards.
- Personnel must have read and understood the safety instructions before installing and operating the product. In the documentation about the product the usage warnings pertain to direct hazards and must therefore be followed directly when operating or handling the product by the operator.
- AMK products must be kept in their original order, that means it is not allowed to do a significant constructional change on hardware side and software is not allowed to be decompiled and change the source code.
- Damaged or faulty products are not allowed to be integrated or put into operation.
- Do not start the system in which the AMK products are installed (begin of intended use) until you can determine that all relevant standards, laws, and directives have been complied with, e. g. low voltage directive, EMC directive, and the machinery directive, and possible further product standards. The plant manufacturer is responsible for the compliance with the laws, directives, and standards.
- The devices must be installed, electrically connected and operated as shown in the device description documentation. The technical data and the required environmental conditions must be observed at all times.

2.2 Presenting safety messages

Any safety information is configured as follows:

⚠ SIGNAL WORD	
Symbol	**Type and source of risk** Consequence(s) of non-observance **Steps to prevent:** • ...

2.3 Safety rules for handling electrical systems

In particular on drive systems, the instructions pertaining to safety and the following five safety rules have to be kept in the specified sequence:

1. Switch off electrical circuits (also electronic and auxiliary circuits).
2. Secure against being switched on again.
3. Determine that there is no voltage.
4. Earth and short circuit.
5. Cover or close off neighbouring parts that are under voltage.
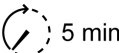
Reverse the measures taken in reverse order after completing the work.

2.4 Class of hazard

Safety and warning messages are graduated into classes of hazard (according to ANSI Z535). The class of hazard defines the risk if the safety message is not heeded and is defined by the signal word. The signal word is followed by a safety alert symbol (ISO 3864, DIN EN ISO 7010). In accordance with ANSI Z535, the following signal words are used to define the class of hazard.

Safety alert symbol and signal word	Class of hazard and its meaning
⚠ DANGER	DANGER indicates a hazardous situation which, if not avoided, **will** result in death or serious injury
⚠ WARNING	WARNING indicates a hazardous situation which, if not avoided, **could** result in death or serious injury
⚠ CAUTION	CAUTION, used with the safety alert symbol, indicates a hazardous situation which, if not avoided, **could** result in minor or moderate injury
NOTICE	NOTICE is used to address preventions to avoid material damage, but not related to personal injury.

2.5 Safety alert symbols used

Safety symbol	Meaning
⚠	Generic warning!
⚡ 5 min	Warning against dangerous electrical voltage! After being electrically disconnected, it takes at least 5 minutes until the energy storage is discharged.

2.6 Mandatory signs used

Mandatory sign	Meaning
🛈	Consult operating instruction!

2.7 General safety notes

- Electricity and pressure in the liquid cooling systems in central inverters present hazards that can pose a danger to life and cause material damage. These hazards are present in particular while starting up and during servicing or maintenance work.
- Personnel must read and understood the safety instructions before installing and operating the unit. In the documentation included with the product, the usage warnings pertain to direct hazards and must, therefore, be followed directly by the operator when operating or handling the unit.
- Do not start the system in which the products are installed (commencement of intended use) until you can determine that all relevant standards, laws, and directives have been complied with.

2.8 Intended use

The central inverters convert the direct voltage generated by photovoltaic modules or made available by accumulator controls into 3-phase alternating voltage and feed the energy generated into the low-voltage grid. A central inverter must be permanently connected to the low-voltage grid; mobile applications are not permitted.

The devices are approved for operation in enclosed spaces and not outdoors.

2.9 CE mark

AMK products have been constructed using the "State of the Art" and are safe to operate. AMK issues an EC / EU declaration of conformity for each of its products in which the standards and guidelines relevant for the product are listed. AMK also designates the products with the CE mark which signifies conformity to the standards.

2.10 Requirements for personnel and their qualification

Only authorised and qualified personnel may work on and with the AMK central inverter systems.

Specialised personnel must:

- Perform mechanical and electrical work that is described in this documentation, such as mounting and connecting
- Observe all information in the documentation accompanying the product in order to work with the product safely and in an error-free manner
- Understand and know hazards that occur when handling the product
- Know connections and functions of the system
- Be familiar with the control concept in order to operate the central inverter
- Be authorised to switch circuits and devices on and off, earth and label them
- Observe local specific safety requirements

2.11 Warranty

- All information in the documents accompanying the product must be complied with for safe and trouble-free operation and the assertion of warranty claims.
- The company AMK Arnold Müller GmbH & Co.KG is not liable for damages resulting from improper use, incorrect installation or operation, exceeding rated data values, and nonobservance of ambient conditions.

3 Produkt overview

3.1 Scope of delivery

Please check whether the delivered parts correspond with the delivery note. If the delivery is incomplete, please contact your nearest AMK representative.

Check the components for signs of transport damage after their arrival. Do not install and operate any damaged components.

If there is any transport damage, immediately inform the delivering freight carrier and inform your AMK representative.

3.2 Product description

AMK central inverters can be operated as standalone devices or networked via a fieldbus. In a fieldbus network, only one central inverter can be equipped with a controller. The central inverter with the controller controls both itself and all other connected inverters.

For optimum energy utilization, liquid-cooled central inverters can be connected to a heat exchanger. AMK supplies heat exchangers with suitable power ratings.

3.2.1 Central inverters for solar power plants

The solar inverters connected in series ("strings") are connected in parallel inside the connectbox. The connectbox is connected to the DC connection of the central inverter. Electricity is fed into the power supply voltage with sinusoidal power supply currents.

Up to three connectboxes each with up to 16 strings can be connected to each central inverter. In larger installations, multiple central inverters operating in parallel are controlled from a single shared operator panel.
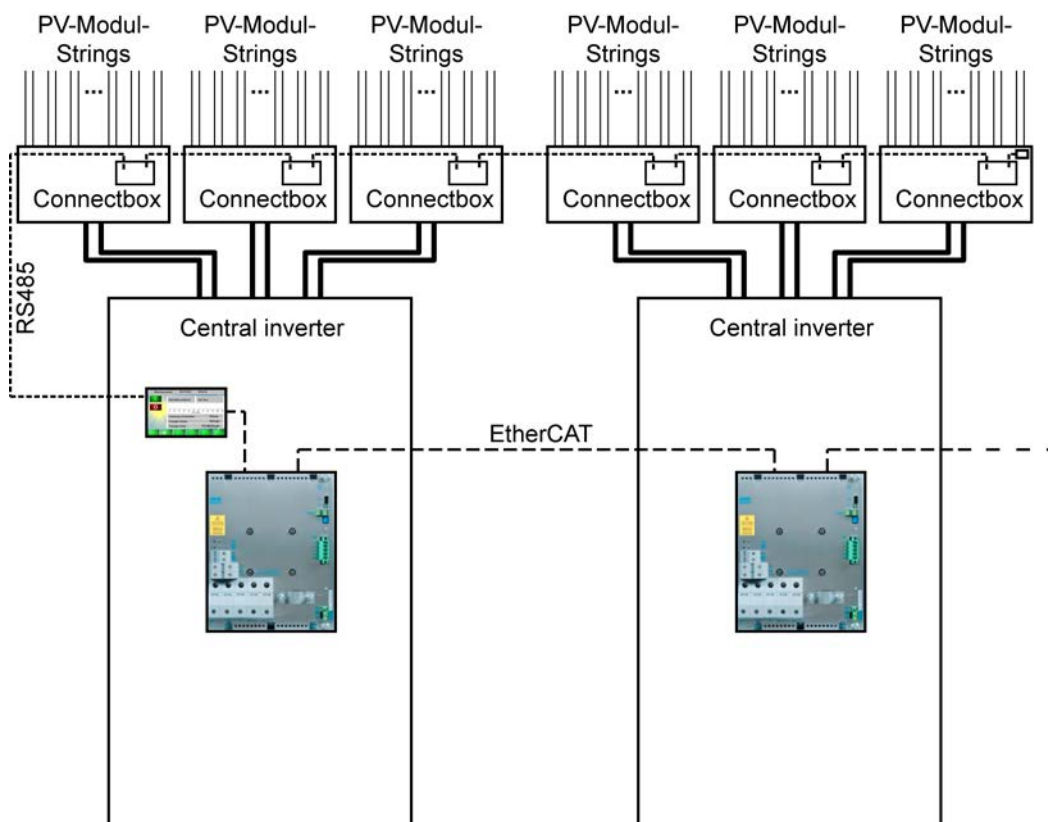
If the manufacturer of the solar cells prescribes grounding of the solar modules with the positive pole or the negative pole, the central inverter must be operated via a transformer with potential separation. AMK supplies solar inverters with and without transformers.
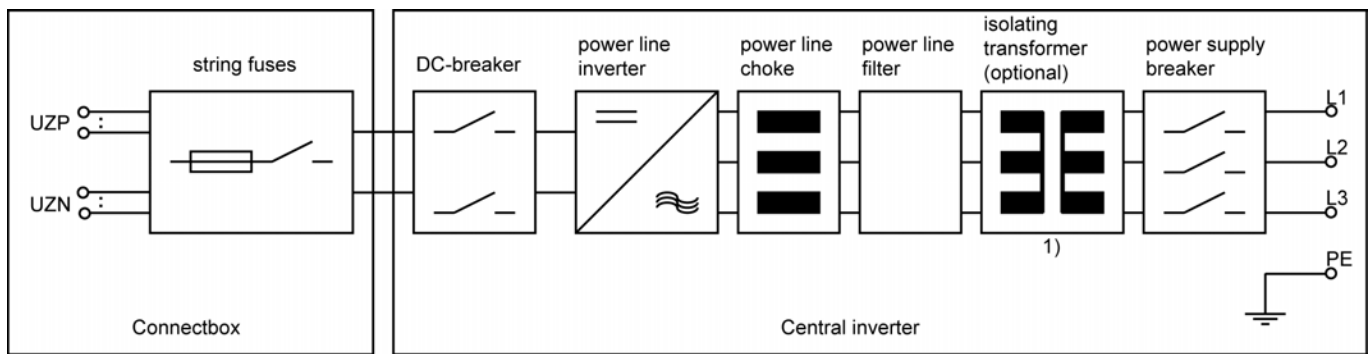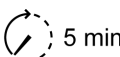
1)   S xx-x**T**x
         solar inverters only

A ripple control receiver is a mandatory requirement for solar power plants > 100kW. The local energy supplier can use the receiver to ripple the output voltage. Up to four absolute or percentage stages can be set. The ripple control receiver can be installed inside the switch cabinet.

3.3 Nameplate and type code

The nameplate is located on the right-hand / left-hand side panel of the central inverter cabinet.

It contains the following information (example S60-W0B):

Arnold Müller GmbH & Co. KG
Antriebs- und Steuerungstechnik
Gaußstrasse 37-39 . D-73230 Kirchheim/Teck
GERMANY

AMKASYN solar inverter

Type:	S60-W0B
Part number:	E956
Year of manufacture:	16/2012
Serial number:	1234567
Input values	
PV generator output power, max.	75 kW
MPP voltage range:	650 to 800 VDC
Output values	
Voltage:	3 x 400 VAC / 50 Hz
Current:	3 x 90 A
Power:	60 kW
Protection class:	IP 54
Ambient temperature:	0 to 50 °C
VDE 0126-1-1	

5 min

The type of central inverter results from the following type code:

S	xx	-	x	x	x

					0: without controller and operator panel
					B: with controller and operator panel
			0: without transformer		
			T: with transformer		
		F: with air cooling			
		W: with liquid cooling			
	Rated power [kW]				

S: central inverter for solar power plants (solar inverter)

Examples:

S 44-FTB	Central inverter for S 44 solar power plants, air cooling, with transformer, with operator panel
S 88-W0B	Central inverter for S 88 solar power plants, liquid cooling, with transformer, with operator panel
S 120-W00	Central inverter for S 120 solar power plants, liquid cooling, with transformer, without operator panel

3.4 Front view based on the example of the S50-WTB

Designation	Description
1	Switch cabinet footplate (can be removed for transport with lifting cart)
2	Door lock
3	Controller with operator panel
4	AC breaker (main switch)
5	Mounting lug, left (for attachment and lifting purposes)
6	Mounting lug, right (for attachment and lifting purposes)
7	Switch cabinet fan louver
8	Filter fan louver

3.5 Interieur view

S 44-W0B, S 44-WTB
S 50-WTB, S 60-W0B
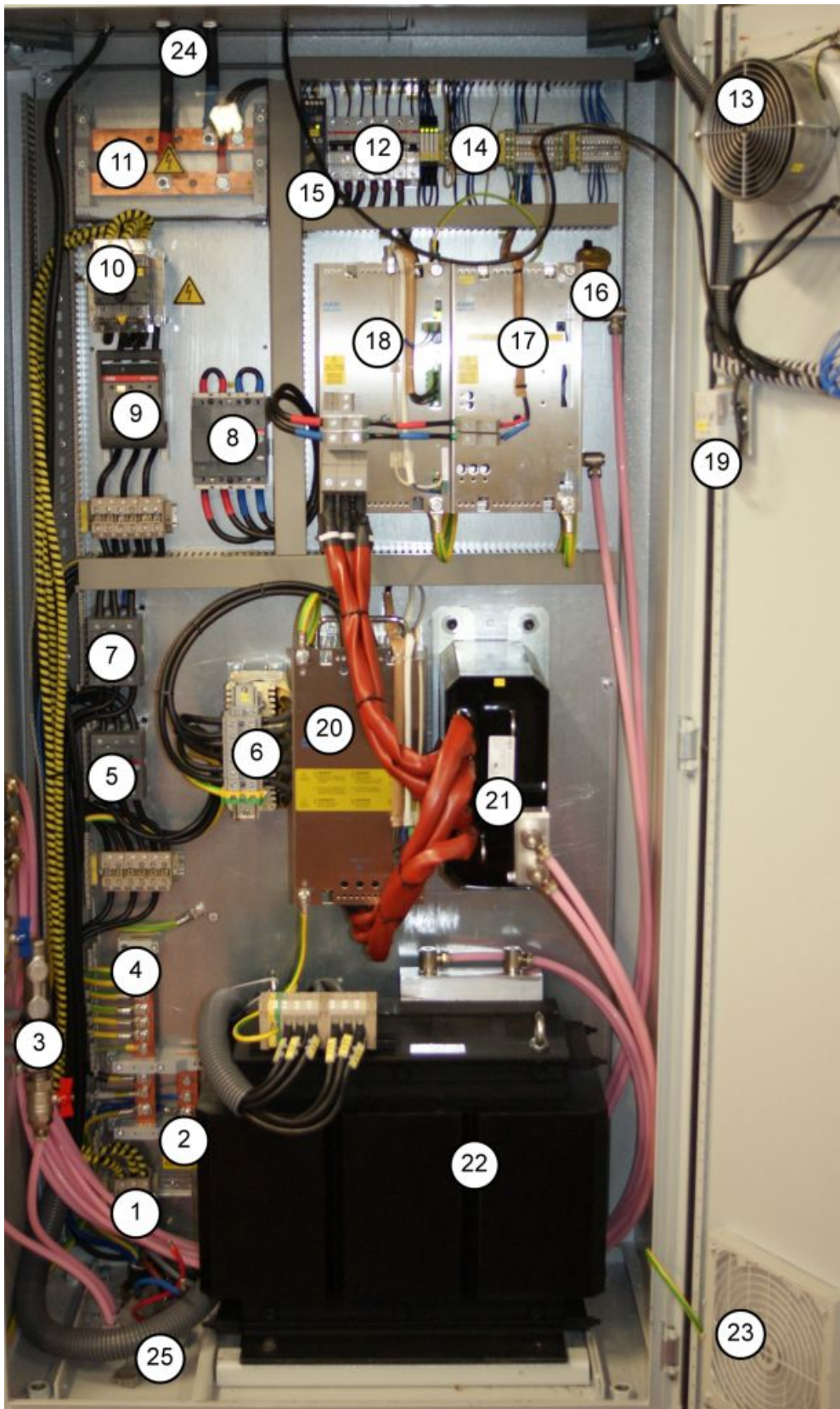
S 88-W00, S 88-WT0, S 88-W0B, S 88-WTB
S 100-WT0, S 100-WTB
S 120-W00, S 120-W0B
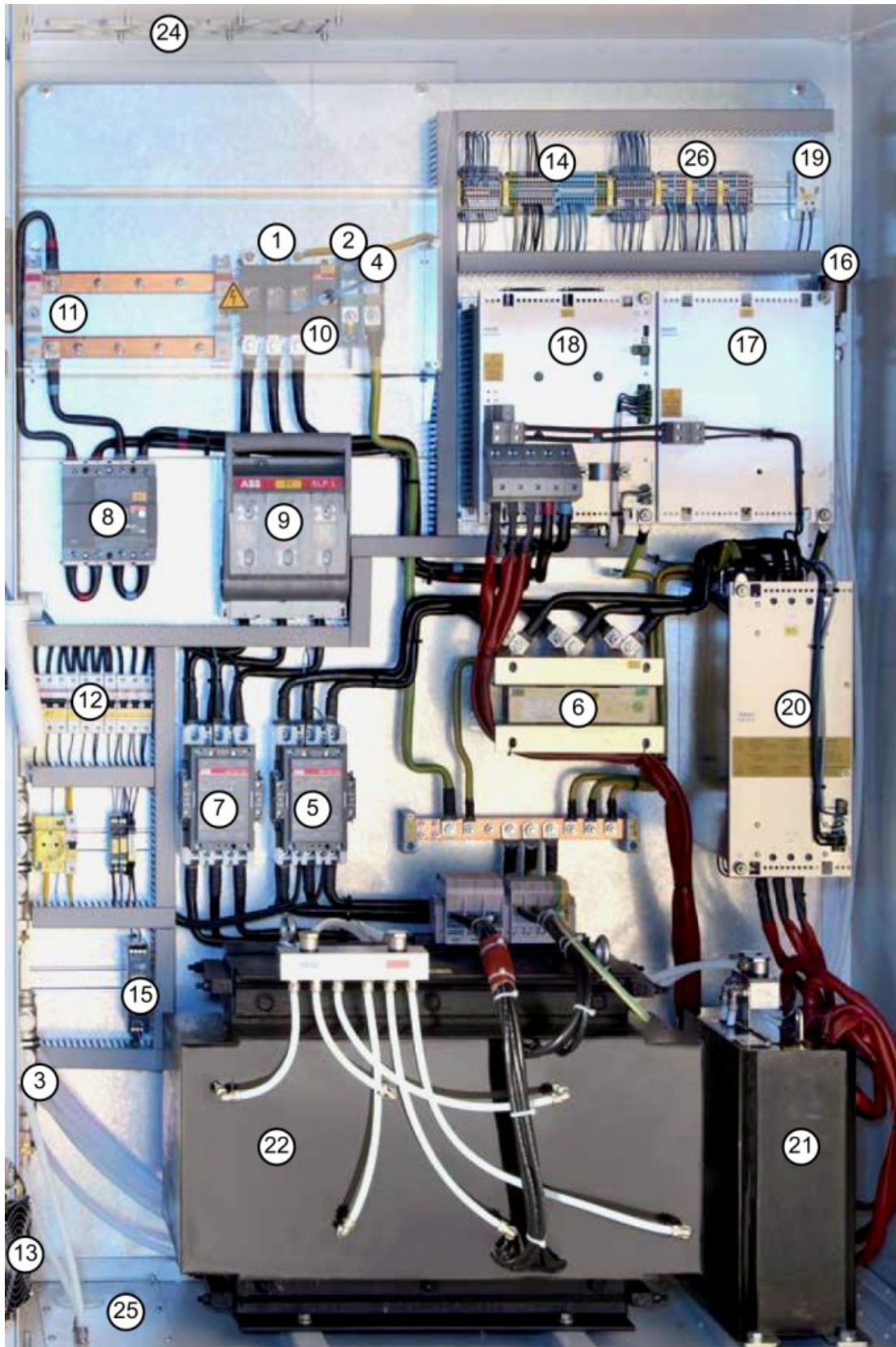
S 240-W00, S 240-W0B
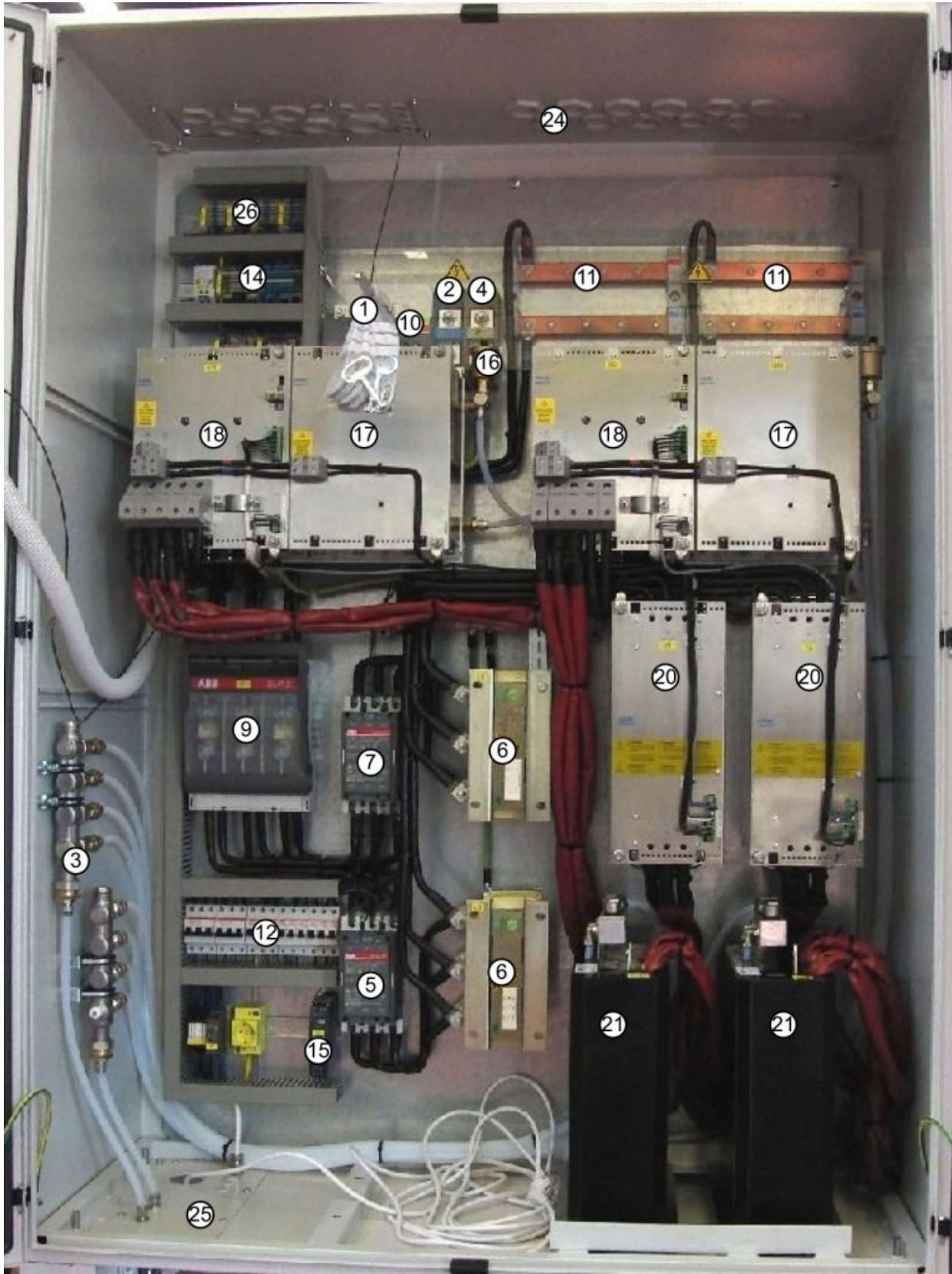
Designation	Identification	Description
1	-Q1	AC line supply
2	-X01	Connection for Neutral conductor
3		Connection for liquid cooling
4	-X07	Connection for PE
5	-K2	Line contactor 2 (between transformer and upstream choke)
6	-R1 / -R4	Upstream choke
7	-K1	Line contactor 1 (between transformer and AC connection)
8	-Q2 / -Q3	DC breaker
9	-F1	Fused breaker
10	-Q1	AC breaker (main switch)
11	-X05 / -X06	DC terminal bus
12		Fuses:
	-F7 / -F8	Fuse for charging circuit
	-F01	Fuse for socket outlet
	-F11	Fuse for heat exchanger
	-F12	Fuse for switch cabinet ventilation
	-F13	Fuse for 24 VDC supply
	-F14	Fuse for ripple control receiver (optional)
	-F15	Fuse for solenoid actuator fire brigade switch connectbox 1
	-F16	Fuse for solenoid actuator fire brigade switch connectbox 2
	-F17	Fuse for solenoid actuator fire brigade switch connectbox 3
13	-E4	Switch cabinet cooler
14	-X1	Terminal strip for heat exchanger (=S1-U3)
	-X01:2	230 VAC
	-X01:12	Neutral conductor
	-X01:PE	PE connection
15	-G1	24 VDC power supply unit
16		Automatic bleed valve for liquid circuit
17	-C2 / -C3	Additional capacitor
18	-T2 / -T3	Inverter KES
19	-SE4	Switch cabinet thermostat
20	-R2 / -R5	Power line filter
21	-R3 / -R6	Power line choke
22	-T1	Transformer (devices with transformer only)
23		Filter fan
24		Cable passage top
25		Cable passage bottom
26	-X21 / -X22 / -X23	Terminal strips for controlling the fire brigade switch
27	-C1	UPS

3.6 Technical data

3.6.1 Ambient conditions for operation

AC grid connection **Grid operation requirements acc. to** **EN 61800-2 Section 4.1.1 or** **EN 60204-1 Section 4.3**	A symmetrical three-phase power supply is required (TN-S (4-conductor), TN-C, TN-C-S, TT, (4-conductor), grounded at neutral point. The max. permitted voltage imbalance is 3%. The AC power supply must be feedback-capable.
Reference potential:	PE

Limit values for radio interference voltages acc. to EN 61800-3: (2000) Acc. to Section 6.3.2 Table 11 and Table 12

Ambient conditions Acc. to EN50178, Tab. 7 and EN 61800-2 Section 4.1.2

Protection class as per EN 60529: IP 54

Ambient temperature: 0 °C to +50 °C

Temperature of the coolant: < 40 °C

Relative air humidity: 0% to 85%, without condensation

Installation altitude: Up to 1,000 m above sea level. If installed at altitudes above 1,000 m up to a maximum of 2,000 m above sea level, the nominal data must be lowered by 1% per 100 m.

Installation position: Upright

Shock resistance: 15 g for 11 ms acc. to EN 60068-2-27

Vibration stress: 1 g at 10 - 150 Hz acc. to EN 60068-2-6

Signal voltage for binary outputs acc. to VDI 2880

Output voltage: 24 VDC

Rated current: 0.1 A

A suppressor for inductive loads is integrated.

3.6.2 S 44-F0B, S 44-W0B, S 44-FTB, S 44-WTB

Data	S 44-F0B air-cooled	S 44-W0B liquid-cooled	S 44-FTB air-cooled	S 44-WTB liquid-cooled
Input values				
PV generator output power, max.	55 kW		55 kW	
MPP (maximum power point) voltage range	430 to 800 VDC		430 to 800 VDC	
Open-circuit voltage, max.	900 VDC		900 VDC	
Input current, max.	128 A		128 A	
Output values				
Rated power	44 kW		44 kW	
Maximum power	48.4 kW		48.4 kW	
Power supply voltage	3 x 280 VAC ±10%		3 x 400 VAC ±10%	
Rated current	90 A		63 A	
Grid frequency / range	50 Hz / 47 to 63 Hz		50 Hz / 47 to 63 Hz	
Infeed phases	L1, L2, and L3		L1, L2, and L3	
Communication / connections				
Display	7" touch screen operator panel		7" touch screen operator panel	
Interfaces	Ethernet		Ethernet	
Fault message	Output 24 VDC, 100 mA		Output 24 VDC, 100 mA	
DC connections	Screw connections		Screw connections	
AC connections	Screw connections		Screw connections	
System data				
Power factor	> 0.98		> 0.98	
Maximum efficiency [*]	97.3%		95.3%	94.9%
European efficiency [*]	96.9%		94.9%	94.5%
Ambient temperature	0 to 40 °C; up to 50 °C with derating		0 to 40 °C; up to 50 °C with derating	
Relative air humidity	0 to 85%, without condensation		0 to 85%, without condensation	
Power loss liquid cooling	-	< 920 W	-	< 1950 W
Power loss air cooling	< 1250 W	< 290 W	< 2050 W	< 290 W
Internal power consumption during operation	< 640 W	< 350 W	< 640 W	< 350 W
Internal power consumption during overnight shutdown	10 W		10 W	
Protection class	IP 54		IP 54	
CE compliant according to	EN 61000-6-2, EN 610000-6-4, EN 50178		EN 61000-6-2, EN 610000-6-4, EN 50178	
Main switch for power supply	yes	yes	yes	yes
Main fuse for power supply	yes	yes	yes	yes
Main contactor for power supply	yes	yes	yes	yes
Isolating transformer	no	no	yes	yes
DC breaker	yes	yes	yes	yes
Housing	Switch cabinet	Switch cabinet	Switch cabinet	Switch cabinet
Dimensions H x W x D [mm]	1900 x 900 x 500	2000 x 900 x 500	1900 x 900 x 500	2000 x 900 x 500
Weight	250 kg		450 kg	

[*] Efficiency measured without internal power consumption

3.6.3 S 50-FTB, S 50-WTB

Data	S 50-FTB air-cooled	S 50-WTB liquid-cooled
Input values		
PV generator output power, max.	62.5 kW	
MPP (maximum power point) voltage range	520 to 800 VDC	
Open-circuit voltage, max.	900 VDC	
Input current, max.	120 A	
Output values		
Rated power	50 kW	
Maximum power	55 kW	
Power supply voltage	3 x 400 VAC ±10%	
Rated current	72 A	
Grid frequency / range	50 Hz / 47 to 63 Hz	
Infeed phases	L1, L2, and L3	
Communication / connections		
Display	7" touch screen operator panel	
Interfaces	Ethernet	
Fault message	Output 24 VDC, 100 mA	
DC connections	Screw connections	
AC connections	Screw connections	
System data		
Power factor	> 0.98	
Maximum efficiency [*]	95.6%	95.2%
European efficiency [*]	95.2%	94.8%
Ambient temperature	0 to 40 °C; up to 50 °C with derating	
Relative air humidity	0 to 85%, without condensation	
Power loss liquid cooling	-	< 2120 W
Power loss air cooling	< 2200 W	< 290 W
Internal power consumption during operation	< 640 W	< 350 W
Internal power consumption during overnight shutdown	10 W	
Protection class	IP 54	
CE compliant according to	EN 61000-6-2, EN 610000-6-4, EN50178	
Main switch for power supply	yes	yes
Main fuse for power supply	yes	yes
Main contactor for power supply	yes	yes
Isolating transformer	yes	yes
DC breaker	yes	yes
Housing	Switch cabinet	Switch cabinet
Dimensions H x W x D [mm]	1900 x 900 x 500	2000 x 900 x 500
Weight	450 kg	

[*] Efficiency measured without internal power consumption

3.6.4 S 60-F0B, S 60-W0B

Data	S 60-F0B air-cooled	S 60-W0B liquid-cooled
Input values		
PV generator output power, max.	75 kW	
MPP (maximum power point) voltage range	650 to 800 VDC	
Open-circuit voltage, max.	900 VDC	
Input current, max.	115 A	
Output values		
Rated power	60 kW	
Maximum power	66 kW	
Power supply voltage	3 x 400 VAC ±10%	
Rated current	90 A	
Grid frequency / range	50 Hz / 47 to 63 Hz	
Infeed phases	L1, L2, and L3	
Communication / connections		
Display	7" touch screen operator panel	
Interfaces	Ethernet	
Fault message	Output 24 VDC, 100 mA	
DC connections	Screw connections	
AC connections	Screw connections	
System data		
Power factor	> 0.98	
Maximum efficiency [*]	97.7%	
European efficiency [*]	97.3%	
Ambient temperature	0 to 40 °C; up to 50 °C with derating	
Relative air humidity	0 to 85%, without condensation	
Power loss liquid cooling	-	< 1090 W
Power loss air cooling	< 1410 W	< 290 W
Internal power consumption during operation	< 640 W	< 350 W
Internal power consumption during overnight shutdown	10 W	
Protection class	IP 54	
CE compliant according to	EN 61000-6-2, EN 610000-6-4, EN50178	
Main switch for power supply	yes	yes
Main fuse for power supply	yes	yes
Main contactor for power supply	yes	yes
Isolating transformer	no	no
DC breaker	yes	yes
Housing	Switch cabinet	Switch cabinet
Dimensions H x W x D [mm]	1900 x 900 x 500	2000 x 900 x 500
Weight	250 kg	

[*] Efficiency measured without internal power consumption

3.6.5 S 88-W00, S 88-W0B, S 88-WT0, S 88-WTB

Data	S 88-W00 liquid-cooled	S 88-W0B liquid-cooled	S 88-WT0 liquid-cooled	S 88-WTB liquid-cooled
Input values				
PV generator output power, max.	110 kW		110 kW	
MPP (maximum power point) voltage range	430 to 800 VDC		430 to 800 VDC	
Open-circuit voltage, max.	900 VDC		900 VDC	
Input current, max.	256 A		256 A	
Output values				
Rated power	88 kW		88 kW	
Maximum power	96.8 kW		96.8 kW	
Power supply voltage	3 x 280 VAC ±10%		3 x 400 VAC ± 10%	
Rated current	180 A		126 A	
Grid frequency / range	50 Hz / 47 to 63 Hz		50 Hz / 47 to 63 Hz	
Infeed phases	L1, L2, and L3		L1, L2, and L3	
Communication / connections				
Display	-	7" touch screen operator panel	-	Touch screen operator panel
Interfaces	-	Ethernet	-	Ethernet
Fault message	Output 24 VDC, 100 mA		Output 24 VDC, 100 mA	
DC connections	Screw connections		Screw connections	
AC connections	Screw connections		Screw connections	
System data				
Power factor	> 0.98		> 0.98	
Maximum efficiency [*]	97.5%		95.6%	
European efficiency [*]	97.1%		95.2%	
Ambient temperature	0 to 40 °C; up to 50 °C with derating		0 to 40 °C; up to 50 °C with derating	
Relative air humidity	0 to 85%, without condensation		0 to 85%, without condensation	
Power loss liquid cooling	< 1820 W	< 1820 W	< 3400 W	< 3400 W
Power loss air cooling	< 410 W	< 410 W	< 560 W	< 560 W
Internal power consumption during operation	< 450 W	< 450 W	< 450 W	< 450 W
Internal power consumption during overnight shutdown	10 W		10 W	
Protection class	IP 54		IP 54	
CE compliant according to	EN 61000-6-2, EN 610000-6-4, EN50178		EN 61000-6-2, EN 610000-6-4, EN50178	
Main switch for power supply	yes	yes	yes	yes
Main fuse for power supply	yes	yes	yes	yes
Main contactor for power supply	yes	yes	yes	yes
Isolating transformer	no	no	yes	yes
DC breaker	yes	yes	yes	yes
Housing	Switch cabinet	Switch cabinet	Switch cabinet	Switch cabinet
Dimensions H x W x D [mm]	2000 x 1300 x 600	2000 x 1300 x 600	2000 x 1300 x 600	2000 x 1300 x 600
Weight	405 kg		800 kg	

[*] Efficiency measured without internal power consumption

3.6.6 S 100-WT0, S 100-WTB

Data	S 100-WT0 liquid-cooled	S 100-WTB liquid-cooled
Input values		
PV generator output power, max.	125 kW	
MPP (maximum power point) voltage range	520 to 800 VDC	
Open-circuit voltage, max.	900 VDC	
Input current, max.	240 A	
Output values		
Rated power	100 kW	
Maximum power	110 kW	
Power supply voltage	3 x 400 VAC ±10%	
Rated current	144 A	
Grid frequency / range	50 Hz / 47 to 63 Hz	
Infeed phases	L1, L2, and L3	
Communication / connections		
Display	-	7" touch screen operator panel
Interfaces	-	Ethernet
Fault message	Output 24 VDC, 100 mA	
DC connections	Screw connections	
AC connections	Screw connections	
System data		
Power factor	> 0.98	
Maximum efficiency [*]	95.5%	
European efficiency [*]	95.1%	
Ambient temperature	0 to 40 °C; up to 50 °C with derating	
Relative air humidity	0 to 85%, without condensation	
Power loss liquid cooling	< 4100 W	< 4100 W
Power loss air cooling	< 560 W	< 560 W
Internal power consumption during operation	< 450 W	< 450 W
Internal power consumption during overnight shutdown	10 W	
Protection class	IP 54	
CE compliant according to	EN 61000-6-2, EN 610000-6-4, EN50178	
Main switch for power supply	yes	yes
Main fuse for power supply	yes	yes
Main contactor for power supply	yes	yes
Isolating transformer	yes	yes
DC breaker	yes	yes
Housing	Switch cabinet	Switch cabinet
Dimensions H x W x D [mm]	2000 x 1300 x 600	2000 x 1300 x 600
Weight	800 kg	800 kg

[*] Efficiency measured without internal power consumption

3.6.7 S 120-W00, S 120-W0B

Data	S 120-W00 liquid-cooled	S 120-W0B liquid-cooled
Input values		
PV generator output power, max.	150 kW	
MPP (maximum power point) voltage range	650 to 800 VDC	
Open-circuit voltage, max.	900 VDC	
Input current, max.	230 A	
Output values		
Rated power	120 kW	
Maximum power	132 kW	
Power supply voltage	3 x 400 VAC ±10%	
Rated current	180 A	
Grid frequency / range	50 Hz / 47 to 63 Hz	
Infeed phases	L1, L2, and L3	
Communication / connections		
Display	-	7" touch screen operator panel
Interfaces	-	Ethernet
Fault message	Output 24 VDC, 100 mA	
DC connections	Screw connections	
AC connections	Screw connections	
System data		
Power factor	> 0.98	
Maximum efficiency [*]	97.8%	
European efficiency [*]	97.4%	
Ambient temperature	0 to 40 °C; up to 50 °C with derating	
Relative air humidity	0 to 85%, without condensation	
Power loss liquid cooling	< 2190 W	< 2190 W
Power loss air cooling	< 410 W	< 410 W
Internal power consumption during operation	< 450 W	< 450 W
Internal power consumption during overnight shutdown	10 W	
Protection class	IP 54	
CE compliant according to	EN 61000-6-2, EN 610000-6-4, EN50178	
Main switch for power supply	yes	yes
Main fuse for power supply	yes	yes
Main contactor for power supply	yes	yes
Isolating transformer	no	no
DC breaker	yes	yes
Housing	Switch cabinet	Switch cabinet
Dimensions H x W x D [mm]	2000 x 1300 x 600	2000 x 1300 x 600
Weight	405 kg	

[*] Efficiency measured without internal power consumption

3.6.8 S 240-W00, S 240-W0B

Data	S 240-W00 liquid-cooled	S 240-W0B liquid-cooled
Input values		
PV generator output power, max.	300 kW	
MPP (maximum power point) voltage range	650 to 800 VDC	
Open-circuit voltage, max.	900 VDC	
Input current, max.	460 A	
Output values		
Rated power	240 kW	
Maximum power	264 kW	
Power supply voltage	3 x 400 VAC ±10%	
Rated current	360 A	
Grid frequency / range	50 Hz / 47 to 63 Hz	
Infeed phases	L1, L2, and L3	
Communication / connections		
Display	-	7" touch screen operator panel
Interfaces	-	Ethernet
Fault message	Output 24 VDC, 100 mA	
DC connections	Screw connections	
AC connections	Screw connections	
System data		
Power factor	> 0.98	
Maximum efficiency [*]	97.8%	
European efficiency [*]	97.4%	
Ambient temperature	0 to 40 °C; up to 50 °C with derating	
Relative air humidity	0 to 85%, without condensation	
Power loss liquid cooling	< 4380 W	< 4380 W
Power loss air cooling	< 820 W	< 820 W
Internal power consumption during operation	< 900 W	< 900 W
Internal power consumption during overnight shutdown	10 W	
Protection class	IP 54	
CE compliant according to	EN 61000-6-2, EN 610000-6-4, EN50178	
Main switch for power supply	yes	yes
Main fuse for power supply	yes	yes
Main contactor for power supply	yes	yes
Isolating transformer	no	no
DC breaker	yes	yes
Housing	Switch cabinet	
Dimensions H x W x D [mm]	2000 x 1300 x 600	
Weight, approx.	700 kg	

[*] Efficiency measured without internal power consumption

4 Storage and transport

⚠ WARNING

Danger of tipping over! There is a risk of personal injury caused by the switch cabinet tipping over during transport, assembly, and operation. Serious crushing of limbs may occur.
 	
Countermeasures:
  • Secure the switch cabinet to prevent tipping over (with the lugs on the top)
  • Do not enter the hazardous area and keep a sufficient distance away

The central inverter must be stored, transported, and operated in an upright position. It can be lifted and moved from underneath with a lifting cart.

- Ambient temperature: –25 °C and +75 °C
- Maximum relative humidity: 95%
- Maximum altitude: 2,000 m above sea level
- Protect devices against condensation
- Store and transport in original packaging
- Keep clean, dry, and protected from the weather
- Protected against sudden changes in temperature and humidity
- Protected against salt spray, industrial gases, corrosive liquids, rodents, and fungal infestation
- Storage period up to 1 year under storage conditions pursuant to EN 61800-2

5 Mounting

5.1 For your Safety

⚠ WARNING	
⚠	**Danger of tipping over!** There is a risk of personal injury caused by the switch cabinet tipping over during transport, assembly, and operation. Serious crushing of limbs may occur. **Countermeasures:** • Secure the switch cabinet to prevent tipping over (with the lugs on the top) • Do not enter the hazardous area and keep a sufficient distance away

5.2 Installation location

- Applicable ambient conditions:
- The drier the environment, the longer the life cycle of the central inverter
- Central inverters for solar power plants are not approved for use outdoors
- The front of the switch cabinet must remain unobstructed to ensure sufficient aeration and deaeration and safeguard access via the door for service and maintenance work.
- The floor must be able to withstand the weight of the switch cabinet.
- There is no need for clearance between the switch cabinet and neighboring equipment and objects at the side and to the rear.

5.3 Liquid cooling

Liquid cooling is only available for central inverter designations S xx-**W**xx:
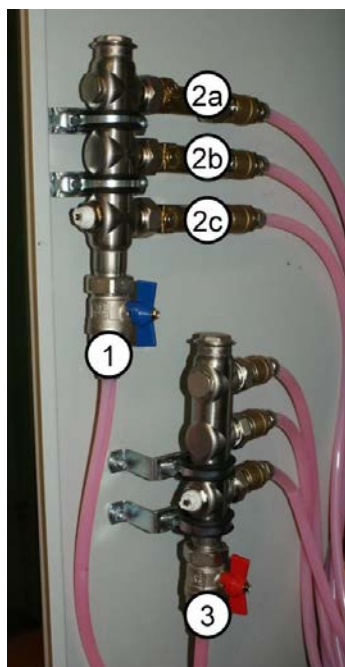
Designation	Description
1	Connection for coolant, cold
	Flow volume controller for
2a	Cooling plate KES inverter
2b	Power line choke
2c	Transformer (devices with transformer only)
3	Connection for coolant, warm

The cold and warm connections for the coolant must be clearly labeled on the volume flow limiter. The flow volume limiter is always installed in the liquid cooling cold connection.

If the cold and warm coolant connections are mixed up, the coolant circuit will not function!

The connections for liquid cooling are located on the underside of the central inverter (bulkhead fitting with bend protection)

6 Electrical connections

6.1 For your safety

⚠ **DANGER**	
⚠	**Danger to life from touching electrical connections!** Electrical terminals and connectors carry voltages that may cause death or serious injury upon contact. When the LEDs on the front panels are OFF, this does not indicate that the electrical terminals have been de-energized. **Steps to prevent:** • Prior to any work on the device: Observe the 5 safety rules. • Measure the terminal voltages. There may be no voltage present. • Plug and pull connections only when there is no voltage. • For devices that are connected to a DC bus, you need to consider the discharge times of the dc bus capacitors mentioned in the converter documentation • Before commencing work, the connections must be isolated from the voltage supply at both ends! (both ends mean: AC and DC bus supply side)

6.2 AC line supply

⚠ **DANGER**	
⚠	**Danger to life from touching electrical connections!** Electrical terminals and connectors carry voltages that may cause death or serious injury upon contact. When the LEDs on the front panels are OFF, this does not indicate that the electrical terminals have been de-energized. **Steps to prevent:** • Prior to any work on the device: Observe the 5 safety rules. • Measure the terminal voltages. There may be no voltage present. • Plug and pull connections only when there is no voltage. • For devices that are connected to a DC bus, you need to consider the discharge times of the dc bus capacitors mentioned in the converter documentation • Before commencing work, the connections must be isolated from the voltage supply at both ends! (both ends mean: AC and DC bus supply side)

6.2.1 Connection for PE and the neutral conductor

⚠ **DANGER**	
⚠	**Danger to life from electrical shock!** In the event of an interruption to the PE connection, avoid touching the casing and the switch cabinet because life-threatening levels of voltage may be present! **Steps to prevent:** • EN 50178 requires that the devices be firmly connected on the power side.

S 44-x, S 50-x, S 60-x

S 88-x, S 100-x, S 120-x

Designation	Description
1	PE connection
2	Neutral conductor connection

6.2.2 Connect phases L1, L2, L3

⚠ DANGER

	Danger to life from touching electrical connections!
⚠	Electrical terminals and connectors carry voltages that may cause death or serious injury upon contact.
	When the LEDs on the front panels are OFF, this does not indicate that the electrical terminals have been de-energized.
	Steps to prevent:
	• Prior to any work on the device: Observe the 5 safety rules.
	• Measure the terminal voltages. There may be no voltage present.
	• Plug and pull connections only when there is no voltage.
	• For devices that are connected to a DC bus, you need to consider the discharge times of the dc bus capacitors mentioned in the converter documentation
	• Before commencing work, the connections must be isolated from the voltage supply at both ends! (both ends mean: AC and DC bus supply side)

S 44-x, S 50-x, S 60-x
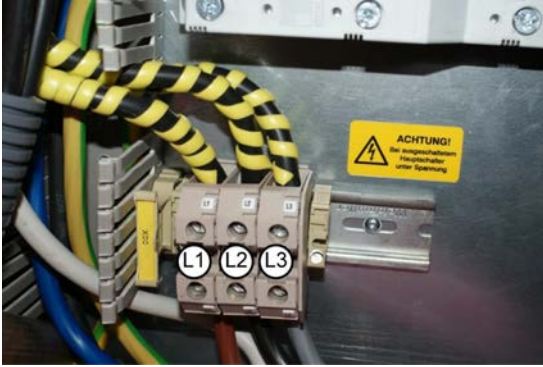
S 88-x, S 100-x, S 120-x
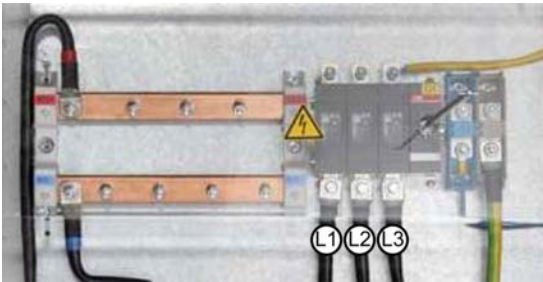
6.3 DC connection

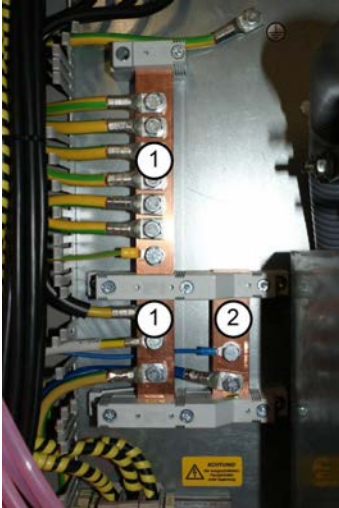| ⚠ **DANGER**	
⚡	**Danger to life from touching electrical connections!** Electrical terminals and connectors carry voltages that may cause death or serious injury upon contact. When the LEDs on the front panels are OFF, this does not indicate that the electrical terminals have been de-energized. **Steps to prevent:** • Prior to any work on the device: Observe the 5 safety rules. • Measure the terminal voltages. There may be no voltage present. • Plug and pull connections only when there is no voltage. • For devices that are connected to a DC bus, you need to consider the discharge times of the dc bus capacitors mentioned in the converter documentation • Before commencing work, the connections must be isolated from the voltage supply at both ends! (both ends mean: AC and DC bus supply side)

For the connection of the DC cables, the perspex cover must be removed. The cables must be assembled with a cable lug. The DC bus has bore holes with internal thread to accommodate M10 screws.

The perspex cover must be screwed back into place immediately as soon as the DC cables have been connected to the DC bus.

S 44-x, S 50-x, S 60-x

S 88-x, S 100-x, S 120-x
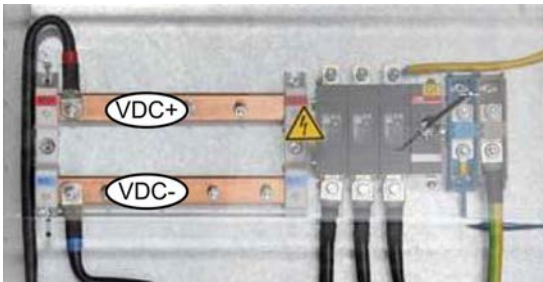
6.4 Connection of the liquid cooler

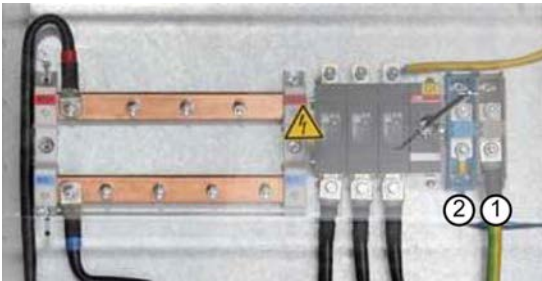| ⚠ **DANGER**	
⚡	**Danger to life from touching electrical connections!** Electrical terminals and connectors carry voltages that may cause death or serious injury upon contact. When the LEDs on the front panels are OFF, this does not indicate that the electrical terminals have been de-energized. **Steps to prevent:** • Prior to any work on the device: Observe the 5 safety rules. • Measure the terminal voltages. There may be no voltage present. • Plug and pull connections only when there is no voltage. • For devices that are connected to a DC bus, you need to consider the discharge times of the dc bus capacitors mentioned in the converter documentation • Before commencing work, the connections must be isolated from the voltage supply at both ends! (both ends mean: AC and DC bus supply side)

The liquid cooler is connected to terminal block -X11 terminal 2 (220 V), terminal 12 (neutral conductor), and PE.

6.5 Central inverter with controller

6.5.1 Interface overview of the controller
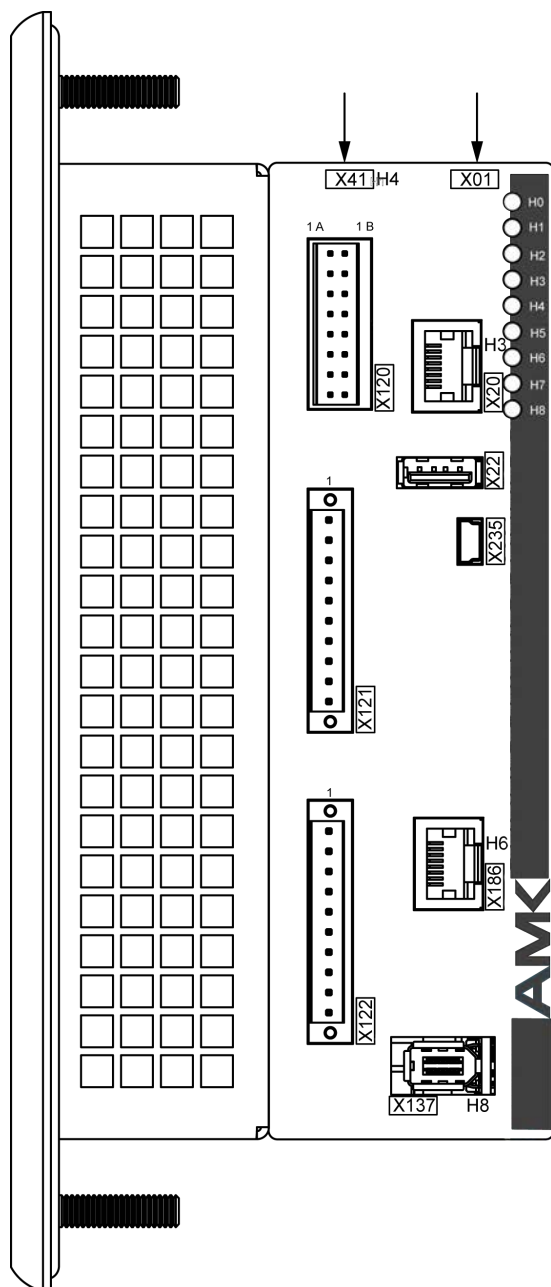
Connection / LED	Use
X01	Voltage supply (power supply)
X20 / H3	Ethernet
X22	USB host
X41	Reserved
X120	Analog inputs and rectangular input
X121	Binary inputs
X122	Binary outputs and probe inputs
X137 / H8	ACC bus master
X186 / H6	Real-time Ethernet master
X235	USB device

6.5.2 [X20] Ethernet

Description:

The Ethernet interface connects the controller to a network.

Status LED H3		Meaning
Off		No physical connection
Green	continuous	Ethernet in link mode (physical connection)
Green / orange	flashing	Ethernet in link/activity mode (connection with data traffic)

Technical data:

- 10/100BASE-T
- Data frame and assignment of the RJ45 socket acc. to IEEE802.3

Style:

Type	Poles	Class
RJ45	8	Female

Assignment:

Drawing	Connection	Signal	Direction	Description
12345678	1	Tx+	O	Transmit data +
	2	Tx-	O	Transmit data -
	3	Rx+	I	Receive data +
	4	-	-	Reserved
	5	-	-	Reserved
	6	Rx-	I	Receive data -
	7	-	-	Reserved
	8	-	-	Reserved

Connection:

Mating plug	RJ45
Cable type	4-wire, patch cable of the category CAT5e, shielded
Cross-section	0.32 mm² / AWG 22
Shield connection	Both sides
Cable assembly	Prefabricated cables:

6.5.3 [X22] USB host

Description:

The USB interface can be connected to:

- USB memory media, e.g. USB memory sticks, external USB hard disk
- USB converters, e.g. USB - serial to connect a remote maintenance modem
- Keyboard and mouse via USB hub for controllers with display
  Note: The USB device must be connected before power on the controller
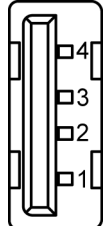
Technical data:

- USB 2.0 with 480 Mbit/s

Style:

Type	Poles	Class	Designation
USB	4	Female	USB type A

Assignment:

Drawing	Connection	Signal	Direction	Description
	1	+5 VDC	O	5 VDC supply for external USB device, maximum current load 500 mA
	2	D–	I/O	Data -
	3	D+	I/O	Data +
	4	GND	O	Reference potential supply

Connection:

Mating plug	USB type A
Cable type	Data - and Data + twisted-pair, shielded
Cross-section	0.08 mm² / AWG 28
Shield connection	Both sides

6.5.4 [X186] Real-time Ethernet master (EtherCAT SoE)

Description:

The real-time Ethernet master interface supports the protocol EtherCAT SoE. The interface contains a status LED (H6) that indicates the current condition of the bus connection.

Status LED H6		Meaning
Off		No physical connection
Green	continuous	EtherCAT in operational mode
	flashing	EtherCAT in pre-operational mode
	flashing (once)	EtherCAT in save-operational mode
Orange	continuous	EtherCAT in link mode (physical connection)
	flashing	EtherCAT in link/activity mode (connection with data traffic)
Red	flashing	General configuration error (hardware error or bus configuration error)
	flashing (once)	Slave leaves the operational mode.
	flashing (twice)	One data package could not be received/sent.
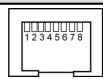
Technical data:

- 100BASE-T 100 Mbit/s Ethernet standard
- Data frame and assignment of the RJ45 socket acc. to IEEE802.3
- Maximum length 50 m (industrial environment)

Style:

Type	Poles	Class
RJ45	8	Female

Assignment:

Drawing	Connection	Signal	Direction	Description
	1	TX+	A	Transmit data +
	2	TX-	A	Transmit data -
	3	RX+	E	Receive data +
	4	-	-	Reserved
	5	-	-	Reserved
	6	RX-	E	Receive data -
	7	-	-	Reserved
	8	-	-	Reserved

Connection:

Mating plug	RJ45
Cable type	Patch cable of the category CAT5e, shielded
Cross-section	0.32 mm² / AWG 22
Shield connection	Both sides
Cable assembly	Prefabricated cables:

6.5.5 [X235] USB device (i.p.)

The USB device interface is not supported.

Mating plug	RJ45
Cable type	Patch cable of the category CAT5e, shielded
Cross-section	0.32 mm² / AWG 22

7 Startup

7.1 For your safety

⚠ **DANGER**
⚡	**Danger to life from touching electrical connections!** Electrical terminals and connectors carry voltages that may cause death or serious injury upon contact. When the LEDs on the front panels are OFF, this does not indicate that the electrical terminals have been de-energized. **Steps to prevent:** • Prior to any work on the device: Observe the 5 safety rules. • Measure the terminal voltages. There may be no voltage present. • Plug and pull connections only when there is no voltage. • For devices that are connected to a DC bus, you need to consider the discharge times of the dc bus capacitors mentioned in the converter documentation • Before commencing work, the connections must be isolated from the voltage supply at both ends! (both ends mean: AC and DC bus supply side)

⚠ **DANGER**
⚡	**Danger to life from electrical shock!** In the event of an interruption to the PE connection, avoid touching the casing and the switch cabinet because life-threatening levels of voltage may be present! **Steps to prevent:** • EN 50178 requires that the devices be firmly connected on the power side.

7.2 Preparation

⚠ **CAUTION**
⚠	**Danger from loose screw connections, terminal connections, and plug connections** Screw connections, terminal connections, and plug connections can come loose during transport. **Countermeasures:** • Check all screw connections, terminal connections, and plug connections. • Tighten all screws to the specified torques.

7.2.1 Central inverter with operator panel (controller)

Check the plug connections for the controller

Connection	Use
X01	Voltage supply (power supply)
X20	Ethernet
X22	USB (connectbox with string monitoring only)
X120	Analog inputs and rectangular input
X121	Binary inputs
X122	Binary outputs and probe inputs
X186	Real-time Ethernet master

Check the plug connections for the data converter
(Solar central inverter with connectbox with string monitoring only)

Connection	Use
X03	RS485
X08	Mini-USB

7.2.2 Mechanical attachment and screw connections

Tightening torques for the terminal connections and screw connections for the various central inverter models are listed in the appendix:

See 'S 44-xxx, S 50-xxx, S 60-xxx' on page 94..

See 'S 88-xxx, S 100-xxx, S 120-xxx' on page 95..

See 'S 240-W00, S 240-W0B' on page 97..

Unless other values are listed in these tables, all screws must be tightened to the following torques:

Unless otherwise specified, all of the screw connections are to be tightened with the following torques:

Tightening torques for screws with a connecting surface

Dimension	Tightening torque [Nm] Property class 8.8 Coefficient of friction $\mu_{total}= 0,125$
M4	2.8
M5	5.5
M6	9.6
M8	23
M10	46
M12	79
M14	125
M16	195
M18	280
M20	395
M22	540
M24	680
M27	1000
M30	1350

7.3 Liquid cooling

⚠ DANGER	
	All work on and with the devices may only be carried out by persons who meet the requirements under chapter 'Requirements for personnel and their qualification.'

NOTICE	
Material Damage!	**Electrical short-circuit due to condensation water!** If electrically conductive fluids such a condensed water enters the inverter module, there may be a short circuit, thus leading to damage or even destruction of the module. Do not allow condensation to form in the cabinet. **Steps to prevent:** • The cabinet cooling needs to be designed according to the dew point table so that no condensation water forms. The dew point table specifies at which surface temperature dew water forms depending on the air temperature and the relative humidity. See 'Dew point table' on page 98. Example: Cabinet temperature: 32°C, humidity: 60 % The temperature of the cooling circuit may not be less than 23 °C, otherwise, condensation water will form.

Prerequisites

- Connect the warm and cold connections for the heat exchanger to the corresponding ports on the central inverter (connecting hose AMK part no. 203255).
- All screw connections in the liquid circuit must be screwed tight and sealed.
- Make sure that the heat exchanger is connected to the electricity supply correctly.

Fill the circuit with coolant

1. Use Tyfocor LS coolant (AMK part no.: 203392). You will need approx. 5 l per inverter (this value does not include any requirement for hoses laid externally).
2. Set all valves for controlling coolant volume inside the switch cabinet to maximum flow (set the slot on the regulating screw horizontal).
3. Connect the filler pump (e.g., Kronimus GmbH, www.kronimus.com type: injection pump, product no.: 705000115) to the filler neck on the heat exchanger by screwing the hose nozzle tight to the filler neck with the 1/2" screwcap.
4. Open the gate valve on the filler neck.
5. Open the automatic bleed valves in the inverter and on the heat exchanger by unscrewing the black caps.
6. During filling, make sure that the air inside the circuit escapes through the automatic bleed valves.

If the resistance causes excess counterpressure during filling, you can switch on the rotary pump to distribute the coolant throughout the entire circuit.

Switch on rotary pump:

⚠ DANGER   **Danger to life by electric shock from touching electrical connections!**

1. Check that the DC breaker is switched off.
2. Close the door of the switch cabinet.
3. Switch on the AC breaker.
4. Wait for the 'Main choice' screen to be displayed.
5. Go from the 'Main choice' screen to the 'Configuration' screen (See 'Configuration' on page 58.)
6. In the 'Configuration' screen, select **'startup'** (See 'Startup' on page 61.)
7. On the 'Outputs controller' screen, select **'cooling on'** to switch on the rotary pump.

If the pressure drops, switch off the rotary pump and add more coolant. You can repeat this process until the entire circuit has been filled and the pressure display indicates 2 bar (operating pressure 2 bar when the equipment is switched off).

7. When the filling process is complete (operating pressure 2 bar when the equipment is switched off), seal the filler neck on the liquid cooler and unscrew the filler pump.
8. Switch on the rotary pump for liquid cooling by selecting **'cooling on'** on the 'Outputs controller' screen. Check the entire system for leaks.
9. Set the flow volume control valves as follows:

Cooling plate KES inverter	10 l/min
Power line choke	3 l/min
Transformer (devices with transformer only)	3 l/min

10. Set the required temperature at the heat exchanger thermostat (e.g., 40°C).
See 'Dew point table' on page 98.

7.4 Central inverter as standalone device

⚠ **DANGER**
Danger to life from touching electrical connections! Electrical terminals and connectors carry voltages that may cause death or serious injury upon contact. When the LEDs on the front panels are OFF, this does not indicate that the electrical terminals have been de-energized. **Steps to prevent:** • Prior to any work on the device: Observe the 5 safety rules. • Measure the terminal voltages. There may be no voltage present. • Plug and pull connections only when there is no voltage. • For devices that are connected to a DC bus, you need to consider the discharge times of the dc bus capacitors mentioned in the converter documentation • Before commencing work, the connections must be isolated from the voltage supply at both ends! (both ends mean: AC and DC bus supply side)

1. Check that the AC breaker is switched off.
2. Check that the DC breakers in the connectboxes are switched off.
3. Check that the central inverter has been assembled and installed correctly.

4. ⚠ **DANGER**   **Danger to life by electric shock from touching electrical connections!**

   Open the door of the central inverter's switch cabinet.

5. ⚠ **DANGER**   **Danger to life by electric shock from touching electrical connections!**

   Check that all connections have been made correctly. (See 'Preparation' on page 38.)

6. If installed: Check that the liquid cooling is ready for operation.

7. ⚠ **DANGER**   **Danger to life by electric shock from touching electrical connections!**

   If installed: Switch on the DC breaker in the connectbox (AMK part no. 47235 or 47236).

8. ⚠ **DANGER**   **Danger to life by electric shock from touching electrical connections!**

   Switch on the DC breaker in the central inverter (not S 240-xxx).

9. Close the door of the switch cabinet.
10. Switch on the AC breaker.
11. Wait for the 'Main choice' screen to be displayed.
12. Configure your equipment: See 'Configuration' on page 58.
13. On the 'Main choice' screen, select **'ON'** to start the central inverter:

14. The central inverter is in operation.

7.5 Networked central inverters

⚠ **DANGER**	
⚡	**Danger to life from touching electrical connections!** Electrical terminals and connectors carry voltages that may cause death or serious injury upon contact. When the LEDs on the front panels are OFF, this does not indicate that the electrical terminals have been de-energized. **Steps to prevent:** • Prior to any work on the device: Observe the 5 safety rules. • Measure the terminal voltages. There may be no voltage present. • Plug and pull connections only when there is no voltage. • For devices that are connected to a DC bus, you need to consider the discharge times of the dc bus capacitors mentioned in the converter documentation • Before commencing work, the connections must be isolated from the voltage supply at both ends! (both ends mean: AC and DC bus supply side)

1. Check that the AC breakers for all central inverters have been switched off.
2. Check that the DC breakers in the connectboxes are switched off.
3. Check that all central inverters have been assembled and installed correctly.

4. ⚠ **DANGER**   **Danger to life by electric shock from touching electrical connections!**

   Open the door of the central inverter's switch cabinet.

5. ⚠ **DANGER**   **Danger to life by electric shock from touching electrical connections!**

   Check that all connections have been made correctly. (See 'Preparation' on page 38.)

6. If installed: Check that the liquid cooling is ready for operation.

7. ⚠ **DANGER**   **Danger to life by electric shock from touching electrical connections!**

   On all central inverters, check that the DIP switch on the KES line inverter is set to 0: See 'Addressing' on page 62.

8. ⚠ **DANGER**   **Danger to life by electric shock from touching electrical connections!**

   Switch on the DC breakers in the connectboxes (AMK part no. 47235 or 47236).

9. ⚠ **DANGER**   **Danger to life by electric shock from touching electrical connections!**

   Switch on the DC breakers in the central inverters (not S 240-xxx).

10. Close the switch cabinet doors
11. First, switch on the AC breaker for the central inverter with controller (head-end station).
12. Wait for the 'Main choice' screen to be displayed on the central inverter with controller.
13. Switch on the AC breakers for all other central inverters.
14. Configure your equipment: See Configuration on page 58.
15. On the 'Main choice' screen, select **'ON'** to start the central inverters:

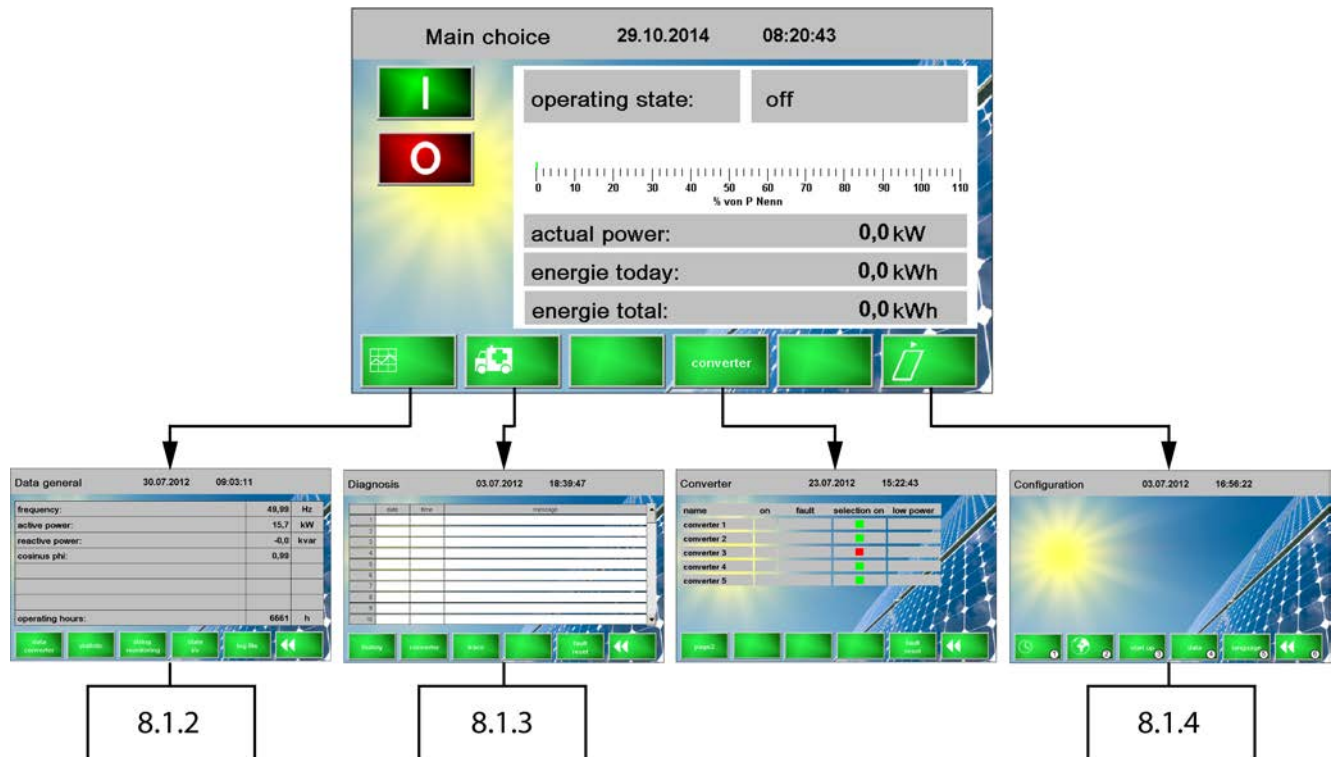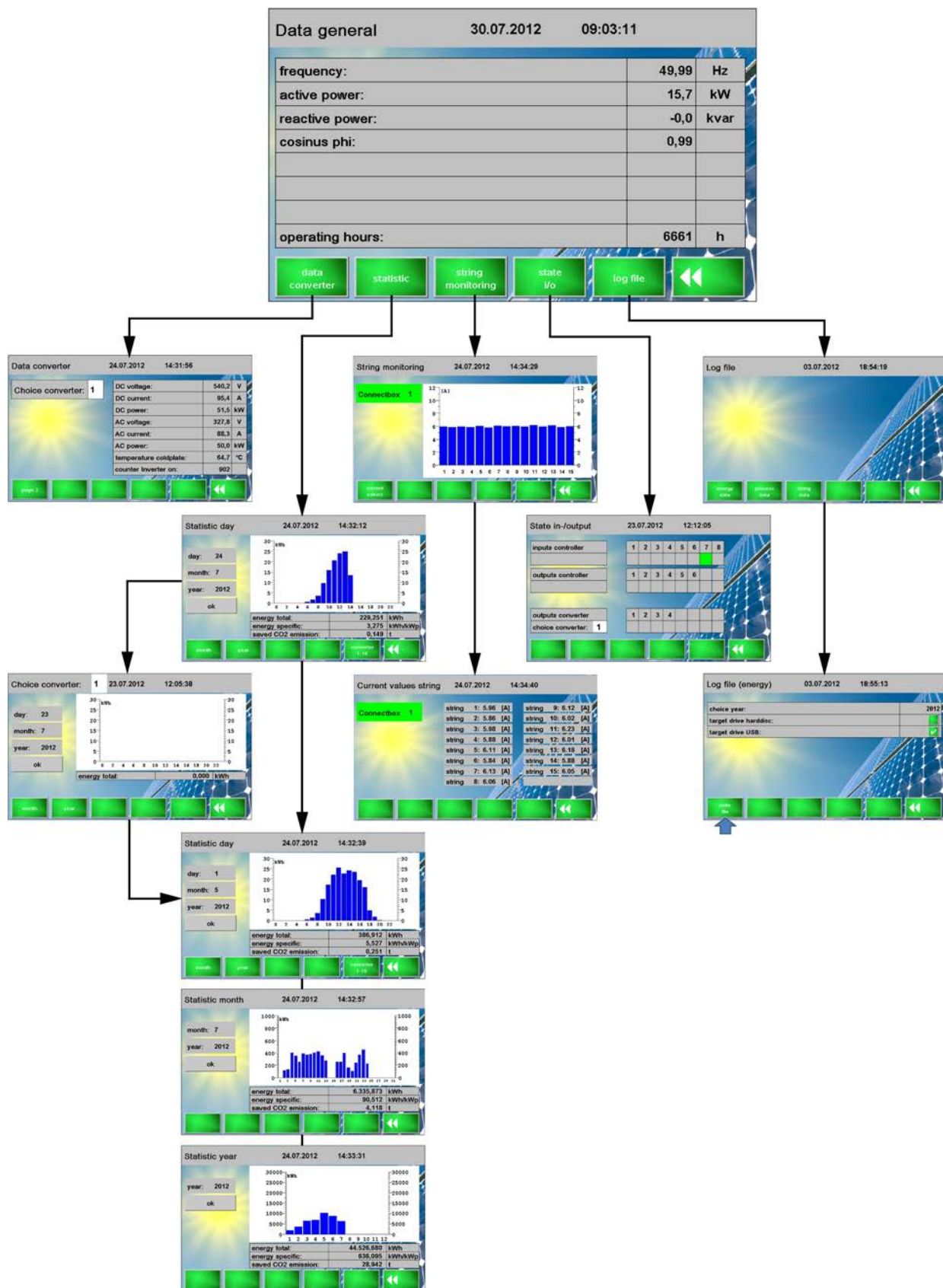16. The central inverters are in operation.
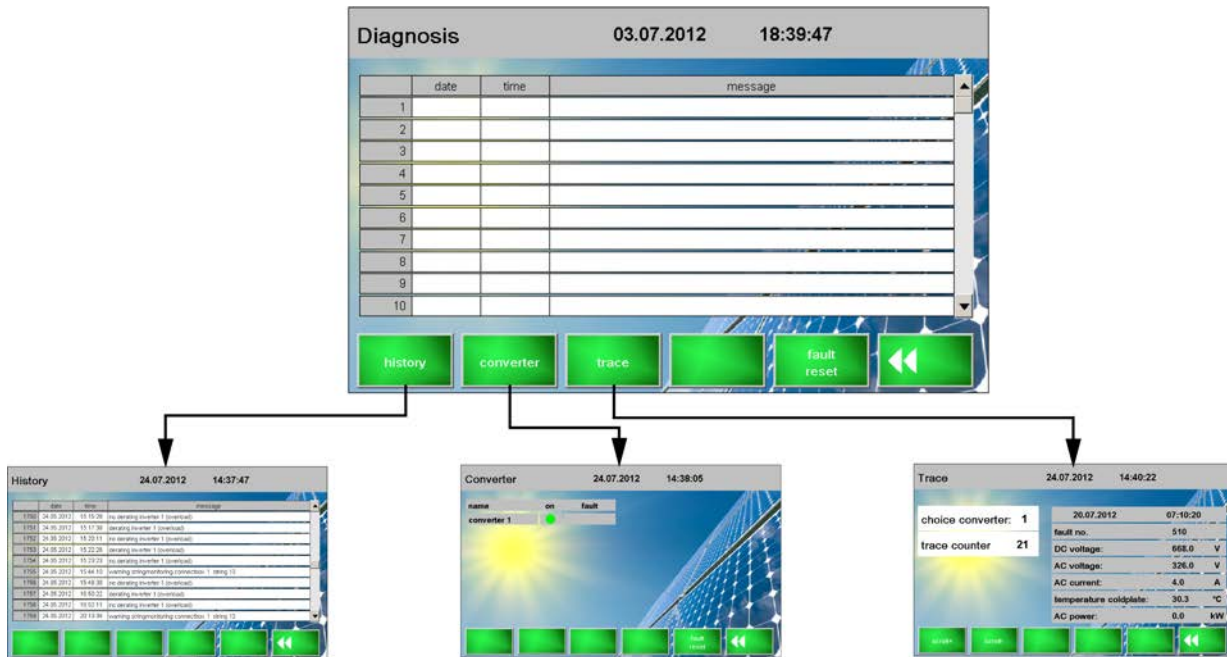
8 Operation

8.1 Overview

8.1.1 Main choice navigation tree

8.1.2 Data general navigation tree

8.1.3 Diagnosis navigation tree

8.1.4 Configuration navigation tree (password-protected)
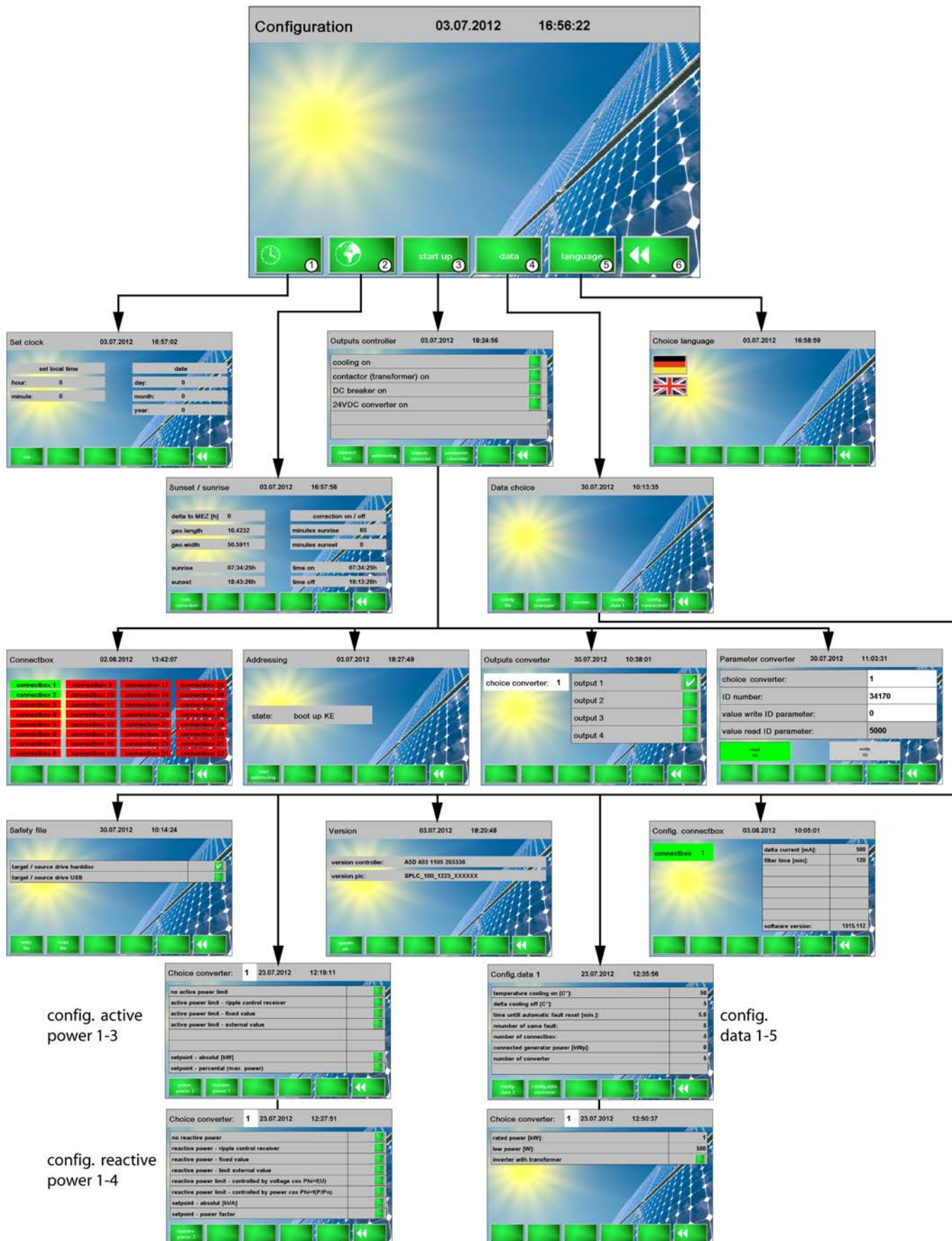
8.2 Start screen

After the controller has been switched on and powered up, the 'Main choice' menu is displayed.

Designation	Description
1	Button for OFF operating state
2	Button for ON operating state
3	Operating state display: OFF — The central inverter is not connected to the power supply => no incoming power supply ON — The central inverter is connected to the power supply => incoming power supply LOW POWER — The central inverter behaves as if it were in the OFF state. The central inverter automatically switches from the ON state to the LOW POWER state if the energy from the photovoltaic system is less than the configured value for a period of more than 5 minutes. The central inverter automatically switches back to the ON state after 10 minutes. If the generated DC voltage is less than the energy recovery voltage threshold, the central inverter remains in the LOW POWER state STANDBY — Overnight shutdown according to configured times
4	Actual power and energy display
5	Go to 'Configuration' screen (See 'Configuration' on page 58.)
6	Go to 'Converter' screen See 'Converter' on page 57.
7	Go to 'Diagnosis' screen (See 'Diagnosis' on page 55.)
8	Go to 'Data general' screen (See 'Data general' on page 48.)

Entries to select an inverter or change configuration data, for example, are made by touching the corresponding field. A number pad is displayed; use this to enter the necessary values.

BACK   Deletes the last character entered

CLEAR   Deletes the entire entry

ESC   Aborts the data entry process and restores the previous value

OK   Confirms the entry and apply the value

8.3 Data general

The central inverter's controller records numerous items of data and provides up-to-date probe values for the central inverter. Start from the 'Main choice' screen.
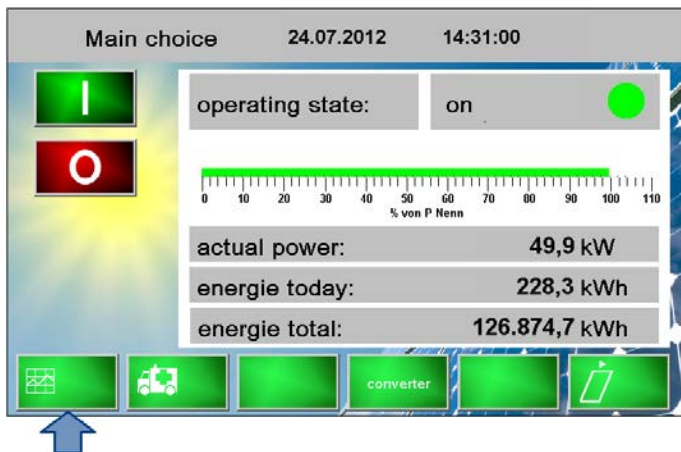
Select the'Data general' button to go to the 'Data' screen:

When the screen first opens, the general data for the central inverter equipment is displayed.

8.3.1 Data converter

Select 'data converter' to go from the 'Data' screen to the 'Data converter' screen where the data of the individual converters is displayed.

For equipment with more than one central inverter, enter the converter for which you wish to display data in the >Choice converter< field.
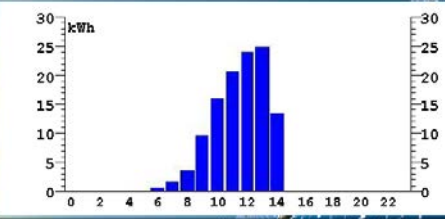
8.3.2 Statistics

Select 'statistic' to go to the daily statistics for the current day:
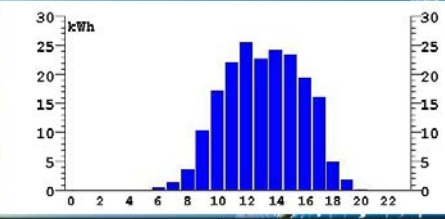
In the >day<, >month<, and >year< fields, you can call up the data for a date in the past.
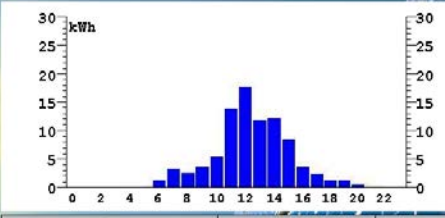
The 'month' and 'year' buttons display statistics for a period of one month or one year.
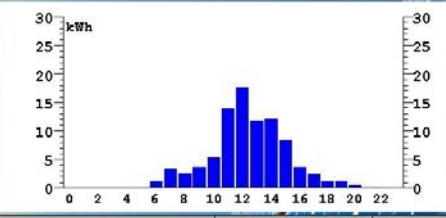
Select the 'converter 1-16' button to switch from the overall statistics display to the statistics for an individual converter.

For equipment with more than one central inverter, enter the inverter for which you wish to display statistics in the >Choice converter< field.
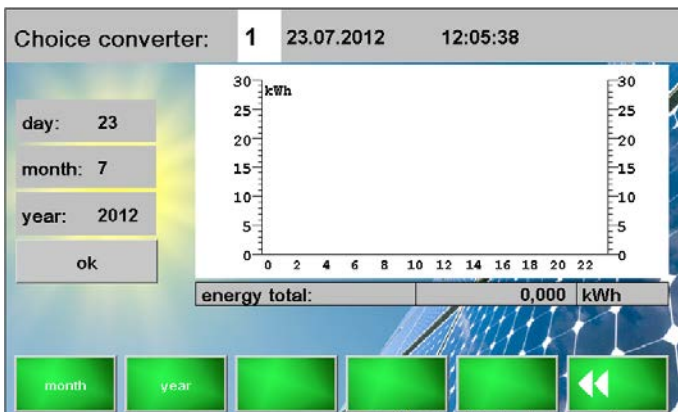
8.3.3 String monitoring

The 'string monitoring' button calls up the following screen:
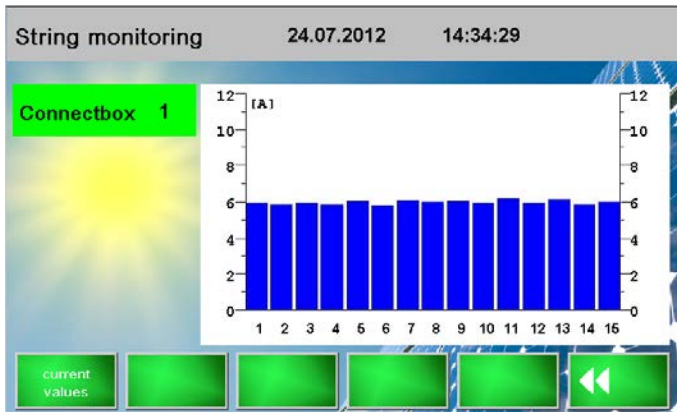
The individual string currents for the currently selected connectbox are displayed in a bar chart so that anomalies can be detected quickly.

In the 'Current values string' screen below, the individual string currents are displayed as decimal values.

8.3.4 Status of the controller inputs / outputs

'state i/o' calls up the following screen in which the status of the controller inputs and outputs is displayed.

Gray: input / output not active
Green: input / output active

Assignment of the binary inputs

Input 1	Ripple control receiver signal 1
Input 2	Ripple control receiver signal 2
Input 3	Ripple control receiver signal 3
Input 4	Ripple control receiver signal 4
Input 5	Reserved
Input 6	Reserved
Input 7	Reserved
Input 8	Reserved

Assignment of the binary outputs

Output 1	Line contactor (transformer) ON (-K1)
Output 2	24 VDC supply ON
Output 3	Heat exchanger / fan ON
Output 4	Reserved
Output 5	DC breaker on
Output 6	Reserved

8.3.5 Log file

In the various log files, data is saved in the form of tables which can be read and processed with Microsoft Excel, for example.

Select 'log file' to open the following screen in which you can select the type of data.
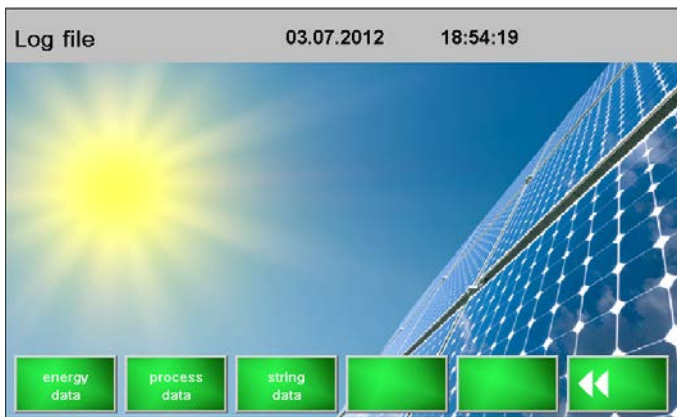
8.3.5.1 Log file: Energy data

Select 'energy data' to call up the interface for saving energy data. Select 'write file' to write the data saved to the hard disk (DOC) of the controller or the USB mass storage device connected to X22.
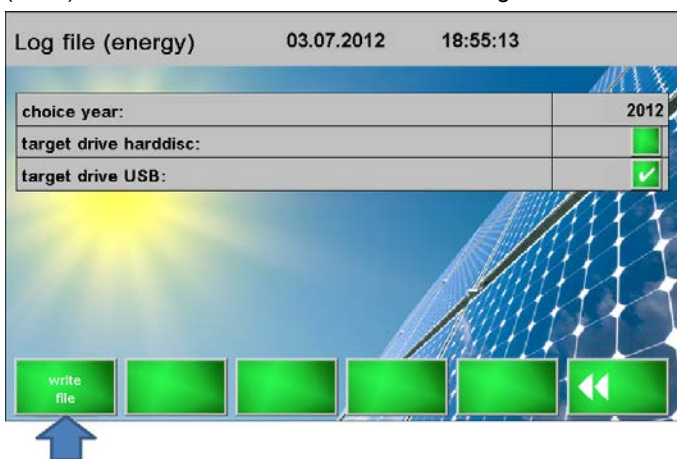
The 'energy_(year).csv' file contains the energy generated in kWh for the selected year, recorded by date and hour.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	CSV-FILE-JAHRESDATEN													
2	Stunde	0h	1h	2h	3h	4h	5h	6h	7h	8h	9h	10h	11h	12h
163	01. Jun 12	0	0	0	0	0	0,429	2,271	7,684	11,75	16,412	27,241	22,503	24,687
164	02. Jun 12	0	0	0	0	0,088	2,382	6,314	12,028	19,352	34,543	41,836	49,55	42,593
165	03. Jun 12	0	0	0	0	0,092	2,488	6,311	5,068	6,976	10,742	27,873	35,596	23,677
166	04. Jun 12	0	0	0	0	0	1,127	3,735	5,946	9,772	20,588	20,4	31,978	38,86
167	05. Jun 12	0	0	0	0	0,111	2,718	3,15	10,583	18,998	27,409	19,627	33,89	29,224
168	06. Jun 12	0	0	0	0	0,091	0,916	5,441	9,883	7,791	14,374	23,565	23,653	16,96
169	07. Jun 12	0	0	0	0	0,491	2,955	7,289	13,534	23,399	30,713	30,718	41,863	17,76
170	08. Jun 12	0	0	0	0	0,014	2,307	6,461	8,338	13,77	10,557	15,521	20,961	15,043
171	09. Jun 12	0	0	0	0	0,118	1,38	5,974	12,031	15,426	29,579	44,565	38,523	53,061
172	10. Jun 12	0	0	0	0	0	0,519	3,093	5,16	6,383	9,185	15,745	16,239	23,597
173	11. Jun 12	0	0	0	0	0,124	0,056	4,704	6,492	18,206	19,949	26,895	33,431	29,519
174	12. Jun 12	0	0	0	0	0,453	3,484	7,165	13,5	15,875	24,347	31,499	28,702	12,826
175	13. Jun 12	0	0	0	0	0,019	1,147	4,426	6,444	11,063	23,551	37,208	32,953	34,971
176	14. Jun 12	0	0	0	0	0,167	1,908	4,015	11,909	23,382	37,839	43,844	48,326	38,307
177	15. Jun 12	0	0	0	0	0,126	3,497	8,469	13,697	21,426	30,567	45,089	43,224	29,065

8.3.5.2 Log file: Process data

Log file: Process data is in preparation.

8.3.5.3 Log file: String data

Log file: String data is in preparation.

8.4 Diagnosis

You are in the 'Main choice' screen.

If the fault indicator is flashing yellow, there is a fault present which the central inverter is attempting to clear without external assistance.See 'Data configuration' on page 75.

If the fault indicator is flashing red, there is a fault present which the central inverter cannot clear without external assistance or which has occurred previously with 'number of same fault'.

Select the 'diagnosis' button to go to the 'Diagnosis' screen:

The 'Diagnosis' screen displays up to 100 diagnostic messages which have occurred since the last 'fault reset'.
Select 'fault reset' to reset all pending errors or warnings affecting the connected converter and delete the entries from the 'Diagnosis' screen.

8.4.1 History

Up to 4,900 diagnostic messages can be saved in the history. From entry 4,901 on, each new entry overwrites the oldest entry.

8.4.2 Converter

The states of the connected central inverters are displayed on the 'converter' screen. Select 'fault reset' to reset all faults on all connected converters in parallel.

8.4.3 Trace

The 'trace' button displays the probe values recorded up to a selected point in time at which an error occurred. A specific event can be selected in the 'trace counter' field;'scroll +' and 'scroll -' scroll up and down through the errors.

Up to 150 errors can be recorded.

8.5 Converter

You are in the 'Main choice' screen.
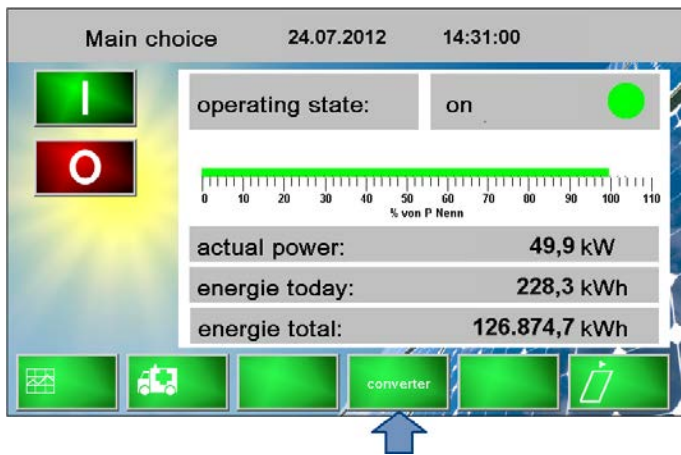
Select the 'Converter' button to go to the 'Converter' screen:

The 'Converter' screen displays the current state of the converters.

Select 'fault reset' to reset all pending errors or warnings affecting the connected converters.

For systems with more than one central inverter, enter the converter that is not to be switched on during startup in the >selection on< field.

Green: Converter is switched on.

Red: Converter is not switched on.
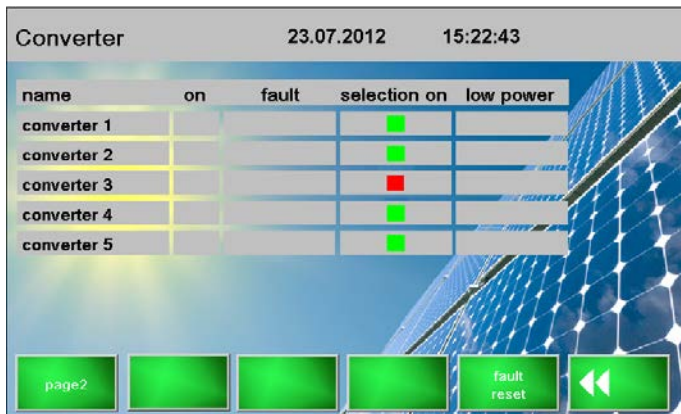
8.6 Configuration

Before you can operate the central inverter, you must configure the equipment data.

You can only switch to the 'Configuration' screen if the equipment is in the OFF operating state.
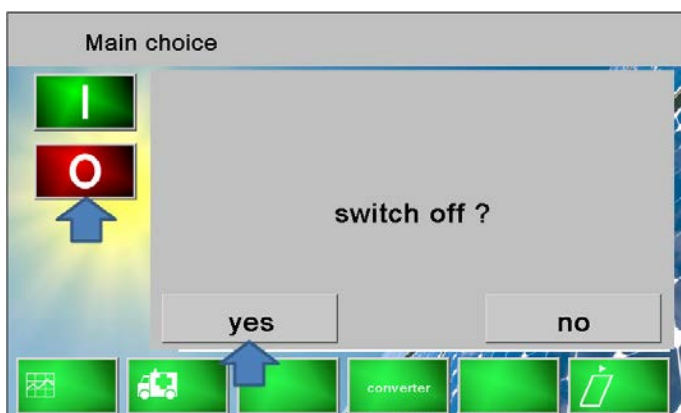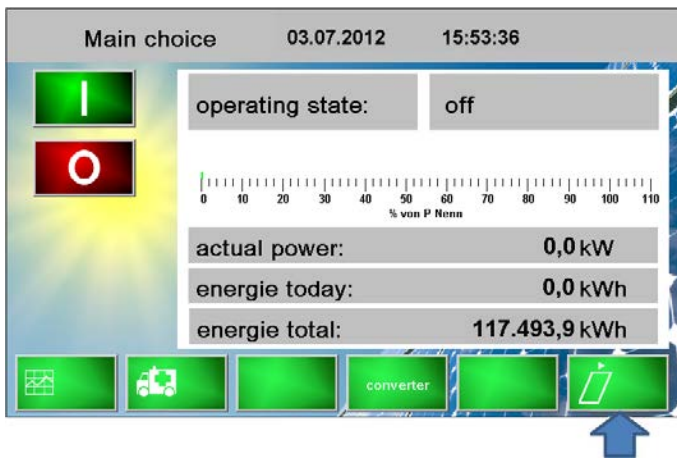
Select 'configuration' to open the equipment configuration menu:

All of the equipment configuration screens are password-protected.
Enter the password.
(If you do not know the password, please contact your supplier or AMK.)

The display automatically changes to the 'Configuration' screen when the correct password is entered.

Designation	Description
1	Go to the 'Set clock' screen
2	Go to the 'Sunset / sunrise' screen
3	Go to the 'Outputs controller' screen
4	Go to the 'Data choice' screen
5	Go to the 'Choice language' screen
6	'Back' button, go to previous screen

8.6.1 Setting the time and date

Enter the >hour<, >minute<, >day<, >month<, and >year< variables. Press 'set' to apply the data.

Set clock		03.07.2012	16:57:02
set local time		date	
hour:	0	day:	0
minute:	0	month:	0
		year:	0
set			◀◀

When prompted, switch off the controller with the AC breaker and wait 10 seconds before switching the AC breaker back on.

Set clock	03.07.2012	18:31:48
please switch off / on controller!		

The new data will be valid once the controller has restarted.

8.6.2 Setting geographical coordinates

Enter the >geo. length< (longitude) and >geo. width< (latitude) of the location of the equipment.

Sunset / sunrise		03.07.2012	16:57:56
delta to MEZ [h]	0	correction on / off	
geo.length	10.4232	minutes sunrise	60
geo.width	50.5911	minutes sunset	0
sunrise	07:34:25h	time on	07:34:25h
sunset	18:43:26h	time off	19:13:26h
calc correction			◀◀

> The geographical coordinates must be entered as decimal degree values.
>
> Entries in degrees, arc minutes, and arc seconds are converted into decimal degrees using the following formula:

$$\text{Decimal degree} = \text{degree} + \frac{\frac{\text{arc seconds}}{60} + \text{arc minutes}}{60}$$

Example:

66° 43' 12.00"

$$\text{Decimal degree} = 66 + \frac{\frac{12.00}{60} + 43}{60}$$

$$\text{Decimal degree} = 66.7200$$

The controller uses the coordinates and the date to calculate the associated times for sunrise and sunset when you press the 'calc correction' button.

You can bring forward (negative sign, e.g., -20) or delay (positive sign, e.g., 20) the times at which the equipment is switched on and off by up to 60 minutes in relation to the calculated times for sunrise and sunset. Enter the required values for >minutes sunrise< and >minutes sunset< and press 'calc correction' again. The applicable times for switching the equipment on and off are displayed in the 'time on' and 'time off' fields.

8.6.3 Startup

8.6.3.1 Controller outputs

The following functions can be triggered manually for test purposes.

cooling on	Switch on liquid cooler and switch cabinet cooler
contactor (transformer) on	Switch on main contactor (central inverters with transformer only)
DC breaker on	Switch on DC breaker in central inverter and optionally DC breaker in connectbox (fire brigade switch option)
24 VDC converter on	Switch 24 VDC for KES inverter on and off

The 'cooling on' and 'contactor (transformer) on' commands are only output to the central inverter's controller; 'DC breaker on' and '24 VDC converter on' are output to all connected central inverters.

The test commands are reset when you exit the 'Outputs controller' screen.

8.6.3.2 Connectbox

The 'Connectbox' button opens the following screen displaying the communication status of the connected connectboxes.

Green: Communication with the connectbox / string monitoring is active

Red: Communication with the connectbox / string monitoring has been interrupted

8.6.3.3 Addressing

As soon as the 'addressing' function is activated, the controller assigns the bus device address to the connected central inverter(s). For this purpose, the S1 DIP switch on all inverters must be set to 0.

Procedure:

1. Set all switches on DIP switch S1 to 0 (to the right):
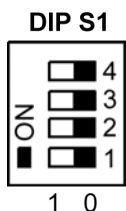
2. Switch off AC breaker
3. Wait 10 seconds
4. Switch on AC breaker
5. Activate addressing:

Select 'addressing' to open the screen for addressing the connected converters:
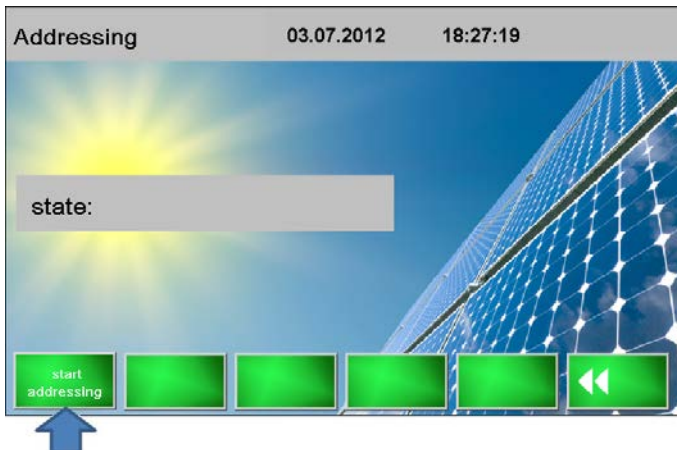
Select 'start addressing' to send the command to reassign the addresses of the connected converters to the controller. This function is only performed at initial startup.

Addressing only needs to be repeated if the equipment is expanded, reduced, or modified.

Addressing completed successfully: **Addressing aborted with errors:**

The addresses are assigned in the order in which the inverters are connected to the controller. Therefore, it is advisable to connect the converters in the same order in which they are physically located side by side in the switch cabinet.

The address assigned to the converter can be read out with the AIPEX PRO PC software.

8.6.3.4 Converter outputs

Select 'outputs converter' to call up and control the outputs of the connected converter.

An converter is selected: A fault is affecting communication with the connected converters:
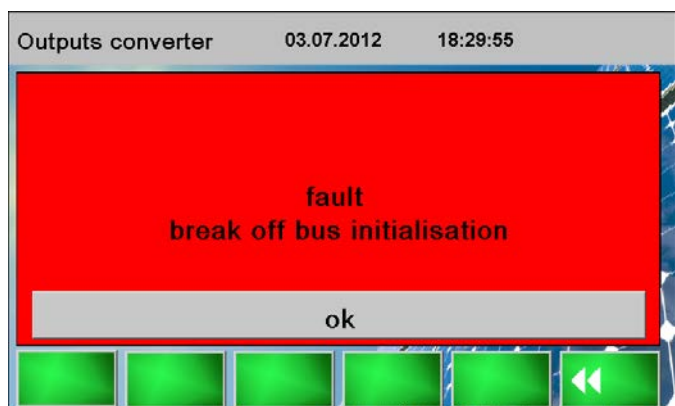
Assignment of the outputs

	Central inverter with operator panel / controller	Central inverter without operator panel / controller
Output 1	Send SMS	Main contactor ON
Output 2	Send email	DC breaker ON

	Central inverter with operator panel / controller	Central inverter without operator panel / controller
Output 3	Reserved	Cooling ON
Output 4	Reserved	Reserved

8.6.3.5 Converter parameters

⚠ CAUTION	
⚠	**Danger from parameter changes** Changes to the parameters of the KES in the central inverter may affect the fundamental functionality of the system. **Countermeasures:** • Only specialist personnel authorized by AMK are permitted to make changes to parameters.

'parameter converter' calls up the parameter list for an converter, providing direct access to the KES parameters in the central inverter so that essential settings can be made.
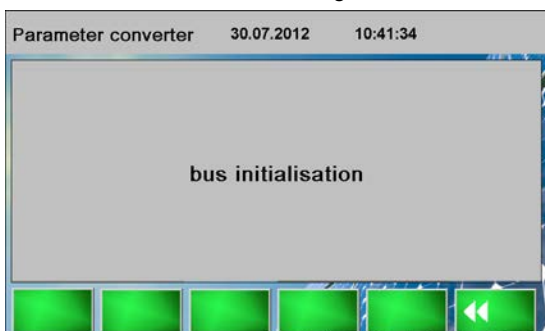
This menu provides a direct means of accessing and modifying all converter parameters.

8.6.4 Data choice

The 'Data' button takes you from the 'Configuration' screen to 'Data choice'.

This is where the central inverter equipment is configured.

8.6.4.1 Safety file

The statistical data of the controller (See Statistics on page 49.) is combined in the safety file and saved in the controller (DOC - Disk On Chip). Data is saved automatically every day at midnight.

If it becomes necessary to replace the controller, for example, the data can be saved manually at any point in time by selecting 'write file'.

Once a file has been saved, it canbe read out from the DOC with 'read file' and viewed on the 'Statistics' page.

Write safety file

Start by selecting a storage medium for the data. Hard disk (DOC) has been selected in the example.

The 'write file' function writes the statistics for the current calendar year (See 'Statistics' on page 49.).

Confirm the prompt with 'yes'.

If 'USB' has been selected as the destination but a USB stick has not been inserted, the following message is displayed. Acknowledge with 'ok'.
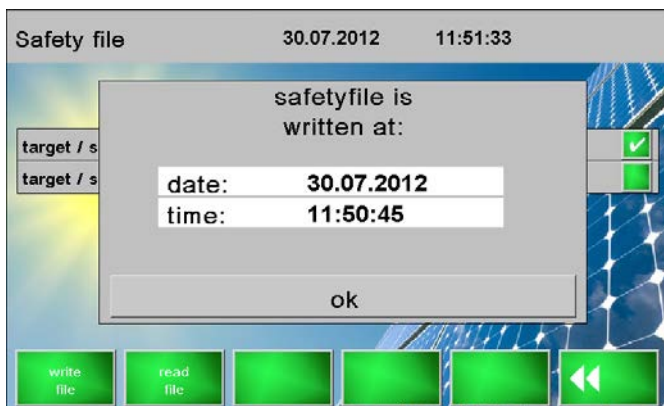
If you have selected 'USB' as the storage destination, connect a non-bootable USB mass storage device to port -X22 of the controller. You will need to disconnect the USB connection to the connectboxes, if there is one.

Data can only be saved to USB stick if the central inverter control cabinet can be opened without switching off the AC breaker; otherwise, the controller will also shut down.

Conversely, the controller cannot be restarted if a USB stick which does not contain a master boot record (i.e., is not bootable) is plugged in.

Once you have saved the data to the USB mass storage device:

Re-establish the USB connection to the connectboxes.

Read safety file

Select "read file" and answer 'yes' to the following security prompt to read the data stored in the safety file into the controller. This process will overwrite any existing data in the controller!
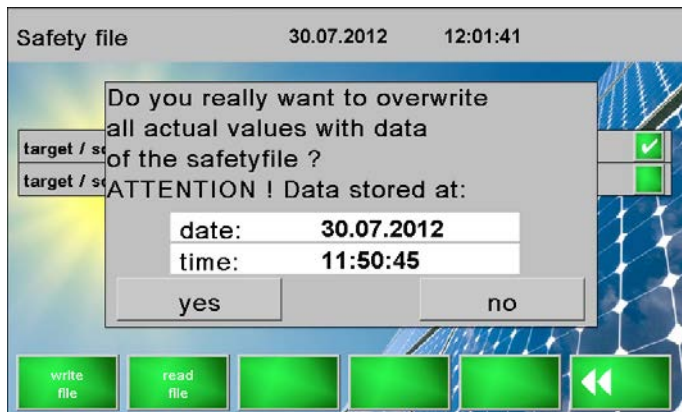
Answer 'no' to abort the process.

8.6.4.2 Powermanager

On the 'Data choice' screen, select 'powermanager' to open the 'Config. active power 1' screens.

This is where the active power limit is configured with a ripple control receiver, for example. The limit can be set in up to four stages as specified by local energy suppliers.

Limits based on a fixed or external value, or even a frequency-based limit, are also set here.

8.6.4.2.1 Active power configuration

Config. active power 1

Choice converter:	1	23.07.2012	12:19:11	
no active power limit				▮
active power limit - ripple control receiver				▮
active power limit - fixed value				▮
active power limit - external value				▮
setpoint - absolut [kW]				▮
setpoint - percental (max. power)				▮

| active power 2 | reactive power 1 | | | | ◀◀ |

no active power limit	No active power limit active	
active power limit - ripple control receiver	Active power limitation by a ripple control receiver is active (for stages, see 'Config. active power 2' screen)	1)
active power limit - fixed value	The active power is limited to a fixed value (see 'Config. active power 2' screen)	1)
active power limit - external value	The active power is limited to an external value set via Ethernet	1)
setpoint - absolute	\ The limits are entered either as absolute values or as percentage	2)
setpoint - percental	/ values based on the rated power Pn	

1) Only one of the active power limit options (ripple control receiver, fixed value, or external value) can be selected.

2) Two independent sets of values for percentage and absolute setpoint limits can be entered in the 'Config. active power 2' table. One of the two sets of values will be active based on whether 'setpoint - absolute' or 'setpoint - percental' is selected.

Config. active power 2

Choice converter:	1	23.07.2012	12:21:05	
setpoint setting - absolute [kW] / proc. [% P]		[kW]	[%]	
setpoint (P) ripple control rec. signal 1		0.0	0.0	
setpoint (P) ripple control rec. signal 2		0.0	0.0	
setpoint (P) ripple control rec. signal 3		0.0	0.0	
setpoint (P) ripple control rec. signal 4		0.0	0.0	
setpoint (P) fixed		0.0	0.0	
setting time setpoint [ms]		1000		

| active power 3 | | | | | ◀◀ |

Setpoint (P) ripple control rec. signal 1	\	
Setpoint (P) ripple control rec. signal 2	\ Grading of the active power limit by the ripple control receiver	
Setpoint (P) ripple control rec. signal 3	/ (See 'Status of the controller inputs / outputs' on page 51.)	
Setpoint (P) ripple control rec. signal 4	/	
setpoint (P) fixed	Fixed value to which the active power is limited	
setting time setpoint	Ramp time used to limit the active power to the new value	

Config. active power 3

Choice converter:	**1**	23.07.2012	12:24:20	

P=f(F)		[Hz]	[%]
frequency value 1 / active power 1		47.50	100.0
frequency value 2 / active power 2		50.20	100.0
frequency value 3 / active power 3		51.00	60.0
frequency value 4 / active power 4		51.50	48.0
limit frequenzy [Hz] for increase active power		50.05	

frequency value 1 / active power 1 \
frequency value 2 / active power 2 \
frequency value 3 / active power 3   Interpolation points for the relationship between active power and frequency
frequency value 4 / active power 4 / $P = f(F)$

Limit frequency for increase active power   The frequency-based active power limit is only lifted once the value has fallen back below this frequency value.
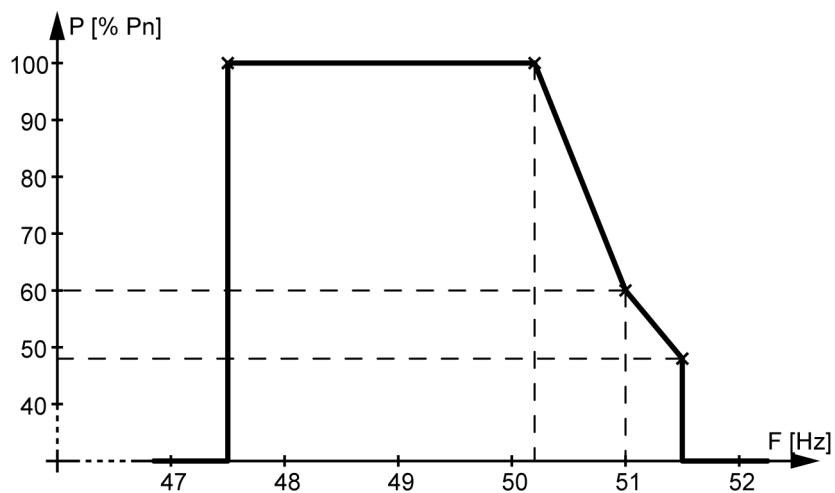
8.6.4.2.2 Reactive power configuration

On the 'Config. active power 1' screen, select 'reactive power 1' to access the 'Config. reactive power 1 - 4' screens.

Config. reactive power 1

no reactive power	No reactive power limit has been set
reactive power - ripple control receiver	Reactive power limitation by a ripple control receiver is active (for stages, see 'Config. reactive power 2' screen)
reactive power - fixed value	The reactive power is limited to a fixed value (see 'Config. reactive power 2' screen)
reactive power - limit external value	The reactive power is limited to an external value set via Ethernet
reactive power limit - controlled by voltage cos Phi = f(U)	The power factor cos φ is specified dependent upon the power supply voltage (see 'Config. reactive power 3' screen)
reactive power limit - controlled by power cos Phi = f(P/Pn)	The power factor cos φ is specified dependent upon the power (see 'Config. reactive power 3' screen)
setpoint - absolute	\ The setpoints are specified either as absolute values or with reference to
setpoint - power factor	/ the power factor

Config. reactive power 2

Setpoint (Q) ripple control rec. signal 1	\
Setpoint (Q) ripple control rec. signal 2	\ Grading of the reactive power limit by the ripple control receiver
Setpoint (Q) ripple control rec. signal 3	/ (See 'Status of the controller inputs / outputs' on page 51.)
Setpoint (Q) ripple control rec. signal 4	/
setpoint (Q) fixed	Fixed value to which the reactive power is limited
setting time setpoint	Ramp time used to limit the reactive power to the new value

Config. reactive power 3

cos Phi=f(U)		[V]	[ ]
voltage value 1 / power factor 1		360.00	-0.90
voltage value 2 / power factor 2		399.99	-1.00
voltage value 3 / power factor 3		400.00	1.00
voltage value 4 / power factor 4		440.00	0.90

Choice converter: 1   18.09.2012   09:56:23

reactive-power 4

voltage value 1 / power factor 1   \

voltage value 2 / power factor 2   \   Interpolation points for the relationship between voltage and power

voltage value 3 / power factor 3   /   factor: cos φ = f(U)

voltage value 4 / power factor 4   /

Config. reactive power 4

Choice converter: 1   23.07.2012   12:33:40

cos Phi=f(P/Pn)		[ ]	[ ]
P/Pn 1 / power factor 1		0.1	-0.90
P/Pn 2 / power factor 2		0.5	-1.00
P/Pn 3 / power factor 3		0.5	1.00
P/Pn 4 / power factor 4		0.9	0.90

P/Pn 1 / power factor 1   \

P/Pn 2 / power factor 2   \   Interpolation points for the relationship between power and power

P/Pn 3 / power factor 3   /   factor: cos φ = f(P/Pn)

P/Pn 4 / power factor 4   /

8.6.4.3 Version

The 'Version' screen displays the current firmware version of the controller and the PLC project

Version   03.07.2012   18:20:48

version controller: A5D 403 1105 203336

version plc: SPLC_100_1223_XXXXXX

update plc

Select 'update plc' to upload a different PLC file to the controller.

Update PLC (Load new controller program)

Prerequisites:

1. A valid version of the controller program, file type *.PLC (e.g., SPLC_Version_JJ/WW_Teilenummer.PLC) must be available.
2. Save the PLC controller program in the main directory (not a subdirectory) of a USB mass storage device.
3. Check that only one PLC controller program is saved in the main directory of the USB mass storage device.
4. Connect a non-bootable USB mass storage device to port X22 of the controller.

Possible errors:

USB mass storage device not detected

If you have not connected a USB mass storage device to port X22 of the controller and you select 'Update PLC' on the 'Version' screen, the following message will be displayed, which you should acknowledge with 'ok':
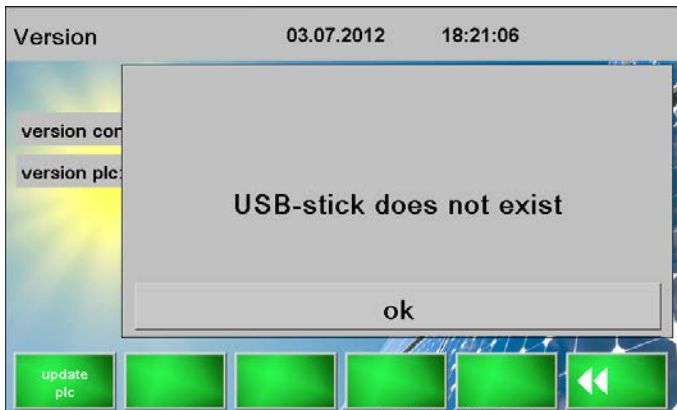
No *.PLC project found on storage device

If a *.PLC file has not be saved in the main directory of the connected USB mass storage device, the following message will be displayed, which you should acknowledge with 'ok':
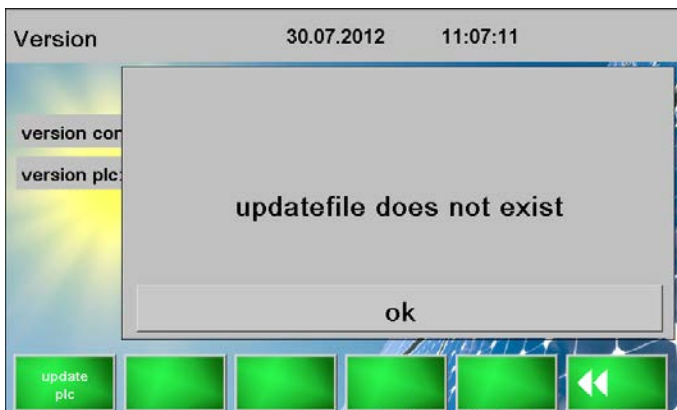
Run update:

If all prerequisites have been met, the following prompt will be displayed. To run the update, confirm the prompt with 'yes'.
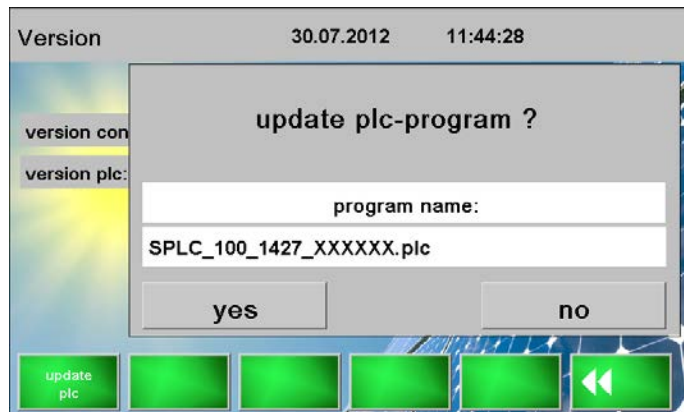
While the transfer of the *.PLC file is in progress, you can cancel the update by selecting 'X'.
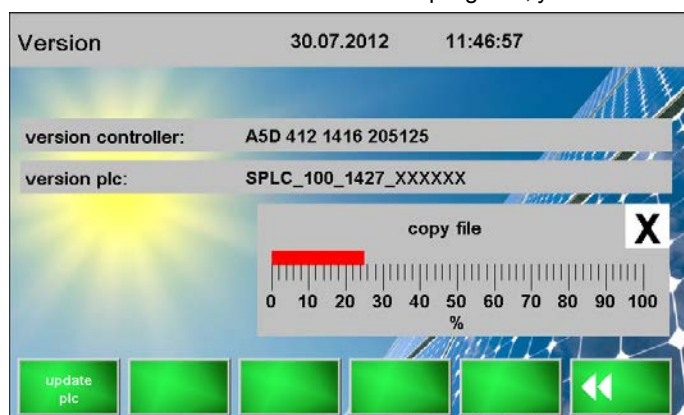
In the event of a fault during the transfer, the following error message is displayed. If you confirm with 'ok' the update process is aborted and the previous version of the *.PLC file remains active.

If the transfer of the controller program is aborted by the operator or due to an error, the previous version is retained and remains active.

Once the transfer of the *.PLC file to the controller is complete, you must shut down and restart the controller. The new program will only be valid and active once the controller has restarted.
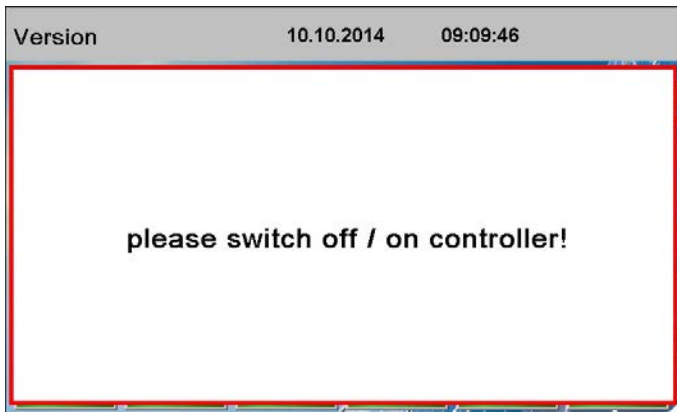
8.6.4.4 Data configuration

On the 'Data choice' screen, select 'config. data 1' button to open the 'Config. data 1' and associated screens.

Enter the characteristics values for your equipment.
The values shown on the following screens are examples and will not necessarily match those of your equipment!

config. Data 1

Config.data 1	23.07.2012	12:35:56
temperature cooling on [C°]:		50
delta cooling off [C°]:		5
time untill automatic fault reset [min.]:		5.0
nnumber of same fault:		5
number of connectbox:		4
connected generator power [kWp]:		0
number of converter		5

config. data 2 | config.data converter | | | | ◀◀

Temperature cooling ON	Temperature at the rear panel of the KES inverter at which the cooling circuit is switched on.
Delta cooling OFF	The 'temperature cooling on' minus the 'delta cooling off' temperature produces the temperature at which the cooling circuit is switched off.
Wait time until automatic fault reset	Defines the time after which the central inverter will automatically attempt to reset a pending error message without external assistance (see the 'fault reset' function on the 'Diagnosis' screen).
Number of same fault	The value defines when the central inverter switches to fault and stops attempting to clear the pending error without external assistance.
	Example:
	No. of same error messages= 3
	An identical error occurring consecutively has been reset automatically by the central inverter twice. If the same error occurs a third consecutive time, the error state is maintained and must be reset by the operator.
Number of connectbox	Total number of all connectboxes connected to the operating unit, regardless of the number of central inverters
Connected generator output power	Total installed output power of the photovoltaic equipment (may be higher than the rated power of the central inverter equipment)
Number of converters	Enter the number of KES modules
	Example for the S240: Number of converters = 2

config. Data 2

Config.data 2	19.07.2012	11:48:07
increase P [%/step]:		10.0
time per step [ms]:		1000
minimal voltage (switch on) [%Un]:		95
maximum frequency (switch on) [Hz]:		50.05
maximum Voltage (switch off) [% Un]:		120
minimale Voltage (switch off) [% Un]:		80
maximum frequency (switch off) [% F]:		105
minimale frequency (switch off) [% F]:		95

config. data 3 | | | | | ◀◀

increase P (acceleration)	\	Rise in active power per time unit (example: the active power rises by 10% per 1 s; i.e., the maximum power will be reached within 10 s)
Time per step (acceleration)	/	
Minimum voltage (switching on)		Minimum permissible voltage for switching on
Maximum frequency (switching on)		Maximum permissible frequency for switching on
Maximum power supply voltage (switching off)	\	
Minimum power supply voltage (switching off)	\	Protection against power outage
Maximum line frequency (switching off)	/	
Minimum line frequency (switching off)	/	

config. Data 3

Config.data 3	19.07.2012	11:48:19
time to switch off over- / undervoltage [ms]:		1000
time to switch off over- / underfrequency [ms]:		1000
voltage increase [%Un/min]:		115
voltage decrease [%Un/min]:		45
time to switch off (U) increase [ms]:		100
time to switch off (U) decrease [ms]:		257
factor k (LVRT voltage drop):		2
maximum temperature cabinet [C°]:		50.0

Time to switch off overvoltage / undervoltage	\	
Time to switch off overfrequency / underfrequency	|	
Protection against voltage rise gradient	\	Protection against power outage
Protection against voltage fallback gradient	/	
Time to switch off (U) increase	|	
Time to switch off (U) decrease	/	
K factor (LVRT voltage drop)		Factor for calculating reactive current
Maximum temperature, cabinet		Maximum permissible temperature inside the cabinet; if the temperature rises above this, the output power of the central inverter is reduced

config. Data 4

Cascading without function

Config.data 4	23.07.2012	12:41:15
threshold cascading (next step)[kW]		0
hysteresis cascading (previous step) [kW]		0
time threshold level cascading (next step) [min.]		0
time threshold level cascading (previous step) [min.]		0

config. Data 5

Config.data 5	23.07.2012	12:44:37
faultmessage per SMS		☐
faultmessage per E-Mail		☐
automatic start after power supply off/on		☐
cascading		☐
accumulator control		☐
testvisualization (setpoints manual)		☐
no standby function		☑

Fault message via SMS	\ Notification via SMS or email; only possible in conjunction with a remote
Fault message via email	/ maintenance router (MB Connect Line)
Automatic start after power supply OFF/ON	
Cascading	Without function
Accumulator control	Central inverter is used as inverter for accumulator control
Test visualization (setpoints manual)	
With transformer	Central inverter with transformer S xx-x**T**x

Configuration data, converter

On the 'Config. data 1' screen, select 'config. data converter' to access the specific converter data.

Rated power	Rated power of the converter
Low Power	If the output power actual value falls below the 'low power' value entered for a period of 5 minutes, the central inverter switches to low power mode.
Inverter with transformer	Central inverter with transformer S xx-x**T**x

8.6.4.5 Connectbox configuration

On the 'Data choice' screen, select 'config connectbox' to go to the 'Config. connectbox' screen.

Select the number of the connectbox in the >connectbox< field. The field is highlighted in red if there is an error in the connectbox or on the communication path.

Enter the values for the selected connectbox.
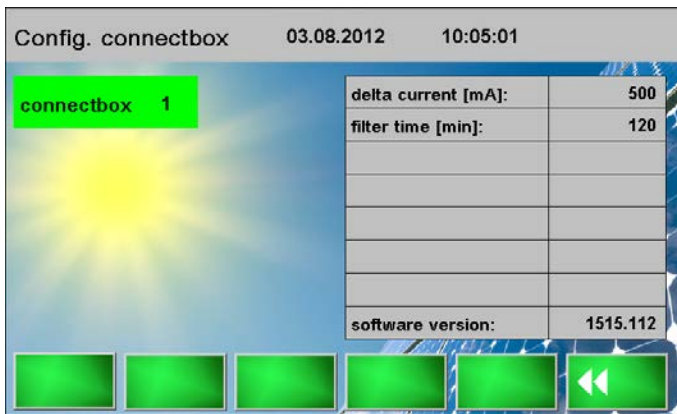
delta current	Tolerance by which a string current may deviate from the mean value
filter time	Time before a message is generated
software version	Displays the software version installed in string monitoring

8.6.5 Language

In the 'Configuration' screen, select 'language' to open the 'Choice language' screen.

Press the national flag corresponding to the desired language to select whether the text on the screen is to be displayed in English or German. The text on the screen immediately switches to the selected language.

9 Diagnostic messages

9.1 Device behavior: Clear errors automatically and restart

In the event of an error in the central inverter, the device switches to 'fault' state and the error is displayed by a yellow flashing LED on the 'Main choice' start screen. The inverter is disconnected from the power supply.

After the 'time until automatic fault reset', the central inverter resets the fault message and reconnects to the power supply.

Should the same error occur again, the inverter will switch back to fault and disconnect from the power supply; the LED flashes yellow.

This procedure repeats itself until the 'number of same fault' is reached.

After this, the inverter switches to fault and the LED lights up steady red. The fault can now only be reset by the operator once its cause has been rectified.

The 'time until automatic fault reset and 'number of same fault' parameters are set on the 'Config. data 1' screen. (See 'Data configuration' on page 75.)

9.2 1041 External Line Over Temperature

• Over temperature mains filter / transformer inverter (n)	
Device	**ZWR**
Description	Over temperature mains filter -Y1 or / and transformer -T1
Class	Error
Device Behaviour	Automatic error reset and switch back on
Additional Error Information (AMK Service)	
Error Removal	• Check mains filter -Y1 • Check transformer -T1 • Check cooling system • Check fan of mains filter • Check wiring

9.3 1042 'Mains phase fault'

• Phase failure inverter (n)	
Device	**ZWR**
Description	Phase failure single-phase or multi-phase in the charging circuit
Class	Error
Device Behaviour	Automatic error reset and switch back on
Additional Error Information (AMK Service)	
Error Removal	• Check charging circuit fuses -F7 / -F8 • Check main fuse -F1

9.4 1045 'Mains overvoltage'

• Mains overvoltage inverter (n)	
Device	**ZWR**
Description	(Mains voltage + 10 %) > ID34270 'Net voltage'
Class	Error
Device Behaviour	Automatic error reset and switch back on
Additional Error Information (AMK Service)	
Error Removal	• Check mains voltage • Check transformer -T1 • Check main contactor -K1

9.5 1046 'Mains undervoltage'

	Mains undervoltage inverter (n)		
Device	**ZWR**		
Description	(Mains voltage - 10%) < ID34270 'Net voltage'		
Class	Error		
Device Behaviour	Automatic error reset and switch back on		
Additional Error Information (AMK Service)			
Error Removal	• Check mains voltage • Check transformer -T1 • Check main contactor -K1		

9.6 1047 Inhibit time for UE

	Twice ON during blocking-time inverter (n)		
Device	**ZWR**		
Description			
Class	Error		
Device Behaviour	Automatic error reset and switch back on		
Additional Error Information (AMK Service)			
Error Removal	• Observe at least 30 s of blocking-time before switching inverter back on		

9.7 1049 'DC bus'

	Fault charging DC bus inverter (n)		
Device	**ZWR**		
Description	DC bus is not charged correctly, ΔU/Δt is too small		
Class	Error		
Device Behaviour	Automatic error reset and switch back on		
Additional Error Information (AMK Service)			
Error Removal	• Check inverter -U1, replace if necessary		

9.8 1056 'Mains phase sequence L1, L2 , L3'

	Fault main contactor inverter (n)		
Device	**ZWR**		
Description	Phase sequence at the terminals -U1.X01:L1.1/L2.1/L3.1 is faulty after main contactor ON		
Class	Error		
Device Behaviour	Automatic error reset and switch back on		
Additional Error Information (AMK Service)			
Error Removal	• Check main contactor -K2 • Check mains filter -Y1 • Check mains choke -L2 • Check upstream mains choke -L1 • Check wiring		

9.9 1059 'DC bus overvoltage'

• DC bus overvoltage inverter	
Device	**ZWR**
Description	UZ > 900 V
Class	Error
Device Behaviour	Automatic error reset and switch back on
Additional Error Information (AMK Service)	
Error Removal	• Check voltage of PV field

9.10 1060 Regeneration fault

• Fault line regeneration inverter (n)	
Device	**ZWR**
Description	Inadmissible high current in the regeneration path
Class	Error
Device Behaviour	Automatic error reset and switch back on
Additional Error Information (AMK Service)	
Error Removal	• Check inverter -U1 • Retighten terminal clamps -U1.X01:L1.1/L2.1/L3.1 if necessary

9.11 1066 System diagnostics

• DC bus undervoltage inverter (n)	
Device	**ZWR**
Description	DC bus voltage about 13 % of max. mains voltage
Class	Warning
Device Behaviour	Automatic error reset and switch back on
Additional Error Information (AMK Service)	
Error Removal	• Check DC bus • Check PV field

9.12 1101 'Logic voltage error'

• Fault 24 VDC supply inverter (n)	
Device	**ZWR**
Description	24 VDC supply of inverter (-U1.X08:1/2) <18 V
Class	Error
Device Behaviour	Automatic error reset and switch back on
Additional Error Information (AMK Service)	
Error Removal	• Check 24 VDC supply -G1 • Check fuse -F12 • Check wiring

9.13 1107 'System diagnostics: Short circuit DC bus voltage'

	• Short circuit DC bus inverter		
Device	**ZWR**		
Description	Short circuit in the DC bus of the inverter -U1		
Class	Error		
Device Behaviour	Central inverter is disconnected from the mains		
Additional Error Information (AMK Service)			
Error Removal	• Replace inverter -U1		

9.14 1108 'System diagnostics: Main contactor'

	• Fault main contactor inverter (n)		
Device	**ZWR**		
Description	see additional information		
Class	Error		
Device Behaviour	Automatic error reset and switch back on		
Additional Error Information (AMK Service)			
	Info 1	1	Main contactor does not drop out. 10 s after inverter OFF, there is still voltage at the terminals -U1.X01:L1.1/L2.1/L3.1
		2	With setting of UE, the voltage is applied to -U1.X01:L1.1/L2.1/L3.1 immediately
Error Removal	• Check main contactor -K2		

9.15 1112 'Overload error external component'

	• Overload mains filter converter (n)		
Device	**ZWR**		
Description	Overload mains filter -Y1		
Class	Error		
Device Behaviour	Automatic error reset and switch back on		
Additional Error Information (AMK Service)			
Error Removal	• Check mains filter -Y1, replace if necessary		

9.16 2345 'Inverter overload error'

	• Overload inverter (n)		
Device	**ZWR**		
Description	Overload inverter -U1 (I^2t error, I_{max} for 10 s)		
Class	Error		
Device Behaviour	Automatic error reset and switch back on		
Additional Error Information (AMK Service)			
Error Removal	• Check inverter -U1		

9.17 2346 'Converter temperature error'

• Overtemperature inverter (n)	
Device	**ZWR**
Description	Overtemperature inverter -U1 (> 75 °C)
Class	Error
Device Behaviour	Automatic error reset and switch back on
Additional Error Information (AMK Service)	
Error Removal	• Check cooling system

9.18 3584 'System diagnostics: Special software message'

• Fault overload protection connectbox (n)	
Device	**ZWR**
Description	Overload protection tripped
Class	Error
Device Behaviour	Automatic error reset and switch back on
Additional Error Information (AMK Service)	
Error Removal	• Replace overload protection -F100 in connectbox

9.19 3585 'System diagnostics: Special software message'

• Fault monitoring power supply	
Device	**ZWR**
Description	NA protection device -A3 has tripped
Class	Error
Device Behaviour	Automatic error reset and switch back on
Additional Error Information (AMK Service)	
Error Removal	• Check mains conditions • Check configuration NA device -A3

9.20 3586 'System diagnostics: Special software message'

• Fault BUS	
Device	**ZWR**
Description	Fieldbus interruption
Class	Error
Device Behaviour	Automatic error reset and switch back on
Additional Error Information (AMK Service)	
Error Removal	• Check bus wiring • Check inverter -U1 • Check control unit -A1

9.21 3587 'System diagnostics: Special software message'

• Temperature cabinet too high	
Device	**ZWR**
Description	Overtemperature in cabinet
Class	Error
Device Behaviour	Automatic error reset and switch back on
Additional Error Information (AMK Service)	
Error Removal	• Check cooling / fan in cabinet • Check fuse -F11 • Check thermostat -S1

9.22 3588 'System diagnostics: Special software message'

• Frequency too low	
Device	**ZWR**
Description	Mains frequency out of configured frequency range
Class	Error
Device Behaviour	Automatic error reset and switch back on
Additional Error Information (AMK Service)	
Error Removal	• Check mains frequency • Check configured values

9.23 3589 'System diagnostics: Special software message'

• Frequency too high	
Device	**ZWR**
Description	Mains frequency out of configured frequency range
Class	Error
Device Behaviour	Automatic error reset and switch back on
Additional Error Information (AMK Service)	
Error Removal	• Check mains frequency • Check configured values

9.24 3590 'System diagnostics: Special software message'

• Voltage too low	
Device	**ZWR**
Description	Mains voltage out of configured voltage range
Class	Error
Device Behaviour	Automatic error reset and switch back on
Additional Error Information (AMK Service)	
Error Removal	• Check mains voltage • Check configured values

9.25 3591 'System diagnostics: Special software message'

	Voltage too high
Device	**ZWR**
Description	Mains voltage out of configured voltage range
Class	Error
Device Behaviour	Automatic error reset and switch back on
Additional Error Information (AMK Service)	
Error Removal	• Check mains voltage • Check configured values

9.26 3592 'System diagnostics: Special software message'

	Fault voltage (switch on)
Device	**ZWR**
Description	Mains voltage below configured switch-on voltage
Class	Error
Device Behaviour	Automatic error reset and switch back on
Additional Error Information (AMK Service)	
Error Removal	• Check mains voltage • Check configured values

9.27 3593 'System diagnostics: Special software message'

	Fault frequency (switch on)
Device	**ZWR**
Description	Mains frequency exceeds configured switch-on frequency
Class	Error
Device Behaviour	Automatic error reset and switch back on
Additional Error Information (AMK Service)	
Error Removal	• Check mains frequency • Check configured values

9.28 3594 'System diagnostics: Special software message'

	Warning string monitoring connectbox (n) string (m)
Device	**ZWR**
Description	String current below configured permissible deviation
Class	Warning
Device Behaviour	Automatic error reset and switch back on
Additional Error Information (AMK Service)	
Error Removal	• Check string • Check configured values

9.29 3595 'System diagnostics: Special software message'

• Fault init bus	
Device	**ZWR**
Description	Bus cannot be initialised
Class	Error
Device Behaviour	Automatic error reset and switch back on
Additional Error Information (AMK Service)	
Error Removal	• Check bus wiring • Check inverter -U1

9.30 3596 'System diagnostics: Special software message'

• Fault check DC	
Device	**ZWR**
Description	DC bus voltage < 300 V
Class	Error
Device Behaviour	Automatic error reset and switch back on
Additional Error Information (AMK Service)	
Error Removal	• Check DC bus

9.31 3597 'System diagnostics: Special software message'

• Fault check AC / DC	
Device	**ZWR**
Description	Switch-on condition $U_{AC} * \sqrt{2} + 100 \text{ V} \leq U_{DC}$ is violated
Class	Error
Device Behaviour	Automatic error reset and switch back on
Additional Error Information (AMK Service)	
Error Removal	• Check AC voltage • Check DC voltage
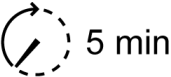
10 Maintenance

10.1 For your safety

⚠ **DANGER**	
⚡	**Danger to life from touching electrical connections!** Electrical terminals and connectors carry voltages that may cause death or serious injury upon contact. When the LEDs on the front panels are OFF, this does not indicate that the electrical terminals have been de-energized. **Steps to prevent:** • Prior to any work on the device: Observe the 5 safety rules. • Measure the terminal voltages. There may be no voltage present. • Plug and pull connections only when there is no voltage. • For devices that are connected to a DC bus, you need to consider the discharge times of the dc bus capacitors mentioned in the converter documentation • Before commencing work, the connections must be isolated from the voltage supply at both ends! (both ends mean: AC and DC bus supply side)

⚠ **DANGER**
All work on and with the devices may only be carried out by persons who meet the requirements under chapter 'Requirements for personnel and their qualification.'

10.2 Isolating the switch cabinet from the voltage supply

⚠ **DANGER**	
⚡ ⟳ 5 min	**Danger to life from electric shock!** When the connection on the AC side or the DC side is switched off, voltages that can pose a danger to life continue to be supplied to the central inverter via the remaining connection. After switching off the AC and DC mains, the buffer capacitors for the DC bus can still have a charge and lead to a life-threatening DC voltage. **Steps to prevent:** • After switching off, expect a discharge time of at least 5 minutes. • Measure the voltage in the DC bus between the UZP / UZN terminals to ensure that the terminals are voltage-free.

AC-side
1. Switch the external feeder line of the central inverter for AC power supply connector with an external AC-breaker (customer-side installation) voltage-free.
2. Switch off the AC breaker Q1 in central inverter..

DC-side
1. Switch the DC bus in the central inverter voltage-free by switching off the DC circuit breaker Q1 in the upstream Connectbox.
2. Switch off the DC-breaker Q11 in central inverter.

The terminals UZP and UZN from KES inverter switch voltage-free
1. Switch off the DC-breaker Q11 in central inverter.
2. Switch off the AC breaker Q1 in central inverter.
3. Wait 5 minutes for discharge terminals UZP and UZN.

10.3 Replacing filter mats

Set the interval for replacing the filter mats in both filter fan louvers as appropriate for the level of contamination in the environment in which the central inverter is operating.

The filter mats are replaced from the outside without opening the switch cabinet. Remove the filter fan louvers and replace the filter mats. Reattach the filter fan louvers.

10.4 Firmware update

The controller firmware and the inverter firmware are updated exclusively by specialist personnel trained and authorized by AMK.

11 Disposal

11.1 For your safety

⚠ WARNING
⚠	**Warning against pressurised lines!** Closed cooling circuits are under high pressure. Opening the circuit while it is under high pressure can result in injuries from escaping coolant. The sudden pressure change can cause lines to rip loose or make uncontrolled movements. **Steps to prevent:** • Never open a line system that is under high pressure! • Drain the coolant at the provided point, e.g. drain valve. Pay attention to the instructions of the manufacturer of the cooling device. • Collect the cooling liquid in a proper containment. Store or dispose it according to the local instructions. • Wear adequate protective clothing, e.g. goggles, gloves, safety shoes.

11.2 Preparing for disassembly

- Ask your local waste disposal company what you need to be aware of during disposal.
- Follow the 5 safety rules:
    1. Switch off electrical circuits (including electronic and auxiliary circuits)
    2. Secure circuits to prevent switching back on
    3. Determine that there is no voltage
    4. Ground and short-circuit
    5. Cover or close off neighboring parts that are under voltage
- Remove all electrical connections and cables
- Remove all liquids, e.g., oil, coolant, etc.

11.3 Disposal

Clarify with your local waste disposal company which materials and chemicals need to be separated and how to dispose of them. Observe the local regulations for disposal.

Examples of materials to be disposed of separately:

Components

- Electronic scrap, e. g., encoder electronics
- Iron scrap
- Aluminium
- Non-ferrous metal, e. g., motor windings
- Insulating materials

Chemicals

- Oils (disposal as hazardous waste, in acc. with the pertinent legislation; in Germany, the Waste Oil Ordinance (AltölV) applies)
- Grease
- Solvents
- Paint residue
- Coolant

12 Accessories

12.1 Connectbox

Designation	AMK part no.	Description
Connectbox Solar without string monitoring	O860	Contents: • DC string fuses for 15 strings, fuse protection for both potentials • Overvoltage and surge protection

Connectbox Solar with string monitoring	O864	Contents:
		• DC string fuses for 15 strings, fuse protection for both potentials
		• Overvoltage and surge protection
		• String monitoring
		  • String current is measured and read and evaluated by the controller via the RS 485 interface.
		  • Status message if the current actual value of a string is greater or less than the average value for all strings by more than a configurable tolerance
		  • String status display on the operator interface of the solar controller

Fire brigade switch	O866	Additional DC breaker in the connectbox with: • Undervoltage trip • Remote shutdown

12.2 Heat exchanger

Designation	AMK part no.	Description
SH02-L15	O849	Water/air heat exchanger ambient temperature < 20 °C
SH05-L15	O850	Water/air heat exchanger ambient temperature < 35 °C

Technical data

Data	SH02-L15	SH05-L15
Cooling capacity [kW]	2.8	5.6
Connections for forward/return flow	G 1/2 "	G 1/2 "
Connected load, fan [W]	79	79
Connected load, pump [W]	520	520
Dimensions (H x W x D) [mm]	627 x 500 x 540	627 x 500 x 540
Weight [kg]	40	40

12.3 Coolant

Designation	AMK part no.	Description
Tyfocor LS	203392	Ready-mix, cryoprotection up to –28 °C

12.4 Cabinet heating

Designation	AMK part no.	Description
Cabinet heating	O879	Fan heater with thermostat

Technical data

Data	Cabinet heating
Operating voltage	230 VAC, 50 / 60 Hz

Data	Cabinet heating
Heat output	950 W
Setting range	0 - 60 °C
Dimensions (H x W x D) [mm]	100 x 145 x 168
Weight	1.4 kg

12.5 Ethernet / EtherCAT cable

Designation	AMK part no.	Description
Cable RJ45 CAT5e PUR 5.00 m	202670	5.00 m length with straight plug, latching connection
Cable RJ45 CAT5e PUR 10.00 m	202671	10.00 m length with straight plug, latching connection

12.6 USB cable

Designation	AMK part no.	Description
USB cable	47058	USB type A acc. to mini-USB type B, length 3 m with ferrite shell

13 Certificates

The certificates are available through AMK sales or on the AMK website.

- Unit certificate

You can get it as follows:

- AMK homepage - service - download - registration - start online documentation - certificates
  (One-time manual activation by AMK sales department is necessary.
  The auto-registration via AMK homepage does not include access to the entire documentation.)
  www.amk-group.com/en/content/download_area

14 Appendix

14.1 Tightening torque for terminals- and screw connections

14.1.1 S 44-xxx, S 50-xxx, S 60-xxx

Check the terminal connections and the screw / plug connections

Des. *)	Description	S xx-Fxx Air-cooled central inverters		S xx-Wxx Liquid-cooled central inverters	S xx-xTx Central inverter with transformer
1	AC line supply	Terminals			
2	Neutral conductor connection	Screw connections			
3	Liquid cooling connection	-			See cooling type
4	PE connection	Screw connections			
5	Line contactor 2	Mechanical	M6	4.6 Nm	
		Main contacts	M6	4 - 4.5 Nm	
		Control contacts	M3.5	1 - 1.2 Nm	
		Auxiliary contacts	M3.5	1 - 1.2 Nm	
6	Upstream choke	Mechanical	M8	23 Nm	
		PE		6 - 8 Nm	
		X01		6 - 8 Nm	
		X02		6 - 8 Nm	
7	Line contactor 1	Mechanical	M6	4.6 Nm	
		Main contacts	M6	4 - 4.5 Nm	
		Control contacts	M3.5	1 - 1.2 Nm	
		Auxiliary contacts	M3.5	1 - 1.2 Nm	
8	DC breaker	Terminals			
9	Fused breaker	Terminals			
10	AC breaker	Terminals		6 Nm	
11	DC terminal bus	Screw connections			
12	Fuses: F7 F11 F12 F13 F14	Terminals Terminals Terminals Terminals Terminals		2.8 Nm 2.8 Nm 2.8 Nm 2.8 Nm 2.8 Nm	
13	Switch cabinet cooler	Mechanical PE Terminals		 Spring terminals	
14	Terminal block X11	-		Spring terminals	See cooling type
15	24 VDC power supply unit	Terminals		0.8 Nm	
17	Additional capacitor	Mechanical		8 Nm	
		PE		15 Nm	
		X02		4 - 4.5 Nm	

Des. *)	Description	S xx-Fxx Air-cooled central inverters	S xx-Wxx Liquid-cooled central inverters	S xx-xTx Central inverter with transformer
18	KES inverter	Mechanical: Clamping bolt Rear panel M6 PE X01 X02 X08 / X09 X21 / X22 X85 / X86	5 Nm 8 Nm 15 Nm 6 - 8 Nm 4 - 4.5 Nm Plug connection Plug connection Plug connection	
19	Switch cabinet thermostat	Terminals	1.4 Nm	
20	Power line filter	Mechanical M6 PE X01 X02 X03 X08 / X09 X25	9.6 Nm 6 - 8 Nm 6 - 8 Nm 6 - 8 Nm 0.7 - 0.8 Nm Plug connection Plug connection	
21	Power line choke	Mech. M10 PE X01 X02	46 Nm 6 - 8 Nm 6 - 8 Nm 6 - 8 Nm	
22	Transformer	-	-	Mech. PE Term.

*)   See 'Interieur view' on page 15.

14.1.2 S 88-xxx, S 100-xxx, S 120-xxx

Check the terminal connections and the screw / plug connections

Des. *)	Description	S xx-Wxx Liquid-cooled central inverters	S xx-xTx Central inverter with transformer
1	AC line supply	Terminals	25 Nm
2	Neutral conductor connection	Terminals	25 Nm
3	Liquid cooling connection		
4	PE connection	Terminals	25 Nm
5	Line contactor 2	Main contacts Control contacts Auxiliary contacts	18 Nm
6	Upstream choke	Mechanical M10 PE X01 X02	46 Nm 25 Nm 25 Nm 25 Nm

Des. *)	Description	S xx-Wxx Liquid-cooled central inverters		S xx-xTx Central inverter with transformer
7	Line contactor 1	Main contacts	18 Nm	
		Control contacts		
		Auxiliary contacts		
8	DC breaker	Terminals	10 Nm	
9	Fused breaker	Terminals	16 Nm	
10	AC breaker	Terminals	25 Nm	
11	DC terminal bus	Screw connections	25 Nm	
12	Fuses: F7 F11 F12 F13 F14	Terminals Terminals Terminals Terminals Terminals	2.8 Nm 2.8 Nm 2.8 Nm 2.8 Nm 2.8 Nm	
13	Switch cabinet cooler	Mechanical		
		PE		
		Terminals	Spring terminals	
14	Terminal block X11	Terminals	Spring terminals	
15	24 VDC power supply unit	Terminals	0.8 Nm	
17	Additional capacitor	Mechanical	8 Nm	
		PE	15 Nm	
		X02	4.5 Nm	
18	KES inverter	Mechanical: Clamping bolt Rear panel M6	5 Nm 8 Nm	
		PE	15 Nm	
		X01	18 Nm	
		X02	4.5 Nm	
		X06	18 Nm	
		X08 / X09	Plug connection	
		X21 / X22	Plug connection	
		X25	Plug connection	
		X85 / X86	Plug connection	
19	Switch cabinet thermostat	Terminals	1.4 Nm	
20	Power line filter	Mechanical M6	9.6 Nm	
		PE	15 - 20 Nm	
		X01	15 - 20 Nm	
		X02	15 - 20 Nm	
		X03	Plug connection	
		X08 / X09	Plug connection	
		X25	Plug connection	
21	Power line choke	Mech. M10	46 Nm	
		PE	23 Nm	
		X01	23 Nm	
		X02	23 Nm	

Des. *)	Description	S xx-Wxx Liquid-cooled central inverters	S xx-xTx Central inverter with transformer
22	Transformer	-	Mech. PE Term. 18 Nm

*)   See 'Interieur view' on page 15.

14.1.3 S 240-W00, S 240-W0B

Check the terminal connections and the screw / plug connections

Des. *)	Description	S 240-W0x Liquid-cooled central inverters	
1	AC line supply	Terminals	38.5 Nm
2	Neutral conductor connection	Terminals	38.5 Nm
3	Liquid cooling connection	Spring terminal	
4	PE connection	Terminals	38.5 Nm
5	Line contactor 2	Main contacts	18 Nm
		Control contacts	
		Auxiliary contacts	
6	2 x upstream choke	Mechanical M10	46 Nm
		PE	25 Nm
		X01	25 Nm
		X02	25 Nm
7	Line contactor 1	Main contacts	18 Nm
		Control contacts	
		Auxiliary contacts	
9	Fused breaker	Terminals	22 Nm
10	AC breaker	Terminals	25 Nm
11	DC terminal bus	Screw conn.	25 Nm
12	Fuses: F7 F11 F12 F13 F14	2.8 Nm 2.8 Nm 2.8 Nm 2.8 Nm 2.8 Nm	
13	Switch cabinet cooler	Mechanical PE Terminals	Spring terminals
14	Terminal block X11	Terminals	Spring terminals
15	24 VDC power supply unit	Terminals	0.8 Nm
17	2 x additional capacitor	Mechanical M6	8 Nm
		PE	15 Nm
		X01	4.5 Nm

Des. *)	Description	S 240-W0x	
		Liquid-cooled central inverters	
18	2 x KES inverter	Mechanical:	
		Clamping	5 Nm
		bolt M6	8 Nm
		Rear panel	
		PE	15 Nm
		X01	18 Nm
		X02	4.5 Nm
		X06	18 Nm
		X08 / X09	Plug conn.
		X21 / X22	Plug conn.
		X25	Plug conn.
		X85 / X86	Plug conn.
19	Switch cabinet thermostat	Terminals	1.4 Nm
20	2 x power line filter	Mechanical M6	9.6 Nm
		PE	15 - 20 Nm
		X01	15 - 20 Nm
		X02	15 - 20 Nm
		X03	Plug conn.
		X08 / X09	Plug conn.
		X25	Plug conn.
21	2 x power line choke	Mech. M10	46 Nm
		PE	23 Nm
		X01	23 Nm
		X02	23 Nm

14.2 Dew point table

The dew point table specifies at which surface temperature condensate forms. This depends on the temperature of the air and the relative humidity.

Example: Ambient temperature: 32 °C, humidity: 60 %
The temperature of the cooling circuit may not be less than 23 °C, else condensate will form!

Ambient air temperature in °C	Dew point in °C at a relative humidity of										
	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%
2	-7,70	-6,26	-5,43	-4,40	-3,16	-2,48	-1,77	-0,98	-0,26	0,47	1,20
4	-6,11	-4,88	-3,69	-2,61	-1,79	-0,88	-0,09	0,78	1,62	2,44	3,20
6	-4,49	-3,07	-2,10	-1,05	-0,08	0,85	1,86	2,72	3,62	4,48	5,38
8	-2,69	-1,61	-0,44	0,67	1,80	2,83	3,82	4,77	5,66	6,48	7,32
10	-1,26	0,02	1,31	2,53	3,74	4,79	5,82	6,79	7,65	8,45	9,31
12	0,35	1,84	3,19	4,46	5,63	6,74	7,75	8,69	9,60	10,48	11,33
14	2,20	3,76	5,10	6,40	7,58	8,67	9,70	10,71	11,64	12,55	13,36
15	3,12	4,65	6,07	7,36	8,52	9,63	10,70	11,69	12,62	13,52	14,42
16	4,07	5,59	9,98	8,29	9,47	10,61	11,68	12,66	13,63	14,58	15,54
17	5,00	6,48	7,62	9,18	10,39	11,48	12,54	13,57	14,50	15,36	16,19
18	5,90	7,43	8,83	10,12	11,33	12,44	13,48	14,56	15,41	16,31	17,25
19	6,80	8,33	9,75	11,09	12,26	13,37	14,49	15,47	16,40	17,37	18,22
20	7,73	9,30	10,72	12,00	13,22	14,40	15,48	16,46	17,44	18,36	19,18
21	8,60	10,22	11,59	12,92	14,21	15,36	16,40	17,44	18,41	19,27	20,19
22	9,54	11,16	12,52	13,89	15,19	16,27	17,41	18,42	19,39	20,28	21,22
23	10,44	12,02	13,47	14,87	16,04	17,29	18,37	19,37	20,37	21,34	22,23
24	11,34	12,93	14,44	15,73	17,06	18,21	19,22	20,33	21,37	22,32	23,18
25	12,20	13,83	15,37	16,69	17,99	19,11	20,24	21,35	22,27	23,30	24,22
26	13,15	14,84	16,26	17,67	18,90	20,09	21,29	22,32	23,32	24,31	25,16
27	14,08	15,68	17,24	18,57	19,83	21,11	22,23	23,31	24,32	25,22	26,10
28	14,96	16,61	18,14	19,38	20,86	22,07	23,18	24,28	25,25	26,20	27,18
29	15,85	15,58	19,04	20,48	21,83	22,97	24,20	25,23	26,21	27,26	28,18
30	16,79	18,44	19,96	21,44	23,71	23,94	25,11	26,10	27,21	28,19	29,09
32	18,62	20,28	21,90	23,26	24,65	25,79	27,08	28,24	29,23	30,16	31,17
34	20,42	22,19	23,77	25,19	26,54	27,85	28,94	30,09	31,19	32,13	33,11
36	22,23	24,08	25,50	27,00	28,41	29,65	30,88	31,97	33,05	34,23	35,06
38	23,97	25,74	27,44	28,87	30,31	31,62	32,78	33,96	35,01	36,05	37,03
40	25,79	27,66	29,22	30,81	32,16	33,48	34,69	35,86,	36,98	38,05	39,11
45	30,29	32,17	33,86	35,38	36,85	38,24	39,54	40,74	41,87	42,91	44,03
50	34,76	36,63	38,46	40,09	41,58	42,99	44,33	45,55	46,75	47,90	48,98

Glossary

A

A
Outputs

A4 / A5 / A6 (A-series)
AMKAMAC controller A-series

ACC
AMK CAN Communication (CAN bus interface with standard CANopen protocol DS301 and additional hardware synchronization signal)

AIPEX
AMK startup and parameterizing software (PC software): Programming, parameterization, configuration, diagnosis, oscilloscope, status information

ATF
AMK Tool Flasher (PC software for transferring firmware to device)

AWG
American Wire Gauge (Coding of wire diameter)

D

DOC
Disc on Chip

E

EtherCAT
Real-time Ethernet bus

EMC
Electromagnetic compatibility

ENS
External mains monitoring relay

E/A
In- and outputs

E
Input

EMV
Electromagnetic compatibility

F

Firmware
System software, loaded by AMK

FL
Command (Causes a new system run-up)

FTP
File transfer protocol

G

GND
Ground potential

I

I
Input

ID
Parameter identification numbers acc. to SERCOS Standard

IGBT
Power electronic component, e. g. transistor

K

KES
AMKASYN compact power supply with sinusoidal voltage and current

KE/KW
Modular AMK drive system (contains compact power supply KE, compact inverter KW with controller card and applicable option card)

M

MST
Master synchronization telegram

MHB
Motor holding break

MPP
Maximum Power Point

N

NA
Mains and system protection

O

O
Output

Operational
In state operational, data are transferred cyclically via fieldbus

P

PDK_xxxxxx_abcdefgh
Product documentation; xxxxxx - AMK part no. , abcdefgh - name

Pre-operational
In pre-operational state, the controller can access the bus participants via the service channel. No cyclic data is exchanged.

PV
Photovoltaics

PWM
Pulse width modulation

Q

QUE
Acknowledgment DC bus on; shows that DC bus is loaded

QFL
Acknowledgment clear error; the command clear error was executed

S

S xx-xxx
Central inverter for solar power plants

SW
Software

SBM
System ready message; shows that the device is error-free In case of error. SBM will be reset

SERCOS
Standardized digital interface for communication between controller and field bus participants.

SR xx-xxx
Central inverter for energy control storage

U

UZN
DC bus voltage pole negative

UE
Command 'DC bus on' control signal to load the DC bus e.g. in KE. DC bus on can only be set if the device is error-free (SBM = TRUE). After the DC bus is loaded, the acknowledgement message QUE is set.

UZ
DC bus (voltage)

UZP
DC bus voltage pole positive

Z

ZWR Energy
Central inverter for energy control storage

ZWR
Central inverter

ZWR Solar
Central inverter for solar power plants

AMK

Your opinion is important!

With our documentation we want to offer you the highest quality support in handling the AMK products.

That is why we are now working on optimizing our documentation.

Your comments or suggestions are always of interest to us.

We would be grateful if you take a bit of time and answer our questions. Please return a copy of this page to us.

e-mail: Documentation@amk-group.com

or

fax no.: +49 7021/50 05-199

Thank you for your assistance.
Your AMK documentation team

1. How would you rate the layout of our AMK documentation?

   (1) very good (2) good (3) satisfactory (4) less than satisfactory (5) poor

2. Is the content structured well?

   (1) very good (2) good (3) moderate (4) hardly (5) not at all

3. How easy is it to understand the documentation?

   (1) very easy (2) easy (3) moderately easy (4) difficult (5) extremely difficult

4. Did you miss any topics in the documentation?

   (1) no (2) if yes, which ones:

5. How would you rate the overall service at AMK?

   (1) very good (2) good (3) satisfactory (4) less than satisfactory (5) poor

AMK Arnold Müller GmbH & Co. KG
Phone : +49 7021/50 05-0, fax: +49 7021/50 05-199
E-Mail: info@amk-group.com
Homepage: www.amk-group.com