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CONTRACTOR

ABB

Consortium ABB Switzerland Ltd.
ABB Transmission & Distribution Ltd.

PROJECT

NEW 400kV GRIDSTATION AND 132/22kV
PRIMARY SUBSTATION AT AL REEM ISLAND AND
ASSOCIATED 400kV CABLE WORKS
Lot 1: Substation Works (Alternative B)

CONTRACT NO. N 4218.1

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Primary Switch Mode Inverter

UNV-F

OPERATION MANUAL

BHB.UNV-F.D65-1050.HB001

Notes to this manual

ATTENTION! Please read this manual very carefully before installing and commissioning the inverter.

This manual is part of the delivered device. Knowledge of this document is obligatory for deals with the specified unit or puts into operation. All works on the module such as transport, putting into operation, adjustment and maintenance is to be carried out by qualified personnel only. The rules for prevention of accidents of the specific country and the universal safety rules acc. IEC 364 are to be observed!

This manual is equivalent to the technical revision of the inverter to the day of its printing. The contents are for information purpose only and it is not included in the contract. Technical changes between this manual and the actual product are possible due to technical progress. The producer is not responsible for uncorrect technical descriptions or data inside this manual because there is no obligation to a permanent actualization of this documentation.
The switch mode inverter will be manufactured according to valid DIN- and VDE-standards such as VDE 0106 (part 100) and VDE 0100 (part 410). The CE-label on the modules confirms the compliance with EU-standards for 73/23 EWG − low voltage and 89/339 EWG − electromagnetical compatibility if the installation and operation rules are observed.

All systems and components are delivered according to the delivery conditions for electrical products and services of electronic industry and our own sales conditions. Changes of contents in this manual such as technical data, dimensions, weight and handling are possible.

In case of reclamation of delivered products please contact us immediatily after receiving with delivery note number, device type, device number and fault description.

In case of visible changes on the device caused by the customer (missing screws, new weldings, unmounted boards a.s.o.) the customer looses the warranty. At operation under non-specified conditions (acc. technical specifications), the customer looses the warranty and there is no liability by the producer. The responsibility for measurements to prevent accidents and material damages has the system operator (customer), not the producer.

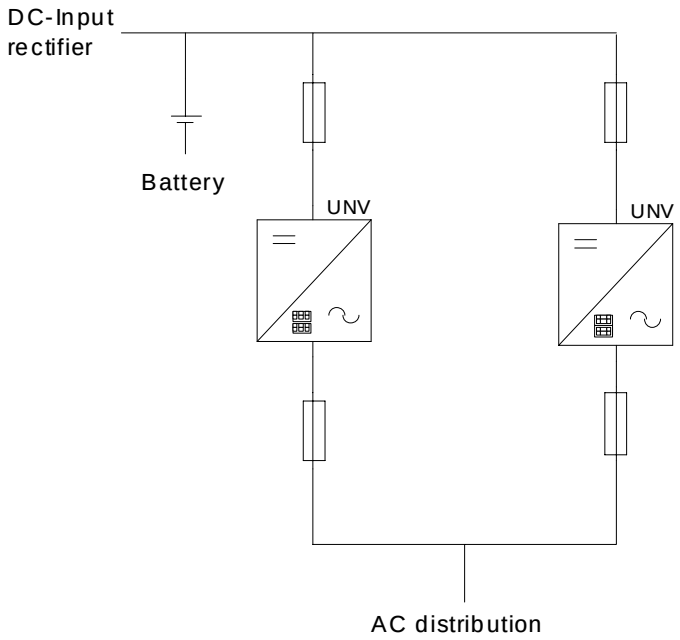
Contents

1. General Information

Inverter type UNV-F (named UNV on next pages) are available for delivery with an output power of 1.2, 1.8, 2.5, 3.3 and 5.0kVA per module. To increase the system output power several units can be operated in parallel.

Typical applications are:

- AC power supply with input side battery buffering
- Industrial modular UPS with input side rectifier and battery



Picture 1.1: UNV in parallel operation

Inverter UNV-F converts input side DC voltage to stable sinewave output voltage.
Several frequencies are available for delivery

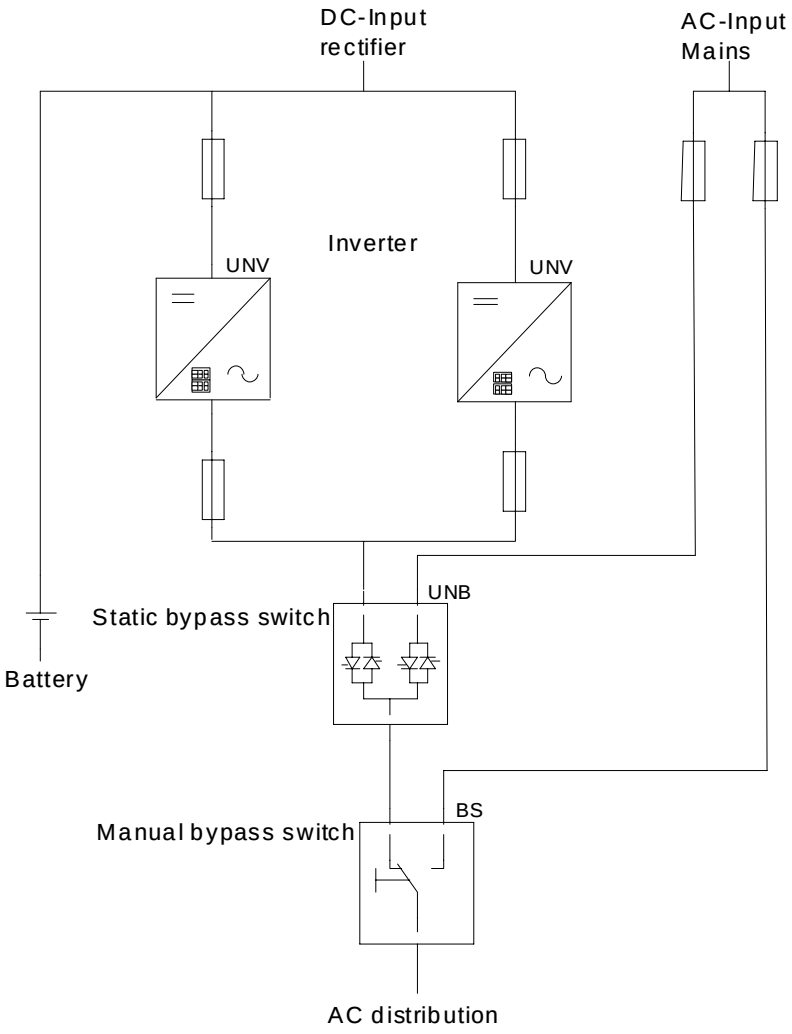
UNV-F are hot-plugable modules with rear side connectors. Only the communication wire (CAN bus) is connected on the front. The inverter is controlled and monitored by internal microprocessor. All main functional parameters are adjustable with front side operating keys and are indicated with digital displays. Due to the excellent overall efficiency (see technical data) the unit has very compact dimensions (19″-rack, 3HU), low weight and so a very high power density.

Due to the special input side regulation principle the ripple voltage limit fulfils the standard of CCITT-A-filtering without any additional filter elements.

To increase the reliability of the inverter it is designed to operate together with static bypass switch UNB. The static by-

pass switch monitores the connected bypass mains and synchronises the inverter output with mains frequency. In inverter preselection mode the UNB transfers the load supply to bypass mains in case of inverter faults, high overload, battery low voltage. The transfer is nearly without voltage interruption. After problem solving the unit switches back to inverter operation automatically. In case of mains preselection mode the inverter will take over the load if mains is not present, out of limits or badly distorted.

The primary source is programmable on static switch unit. For the UNB a separate manual is available.



Picture 1.2:
Inverter operation with static bypass switch UNB

2. Type Range

Type designation UNV..	Item-number	Input-voltage in V DC	Output-voltage in V AC	Output-power in VA (bei cosφ=0.8)	Dimensions W/H/D in mm
48-1.2F	C65-1051	48/60	230	1200	483/133/360
48-1.8F	C65-1052	48/60	230	1800	483/133/360
48-2.5F	C65-1053	48/60	230	2500	483/133/360
48-3.3F	C65-1054	48/60	230	3300	483/133/360
48-5.0F	C65-1055	48/60	230	5000	483/133/440
108-1.2F	C65-1061	108	230	1200	483/133/360
108-1.8F	C65-1062	108	230	1800	483/133/360
108-2.5F	C65-1063	108	230	2500	483/133/360
108-3.3F	C65-1064	108	230	3300	483/133/360
108-5.0F	C65-1065	108	230	5000	483/133/440

Available options and accessory parts

- Additional connector
- 19″-sliding bar
- connector fastening

3. Storage

The modules have to be stored in a dry, dustfree room with the specified storage temperature (observe technical specifications; chapter 11).

4. Commissioning

After unpacking the module search for damage based on external influences. In case of mechanical deformation do not put the module in operation. The module is mounted into the subrack with 4 frontside screws.

Please check the input voltage level and compare it with the type lable value on the inverter module before connecting DC voltage.

For mounting of the units and putting into operation onsite. Following instructions and rules have to be observed:

- mount in dry, dustfree rooms only
- observe the specifications about ambient conditions such as ambient temperature or relative humidity
- highly dusty or aggressive chemical atmosphere is not allowed; dew and dust together can cause short circuits on printed circuits
- sufficient air cooling is required, especially when mounting in cabinets with several 19" subrack levels

Check DC voltage before connecting the inverter (observe nominal values on type label).
For connection of DC input and AC output the backside panel connector have to be used. The DC input is protected against wrong polarity (unit does not switch on). The UNV is equipped with input and output fusing (MCB`s on front panel).
The inverters (1.2 to 5.0kVA) operates with temperature controlled fan cooling. The ambient temperature has to be lower than 40 °C.
Please check the load power before connecting the module. A permanent overload is not allowed and decreases the in-

verters lifetime. Especially the inrush currents of loads have to be observed (for instance, a usual computer monitor can have an inrush current of more than 50A!).
The connection of the non-fused earthed conductor is required. The electrical connections have to be carried out acc. pin list in chapter 8. Please use wires acc. VDE 0100 or equal standard. To decrease voltage losses on cables usage of bigger sizes of wire as specified is recommended. For instance, a high voltage loss on battery wires can decrease the backup time.

Following installation rules should be observed:

<u>single inverter:</u>

- check system wiring (polarity of DC- supply line)
- check that inverter is switched off
- connect DC input with open DC bushbar fuses
- connect AC loads
- close DC bushbar fuses
- switch on the unit with front side MCB
- switch on load

<u>inverters in parallel:</u>

- check system wiring (polarity of DC- supply line, synchron bus)
- check if inverters are switched off
- connect DC input with open DC bushbar fuses
- check wiring between inverters (synchronization wires)
- connect AC loads
- close DC busbar fuses
- switch on the units with front side MCB's
- switch on load

5. Handling

All operating elements are located on the front of the module. The input and output side MCB are used as ON/OFF-switch. The LED's indicate the operation state of inverter. All signals and monitorings will be described in the next chapters.

LED	Color	Meaning
OPERATION	green	Inverter is switched on and operates
Uo	green	Inverter output voltage o.k. (see pt. 6.3.5)
Ui>	red	Input voltage high; input voltage > Adjusted monitoring threshold; inverter switches off(see pt. 6.3.5)
Ui<	red	Input voltage low; input voltage < Adjusted monitoring threshold; inverter switches off(see pt. 6.3.5)
Io>	red	Output current to high; short circuit or overload on output
T>	red	lights Continously: overheating of inverter by overload light Blinks: poor cooling; Inverter switches off delayed
ALARM	red	Collective failure, delay time of relay alarm adjustable, relay contact on X1; all single errors included

Adjustment of the standard values and thresholds

The adjustment takes place with the two up / down keys, which have following functions:

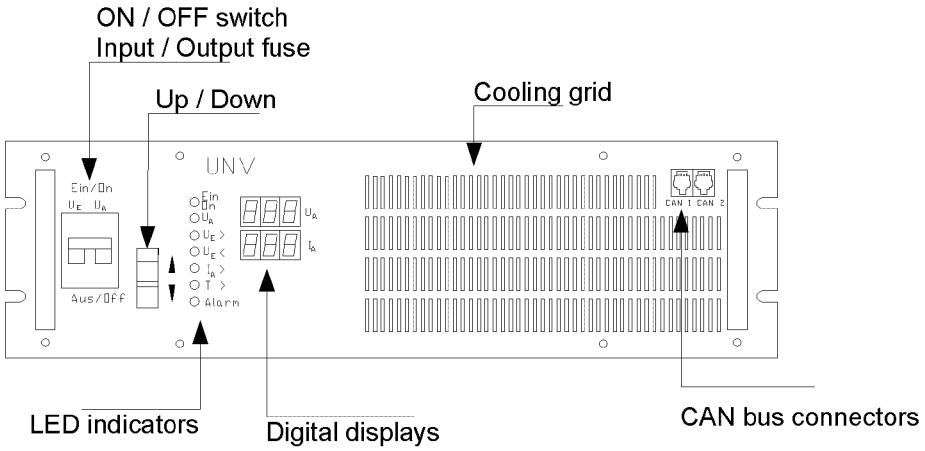
▲ - during menu item selection: change to previous item (parameter)

- during adjustment mode: increase value

▼ - during menu item selection: change to next item (parameter)

- during adjustment mode: increase value

For switching between the menues please press both buttons for 3 sec.



Picture 5.1:
Front view UNV-F

inverters in parallel

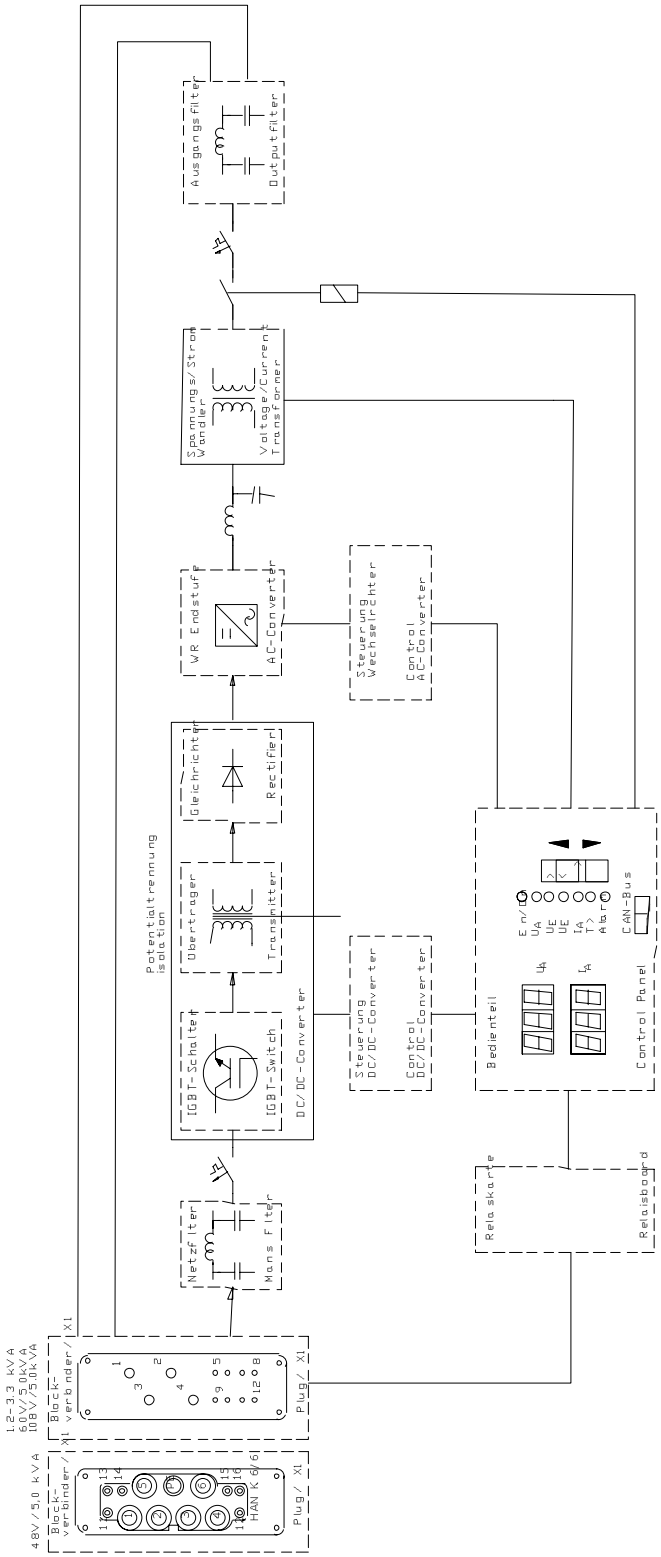
One unit operates as master and synchronizes all other units.

ATTENTION! The unit which transmits the synchonization signal to synchronization bus at first will be the master. If this master unit is disturbed or switched off, another unit overtakes the master function. In systems with static bypass switch (SBS) the inverters will be synchronized by SBS unit.

6. Functions

6.1 Schematic block diagram

Picture 6.1:
Schematic Block Diagramm
Inverter UNV (F type)



6.2 Functional description

Inverters of the UNV-type are new switch mode inverters with an innovate operation principle. The inverter transforms the input side DC voltage into an AC voltage with high stability concerning frequency, amplitude and waveshape. The unit consists of following main parts:

1. Input / output connector HAN K 4/8 (UNV48-1.2F – UNV108-5.0F) / HAN K 6/6 (UNV48-5.0F) to connect input, output voltage and signals

2. Passive filter to reduce RF interferences

3. Input circuit breaker (MCB) ; used as ON/OFF switch

4. Innovate DC/DC-converter topology consisting of MOSFET/IGBT-converter , isolation transformer, rectifier bridge to produce a voltage of appr. 380V DC, capacitor block to store the DC voltage. The DC/DC-converter modulates the input current to suppress the input AC.

5. Pulse width modulated inverter bridge (20kHz) with IGBT`s to convert the DC voltage into an AC voltage with high frequency and a stable amplitude

6. Monitoring system for input, output and internal parameters

7. Output relay (necessary for paralleling operation)

8. Output circuit breaker (MCB), mechanically coupled with DC circuit breaker

9. Output AC filter for RFI suppression

10. Control board for DC/DC converter

11. Control board for AC converter

12. Microprocessor based control unit performs controlling, monitoring, adjustments (value storage) and displaying of inverters parameter and serial communication via CAN-Bus

6.2.1 Safe electrical decoupling

The unit fulfills the standard EN60950.
Observance of air and creeping distances, the isolation transformer and the separate wiring guarantee a safe electrical decoupling between primary (input) and secondary (output) side.

6.2.2 Input

The DC input is protected by a magnetic circuit breaker (MCB) – except the inverter with output-power of 5kVA.
The input is equipped with inrush current limitation to limit the inrush current to the level of nominal input current. The input voltage and current is visible on the front side digital displays.

6.2.3 Output

The unit is generally equipped with an output MCB.
The output is continuously short circuit proof and supplies a short circuit current of 2 to 3xInom for 2,5 sec.
In case of short circuit the unit switch on every 15sec. again to check if the short circuit is away.
The inverter can be overcharged for a short time without switching off. The overload alarm is preset to 10% overload for 30 sec. It is possible to increase the load to 130% of nominal load for a short period only.

6.2.4 Dynamic regulation of output voltage

For load steps between 10% and 100% Inom / 100% and 10% Inom the dynamic voltage deviation is < 3 % and is regulated in < 1,5 ms to static accuracy.

6.2.5 RFI-Suppression

Inverter type UNV fulfills the standards EN 55011/55022 class „B".

6.3 Monitoring

6.3.1 Input voltage monitoring

The input voltage is monitored continuously. The actual value is compared with the programmed monitoring thresholds. The thresholds can be adjusted with the front keys (see chapter 6.3.5).

The red LED "Ui<" signalizes inverter input voltage low (voltage is lower than adjusted threshold Ui<).
The inverter switches off with an adjustable delay time. It switches on again if the input voltage is in the correct range. The switch-on voltage is adjustable. The hysteresis and delay time protects the unit from an oscillation of the automatic switch off function, e.g. if a discharged battery is unloaded by inverter switch off.

The red LED "Ui>" signalizes inverter input voltage high (voltage is higher than adjusted threshold Ui>)
The inverter switches off without delay time (protection against overvoltage). The inverter switches on again if the input voltage is lower than adjusted switch off threshold.

6.3.2 Output voltage monitoring

The inverter output voltage is transmitted to the control unit by a voltage transformer and is compared to internally adjusted values.
If there is a correct output voltage the green LED "Uo O.K." is on. If the output voltage is lower than the adjusted threshold (e.g. high overload or short circuit), the inverter switches off with a delay time of 2.5 sec. After 15 sec follows an automatic restart.
The red LED „Error" is on. The inverter is continuously short circuit proof.

6.3.3 Monitoring of Overheating

Signal "T>" (red LED) ; if the internal temperature of the inverter is higher than the adjusted threshold. High ambient temperature, poor cooling , permanent overload (appr. 20-25%) or a defective fan can cause overheating of the unit. The inverter switches off with an adjustable delay time. The inverter switches on again if the temperature is lower than the adjusted switch on threshold. Additionally, the fan voltage and current characteristic is monitored to detect a defective fan. This is indicated by a blinking LED „T>".

6.3.4 Signals

All operation modes and error-states are indicated by LED's situated on the front panel. The collective failure signal is available by an isolated relay contact on connector X1.

Max. contact load: 60V DC / 1A, 110V DC / 0.45A.

In case of failure the contacts "COM" and "NO" are closed.

6.3.5 Adjustment of output parameters and monitoring thresholds

The adjustment of output parameters and monitoring thresholds is easy. The values can be adjusted with the two frontkeys by displaying the actual value.

The inverter offers two adjustment menus:

- Basic menu PM1 is available for all users
- Service menu PM2 is for service personnel only. PM2 has a code protection to protect against unallowed parameter changes.

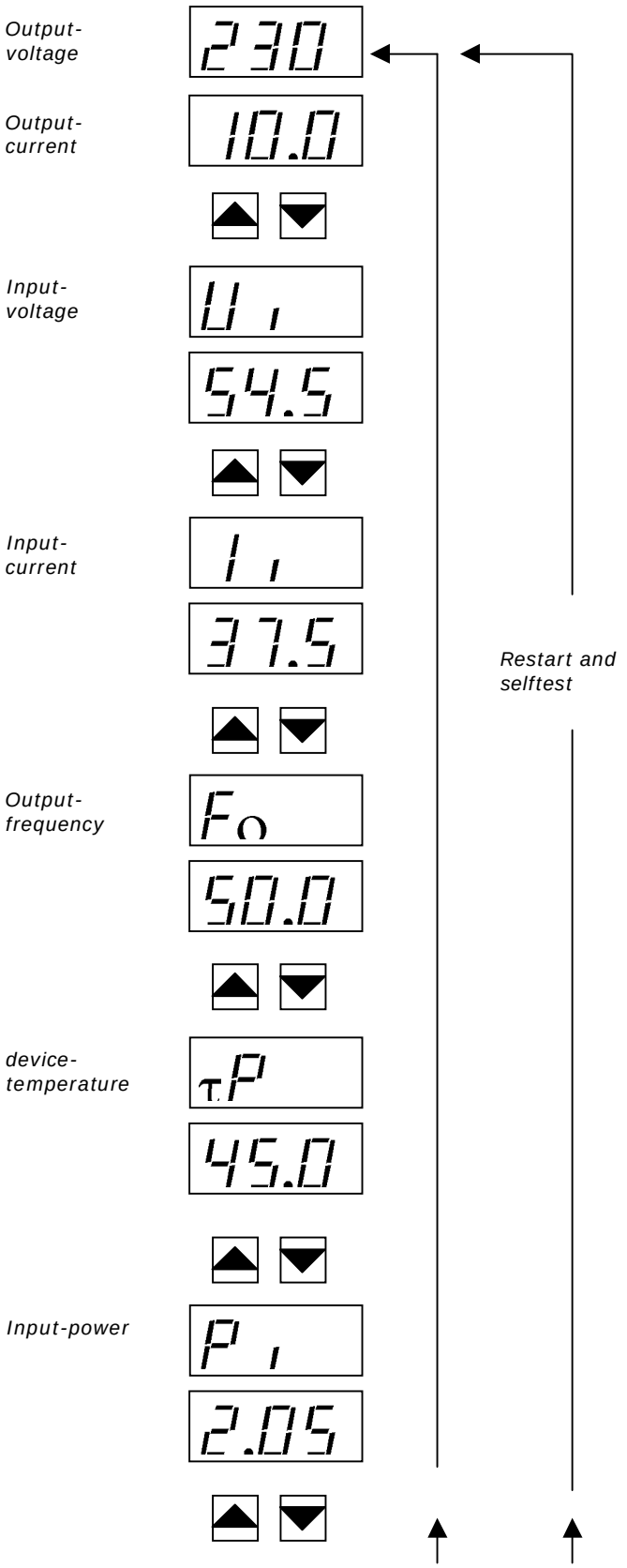
In operation mode the top display shows the output voltage and the bottom display shows the output current.

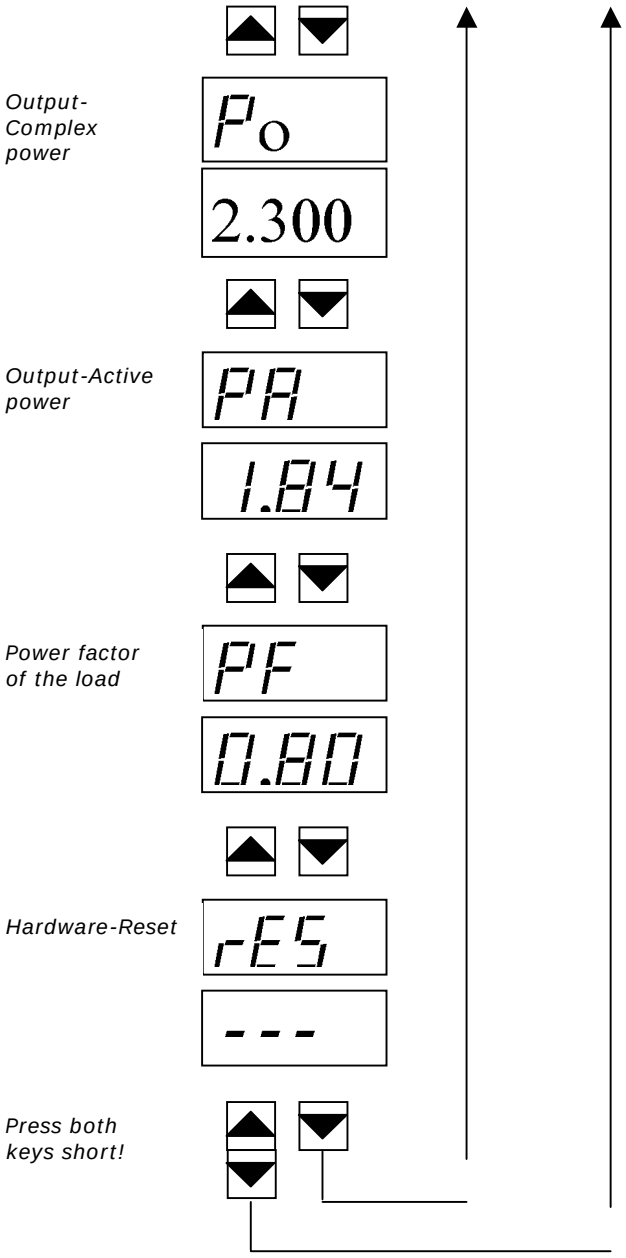
For adjustment of parameters in basic menu PM1 the following procedure has to be carried out:

1. press both keys UP/DOWN(↑↓) together for a short time; the inverter changes to adjustment mode
2. press the key UP(↑) or DOWN(↓) to change the adjustment parameter (see also table on bottom)
3. press both keys UP/DOWN(↑↓) together for a short time; the inverter changes to value change mode
4. press the key UP(↑) or DOWN(↓) to change the adjustment value
5. press both keys UP/DOWN(↑↓) together for a short time; the inverter changes back to adjustment mode (the upper display shows a horizontal line / the changed value is stored at this moment)
6. press both keys UP/DOWN(↑↓) for appr. 3 sec. to change back into operation mode

Adjustable parameters in PM1 (see a)):

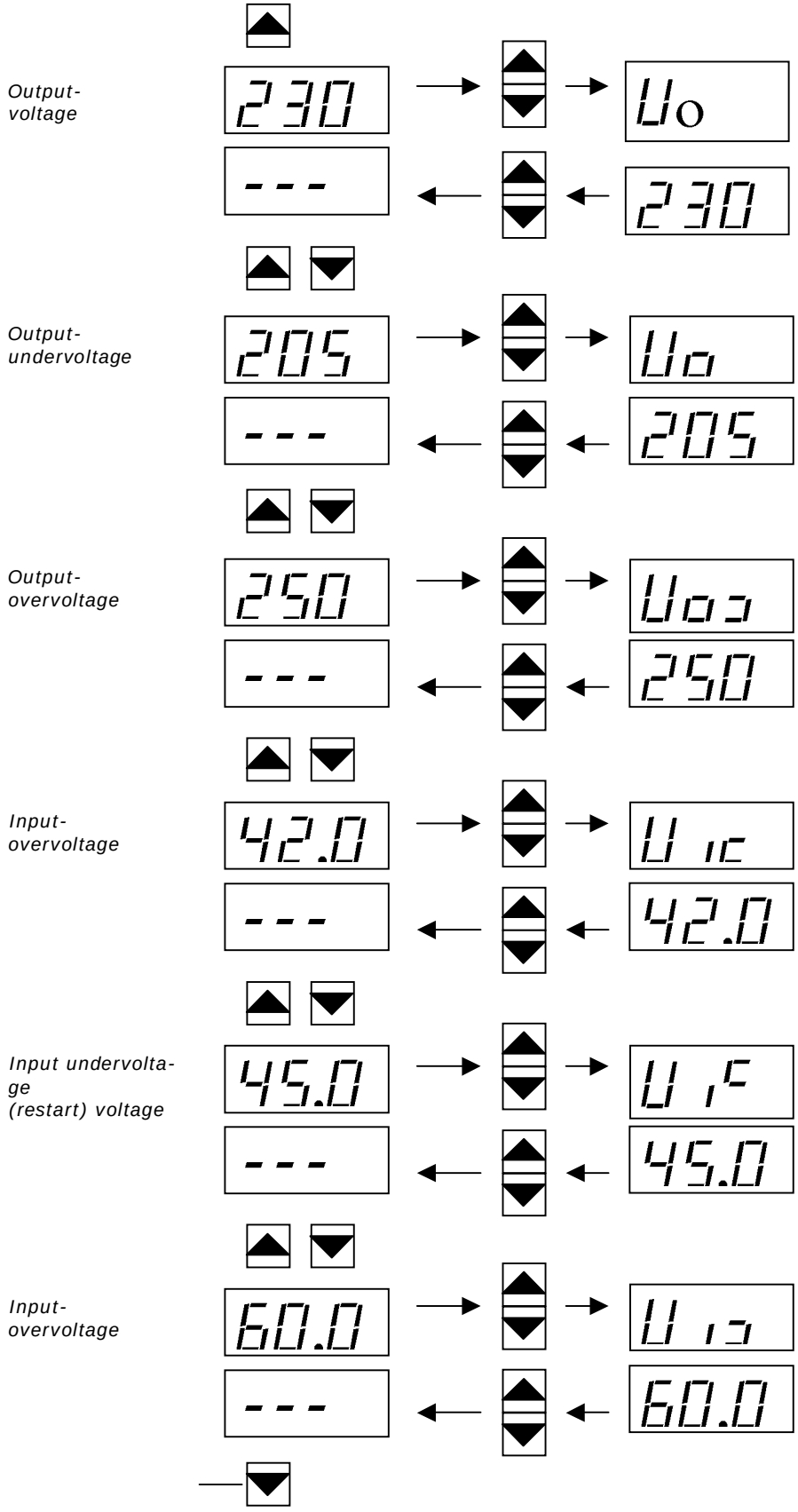
a) Standard display during operation / monitoring of in - / output parameters:





For switching to the adjust menu please press both buttons for 3 sec (see next page).

Adjust the values and Thresholds as follows

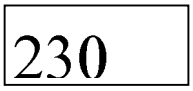


Following diagramm shows standard values, adjustment range and steps:

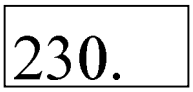
Dis-play1	notice	Standard	Range	Step
Uo	nominal value of out-put voltage Uo*	230 [V AC]	200...255	0,25 [V]
Uo<	monitoring threshold of output voltage low Uo<*	207 [V AC]	180...230	1,0 [V]
Uo>	Monitoring threshold of output voltage high Uo>*	253 [V AC]	230...270	1,0 [V]
Ui>	switch off threshold input voltage high Ui>	48V:75 [V DC] 108V: 130	0...80 0...135	0,1 [V] 0,25
Ui<	switch off threshold input voltage low Ui<	48V:41 [V DC] 108V: 92	41...80 90...110	0,1 [V] 0,25
Ui^	switch on again threshold input volt-age low Ui<	48V:45 [V DC] 108V: 96	41...80 90...110	0,1 [V] 0,25

*When adjusting thresholds Uo, Uo> with up / down keys the moving dot shows the actual value:

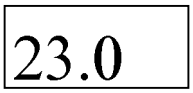
For example:



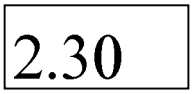
Correspond to 230,0



Correspond to 230,25



Correspond to 230,5



Correspond to 230,75

6.3.6 CAN-Interface

The inverter is equipped with a serial data interface according to CAN (= controlled area network) −specification.
Via CAN-Bus, several inverters in a system or parallel connection can be controlled and monitored by a central unit which is integrated into the static switch unit UNB.

Following parameters of a specific inverter unit can be controlled or read out:

- Remote ON/OFF
- Inverter status (OK/failure)
- Input voltage (measurement value)
- Input current (measurement value)

The CAN-Bus connectors are located on the front panel. The wiring to the central unit should be as shorte as possible. Cable length must not exceed 30m.

7. Operation in parallel

ATTENTION! Before starting several units in parallel it is important to check the output frequency and voltage on each unit without any connections between the units.
In the next step it has to be checked that the connections of the SYNC-BUS wires between the modules are correct.

ATTENTION! The unit which transmits the synchonization signal to synchronization bus at first will be the master. If this master unit is disturbed or switched off, another unit overtakes the master function. In systems with static bypass switch (SBS) the inverters will be synchronized by SBS unit.

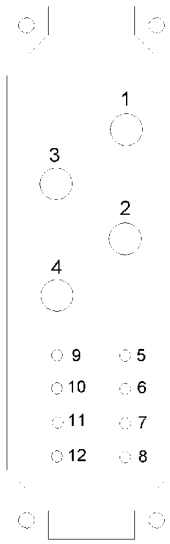
The inverter output relay switches the inverter output to AC busbar if the internal voltage is O.K. and the output voltage is in the correct range. In this way defective modules switch off themselves and are disconnected from the AC bus automatically.

8. Connectors

8.1 Connector F-type

X1 (HAN-K4/8,) socket outlet (DC input voltage / AC output voltage and signaling) :

Picture 8.1:
Connector X1
UNV-F 1.2-3.3kVA
UNV 60-5.0F
UNV 108-5.0F

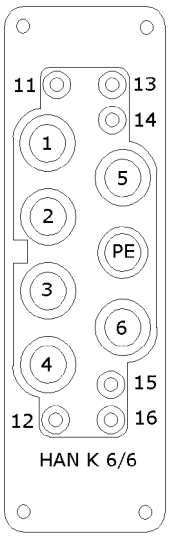


Pin	Designaton
1	DC input, plus pole
2	AC output, neutral conductor
3	DC input, minus pole
4	AC output, phase L1
5	No connection
6	SYNC-GND (synchronbus ground)
7	SYNC-SIG[1] (synchronbus 50Hz-signal)
8	SYNC-STAT[2] (synchronbus state lines)
9	No connection
10	Collective failure COM[3]
11	Collective failure OK (make contact) NO
12	Collective failure error (back contact) NC

1. In parallel operation the contacts SYNC − GND and SYNC − SIG of each inverter has to be wired.
   The allowed load for relay contacts is:
   U_{max} = 110 V DC I < 0.45 A DC
   U_{max} ≤ 60 V DC I < 1 A DC

2. In operation with an UNB it is necessary to connect aditional to SYNC − GND, SYNC − SIG the contacts SYNC − STAT between all of the inverters and the UNB.
3. Potentialfree relay contact with safe electrical seperation to the AC and DC connectors; COM and DC connectors; COM and back contact in case of failure closed

Connector for UNV48-5.0F (HAN K 6/6):



Picture 8.2:
Connector X1
(UNV48V-5.0kVA)

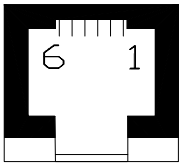
Pin	Designaton
1	DC input, Plus
2	No connection
3	No connection
4	AC output, phase L1
5	DC input, Minus
PE	PE
6	AC output, neutral conductor
11	Collective failure COM[4]
12	SYNC-GND (synchronbus ground)
13	Collective failure OK (make contact) (NO)
14	Collective failure error (back contact) (NC)
15	SYNC-SIG[6] (synchronbus 50Hz-signal)
16	SYNC-STAT[5] (synchronbus state lines)

4. Potentialfree relay contact with safe electrical separation to the AC and DC connectors; COM and back contact in case of failure closed.
5. In operation with an UNB it is necessary to connect aditional to SYNC − GND, SYNC − SIG the contacts SYNC − STAT between all of the inverters and the UNB.
6. In parallel operation the contacts SYNC − GND and SYNC − SIG of each inverter has to be wired

8.2 Connector – CAN-Bus

Connector X2 (socket outlet RJ45,6pol):

CAN-Bus-Interface



Pin	Signal – CAN1	Signal-CAN2	Name
1	CAN_V+		DC-Supply +8...15V
2	CAN_V+		DC-Supply +8...15V
3	CAN_H		Signal (high)
4	CAN_L		Signal (low)
5	CAN_V-		DC-Supply Ground
6	CAN_V-		DC-Supply Ground

9. Maintenance

In general, the inverter is maintenance-free.
A yearly inspection with following checks is recommended:

- Correct fan operation
- Mechanical inspection
- Removal of dust and dirt, especially on radiator surfaces
- Check for internal dust or humidity

Attention! Dust together with dew or water can destroy the internal circuits by short circuit.
Dust inside the unit can be blown out with dry compressed air.
The intervals between these checks depends on ambient conditions of the installed module.

10. Trouble shooting

All works has to be done by qualified personnel only.

10.1 No output voltage

- DC input voltage O.K.?
- mains switch (MCB) on?
- green LED„Operation" on?
- DC input voltage is connected properly?
- DC input fuse (on DC busbar) O.K.?
- signalling LED's Ui> or Ui< on ?
- short circuit or overload on output?
- output fuse O.K.?

If no error was found but the module still does not operate, contact your sales agent or the producer service department.

10.2 Distortion of output voltage

- overload on output? - check and reduce the load!
- big inrush current of load?
- distortions by load steps or current peaks?
- adjustment of voltage value Uo not correct? adjust the correct value

If no error was found but the module still does not operate, contact your sales agent or the producer service department.

11. Technical specifications – UNV-F

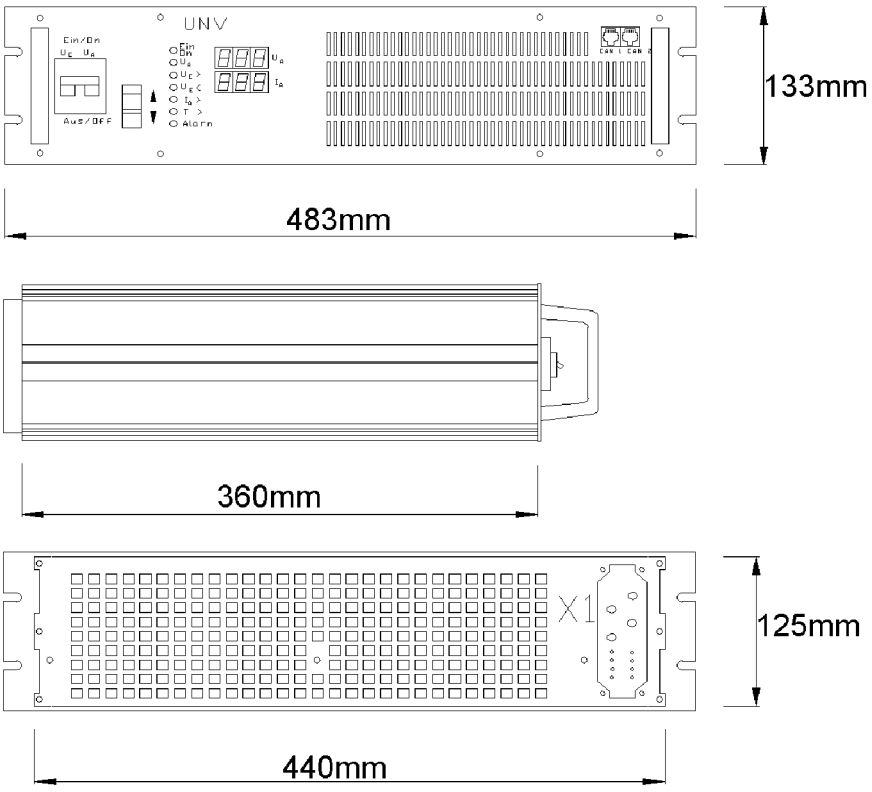
Nominal input voltage	acc. type list (chapter 2)
Input voltage range	48/60V types: 42-75VDC; 108V types: 77-138VDC
Inrush current	≤ nominal input current
Nominal output voltage	230V AC +/-0,5%
adjustment range:	200...252VAC
Output frequency	50Hz or 60Hz +/-0,05%; synchronization range by external static switch unit 45-65Hz
Nominal output power	acc. type list; cos phi=0.8
Output power factor range	0,5ind. – 1 – 0,5cap.
Total harmonic distortion	<2% for linear load
Overall efficiency	up to 92% for 50...100% load
Crest factor	≤ 3
RFI suppression / immunity	CE-label (EN50081-1 EN55011/55022 class „B" EN50082-2, EN61000-4 part 2/3/4/5)
Isolation voltage	acc. EN60950
Reflected input voltage ripple	≤ 1,8mV psophometric (CCITT-A-filter)
Dynamic bahavior	≤ 3 % for load transients between 10 % - 100 % - 10 % of nominal output current (recovery time ≤ 0,3 ms)
Short circuit protection	continiously short circuit proof, short circuit current 2-2,5x I_{nom} for appr.2,5sec (with delayed restart)

Monitoring	DC-input voltage (U_{IN}<,U_{IN}>) with automatic switch ON/OFF function, AC-output voltage(U_{OUT}); overtemperature (T>) and overload with automatic switch off function; fan monitor
Overload capability	130% for 30 sec.
LED-Signals	OPERATION, U_{OUT}, U_{IN}<, U_{IN}>, I_O>, T> and ALARM
Relay contacts	collective failure (contact current 110V DC / 0,5A; 60V DC / 1A)
Parallel operation	max. 7 devices, load sharing appr. 5% I_{nom} by degressive output characteristic
Audible noise	≤ 40dB(A) at 1m distance
Dimensions	acc. to type list
Mechanical construction	acc. VDE 0160 edition 5.88 chapter 7.2.2
Protection class	IP20
Cooling	(1.2kVA – 5.0kVA); speed controled fan with monitoring
Ambient temperature	operation: 0...+40°C; storage: -30...+65°C
Max. installation altitude	1000m a.s.l.
Humidity class	F
Surfaces	powder coating RAL 7032 (front panel only); constructive parts: anodized metal
Connectors (48-1.2F - 108-5.0F) nals:	input / output and sig-
	HAN K 4/8 (rearside)
Connectors (48-5.0F) nals:	input / output and sig-
	HAN K 6/6 (rearside)
Additional parts included in	

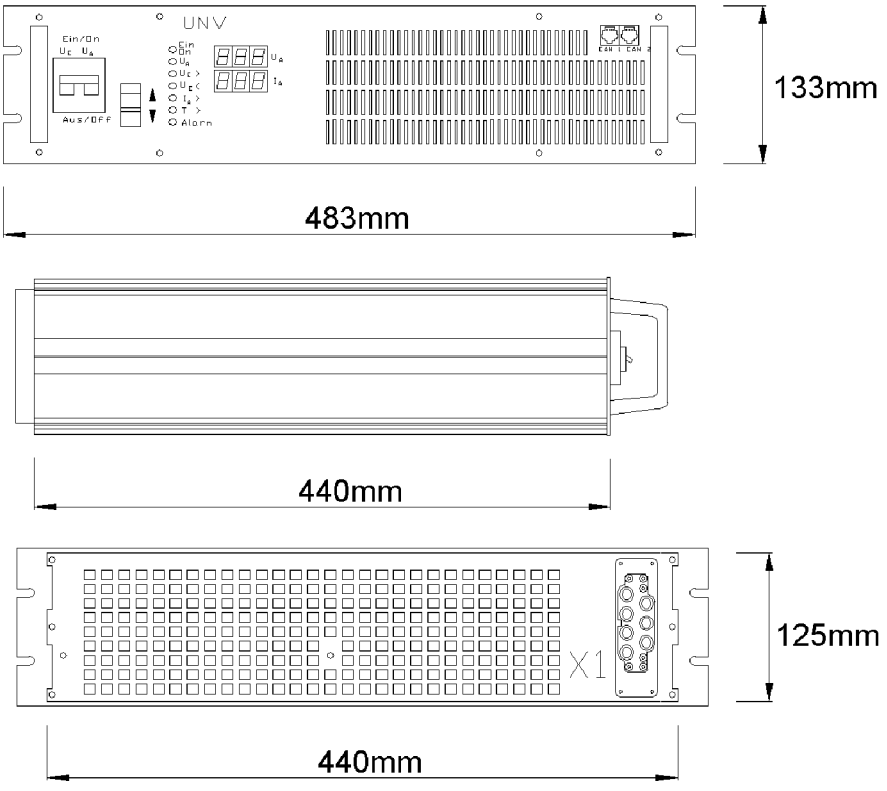
delivery	input and output connector

12. Dimensional Drawings

Picture 12.1:
Outlook-drawing
Inverter
UNV-F 1,2kVA-3,3kVA
UNV 60-5.0F
UNV 108-5.0F



Picture 12.2:
Outlook-drawing
Inverter
UNV 48-5.0F



Universal Bypass Switch Unit

UNB

OPERATION MANUAL

Leimenstoll / 22.08.06 / Rev. 0
BHB.UNB.D68-1000.HB101

UNB_2357E

Notes to this manual

ATTENTION! Please read these instructions very carefully before installing and commissioning the switching device.

This manual is part of the delivered device. Knowledge of this document is obligatory before dealing with the specified unit or putting it into operation. All work on the module such as transport, putting into operation, adjustment and maintenance has to be carried out by qualified personnel only. The rules for prevention of accidents for the specific country and the universal safety rules acc. IEC 364 have to be acknowledged!

This manual is equivalent to the technical revision of the rectifier on the day of its printing. The contents are for information purposes only and is not included in the contract. Technical changes between this manual and the actual product are possible due to technical progress. Exendis is not responsible for incorrect technical descriptions or data inside this manual because there is no obligation for a permanent actualisation of these documents.
The switch mode inverter will be manufactured according to valid DIN- and VDE-standards such as VDE 0106 (part 100) and VDE 0100 (part 410). The CE-label on the modules confirms the compliance with EU-standards for 73/23 EWG – low voltage and 89/339 EWG – electromagnetic compatibility when installation and operation rules are observed.

All systems and components are delivered according to the delivery conditions for electrical products and services of the electronic industry and our own sales conditions. Differences to the contents in this manual such as technical data, dimensions, weight and handling are possible.

In case of a reclamation of the delivered product please contact us immediately after receipt, with delivery note number, device type, device number and fault description.

In the case of visible changes on the device caused by the customer (missing screws, broken welds, dismounted boards ect.) the customer looses the warranty .or at operation under non-specified conditions (acc. technical specifications), the customer looses the warranty and there is no liability by Exendis. The responsibility for measurements to prevent accidents and material damages has the system operator (customer), not Exendis.

Supplier

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Contents

1. General

The Static bypass switch SBS is available for power ratings between 5 and 40 kVA.
Typical applications are for use in UPS systems designed with an input side rectifier, battery-circuit and on the output side inverters or PWS.
The STATIC BYPASS SWITCH SBS is used for interruption free switching between two AC-sources (usually inverter and substitute-mains input) and is intended for the operation for both inverter type ranges UNV and PWS. Consequently AC-consumer can be driven without interruption, if one of the two power sources fails.

The STATIC BYPASS SWITCH SBS is in a ready to connect-configuration designed 19“-unit with reverse side preinstalled high voltage connection terminals. The operation and indication elements as well as the plug in connections for the data-interface are integrated in the front plate of the unit.

2. Type Range

Type designation	Part number	Battery voltage in V DC	Rated output power in kVA (at 230 V AC)
UNB 5.0-24	68-1001	24	5.0
UNB 12.5-24	68-1002	24	12.5
UNB 23.0-24	68-1003	24	23.0
UNB 30.0-24	68-1004	24	30.0
UNB 40.0-24	68-1005	24	40.0
UNB 5.0-48	68-1011	48	5.0
UNB 12.5-48	68-1012	48	12.5
UNB 23.0-48	68-1013	48	23.0
UNB 30.0-48	68-1014	48	30.0
UNB 40.0-48	68-1015	48	40.0
UNB 5.0-108	68-1021	108	5.0
UNB 12.5-108	68-1022	108	12.5
UNB 23.0-108	68-1023	108	23.0
UNB 30.0-108	68-1024	108	30.0
UNB 40.0-108	68-1025	108	40.0
UNB 5.0-216	68-1031	216	5.0
UNB 12.5-216	68-1032	216	12.5
UNB 23.0-216	68-1033	216	23.0
UNB 30.0-216	68-1034	216	30.0
UNB 40.0-216	68-1035	216	40.0

3. Storage

The unit is an electronic precision-unit and must be treated with appropriate care. If the system is not immediately installed after delivery it is to be put into storage. Taking acknowledgement of all storage conditions that are written in this manual. For e.g. Dust free and dry environment

4. Installation

Before installation of the system at the operation-site, following rules are to be adhered to:

- provided not otherwise expressed, the systems are intended for inside-installation in dry, dust-poor areas
- the specifications regarding ambient-temperature, relative humidity and maximum altitude above see level, i must be adhered to.
- high dust-burden or a chemically aggressive atmosphere is not admitted; the system is to be protected against conductive moisture dust-settlements and condensation.
- adequate cooling. Air-admittance is necessary, especially, if the unit is installed in existing system cubicles or a 19 " rack.

Before connecting to a network. To be controlled is whether the voltage-statement on the type plate corresponds to both power sources of the existing voltage. The connection of the inverter as well as the substitute-network takes place via plug- in terminal at the unit-rear. The unit is delivered without internal safeguarding. The unit must be safeguarded consequently at the input of both sources in order to avoid a damage to the thyristor switch in the case of short-circuit.

The signalling unit is connected via the X2 plug- in terminal as well as the frontal located CAN-BUS-interface.
The STATIC BYPASS SWITCH SBS works from a power range of 12.5kVA with a temperature-controlled fan-cooling (with supervision). The inflow temperature must not exceed 40 ° Celsius. Cubicle-installations have to be designed for a maximum ambient temperature of 40 °C.
The load of the consumers is to be checked previously; a permanent overload operation is not allowable and has an effect extremely adverse on the reliability and designed lifetime of the system. Especially, the inrush current of badly tarnishing consumers are to be taken into consideration (a simple Computer screen can lift up to 50 A inrush current!).
The connection of a protection-phase is to be intended generally in the interest of human safety. Short-term, the STATIC BYPASS SWITCH SBS can manage very high overload-conditions (see technical data).

The electrical connections have to be carried out in accordance with the enclosed connection terminal-plan.

The diameter of the mains cable is to be calculated in accordance to VDE 0100; generally the diameter should be as large as possible, in order to keep voltage disturbances over the inlet cables to a minimum.

Following steps are required to connect the unit with inverters of the series UNV as well as PWS:

- System-wiring checks (high-voltage-connections; synchronous-cable; CAN-BUS, if used)
- Checking, that the inverter as well as the STATIC BYPASS SWITCH SBS is switched off
- Power supply sources 1 and 2 in disconnected voltage free condition with opened fuses of the STATIC BYPASS SWITCH SBS to be connected
- AC-consumer load to be connected
- Fuses to be closed
- Switches on the STATIC BYPASS SWITCH SBS via front-key
- Adjustment of the real-time-clock
- Inverter switch ON

5. Operation

The operation of the unit takes place over the On-/Off switch located on the front plate as well as the control buttons for the micro-controller control unit The present valid condition of the unit, also the input and output values are shown over a clear letter LCD- display as well as via the LED-status indicator. These are described in the relevant chapters and, are assigned via the labelling on the front-plate of the unit.

LED	Indication	Colour.	Operation mode
●	STATIC BYPASS SWITCH operation	green	STATIC BYPASS SWITCH SBS is switched on, internal operation current available
●	Source 1 online present	green	Voltage and frequency of source 1 (preferred source) in limit
●	Source 2 online present	green	Voltage of source 2 (substitute source) available
●	Synchronisation	green	SBS and inverter are synchronous or STATIC BYPASS SWITCH SBS synchronised with mains (see Synchronisation process)
●	Load at inverter	green	Load fed by inverter
●	Load at mains	green	Load fed by mains
●	General fault alarm	red	Time delayed general fault alarm, time delay 20sec., parallel an indication relay acts; all distortion will be monitored.

The adjustment takes place with the four front keys:

Front keys

▲ - during menu item selection: change to previous item (parameter)
- during adjustment mode: increase value

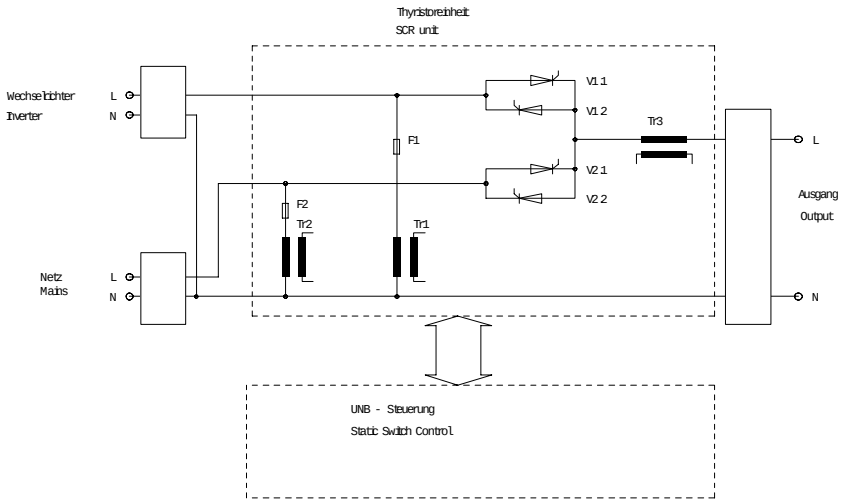
▼ - during menu item selection: change to next item (parameter)
- during adjustment mode: decrease value

ESC - leave the menu without changing

ENTER - call menu
- leave menu with changing
- to store parameter

6. Functions

6.1 Schematic-diagram



Picture 6.1: Schematic diagram Static Bypass Switch (SBS)

6.2 Electric function

6.2.1 General

A static electronic bypass switch is to be installed, if critical consumers have to be switched without interruption between inverters and mains supply with a reaction time not able to reached with mechanical switch-elements. The STATIC BYPASS SWITCH SBS guarantees the frequency - and phase-synchronisation of the inverter with the alternative network and a switch over time of the disturbed source to the alternative-source within 0,5-3 ms, depending on the adjusted sensitivity-tolerance. The return-switching takes place interruption free in the zero-crossing of the current. In the case of a synchronisation-disturbance between mains and inverter(s), the switch back always takes place in the current-zero-passageway.

6.2.2 Function-principles

The schematic diagram (picture 6.1) shows a functional diagram of the STATIC BYPASS SWITCH SBS-configuration. The switch over of connected load will be done via -two anti-parallel connected thyristors per feeding, (V 1.1 / V1.2 and V 2.1 / V .2.2). The thyristor pair V 1.2 and V 2.1 switches during the positive half-sine wave whereas V1.2 and V2.2 switches during the negative half-sine wave . The thyristors are driven in continuous -ignition, so that the control current is switched depending of the actual polarity of the output current. The connected thyristors stacks contains both thyristors of one feeder.

Polarity and value of the output current is controlled by the current transformer Tr 3 , the voltages of source 1 and 2 are measured by the voltage-transformers TR1 and TR2. The measured voltage is taken directly at the connections of the involved thyristors. Safeguarding of the voltage-transformers takes place with the fuses F1 and F2 on the thyristor PCB.

6.2.3 Input terminals

The STATIC BYPASS SWITCH SBS is designed in the standard-configuration with two AC-input terminals, one for the inverter and the other for the substitute-mains input. Both sources must have the same frequency and the same nominal-voltage-level because there are no protection fuses integrated in the unit, both sources must be protected externally.
In parallel-configuration of several inverters, the parallel-circuit of the inverter-outputs are to be set externally. With inverters of the series PWS, a symmetry-choke per inverter is to be additionally installed into the L-phase.
The plug in connectors for the AC-input are to be found on the rear side of the unit in the full 19” unit version, in the cassette version they are located on the front. In the 100A-unit, a parallel-circuit of 2 contacts are required for reasons of the contact-loading capacity. In this case, both contacts require an identical cable diameter and length. This applies also to the subsequently described AC-output connection terminals.

6.2.4 Output terminals

The unit is designed with a plug- in AC-output connection terminal. In case of short circuit, the short-circuit power is transferred to the STATIC BYPASS SWITCH SBS input, which causes the fuse of source 1 or 2 to blow. The STATIC BYPASS SWITCH SBS may be overloaded for a short-time (see technical data). Additional connection-information is to be read under point 6.2.3.

6.2.5 Operating modes

The STATIC BYPASS SWITCH SBS allows the operating modes inverter, and mains-priority. Source 1 of the STATIC BYPASS SWITCH SBS is always the priority source,for e.g. the consumers are supplied by an operating system from this source. Source 2 is only required to feed the consumer load if source 1 fails or is overloaded (i.e. distortions through short circuit behaviour or overload).

6.2.5.1 Inverter priority configuration

In the operating mode inverter-priority the priority is inverter as source 1 and the substitute-mains as source 2. This is also the adjusted standard-configuration.

6.2.5.2 Mains-priority configuration

In the operating mode mains-priority The AC-mains is as source 1 and the inverter (as „substitute- mains “) as source 2.

6.3 Monitoring/Adjustment

6.3.1 Input “over-voltage monitoring “; source 1 (priority-source)

The input-voltage of source 1 is monitored and compared continuously with a reference-curve; this is programmed in an EEPROM. The analogous sensitivity around the nominal-input-voltage is variable and adjustable within a certain area (see settings of the analogous-sensitivity). The voltage-variation for the supervision decides the attitude in the parametric-menu. The indication of this monitoring-function takes place over the LED „source 1 “.

6.3.2 Input “over-voltage monitoring”; source 2 (substitute-sources)

For the substitution-source, only the presence of the voltage is monitored, not however the sine wave form. If the voltage-level of the substitution source is within the nominal-voltage area the LED „source 2 “ is on. As positive

6.3.3 STATIC BYPASS SWITCH SBS-Programming

Following functions can be chosen in the parametric menu of the STATIC BYPASS SWITCH SBS:

- Load blocked on inverter
- Load blocked on mains
- Mains-priority-operation
- Inverter-priority operation *
- Switchover delay 0,5-10ms (2,5ms *)
- Nominal-input voltage 220/230*/240VAC
- Mains frequency 50*/60Hz

*suppliers fixings

An alteration of the nominal-voltage and –frequency is only stored after a restart of the STATIC BYPASS SWITCH SBS.

6.3.4 Settings of analogous-sensitivity

The monitoring sensitivity of the priority-source (source 1) can be set via the parametric menu. The wider this setting is made, the more sensitive the STATIC BYPASS SWITCH SBS reacts on voltage-drops of the monitored source. The sensitivity covered is chosen in the area from -6/+9 to -15/+22,5% on the set input nominal-voltage. Factory adjusted the unit setting is +15/-10%.

6.3.5 Indication

The STATIC BYPASS SWITCH SBS-status as well as all possible malfunction is shown via LED's on the front and as general fault alarm via a potential-free relay-contact.

As optional extra a second, free programmable indication relay is available.

The allowable relay contact loads are as follows:

U max.	= 110 V DC	I. zul. < 0.45 A DC
U. max.	= 60 V DC	I. Zul. < 1 A DC
U. max.+	= 24 V DC	I. zul. < 8 A DC

6.3.6 CAN-Interface / serial interfaces

Via the front-located connectors for the data-network via CAN-Bus the communication of the STATIC BYPASS SWITCH SBS with the connected inverters and a possible implemented supervision monitoring device (MU1000C) can take place.
Additional, another serial interface via an optional interface-component (RS232, RS485, RS422) is also available.

Following information will be available via the CAN as well as additional optional Interface:

- Status-information of the SBS according to point 6.3.5
- Availability of the connected inverter
- Availability of the substitute mains
- Input - and output current of the SBS (real-time)
- Input - and output current of the SBS
- Battery-voltage at the SBS
- Frequency of source 1 and source 2
- Input- and output value of the connected inverter
- History of the last 50 events with date and time

6.3.7 Parameter adjustment / Menu items

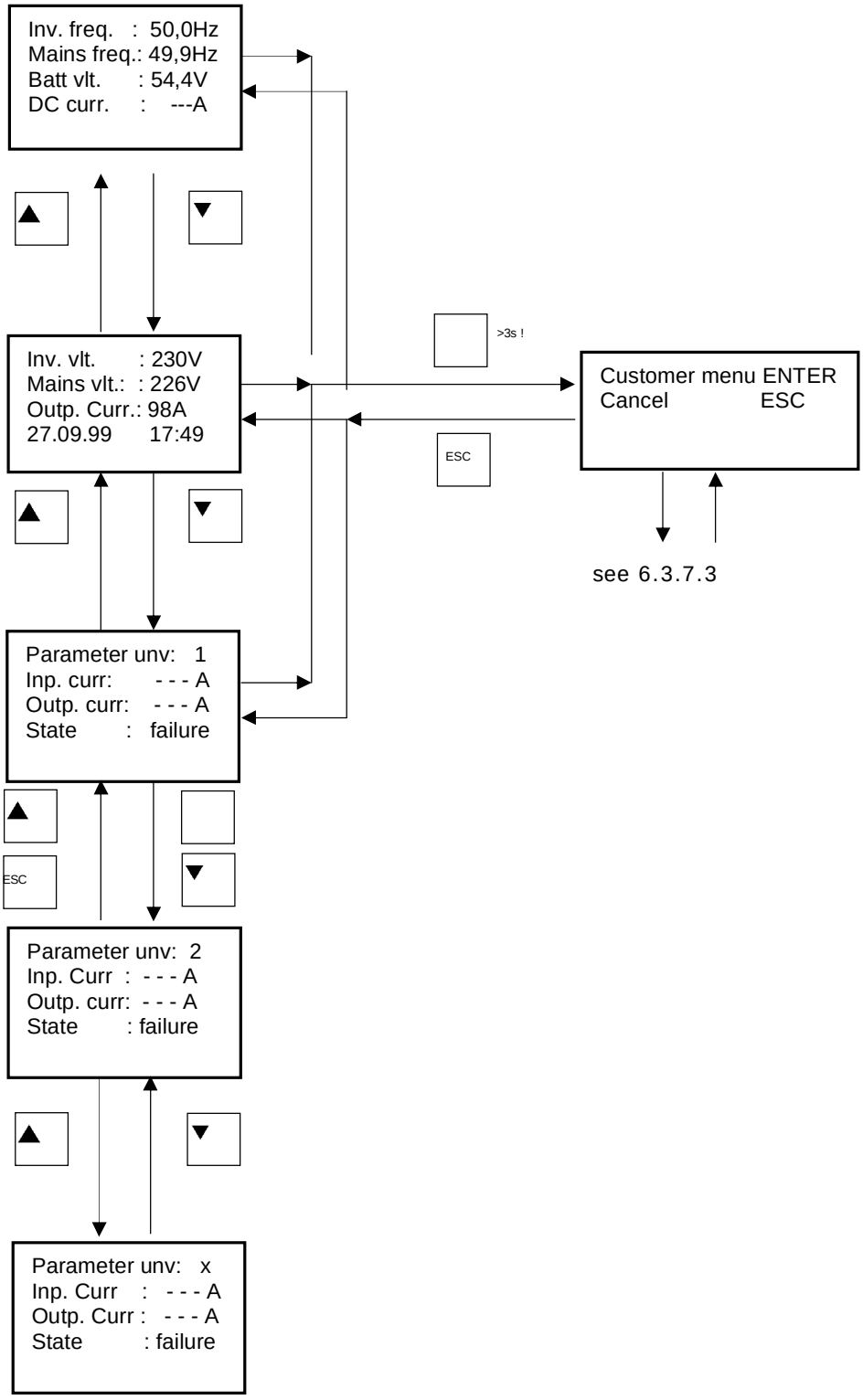
6.3.7.1 Adjustable parameters

Customer menu	Functions	Range	Default value
Time/Date	Time and date adjustment	-	-
Configuration SA	Selection of single failures for collective failure signalisation (LED and relay)	All single failures	all
Delay.LED SA	LED time delay of collective failure signal	1 – 60sec	30
Delay Rel.SA	Time delay of collective failure relay	1 – 60sec	30
LCD-contrast	Contrast adjustment of display	0 - 255	220
Illumination	Background illumination	On / off	on
Language	Selection of language	german, english, italian, schwedish, polish	german

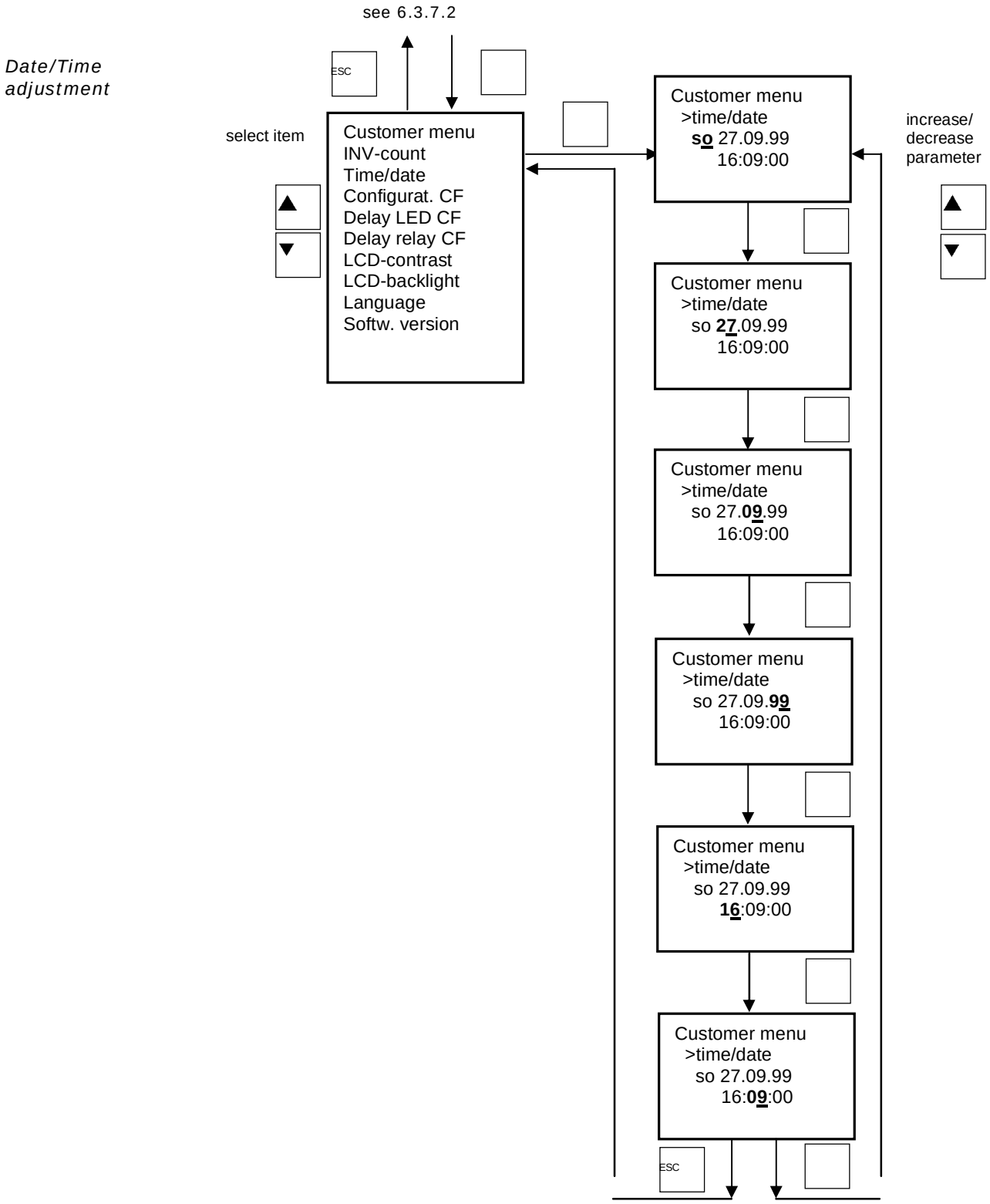
For the configuration of the system during commissioning (adjustments of service menu) special documents are available. These documents are available only for qualified and trained service personnel.

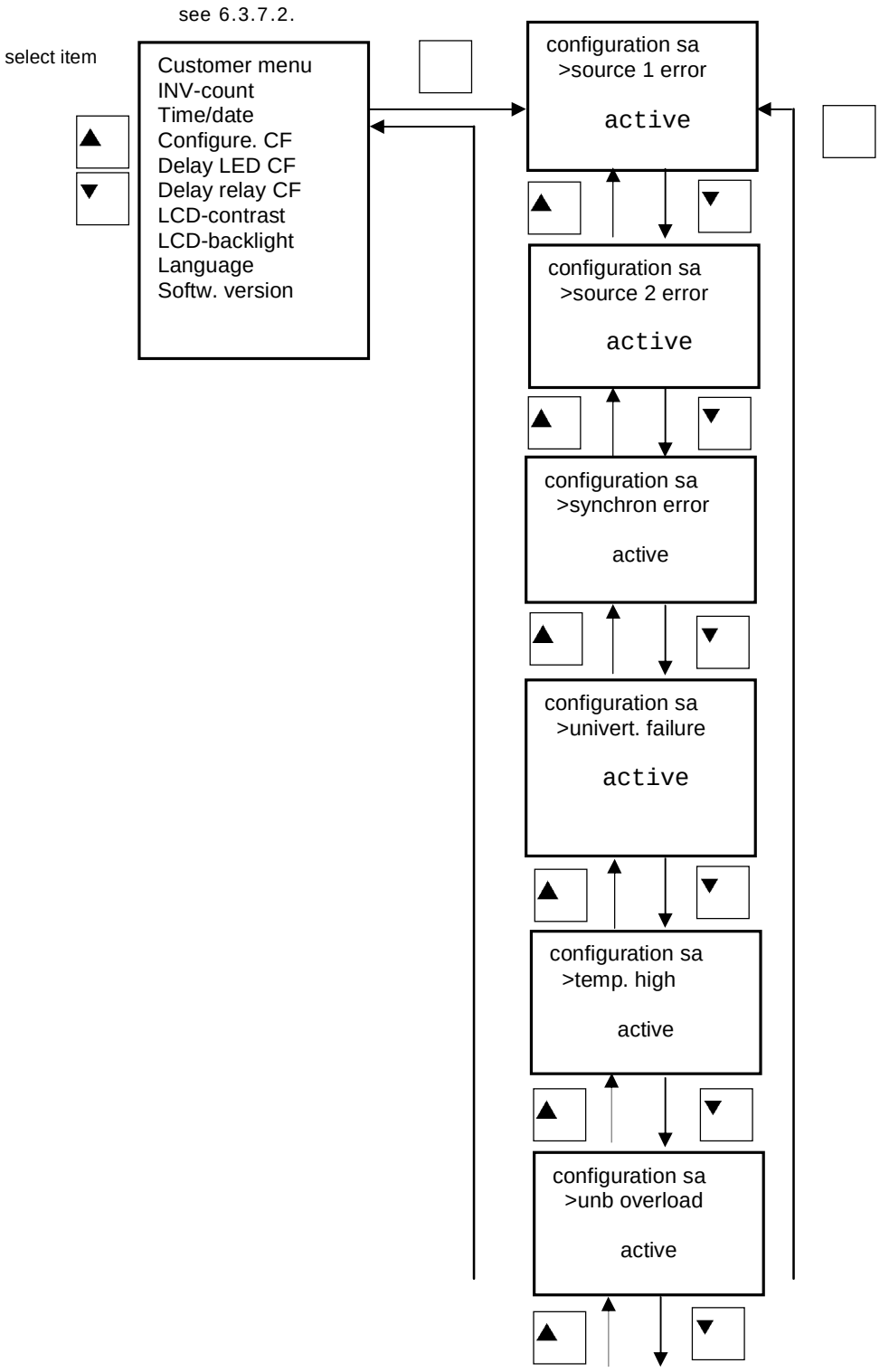
6.3.7.2. Measuring indication / Main menu structure

Main menu structure



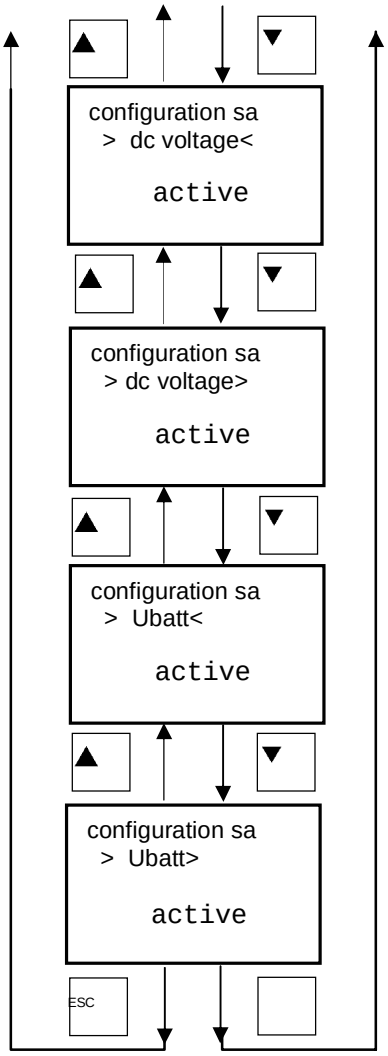
6.3.7.3. Parameter adjustment / Customer menu



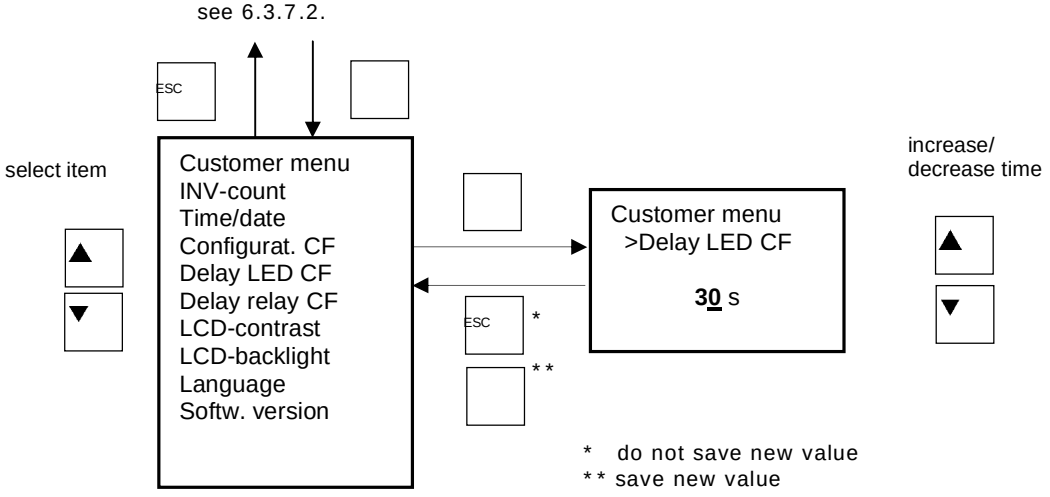


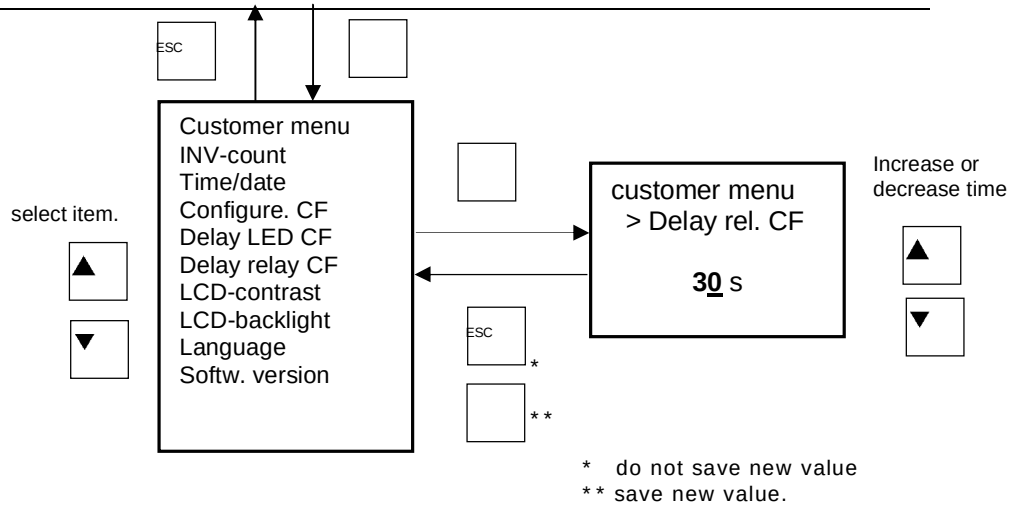
see next page

Configuration of collective failure signal



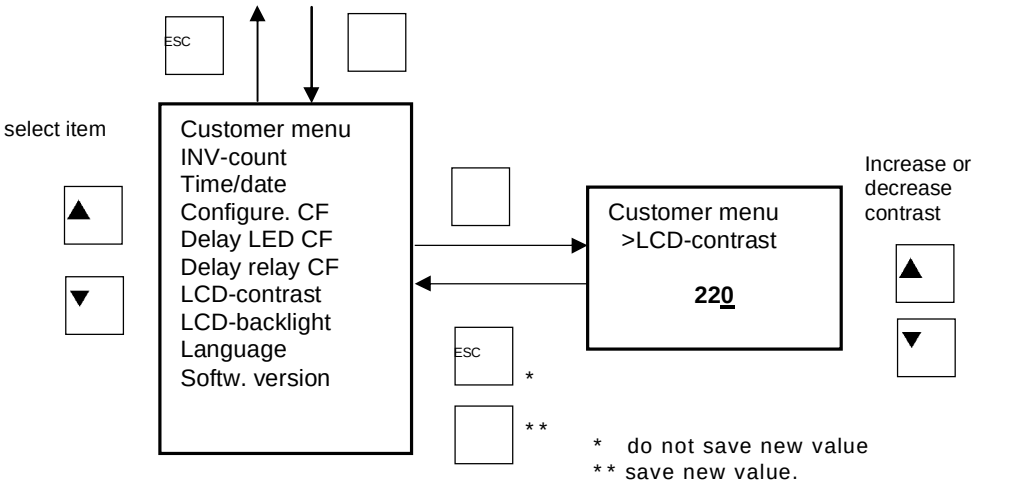
Delay time of collective failure LED





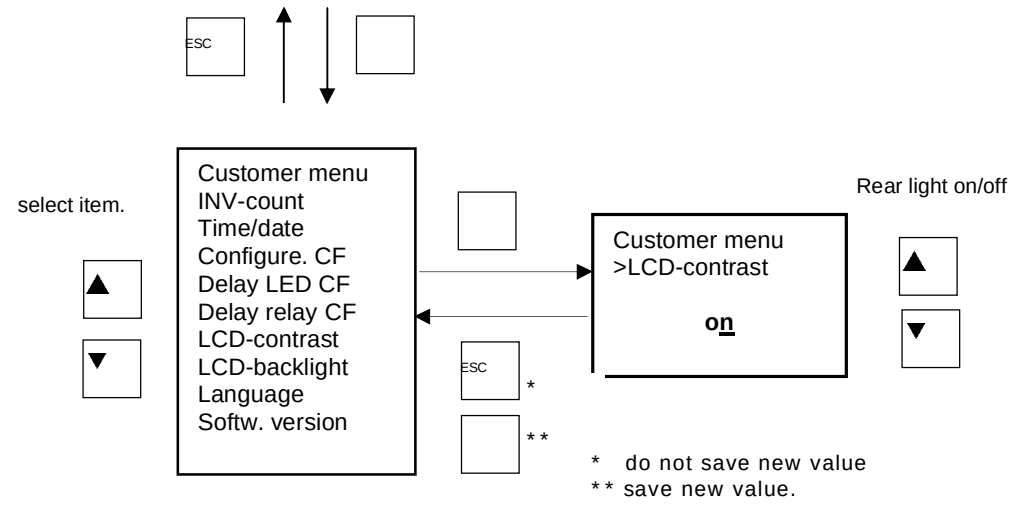
See. 6.3.7.1.

LCD-contrast adjust

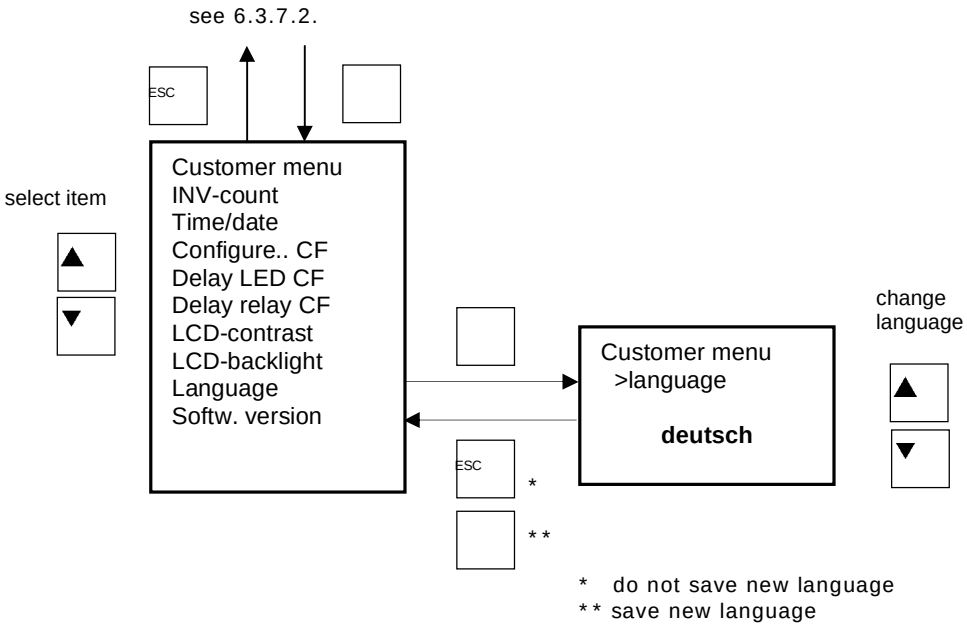


see 6.3.7.2.

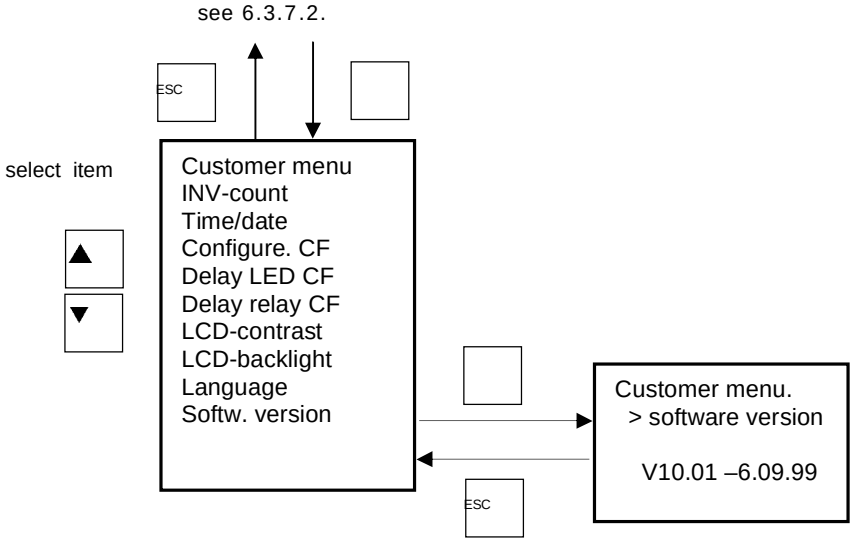
Rear Light



Select language.



Show software version



7. Synchronisation

The STATIC BYPASS SWITCH SBS is designed for two internal synchronisation procedures. The first one being the synchronisation between the internal fixed-frequency of the SBS and the attached inverter (as well as for several inverters in case of parallel operation mode) and additionally the synchronisation of SBS for the frequency of the substitute mains. Both synchronisation-processes will be shown via the LED „synchronisation “.

Synchronisation-process for inverter preference with disconnected substitution-mains:

- If the SBS switches on, load immediately switches at substitute-source (even if not existing)
- SBS feeds own-frequency in synchronous-bus (SYNC-BUS) a (50 Hz - signal, amplitude approximately 15V between SYNC-BUS and SYNC-GND)
- SBS registers via signal-bus as master (square-signal approximately 15V between SBS-SYNC and SYNC-GND)
- After synchronisation with the inverter indication LED shows synchronisation in progress
- SBS switches the consumer load to inverter output; LED „load at inverter“ signal.
- Connection of the substitute-mains
- After a postponement from approximately 5 seconds (SBS waits for a stabilised substitute mains) the SBS tries to synchronise on the substitute source frequency. During this action the LED “Synchronisation“ signal is off.
- After the successful synchronisation of the SBS with the substitute source, all units work with the frequency of the substitute-source (SYNC-BUS carries substitute-frequency) and the LED „synchronisation “ lights; according to the difference of the Monitoring signal (internal PLL) to the actual sine-wave of the voltage the synchronisation requires up to 30 seconds.

Synchronisation-process for inverter preference operation with connected substitute-mains:

- SBS switches on, load is immediately connected to the substitute-source.
- SBS registers via the signal-bus as masters (a square signal approx. 15V between SBS-SYNC and SYNC-GND)
- After a postponement of approx. 5 seconds (SBS waits for stabilised substitute mains.) then it synchronises on the frequency of the substitute source; during this

operation the LED “Synchronisation“ is off when synchronisation follows the LED shows green

- After the successfull synchronisation of the SBS with the substitute-source, all units work with the frequency of the substitute-source (SYNC-BUS carries the substitute-frequency) and the LED „synchronisation “ lights; according to the difference of the Monitoring signal (internal PLL) to the actual sine-wave of the voltage the synchronisation requires up to 30 sec.

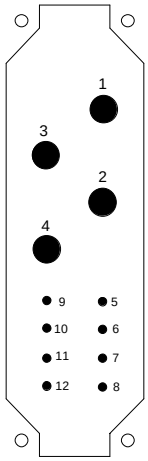
- SBS switches consumer load to inverter output; LED „load on inverter “ lights

8. Connections

8.1 Pinning UNB 5.0, 12.5 kVA

connector X1 (HAN-K4/8, socket outlet):

Picture 8.1:
Pinning –
UNB 5.0kVA
UNB 12.5kVA



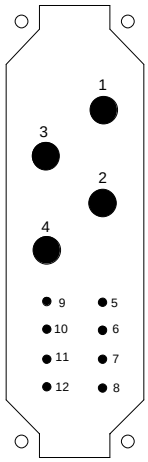
Pin	Name
1	Source 1 (inverter)/Phase L1
2	Source 2 (substitute mains)/Phase L1
3	Source 1 & 2/ neutral
4	UNB Output/Phase L1
5	DC-supply / L+ (24 / 48 / 108 / 216V DC)
6	DC-supply / L- (24 / 48 / 108 / 216V DC)
7	Synchronisation / SYNC - SIG
8	Synchronisation / SYNC - STAT
9	Indication relay general fault / NC
10	Indication relay general fault / NO
11	Indication relay general fault / COM*
12	Synchronisation / SYNC - GND

*logic: fault = COM and NC closed
OK = COM and NO closed

In operation with an UNB it is necessary to connect aditional toSYNC – GND, SYNC – SIG the contacts SYNC – STAT between all of the inverters and the UNB.

8.2 Pinning UNB 23.0 kVA

connector X1 (HAN-K4/8, socket outlet):



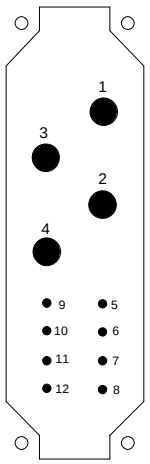
Picture 8.2:
Pinning – X1
UNB 23.0kVA

Pin	Name
1	Source 1 (inverter)/Phase L1
2	Source 2 (substitute mains) / Phase L1
3	Source 1 & 2/ neutral
4	UNB Output/Phase L1
5	DC-supply / L+ (24 / 48 / 108 / 216V DC)
6	DC-supply / L- (24 / 48 / 108 / 216V DC)
7	Synchronisation / SYNC - SIG
8	Synchronisation / SYNC - STAT
9	Indication relay general fault / NC
10	Indication relay general fault / NO
11	Indication relay general fault / COM*
12	Synchronisation / SYNC - GND

*logic: fault = COM and NC closed
OK = COM and NO closed

In operation with an UNB it is necessary to connect aditional toSYNC – GND, SYNC – SIG the contacts SYNC – STAT between all of the inverters and the UNB.

connector X2 (HAN-K4/8, socket outlet):

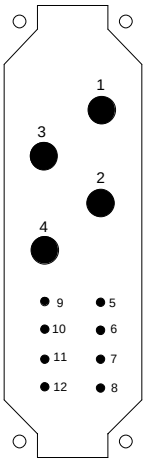


Picture 8.3:
Pinning – X2
UNB 23.0kVA

Pin	Name
1	Source 1 (inverter)/Phase L1
2	Source 2 (substitute mains) / Phase L1
3	No connection
4	UNB Output/Phase L1
5	No connection
6	No connection
7	No connection
8	No connection
9	No connection
10	No connection
11	No connection
12	No connection

8.3 Pinning UNB 30.0, 40.0 kVA

connector X1 (HAN-K4/8, socket outlet):



Picture 8.4:
Pinning –
X1/X2/X3
UNB 30.0kVA
UNB 40.0kVA

Pin	Name
1	Source 1 (inverter) / Phase L1
2	Source 1 (inverter) / Phase L1
3	Source 1 (inverter) / Phase L1
4	No connection
5	No connection
6	Synchronisation / SYNC - GND
7	Synchronisation / SYNC - SIG
8	Synchronisation / SYNC - STAT
9	No connection
10	No connection
11	No connection
12	No connection

In operation with an UNB it is necessary to connect additional to SYNC – GND, SYNC – SIG the contacts SYNC – STAT between all of the inverters and the UNB.

connector X2 (HAN-K4/8, socket outlet);see picture 8.4:

Pin	Name
1	Source 2 (substitute mains) / Phase L1
2	Source 2 (substitute mains) / Phase L1
3	Source 2 (substitute mains) / Phase L1
4	Source 1 & 2 / neutral
5	DC-supply / L+
6	DC-supply / L-
7	No connection
8	No connection
9	No connection
10	Indication relay general fault / COM*
11	Indication relay general fault / NO
12	Indication relay general fault / NC

= COM and NC closed

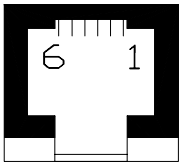
OK = COM and NO closed

connector X3 (HAN-K4/8, socket outlet);see picture 8.4:

Pin	Name
1	UNB Output/Phase L1
2	UNB Output/Phase L1
3	UNB Output/Phase L1
4	No connection
5	No connection
6	No connection
7	No connection
8	No connection
9	No connection
10	No connection
11	No connection
12	No connection

8.4 Pinning – CAN-Bus

Connector X5/X6 (RJ45, 6pol):



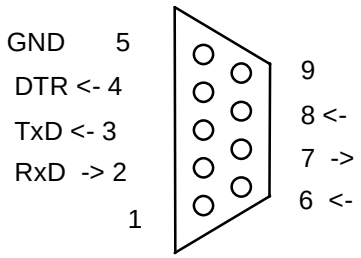
Picture 8.5:
Pinning - X5/X6
CAN-Bus-Interface

Pin	Signal – CAN1	Signal-CAN2	Name
1	CAN_V+		DC-Supply +8...15V
2	CAN_V+		DC-Supply +8...15V
3	CAN_H		Signal (high)
4	CAN_L		Signal (low)
5	CAN_V-		DC-Supply Ground
6	CAN_V-		DC-Supply Ground

8.5 Pinning – Interface RS232

Connector X7 (Sub-Min-D, 9pol):

Picture 8.6:
Pinning – X7
RS232 - Interface



Signal	Term	UNB PC	Pin	Level
RS232_2_RxD	Receive data	<-	2	V.28
RS232_2_TxD	Transmit data	->	3	V.28
RS232_2_DTR	Data transmit ready	->	4	V.28
RS232_2_GND	Signal ground	-	5	V.28
RS232_2_DSR	Data set ready	<-	6	V.28
RS232_2_RTS	Request to send	->	7	V.28
RS232_2_CTS	Clear to send	<-	8	V.28

9. Maintenance

The SBS consists of ultramodern and nearly wear-free components. Nevertheless, it is recommended that, to ensure continuous availability and reliability, visual inspection and function tests should take place in regular intervals.

During visual inspection to be checked,is whether:

- mechanical damages or external-particle is noticed,
- hazardous filth or dust-particles are existing disturbing the airflow and cooling facilities.

If heavy dust-attack happens, the unit should be blown out with dry compressed air in order to enable a better heat-exchange as a precaution. The time-periods of the visual inspection to be enforced primarily depend on the ambient conditions of the units.

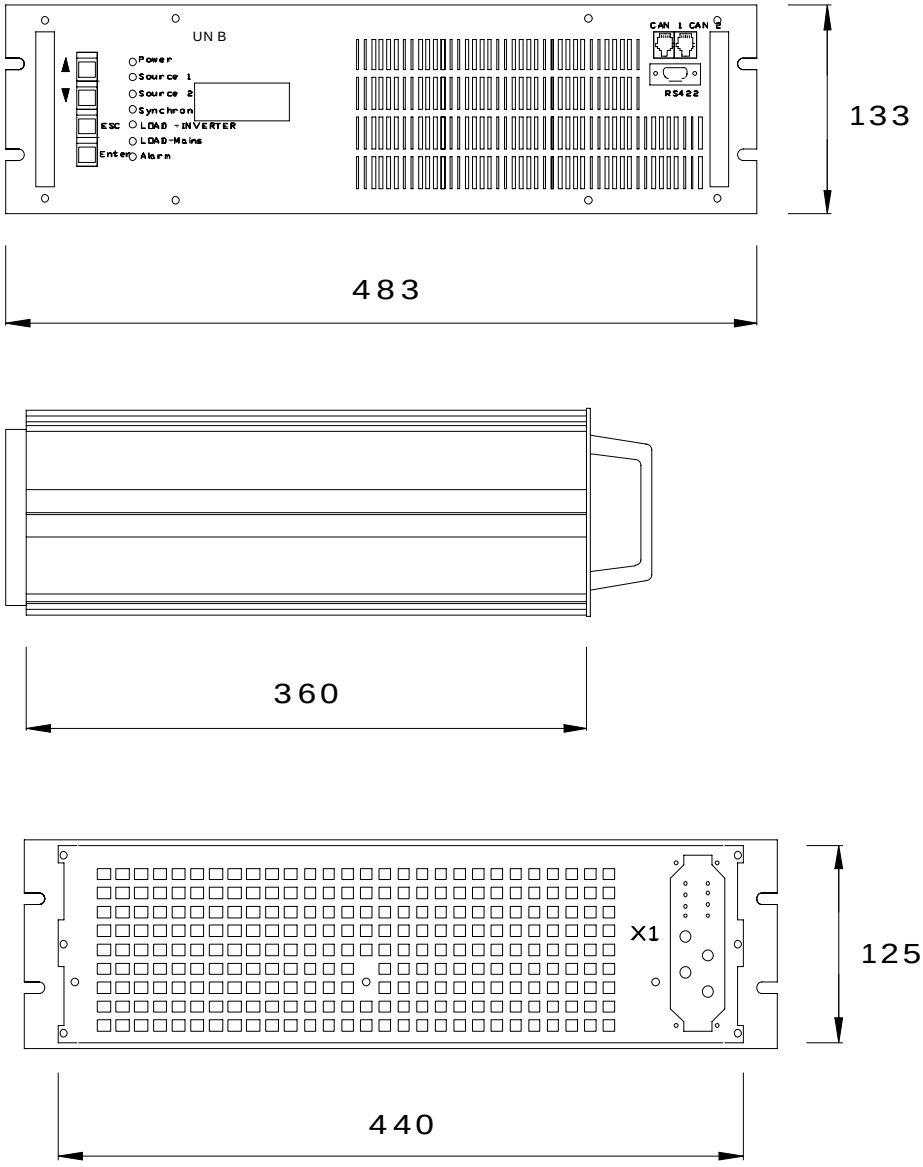
10. Technical data

10.1 General technical data

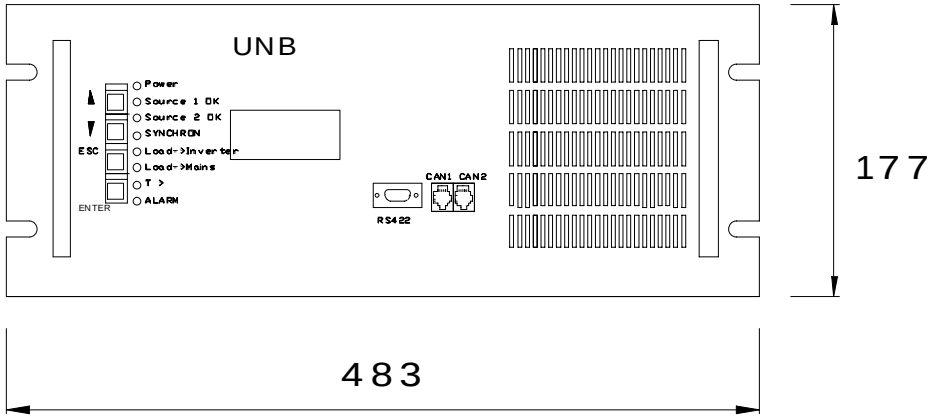
Nominal-input voltage according to settings	220/230/240VAC
Input variation range	+/-20% U_{nom}
Output voltage	see nominal-input voltage
Output rating	see type list
Frequency range (in/out)	50/60Hz +/-3%, changeable
Transfer time	<=3ms
Monitoring devices	Power Source 1 and Power Source 2 with switchable load, synchronisation,
Overload-ability	1000% for 10ms
LED-indications	Operation mode, Power Source 1 available, Power Source 2 available, synchronisation, load at inverter, load at mains and general fault alarm
Clear letter display	2x16 signs LCD with background-illumination
Relay-contacts	general fault alarm as well as an additional freely programmable relay-indication
Noise level	<=30dB(A) in 1m distance
Dimensions W x H x D	
UNB 5kVA/12.5kVA:	483x133x360mm (3HE)
UNB 23kVA/30kVA/40kVA:	483x177x460mm (4HE)
Protection class	IP 20/1
RFI	according to EN 55011 /EN55022 limit-categories " B "

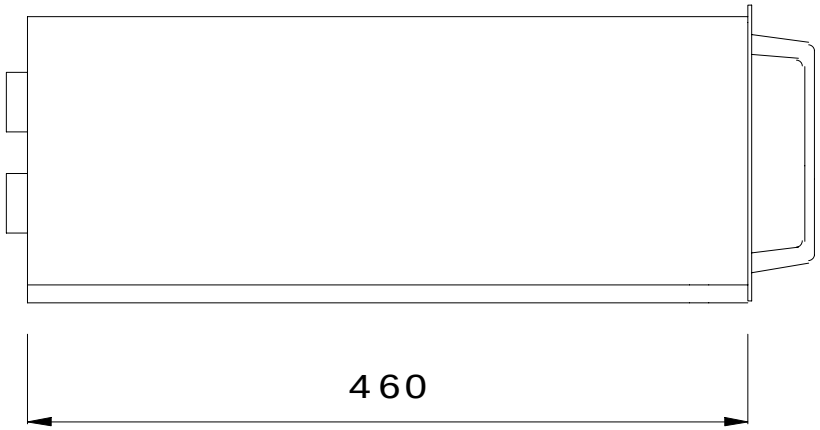
EMC	according to EN 61000-4 part 2-5
Isolation	according to EN60950
Cooling system	forced air cooling with monitoring
Ambient-temperature	in operation: 0-40°C; storage: -30-+50°C
Maximum installation altitude	2000m above sea level
Maximum humidity	85% without condensation
weight	
UNB 5kVA:	12.6kg
UNB 12.5kVA:	12.6kg
UNB 23.0kVA:	13.2kg
UNB 30.0kVA:	15.8kg
UNB 40.0kVA:	16.3kg
Connections	plug in terminals
Varnishing	front-plate RAL7032
Options	serial interface (RS232, RS485)

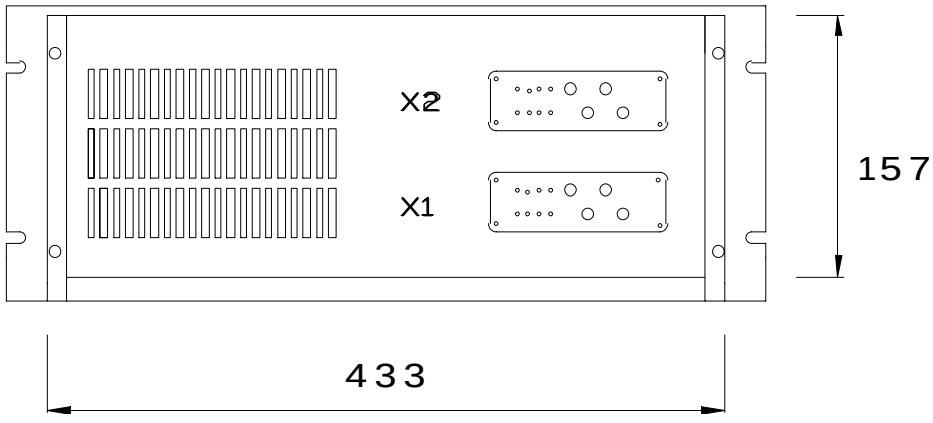
10.2 Dimensional Drawings
UNB 5.0/12.5kVA



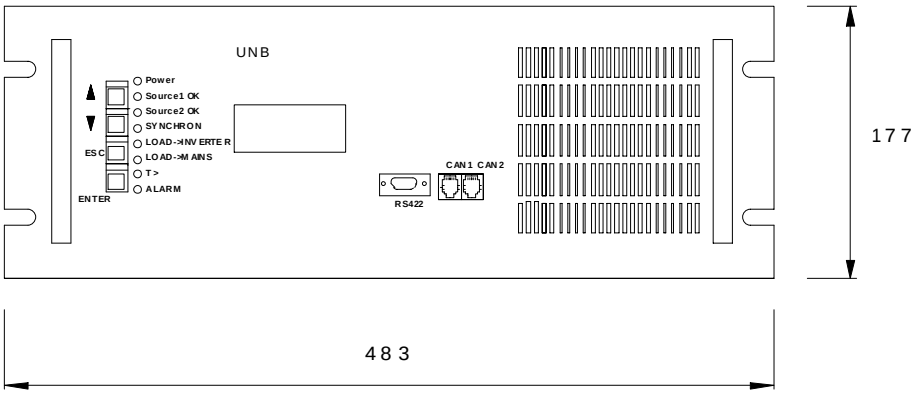
10.3 Dimensional Drawings
UNB 23.0kVA

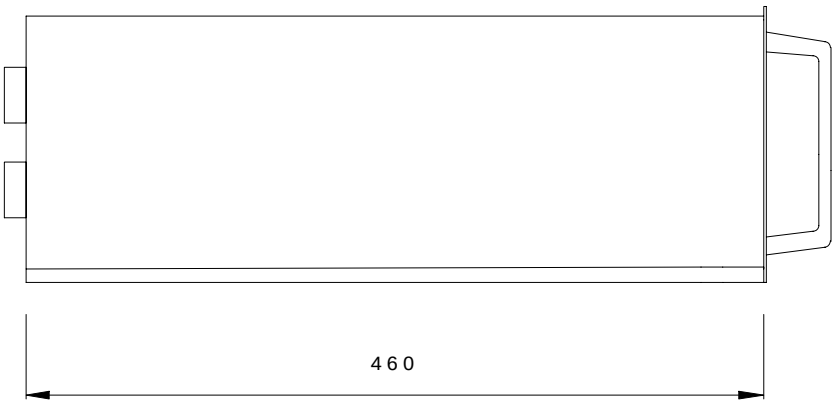


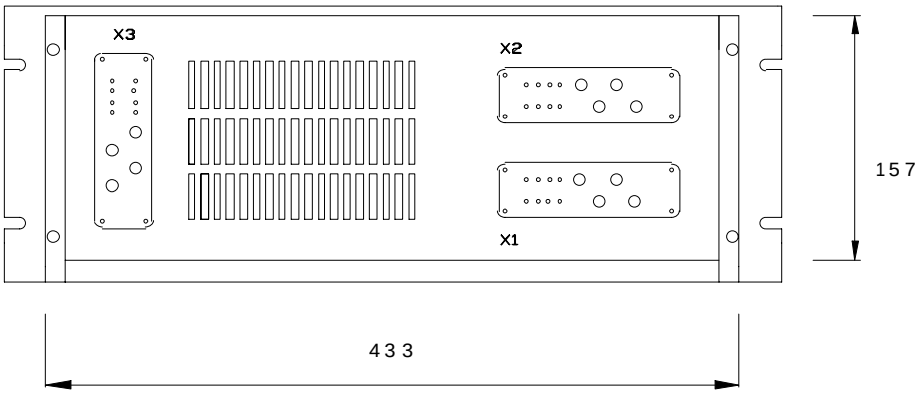




10.4 Dimensional Drawings
UNB 30.0 / 40.0kVA







10.5 Photograph UNB 5.0 / 12.5 kVA

See cover (1. side)

10.6 Photograph UNB 23.0 / 30.0 / 40.0 kVA