VACON

DRIVEN BY DRIVES

USER'S MANUAL

3-PHASE PHOTOVOLTAIC INVERTERS FOR CONNECTION TO MAINS SUPPLY

DRIVES NXV0010 TO NXV0100

CONTENTS

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1. SAFETY

1.1 Danger and warning symbols used in this manual

This manual contains clearly marked cautions and warnings which are intended for your personal safety and to avoid any unintentional damage to the product or connected appliances.

Please read the information included in cautions and warnings carefully.

The cautions and warnings are marked as follows:

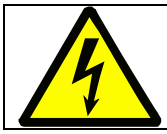
	= *Dangerous voltage! Risk of electric shock*
	= *General warning! Risk of equipment damage*

1.2 Symbols and warning marks used in the product

The product carries some additional symbols and marks. The meanings of these are as follows:

	= *Dangerous voltage! Risk of electric shock*
	***= See User's Manual***
	***= Caution! Risk of electric shock!*** *Energy storage timed discharge:* ***5 minutes***

1.3 Safety rules

	**ONLY A COMPETENT ELECTRICIAN IS ALLOWED TO CARRY OUT THE ELECTRICAL INSTALLATION! RISK OF ELECTRIC SHOCK!**

The solar inverter VACON 8000 SOLAR has been designed to be installed in enclosed places. It shall be protected against harsh weather conditions.

The solar inverter VACON 8000 SOLAR can only be opened by qualified technicians. Inside the inverter module, there is no element which can be fixed or adjusted by the user.

	There is a serious risk of electric shock, even after the device has been disconnected from the mains supply or solar panels. This electric shock may cause death or serious injury.
	If the short circuit current of the grid is higher than the short circuit withstanding capability of the QA2, additional circuit breaker must be installed. If the possible short circuit current at the grid point of connection is higher than the solar inverter's breaking capacity, additional current limiting device must be installed (see chapter 5.4).
	If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Even when the solar inverter has been disconnected from mains and solar panels, wait until the control panel switches off. After this, it is recommended that you wait at least 5 minutes before opening, and /or making any kind of alteration or connection to, the device.

Check that there is no voltage present before handling and performing any kind of work on the device. To verify the absence of voltage, type III measurement elements (1000 volts) must be used.

Do not perform any measurement or test when the VACON 8000 SOLAR is connected to mains or solar panels.

Do not perform any kind of dielectric strength test on the VACON 8000 SOLAR. Unless the appropriate process is followed, performing this test may damage the inverter module.

Appropriate personal protective equipment (PPEs) must be used:

- Helmet
- Safety goggles for electrical risk
- Safety footwear
- Electrically resistant gloves adequate for the voltage
- Protective gloves against mechanical risk

	Access to the photo-voltaic field is strictly prohibited!

1.4 Earthing and earth fault protection

	**CAUTION!**

The Vacon 8000 Solar inverter must always be earthed with an earthing conductor connected to the earthing terminal marked with ⏚.

The touch current of Vacon 8000 Solar exceeds 3.5mA AC. According to EN62109-1, one or more of the following conditions for the associated protective circuit shall be satisfied:

A fixed connection and

a) the ***protective earthing conductor*** shall have a cross-sectional area of at least 10 mm² Cu or 16 mm² Al.

or

b) an automatic disconnection of the supply in case of discontinuity of the ***protective earthing conductor***. See chapter 4.

or

c) provision of an additional terminal for a second ***protective earthing conductor*** of the same cross-sectional area as the original ***protective earthing conductor***.

Cross-sectional area of phase conductors (S) [mm²]	Minimum cross-sectional area of the corresponding ***protective earthing conductor*** [mm²]
$S \leq 16$ $16 < S \leq 35$ $35 < S$	S 16 $S/2$
The values above are valid only if the protective earthing conductor is made of the same metal as the phase conductors. If this is not so, the cross-sectional area of the protective earthing conductor shall be determined in a manner which produces a conductance equivalent to that which results from the application of this table.	

The cross-sectional area of every protective earthing conductor which does not form a part of the supply cable or cable enclosure shall, in any case, be not less than

- 2.5 mm² if mechanical protection is provided or
- 4 mm² if mechanical protection is not provided. For cord-connected equipment, provisions shall be made so that the protective earthing conductor in the cord shall, in the case of failure of the strain-relief mechanism, be the last conductor to be interrupted.

However, always follow the local regulations for the minimum size of the protective earthing conductor.

NOTE: Due to the high capacitive currents present in the AC drive, fault current protective switches may not function properly.

	***Do not perform any voltage withstand tests*** on any part of Vacon 8000 Solar. There is a certain procedure according to which the tests shall be performed. Ignoring this procedure may result in damaged product.

2. TECHNICAL SPECIFICATIONS

2.1 Inverter ratings

Range of input voltages 340-800Vcc, 50 Hz, 3~							
Inverter type	**Nom. output power [kW]**	**Recommended max PV power [kW]**	**Max allowed PV power [A]**	**Max efficiency [%]**	**Power consumption at night [W]**	**Inverter dimensions [mm]**	**Inverter weight [kg]**
NXV0010	10	12	50	>94%	<5	600x1481x600	220
NXV0015	15	18.5	50	>94%	<5	600x1481x600	220
NXV0020	20	24	99	>94%	<5	600x1481x600	300
NXV0025	25	30	99	>94%	<5	600x1481x600	300
NXV0030	30	36	99	>94%	<5	600x1481x600	300
NXV0040	40	48	198	>95%	<30	800x1881x600	550
NXV0050	50	60	198	>96%	<30	800x1881x600	550
NXV0080	80	96	353	>96%	<30	800x2281x600	850
NXV0100	100	120	353	>96%	<30	800x2281x600	850

Table 2-1. Power ratings, dimensions and weights

2.2 Technical data

DC Input	Range of input voltages	340...800 VDC
	Maximum input voltage	900 VDC
AC Output	Mains voltage	3*400 ± 10%
	Galvanic isolation	For each isolator transformer attached
	Frequency	50/60 Hz ± 0,5%
	Cos φ	>0.99, for output 20%-100% of Pn
	Harmonic distortion	< 2.5% for output > 30% of power
	Consumption at night	< 5W (NXV0010...NXV0030); <30 W (NXV0040...NXV0100)
	Maximum efficiency	> 94...96%
	Ambient temperature	-10...+40°C; 1-% derating for each degree up to 50°C required
	Relative humidity	< 95% no condensation
	Protection	IP21
	Display	Alfanumeric display per unit with two lines of 14 characters, leds indicating functioning, plus fault and function push buttons.
	Signalling	3 potential free contacts to indicate faults and alarms
	Communications	May include one of the following communication buses as an optional feature: Modbus RTU, Ethernet (Modbus/TCP), RS485, GPRS, string and inverter monitoring May include a monitoring system with http-access as an optional feature.
	IEC61000-3-3	For the product to meet the technical requirements of IEC 61000-3-3, the supply should have a system impedance accordingly: ≤ NXV0015: Zsys = 0.105 ohm ≤ NXV0030: Zsys = 0.270 ohm ≤ NXV0050: Zsys = 0.176 ohm ≤ NXV0100: Zsys = 0.136 ohm
Ambient conditions	Altitude	Max. 2,000m
	Environmental category	Indoor, conditioned
	Pollution degree	PD2
Overvoltage category	AC (Mains)	OVCIII
	DC (Panels)	OVCII

Table 2-2. Technical data

3. RECEIPT OF DELIVERY

3.1 Type designation code

Vacon 8000 Solar inverters have undergone scrupulous tests and quality checks at the factory before they are delivered to the customer. However, after unpacking the product, check that no signs of transport damages are to be found on the product and that the delivery is complete (compare the type designation of the product to the code below).

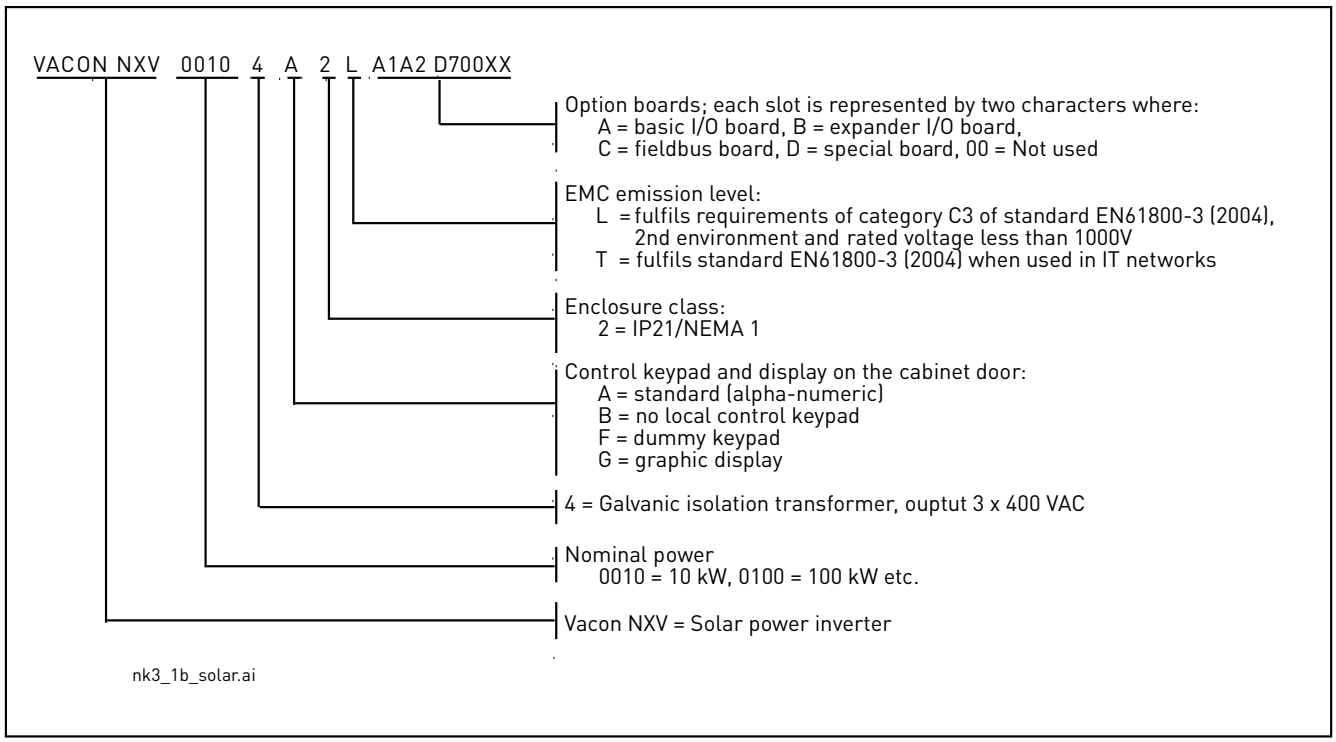


Figure 3-1. Type designation code

3.2 Lifting the unit out of the transport packaging

Before unpacking the device, check the correctness of delivery by comparing your order data to the drive information found on the package label.

The unit is delivered either in a wooden box or a wooden cage. The box may be transported either horizontally or vertically, while transportation of the cage in a horizontal position is not allowed. Always refer to shipping marks for more detailed information. To lift the unit out of the box, use lifting equipment capable of handling the weight of the cabinet.

There are lifting lugs on the top of the cabinet and these lugs can be used to lift the cabinet into an upright position and to move it to the place needed.

Units NXV 0010 and NXV0100 may be lifted as shown in Figure 3-2, in vertical or horizontal position.

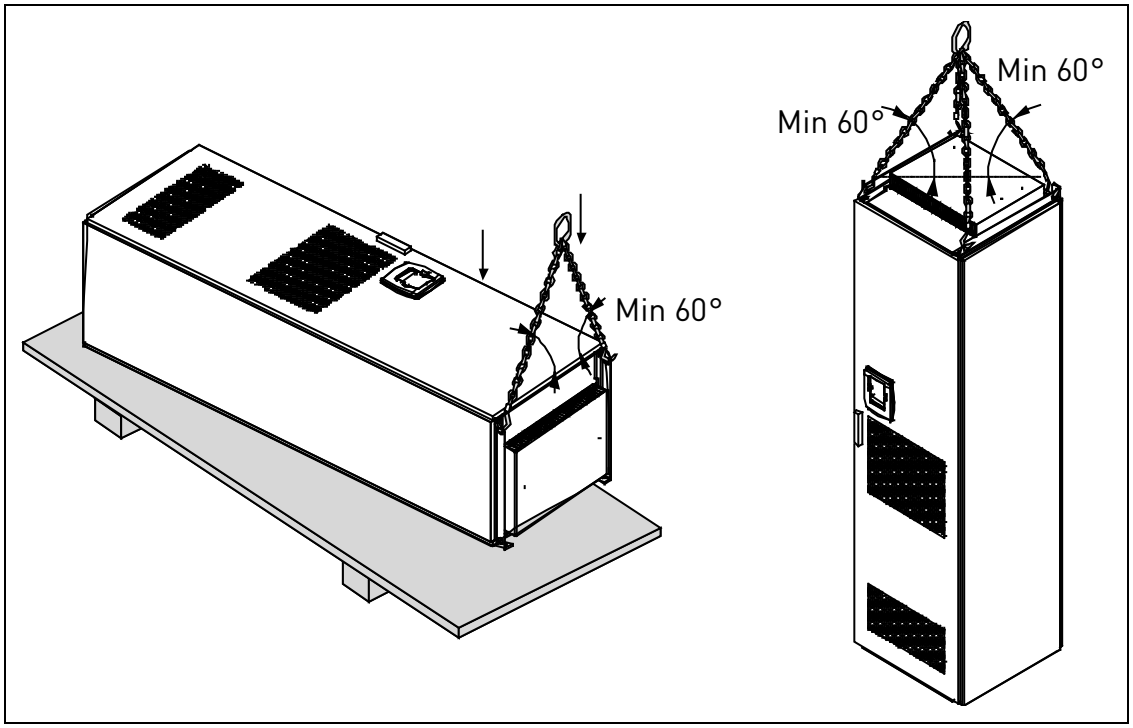


Figure 3-2. Lifting unit cabinet

After unpacking the product, check that no signs of transport damages are to be found on the product and that the delivery is complete.

If the delivery does not correspond to your order, contact the supplier immediately.

Should the drive have been damaged during the shipping, please contact primarily the cargo insurance company or the carrier.

If the equipment has been damaged, do not install it.

Keep the original packaging in case it is necessary to return the equipment to the manufacturer. Otherwise recycle the packaging material according to local regulations.

3.3 Storage

If the inverter is to be kept in store before use make sure that the ambient conditions are acceptable:

Storing temperature	–40...+70°C
Relative humidity	<95%, no condensation

The environment should also be free from dust. If there is dust in the air the inverter should be well protected to make sure dust does not get inside it.

If the inverter is to be stored during longer periods the power should be connected to the inverter once in 24 months and kept on for at least 2 hours. If the storage time exceeds 24 months the electrolytic DC capacitors need to be charged with caution. Therefore, such a long storage time is not recommended.

If the storing time is much longer than 24 months, the recharging of the capacitors has to be carried out so that the possible high leakage current through the capacitors is limited. The best alternative is to use a DC-power supply with adjustable current limit. The current limit has to be set for example

to 300...500mA and the DC-power supply has to be connected to the B+/B- terminals (DC supply terminals).

DC-voltage must be adjusted to nominal DC-voltage level of the unit (1.35*Un AC) and supplied at least for 1 hour.

If DC-voltage is not available and the unit has been stored de-energized much longer than 1 year consult factory before connecting power.

3.4 Maintenance

In normal conditions, Vacon NX 8000 Solar inverters are maintenance-free. However, we recommend to keep the inverter clean, e.g. by cleaning the heatsink with compressed air whenever necessary.

We also recommend to follow proactive maintenance schedule below to ensure the highest possible utilization rate of the cabinet drive.

Maintenance interval	Maintenance action
12 months (if unit stored)	• Reform capacitors (see separate instruction)
6-24 months (depending on environment)	• Check I/O terminals • Check tightness of mains connection (e.g. with thermography) • Clean cooling tunnel • Check operation of cooling fan, check for corrosion on terminals, busbars and other surfaces
5-7 years	• Change cooling fans: - main fan - fan of the LCL filter
5-10 years	• Change DC bus capacitors if DC voltage ripple is high

Table 3-1. Proactive maintenance schedule

3.5 Warranty

Only manufacturing defects are covered by the warranty. The manufacturer assumes no responsibility for damages caused during or resulting from transport, receipt of the delivery, installation, commissioning or use.

The manufacturer shall in no event and under no circumstances be held responsible for damages and failures resulting from misuse, wrong installation, unacceptable ambient temperature, dust, corrosive substances or operation outside the rated specifications.

Neither can the manufacturer be held responsible for consequential damages.

The Manufacturer's standard time of warranty is 18 months from the delivery or 12 months from the commissioning whichever expires first (Vacon Warranty Terms).

The local distributor may grant a warranty time different from the above. This warranty time shall be specified in the distributor's sales and warranty terms. Vacon assumes no responsibility for any other warranties than that granted by Vacon itself.

In all matters concerning the warranty, please contact first your distributor.

4. INSTALLATION

The installation of the VACON 8000 SOLAR solar inverter may only be carried out by a qualified technician who fully understands the safety and installation instructions included in this manual.

The IP21 protection of the VACON 8000 SOLAR inverter only allows for installation in enclosed places. Note the locations of some essential components of the inverters in pictures below:

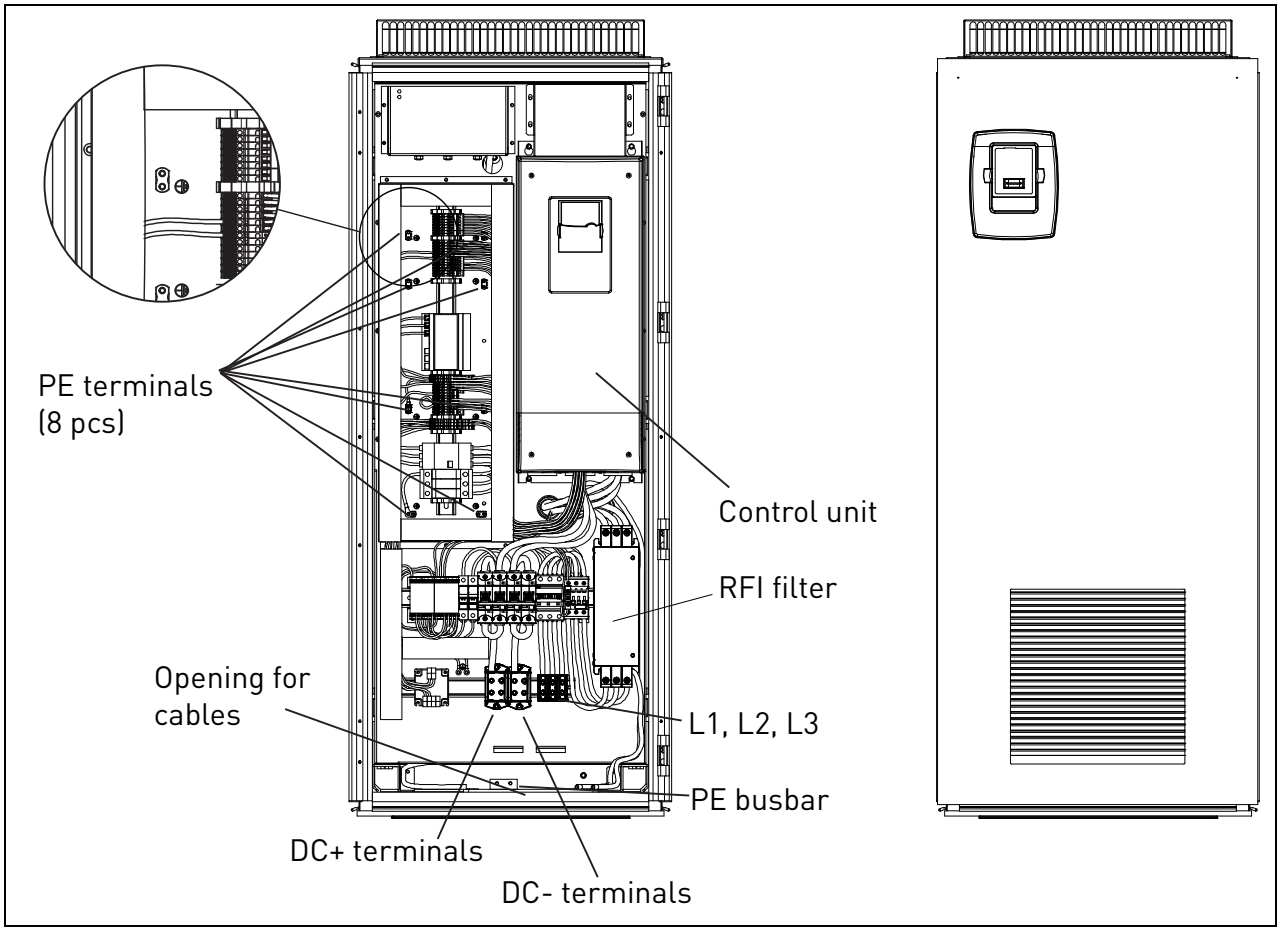


Figure 4-1. Pricipal drawing of inverter modules NXV0010 to NXV0030 with some essential components

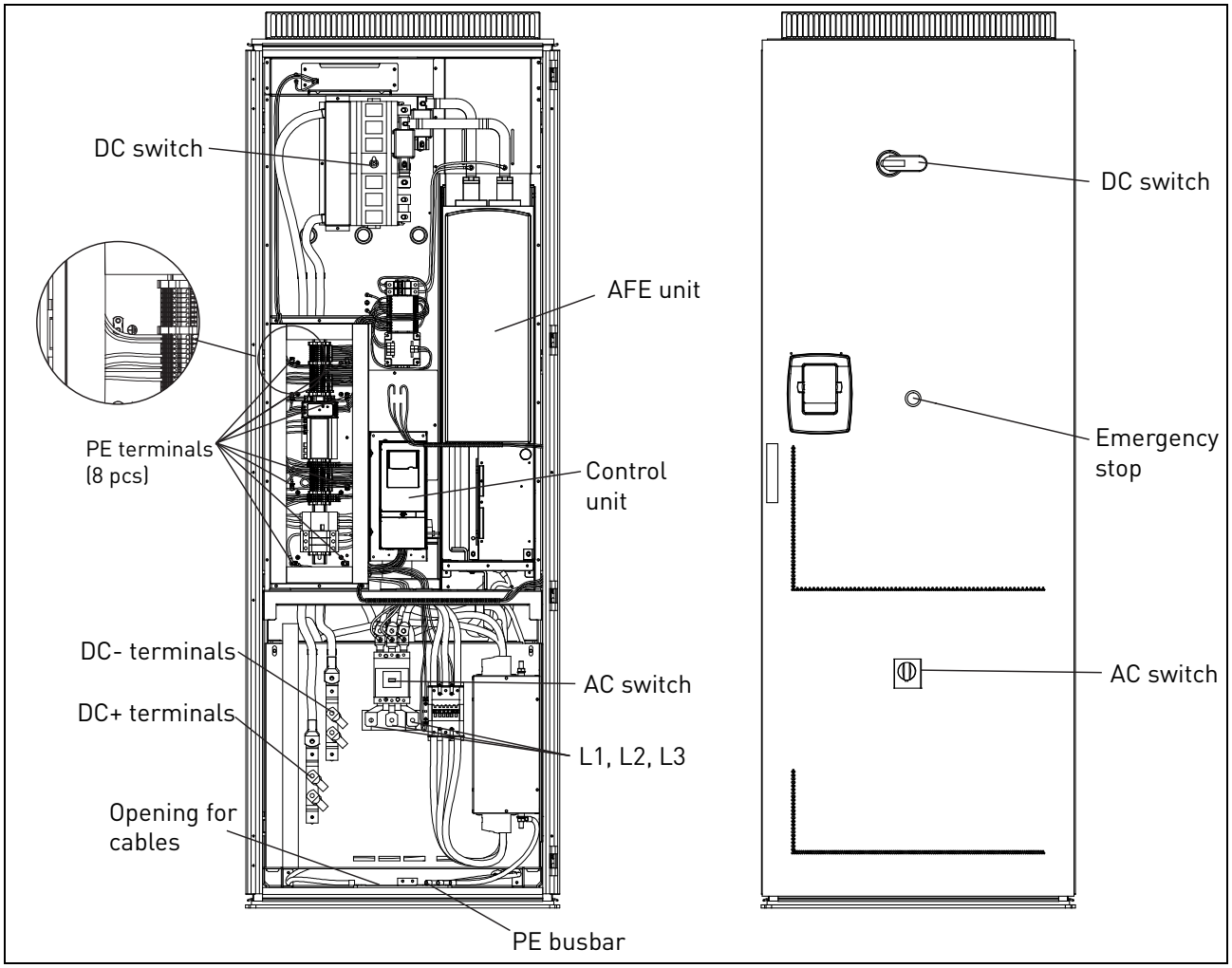


Figure 4-2. Pricipal drawing of inverter modules NXV0040 and NXV0100 with some essential components

Due to the heavy weight of the device, it must be placed on a firm and horizontal surface.

The equipment has to be installed in a place where the room temperature is between -10ºC and +40ºC. Lower temperatures prevent the equipment from starting up and higher temperatures limit the output power.
The buzzing noise occurring during the operation of the equipment is normal. Do not install the equipment in an occupied dwelling.

⚠	NOTE: It is important to prevent small particles falling onto the device. Small particles may enter the equipment through the ventilation grids and damage the equipment.
⚠	Do not block the ventilation grids.
⚠	Unit must be installed on non-flammable ground.
⚠	The unit is not intended for wet location.

4.1 Free space around the cabinet

Enough space must be left above, behind and in front of the cabinet to ensure sufficient cooling and space for maintenance.
The amount of cooling air required is indicated in the table below. Also make sure that the temperature of the cooling air does not exceed the maximum ambient temperature of the inverter.

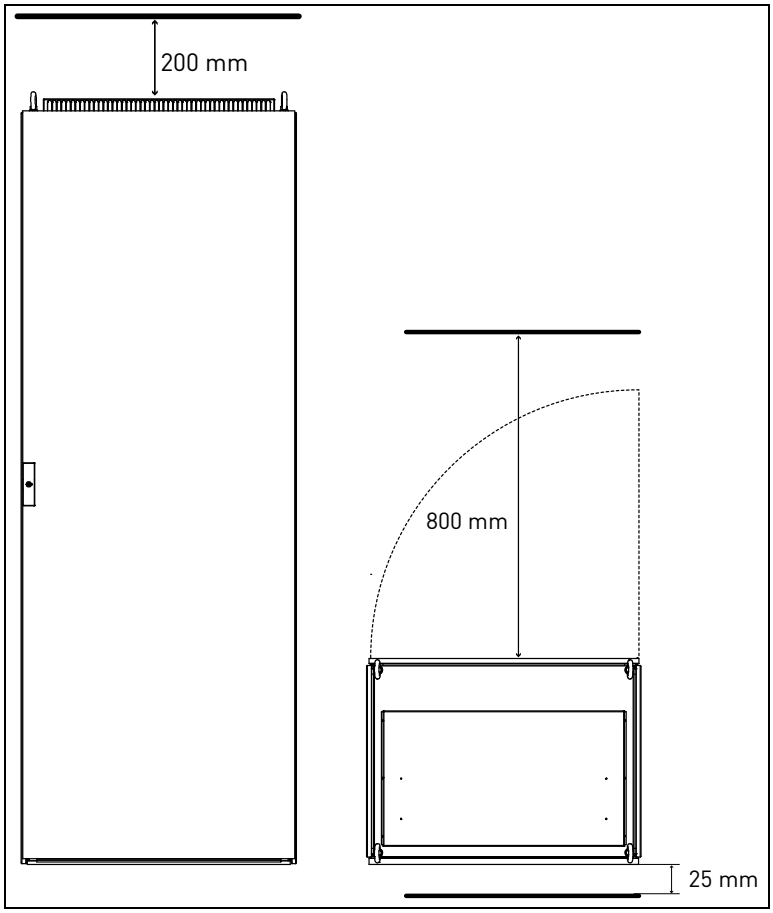


Figure 4-3. Space to be left free above (left) and in front of (right) the cabinet.

Type	Cooling air required [m^3/h]
NXV0010	300
NXV0015	300
NXV0020	425
NXV0025	425
NXV0030	425
NXV0040	700
NXV0050	700
NXV0080	800
NXV0100	800

Table 4-1. Required cooling air

4.2 Fixing the unit

The cabinet can be fixed to the floor alone or to the floor and the back wall.

4.2.1 Fixing the unit to floor alone

For the floor-only-mounting, the fixing points in all four bottom corners of the cabinet shown in Figure 4-4 below must be used.

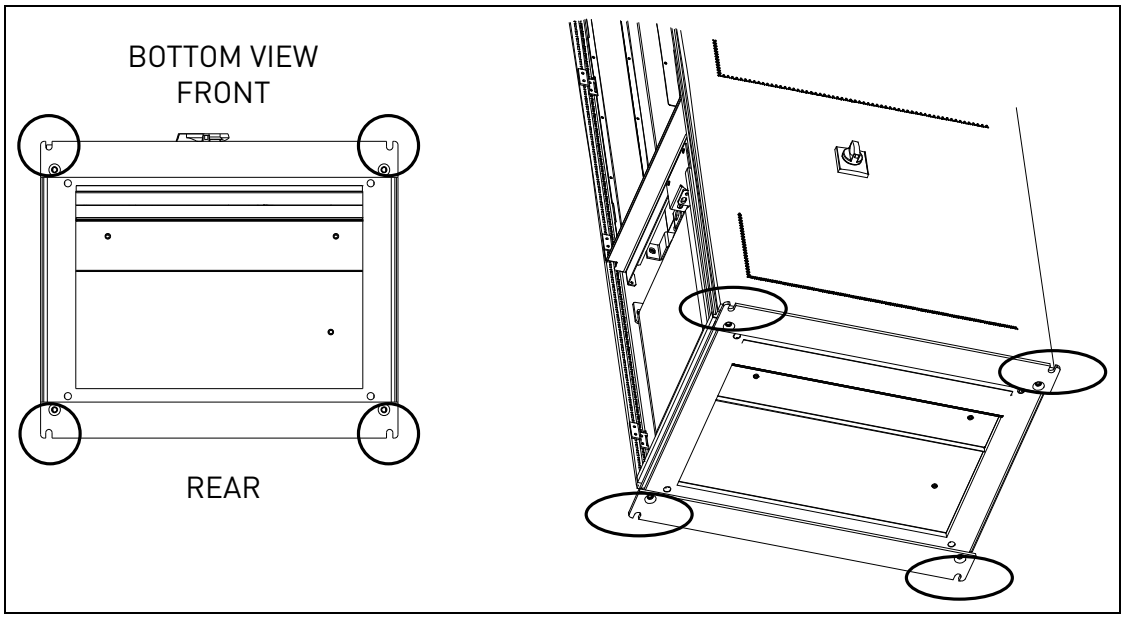


Figure 4-4. Fixing the cabinet to the floor only

4.2.2 Fixing the unit to floor and wall

For additional stability, the cabinet can also be mounted to the floor and the back wall. To accomplish this, follow this procedure:

1. On the bottom of the cabinet, remove the screws of the **rear iron clamp**. Flip it and refix the screws as shown in Figure 4-5.
2. Then bolt the cabinet to the floor at the fixing points on the bottom front side, see Figure 4-5.

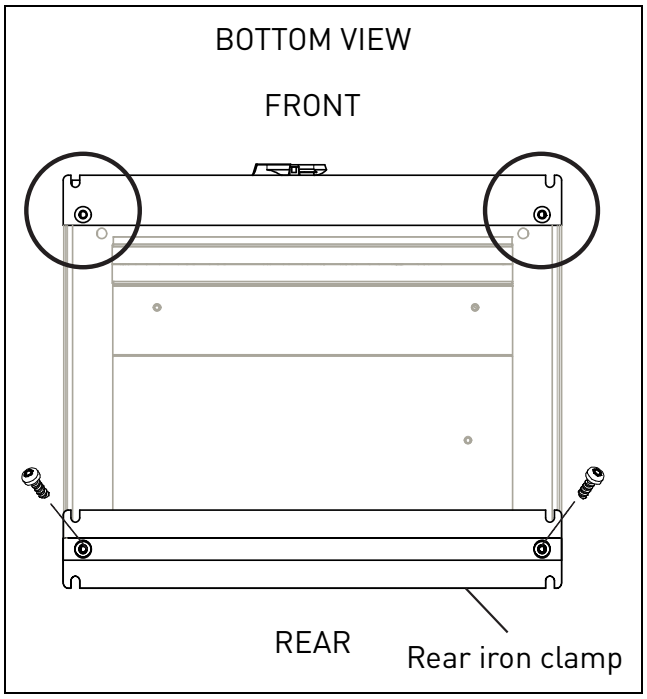


Figure 4-5.

3. Use the fixing points at the top rear side of the cabinet to bolt it to the back wall. See Figure 4-6.

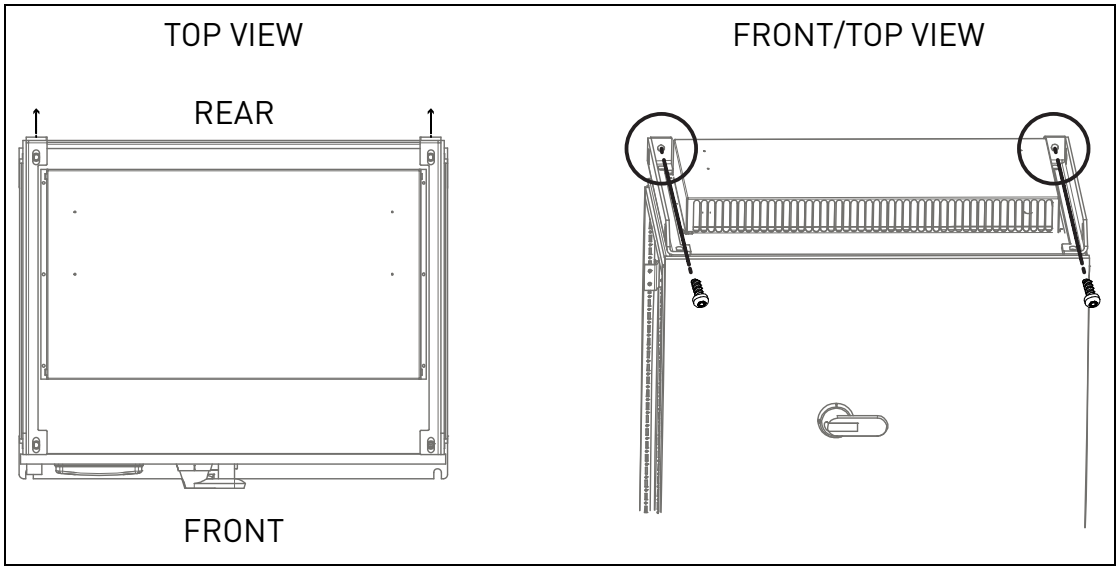


Figure 4-6.

	Welding of the cabinet might risk sensitive components in the converter. Ensure that no grounding currents can flow through any part of the converter.

5. ELECTRICAL CONNECTION

Only a competent electrician is allowed to install the electrical connection. The equipment uses dangerous voltages.
There is danger of electrical shock which may cause death or serious injury.

5.1 Electrical diagrams

5.1.1 NXV0010 to NXV0030

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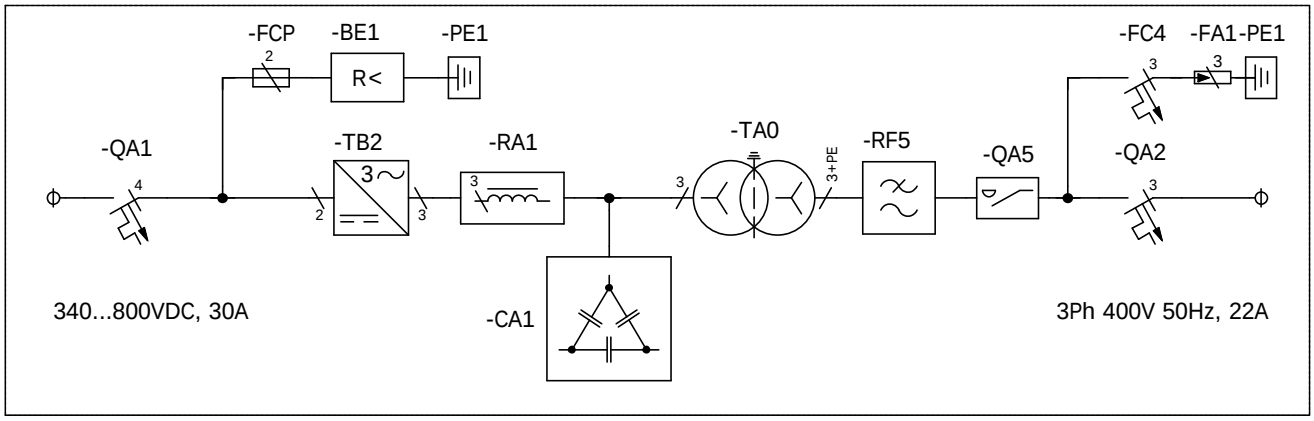

Figure 5-1. Electrical diagram for NXV0010 to NXV0030

5.1.2 NXV0040 to NXV0050

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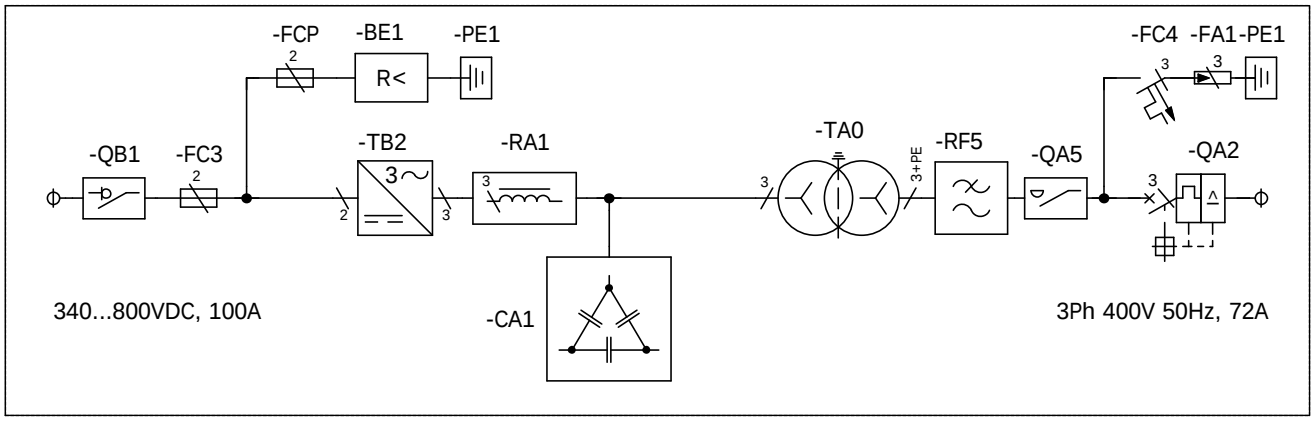

Figure 5-2. Electrical diagram for NXV0040 to NXV0050

5.1.3 NXV0080 to NXV0100

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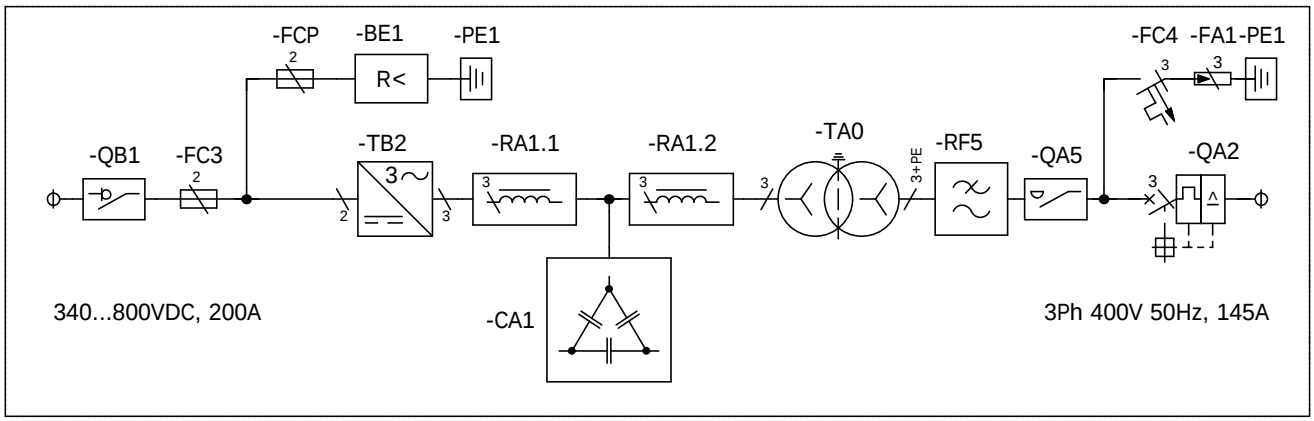


Figure 5-3. Electrical diagram for NXV0080 to NXV0100

5.2 Cabling

Before connecting the cables to the solar inverter, use a multimeter to check that the cables to be connected are not live.

Cables coming from photovoltaic panels will be active while panels are lit.

5.2.1 Earth connection

The solar inverter has an earth connection terminal to which all the inverter's metallic parts are connected. This connection terminal must be connected to earth. Remember to earth the PE busbar. See Table 5-1 on page 18.

5.2.2 Connection to mains

The terminals of the power supply can be reached through the bottom part of the equipment. The solar inverter has three connection terminals, to which mains cables are connected.

Run the cables through the opening on the bottom of the cabinet. See Figure 5-5.

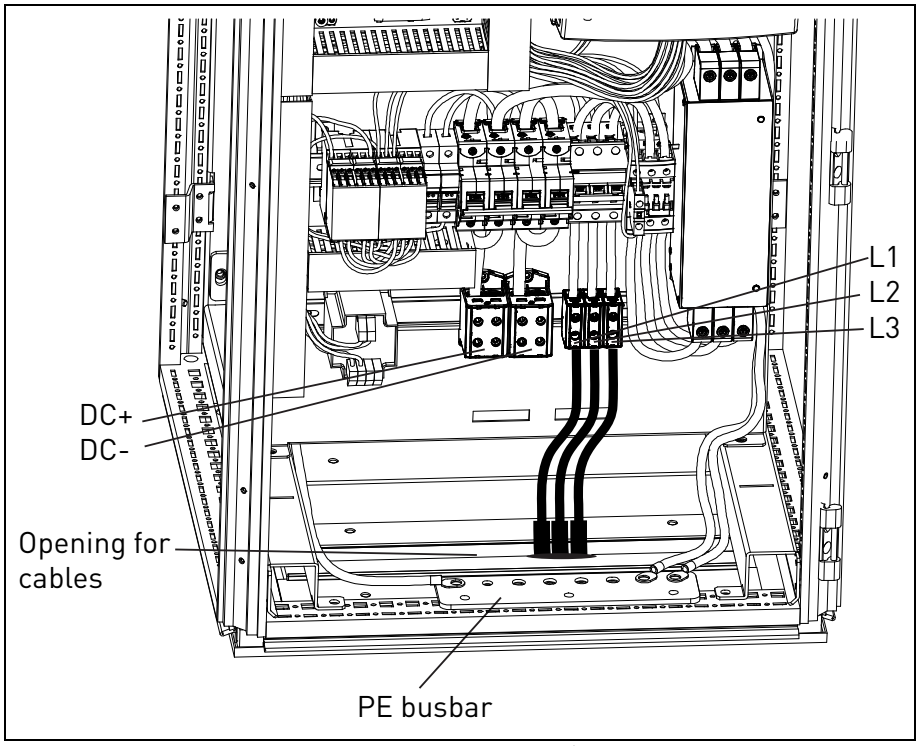


Figure 5-4. Mains cabling NXV0015 to NXV0030 (cable clamps not included in delivery)

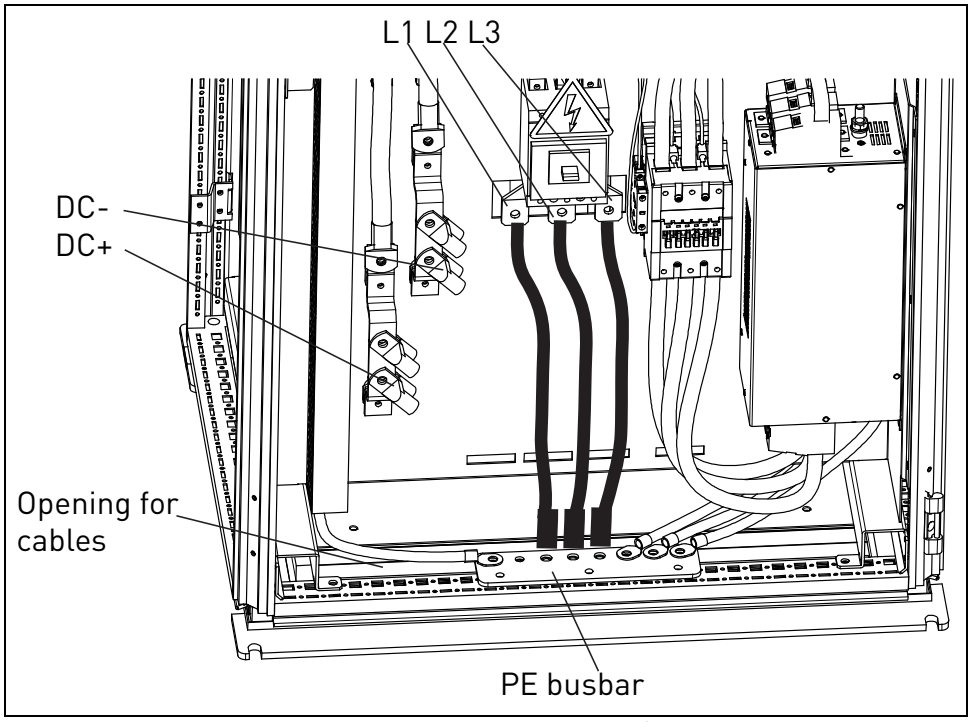


Figure 5-5. Mains cabling NXV0040 and NXV0100 unit (cable clamps not included in delivery)

The cable cross section will be determined according to the power and distance to the connection point, following the local regulations.

Size	Minimum cross section per unit [mm²]			Maximum cross section per unit [mm²]		
	AC	DC	PE	AC	DC	PE
NXV0010	1,5	6	10	50	95	240
NXV0015	1,5	6	10	50	95	240
NXV0020	1,5	6	10	50	95	240
NXV0025	1,5	6	10	50	95	240
NXV0030	1,5	6	10	50	95	240
NXV0040	10	10	10	240	240	240
NXV0050	10	10	10	240	240	240
NXV0080	10	10	10	240	240	240
NXV0100	10	10	10	240	240	240

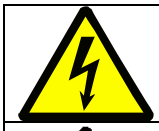
Table 5-1.Minimum and maximum cable cross sections

The tightening torques of power connections are given in tables below:

Drive size	Terminal size [mm²]	Screw/Bolt size	Tightening torque [Nm]
NXV0010...NXV0030	1,5...2,5		1,5
	4...10		5
	16...50		12
NXV0040...NXV0100		M6	8...10
		M8	18...22
		M10	35...45
		M12	65...75

Table 5-2. Tightening torques of power connections

5.2.3 Connection to photovoltaic panels

	**Remember** that photovoltaic panels produce a current while they are illuminated. Be sure to check that cables are not live.
	**NOTE!** Wrongly connected cables may damage the equipment.

Run the solar panel cables to the respective terminals on the drive through the bottom of the supply unit (see Figure 5-5 and Figure 5-6). Check for the cable sizes and the appropriate number of cables in tables on page 20.

In drives NXV0050 and NXV0100, always connect the two cables on both sides of the terminal bar (see Figure 5-6).

Connect the positive pole of the photovoltaic panel to the terminal marked with '+' and the negative pole to the terminal marked with '-'.

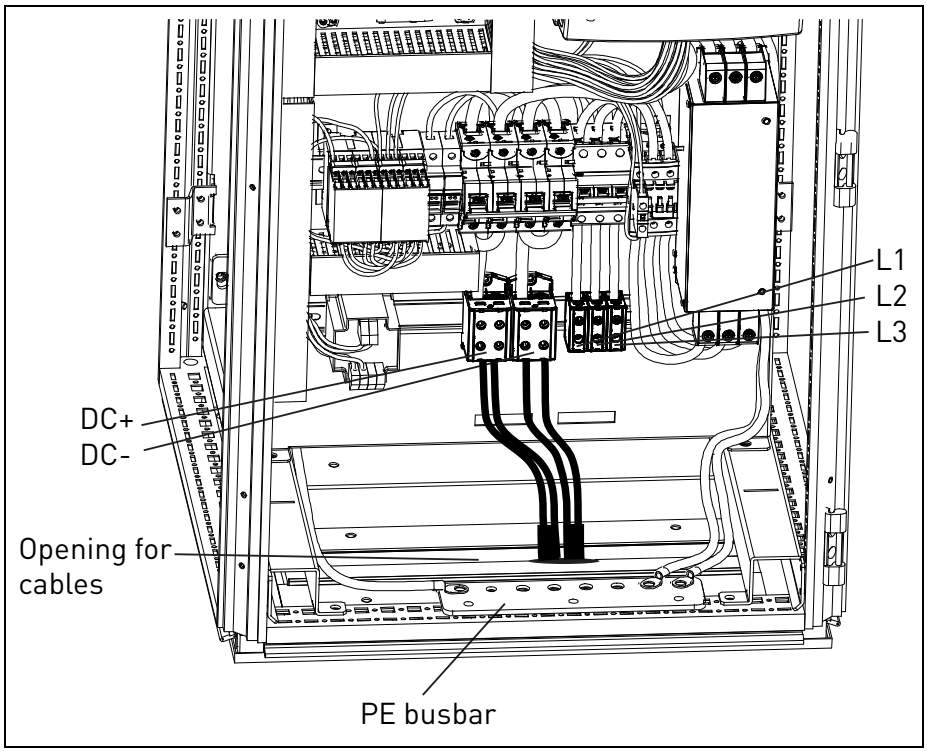


Figure 5-6. Inverter connection to solar panels, NXV0015 to NXV0030

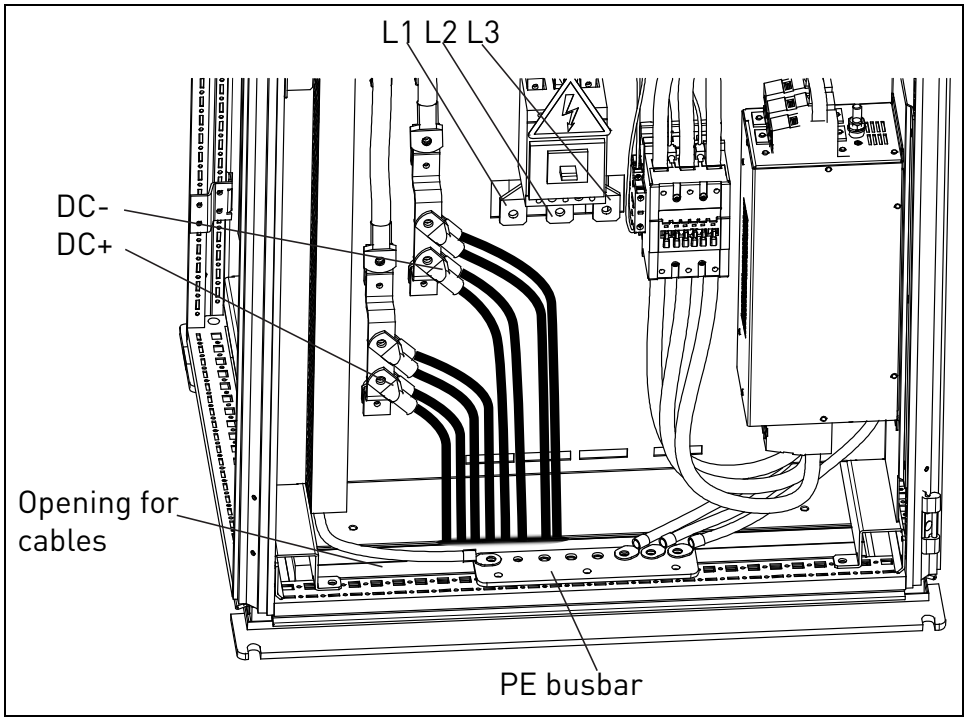


Figure 5-7. Inverter connection to solar panels, NXV0040 to NXV0100

Model	Minimum cross section	Recommended cross section	Maximum cross section
NXV0010	2x6mm^2	2x50mm^2	2x 2x95mm^2
NXV0015	2x16mm^2	2x70mm^2	2x 2x95mm^2
NXV0020	2x25mm^2	2x95mm^2	2x 2x95mm^2
NXV0025	2x35mm^2	2x95mm^2	2x 2x95mm^2
NXV0030	2x35mm^2	2x 2x70mm^2	2x 2x95mm^2
NXV0040	2x70mm^2	2x 2x95mm^2	4x 2x185mm^2
NXV0050	2x95mm^2	2x 2x95mm^2	4x 2x185mm^2
NXV0080	2x 2x70mm^2	4x 2x95mm^2	4x 2x185mm^2
NXV0100	2x 2x95mm^2	4x 2x95mm^2	4x 2x185mm^2

Table 5-3. Panel input cable dimensions

Model	Minimum cross section	Recommended cross section	Maximum cross section
NXV0010	3x1,5mm^2	3x16mm^2	3x50mm^2
NXV0015	3x1,5mm^2	3x25mm^2	3x50mm^2
NXV0020	3x1,5mm^2	3x25mm^2	3x50mm^2
NXV0025	3x1,5mm^2	3x35mm^2	3x50mm^2
NXV0030	3x1,5mm^2	3x50mm^2	3x50mm^2
NXV0040	3x16mm^2	3x50mm^2	3x120mm^2
NXV0050	3x25mm^2	3x70mm^2	3x120mm^2
NXV0080	3x50mm^2	3x95mm^2	3x120mm^2
NXV0100	3x70mm^2	3x120mm^2	3x120mm^2

Table 5-4. Panel output cable dimensions

Model	Cross section
NXV0010	10mm^2
NXV0015	10mm^2
NXV0020	16mm^2
NXV0025	16mm^2
NXV0030	16mm^2
NXV0040	25mm^2
NXV0050	25mm^2
NXV0080	35mm^2
NXV0100	35mm^2

Table 5-5 Panel earthing cable dimensions

The minimum cable cross section is calculated in compliance with loading capacity of cables. The recommended cross section is calculated in compliance with 1-% voltage drop for a cable 100 m in length.

5.3 Control connections

The control boards are situated inside the control unit of the Vacon 8000 Solar inverter (see Figure 5-8). Four different board types can be used with the inverter: A1, A2, B5, C2 and D7. The control connections of these boards are described below. For more detailed information on the boards you can find in Vacon Option Board Manual.

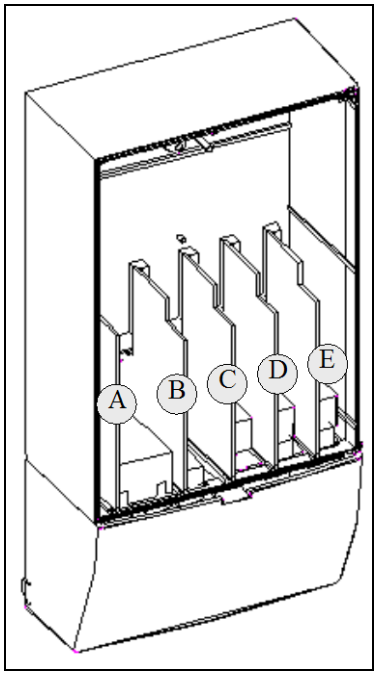


Figure 5-8. Board slots in control unit

5.3.1 Basic board OPTA1

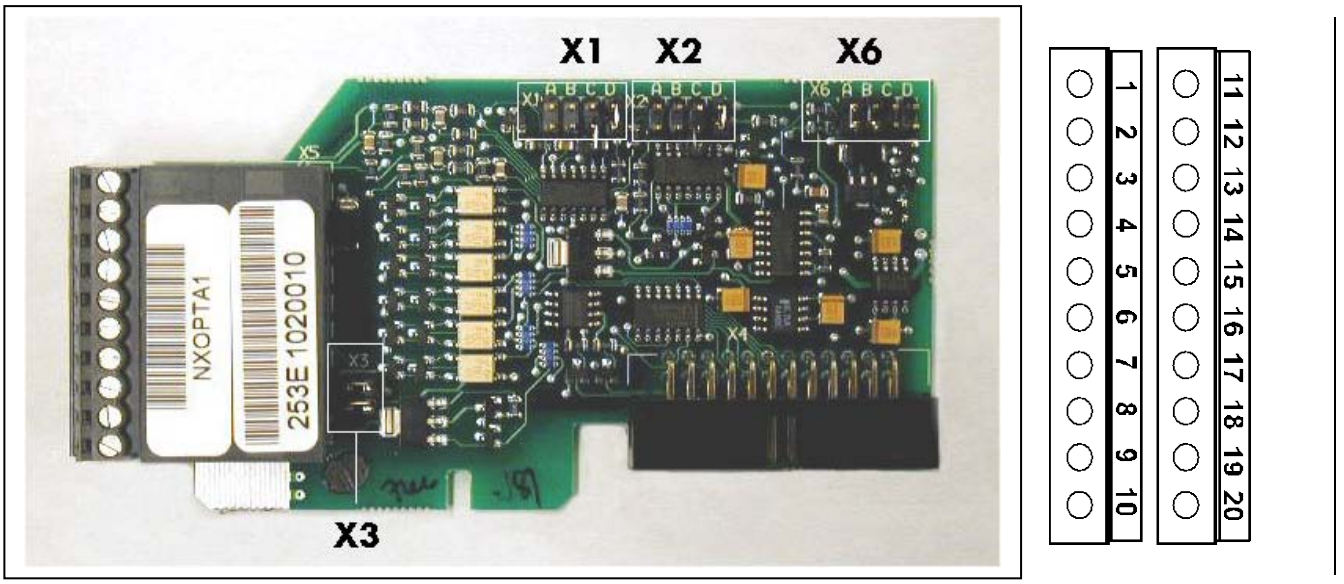


Figure 5-9. Vacon OPT-A1 option board

Description: Standard I/O board with digital inputs/outputs and analogue inputs/outputs
Allowed slots: A

Type ID: 16689

Terminals: Two terminal blocks (coded = mounting of blocks in wrong order prevented, terminals #1 and #12);
Screw terminals (M2.6)

Jumpers: 4; X1, X2, X3 and X6 (See *Figure 5-10.*)

Board parameters: Yes (see page 26)

I/O terminals on OPTA1 (coded terminals painted black)

Terminal		Parameter reference on keypad and NCDrive	Technical information
1	+10 Vref		Reference output +10V; Maximum current 10 mA
2	AI1+	An.IN:**A.1**	Selection V or mA with jumper block X1 (see page 25): Default: 0– +10V (Ri = 200 kΩ) (-10V..+10V Joy-stick control, selected with ajumper) 0– 20mA (Ri = 250 Ω) Resolution 0.1%; Accuracy ±1%
3	AI1–		Differential input if not connected to ground; Allows ±20V differential mode voltage to GND
4	AI2+	An.IN:**A.2**	Selection V or mA with jumper block X2 (see page 25): Default: 0– 20mA (Ri = 250 Ω) 0– +10V (Ri = 200 kΩ) (-10V..+10V Joy-stick control, selected with a jumper) Resolution: 0.1%; Accuracy ±1%
5	AI2–		Differential input if not connected to ground; Allows ±20V differential mode voltage to GND
6	24 Vout (bi-directional)		24V auxiliary voltage output. Short-circuit protected. ±15%, maximum current 150 mA +24Vdc external supply may be connected. Galvanically connected to terminal #12.
7	GND		Ground for reference and controls Galvanically connected to terminals #13,19.
8	DIN1	DigIN:**A.1**	Digital input 1 (Common CMA); R_i = min. 5kΩ
9	DIN2	DigIN:**A.2**	Digital input 2 (Common CMA); R_i = min. 5kΩ
10	DIN3	DigIN:**A.3**	Digital input 3 (Common CMA); R_i = min. 5kΩ
11	CMA		Digital input common A for DIN1, DIN2 and DIN3. Connection by default to GND. Selection with jumper block X3 (see page 25):
12	24 Vout (bi-directional)		Same as terminal #6 Galvanically connected to terminal #6.
13	GND		Same as terminal #7 Galvanically connected to terminals #7 and 19
14	DIN4	DigIN:**A.4**	Digital input 4 (Common CMB); R_i = min. 5kΩ
15	DIN5	DigIN:**A.5**	Digital input 5 (Common CMB); R_i = min. 5kΩ
16	DIN6	DigIN:**A.6**	Digital input 6 (Common CMB); R_i = min. 5kΩ
17	CMB		Digital input common B for DIN4, DIN5 and DIN6. Connection by default to GND. Selection with jumper block X3 (see page 25):
18	AO1+	AnOUT:**A.1**	Analogue output Output signal range: Current 0(4)–20mA, R_L max 500Ω or Voltage 0—10V, R_L >1kΩ Selection with jumper block X6 (see page 25): Resolution: 0.1% (10 bits); Accuracy ±2%
19	AO1–		
20	DO1	DigOUT:**A.1**	Open collector output Maximum U_{in} = 48VDC Maximum current = 50 mA

Table 5-6. OPTA1 I/O terminals

Jumper selections

There are four jumper blocks on the OPTA1 board. The factory defaults and other available jumper selections are presented below.

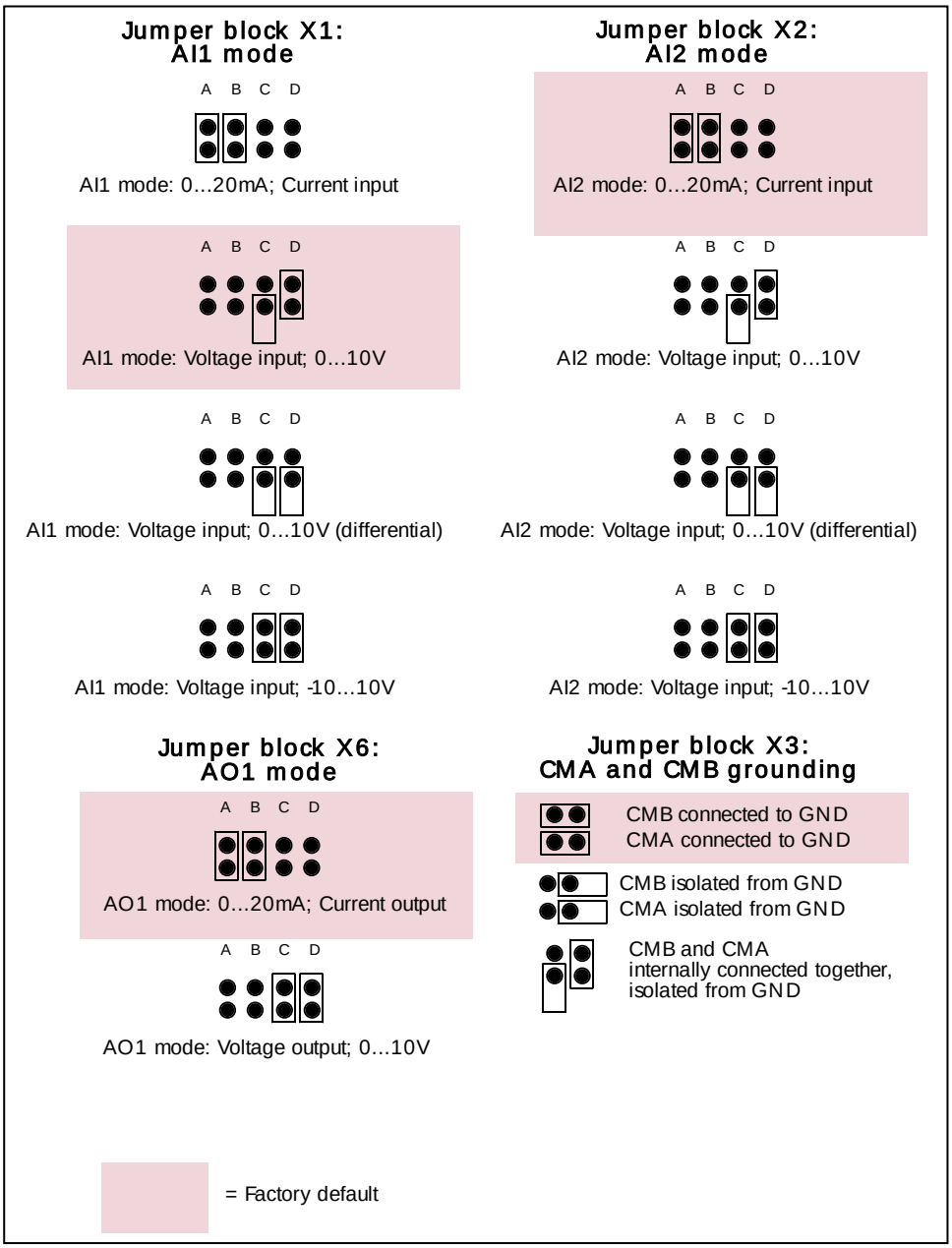


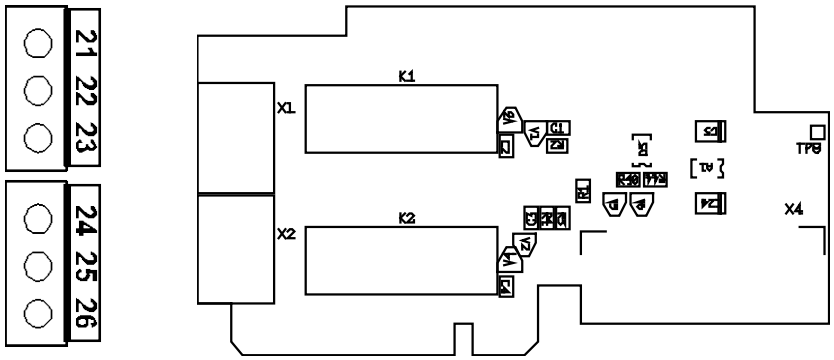
Figure 5-10. Jumper block selection on OPTA1

OPTA1 parameters

Number	Parameter	Min	Max	Default	Note
1	AI1 mode	1	5	3	**1** = 0...20mA **2** = 4...20mA **3** = 0...10V **4** = 2...10V **5** = -10...+10V
2	AI2 mode	1	5	1	**1** = 0...20mA **2** = 4...20mA **3** = 0...10V **4** = 2...10V **5** = -10...+10V
3	AO1 mode	1	4	1	**1** = 0...20mA **2** = 4...20mA **3** = 0...10V **4** = 2...10V

Table 5-7. OPTA1 board-related parameters

5.3.2 Option board OPTA2



Description: Standard Vacon NX frequency converter relay board with two relay outputs

Allowed slots: B

Type ID: 16690

Terminals: Two terminal blocks; Screw terminals (M3); No coding

Jumpers: None

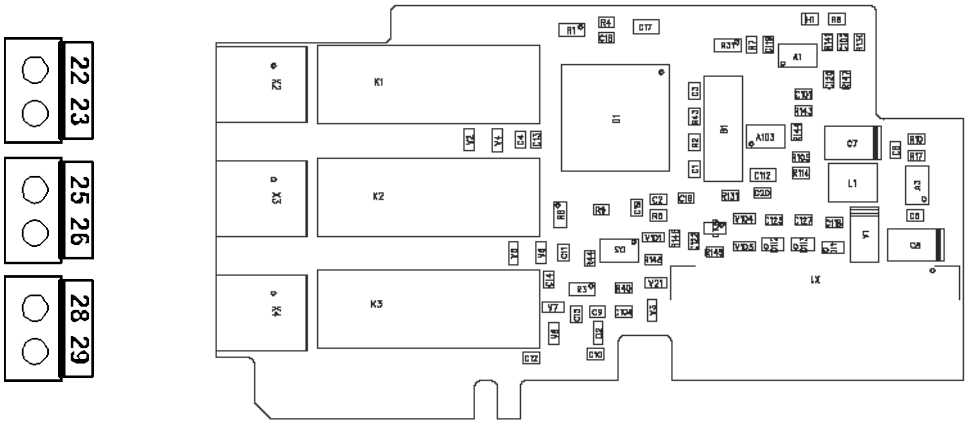
Board parameters: None

I/O terminals on OPTA2

Terminal		Parameter reference on keypad and NCDrive	Technical information	
			Relay output 1 (NO/NC)	
21	RO1/normal closed		Switching capacity	24VDC/8A
22	RO1/common	DigOUT:B.1		250VAC/8A
23	RO1/normal open			125VDC/0.4A
			Min. switching load	5V/10mA
			Relay output 2 (NO/NC)	
24	RO2/normal closed		Switching capacity	24VDC/8A
25	RO2/common	DigOUT:B.2		250VAC/8A
26	RO2/normal open			125VDC/0.4A
			Min. switching load	5V/10mA

Table 5-8. OPTA2 I/O terminals

5.3.1 Option board OPTB5



Description: I/O expander board with three relay outputs.

Allowed slots: B, C, D, E

Type ID: 16949

Terminals: Three terminal blocks; Screw terminals (M3); No coding

Jumpers: None

Board parameters: None

I/O terminals on OPTB5

Terminal		Parameter reference Keypad/NCDrive	Technical information	
22 23	RO1/common RO1/normal open	DigOUT:**X.1**	Switching capacity Min. switching load	24VDC/8A 250VAC/8A 125VDC/0.4A 5V/10mA
25 26	RO2/common RO2/normal open	DigOUT:**X.2**	Switching capacity Min. switching load	24VDC/8A 250VAC/8A 125VDC/0.4A 5V/10mA
28 29	RO3/common RO3/normal open	DigOUT:**X.3**	Switching capacity Min. switching load	24VDC/8A 250VAC/8A 125VDC/0.4A 5V/10mA

Table 5-9. OPTB5 I/O terminals

Note: This expander board can be placed into four different slots on the control board. Therefore, the '**X**' given in the Parameter reference shall be replaced by the slot letter (B, C, D, or E) depending on the slot which the expander board is plugged into.

5.4 Option board OPTC2 (RS-485)

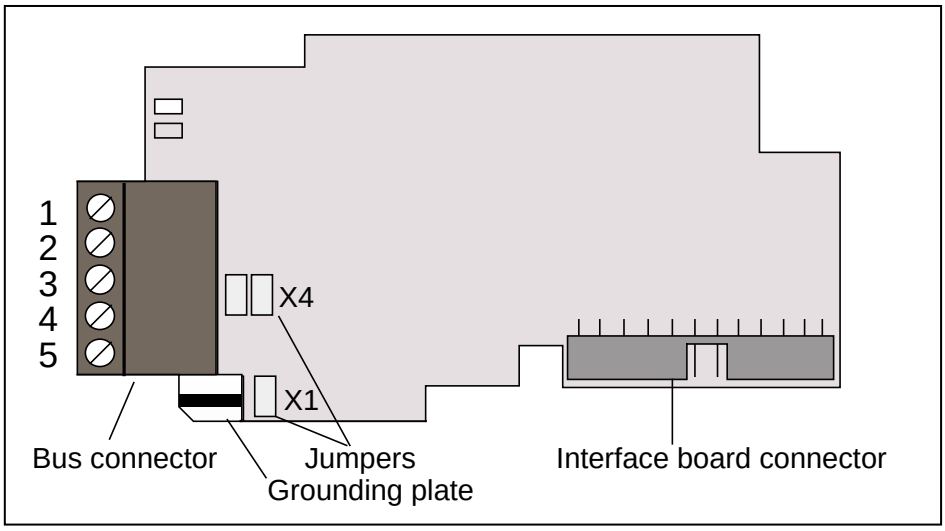
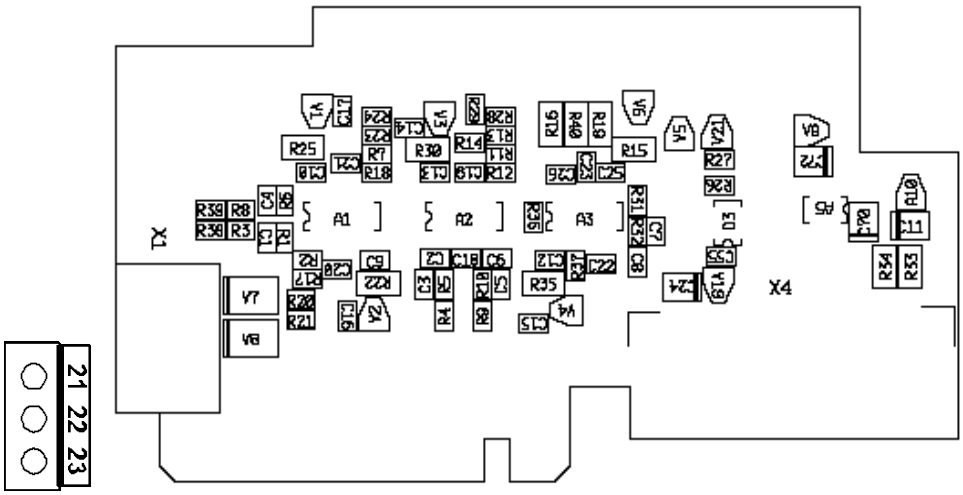


Figure 5-11. Vacon RS-485 option board OPTC2

Signal	Connector	Description
NC*	1*	No connection
VP	2	Supply voltage – plus (5V)
RxD/TxD –N	3	Receive/Transmit data – A
RxD/TxD –P	4	Receive/Transmit data – B
DGND	5	Data ground (reference potential for VP)
*You can use this pin (1) to bypass the cable shield to the next slave		

Table 5-10. OPTC2 bus connector signals

5.5 Option board OPTD7 (Line voltage measurement board)



OPTD7 is an AC sinusoidal voltage measurement board. Using this board, the drive measures the line voltage, frequency and voltage angle information. The drive can compare this information with its output voltage angle when running. This feature can be used to develop applications for different purposes using NC61131-3 application programming tool.

The OPTD7 board is delivered with the transformer which is suitable for voltage range 380V ...690V. Please note that the transformer can not be used with the pulse width modulated (PWM) voltage input.

It is possible to use custom built transformer when the input voltage to be measured is not within the above voltage range. The transformation ratio parameter then can be adjusted as per the transformer primary to secondary ratio. Please refer to specification section for further engineering.

The measurement signal connected into the OPT-D7 option board can not exceed 14.26 Vrms.

The board can only be placed in slot C.

OPTD7 connections

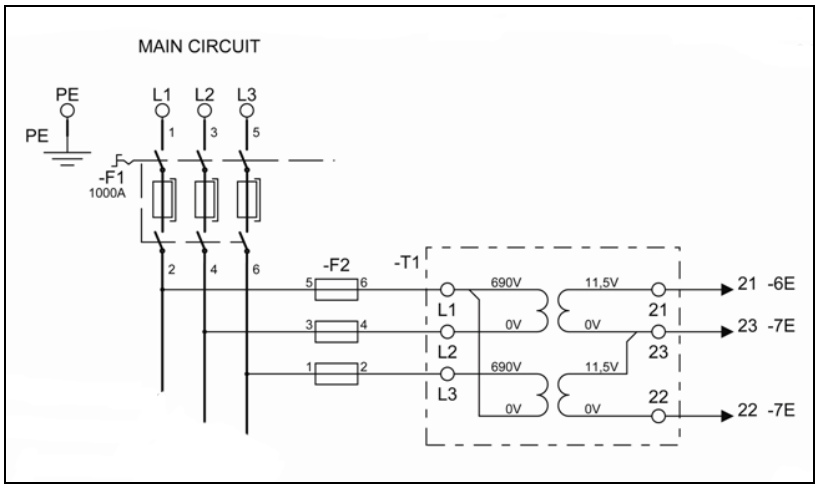


Figure 5-12.

OPTD7 board specification

Transformer primary/ input voltage range	Min 380VAC -15% Max 690VAC +15%	
Transformer ratio Primary : secondary	60:1	
Transformer second-ary/output voltage range	14V rms	Between the terminals L1/L2/L3.
Input impedence	L1/L2 =50kOhm L1/L3 = 25kOhm L2/L3 = 25kOhm	L3 is internal virtual common
Cable recommendation	Max 1.5 mm^2, shielded	From transformer output to OPTD7
Measurement resolution	10 bit	
Voltage measurement Accuracy	0.2%	

Table 5-11. OPTD7 board specification

5.6 Fuse selection

The table below shows typical cable sizes and types that can be used with the Vacon 8000 Solar inverter. The final selection should be made according to local regulations, cable installation conditions and cable specification.

CAUTION! Maximum AC-side short-circuit breaking capacity I_{cu}=30kA.
With optional AC-section I_{cu}=50kA.

5.6.1 Fuses for inverters

Inverter type	Nominal current [A]	Nominal voltage [V]	Braking capacity [kA]	Acting behaviour	Fuse size	Suitable fuse type (Cat. nr by Ferraz-Shawmut
NXV0010	No fuses needed					
NXV0015						
NXV0020						
NXV0025						
NXV0030						
NXV0040	160	1200	100	gPV	121	DC121GPV12C160E
NXV0050	200	1200	100	gPV	121	DC121GPV12C200E
NXV0080	315	810	125	aR	71 DIN110	PC71UD13C315D1A
NXV0100	400	810	125	aR	71 DIN110	PC71UD13C400D1A

Table 5-12. Fuse selection; suitable fuses for Vacon 8000 Solar inverter types

5.6.2 Fuse for measuring

Nominal current [A]	Nominal voltage [V]	Braking capacity [kA]	Acting behaviour	Fuse size	Suitable fuse type (Cat. nr by Ferraz-Shawmut
4	1000	10	gPV	10*38	HP10M4

Table 5-13. Fuse selection, fuse for measuring

6. START UP

Starting up the VACON 8000 SOLAR inverter is simple, but it is important that the following instructions are followed:

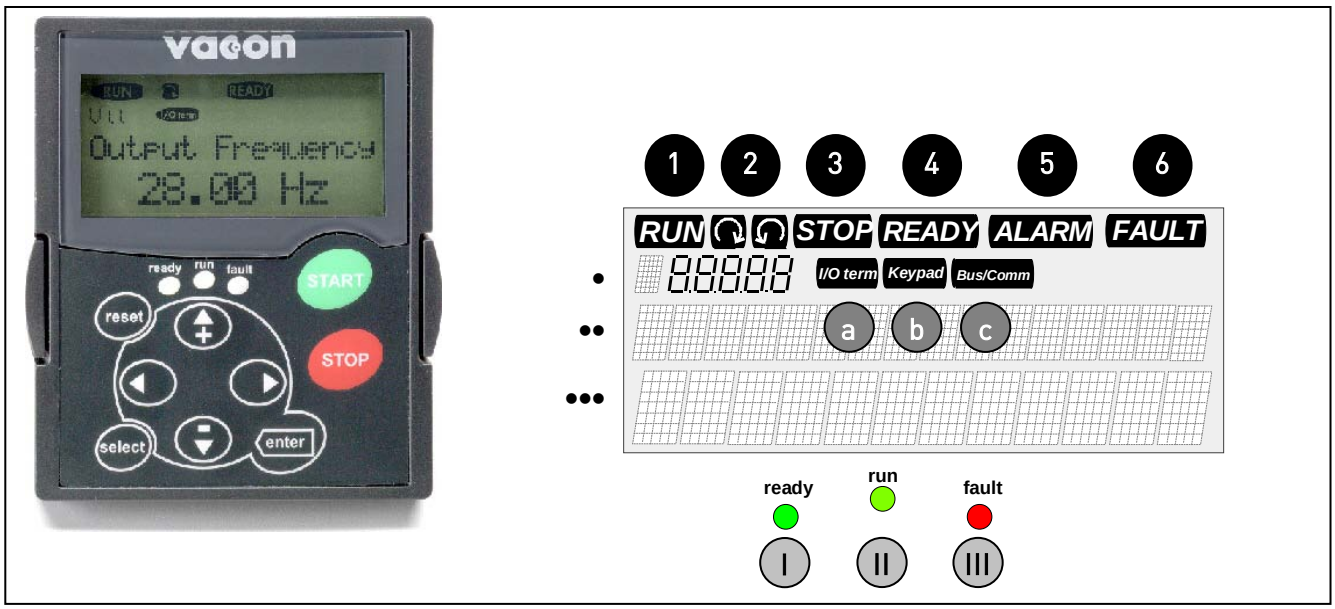
1. Check that the cables from the solar panels are correctly connected and that the DC connection switch is connected.
2. Ensure that the cables coming from the mains supply, including the earth cable, are correctly connected. Check that the main AC-circuit breaker and possible auxiliary circuit breakers are connected and closed.
3. Press the START button on the control panel.

Once these steps have been followed, the inverter will automatically start when the voltage of solar panels exceeds the minimum wake-up voltage, 340 V DC, provided that there is mains voltage.

The inverter starts up every day in the morning and automatically stops at night. Due to different atmospheric conditions, the inverter may start up and stop more than once each day.

6.1 Inverter control keypad

The inverter has a control panel that displays its different variables and conditions.



6.1.1 Indicators of the inverter condition

Inverter state informs the user about conditions of the inverter and whether the control software has detected any operating fault.

1 RUN = The inverter is running.

2 = Indicates the order of phases in the mains.

3 STOP = Indicates that the inverter is not running.

4 READY = Illuminated when DC level is OK. In case of a fault, the symbol will not light up. Also signifies a valid license or trial time.

5 ALARM = Indicates that the unit is running above a certain limit and issues an alarm.

6 FAULT = Indicates that there are unsafe running conditions and therefore the unit has stopped.

6.1.2 State leds

State LEDs light up according to state indicators READY, RUN and FAULT of the inverter. If all LEDs blink the drive is uncommissioned.

I ● = Lights up with DC voltage connected to the converter with no active failure. The state indicator READY also lights up simultaneously.

II ● = Lights up when the converter is running.

III ● = Blinks when there are unsafe running conditions and the unit has therefore stopped (fault trip). Simultaneously, the state indicator FAULT blinks in the display and shows a description of the fault; see chapter Active Faults.

6.1.3 Text lines

The three text lines (•,••,•••) provide the user with information about the current location within the menu structure of the panel, separate from information related to the operation of the unit.

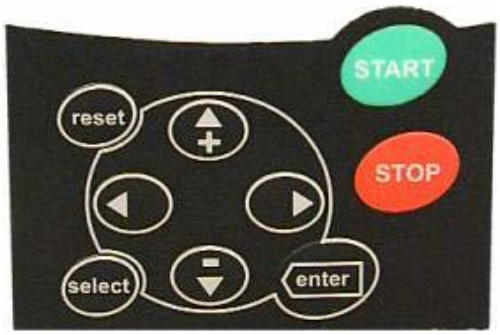
• = Indication of the place in the panel; it shows the menu symbol and number, parameter, etc.
Example: M1 = Menu 1 (Display); P1.3 = Generated power

•• = Description line; Shows the description of the menu, value or fault.

••• = Value line; it shows numeric values and reference texts, parameters, etc, as well as the number of submenus available for each menu.

6.1.4 Panel push buttons

The alphanumeric control panel of the inverter VACON 8000 SOLAR has 9 push buttons used to control the inverter and to monitor values.

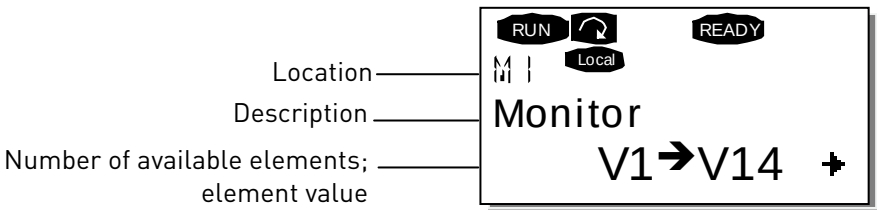


6.1.4.1 Description of push buttons

reset	=	This push button is used to reset active faults.
select	=	This push button is used to switch between the two last displays.
enter	=	The Enter push button serves to: Restore the fault history (2-3 seconds)
▲ +	=	Push button browser up Browse the main menu and the pages of different submenus.
- ▼	=	Push button browser down Browse the main menu and the pages of different submenus.
◄	=	Push button Menu left Return to the menu.
►	=	Push button Menu right Go forward in the menu.
start	=	To start the inverter
stop	=	To stop the inverter

6.1.5 Browsing the control panel

Data on the control panel is arranged in menus and submenus. Menus are used, for example, to display control signals and the measurements of reference values and faults shown

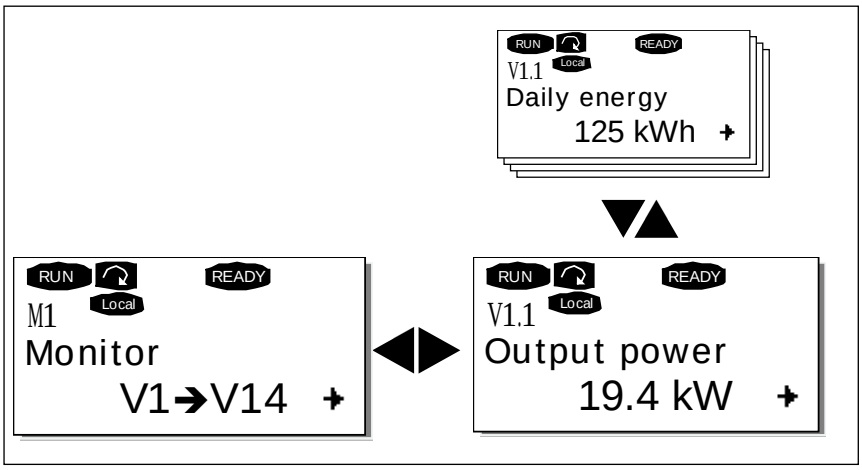


The first menu level has menus from M1 to M7 and it is called *Main menu*. The user can browse the main menu using the Browse push buttons up and down. The chosen submenu can be accessed from the main menu using the Menu push buttons. When there are pages under the menu or page shown, you will see an arrow (+) in the bottom right corner of the display and you will be able to access the following menu level by pressing the *Push button Menu right*.

6.1.5.1 Monitoring menu

To enter the Monitoring menu from the Main menu, press the Push button Menu right when the location indication **M1** appears in the first line of the screen. The following figure shows how to view the monitored values.
The monitored signals have the indication **V#.#** and are listed in the following table. Values are updated every 0.3 seconds.

This menu is used only to verify the signals. Values can not be modified.



Code	Parameter	Min	Max	Unit	ID	Description
V1.1	Output power	0	1000	kW	1707	Output power of inverter, with compensated LCL filter losses.
V1.2	Total energy kWh	0	4,29E+09	kWh	1837	Total energy of inverter fed into the grid.
V1.3	Energy today kWh	0	6553,5	kWh	1708	Energy fed into the grid today.
V1.4	Energy yesterday	0	6553,5	kWh	1733	Energy fed into the grid yesterday.
V1.5	DC voltage reference	50	150	%	1200	Used DC voltage reference by the regenerative unit in % of the nominal DC voltage.
V1.6	DC-link voltage	0	1000	V	1839	Filtered DC-link voltage in Volt.
V1.7	Unit temperature	-50	200	°C	1109	Temperature of the unit in Celsius
V1.8	AC voltage	0	1000	V	1709	AC voltage measured on the grid side of the main contactor by an external measurement circuit.
V1.9	AC frequency	-60	60	Hz	1835	Grid frequency in Hz. The sign indicates the phase order. Can be monitored only when UNIT is in RUN state.
V1.10	Output current	0	Varies	A	1834	Output current of the inverter coming out of the cabinet (transformers inside cabinet are taken into consideration).
V1.11	Run time total [h]	0	99999999	h	1836	Total time the inverter has been running.
V1.12	Run time today	0	255	h	1731	The time the inverter has been running today.
V1.13	Run time yesterday	0	255	h	1732	The time the inverter ran yesterday.
V1.14	Grid connections	0	4,29E+09		1706	Total number of times the inverter has closed the main contactor and connected to the grid.
V1.15	Standby remaining	0	65535	s	1201	Remaining time in standby mode, if standby mode is activated.

Table 6-1. Monitoring values

6.1.5.2 Active faults menu

The Active faults menu can be reached from *Main menu* pressing the *Menu right push button* when the location indication **M4** can be seen in the first line of the panel display.

When the frequency converter stops due to a fault, the location indication F1, the fault code, a short description of the fault and the symbol of the fault type appear on the display. Besides, the indication FAULT or ALARM will appear and, in case of FAULT, the red LED of the panel will start to blink. If there are several faults simultaneously, the list of active faults may be browsed using the push buttons in the browser

Fault codes are listed in chapter 7.2.
The memory of active faults can store a maximum of 10 faults in order of occurrence. You can delete the display using the *Reset push button* and the reading device will go back to the same state where you were before the fault trip. The fault is active until it is deleted with the *Reset push button.*

Normal state, no faults:

6.1.5.3 Fault history menu (M5)

The *Fault history menu* can be accessed from the *Main menu* pressing the *Menu right Push button* when the location indication **M5** is visible on the first line of the panel display.

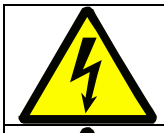
All faults are stored in the *Fault history menu,*which can be browsed with *Browser Push buttons*. You can go back to the previous menu at any time, pressing the *Menu left push button* .

The memory can store a maximum of 30 faults in order of appearance. The number of faults included in the fault history is shown in the value line of the main page (**H1→Hn°**). The order of faults is indicated through the place indication on the top left corner of the screen. The last fault is indicated by F5.1, the penultimate fault, F5.2, etc. If there are 30 faults not deleted in the memory, the next fault will delete the oldest one.

If you press the *Enter push button* for 2-3 seconds, the fault history will be restored. The number of the symbol **Hn°** will change to **0**.

7. MAINTENANCE AND TROUBLESHOOTING

7.1 Maintenance

	**Only a qualified electrician may carry out the maintenance work. There is risk of electric shock.**
	**No maintenance must be given unless the unit is reliably isolated from AC and DC power sources.**
	**Safety instructions included in chapter 1 must be followed.**

Maintaining the solar inverter VACON 8000 SOLAR is simple. It is recommended that the following checks are carried out at least once a year.

- ❑ Visually check the external condition of the inverter, checking mainly the good condition of the door and its locking elements.
- ❑ Visually check the internal condition of the inverter, checking mainly that wires are correctly located, wearing of isolation of wires, lack of hot points on checking the color of terminals and isolations. Check also for humidity and the correct fixing of the elements of the inverter.
- ❑ Check the tightness of connection screws on the terminals.
- ❑ Check that the fans operate correctly. Check if they need to be cleaned.
- ❑ Clean the ventilation grids.
- ❑ Check that the acoustic noise produced by the inverter has not increased.

If there is something wrong, please contact the installer.

7.2 Troubleshooting

The microprocessor for the Vacon solar inverter continuously monitors the running condition of the inverter and the elements connected to it.

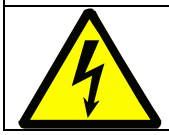
If the microprocessor finds any abnormal running values or that some of the elements do not work correctly, the device issues an alarm signal, if the malfunction does not imply any kind of a safety hazard for the inverter or the installation, and it issues a fault signal if there is any kind of a safety hazard for the inverter or the installation.

Every indication of fault or alarm is shown on the control panel described in chapter 6. In the control panel, the letter A (Alarm) or F (Fault) appears together with the order number of the Fault or Alarm, the fault or alarm code and a short description.

The fault can be reset using the reset push button on the control panel.

Below you can find the fault and alarm codes, their causes and how to solve them.

THE SOLUTION FOR SOME OF THE PROBLEMS INDICATED HERE IMPLIES TO PERFORM CHECKING INSIDE THE INVERTER, THE WIRES OF AC MAINS OR THE DC WIRES IN THE SOLAR PANELS. THESE CHECKS HAVE TO BE CARRIED OUT TAKING THE INSTRUCTIONS IN CHAPTER 1 INTO ACCOUNT.



REPAIR WORK SHOULD ONLY BE CARRIED OUT BY A QUALIFIED TECHNICIAN. THERE IS A RISK OF AN ELECTRIC SHOCK.

Fault code	Fault	Possible cause	Correcting measures
1	Overcurrent	- AFE has detected too high a current (>4*I_H) in the cables:	
2	Overvoltage	The DC-link voltage has exceeded the drive limit. See User manual. - high overvoltage spikes in supply	- Check input voltage
3	Earth fault	Current measurement has detected that the sum of phase currents is not zero. – insulation failure in cables	- Check cables.
4	Inverter fault		
5	Charging switch	The charging switch is open, when the START command has been given. – faulty operation – component failure	- Reset the fault and restart. - Should the fault re-occur, contact your local distributor.
7	Saturation trip	Various causes: – defective component	- Cannot be reset from the keypad. - Switch off power. - DO NOT RE-CONNECT POWER! - Contact your local distributor.

8	System fault	- component failure - faulty operation Note exceptional fault data record Subcode in **T.14:** S1 = Reserved S2 = Reserved S3 = Reserved S4 = Reserved S5 = Reserved S6 = Reserved S7 = Charging switch S8 = No power to driver card S9 = Power unit communication (TX) S10 = Power unit communication (Trip) S11 = Power unit comm. (Measurement)	Reset the fault and restart. Should the fault re-occur, contact your local distributor.
9	Undervoltage	DC-link voltage is under the drive fault voltage limit. See user manual. – most probable cause: too low a supply voltage – AFE internal fault – One of input fuse is broken.	- In case of temporary supply voltage break, reset the fault and restart the frequency converter. - Check the supply voltage. - If it is adequate, an internal failure has occurred. - Check input fuses - Check DC charge function
10	Input line supervision Line Sync Fail	Input line phase is missing. Subcode in T.14: S1 = Phase supervision diode supply S2 = Phase supervision active front end	Check supply voltage, fuses and cable.
11	Input phase supervision	Input line phase is missing.	Check supply voltage, fuses and cable.
13	Frequency converter undertemperature	Heatsink temperature is under –10°C	
14	Frequency converter overtemperature	Heatsink temperature is over 90°C Overtemperature warning is issued when the heatsink temperature exceeds 85°C.	- Check the correct amount and flow of cooling air. - Check the heatsink for dust. - Check the ambient temperature.
18	Unbalance (Warning only)	Unbalance between power modules in paralleled units. Subcode in T.14: S1 = Current unbalance S2 = DC-Voltage unbalance	Should the fault re-occur, contact your local distributor.
22	EEPROM checksum fault	Parameter save fault – faulty operation – component failure	Should the fault re-occur, contact your local distributor.
24	Counter fault	Values displayed on counters are incorrect	Have a critical attitude towards values shown on counters.
25	Microprocessor watchdog fault	– faulty operation – component failure	Reset the fault and restart. Should the fault re-occur, contact your local distributor. Please visit: http://www.vacon.com/wwcontacts.html
26	Start-up prevented	- Start-up of the drive has been prevented. - Run request is ON when new application is loaded to drive	- Cancel prevention of start-up if this can be done safely. - Remove Run Request.

29	Thermistor fault	The thermistor input of option board has detected too high temperature	Check thermistor connection (If thermistor input of the option board is not in use it has to be short circuited)
30	Safe disable	OPTAF board input have been opened	- Cancel Safe Disable if this can be done safely.
31	IGBT temperature (hardware)	IGBT Inverter Bridge overtemperature protection has detected too high a short term overload current	- Check loading.
32	Fan cooling	Cooling fan of the frequency converter does not start, when ON command is given	Contact your local distributor.
35	Application	Problem in application software	Contact your distributor. If you are application programmer check the application program.
36	Control unit	NXS Control Unit can not control NXP Power Unit and vice versa	Change control unit
37	Device changed (same type)	Option board or power unit changed. New device of same type and rating.	Reset. Device is ready for use. Old parameter settings will be used.
38	Device added (same type)	Option board added.	Reset. Device is ready for use. Old board settings will be used.
39	Device removed	Option board removed.	Reset. Device no longer available.
40	Device unknown	Unknown option board or drive. Subcode in T.14: S1 = Unknown device S2 = Power1 not same type as Power2	Contact the distributor near to you. Please visit: http://www.vacon.com/wwcontacts.html
41	IGBT temperature	IGBT Inverter Bridge overtemperature protection has detected too high a short term overload current	- Check loading.
44	Device changed (different type)	Option board or power unit changed. New device of different type or different rating than the previous one.	Reset Set the option board parameters again if option bard changed. Set converter parameters again if power unit changed.
45	Device added (different type)	Option board of different type added.	Reset Set the option board parameters again.
48	Parameter Fault	Parameter Fault	Check parameters value
49	Division by zero in application	Division by zero has occurred in application program	Contact your distributor if the fault reoccurs while the converter is in run state. If you are application programmer check the application program.
51	External Trip	Trip signal from digital input.	Remove fault situation from external device.
53	Fieldbus Board	A Fieldbus card in slot D or E has status "Faulted"	Check installation. If installation is correct contact the nearest Vacon distributor.
54	Slot Communication	A option board in slot B,C,D or E has status "Communication Lost"	Check board and slot. Contact the nearest Vacon distributor.
55	SB Board Fault	A systembus card in slot D or E has status "Faulted"	Check the System bus Board
59	SB Heartbeat	An inverter is activated as a slave inverter in array configuration without a heartbeat signal on the bus, Hence, no master inverter active.	Check the System bus

64	MCC Fault	Contactor acknowledgment is used through digital input and close command is given without response within the time set with parameter "MCont FaultDelay"	Check the main power switch of the Drive and Acknowledge input.
70	LCL Temperature	LCL Overtemp trip from digital input.	Check the LCL filter and signal connection. Check fan
72	AC VoltMax Trip	AC voltage on line side is above the max limit.	Check AC Voltage
73	AC VoltMin Trip	AC voltage on line side is below the min limit.	Check AC Voltage
74	FreqOverLimit	AC frequency on line side is above the max limit.	Check AC Frequency
75	FreqUnderLimit	AC frequency on line side is below the min limit.	Check AC Frequency
76	DC Ground Warning	DC Insulation measurement signal has gone above the warning limit.	Check DC Insulation
77	DC Ground Fault	DC Insulation measurement signal has gone above the fault limit.	Check DC Insulation
83	Surge Alarm	Surge alarm from digital input.	Remove fault situation from external device.
85	Fieldbus	Heartbeat signal from touchpad panel is missing while running in array configuration. Warning = inverter not active Fault = inverter active	Check touchpad panel. Check the control place
86	Input Switch	Input Switch in wrong state	Check the input Switch

Table 7-1. Fault codes

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