

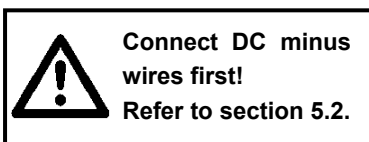


USER'S AND INSTALLATION MANUAL / GEBRUIKERS- EN INSTALLATIEHANDLEIDING  
BEDIENUNGS- UND INSTALLATIONSANLEITUNG / MANUEL UTILISATEURS ET D'INSTALLATION  
MANUAL DEL USUARIO Y DE INSTALACIÓN / MANUALE DI USO E MANUTENZIONE

# Sunmaster XL

## 10K/15K

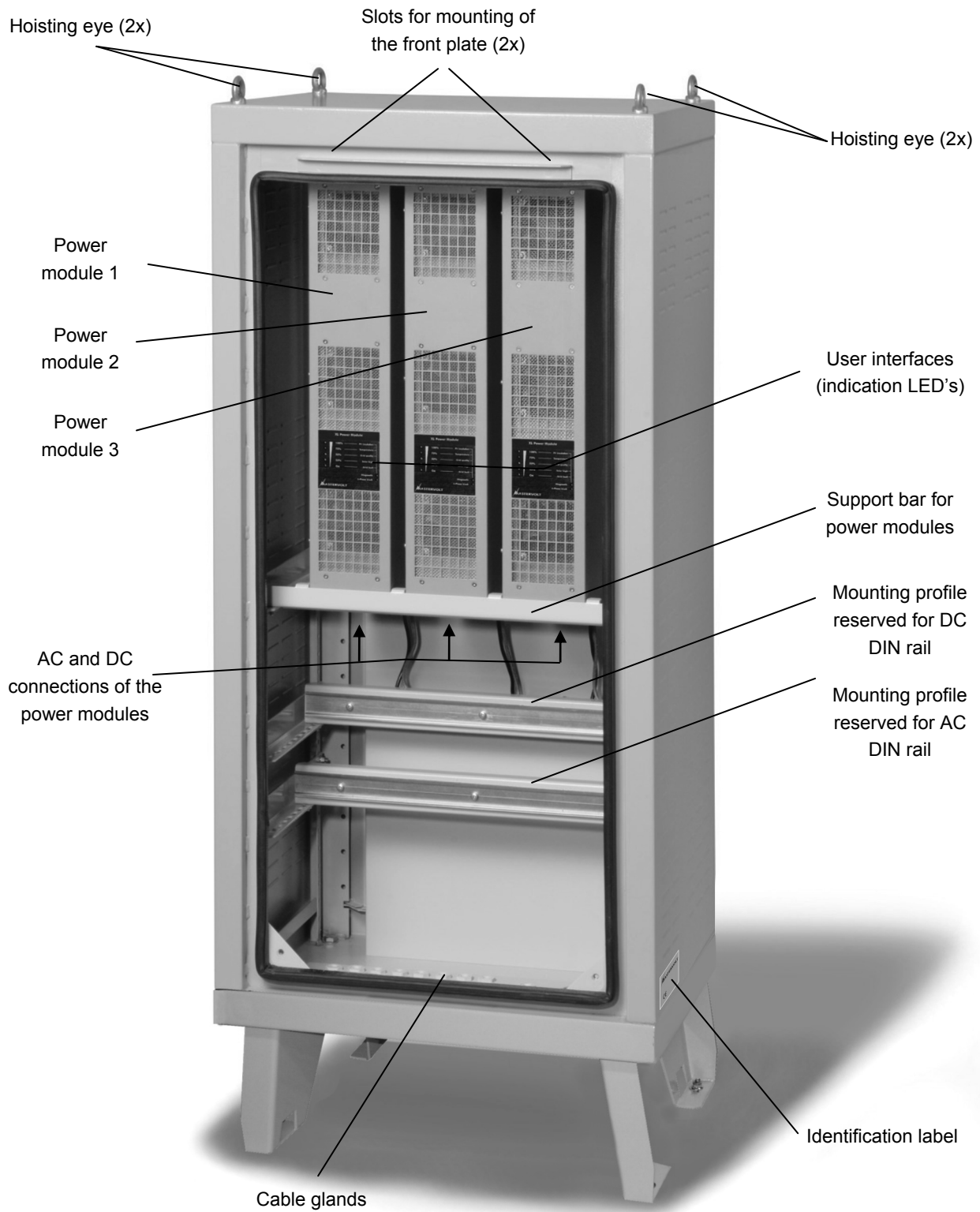
High power grid connected solar inverter



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## OVERVIEW SUNMASTER XL ENCLOSURE



Note: DIN rails and components for AC / DC distribution are not included with the standard delivery.

Figure 1: Inside view of the Sunmaster XL, including the power modules

**OVERVIEW POWER MODULE**

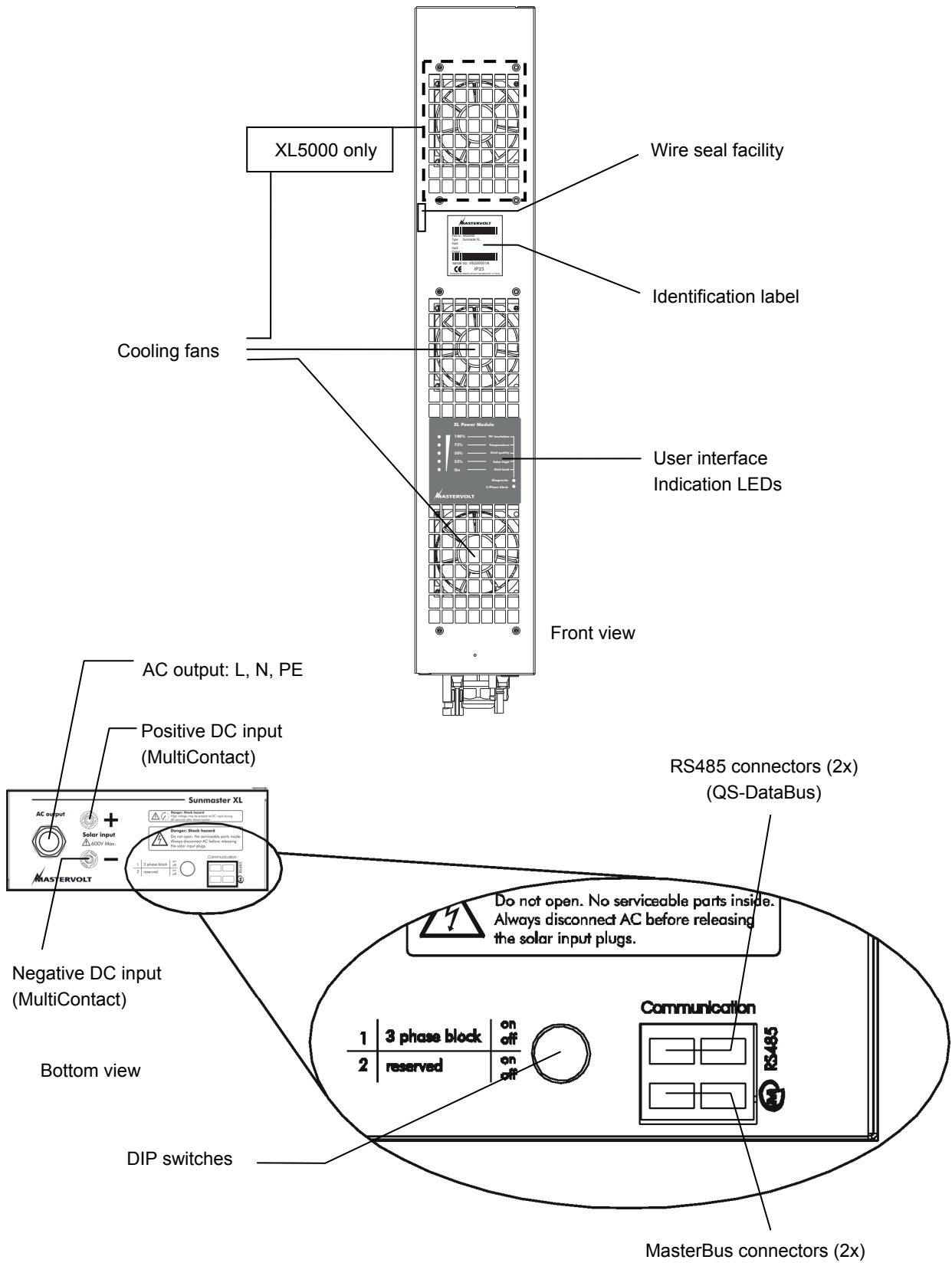


Figure 2: Front view and bottom view of the power module

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v 1.6 April 2008

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# 1 GENERAL INFORMATION

## 1.1 PRODUCT DESCRIPTION

Congratulations for choosing the Mastervolt Sunmaster XL 10K/ XL 15K, further referred to as “Sunmaster XL”. The Sunmaster XL is a grid connected solar inverter, used for the feed back into a three phase utility grid of power generated by photovoltaic modules.

Depending on the application and in order to meet the local applicable regulations, the Sunmaster XL can be ordered in several models. See section 4.3 for an overview of the available models.

The Sunmaster XL is not suitable for stand-alone use (i.e. use without public grid).

## 1.2 USE OF THIS MANUAL

This manual serves as a guideline for the safe and effective installation of the Sunmaster XL:

- For the electrician this manual gives directions for the installation, operation and commissioning.
- For the end-user this manual gives directions for the operation, maintenance and possible correction of minor malfunctions of the Sunmaster XL.
- Every person who works with the apparatus should be familiar with the contents of this manual, and must carefully follow the instructions contained herein.
- Store the manual in a user accessible place.

This English manual has 32 pages.

## 1.3 VALIDITY OF THIS MANUAL

All the specifications, provisions and instructions contained in this manual apply solely to the Mastervolt-delivered standard versions of the Sunmaster XL (refer to section 4.3).

## 1.4 GUARANTEE SPECIFICATIONS

Mastervolt assures the product guarantee of the Sunmaster XL during five years after your purchase, on the condition that all instructions and warnings given in this manual are taken into account during installation and operation.

Among other things, this means that installation is carried out by a qualified electrician, that installation and maintenance are executed according to the stated instructions and correct working sequence and that no changes or repairs may have been performed on the Sunmaster XL other than by Mastervolt.

The warranty is limited to the costs of repair and/or replacement of the product by Mastervolt only. Costs for installation labour or shipping of the defective parts are not covered by this warranty.

For making an appeal on warranty you can directly contact your supplier, stating your complaint, application, date of purchase and part number / serial number

## 1.5 LIABILITY

Mastervolt accepts no liability for:

- consequential damage due to use of the Sunmaster XL;
- possible errors in the manuals and the results thereof.

## 1.6 CHANGES TO THE SUNMASTER XL

Changes on the Sunmaster XL may be carried out only after the written permission of Mastervolt

## 1.7 IDENTIFICATION LABELS



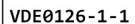

Type	<input type="checkbox"/> XL10K	<input type="checkbox"/> XL15K		
----- Three phase solar inverter -----				
Article no:	130501000 131110000	Enclosure Inverter	130501500 131115000	Enclosure Inverter
Input:	100 - 550Vdc 3 x 15A max.		100 - 600Vdc 3 x 30A max.	
Output:	230Vac 50Hz 3x15A max. 10.000W nom.		230Vac 50Hz 3x22A max. 15.000W nom.	
Serial no:	TN28C0123			
Power Module no:	#1	#2	#3	#
   				

Figure 3

See figures 1, 2 and 3 for location of the identification labels. Important technical information required for service, maintenance & secondary delivery of parts can be derived from the identification labels (figure 2).



A small serial number sticker is provided with each power module. Stick these on the reserved locations of the Sunmaster XL label. See figure 3, #1, #2 and #3.



### CAUTION!

Never remove the identification label(s).

## 2 SAFETY GUIDELINES AND WARNINGS

### 2.1 WARNINGS AND SYMBOLS

Safety instructions and warnings are marked in this manual by the following pictograms:



A procedure, circumstance, etc which deserves extra attention.



#### **CAUTION!**

Special information, commands and prohibitions in order to prevent damage.



#### **WARNING**

A WARNING refers to possible injury to the user or installer or significant material damage to the Sunmaster XL if the installer / user does not (carefully) follow the stated procedures.

### 2.2 USE FOR INTENDED PURPOSE

The Sunmaster XL is constructed as per the applicable safety-technical guidelines. Use the Sunmaster XL only in installations that meet the following qualifications:

- in permanent installations;
- connected to a separate, grounded three phase AC group, to which no other electrical equipment is connected;
- the electrical installation must meet the applicable regulations and standards, must be carried out correctly and must be in a good condition.
- according to the technical specifications as stated in chapter 8.1.



#### **WARNING**

Never use the Sunmaster XL in situations where there is danger of gas or dust explosion or potentially flammable products!

Use of the Sunmaster XL other than as mentioned under § 2.2 and 4.4 is not considered to be consistent with the

intended purpose. Mastervolt is not liable for any damage resulting from the above.

### 2.3 ORGANISATIONAL MEASURES

The installer / user must always:

- have access to this manual;
- be familiar with the contents of this manual. This applies particularly to Chapter 2, Safety Guidelines & Warning.

### 2.4 INSTALLATION, MAINTENANCE AND REPAIR

As lethal voltages exist, allow installation, maintenance and repair of the Sunmaster XL and changes in your electrical system to be carried out by qualified electricians only.

Connections and safety features must be executed according to the locally applicable regulations.

In case of decommissioning and/or demounting follow the instructions as stated in chapter 5.5.

If such are required, use only original spare parts.

### 2.5 WARNING OF SPECIAL DANGERS

- Not only AC-grid voltage, but DC voltages up to 600V may exist in the Sunmaster XL as well.
- The voltages present at the grid and solar side of the Sunmaster XL are not safe to touch and cannot be switched off at the solar side. Depending on local applicable regulations the use of an internal or external DC switch may be obligatory.
- Do not work on the Sunmaster XL and/or the electrical installation if it is still connected to the solar panels and/or AC-grid.
- Only allow changes in your electrical system to be carried out by qualified electricians.

### 3 HOW IT WORKS

The Sunmaster XL converts the energy from a PV array and feeds this energy back to the electric grid. The mechanical layout of the electrical components in the Sunmaster XL is of a modular concept and housed in an IP55 enclosure.

See figure 4. The Sunmaster XL consists of three identical power modules, indicated as “SOLAR 1”, “SOLAR 2” and “SOLAR 3”. These separate power modules have their own individual system control, monitoring and protection. Each power module can convert up to 3.5 or 5 kW, depending on the model. This means that the Sunmaster XL can convert up to 10 or 15kW. The DC voltage range of the power modules is 100-550V DC (XL3301) or 100-600V DC (XL5000).

The AC-outputs are connected in a 230 V AC three-phase star configuration. Islanding protection is provided according to national standards. If one of the phases of the AC-grid fails in operation, all power modules will switch off immediately. A communication cable must be used for communication between the power modules.

Extended diagnostics and remote monitoring may be ordered as an option.

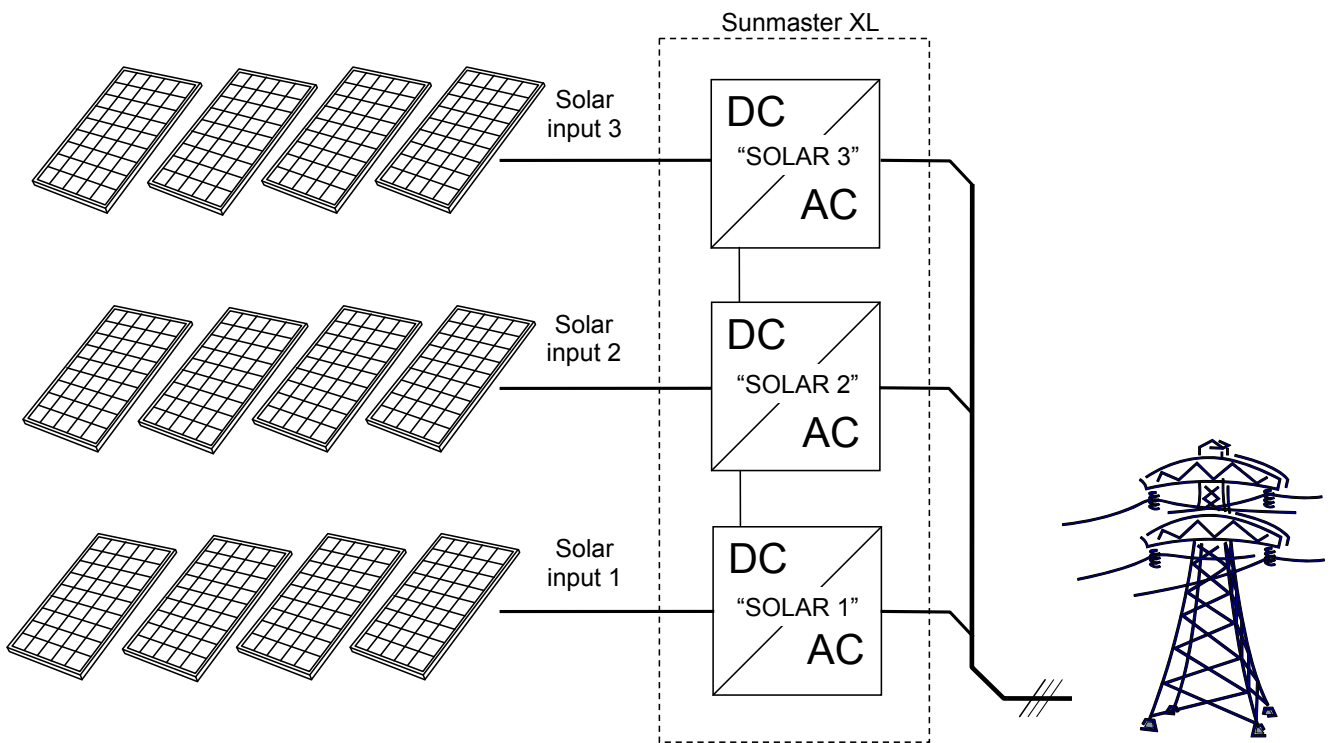


Figure 4: principle operation of the Sunmaster XL



## 4 BEFORE YOU START

### 4.1 TRANSPORT, LIFTING AND STORAGE

Ensure adequate and secure mounting during transportation of the Sunmaster XL. Always use suitable handling equipment for transportation. On top of the enclosure are four hoist eyes which can be used for lifting and transportation (see figure 1). To avoid damage, use slings for lifting.



When lifting the Sunmaster XL avoid any risk of personal injuries, do not stand under the Sunmaster XL.

### 4.2 UNPACKING

The delivery of the Sunmaster XL consists of:

- 1 Sunmaster XL enclosure
- 3 XL power modules with AC wiring attached
- 6 multicontact DC cables
- 1 cable gland + 2 caps PG21
- 14 cable glands + 12 caps PG9
- 2 MasterBus communication cables
- 2 MasterBus terminating devices
- This user's and installation manual.

After unpacking, check the contents for possible damage. Do not use the product if is damaged. If in doubt, contact your supplier.

As one electrical installation differs from the other, the Sunmaster XL is delivered without fuses, circuit breakers, terminal blocks, mains switches and DC-switches

### 4.3 APPARATUS VERSION

The Sunmaster XL is equipped with an anti-islanding device that ensures the switch off in case of grid failure. European countries maintain different regulations with regard to anti-islanding devices and grid connection of distributed generation in general. The common islanding device switches off the inverter if the grid voltage or frequency is out of range. In some countries like Germany the ENS device (VDE-V-0126-1-1 compliant) which also measures the grid impedance, is compulsory.

Mastervolt provides both versions of the Sunmaster XL. These versions are available as several alternatives, suited to national regulations.

Check from the part number on the type number plate whether the Sunmaster XL is appropriate to be used for the intended application (refer to table 1).



#### CAUTION!

NEVER connect the Sunmaster XL to a utility grid other than specified (refer to table 1).

Part number	Description	Part number	Allowed to be used in:
Sunmaster XL		Power module	
131110000*	Sunmaster XL 10 kW	131103300*/ 131103301*	- see section 4.8 -
131110030	Sunmaster XL 10 kW – ENS	131103330/ 131103331	Germany, Belgium, France, Greece, Austria
131110040	Sunmaster XL 10 kW – KOR	131103340/ 131103341	South Korea
131110050	Sunmaster XL 10 kW – ESP	131103350/ 131103351	Spain
131110060	Sunmaster XL 10 kW – GBR	131103360/ 131103361	Great Britain
131110070	Sunmaster XL 10 kW – ITA	131103370/ 131103371	Italy
131110080	Sunmaster XL 10 kW –GRC	131103380/ 131103381	Greece
131115000*	Sunmaster XL 15 kW	131105000*	- see section 4.8 -
131115030	Sunmaster XL 15 kW – ENS	131105030	Germany, Belgium, France, Greece, Austria
131115040	Sunmaster XL 15 kW – KOR	131105040	South Korea
131115050	Sunmaster XL 15 kW – ESP	131105050	Spain
131115060	Sunmaster XL 15 kW – GBR	131105060	Great Britain
131115070	Sunmaster XL 15 kW – ITA	131105070	Italy
131115080	Sunmaster XL 15 kW –GRC	131105080	Greece

\* These models must be configured at first installation. See Appendix for configuration instructions.

Table 1

#### 4.4 INSTALLATION ENVIRONMENT

Obeys the following stipulations during installation:

- The Sunmaster XL is designed for both indoor and outdoor use, according to safety class IP55.
- The Sunmaster XL must be mounted in vicinity of the solar panels.
- Do not install the Sunmaster XL in dusty environments
- Ambient temperature: -20 ... 60°C; (power derating above 45°C).
- Keep at least 50 cm space at the front side and back side of the Sunmaster XL and 30 cm between the XL enclosures, see figure 5.
- If the Sunmaster XL is installed in the immediate vicinity of living areas, take into account that the Sunmaster XL can produce a certain noise level when operating (refer to section 6.3).
- The Sunmaster XL must be mounted vertically on a solid floor.
- The wiring is connected inside the enclosure. Always feed the wiring through the cable glands of the enclosure, and then connect the wiring to the terminals. Close unused holes with the caps supplied.

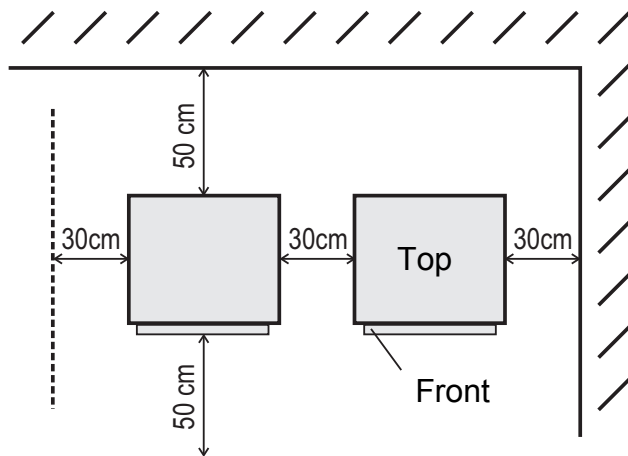


Figure 5

#### 4.5 OPENING AND CLOSING THE ENCLOSURE



##### CAUTION!

Make sure that you do not disconnect nor damage the green/yellow ground connection cable which is attached to the inner side of the front plate.

For opening of the enclosure execute the steps below:

- Loosen the two hexagonal bolts at the lower side of the front plate (see figure 6).
- Lift the front plate from the enclosure (see figure 7).
- Disconnect the earth cable that is fixed to the front plate.



Figure 6

Proceed as follows to close the enclosure:

- Hang the front plate in the two slots at the top of the front side (see figure 1).
- Fix the earth cable to the front plate again.
- Fix the two hexagonal bolts at the lower side of the front plate (see figure 6).



Figure 7

## 4.6 PLACING THE POWER MODULES

- Remove the support bar (figure 8) by unscrewing the two bolts.
- Place the power modules into the enclosure, facing the wiring and the connectors downwards. Hold the top front edge between the tongues of the top support bar and turn the power module into position (see figure 9). Avoid damaging the MultiContact connectors of the power modules!
- Fix the support bar (figure 8) by fastening the two bolts again. Make sure that all power modules are securely fixed in place by the support bar.

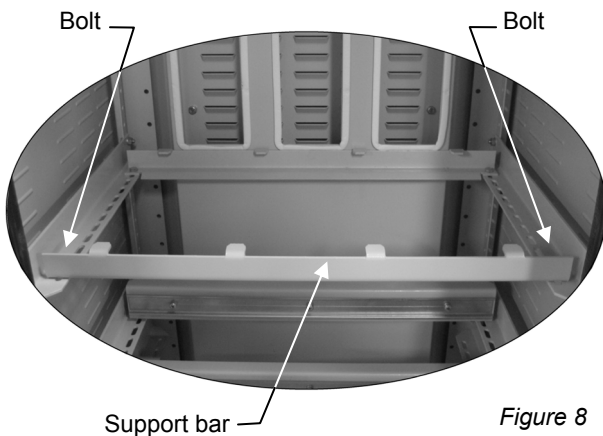


Figure 8



Figure 9

## 4.7 GROUNDING AND SURGE PROTECTION

### 4.7.1 General

The enclosure of the Sunmaster XL must be connected to protective earth (PE) by means of an equipment-grounding conductor. For this purpose a grounding terminal is situated at the lower right corner inside of the enclosure (see figure 10). The power modules PE cable must be grounded according to figure 12, section 4.8.3.

Grounding of the solar array is not obligatory thanks to the galvanic isolation between the DC-input and the AC output of the Sunmaster XL. However, if you want to make a connection between the solar array structure and the ground, you need to lead the grounding cable together with the DC-cables to the Sunmaster XL and then to the AC distribution. Connect the grounding cable going from the PV-modules to the AC-distribution and the grounding terminal of the Sunmaster XL.

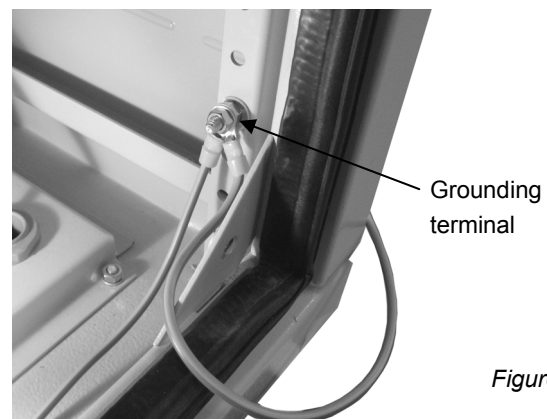


Figure 10

### 4.7.2 Optional DC grounding

Grounding of the positive or negative DC wiring is possible. The insulation protection function should be disabled. Refer to the Mastervolt M 2397 "Array grounding technical bulletin" for background information and instructions.

### 4.7.3 Lightning protection

Due to large distances between the components of a solar installation, precautions must be taken to avoid damage from induced surges caused by lightning. Although the power modules are designed to withstand overvoltages, Mastervolt recommends to consult a specialist on lightning protection systems for advice.

## 4.8 THREE PHASE AC CONFIGURATION

### 4.8.1 Phase balance protection circuit

Depending on local regulations, all power modules must switch off immediately as soon as one of the phases of the AC-grid fails in operation. To achieve this, communication between the power modules is necessary. This is done by means of communication cables.

Take the following steps to configure the power modules for three phase operation:

- Connect the MasterBus communication cables and the MasterBus terminating devices as indicated in figure 10. The MasterBus communication ports can be found at the bottom side of the power modules (figure 2).



Make sure that you neither connect the MasterBus communication cables nor the MasterBus terminating devices to the RS485 communication ports (see figure 10)!

- The default setting of DIP switch 1 (3-phase block) is ON. Do NOT change the setting of the DIP switches (see figure 2).

### 4.8.2 Monitoring wiring RS485

For correct monitoring the three power modules have to be connected serially, using RS485 cables. These are to be inserted into the Communication ports, see figure 11.

### 4.8.3 AC Wiring is intended for use

The Sunmaster XL is intended for use in a permanent installation, connected to a separate three phase AC distribution group, to which no other electrical equipment is connected.

All electrical connections must comply with local codes and regulations.

The AC-outputs of the three power modules must be arranged in a 230 V AC three-phase star configuration. The cabling between the junction box or electric cable duct and the Sunmaster XL must be double insulated. Use an appropriate cross section, so that the cable loss is well below 1%.

Recommended cross sections for 10m cable length:

Model	Minimum cross section:
Sunmaster XL 10kW	2,5mm <sup>2</sup>
Sunmaster XL 15kW	4,0mm <sup>2</sup>



See figure 12 for a typical three phase AC configuration.

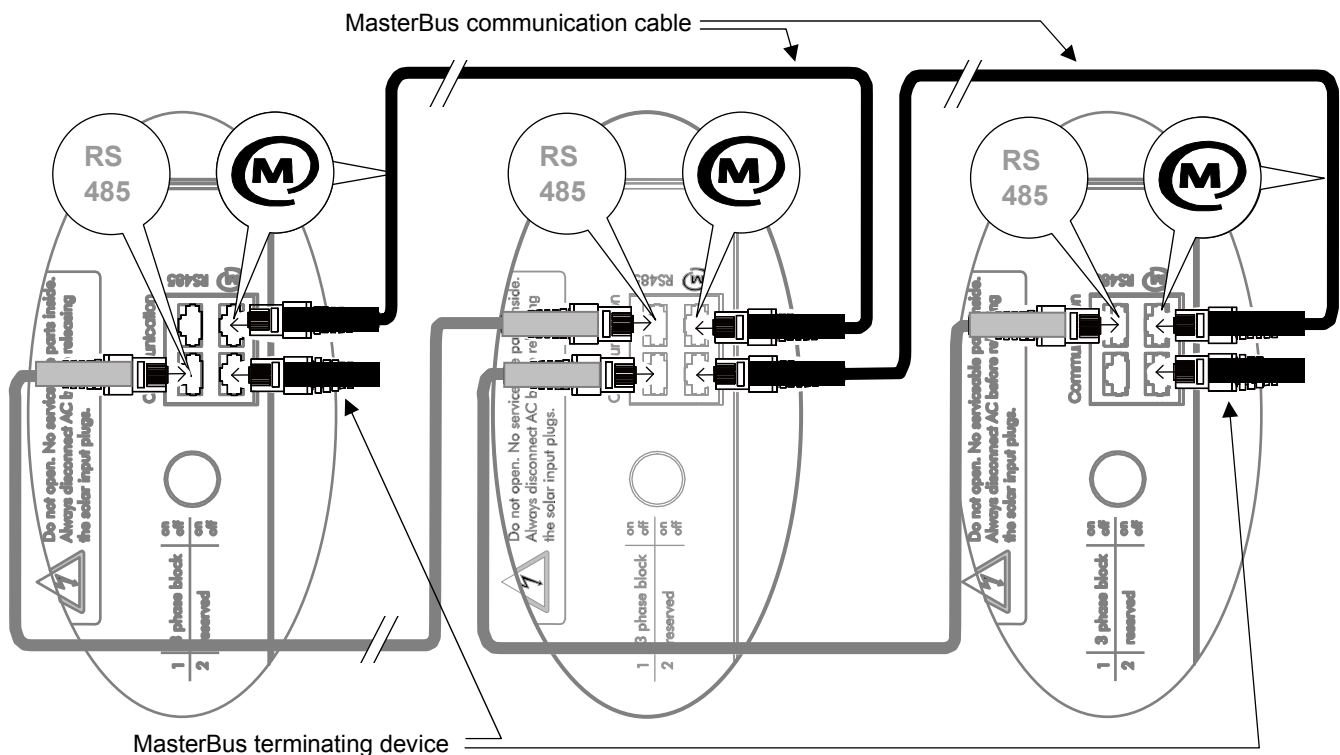
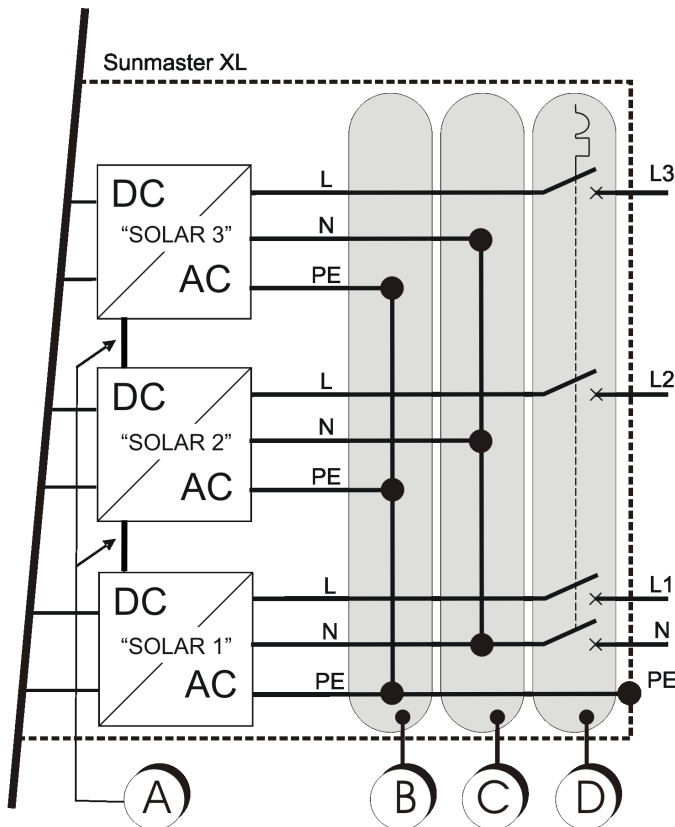


Figure 11: Communication ports of the Sunmaster XL



- A.: MasterBus communication cable (see section 4.8.2)
  - B PE terminal block
  - C: N terminal block
  - D: Three phase circuit breaker
- Recommended rating:
- |                    |     |
|--------------------|-----|
| Sunmaster XL 10kW: | 25A |
| Sunmaster XL 15kW: | 32A |

Figure 12: AC wiring

**4.9 DC CONNECTIONS**

**4.9.1 General**

The solar or DC side of the system consists of several photovoltaic (solar) modules, further referred to as “PV modules”. The PV-modules are connected in series to form a so called “string”. These strings consist of a plus (+) and a minus (-) connection which can be connected directly to the Sunmaster XL.

The string voltage should be equal to the open circuit voltage (Voc) per PV module (refer to the specifications of the PV-module), multiplied by the number of PV-modules in each string. Depending on the solar irradiation and temperature, this value should be equal to 70-95% of the calculated string voltage.

The Sunmaster XL consists of three separate inverters, indicated as “SOLAR 1”, “SOLAR 2” and “SOLAR 3”. Refer to figure 13.

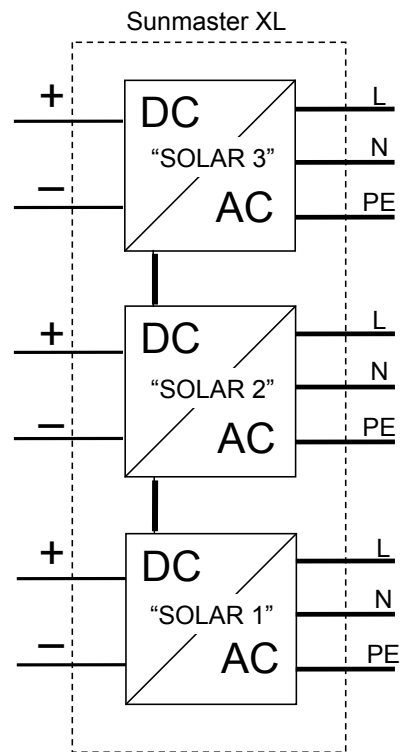


Figure 13

#### 4.9.2 Specifications of the PV-installation

The PV-installation should meet the following specifications:

- The maximum open circuit string voltage for each power module at lowest possible temperature of the PV modules may not exceed 550V (XL3301) or 600V (XL5000).
- Double isolated PV-wiring, fitted with MultiContact connectors must be used.
- The maximum power connected to each power module may not exceed 4600Wp (XL3301) or 6700Wp (XL5000).
- The total input power must be distributed equally over the three power modules as much as possible.
- All connection devices (wiring, terminal blocks, fuse holders, fuses, switches, etcetera) must be suitable for the applicable voltage (up to 600V DC) and current ratings (up to 30A DC) of the solar installation.



#### CAUTION!

Do not install the Sunmaster XL if the solar-system does not comply with the above mentioned stipulations.



See section 4.10 for examples of typical PV-installations.

#### 4.9.3 DC Switch

Depending on local applicable regulations the use of a DC switch between the PV modules and the power modules may be mandatory. For example international standard IEC60364-7-712 prescribes a DC switch in solar electric installations in buildings.

#### 4.10 TYPICAL PV-INSTALLATIONS

##### 4.10.1 Connection of six strings

See figure 14.

If two strings are connected to the same power module, DIN-rail mounted terminal blocks must be applied to combine the strings. The strings connected to the same power module should exist of an equal number of identical PV-modules.



Note that the maximum power connected to each power module may not exceed 4600Wp (XL3301) or 6700Wp (XL5000) and that the total input power must be distributed equally over the three power modules as much as possible.

To avoid damage to the power module in case of miswiring, a common coupling negative OR positive pole is recommended.

Connections to be made by means of DC DIN-rail mounted terminal blocks

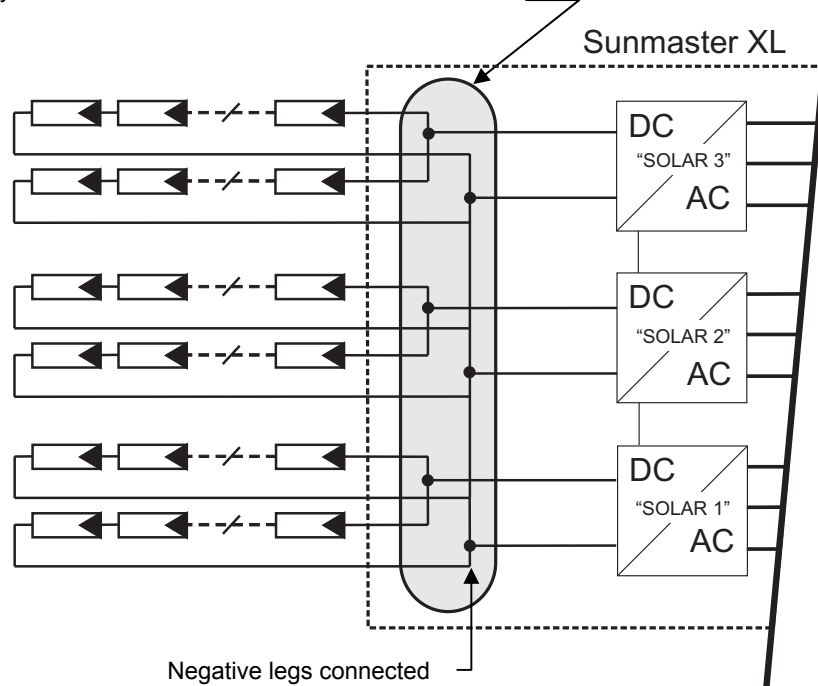


Figure 14: Connection of six strings

## 4.10.2 Connection of more than six strings

See figure 15.

If more than two strings are connected to the same Solar-input, string fuses must be integrated in both the positive and negative legs of the string cabling. Fuse ratings should be chosen 50 % higher than the MPP current of the PV modules used. DIN-rail mounted terminals blocks and/or fuse holders can be applied to combine the strings. The strings connected to the same Solar-input should exist

of an equal number of identical PV-modules. Note that the maximum power connected to each Solar-input may not exceed 6700Wp (XL5000) or 4600 Wp (XL3300) and that the total input power must be distributed equally over the three Solar-inputs as much as possible. To avoid damage to the power module in case of miswiring, a common coupling negative OR positive pole is recommended.

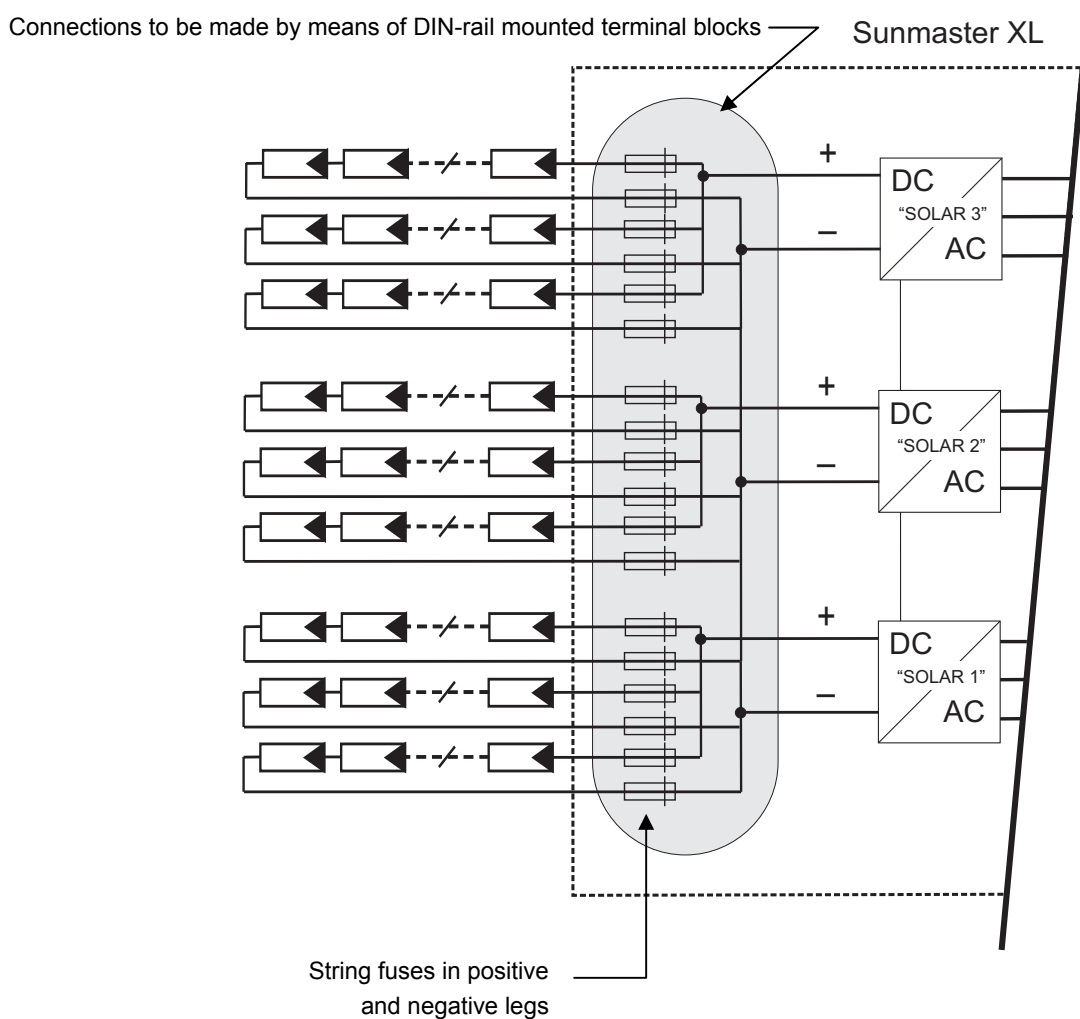


Figure 15: Connection of more than six strings

## 4.11 REMOTE MONITORING

Each power module is provided with two RS485 connectors for connection of the QS Databus.

See figure 2.

Mastervolt provides several monitoring solutions like PC software, dataloggers, remote monitoring and so on.

Consult our web-site at [www.mastervolt.com](http://www.mastervolt.com) for a comprehensive overview of all possibilities.



Make sure that you do not mistake the QS Databus for the MasterBus communication ports (see figure 2)!

## 5 INSTALLATION AND COMMISSIONING



### CAUTION!

Read chapters 2 and 4 prior to installation.



### WARNING

Be sure that all wiring is disconnected from any power source during the entire installation.



### CAUTION!

- Short circuiting, miswiring or reverse polarity may lead to damage to the Sunmaster XL, the cabling and/or the terminal connections.
- Follow all steps of the installation instructions in order of succession as described.
- If applied, both the DC switches and the AC circuit breaker(s) should stay in the OFF-position (or "O"-position) during the entire installation.

### 5.1 THINGS YOU NEED FOR INSTALLATION

Make sure you have all the parts you need to install the Sunmaster XL:

- Sunmaster XL enclosure (included)
- Three power modules (included)
- Cable glands and grommets (included)
- 2 MasterBus communication cables (included)
- 2 MasterBus terminating devices (included)
- Bolts and dowels to fix the Sunmaster XL enclosure to the ground. Use mounting materials that are suitable for the application
- 2 DIN-rails (50cm) for mounting of breakers, fuse holders, switches, terminal blocks
- DIN-rail mounted terminal blocks to connect the DC-wiring
- DIN-rail mounted DC-switches to switch off the solar strings (if applicable; see section 4.9.3)
- DIN-rail mounted fuse holders and fuses for the connection of the solar strings (if applicable; see section 4.10.2)
- DIN-rail mounted terminal blocks, to configure the AC outputs of the power modules for three phase grid connection
- Three phase AC circuit breaker, see section 4.8
- Wiring

Required tools:

- Tools to fix Sunmaster XL enclosure to the floor
- Hexagon socket wrench (5mm) to open and close the enclosure of the Sunmaster XL
- Socket wrench 10 mm to remove and fix the support bar (see section 4.6)
- Tools to install the wiring.

### 5.2 INSTALLATION STEP BY STEP

- 1 Fix the enclosure of the Sunmaster XL to the floor. Determine the mounting spots on the basis of figure 19. Use suitable screws and dowels.
- 2 Open the enclosure of the Sunmaster XL (see section 4.5).
- 3 Connect system grounding (section 4.7).
- 4 Place the power modules in the enclosure (see section 4.6).
- 5 Configure the power modules for three phase operation (see section 4.8.1 and 4.8.2).
- 6 Connect the AC-wiring (see section 4.8.3).
- 7 Then proceed with the DC Solar wiring (see section 4.10).
- 8 Option: connect the QS Databus to the RS485 connectors of the power modules (see section 4.11).



### WARNINGS

To avoid damage to the power module in case of miswiring, connect all minus wires first.

High voltages (up to 600 VDC) may exist on the PV-strings! Connection of the DC-cabling may only be carried out if the DC-cables are voltage free. Therefore the PV-modules must be disconnected from the DC-cabling (for instance by disconnecting the MultiContact connectors at the PV-modules).



## 5.3 INSTRUCTIONS FOR USE IN ITALY



In Italy ENEL may require sealing parts of the AC wiring.

All power modules are equipped with a wire seal facility. Figure 2 shows where this is located. A detailed view is shown in figure 16.

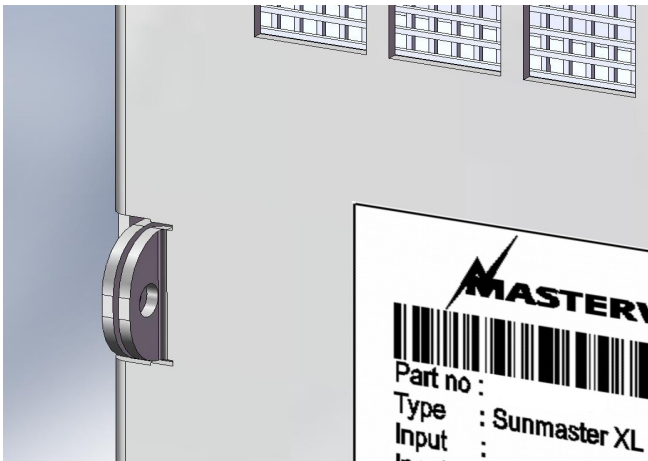


Figure 16: Detailed view of wire seal facility

## 5.4 COMMISSIONING AFTER INSTALLATION



To check the correct operation of the Sunmaster XL, commissioning should be carried out during daytime only.

### 5.4.1 Switching on

Follow the steps described below to switch on the Sunmaster XL:

- 1 Check whether the DC switches (if applied) and the AC circuit breaker(s) are still in the OFF position.
- 2 Move the DC-switch (if applied) of the solar array to the ON position.
- 3 Check the part number on the power module identification label (see section 1.7). If the part number ends with 01 or 00 (e.g. 131103301 or 131115000) the Sunmaster XL must be configured in accordance with the local regulations for grid connection first. Refer to the APPENDIX.



As long as the Sunmaster XL is not configured in accordance with the local

regulations for grid connection, the power modules will stay in idle mode. This means that no power can be converted.

- 4 Switch on the AC grid.
- 5 Check the AC voltage at the grid side of the AC circuit breaker using a suitable AC voltmeter. The voltages should be as follows:

AC Voltage:		
L1	N	230V AC (184-276V)
L2	N	230V AC (184-276V)
L3	N	230V AC (184-276V)
L1	L2	400V AC (320-475V)
L2	L3	400V AC (320-475V)
L3	L1	400V AC (320-475V)

- 6 If the AC voltages are correct, move the AC circuit breaker to the ON position.

If connection has been made correctly and solar irradiation is sufficient, the Sunmaster XL will switch on automatically. This may take a few seconds.

- 7 Close the enclosure of the Sunmaster XL (see section 4.5).

## 5.5 DE-COMMISSIONING

If it is necessary to put the Sunmaster XL out of operation, follow the instructions in order of succession as described below:



### CAUTION!

Follow below mentioned instructions in order of succession as described.

- 1 Cut off the grid voltage by switching off AC distribution switch in the meter cupboard.
- 2 Move the AC circuit breaker to the OFF position.
- 3 If such is applied, move the DC switch to the OFF-position.
- 4 Check with a suitable voltage meter whether the inputs and the outputs of Sunmaster XL are voltage free.
- 5 Disconnect the MultiContact connectors from the Sunmaster XL.
- 6 Disconnect the AC wiring.

Now the Sunmaster XL can be demounted in a safe way.

## 6 OPERATION

### 6.1 GENERAL

After installation and commissioning the Sunmaster XL will switch on automatically if solar irradiation is sufficient. The Sunmaster XL operates automatically: there is no need for operating it. If the irradiation of the PV-modules is insufficient, for instance at night, the Sunmaster XL switches off automatically. When switched off, none of the LED indications on front of the power modules will illuminate.

The Sunmaster XL has no ON/OFF switch; In the event of decommissioning, refer to section 5.5.



#### CAUTION!

Never disconnect the MultiContact plugs during operation of the Sunmaster XL. Not complying with this instruction may cause a spark or an electric arc. Should an arc develop, both plug and socket of the Sunmaster XL must be replaced.

### 6.2 USER INTERFACE

The operation of the Sunmaster XL is displayed by means of LED indicators at the front side of each power module (figure 17).

#### 6.2.1 Normal operation

If the module is operating normally (the yellow and the red indicator are not illuminated or flashing), the green LED-indicators show the amount of power that is fed into the grid: the more LED's illuminate, the more power is converted.



As long as the red and yellow LED's are not illuminated, no failure is detected: the Sunmaster XL is operating normally!



If the irradiation of the PV-modules is insufficient, for instance at night, the LED indicators will switch off automatically. This is a normal situation!

#### Power conversion (Wac)

Sunmaster XL 10kW	Sunmaster XL 15kW
2870–3465	4350–5250
2050–2870	3100–4350
1220–2050	1850–3100
400–1220	600–1850
0–400	0–600

The inverter is starting up.  
This can take up to 300 sec.

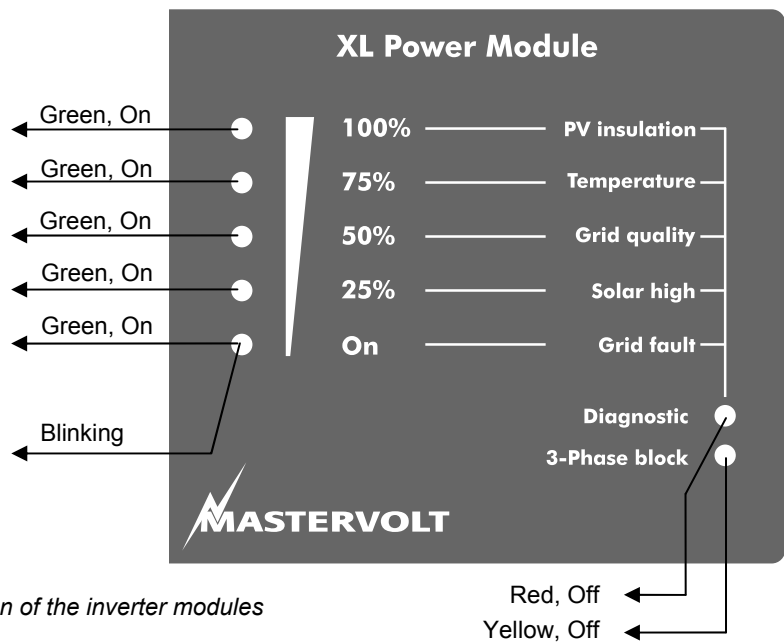


Figure 17 LED illumination during normal operation of the inverter modules

**6.2.2 Failures**

If one or more of the phases of the AC-grid fails in operation the yellow “3 phase block” LED will illuminate on all power modules. See also section 4.8.1

In case of a hardware failure on one of the power modules, the red “diagnostic” LED illuminates or flashes in combination with one or more green LEDs.

Refer to chapter 7 for an explanation of the power- and failure indications. Consult an installer, if you cannot solve the problem by means of this table.

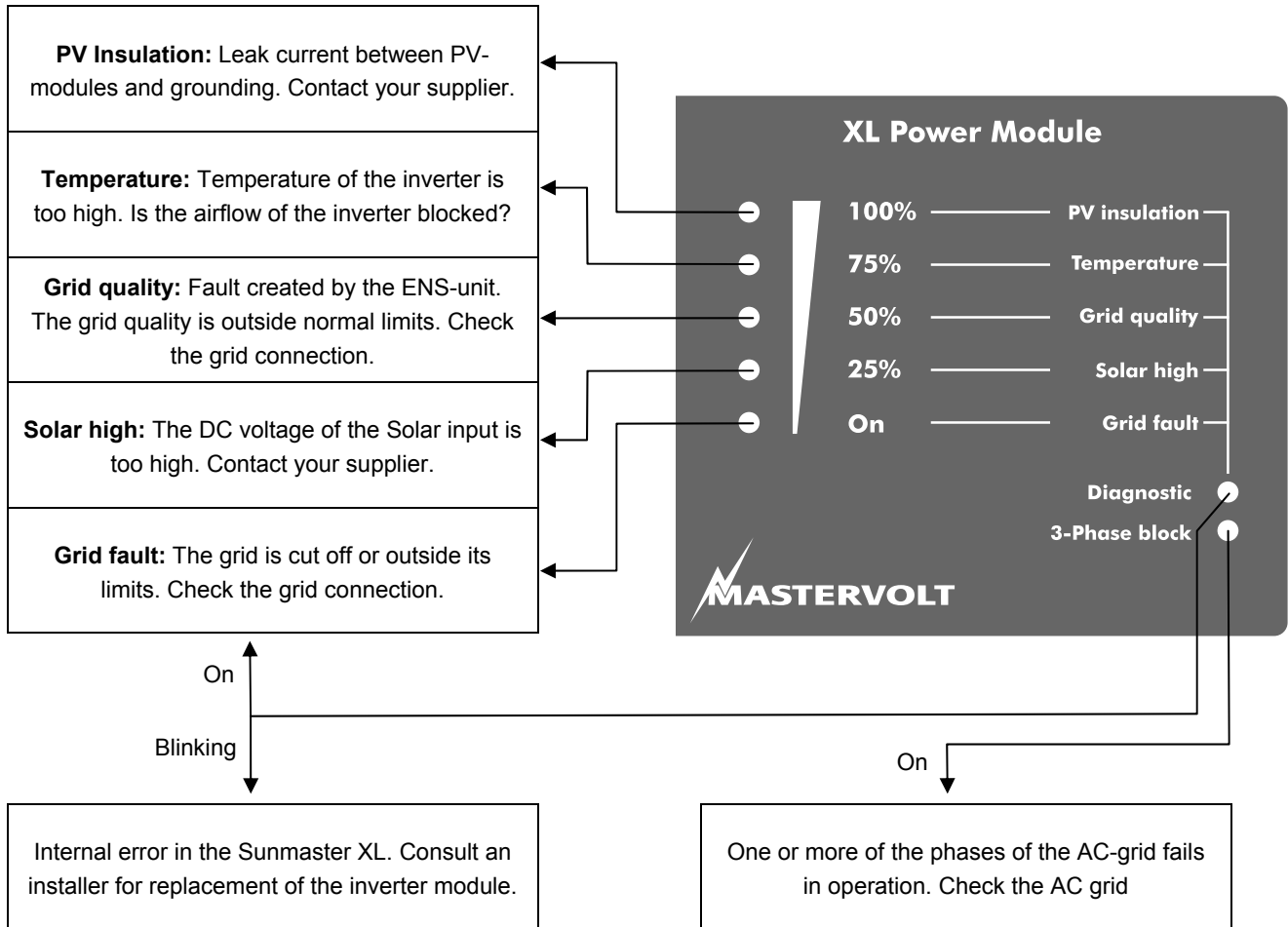


Figure 18: LED illumination in case of a failure

### 6.3 FORCED COOLING

For an optimum internal temperature control each inverter module is provided with three cooling fans. At low power the cooling fans start running slowly. If the power increases, the cooling fans will run at a higher speed. This is a normal effect which has a positive influence on the efficiency and lifetime of the Sunmaster XL.

### 6.4 MAINTENANCE

If necessary, use a soft clean cloth to clean enclosure of the Sunmaster XL. Never use any liquids, acids and/or scourers.

#### 6.4.1 Air filter

The Sunmaster XL is standard supplied with an air filter which is placed at backside of the front plate (figure 18). Filter maintenance depends on environmental contamination. Check the air filter at least every 6 months. See section 4.5 to open the housing of the Sunmaster XL. Clean or replace if necessary. See section 9 for ordering information.

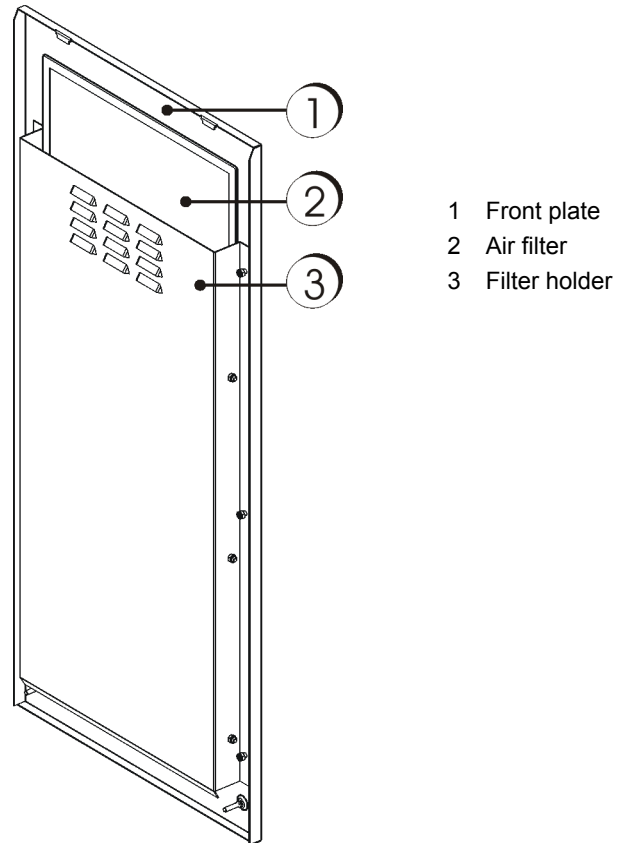


Figure 19: Air filter

#### 6.4.2 Electrical connections

Examine your electrical installation on a regular base, at least once a year. Defects such as loose connections, burnt wiring etc. must be corrected immediately.

## 7 TROUBLE SHOOTING

Consult an installer, if you cannot solve the problem by means of the table below.

Problem	Possible cause	What to do?
All LED indicators are off.	Insufficient irradiation.	Nothing. Irradiation of the PV modules is insufficient (for instance during night time).
	DC-switch (if applied) in OFF position.	Move DC-switch to the ON position.
	DC fuse (if applied) defect.	Check string fuses.
	No power from the PV modules.	Check DC voltage. It should be 220-600V (XL10K) or 180-600V (XL15K). Consult an installer if the display does not show any information during daytime.
LED "3 phase block" at one or more power modules is illuminated yellow.	Sunmaster XL is not configured in accordance with the local regulations for grid connection.	See Appendix to configure the power modules.
	One or more of the phases of the AC-grid fails in operation.	Check the AC grid voltages.
	One of the MasterBus communication cables is loose	Check MasterBus communication cables.
	MasterBus communication cables connected to the RS485 port(s)	MasterBus communication cables must be connected to the MasterBus ports. See section 4.8.1
	No terminating device placed at the ends of the MasterBus network	See section 4.8.1
LED "Diagnostic" constantly illuminated red and LED "on" blinking slowly green.	Start-up	Nothing. After the Sunmaster XL was (re)connected to the AC grid, it checks the quality of the AC grid before it starts operating normally. This may take up to 5 minutes.
Red LED "Diagnostic" at one or more power modules is illuminated red.	Installation fault or grid fault	See section 6.2.2
Red LED "Diagnostic" at one or more power modules is <b>blinking red</b>	Internal error in the Sunmaster XL power module.	Write down which LED's are lighting or blinking. Consult an installer for replacement of the power module.

## 8 SPECIFICATIONS

### 8.1 TECHNICAL SPECIFICATIONS

<b>GENERAL SPECIFICATIONS</b>		
Article number	See chapter 4.3	
Typical string length	5-9 modules (72 cells), 7-12 modules (54 cells) or 10-18 modules (36 cells)	
Operating temperature	-20°C to 60°C ambient, full power up to 45°C, thereafter derating -3%/°C, (fully protected against over temperature)	
Storage temperature	-20°C to 60°C	
Relative humidity	max. 95%; PCB has anti-moisture coating	
Protection degree	IP55	
Safety class	class I	
Galvanic isolation	class II	
Dimensions	See section 8.2.	
Weight	95 kg [209 lbs] without power modules, 135 kg [298 lbs] including power modules	
<b>SOLAR INPUT (DC)</b>	<b>Sunmaster XL 10kW</b>	<b>Sunmaster XL 15kW</b>
Power module type	XL3300+	XL5000
Recommended PV power range	9kWp – 14 kWp	14kWp – 20 kWp
Maximum input power	3x 3750W DC	3x 5600W DC
Continuous power @ 40°C	3x 3550W DC	3x 5325W DC
Start-up power	3x 10W	3x 15W
Operating voltage range	100 – 550V DC, nominal 400V	100 – 600V DC, nominal 400V
MPP voltage range	220 – 440V DC	180-480V DC
Maximum voltage	550V DC	600V DC
Number of input	3	3
Rated current	3x 15A	3x 30A
MPP tracker	3 MPP trackers (Fraunhofer algorithm)	3 MPP trackers (Fraunhofer algorithm)
DC connections	MC2 (4 mm type)	MC2 (4 mm type)
<b>GRID OUTPUT (AC)</b>	<b>Sunmaster XL 10kW</b>	<b>Sunmaster XL 15kW</b>
Voltage*	3x 230V AC (184-276V*) (3ph-star)	3x 230V AC (184-276V*) (3ph-star)
Nominal power at 40°C ambient	3x 3300W AC	3x 5000W AC
Maximum power*	3x 3465W AC	3x 5250W AC
Nominal current	3x 15A	3x 22A
Frequency*	50 Hz (48 – 52 Hz) or 60 Hz (57 – 63 Hz)	50 Hz (48 – 52 Hz) or 60 Hz (57 – 63 Hz)
Power factor	>0.99 at full power	>0.99 at full power
Harmonic distortion:	THD < 3% at full power; UL1741 / IEEE1547(2003) / IEEE 1547.1(2005) compliant	
DC current injection	galvanic grid disconnection at 1000 mA DC (to VDE 0126-1-1:2006)*	
Stand-by power	3x < 0.5W	3x < 0.5W
EU efficiency	95% @ Unom	95% @ Unom
Maximum efficiency	96%	96%
AC connections	AC and DC glands on detachable plate in bottom of connection compartment. Power modules supplied with 3 x 4 mm <sup>2</sup> cable. DIN rail, connection equipment, fuses, terminal blocks etc. not included.	
Fuse	Three ceramic fuses 6.3x32 mm. 250V/30A T (in power modules).	

\* model dependent

<b>SAFETY DEVICES</b>	
General	galvanic separation between DC and AC side, by means of a class II transformers
Island protection*	An AC fault in any of the phases will disable all 3 power modules. QNS versions: Redundant voltage and frequency window monitoring ENS versions: Independent cut-off by means of 2 pole relay and solid state switch according to VDE 0126-1-1:2006.
Temperature protection	Thermal switch off at power module internal over temperature
DC side	<ul style="list-style-type: none"> <li>• DC-to-earth isolation resistance monitoring</li> <li>• DC over-voltage detection (LED warning and switch off)</li> <li>• DC inverse polarity protection (diodes)</li> <li>• DC current limiting by up-shifting operating voltage</li> <li>• Transients (varistors and buffer capacitor)</li> <li>• Overload (power limiting and temperature controlled power derating)</li> </ul>
AC side	<ul style="list-style-type: none"> <li>• AC current limiting</li> <li>• DC current injection protection</li> <li>• short circuit (ceramic fuse)</li> <li>• transients / surge up to 4 kV (varistors)</li> </ul>
Reclosure time*	10-300 sec

<b>MONITORING / DIAGNOSTICS / COMMUNICATION</b>	
User interface	7 status LED's for each power module
External communication	2 galvanic isolated RS485 QS databus connections
Indicator	Backlit display with indication of power and diagnostic messages
External communication	2 surge protected RS485 connections Up to 10 Sunmaster XLs can be connected to one Data Control Pro datalogger

<b>REGULATIONS &amp; DIRECTIVES</b>	
CE conformity	Yes
EMC directive	EMC 89/336/EEG
Emission	EN 55022
Harmonics	EN 61000-3-2, IEEE1547
Dips, variations and flicker	EN 61000-4-11, EN 61000-3-3
Immunity	EN 61000-6-2
LV directive	2006/95/EC
Safety	EN 60950
Anti islanding*	VDE 0126-1-1: 2006

\* model dependent

8.2 OUTLINE DRAWINGS

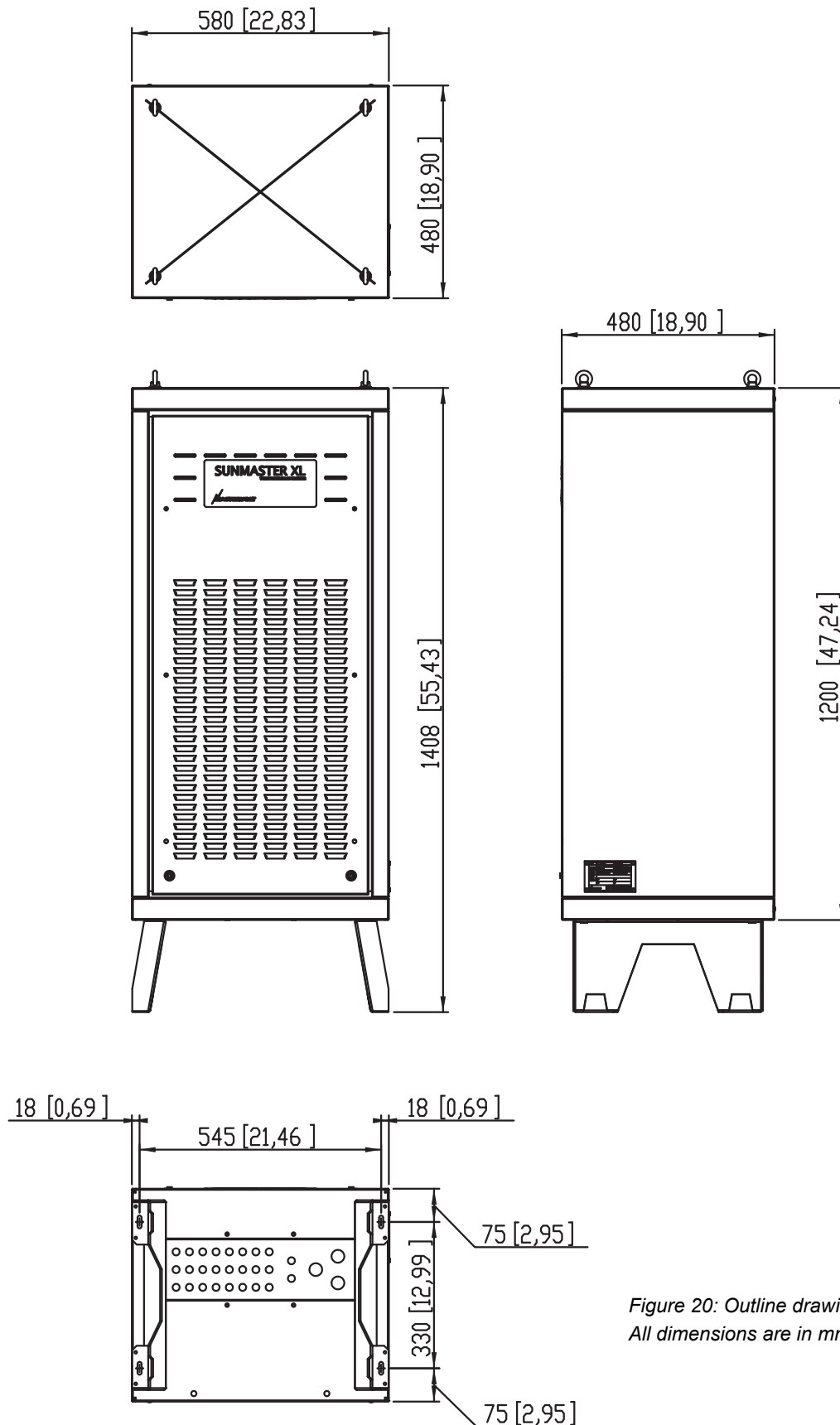


Figure 20: Outline drawings of the Sunmaster XL.  
All dimensions are in mm [inch]



## 9 ORDERING INFORMATION

Part number	Description
131103301	Sunmaster XL power module 3.3kW (for Sunmaster XL 10kW)
131105000	Sunmaster XL power module 5kW (for Sunmaster XL 15kW)
130504000	Air filter for Sunmaster XL
77040000	MasterBus terminating device
77040020*	MasterBus connection cable (UTP patch cable), 0,2m / 0.6ft
77040050*	MasterBus connection cable (UTP patch cable), 0,5m / 1.6ft
77040100*	MasterBus connection cable (UTP patch cable), 1,0m / 3.3ft
77030100	MasterBus - USB interface (required as interface between your PC and the Sunmaster XL power modules for configuration of the power modules with the local regulations for grid connection; see Appendix).
77010100	MasterView Classic. (monitoring and control panel for configuration of the power modules with the local regulations for grid connection; see Appendix )
130394000	QS Data Control 'Basic' – Free software package to monitor your photovoltaic (PV) system using your PC or notebook. Use of QS PC Link is compulsory.
130391010	QS PC Link, RS485/232 converter (up to 3 Sunmasters XL)
130391020	QS PC Link Industrial, RS485/RS232 converter for the connection of more than 3 Sunmasters XL or for cable lengths of more than 100 meters.
130391040	QS PC-Link Industrial, RS485/USB converter for the connection of more than 3 Sunmasters XL or for cable lengths of more than 100 meters.
130396000	QS Data Control 'Premium' II local – Datalogger to monitor up to 6 Sunmaster XL inverters locally
130396100	QS Data Control 'Premium' II remote – Datalogger to monitor up to 6 Sunmaster XL inverters over the Internet
130396200	QS Data Control 'Pro' Analogue – Datalogger to monitor up to 20 Sunmaster XL inverters locally or over the Internet
130396210	QS Data Control 'Pro' ISDN – Datalogger to monitor up to 20 Sunmaster XL inverters locally or over the Internet
130396220	QS Data Control 'Pro' GSM – Datalogger to monitor up to 20 Sunmaster XL inverters locally or over the Internet
130396230	QS Data Control 'Pro' Ethernet – Datalogger to monitor up to 20 Sunmaster XL inverters locally or over the Internet
130010905	RS485 modular communication cable, cross wired, 8 pole, 1 meter / 3 ft
130010906	RS485 modular communication cable, cross wired, 8 pole, 5 meter / 16 ft
130010910	RS485 modular communication cable, cross wired, 8 pole, 10 meter / 33 ft
130010915	RS485 modular communication cable, cross wired, 8 pole, 15 meter / 49 ft
120107000	Complete set to assemble RS485 modular communication cables. Delivery includes: 100 meter modular cable, 100 pcs. modular jacks and crimping tool

\*Other lengths of MasterBus connection cables upon request

See section 5.1 for an overview of parts that are standard included with the delivery of the Sunmaster XL

Mastervolt offers a wide range of products for both grid connected and independent autonomous electrical installations.

See our website [www.mastervolt.com](http://www.mastervolt.com) for an extensive overview of all our products

## 10 SELF TEST ITALY

### GENERAL

The Italy Self Test is meant to check the upper and lower limits of the AC voltage and AC frequency at which the inverter will shut off.

The Italy Test is included in the MasterAdjust software, available as free download, see below.

Connect the masterBus USB interface to a MasterBus connector on the inverter.

See for instructions "USB Connect" at the last page of this document.

The Italy Self Test will show only if the unit is configured for Italy.

To perform the test, select the MasterAdjust "Configuration" tab.

See figure 21.

You can choose all four tests together (All) or one individual test.

With option "All", the four tests are done in this sequence:

- UH (high off limit AC voltage);
- UL (low off limit AC voltage);
- FH (high off limit AC frequency);
- FL (low off limit AC frequency).

Press "Start Test" to let the test begin. Testing may take up to 10 seconds.

Refer to the individual tests to learn more about the operating principle of these tests.

After each test you have to confirm the test result (button "Confirm") before the inverter starts the Reclosure Time. During the test, reclosure time is reduced to 10s.

After the last test and after reconnecting to the grid the inverter will continue in normal operation. -

The test accuracy is better than 1V/ 0.1Hz if grid voltage and frequency are stable.

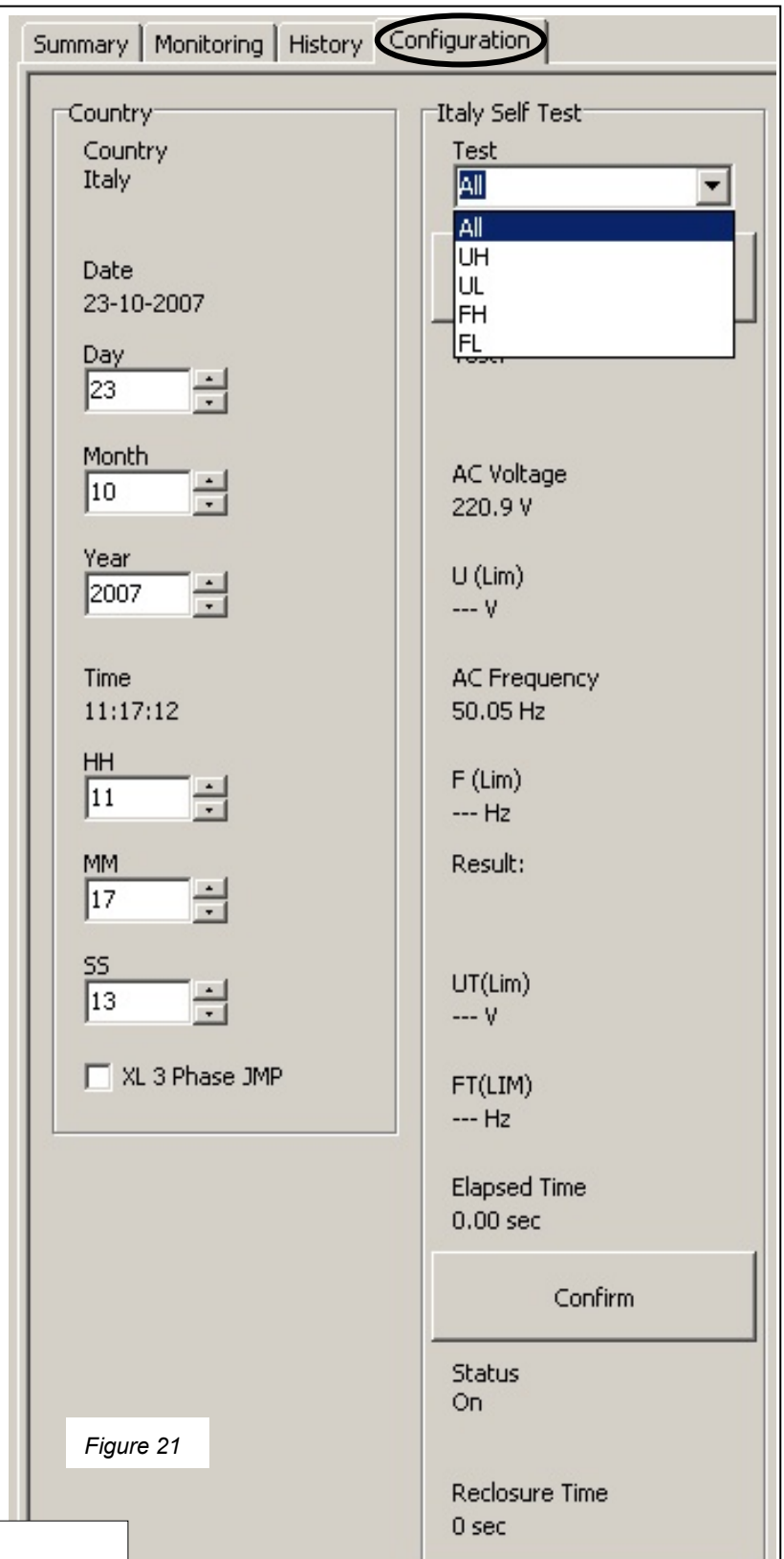
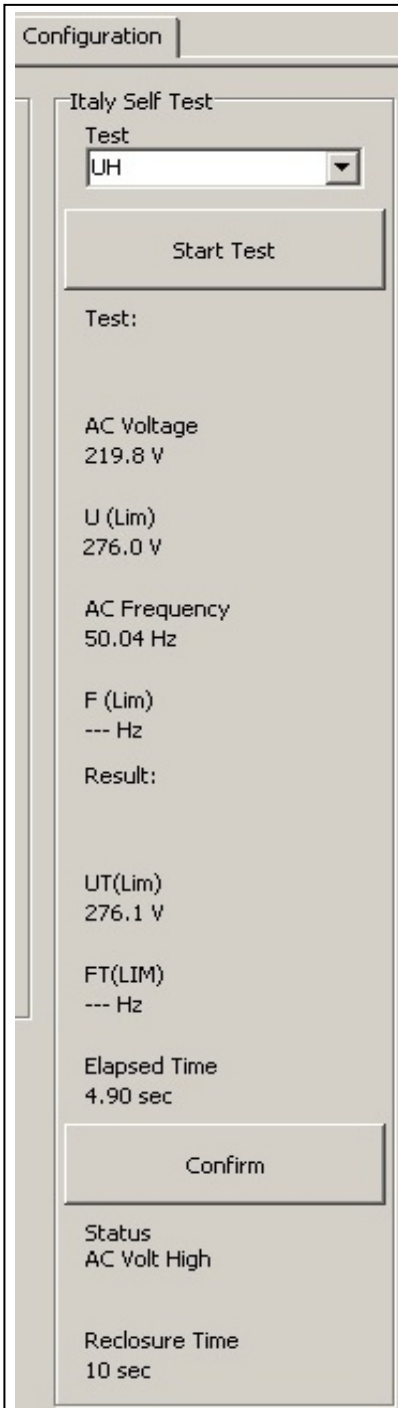


Figure 21

Software: free download at <http://www.mastervolt.com>.  
 Select: products/ instrumentation/ miscellaneous



**UH-TEST**

See figure 22. Start the UH test by pressing “Start Test”.

The screen shows:

- AC Voltage or UG = the grid voltage measured during the test;
- U (Lim) = the **high voltage limit UH** of the inverter, decreasing by rate -11.5V/ sec during test;
- UT (Lim) = the **measured UH**;
- Elapsed Time = the measured test time.

The test ends when UH reaches UG. The inverter will disconnect and the grid fault LED on the inverter illuminates. UT (Lim) and elapsed Time are shown.



Write down UT (Lim), UG and Elapsed Time.  
After confirming, the next test overwrites all values.

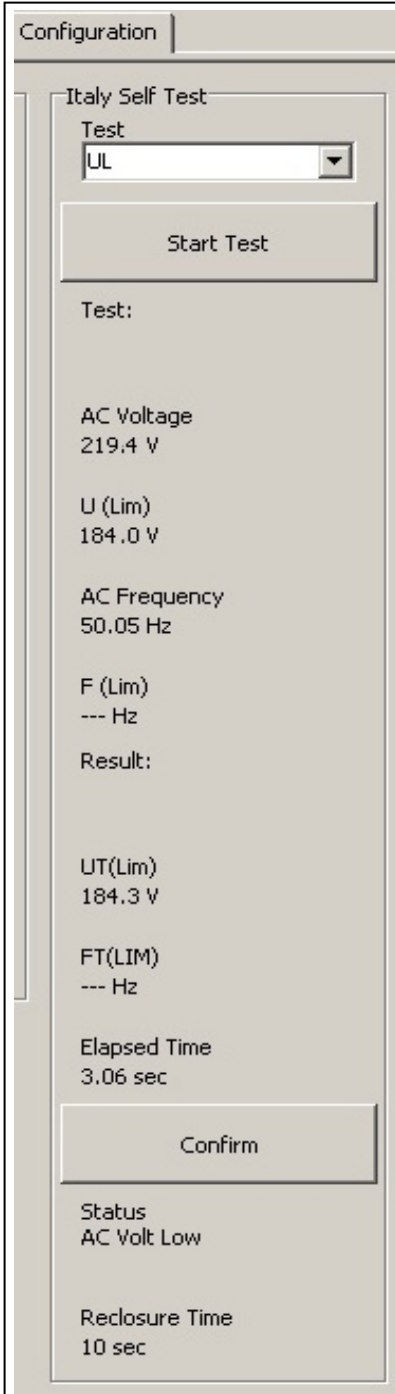
Calculation by hand:

$$UT = UG + (Elapsed\ Time * 11.5).$$

Example: if UG = 230.0V and Elapsed Time = 4.00 seconds,  
the result UT is 230.0 + (4.00\*11.5) = 276V

After Confirming the inverter starts the reclosure time count down to reconnect to the grid.

Figure 22



**UL-TEST**

See figure 23. Start the UL test by pressing “Start Test”.

The screen shows:

- AC Voltage or UG = the grid voltage measured during the test;
- U (Lim) = the **low voltage limit UL** of the inverter, increasing by 11.5V/ sec during test;
- UT (Lim) = the **measured UL**;
- Elapsed Time = the measured test time.

The test ends when UL reaches UG. The inverter will disconnect and the grid fault LED on the inverter illuminates. UT (Lim) and elapsed Time are shown.



Write down UT (Lim), UG and Elapsed Time.  
After confirming, the next test overwrites all values.

Calculation by hand:

$$UT = UG - (Elapsed\ Time * 11.5)$$

Example: if UG = 230.0V and Elapsed Time = 4.00 seconds,  
the result UT is 230.0 - (4.00\*11.5)= 184V

After Confirming the inverter starts the reclosure time count down to reconnect to the grid.

Figure 23

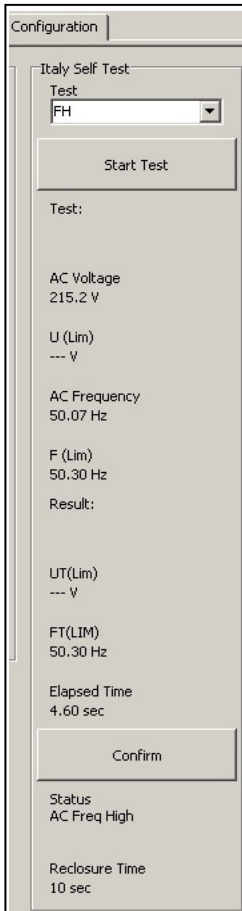


Figure 24

### FH-TEST

See figure 24. Start the FH test by pressing “Start Test”.

The screen shows:

- AC Frequency or FG = grid frequency measured during the test;
- F (Lim) = **high frequency limit FH** of the inverter, decreasing with a rate of -0.05 Hz/sec;
- FT (Lim) = the **measured FH**;
- Elapsed Time = the measured test time.

The test stops when FH reaches FG. The inverter will disconnect and the grid fault LED on the inverter illuminates. FT (Lim) and elapsed Time are shown.



Write down FT (Lim), FG and Elapsed Time.  
After confirming, the next test overwrites all values.

Calculation by hand:

$$FT = FG + (\text{Elapsed Time} \times 0.05)$$

Example: if FG = 50.00 Hz and Elapsed Time = 6.00 seconds, the result is  $50.00 + (6.00 \times 0.05) = 50.30$  Hz.

After Confirming the inverter starts the reclosure time count down to reconnect to the grid.

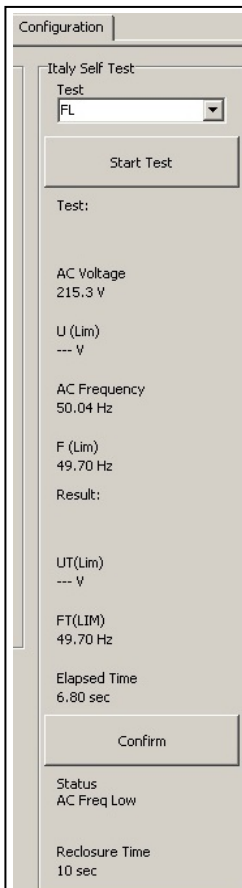


Figure 25

### FL-TEST

See figure 25. Start the FL test by pressing “Start Test”.

The screen shows:

- AC Frequency or FG = grid frequency Fg measured during the test;
- F (Lim) = **low frequency limit FL** of the inverter, increasing with a rate of 0.05 Hz/sec;
- FT (Lim) = the **measured FL**;
- Elapsed Time = the measured test time.

The test stops when FL reaches FG. The inverter will disconnect and the grid fault LED on the inverter illuminates. FT (Lim) and elapsed Time are shown.



Write down FT (Lim), FG and Elapsed Time.  
After confirming, the next test overwrites all values.

Calculation by hand:

$$FT = FG - (\text{Elapsed Time} \times 0.05)$$

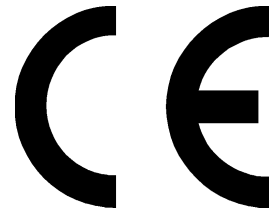
Example: if FG = 50.00 Hz and Elapsed Time = 6.00 seconds, the result is  $50.00 - (6.00 \times 0.05) = 49.70$  Hz.

After Confirming the inverter starts the reclosure time count down to reconnect to the grid. As the FL-test is the last test, the inverter will return to normal operation.

## 11 CERTIFICATES

### 11.1 CE DECLARATION OF CONFORMITY

Manufacturer Mastervolt  
Address Snijdersbergweg 93  
1105 AN Amsterdam  
The Netherlands



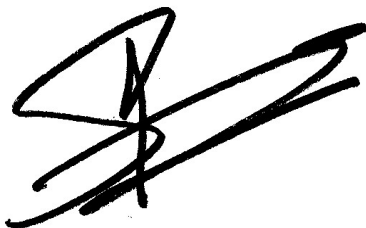
Herewith declares that:

Product:	Sunmaster XL 10kW	Sunmaster XL 15kW
	Power module XL3300	Power module XL5000
	Power module XL3300+	

is CE-marked and complies with the following standards:

EMC directive:	EMC 89/336/EEG
Emission:	EN 50081-1 EN 55011 class B (VDE 0875-11) EN 55014-1 EN 55022 VDE 0871 class B
Harmonics:	EN 61000-3-2 IEEE 929
Flicker:	EN 61000-3-3
Electro static discharges (ESD):	EN 61000-6-1 / EN50082-1
Radiated Immunity:	EN 61000-6-1 / EN50082-1
Electrical fast transients (EFT):	EN 61000-6-1 / EN50082-1
Conducted immunity:	EN 61000-6-1 / EN50082-1
LV directive:	2006/95/EC
Electrical safety :	EN 60950
ENS:	DIN VDE 0126

Amsterdam,



P.F. Kenninck,  
CEO MASTERVOLT

11.2 VDE0126-1-1 CERTIFICATE OF COMPLIANCE



**Innova Product Service GmbH, A Bureau Veritas Company**

Gewerbestr. 28  
87600 Kaufbeuren  
Germany  
+ 49 (0) 8341 96660-0  
Info@innova-ps.de

## Certificate of compliance

**Applicant:**            **Mastervolt International B.V.**  
                                   Snijdersbergweg 93  
                                   1105 AN Amsterdam  
                                   The Netherlands

**Product:**            **Automatic disconnection device between a  
                                   generator and the public low-voltage grid**

**Model:**                **XL5000, XL3300**

**Use in accordance with regulations:**

Automatic disconnection device with single-phase mains surveillance in accordance with DIN V VDE V 0126-1-1:2006-02 for photovoltaic systems with a single-phase parallel coupling via an inverter in the public mains supply. The automatic disconnection device is an integral part of the aforementioned inverter. This serves as a replacement for the disconnection device with insulating function which the distribution network provider can access at any time.

**Applied rules and standards:**

DIN V VDE V 0126-1-1:2006-02 and „Generator at the public low-voltage grid, 4th edition 2001, guideline for connection and parallel operation of generators in the public low-voltage grid” with VDN additions (2005) from the German Electricity Association (VDW) and Association of network operator (VDN).

The safety concept of the aforementioned product, tested in the week 21/2007, corresponds to the time of issue of this certificate of valid safety specifications for the specified use in accordance with regulations.

The conformance certificate will be invalidated no later than 22 June 2010.

**Report number:**            **07KFS057**  
**Certificate number:**        **U07-061**  
**Issued:**                      **22 June 2007**

This certificate is valid for 3 years from the date of issue. The manufacturing location is subject to an annual manufacturing inspection by INNOVA.

Andreas Aufmuth



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