● 15P00EEB100 ●

SUNWAY TG

GRID-CONNECTED THREE-PHASE PHOTOVOLTAIC INVERTER WITH INTEGRATED TRANSFORMER

USER MANUAL

- INSTALLATION GUIDE -

Updated: 17/02/2012
Rev. 03

English

- This manual is integrant and essential to the product. Carefully read the instructions contained herein as they provide important hints for use and maintenance safety.
- This product is to be used only for the purposes it has been designed to. Other uses should be considered improper and dangerous. The manufacturer is not responsible for possible damages caused by improper, erroneous and irrational uses.
- Elettronica Santerno is responsible for the product in its original setting.
- Any changes to the structure or operating cycle of the product must be performed or authorized by Elettronica Santerno.
- Elettronica Santerno assumes no responsibility for the consequences resulting by the use of non-original spare-parts.
- Elettronica Santerno reserves the right to make any technical changes to this manual and to the product without prior notice. If printing errors or similar are detected, the corrections will be included in the new releases of the manual.
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1. GENERAL INFORMATION ON THE PRODUCT

S000001-00EE

Figure 1: SUNWAY TG line

The SUNWAY TG line includes low- to medium-power three-phase solar inverters for connection to the electric grid in low voltage.

The range offers the following versions:

- 600V version, for field voltages up to 740 Vdc maximum
- 800V version, for field voltages up to 880 Vdc maximum

SUNWAY TG inverters, designed for maximum conversion efficiency and maximum reliability, are completely protected from short-circuiting and power surges as well as being in compliance with the most stringent national and European standards on safety and introduction in to the power grid.

All SUNWAY TG inverters are fully compatible with Tracker applications.

The modular design philosophy of Elettronica Santerno inverters and the vast range of products available ensure it is possible to successfully adapt them to the individual needs of the customer.

Careful and precise design down to the very last detail and quality control guaranteed by standard ISO 9001 are the strong points of a reliable product which is able to maintain its features unaltered over time.

Designed to last in even the most arduous environmental conditions, Elettronica Santerno inverters guarantee wide safety margins during daily use.

These and other design features are what put SUNWAY TG inverters amongst the leaders in photovoltaic field energy production

NOTE

The string surveys illustrated in this manual are susceptible to changes both from a technical point of view and in appearance at the manufacturer's discretion, hence the illustrations are not binding for the end user.

1.1. Operating Principles

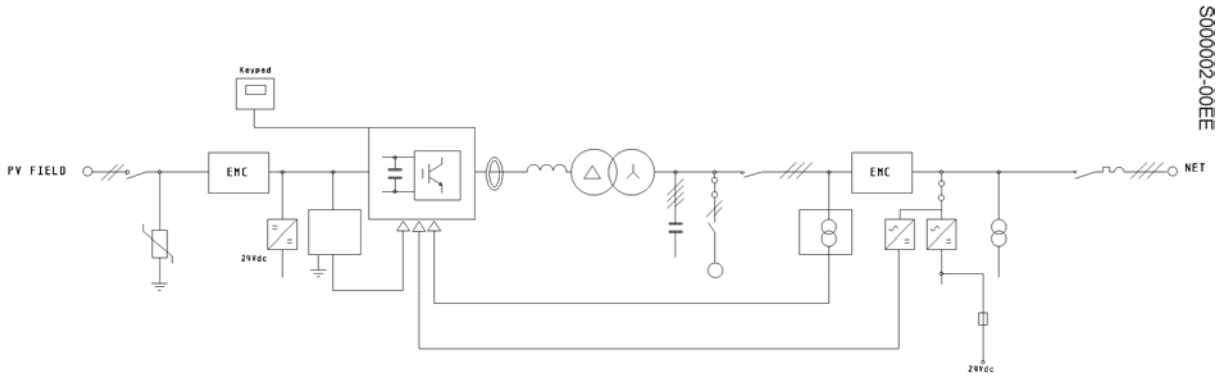


Figure 2: Single-wire diagram of a SUNWAY TG inverter

The SUNWAY TG inverters include the following functional blocks:

DC input unit

The DC input unit allows connecting the inverter to the photovoltaic generator. It is provided with underload switch, input EMI filters and SPDs. It checks the ground isolation of the PV generator.

Static converter

The Static Converter comprises the forced switching IGBT stack and the control board. The Static Converter implements the most advanced features of the inverter, such as the control logics, the current and voltage measures, the interface protections integrated into the control software, the autodiagnostics functions and the serial communications.

AC output unit

This AC Output Unit comprises control devices, such as Contactor for the connection to the grid that can operate as an Interface Device (please refer to the heading "Control Devices"), the sinusoidal filters and the output EMI filters.

The inverter is provided with an interface device operating on minimum and maximum voltage / frequency thresholds in compliance with the standards in force (see “SUNWAY TG CERTIFICATION AND GRID INTERFACE FILE”).

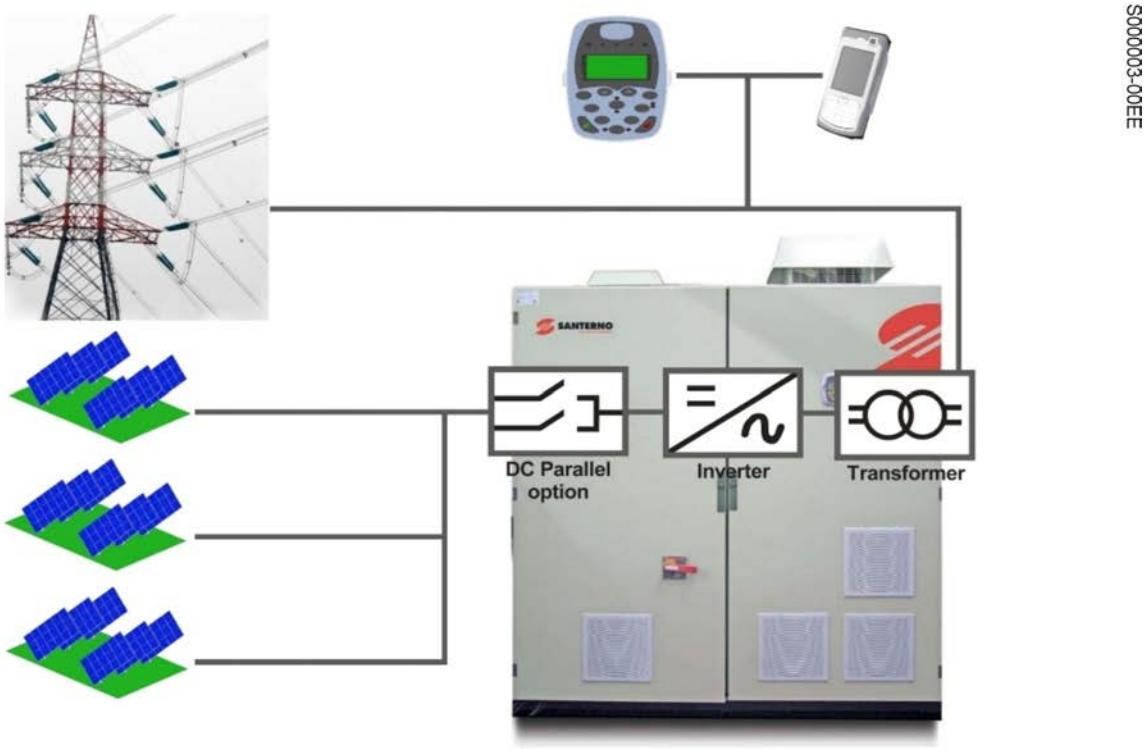


Figure 3: Block diagram

Once the SUNWAY TG is connected to the photovoltaic generator and is properly started, the control system synchronises with the grid and closes the parallel contactor when the PV field voltage exceeds the starting voltage value.

The inverter will then operate as a generator of sinusoidal current with a power factor that is typically equal to 1.

The integrated MPPT (Maximum Power Point Tracker) algorithm constantly keeps the working point of the PV field at the maximum power delivered.

The grid frequency and the grid voltage values are constantly checked during normal operation. This allows detecting undesired islanding operation. Islanding detection can be performed by an external relay according to the regulations in force (see paragraph “Interface Protection (IP)”).

The plant data can be read from the LCD display/keypad placed on the front wall. The plant data includes the active energy and the reactive energy, the operation time and the temperature of the internal components. The keypad allows accessing all the inverter measures and programming parameters.

The inverter is provided with standard RS485 comms ports for the connection to the remote monitoring system, both in local mode and in remote mode (see paragraph “Serial Ports”).

The Data Logger board is available as an option board. It is a telecommunications unit between the inverter and the connected String Box. It stores local production data and allows connecting to the Santerno Remote Monitoring (see paragraph “Data Logger”).

Several diagnostic functions are integrated in the inverter logic, such as the constant check of the program memory integrity, the PV field isolation monitoring, the detection of the temperature of the internal components, the detection of the input / output overcurrent, the detection of the DC-Parallel input fuses (if a DC-Parallel cabinet is installed).

1.2. Main Integrated Standard Functions

The main integrated standard functions of a SUNWAY TG are listed below:

- Continuous PV field isolation control.
- Protection against grid power loss, surges and short circuits to provide maximum reliability.
- Protection against power surges on PV field input.
- Protection against PV field polarity reversal.
- Interface Protection integrated in the SW.
- Digital input for external grid supervisor.
- Possibility for external grid power supply to the ventilation system to maximize power delivered to the grid.
- Full integration with the Santerno remote monitoring system for checking production performance and detecting alarms.
- Complete remote monitoring accessibility in both local and remote mode from PC and SunwayPortal web portal.

1.3. Optional Functions

The main optional functions available for SUNWAY TG inverters are listed below:

- Data Logger Board
- GPRS Router
- Field connection with earth pole (Positive Earthed or Negative Earthed)
- Anti-condensation heater
- Environmental Sensors and Field I/Os Expansion Board
- Ventilation kit IP20

1.4. Scope of this Manual

The scope of this manual covers:

- All inverters belonging to the SUNWAY TG series.

1.5. For Whom this Manual is Intended

This manual must be read by:

- Installers
- Operators
- Plant manager

Please refer to the heading “Definitions”.

1.6. Attached Documentation

The SUNWAY TG is supplied complete with the following documents:

Name of the document	Scope
Installation Guide	Contains all the information necessary for the transport, assembly, installation and maintenance of the product.
Programming Guide	Contains all the information on inverter operation and for accessing measurements and programming parameters.
Electrical and Mechanical Diagram	Contains detailed information on the internal layout and electrical diagram of the product.
Final Test Certificate	Contains all the information concerning the execution and outcome of Production Tests.
Certification and Grid Interface File	Contains the Declaration of Conformity to standards which are applicable to the product and information on the network interface parameters.

Table 1: Documentation supplied with the product

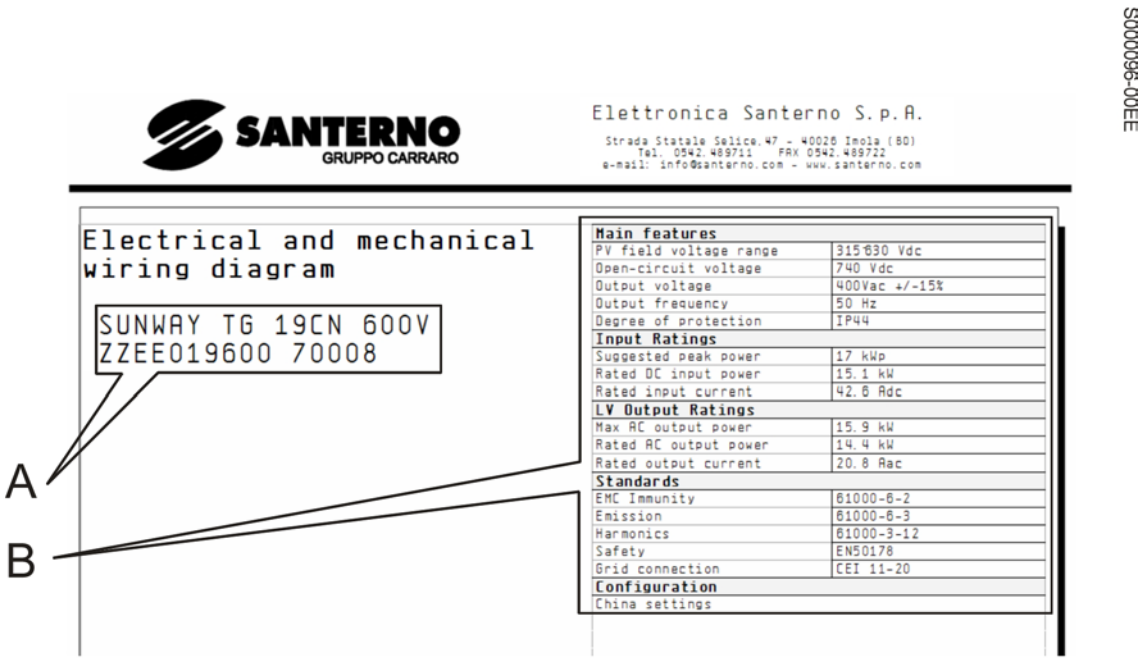
1.6.1. Preservation of the Documentation

All documents must be kept for the entire life span of the equipment together with the system documentation. They must be kept in a place where they are readily available.

1.6.2. Electrical and Mechanical Diagram

To facilitate understanding of the Electrical and Mechanical Diagram and help the user to identify the various parts illustrated therein, here is a description of how it has been drawn up.

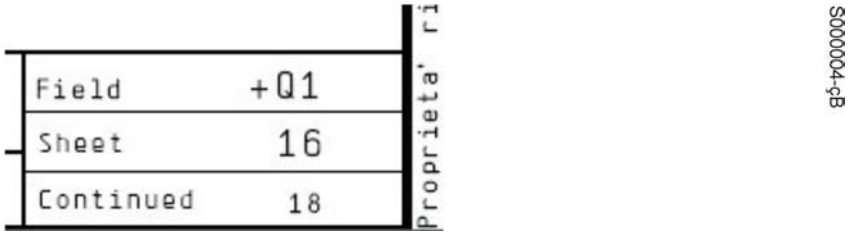
The first page of the Electrical and Mechanical Diagram contains the technical features and configuration of the inverter, as illustrated below:



A Type of inverter and code

B Inverter technical data and configuration

The pages of the electrical diagram are distinguished by three different numbers in the bottom right-hand corner:



"**Field**" indicates the location of the components:

+Q1 = Inside the electrical cabinet

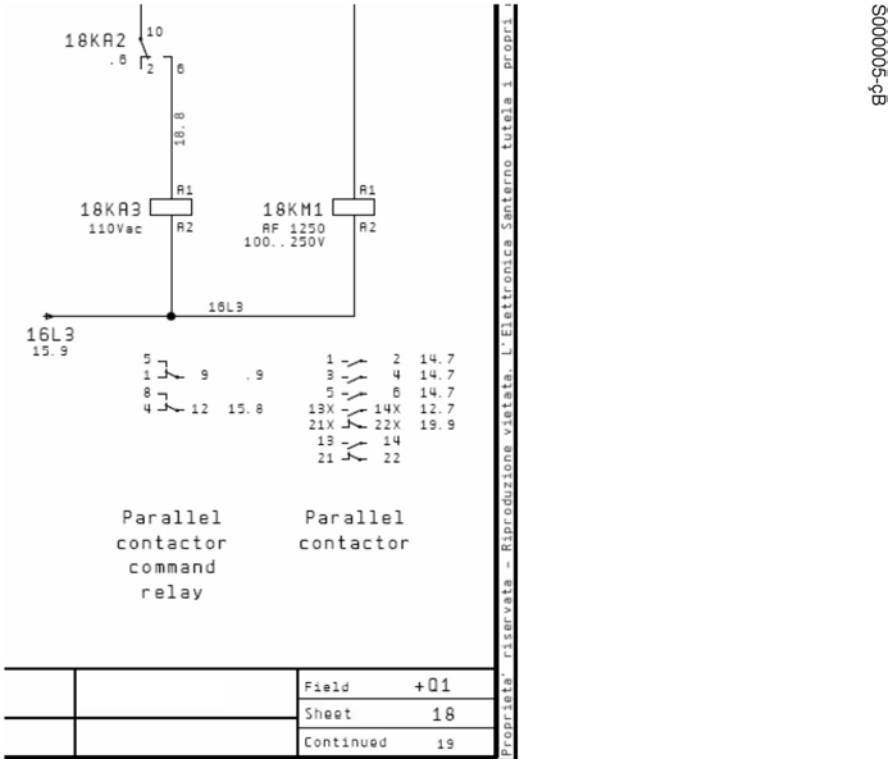
+Q1F = On the front of the electrical cabinet

+EXT = External device

"**Sheet**" indicates the progressive number of each sheet in the electrical diagram

"**Continued**" indicates the number of the following sheet

The ID code for each component and conductor relates to the first page in which the component or conductor appears, usually based on the direction of energy flow, followed by a progressive number.



Cross-references are provided in the electrical diagram for conductors and components which appear on more than one page. The cross-reference format is: Sheet. Column.

1.6.3. Final Test Certificate

The Final Test Certificate is drawn up by Elettronica Santerno technicians at the time of testing the SUNWAY TG inverter. It contains all the information concerning the execution and outcome of Production Tests.

1.7. References for the Electronic Board ID Codes

The table below indicates the electronic board ID codes used in the Electrical and Mechanical Diagram.

ID code	Description
ES768	ISOLATION CONTROL BOARD
ES821	CONTROL BOARD
ES822	RS485 GALVANIC ISOLATION BOARD
ES847	ENVIRONMENTAL SENSORS AND FIELD I/Os EXPANSION BOARD
ES851	DATA LOGGER BOARD
ES914	AUXILIARY POWER SUPPLY AND RS485 GALVANIC ISOLATION BOARD
ES942	EARTH LEAKAGE DETECTOR BOARD

1.8. Symbols used

KEY:

DANGER

Indicates an operating procedure which, if not carried out correctly, may lead to injuries or even death caused by electric shock.

WARNING

Indicates an operating procedure which, if not carried out correctly, may cause serious damage to equipment.

NOTE

Indicates important information concerning use of the equipment.

PROHIBITION

Strictly forbids the execution of operating procedures.

1.9. Definitions

Installer

Technician responsible for setting up, positioning and installing the equipment in compliance with the system diagram and in accordance with first-class, professional criteria.

Operator

Worker who has been suitably trained and informed on the risks and relative safety procedures to be adopted. The operator can carry out routine maintenance on the equipment.

Plant manager

Person who co-ordinates or manages system management activities and is responsible for ensuring health and safety standards are adhered to.

Technical room

Place used for housing the technological systems such as the wiring, plumbing, heating, air-conditioning, lifting and telecommunications systems.

It is equipped with suitable forced-air ventilation and/or air conditioning and is also fitted with appropriate safety devices governing access, maintenance and fire-prevention.

Person in charge of running the electrical system (System Manager)

Person with the highest level of responsibility concerning operation of the electrical system. If required some of his/her tasks may be delegated to others.

Person in charge of working activities (Works Supervisor)

Person with the highest level of responsibility concerning the execution of work. If required some of his/her tasks may be delegated to others.

The Works Supervisor must give all persons involved in the execution of work activities the relative instructions concerning reasonably foreseeable dangers which may not be immediately apparent.

Skilled electrician

Someone who has been trained and has enough technical knowledge or experience to enable him/her to avoid the dangers which may be generated by electricity.

Instructed person

Someone who has been adequately advised or supervised by a skilled person to enable him/her to avoid the dangers which may be generated by electricity.

2. CAUTION STATEMENTS

This section covers safety statements. The non-observance of the safety instructions below may cause serious injury or death and equipment failure. Carefully read the instructions below before installing, starting and operating the equipment.

Only competent personnel must carry out the equipment installation.

SAFETY RECOMMENDATIONS TO FOLLOW DURING USE AND INSTALLATION OF THE EQUIPMENT:

NOTE

Always read this instruction manual thoroughly before starting the equipment.

DANGER

ALWAYS EARTH THE EQUIPMENT.

OBSERVE THE PRESCRIPTIONS CONCERNING CONDUCTOR SECTION INDICATED IN THE CHAPTER "TECHNICAL DATA" , UNDER THE HEADING "CONNECTING EARTH CABLES".

WARNING

Do not connect supply voltages which exceed the rated voltage. If voltage exceeding the rated value is applied, the internal circuits may be damaged.

In the event of an alarm, please consult the chapter "TROUBLESHOOTING". Only restart the equipment once the problem has been rectified.

Do not carry out isolation tests between the power terminals or between the control terminals.

Make sure that the screws on the connection terminal board have been tightened correctly.

Observe the ambient conditions for installation.

The electronic boards contain components which are sensitive to electrostatic charges. Do not touch the boards unless absolutely necessary. Should this be the case, take all the necessary precautions to prevent damages caused by electrostatic charges.

2.1. Precautions for Use and Prohibitions

DANGER

RISK OF ELECTRIC SHOCK

NEVER carry out operations on the equipment when it is powered.

EXPLOSION AND FIRE RISKS

The risk of explosion or fire may exist if the equipment is installed in a room containing flammable vapours. Do not install the equipment where there is a risk of explosion or fire.

PROHIBITION

The product described in this manual has not been designed to operate in potentially explosive atmospheres. Consequently, installation in such an environment is strictly prohibited.

PROHIBITION

It is forbidden to make any technical or mechanical modifications to the cabinet even when out of warranty.

Elettronica Santerno is not responsible for any risks that may arise due to unauthorised alterations, modifications or tampering.

2.2. Intended Use

SUNWAY TG inverters are digitally controlled appliances which convert electrical energy from a DC power source produced by photovoltaic (PV) panels into an AC current which is then delivered to the grid.

SUNWAY TG inverters may only be used as described in this manual. The DC power supply must come from the PV field only. The AC output must be parallel-connected to the grid only.

Any use other than that described in this manual is to be considered inappropriate and therefore improper.

2.3. Qualified Technical Personnel

All work on SUNWAY TG products must be carried out by skilled technical personnel only. By skilled personnel it is intended persons who have been suitably trained to carry out the work in question.

To commission and use the SUNWAY TG, personnel must know and understand the instructions for installation and use. In particular all safety warnings must be strictly observed.

2.4. Specific Dangers Linked to Photovoltaic (PV) Systems

PV systems have certain characteristics which are the source of additional hazards and are described below:

- A live current source is connected. Depending on the operating conditions, there may be live voltage from the PV generator or from the electrical grid. This must be taken into consideration, particularly when disconnecting parts from the system.
- Very high DC voltages are involved (with no periodic zero crossings) hence failure or the incorrect use of fuses or plugs may cause electric arcs.
- The short-circuit current of the PV generator is only slightly higher than the maximum operating current and furthermore is linked to radiation. This means that fuses may not always blow in the event of a short-circuit.
- The PV generator grid is usually an IT type, i.e. it is only earthed in the event of a fault or energy leakage. For connection to PV fields with earthing pole, connection is of the TN type, but the earth connection is protected by a fuse which may trip in the event of a single fault.
- In the event of a fault (for example a short-circuit), cutting off a generator with a high number of branches may prove to be somewhat difficult. Take great care to ensure each sub-field disconnecting switch has been opened before going near the devices installed in the technical room.

2.5. Execution of Work

Maintenance, configuration modifications and management operations require the involvement of all production and maintenance personnel. These activities **must be carried out in observance of health and safety regulations**.

The Standards and Laws governing this aspect vary depending on the personnel involved, methods of access and/or the tasks which may be carried out on the product and envisage constructive measures aimed at guaranteeing adequate levels of safety.

Standard EN 50110-1, second edition, identifies the people who are granted access to the product:

- Person in charge of running the electrical system (System Manager).
- Person in charge of work activities (Works Supervisor).
- Skilled electrician.
- Instructed person.

Please refer to the heading “Definitions”.

Standard EN50110-1 governs the way work in a plant is carried out and the relationship between the aforementioned persons who may work on the plant to maintain the electrical safety conditions stipulated by European Directives.

This standard and its national equivalents must therefore be adhered to whenever it is necessary to access a PV system.

2.5.1. Placing the System in Safety Conditions

Affix the following warning sign next to all the PV field disconnecting switches.

Figure 4: System safety warning sign

WARNING

Always operate in accordance with the indications provided in heading "Placing the System in Safety Conditions".

WARNING

Before carrying out any operations inside the electrical cabinet make sure it is in safety conditions by turning it off and opening the DC side and AC side switches.

DANGER

After turning off the inverter wait at least 10 minutes before opening the cabinet doors to give the DC-link capacitors time to discharge.

NOTE

In the event of any fault, please contact the Elettronica Santerno SpA CUSTOMER SERVICE for instructions on the necessary corrective action to be taken.

2.6. Personal Protective Equipment

Maintenance technicians must be provided with the following personal protective equipment as envisaged by European Directives and relative implementation of the same on national territory.

SYMBOL		DESCRIPTION
	Safety glasses/face shield	Throughout operations.
	1000 V high-voltage insulated gloves	Throughout operations.
	Dielectric helmet	Throughout operations.
	Safety footwear/dielectric boots	Throughout operations.
	Insulated tools	Throughout operations.
	Operators must also be provided with a suitable means of communication for contacting the emergency services if necessary.	

NOTE

It is always advisable to work on the electrical cabinets with THE POWER SUPPLY SWITCHED OFF and the equipment in safety conditions (please refer to the heading "Electrical Connections: Safety Procedure").

2.6.1. Hearing Protection

The inverter and technical room cooling fans may generate considerable noise levels.

It is therefore necessary to observe all the necessary precautions aimed at protecting hearing. It is advisable to wear hearing protection when working continuously in the vicinity of the inverters.

2.6.2. Burns

Some components may reach very high temperatures and still be very hot even after the equipment has been switched off.

Consequently all the necessary precautions aimed at preventing the risk of burns must be taken. Always wear protective gloves.

2.7. Electric Connections: Safety Procedure

Before carrying out any kind of operation inside the inverter, always place the equipment in safety conditions. To do this follow the instructions provided below:

- Make sure that the inverter is NOT running.
- Press the emergency stop button on the front door.
- Disconnect the cabinet's auxiliary power supply.
- Wait at least 10 minutes before opening the doors.
- Turn off any disconnector switches up- and downstream from the inverter.

DANGER

Turning off the switches on the PV field side and the grid side inhibits operation of the SUNWAY TG but hazardous stored residual energy may persist on the AC grid and PV field connection terminals, terminal boards X1 and X2 (please refer to the Electrical and Mechanical Diagram).

3. PRODUCT IDENTIFICATION

3.1. Checking the Product on Delivery

On receiving delivery of the equipment make sure that the packaging shows no signs of damage. Check that it complies with your order by referring to the dataplates described below. In the event of any damage, please contact the relative insurance company or the supplier. If the delivery does not match your order, contact the supplier immediately.

Figure 5: Packaging of SUNWAY TG

NOTE

The labels indicating the codes and product description and any optionals selected, may differ in colour to the ones shown in the figure.

If the equipment is to be stored before installation, make sure that the ambient conditions in the warehouse meet the necessary specifications (please refer to the heading “Environmental Requirements for Storage and Transport"). The warranty covers manufacturing defects. The manufacturer shall not be held liable for any damage which may have occurred during transport and unpacking. Under no circumstances shall the manufacturer be held liable for damage or faults caused by incorrect use, misuse, incorrect installation or inadequate temperature or humidity conditions or exposure to corrosives nor for faults caused by operation outside the rated values. Nor shall the manufacturer be held liable for consequential or accidental damage.

NOTE

For the terms of warranty please refer to the warranty certificate supplied with the product.

3.2. Product ID Code

The product code identifies the inverter and is indicated on the relative dataplate. The dataplate also holds all the necessary technical data (please refer to the heading “Identification Dataplate”).

The product code is made up of the following elements:

SUNWAY TG XXX YY ZZZ

XXX	**Model**	See the Solar Energy catalogue
YY	**Country of Destination**	If absent: Italy ES: Spain DE: Germany FR: France GR: Greece KR: Korea CN: China
ZZZ	**Maximum Vdc Field Voltage**	600V: Field Voltage Max. Voc 740 Vdc 800V: Field Voltage Max. Voc 880 Vdc

Examples:

SUNWAY TG 14 600V	for the Italian market
SUNWAY TG 14DE 600V	for the German market

3.3. Product Revision Index

The product revision index is indicated on the dataplate Please refer to the heading “Dataplate”.

3.4. Serial Number

The inverter’s serial number is indicated on the dataplate. Please refer to the heading “Dataplate”.

4. PRODUCT CONFIGURATION

4.1. Controls on the Front of the Cabinet

S000008-00EE

Figure 6: Controls on the front of the SUNWAY TG cabinet

The following controls and devices are located on the front door of the inverter cabinet (the relative ID codes used in the Electrical and Mechanical Diagram are provided in the brackets):

Key-operated selector switch: Enable/Disable Inverter (12SA1)

This key-operated selector switch enables/disables operation of the SUNWAY TG.

Key-operated selector switch: door switch Enabling/Disabling (18SA2)

This key-operated selector switch enables/disables the door closure safety microswitches. If the safety microswitches are activated, door opening will open the switches on the PV field side and grid side.

Display/keypad (12A4)

Using the display/keypad the operator can:

- Inverter START, STOP and alarm RESET (start, stop, reset of the alarms tripped).
- Set machine parameters (please refer to the Programming Guide).
- See measurements and any indications concerning the operating status of the inverter (please refer to the Programming Guide).

Emergency Stop Button (18SB2)

The emergency stop button opens the switches on the PV field side and the grid side immediately, thus inhibiting operation of the SUNWAY TG in parallel with the grid.

The safety circuits and the release coils function at 24 V. SUNWAY TG inverters are equipped with two 24 V power supply units which operate in parallel. The first power supply unit is connected to the PV power supply source while the other is connected to the grid. In this way the inverter safety circuits are always powered by one inverter power source or the other.

The emergency function can have a remote operation facility by means of a contact available on the inverter. Please refer to the heading “External Emergency Stop Command Management”.

4.2. Control Devices

The following control devices are located inside the inverter (the relevant ID codes used in the Electrical and Mechanical Diagram are provided in brackets):

PV Generator DC Switch (10QM1)

The DC switch (PV field side), located inside the cabinet, makes it possible to connect the inverter to the PV field.

Grid AC Switch (16QM2)

The AC switch (PV field side) located inside the cabinet, makes it possible to connect the SUNWAY TG to the grid.

Grid Connection Contactor (18KM1)

The grid connection contactor is closed and/or opened by the control board and is normally interlocked with the Interface Protection (DI). Please refer to the headings “Interface Protection IP” and “Grid Connection Contactor”.

DANGER

The SUNWAY TG is powered by two completely separate voltage generators: the grid and the PV field. Make sure that both generators are disconnected before carrying out any kind of work inside the inverter.

4.2.1. Interface Protection IP

The Interface Protection (IP) relay is a component which performs the function of grid supervisor.

The grid interface represents one of the inverter's main safety functions.

All the electric grid values are measured and compared with an acceptance template. If the measured values exceed the set thresholds, the inverter stops by opening the parallel contact.

The basic safety functions of the grid interface include the over/under frequency and the under/over voltage thresholds.

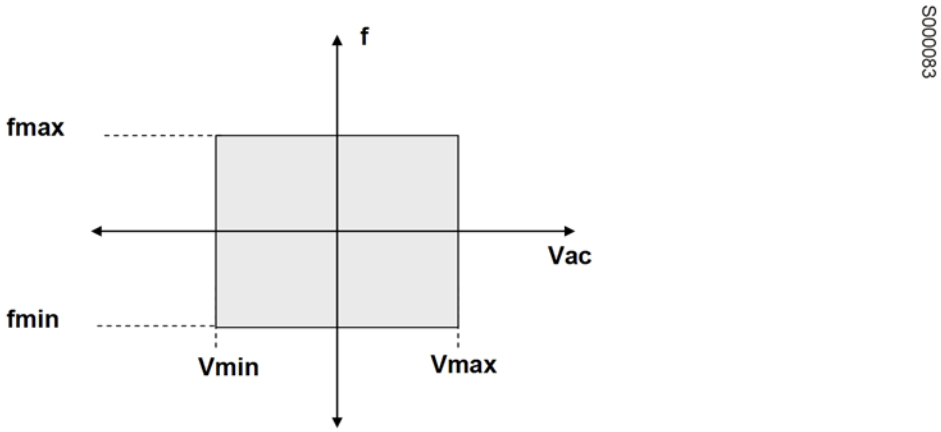


Figure 7: Interface Protection diagram

The tripping values and times depend on the connection regulations in force in different countries. Other measurements, both direct and derivative, may be considered for Interface Protection, depending on the connection regulations in force in the country of installation.

The Interface Protection function may be performed by an external device or via the control software. The two functions may also coexist and operate in parallel.

For all SUNWAY TG inverters an Interface Protection function is incorporated in the control software which acts on the Grid Connection Contactor. All the parameters relative to the tripping thresholds and times are set in the factory depending on the designated geographical location of installation.

It is also possible to connect an external Interface Protection to SUNWAY TG inverters whenever this is prescribed by the regulations in force (e.g. CEI 0-16 for Italy). See terminal X3, contacts 13 and 14 in the Electrical and Mechanical Diagram.

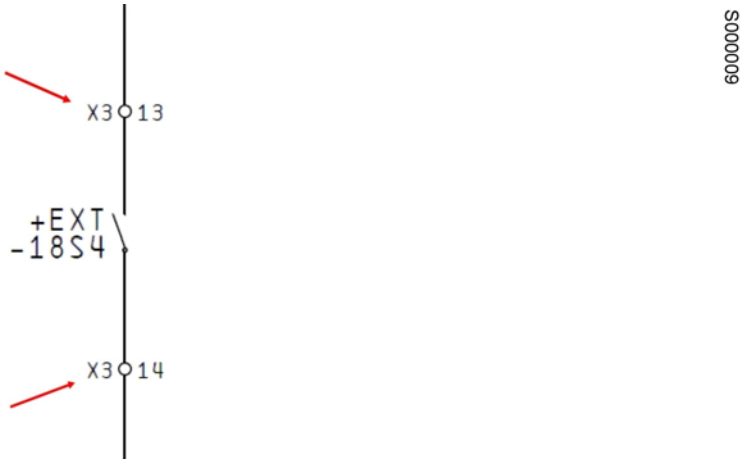


Figure 8: External Interface Protection (IP) relay connection

For connection of an external Interface Protection, the protection acts with redundancy on inverter control:

- The control software acquires the status of external Interface Protection in real time. In the event of tripping the inverter stops and the Grid Connection Contactor is opened.
- The external Interface Protection contacts are wired in such a way as to open the Grid Connection Contactor.

The sudden tripping of the Interface Device may cause transients on the AC output line. This phenomenon may occur to a higher or lesser degree depending on the characteristics of the system and the connected loads. The wiring of the Interface Protection feedback signal contact minimizes these transients. Hence it is advisable to ensure such wiring is made in all systems.

Operation of the SUNWAY TG inverters is in any case guaranteed regardless of the wiring of the Interface Protection feedback signal contact.

SUNWAY TG inverters are configured in the factory with an external Interface Protection input enabled and a jumper on terminal X3 (contacts 13 and 14). To acquire the status of the grid from an external Interface Protection, remove the jumper and wire a normally excited NO contact on the X3 terminal board (contacts 13 and 14).

4.2.2. Grid Connection Contactor

The AC Grid Connection Contactor, located inside the cabinet, makes it possible to connect the SUNWAY TG to the grid.

Should the Interface Protection trip, or in the event of an alarm, the Grid Connection Contactor is opened disconnecting the inverter from the grid and stopping it. The Grid Connection Contactor is the component which can perform opening under load, sized for the maximum inverter output current. It is referred to in the Electrical and Mechanical Diagram as 18KM1.

The Connection Contactor may also act as an Interface Protection device (IP), depending on the type of system, the connection prescriptions and relative regulations in force.

The status of the AC Grid Connection Contactor is indicated by the RUN LED on the display/keypad.

Status of the RUN LED	Description
LED ON	Contactor closed, the inverter is connected to the grid.
LED OFF	Contactor open, the inverter is NOT connected to the grid.

Figure 9: RUN LED on the display/keypad

WARNING

The emergency stop button disables operation of the SUNWAY TG in parallel with the grid.

The contactor is equipped with a feedback signal contact, connected to the digital input MD15 (please refer to the Programming Guide).

See TECHNICAL DATA under the heading "Interface Device".

4.2.3. DC Input Switch

The PV field DC disconnecting switch (10QM1), located inside the cabinet, makes it possible to connect the SUNWAY TG to the PV generator.

The disconnecting switch is equipped with a return contact, connected to the digital input MD14 (please refer to the Programming Guide).

4.2.4. AC Output Switch

The AC switch (PV field side) located inside the cabinet, makes it possible to connect the SUNWAY TG to the grid.

The switch is equipped with a return contact, connected to the digital input MD18 (please refer to the Programming Guide).

4.3. Display/keypad

The display/keypad module represents the inverter's HMI interface.

It includes seven LEDs, an LCD display with four 16-character lines of text, a buzzer and nine function keys. The display shows parameter values, diagnostic messages and the value of the variables processed by the inverter.

For details concerning the structure of menus, parameter setup, the selection of measurements and the messages shown on the display, please refer to the Programming Guide.

Figure 10: Display/keypad

Key	Function
ESC	BROWSING – Used for quitting menus and submenus (the display moves up a menu level).
	PROGRAMMING – In programming mode (flashing cursor) it ends parameter modification and allows the user to select the next set of parameters (the switch from programming mode to display mode is indicated by the cursor which stops flashing). The value of the modified parameter is NOT saved on the non-volatile memory, consequently it will be lost when the equipment is turned off.
	BROWSING – Scrolls through the menus and submenus, the pages in the submenus or parameters in descending order.
	PROGRAMMING – Down arrow; decreases the value of the parameter.
	BROWSING – Scrolls through the menus and submenus, the pages in the submenus or parameters in ascending order.
	PROGRAMMING – Up arrow; increases the value of the parameter.
SAVE/ENTER	BROWSING – For entering menus and submenus and selecting parameters for modification (the switch from display mode to programming mode is indicated by the cursor which starts flashing).
	PROGRAMMING – Saves the value of the modified parameter on the non-volatile memory to prevent the modifications from being lost when the equipment is turned off.
MENU	BROWSING - Each time this key is pressed it moves to the next status page.
TX | RX	Not used for this application.
RESET	Resets an alarm once the condition which caused it has been rectified.
START	Starts the device. The START command is stored in the memory. If the inverter switches itself off without having received the STOP command, when it comes back on, the run status will still be active and as soon as the solar radiation conditions are adequate, the inverter will connect to the grid in parallel and supply power.
STOP	Stops the device. The STOP command is stored in the memory. If the inverter switches itself off, the STOP command will still be active when it is next turned on and the operator must press the START key to start the inverter.

LED	Function
RUN	● Inverter in STOP or STAND-BY Grid Connection Contactor open
	● Inverter running Grid Connection Contactor closed
MPPT ON	● MPPT disabled
	● MPPT enabled
ALARM	● Inverter OK
	● Inverter in ALARM status
PV OK	● PV field voltage too low or too high
	● PV field voltage OK
GRID OK	● Incorrect grid parameters NOTE: ***This LED remains OFF at night and when the PV field is not correctly connected.***
	● Grid parameters OK

Table 2: Function of the display/keypad LEDs

4.3.1. Adjustment of Contrast only

Press the SAVE key for more than 5 seconds; ***TUNING*** appears on the display and the LEDs above the display come on and act as a 5-stage bar whose length is proportional to the level of contrast set. Press the ⩔ and ⩓ keys to adjust the contrast. Press the SAVE key again for at least 2 seconds to return to normal operating conditions with the new contrast setting active.

4.3.2. Adjusting the Contrast, Backlighting and Buzzer

Press the TX|RX + SAVE keys for more than 5 seconds to enter full setup mode. Use the ⩔ and ⩓ keys to scroll through the seven display/keypad parameters. Once the parameter you wish to modify is displayed, select by pressing the PROG key to enter setup mode and then use the ⩔ and ⩓ keys to alter the parameter accordingly. Press SAVE to save the new value in the display/keypad unit's non-volatile memory.

The table below provides a summary of the values which can be set for the various parameters and their meanings.

Parameter	Possible values	Meaning
SW ver.	-	Indicates the version of the software installed in the display/keypad unit (cannot be modified).
Language	Not used for this application	
Contrast	**LOC**	Contrast is set locally on the display
	REM	Contrast is set by the inverter which forces the display setting
Contrast val.	**nnn**	Numerical value of contrast adjustment from 0 (low) to 255 (high)
Buzzer	**KEY**	The buzzer sounds when the keys are pressed
	REM	The buzzer is controlled by the inverter
	OFF	The buzzer is disabled
Backlight.	**ON**	LCD backlighting is permanently ON
	REM	LCD backlighting is controlled by the inverter
	OFF	LCD backlighting is permanently OFF
Address	Not used for this application	

Table 3: Display/keypad parameter setup

Once all parameter values have been set, press the SAVE key for more than 2 seconds to return to normal operation.

4.4. Converter Module

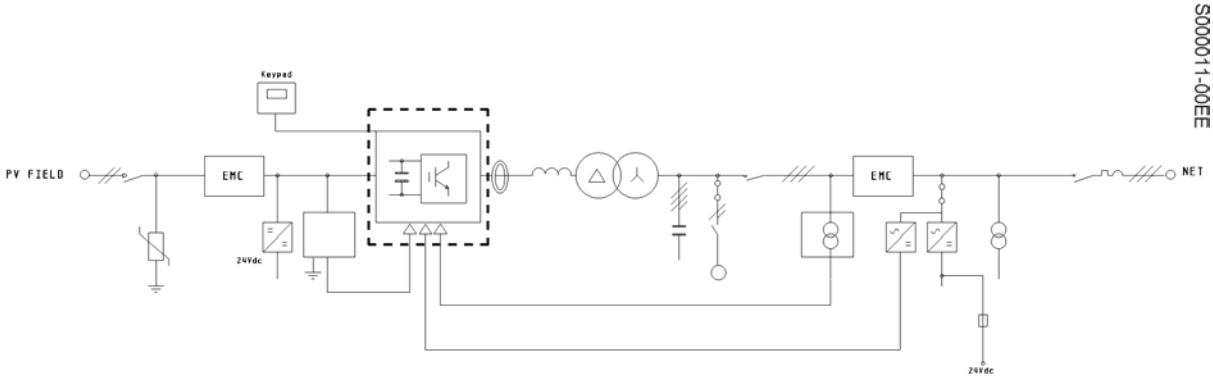


Figure 11: Single-line diagram of a SUNWAY TG - dotted line highlighting the converter module

SUNWAY TG modules are designed using a modular approach in order to maintain high standards in quality and guarantee maximum performance.

The conversion unit is the module with component ID code 12U1 (11U1) in the Electrical and Mechanical Diagram. It houses the DSP control board and the IGBT power switching devices using avant-garde conversion technology which guarantees excellent reliability over time, even in the most demanding conditions.

Should any faults arise involving the conversion unit, the inverter has been specially designed to make repair and replacement operations quick and easy, thus limiting machine downtimes.

Convertors can be either monolithic or modular. Larger inverters use modular converters, first-class technology in terms of performance and simplicity of maintenance operations.

For further details and the list showing correspondence between the inverter and converter installed, please refer to the heading "Installed Converter Module".

4.5. Isolation Control Device

The inverter continually checks insulation resistance between the power supply and earth, indicating any isolation loss.

The method of intervention and signalling if isolation loss is detected can be programmed:

- Isolation loss generates a WARNING signal but does not stop the inverter.
- Isolation loss generates an ALARM and stops the inverter.
- Isolation loss is disabled.

Please refer to the Programming Guide in the Alarm Auto-reset menu.

If the PV field Earthed option is installed isolation loss is not checked. However, the inverter does indicate that earth connection fuses have blown (please refer to the heading “Earthed Option – Connection of the PV Field to Earth”.

Depending on production batches and product updates, two distinct isolation control boards may be installed which can be distinguished by the position of the configuration switches and by certain functions. The two boards are described later in the manual.

4.5.1. Isolation Control Board ES768

It is possible to select the alarm threshold by means of jumpers JP2, JP3 and JP4 on the control board. See Figure 12: Isolation Control Board ES768

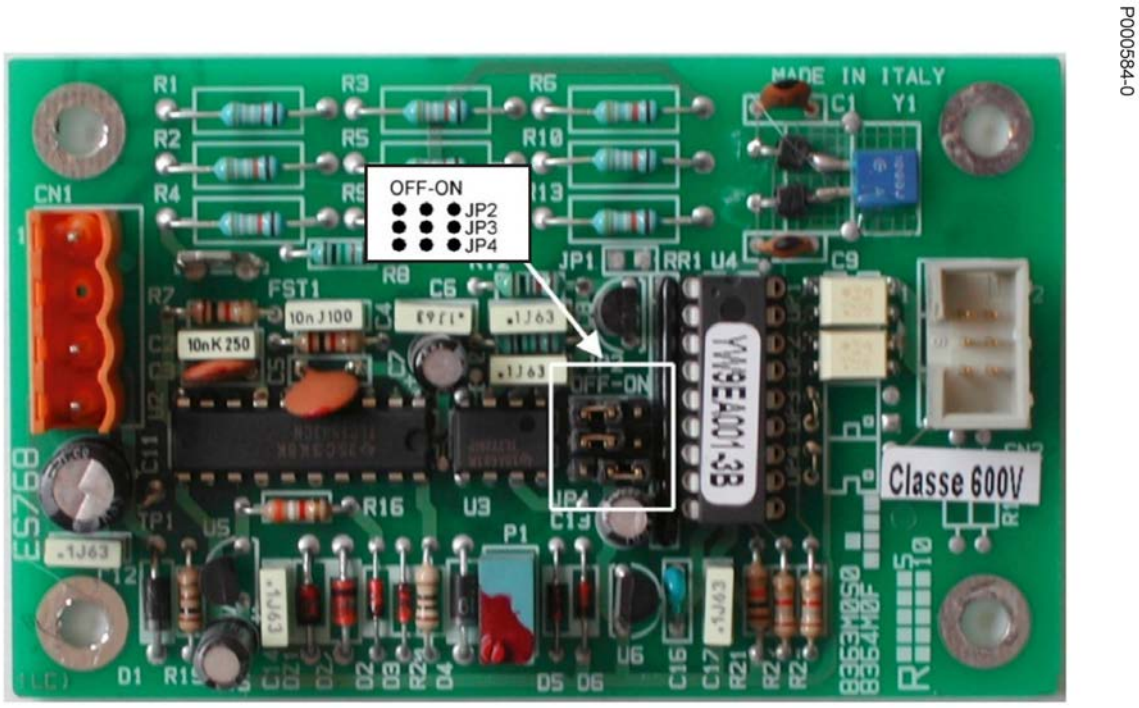


Figure 12: Isolation Control Board ES768

Table 4: Jumper positions indicates the relationship between the position of the Jumpers JP2, JP3 and JP4 on the board and the relative isolation resistance threshold values below which an alarm is generated.

JP2	JP3	JP4	Isolation resistance
ON	ON	ON	12.5 kΩ (±10%)
OFF	ON	ON	25 kΩ (±10%)
ON	OFF	ON	37.5 kΩ (±10%)
OFF	OFF	ON	50 kΩ (±10%)
ON	ON	OFF	62.5 kΩ (±10%)
OFF	ON	OFF	78 kΩ (±10%)
ON	OFF	OFF	87 kΩ (±10%)
OFF	OFF	OFF	100 kΩ (±10%)

Table 4: Jumper positions

The factory setting envisages an isolation resistance of 100 kΩ (±10%).

4.5.2. Isolation Control Board ES942

It is possible to select the alarm threshold by means of the Rotary Switch CE1 located on the control board. See Figure 13: Isolation Control Board ES942

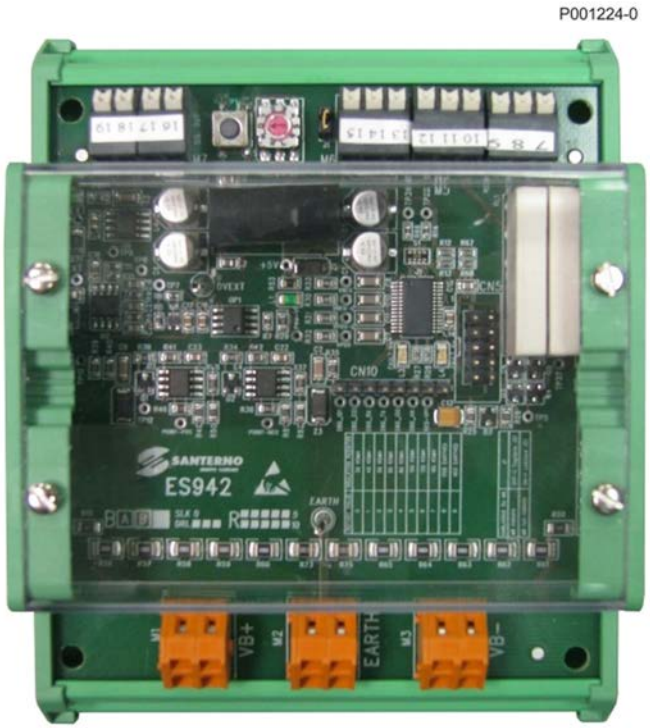


Figure 13: Isolation Control Board ES942

Table 5: Rotary switch position indicates the relationship between the position of the Rotary Switch CE1 located on the board and the relative isolation resistance threshold values below which an alarm is generated.

Positions 8 and 9 refer to configurations for the Earthed PV field (please refer to the heading “Earthed Option – Connection of the PV Field to Earth”).

Rotary value	Isolation resistance value
0	30 KΩ
1	40 KΩ
2	50 KΩ
3	60 KΩ
4	80 KΩ
5	100 KΩ
6	130 KΩ
7	160 KΩ
8	POS EARTHED
9	NEG EARTHED

Table 5: Rotary switch position

The board is fitted with an AUTO-TEST button. When button “P1” is pressed, an isolation leakage alarm is simulated for 30 seconds. During the test the board’s self-diagnostics LEDs (L3, L4) flash slowly.

The factory setting envisages an isolation resistance of 100 kΩ (±10%).

4.6. Surge Protection

SUNWAY TG inverters are protected from power surges on the PV field input by appropriate Class II SPDs (Surge Protective Devices), suitable for protecting the equipment from indirect discharges.

The “Y” configuration has been adopted which is perfectly compatible with Earthed or floating PV field plants (please refer to the heading “Earthed Option – Connection of the PV Field to Earth”).

The SPDs are referred to in the Electrical and Mechanical Diagram using the component ID codes 10AP1, 10AP2 and 10AP3.

Each SPD is protected by an integrated MCCB (Moulded Case Circuit Breaker) against any overload of the component.

Should the MCCB trip, a signalling contact is made available on terminal X3, contacts 56 and 57.

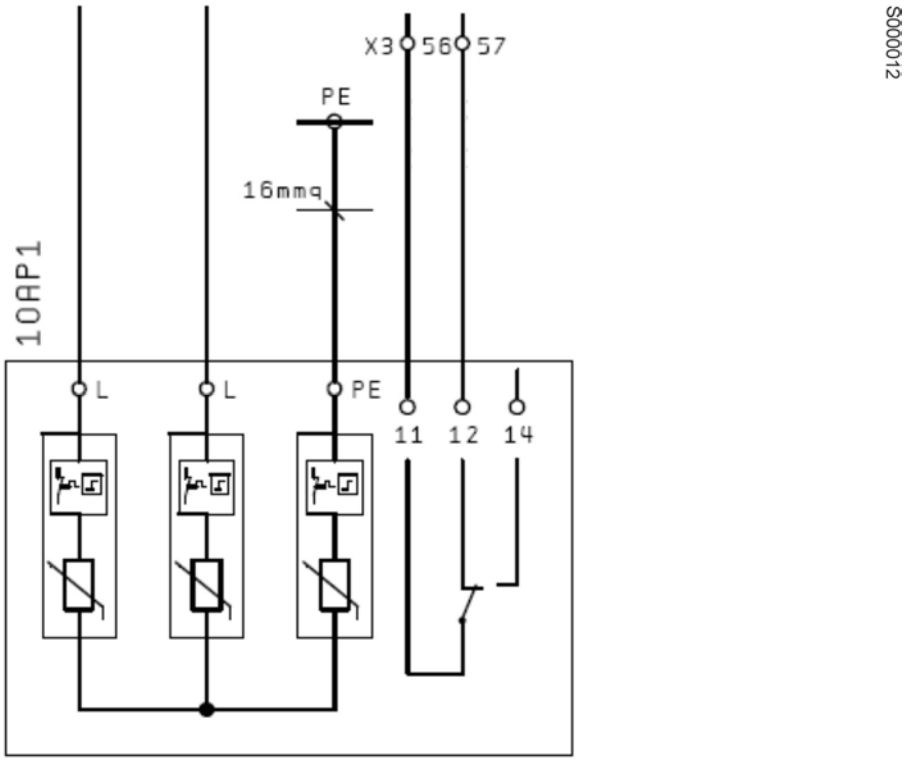


Figure 14: SPD (Surge Protective Device)

As well as the integrated MCCB, a pair of back-up fuses are installed in SUNWAY TG inverters which are co-ordinated with the SPDs.

No surge protective devices are provided for the AC output section.

The configuration adopted by Elettronica Santerno has proved to be very reliable and effective in the field. However, the PV plant designer may include further protective devices both in inverter input and output in addition to the ones already installed. Please refer to the heading “SPD Configuration”.

For the technical features, please refer to the heading “SPDs”.

4.7. Serial Ports

SUNWAY TG inverters are equipped with a COM0 serial communication port for connecting external devices.

If the optional Data Logger is installed, two further serial ports (COM1 and COM2) are also made available (please refer to the heading "Data Logger Option") as well as an Ethernet port.

The main features of the serial ports are listed below:

- RS485 Bus with standard MODBUS/RTU protocol

For further information on remote control, serial ports and the Ethernet port, please refer to the heading “COMMUNICATION AND REMOTE CONTROL”.

4.8. Environmental Measures

This function is an optional extra, please consult the chapter "OPTIONAL EXTRAS".

SUNWAY TG inverters have six inputs for environmental measures via the environmental sensors expansion and field I/Os board.

Inputs available for SUNWAY TG:

- Four 12-bit resolution inputs configurable as 0-10 V f.s., 0-20 mA f.s., 0-100 mV f.s., temperature acquisition with two-wire PT100.
- Two 12-bit resolution inputs, 0-10 V f.s.

The factory settings of the six environmental inputs are indicated in the table below:

Environmental measure	Sensor type	Factory setting	Measure
Environmental measure 1	Sample cell	0-100 mV	Module surface radiation
Environmental measure 2	Sample cell	0-100 mV	Horizontal surface radiation
Environmental measure 3	Thermocouple	PT100	Ambient temperature
Environmental measure 4	Thermocouple	PT100	Module temperature
Environmental measure 5	Anemometer	0-10 V	Wind direction
Environmental measure 6	Anemometer	0-10 V	Wind speed

Table 6: Factory settings of environmental inputs

The environmental sensor inputs are available on the X3 terminal board (please refer to the Electrical and Mechanical Diagram).

For connection of the sensors please refer to the heading “Environmental Inputs and Field I/Os Connection”.

For the technical specifications, please refer to the heading “Environmental Sensors and Field I/Os Expansion Board”.

4.9. Acquisition of Energy Measurements from External Meters

This function is an optional extra, please consult the chapter "OPTIONAL EXTRAS".

The field I/Os and environmental sensors expansion board makes it possible to connect one or two external pulsed meters for measuring the energy delivered to the grid and the energy absorbed.

For connection of the counters, please refer to the heading "External Pulsed Meters for Measuring Energy".

4.10. Power Control

This function is an optional extra, please consult the chapter "OPTIONAL EXTRAS".

SUNWAY TG inverters come with a 4-wire Power Control function for limiting the power delivered based on external signals. The external signals are usually acquired by the environmental sensors and field I/Os expansion board.

It is also possible to manage the Power Control function by setting, locally or in remote mode, certain parameters.

An 0-10 V analogue input can also be used. This mode is implemented on the inverter by means of a factory configuration. For this purpose, please contact the Elettronica Santerno SpA CUSTOMER SERVICE.

Please refer to the Programming Guide for correct programming of the Power Control function.

For connection of the external signals, please refer to the heading “External Signals for Controlling Power Delivery”.

4.11. Programmable Digital Output

This function is an optional extra, please consult the chapter "OPTIONAL EXTRAS".

A programmable digital output is available on SUNWAY TG inverters. It is located on terminal X3, contacts 20, 21 and 22. Please refer to the Electrical and Mechanical Diagram.

For further details on how to program the digital output, please refer to the Programming Guide.

4.12. Ventilation System

SUNWAY TG inverters have a modular ventilation system made up of the following elements:

- a series of fans installed on the converter
- a series of fans inside the cabinet

The fans installed on the converter are driven directly by the control board.

The fans installed in the cabinet are interlocked with an electronic thermostat.

The thermostat is indicated with the ID code 14A1 (see Electrical and Mechanical Diagram) and the thresholds are set as follows:

- OUT1, the fans switch on at 31 °C and switch off at 29 °C.

For the technical data concerning ventilation absorption and flow rate, please refer to the heading “Ventilation System”.

4.12.1. External Power Supply for Ventilation

The cabinet ventilation system may be powered by an external power source in order to save the energy delivered to meet fiscal incentives.

Please refer to the heading "External Power Supply for Ventilation".

5. HANDLING AND ASSEMBLY

5.1. Conditions for Transport

Handling may be carried out using one of the following systems:

- Hoist
- Pallet jack
- Forklift

For further information, please consult heading “Measurements and Weights”.

WARNING

For safety reasons and to ensure correct operation, it is strictly PROHIBITED to tilt SUNWAY TG inverters forward or backwards.

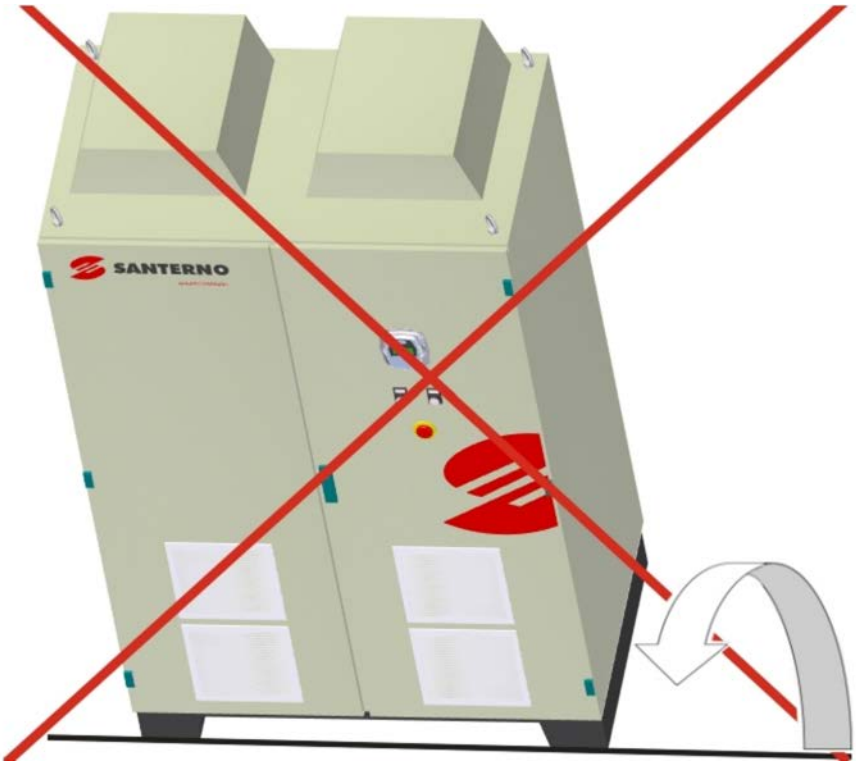


Figure 15: Inverter tilting

5.1.1. Hoisting the Equipment

To hoist the equipment use the eyebolts and/or the perforated bars incorporated in the inverter frame. Make sure that the length of the hoisting ropes is such to form an angle which does not exceed 60 °.

The following figures show the correct way of hoisting the inverter.

Inverter with two-door cabinet

Figure 16: Hoisting the Inverter

5.1.2. Crane Fork Hoisting

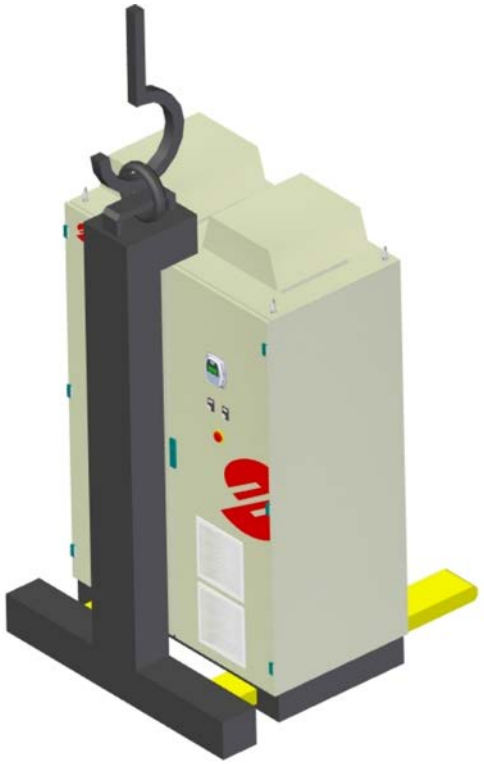


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Figure 17: Hoisting the inverter with a crane fork

5.1.3. Handling Using a Pallet Jack or Forklift Truck

If the inverter is to be lifted from underneath, a forklift must be used. Position the fork tines in the spaces along the base which must be opened up beforehand by removing the central base panels.

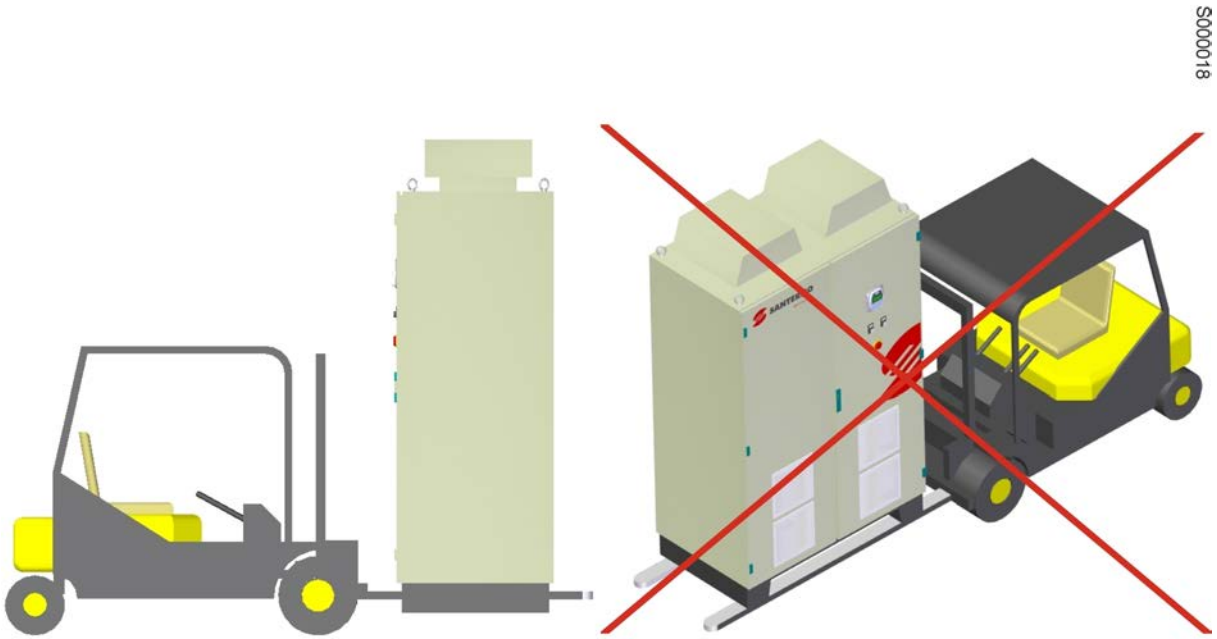


Figure 18: Lifting the equipment from underneath

5.2. Environmental Requirements for Storage and Transport

Required conditions	
Ambient temperature for storage and transport	-25 °C ÷ +70 °C
Ambient humidity for storage	From 5% – 95%, from 1 g/m^3 – 25 g/m^3, with no condensation or ice formation (category 3K3 in compliance with EN50178).
Ambient humidity during transport	Maximum 95% up to 60 g/m^3. Slight condensation may occur when the equipment is not running (category 2k3 in compliance with EN50178).
Atmospheric pressure for storage	86 – 106 kPa (categories 3k3 and 1k4 in compliance with EN50178).
Atmospheric pressure during transport	70 – 106 kPa (category 2k3 in compliance with EN50178).

Table 7: Environmental requirements for storage and transport

5.2.1. Base

To lift the cabinet off the pallet and for final positioning, remove the front and back plates found on the base so that the forklift tines can be inserted under the cabinet. Please refer to the heading “Centre of Gravity and Fork Tine Positioning”.

After the cabinet has been positioned the openings can be closed off by replacing the plates.

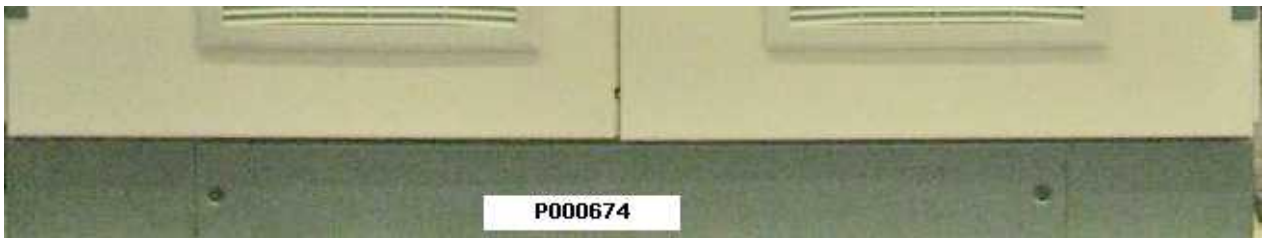


Figure 19: Base with removable plate

Figure 20: Base with the plate removed

5.3. Assembly of the Inverter on the Installation Site

All inverters belonging to the SUNWAY TG series are designed for indoor installation.

WARNING

Environmental conditions significantly affect the life-expectancy of inverters, consequently DO NOT install the inverter in a location which does not meet the required specifications.

Provide adequate ventilation or air cooling system.

NOTE

Always leave enough room in front of the inverter to be able to fully open the cabinet doors.

In order to prevent problems in door closure and/or incorrect operation of the door microswitches, the cabinet must be perfectly level even using shims if necessary.

The correct distances to be observed are indicated in the table “Clearance values for SUNWAY TG”.

5.3.1. Centre of Gravity and Fork Tine Positioning

This heading concerns the position of the SUNWAY TG inverters' centre of gravity. The indication refers to the distance of the centre of gravity from the far left of the cabinet.

To assist in handling operations the correct position for the fork tines is indicated, taking into consideration the gaps available in the inverter base.

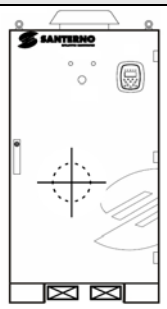
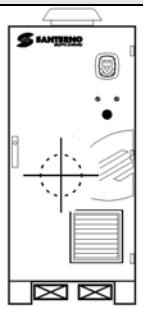
SUNWAY TG One-door model W = 800	
	

Table 8: Centre of gravity and fork tine position for one-door model W = 800

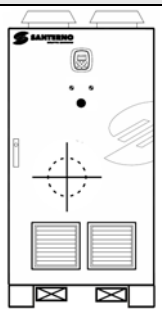
SUNWAY TG One-door model W = 1000


Table 9: Centre of gravity and fork tine position for one-door model W = 1000

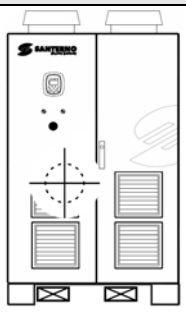
SUNWAY TG Two-door model W = 1200


Table 10: Centre of gravity and fork tine position for two-door model W = 1200

5.4. Removal of Transport Bracket

SUNWAY TG inverters are fitted with a support bracket for the transformer which must be removed once assembly has been completed.

WARNING

Failure to remove the bracket may lead to excessive noise due to vibration of the frame.

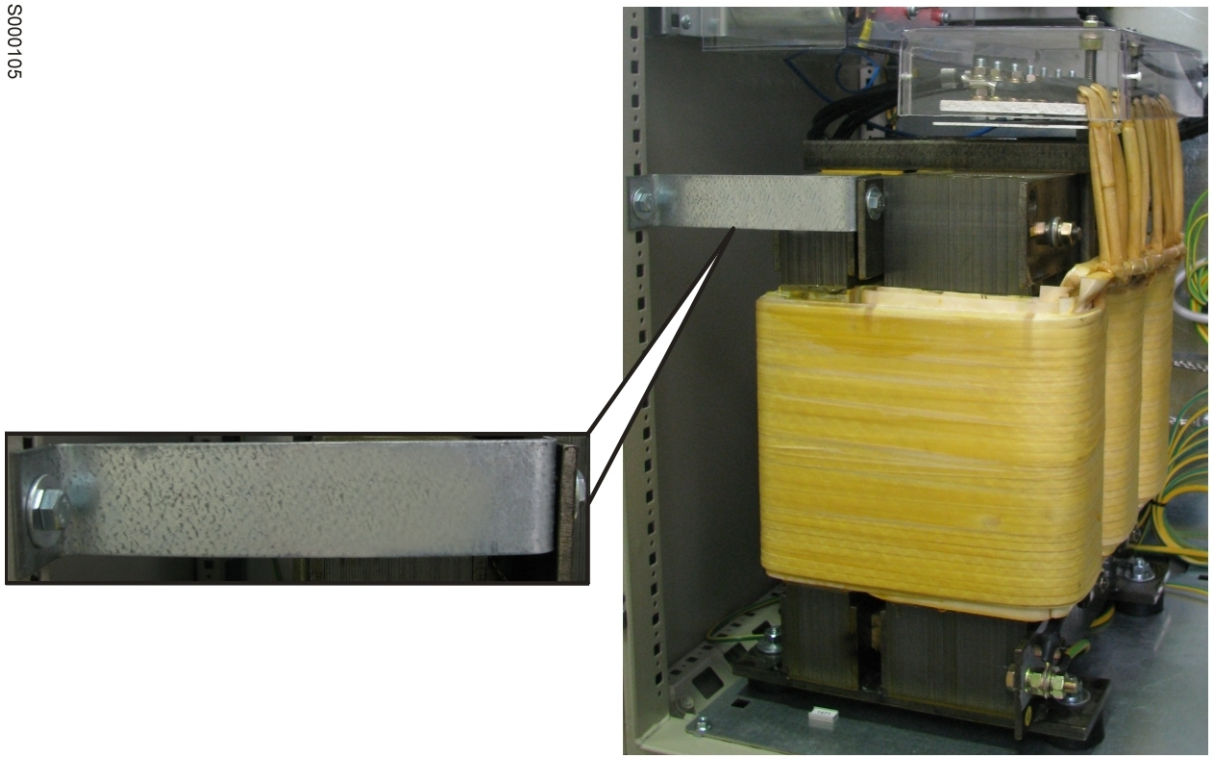


Figure 21: Removal of the transformer bracket

6. INSTALLATION AND COMMISSIONING

Figure 22: Internal view of the SUNWAY TG inverter cabinet

The following paragraphs provide information on power and signal cable connection, how to connect multiple inverters in parallel and commissioning.

6.1. Wire Connection Terminal Board

Terminal	Type	Function
X1	Power	Three-phase AC grid
X2	Power	PV field
X3	Signals	Auxiliary terminal board
X4	Signals	COM0, COM1 and COM2 serial links
X7	Auxiliary circuits power supply	Auxiliary mains and UPS

Table 11: Wire Connection Terminal Board

6.1.1. Cable Inlet

Cable inlet is at the bottom of the cabinet. Please refer to the Electrical and Mechanical Diagram, sheets 7 and 8.

6.1.2. DC Cable Connection

For the technical data concerning the number of cables to be connected, the maximum allowable cross-section and cable lug type, please refer to the heading “DC Connection - Cables".

6.1.3. AC Cable Connection

For the technical data concerning the number of cables to be connected, the maximum allowable cross-section and cable lug type, please refer to the heading “AC Connection - Cables".

6.1.4. Connecting Earth Cables

For the technical data concerning the number of cables to be connected, the maximum allowable cross-section and cable lug type, please refer to the heading “Connection of Earth Cables".

6.1.5. Connecting the Signal and Auxiliary Power Supply Cables

For the technical data concerning the number of cables to be connected, the maximum section and cable lug type, please refer to the heading “Connection of the Signal and Auxiliary Power Supply Cables ".

6.2. External Emergency Stop Command Management

The emergency function can have a remote operation facility by means of a contact. For this purpose, two terminals are available, X3-60 and X3-61 (please refer to the Electrical and Mechanical Diagram).

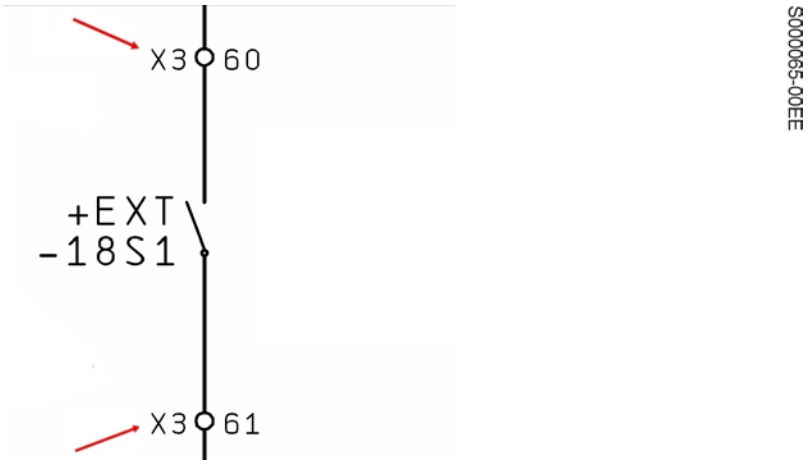


Figure 23: External emergency stop command contact

6.3. Connecting Multiple Inverters in Parallel

SUNWAY TG inverters can easily be connected in parallel on the AC output, with maximum simplicity in terms of design and installation.

6.4. Segregation and Lead-sealing of AC Output

The AC output section of inverters uses commercial switches which can be lead-sealed for anti-fraud purposes.

For this purpose, the inverter is supplied with special sealable terminal covers for the AC output switches (see the following figures).

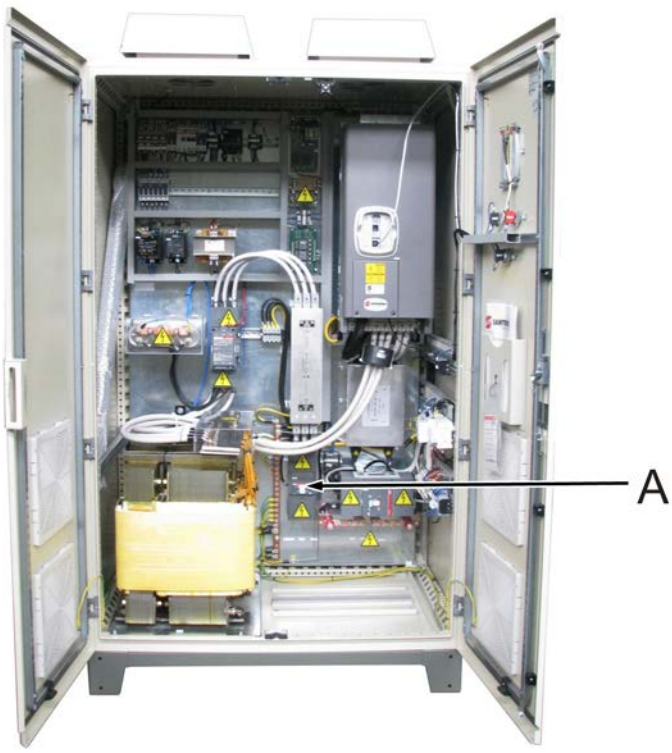


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Figure 24: Lead-sealable AC output section segregation

A Lead-sealable AC output section segregation

S000022-00EE

Figure 25: Sealable terminal covers

6.5. Connection to the Communications Ports

Please refer to “COMMUNICATION AND REMOTE CONTROL” under the heading "Connection".

6.6. Connection to the Environmental and Field I/O Inputs

This function is an optional extra, please consult the chapter "OPTIONAL EXTRAS".

SUNWAY TG inverters have six inputs for environmental measures via the environmental sensors and field I/O expansion board. For the technical specifications of the environmental sensors and field I/Os expansion board, please refer to the heading “Environmental Sensors and Field I/Os Expansion Board”.

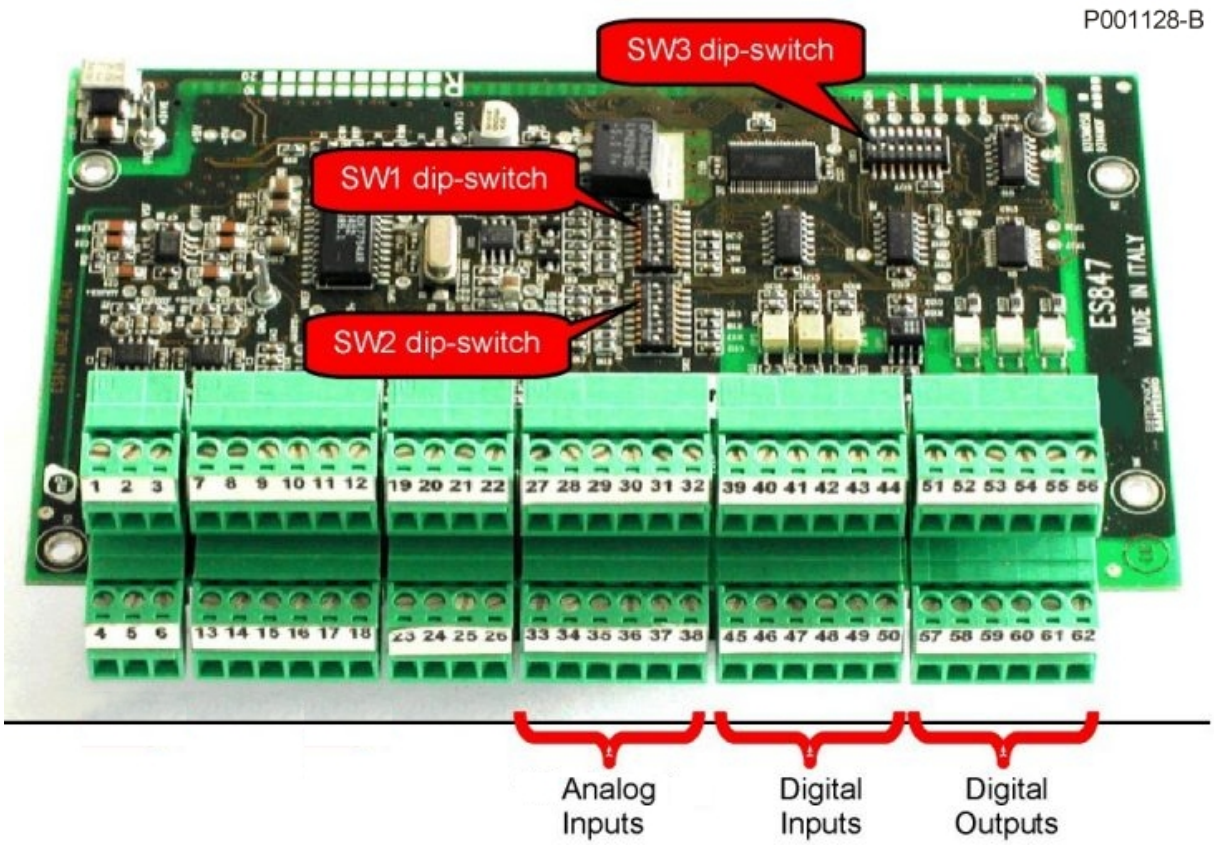


Figure 26: Environmental sensors and filed I/Os Expansion Board

6.6.1. Environmental Sensors Terminal Board

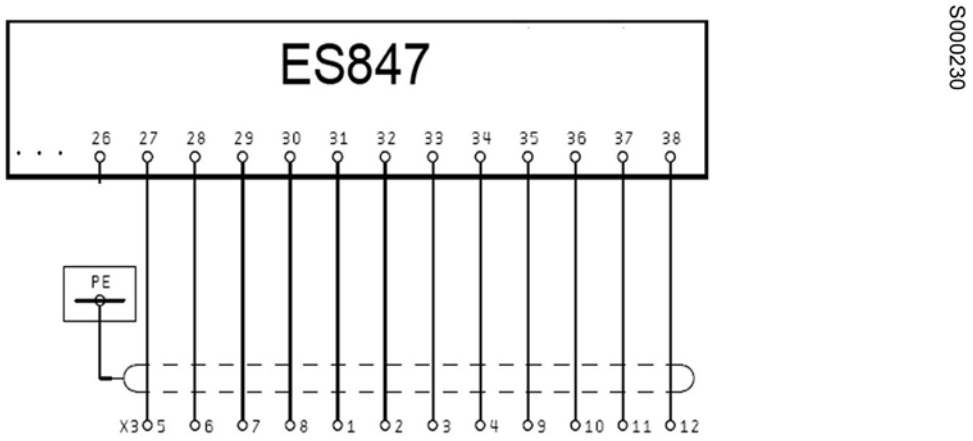


Figure 27: Diagram of environmental sensors terminal board

Environmental measure	Type of sensor set in the factory	Factory setting	Terminal
Environmental measure 1	Sample cell	0-100 mV	X3, contacts 5-6
Environmental measure 2	Sample cell	0-100 mV	X3, contacts 7-8
Environmental measure 3	Thermocouple	PT100	X3, contacts 1-2
Environmental measure 4	Thermocouple	PT100	X3, contacts 3-4
Environmental measure 5	Anemometer	0-10 V	X3, contacts 9-10
Environmental measure 6	Anemometer	0-10 V	X3, contacts 11-12

Table 12: List of environmental sensors terminals

6.6.2. Configuration DIP-switches

The environmental sensors and field I/Os expansion board is equipped with 3 configuration DIP-switches (see **Figure 26:**) which allow the user to set the operating mode as indicated in Table 13: Function of the 3 DIP-switches on the environmental sensors and field I/Os expansion board.

DIP-switch	Function
SW1	For setting the operating mode for the environmental analogue inputs 1 and 2
SW2	For setting the operating mode for the environmental analogue inputs 3 and 4
SW3	Factory-set configuration SW3.2=ON, SW3.5=ON, all the others OFF (do not modify)

Table 13: Function of the 3 DIP-switches on the environmental sensors and field I/Os expansion board

The following table indicates the possible configurations of the SW1 and SW 2 DIP-switches depending on the required set-up of the analogue channels.

SW1

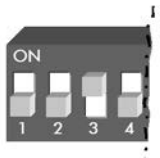
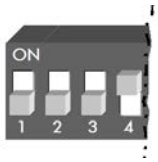
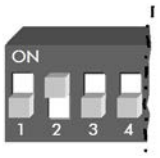
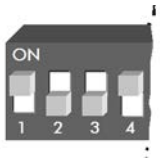
Configuration of environmental analogue channel 1			
0-10 V f.s. mode	0-100 mV f.s. mode	0-20 mA f.s. mode	Temperature reading with PT100 thermistor
			

Table 14: Environmental analogue channel 1 DIP-switch configuration

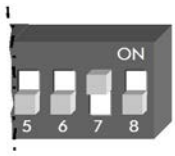
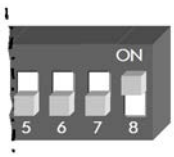
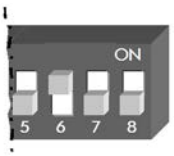
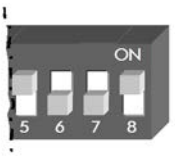
Configuration of environmental analogue channel 2			
0-10 V f.s. mode	0-100 mV f.s. mode	0-20 mA f.s. mode	Temperature reading with PT100 thermistor
			

Table 15: Environmental analogue channel 2 DIP-switch configuration

SW2

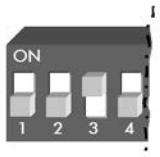
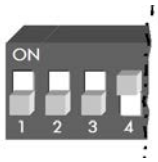
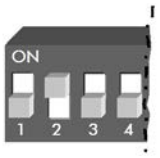
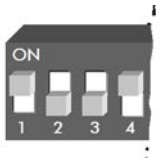
Configuration of environmental analogue channel 3			
0-10 V f.s. mode	0-100 mV f.s. mode	0-20 mA f.s. mode	Temperature reading with PT100 thermistor
			

Table 16: Environmental analogue channel 3 DIP-switch configuration

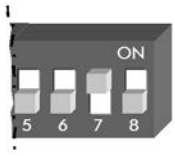
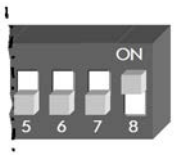
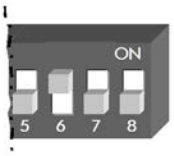
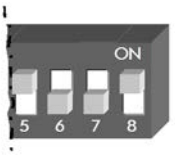
Configuration of environmental analogue channel 4			
0-10 V f.s. mode	0-100 mV f.s. mode	0-20 mA f.s. mode	Temperature reading with PT100 thermistor
			

Table 17: Environmental analogue channel 4 DIP-switch configuration

The factory settings for these DIP-switches are indicated below:

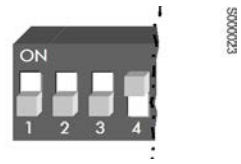
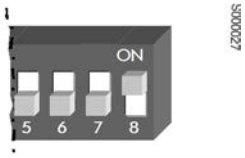
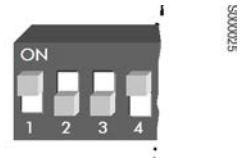
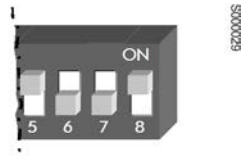
Factory-set configuration	
Environmental analogue channel 1	
0-100 mV f.s. mode	
Environmental analogue channel 2	
0-100 mV f.s. mode	
Environmental analogue channel 3	
Temperature reading with PT100 thermistor	
Environmental analogue channel 4	
Temperature reading with PT100 thermistor	

Table 18: Environmental sensors and field I/Os expansion board DIP-switch configuration

WARNING

The inputs configured for voltage have a high input impedance and must never be left open if active. Isolating a conductor relative to an analogue input configured as a voltage input does not guarantee that the channel reading will be zero. Zero is only correctly detected if the input is wired to a low-impedance or short-circuited signal source. Therefore, do not put relay contacts in series on the inputs to reset the reading.

NOTE

It is necessary to set the software parameters to match the DIP-switch settings. Hardware configuration settings which do not correspond with the type of acquisition set in the parameters produce results which do not reflect the values actually acquired (Please refer to the Programming Guide)

A voltage or current value which exceeds the upper full scale value or is less than the lower full scale value produces a saturated acquired value of the maximum and minimum measures respectively.

6.6.3. Analogue Inputs to Sensors with Voltage Output

It is advisable to carry out connection of the voltage source using a shielded twisted pair by connecting the braid onto the side of the environmental sensors and field I/O expansion board.

Although the “slow” acquisition analogue channels have a cut-off frequency just above 10 Hz, and hence the main source of disturbance, i.e. the grid frequency, is already reduced, it is advisable to take care over the connections especially for configurations with a full scale of 100mV or with connections using cables over 10 metres in length. Figure 28: Connection to 0 – 10 V analogue input and Figure 29: Connection to 0 – 100 mV analogue input provide an example of the connection for voltage source acquisition.

Appropriately set the DIP-switches for configuring the relative analogue channel used, setting the full scale at 10 V f.s. or 100 mV f.s depending on needs and setting the relative programming parameter to be consistent with the settings just made.

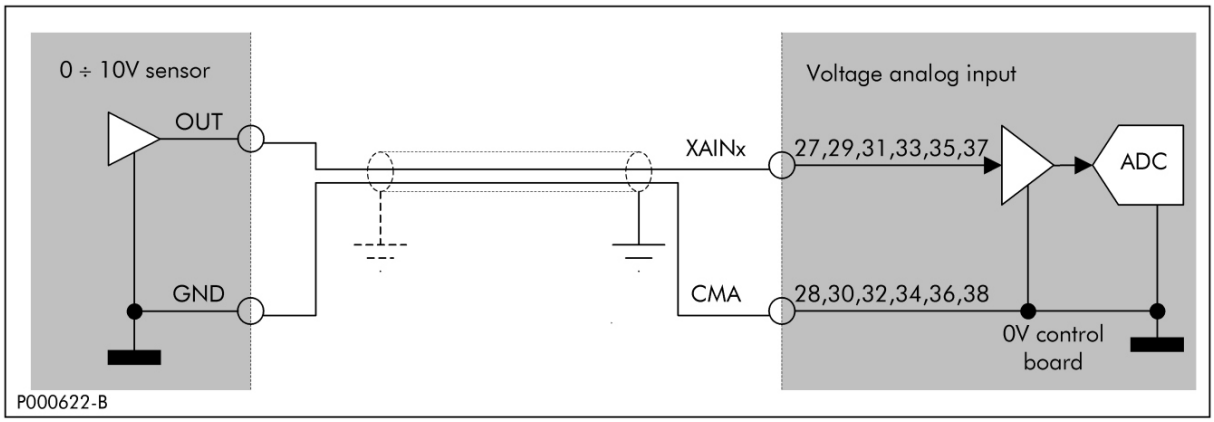


Figure 28: Connection to 0 – 10 V analogue input

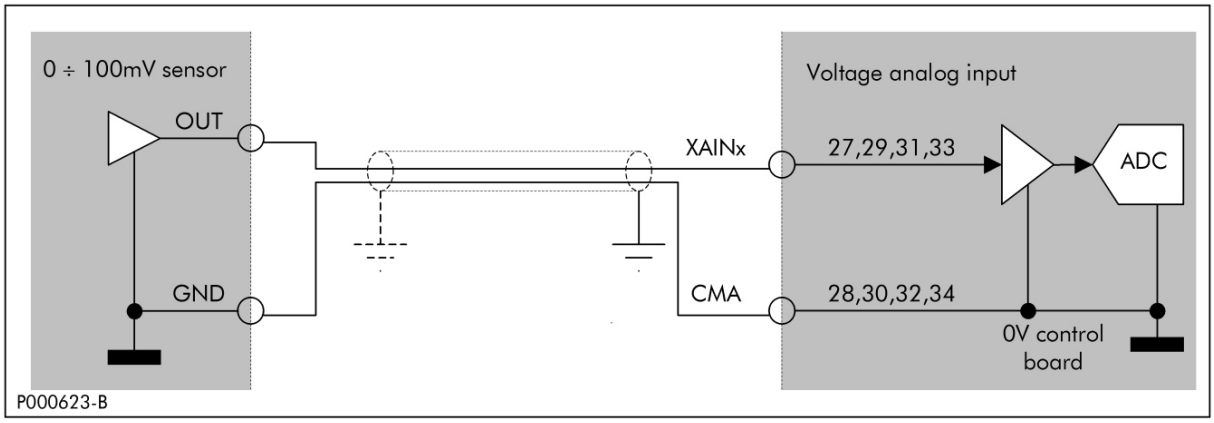


Figure 29: Connection to 0 – 100 mV analogue input

6.6.4. Analogue Inputs to Sensors with Current Output

Connection of the slow analogue inputs to current sources is illustrated in Figure 30: Connection of 0 – 20 mA (4 – 20 mA) sensors to current inputs. The channels capable of receiving current signals with 20 mA f.s. are XAIN8, XAIN9, XAIN10 and XAIN11, which correspond to terminals 27, 29, 31 and 33. As always, it is necessary to set the configuration DIP-switches relative to the analogue channel used by setting the end scale at 20 mA f.s and setting the relative programming parameter at 0 – 20 mA or 4 – 20 mA.

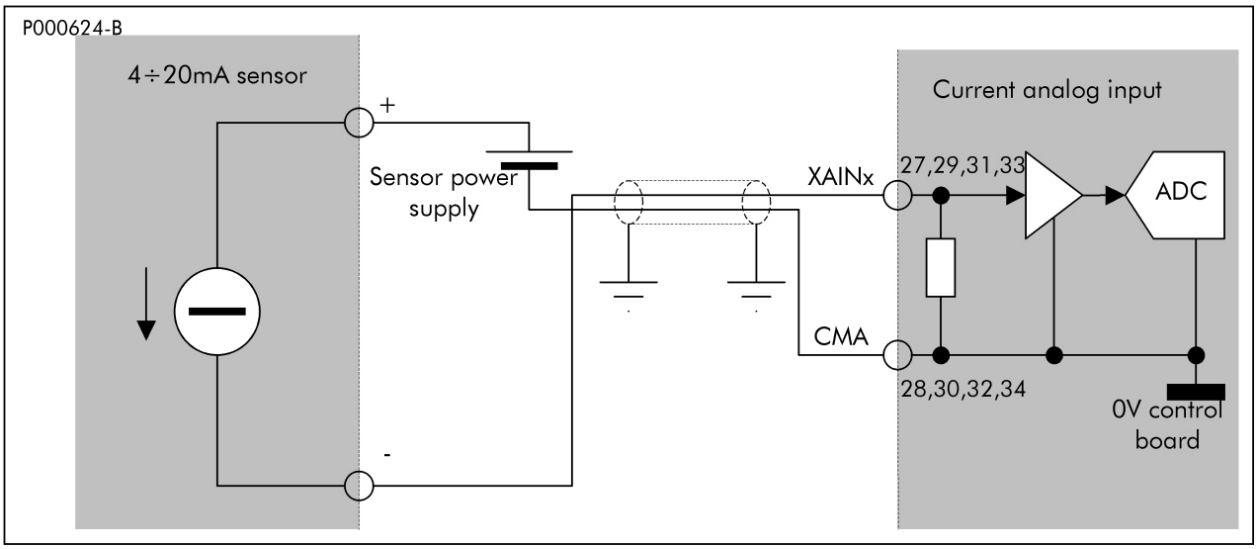


Figure 30: Connection of 0 – 20 mA (4 – 20 mA) sensors to current inputs

6.6.5. Analogue Inputs to PT100 Thermistor

The environmental sensors and field I/Os expansion board makes it possible to directly carry out temperature measurements by means of the connection to the standard PT100 thermistor. To simplify wiring a two-wire connection has been adopted. For this reason it is highly recommended to limit the length of the connection cable and ensure that the cable is not exposed to high temperature variations during operation. The channels capable of receiving PT100 signals are XAIN8, XAIN9, XAIN10 and XAIN11, corresponding to terminals 27, 29, 31 and 33. Figure 31: Connection of the PT100 thermistor to the analogue channel illustrates how to carry out connection: it is advisable to use a shielded cable whose braid is connected directly to the inverter's metal frame using the cable holding terminals provided.

If the connection is made using a cable over 10 metres in length, system measurement calibration must be carried out. For example, if the connection is made using a 1 mm^2 (AWG 17) shielded twisted pair, a reading error equal to approximately +1°C occurs for every 10 metres of cable.

Measurement calibration is obtained by connecting, in place of the sensor, a PT100 sensor emulator set at 0°C (or a precision resistor at 100 Ω 0.1%) to the line terminals and then correcting the relative offset value (please refer to the Programming Guide).

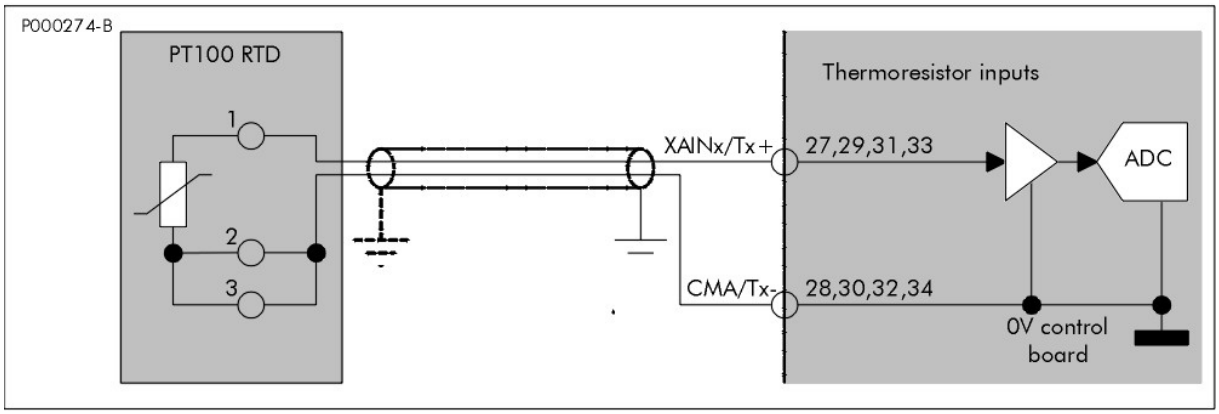


Figure 31: Connection of the PT100 thermistor to the analogue channel

6.6.6. External Pulsed Meters for Measuring Energy

The external meters are connected by means of one or two voltage-free contacts as illustrated below.

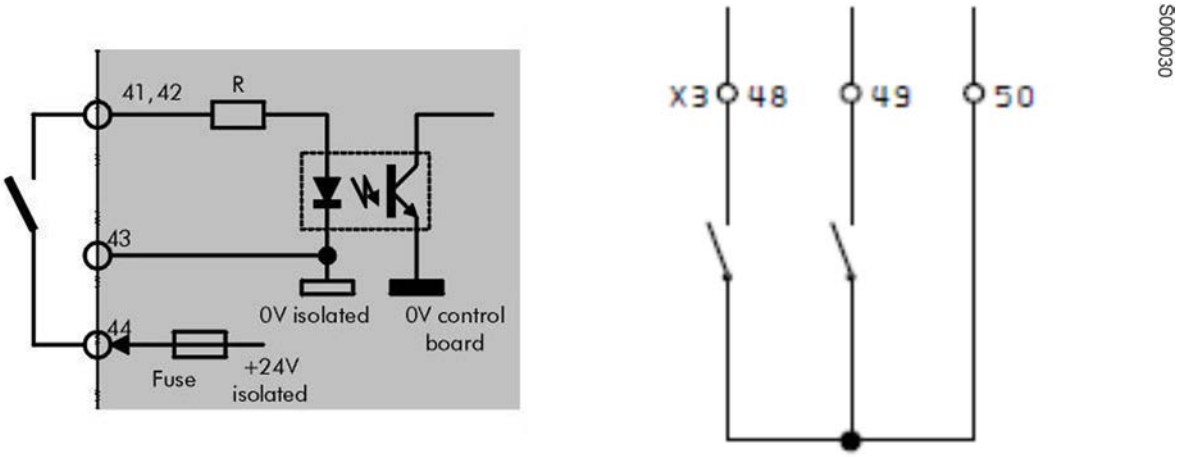


Figure 32: Connection of the external signals for pulsed meter energy measurements

Digital input	Environmental sensors and field I/Os expansion board terminal	Terminal X3	Function
XMDI3	41	48-50	Energy pulsed meter 1
XMDI4	42	49-50	Energy pulsed meter 2

Table 19: Digital inputs for external meters

NOTE

The voltage levels to be used for pulsed meters are:

0 V - Low level

24 V - High level

As an alternative, use a voltage-free or PNP contact and on-board +24V power supply.

The maximum input frequency for auxiliary digital inputs is 40 Hz.

The external contacts must be potential free. Please refer to the Programming Guide for correct setting of the scale factors of the external pulsed meters.

6.6.7. External Signals for Controlling the Power Delivered

Digital inputs available for SUNWAY TG:

Digital input	Board terminal	Terminal X3	Function
XMDI1	39	64-65	Multifunction auxiliary digital input 1 used for controlling the power delivered.
XMDI2	40	64-66	Multifunction auxiliary digital input 2 used for controlling the power delivered.
XMDI5	45	64-67	Multifunction auxiliary digital input 3 used for controlling the power delivered.
XMDI7	47	64-68	Multifunction auxiliary digital input 4 used for controlling the power delivered.

Table 20: Digital inputs for controlling the power delivered

4-WIRE POWER CONTROL FUNCTION

Connection of the external signals for management of the power delivered is carried out via four voltage-free contacts as illustrated below.

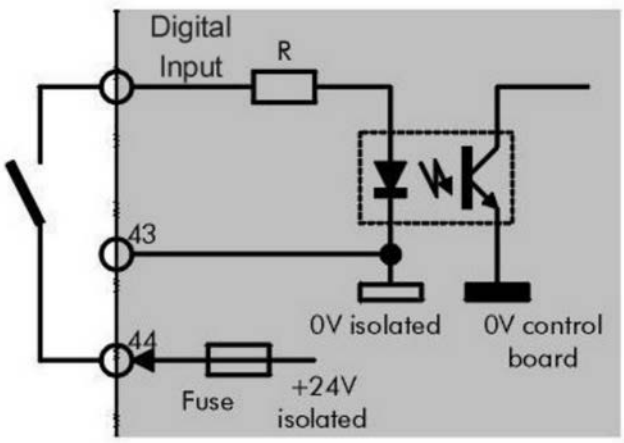


Figure 33: Connection of the external signals for controlling the power delivered

NOTE

The voltage levels to be used for the external signals for controlling the power delivered are:

0 V - Low level

24 V - High level

As an alternative, use a voltage-free or PNP contact and on-board +24V power supply.

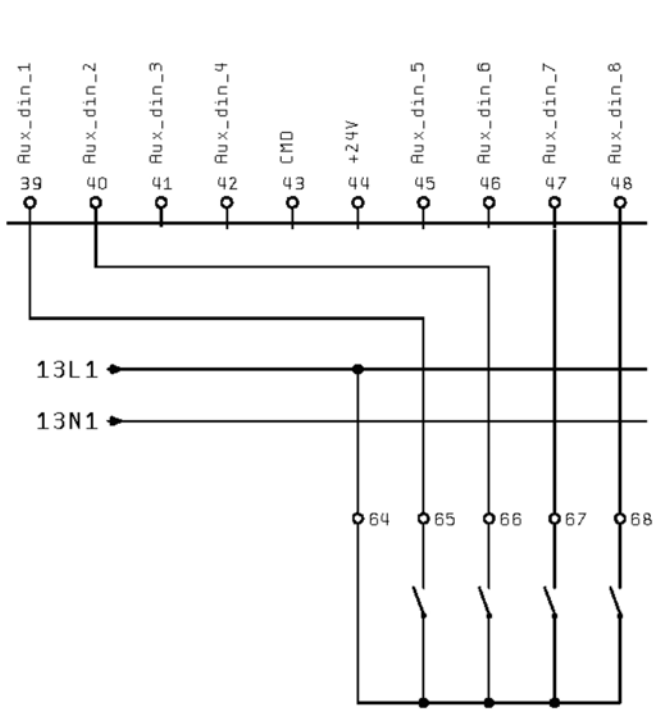


Figure 34: External signals for controlling the power delivered via four contacts

Please refer to the Programming Guide for correct programming of the Power Control function.

POWER CONTROL FUNCTION WITH 0 - 10 V ANALOGUE SIGNAL

The Power Control function allows the power delivered to be controlled also by an 0 - 10 V analogue signal.

6.7. Auxiliary Circuits Power Supply

6.7.1. UPS

SUNWAY TG inverters can be connected to a UPS (to guarantee back-up power for the Santerno anti-theft system) on terminals X7-3 and X7-4 (please refer to the Electrical and Mechanical Diagram).

Factory configuration involves jumpers between terminals X7-1 and X7-3 and between terminals X7-2 and X7-4.

If connection to a UPS is made, remove the jumpers between X7-1 and X7-3 and between X7-2 and X7-4. Terminals X7-1 and X7-2 remain free but must NOT be used.

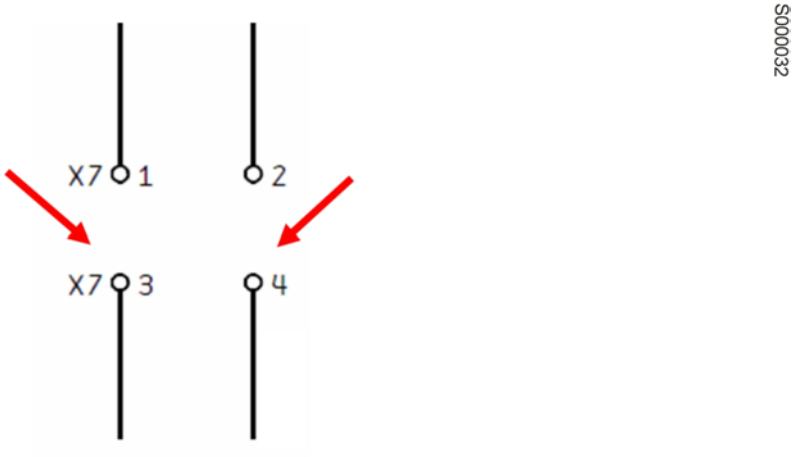


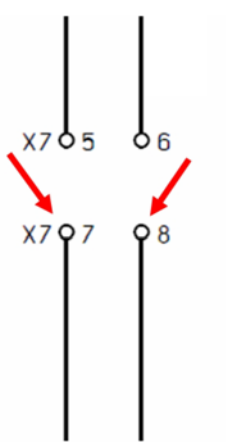
Figure 35: Terminals available for connection to a UPS

6.7.2. External Power Supply for Ventilation

The cabinet ventilation system may be powered by an external power source in order to save the energy delivered to meet fiscal incentives. For this purpose, two terminals are available, X7-7 and X7-8 (please refer to the Electrical and Mechanical Diagram).

The factory setting involves jumpers between terminals X7-5 and X7-7 and between terminals X7-6 and X7-8. If the power supply to the cabinet ventilation system is external, remove the jumpers between terminals X7-5 and X7-7 and between X7-6 and X7-8. Terminals X7-5 and X7-6 remain free but must NOT be used.

The inverter must be appropriately programmed by setting the parameter relative to the auxiliary power supply (please refer to the Programming Guide, Manager menu). In this way, the auxiliary power supply is continuously monitored so that should it be cut off, the inverter stops. Hence maximum safety is ensured for operation of the SUNWAY TG.



S000033

Figure 36: External Power Supply for Ventilation

6.8. Configuration of the IT/non-IT System

It is usually preferable for the PV field configuration to be an IT type.

An IT configuration guarantees continuity of service and makes it possible to handle single earth fault by means of simple detection systems.

Usually the IT configuration of the plant is lost when one of the following occurs:

- Earth fault
- Installation of the Earthed Option (please refer to the heading “Earthed Option – Connection of the PV field to earth”).

6.9. Commissioning

This chapter deals with the essential procedures involved in equipment commissioning.

WARNING

Before interconnecting the SUNWAY TG to the PV field, check that all the power, signal and auxiliary connections are securely tightened.

Before connecting the PV field cables to the inverter, check:

- the polarity of the individual sub-field connections to the DC-Parallel (if installed) is correct.

- the polarity of the individual string connections to the String Boxes (if installed) is correct.

Checks:

- Check DC switch 10-QM1 is open.
- Check grid AC switch 16-QM12 is open.
- Check the emergency stop button is released and inhibit door safety by means of the relative Key-operated selector switch located on the front of the cabinet.
- Access terminal board X2 and check the correct polarity of the PV field input terminals.
- Turn on the main switch upstream to power the inverter's AC output.
- Check the correctness of the phase-to-phase voltage at terminal board X1.

Inverter power supply:

- Close the DC switch located inside the cabinet. If the field voltage is sufficient, the inverter comes on in STOPPED status.
- Close the AC switch. After a few seconds the GRID LED on the display comes on.

NOTE

The optional Interface Protection (IP) is sensitive to the phase sequence of the grid voltage. If installed and the GRID LED does not light up on the display this may be due to incorrect phase sequence. Check the LED indicators on the device. If necessary, invert the two phases on the X1 terminal board.

- The equipment is now ready to deliver active power to the grid with power factor = 1 and is ready for automatic maximum power point tracking (Automatic MPPT) Close the cabinet doors and enable door safety by means of the relative Key-operated selector switch located on the front of the cabinet.
- Enable the cabinet by means of the relative Key-operated selector switch located on the front of the cabinet and press the START button on the display/keypad. If the open-circuit voltage of the PV field exceeds the value set in parameter P020*1.1 (Field Menu), the inverter will start running and begin delivering power to the grid.

NOTE

Pressing of the START button is a condition stored in the system memory, hence, if the SUNWAY TG power supply is cut off without an alarm tripping or without the STOP button being pressed, the inverter will still have the RUN command active when the power supply comes back on.

- To reset any alarm, press RESET on the display/keypad. If the cause which caused the alarm has been removed, the alarms are reset and the START command can be given to restart the inverter.

NOTE

Alarms which are automatically reset (please refer to the Programming Guide, Autoreset Menu) do not end the run command. So, as soon as the alarm which generated the alarm has ceased to exist, the alarm will be reset automatically and the inverter will return to run mode without the START button being pressed.

Pressing the emergency stop button brings the inverter to a standstill and the grid interface devices open.

WARNING

When an alarm message appears, before restarting the inverter, find out what caused the alarm.

DANGER

After turning off the inverter, wait at least 10 minutes before carrying out any connection modifications, in order to give the DC-link capacitors time to discharge.

7. COMMUNICATIONS AND REMOTE MONITORING

7.1. General Information

SUNWAY TG inverters provide extensive and modular connectivity, both in the basic version and the version with the optional Data Logger (please refer to the heading "Data Logger - Optional").

- Full integration with the Santerno remote monitoring system for checking production performance and detecting alarms.
- Complete remote monitoring accessibility in both local and remote mode from PC and SunwayPortal web portal.

Connectivity of SUNWAY TG inverters:

- Up to three RS485 Modbus/RTU serial links available
- Ethernet port available

7.2. Communication Ports and Protocol Used

The SUNWAY TG inverter serial ports use 2-wire RS485 electric standard plus a 0 volt reference wire and standard Modbus/RTU protocol.

The inverter usually behaves as a Modbus slave, i.e. it responds to requests made by a Modbus Master device, usually a PC, Data Logger board or a PLC.

Via the serial connection to the inverter internal measurements can be read and all operating parameters can be read, written and saved (COM0 port).

The COM1 and COM2 ports can be used as Modbus Masters for the field trunk lines the Smart String Boxes are connected to.

The SUNWAY TG inverters Ethernet port uses a standard Modbus over proprietary TCP/IP. Connection is made using the RemoteSunway application or using one of the remote monitoring services made available by the SunwayPortal.

Protocol and availability relative to the serial ports are indicated below.

Communication Port	Available with BASIC configuration	Available with Data Logger optional	Protocol
COM0	Yes	Yes	Slave Modbus
COM1	No	Yes	Master/Slave Modbus
COM2	No	Yes	Master/Slave Modbus
Ethernet	No	Yes	Modbus Over Proprietary TCP/IP

Table 21: Communication ports

For specifications concerning the protocol, programming of the serial parameters, the Modbus address etc., please refer to the Programming Guide.

7.3. Connection Topologies

The connection topologies may be point-to-point or multidrop. The connection methods are described below.

7.3.1. SUNWAY TG - Basic Version

Configuration diagram for the basic version of the SUNWAY TG.

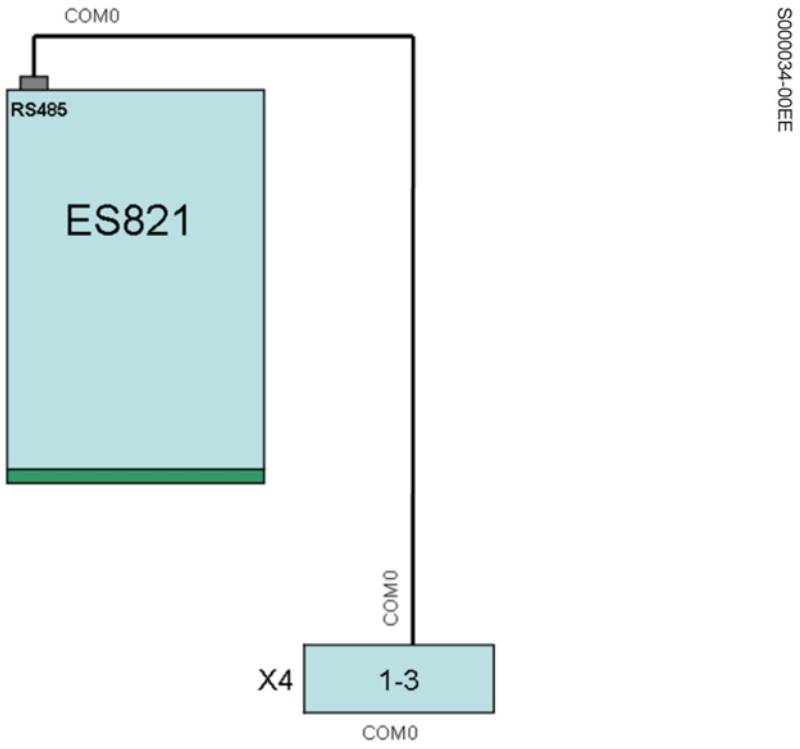


Figure 37: Configuration diagram of SUNWAY TG without optional Data Logger board

Communication ports on X4 terminal board:

- COM0 control board

The COM0 serial link on the control board is available on the X4 terminal board. This serial link can only be used in Modbus Slave mode. The default Modbus address is 1.

NOTE

The standby bus voltage values for COM0, connected to the RS485 galvanic isolation board drivers are:

2.6 V between line A (D1) and 0 V

2.4 V between line B (D0) and 0 V

7.3.2. SUNWAY TG with Optional Data Logger Board

Configuration diagram of SUNWAY TG with optional Data Logger board.

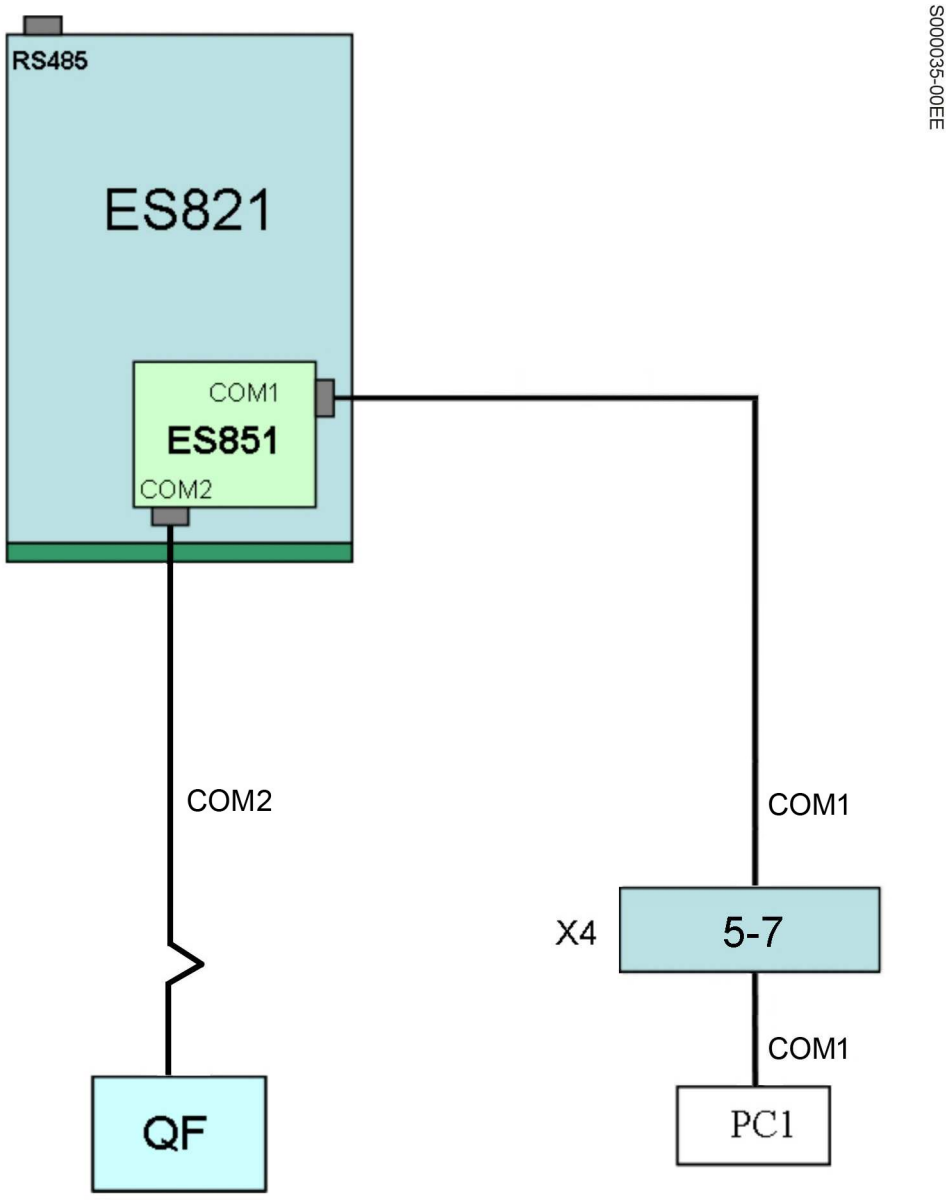


Figure 38: Configuration diagram of SUNWAY TG with optional Data Logger board

- PC1: a PC, PLC or other Modbus Master device
- QF: RS485 communication trunk line between the inverter and the Smart String Box (for example modules in a subfield).

Communication ports on X4 terminal board:

- COM1 Data Logger.

The COM0 serial link is not accessible from the terminal board.

The COM1 serial link on the control board is available on the X4 terminal board. This serial link can only be used in Modbus Slave mode.

The COM2 serial link is available on the Data Logger board DB9 connector and is galvanically isolated

It can be used in Modbus Master or Slave mode.

The COM2 port can be used as Modbus Master for the field trunk lines to the Smart String Boxes.

NOTE

The standby bus voltage values for COM2, connected to the RS485 galvanic isolation board drivers are:

2.6 V between line A (D1) and 0 V

2.4 V between line B (D0) and 0 V

For COM2 the terminators are enabled by default. If the COM2 is used for a multidrop connection between the inverters, only the last section must be terminated.

7.3.3. Interconnection of SUNWAY TG with Optional Data Logger Board

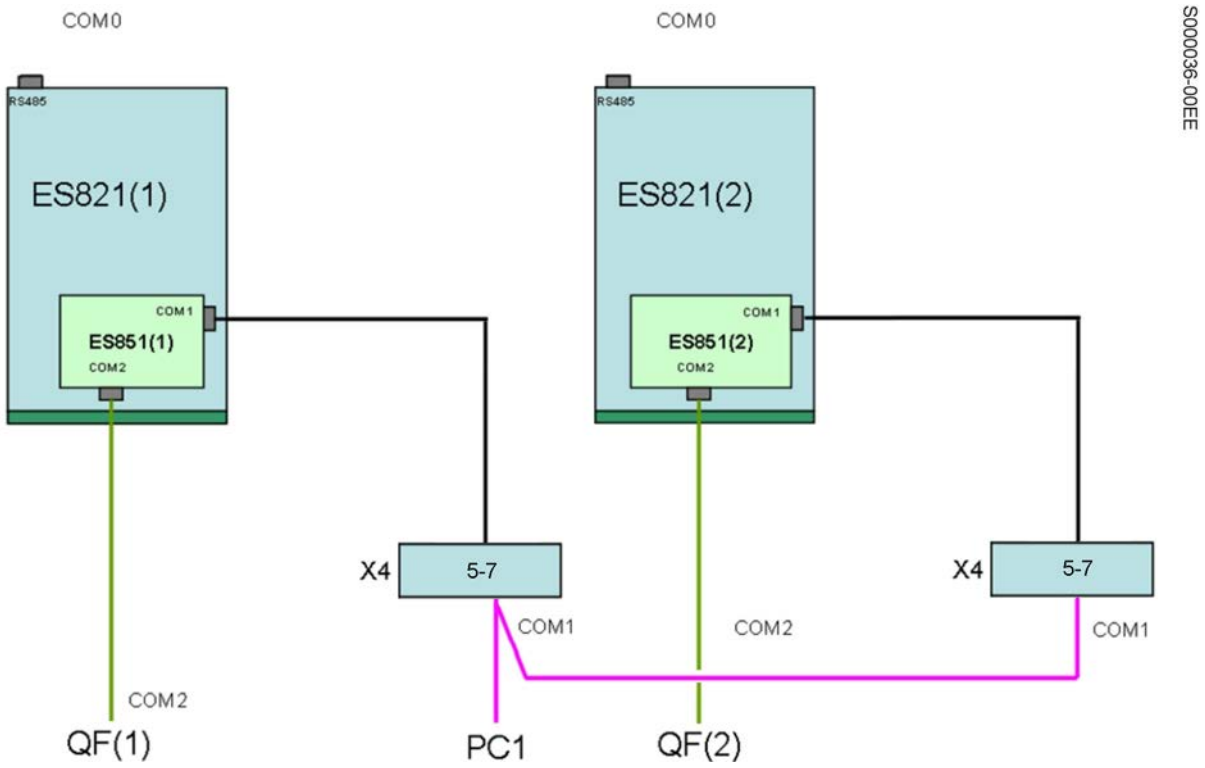


Figure 39: Configuration diagram of SUNWAY TG with multiple Data Logger boards

Connection to the following external communication devices is indicated in the diagram above:

- PC1: a PC, PLC or other Modbus Master device
- QF(1): RS485 communication trunk line between the inverter and the Smart String Box (for example modules in a subfield).
- QF(2): a second RS485 communication trunk line between the inverter and the Smart String Box (for example, modules in a second subfield).

7.3.4. Point-to-Point Connection

A point-to-point connection is made via a wired connection between the inverter and a PC, a PLC or other Modbus Master device.

If a PC is used it must be equipped with a RS485 port which is usually available as an optional on industrial PCs. If only USB ports are available, a USB to RS485 converter must be used. Elettronica Santerno is able to supply you with a converter if required. It is advisable to use the COM0 port on the inverter and enable the line terminators.

7.3.5. Multidrop Connection

It is possible to connect a series of SUNWAY TG inverters using a multidrop connection on RS485 bus.

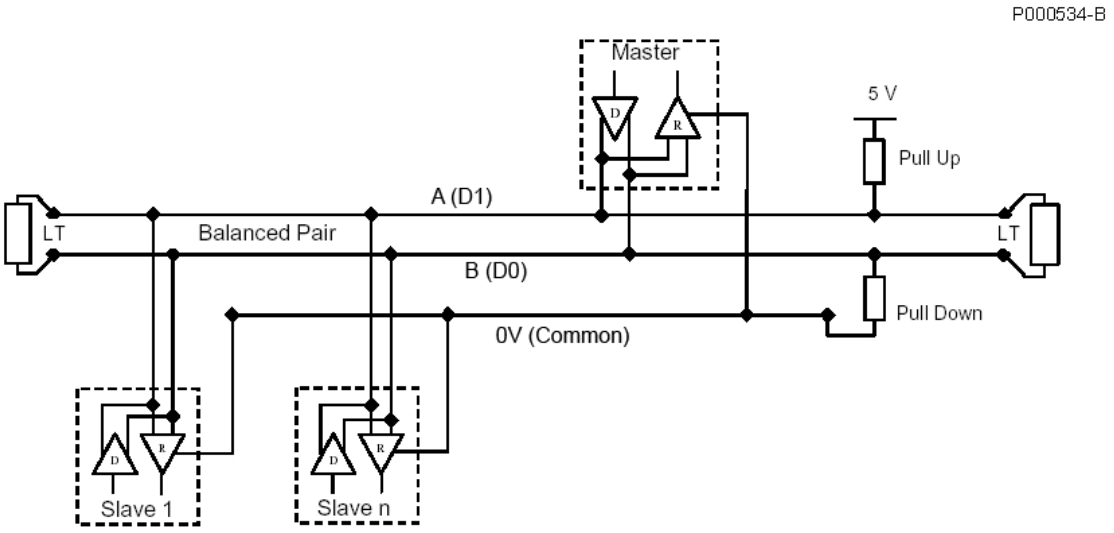


Figure 40: Multidrop connection diagram

The RS485 multidrop line to multiple devices must be wired using a linear and not a star topography: each device connected to the line must be connected by an incoming cable from the previous device and have an outgoing cable to connect the next device. The exceptions are obviously the first and last devices in the chain which, will have only an outgoing line and an incoming line respectively.

Elements participating in a RS485 section are called nodes. The maximum number of nodes which can be connected on a section is limited to the following aspects:

- Logic limit of the bus, equal to 247
- Length of the connection
- Transmission speed
- Electronic drivers used

The limit set by the line drivers used in SUNWAY TG inverters is 30 devices. It is not advisable to use section lengths exceeding 500m. Should it be necessary to connect more than 30 devices on the same line or over a length exceeding 500 m, it is advisable to break the connection up into more than one section using RS485 repeaters.

NOTE

The RS485 bus default rate is 38400 baud. It is not advisable to exceed this value. In the event of communication disturbances, it is possible to set the rate at a lower value (19200 or 9600 baud).

Each inverter has its own identification number to distinguish it in a univocal manner in the network under one PC. To change the factory settings of the Modbus address, please refer to the Programming Guide.

7.4. Connection

7.4.1. RS485 Bus – Main Principles

The MODBUS-IDA organization (http://www.modbus.org) defines the connection for Modbus communication on RS485 serial link (used by the inverter) as 2-wire cable type. For this type of cable, the following specifications are recommended:

Connection cable	
Type of cable	Shielded cable made up of a balanced pair known as D1/D0 + common conductor. Recommended cable: Belden 3106A Paired EIA Industrial RS485 PLTC/CM.
Minimum section for conductors	AWG23 corresponding to 0.258 mm^2. For long lengths it is advisable to use a larger section, up to 0.75 mm^2.
Maximum length	500 metres with reference to the maximum distance measured between the two stations furthest apart.
Impedance specifications	Recommended over 100 Ω, usually 120 Ω.

Table 22: Connection cable

It is advisable to connect all the equipment connected to the multidrop connection network to the earth by means of a common conductor. In this way, any differences in earth potential between different equipment which may interfere with communications is reduced to a minimum.

The common terminal 0V connection is necessary. An 0V connection which is common to all equipment in the multidrop communication network minimizes possible differences of reference potential between the equipment which could interfere with communication.

The common reference of control board power supply is isolated in relation to earth. By connecting one or more inverters to a communication device with a common earth (for example a PC) a low-impedance path between the control board and earth is obtained. It is possible that disturbances conducted at high frequency from the power parts of the inverter may transit along this path and this can cause malfunctions to the communication apparatus.

It is always advisable to equip the communication equipment with a galvanically isolated RS485 communication interface or a galvanically isolated RS485/USB convertor.

WARNING

Cat. 5 2-, 3- or 4-pair data transmission cables cannot be used for the serial connection, not even over short sections.

Wiring operations of the module must be carried out when the inverter is NOT powered. Remember to take all the necessary precautions before accessing the connectors and before handling the board.

7.4.2. COM0 and COM1 Ports

Serial port	Available with BASIC configuration	Available with Data Logger optional	Optoisolated port	Terminal and contacts
COM0	Yes	No (*)	No	X4-1: A (D1) X4-2: B (D0) X4-3: 0V

Table 23: COM0 serial port connection

(*) Available inside the converter however.

The line terminator of the COM0 serial port is inserted on the control board.

DIP-switch	Function	Factory setting	Notes
SW3-1, SW3-2 Control Board	RS485 terminator	Both OFF: terminators not activated	ON: 150 Ω resistor between A (D1) and B (D0), 430 Ω resistor between A (D1) and +5 VE, 430 Ω resistor between B (D0) and 0 VE OFF: no termination and polarization resistor

Table 24: COM0 – SW3 termination DIP-switches

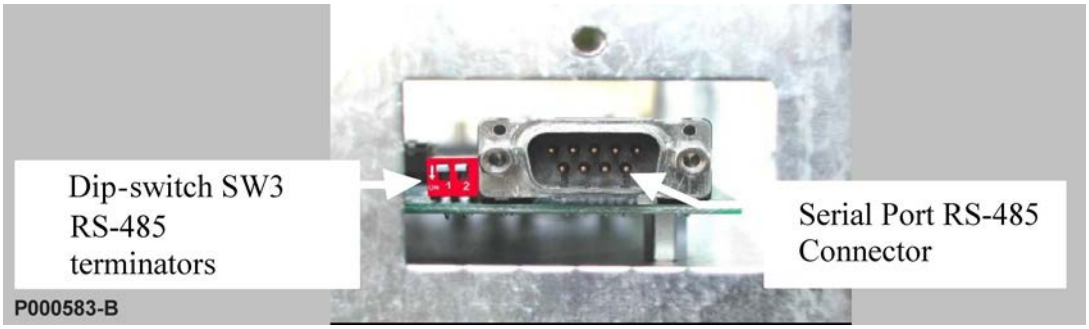


Figure 41: COM0 – Position of SW3 termination DIP-switches

The factory settings of the DIP-switches are indicated in the following figure.

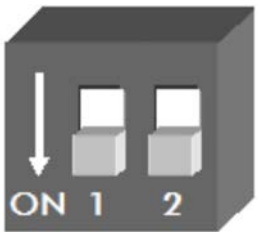


Figure 42: SW3 termination DIP-switches

Serial port	Available with BASIC configuration	Available with Data Logger optional	Optoisolated port	Terminal and contacts
COM1	No	Yes	No	X4-5: A (D1) X4-6: B (D0) X4-7: 0V

Table 25: COM1 serial port connection

The line terminator of the COM1 serial port is inserted on the Data Logger board.

DIP-switch	Function	Factory setting	Notes
SW4-3, SW4-4 Data Logger Board	RS485 terminator	Both OFF: terminators not activated	ON: 150 Ω resistor between A (D1) and B (D0), 430 Ω resistor between A (D1) and +5 VE, 430 Ω resistor between B (D0) and 0 VE OFF: no termination and polarization resistor

Table 26: COM1 – SW4 termination DIP-switch

NOTE

Incorrect setting of the terminators in a multidrop line may inhibit communication and lead to communication difficulties particularly at high baud rates. If more than the two prescribed terminators have been installed on a line some drivers may enter protection mode for thermal overload thus blocking the communication of some devices.

To reach the DIP-switches remove the cover on the converter.

S000061

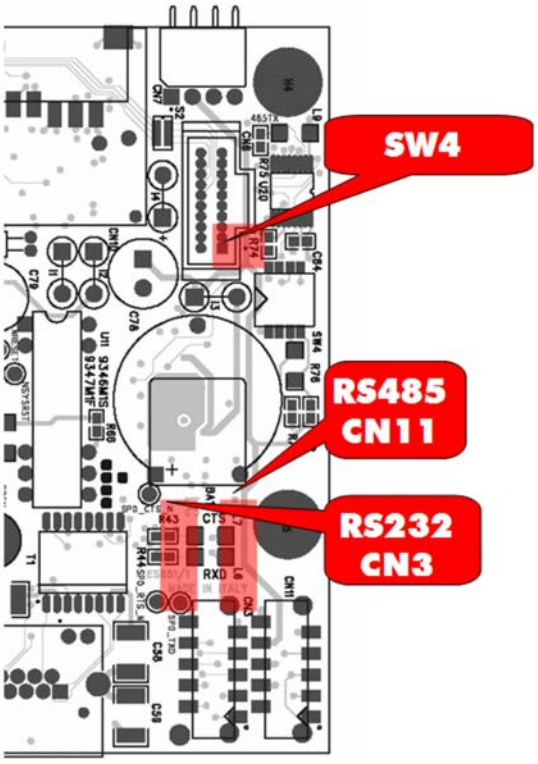


Figure 43: COM1 – Position of SW4 termination DIP-switches

The factory settings of the DIP-switches are indicated in the following figure.

S000106

Figure 44: D SW4 termination DIP-switches

In the event of serial communication problems, please consult heading “TROUBLESHOOTING”.

7.4.3. COM2 Port

Serial port	Available with BASIC configuration	Available with Data Logger optional	Optoisolated port	Terminal and contacts
COM2	No	Yes	Yes	DB9 on Data Logger board

Table 27: COM2 serial port connection

The galvanic isolation between the inverter's COM2 serial port and the external communication devices is implemented via the Data Logger board. Terminators of the RS485 line of the COM2 serial port are inserted on the Data Logger board.

The pin layout is as follows:

No.	Name	Description
1		Not connected
2		Not connected
3	A (D1)	Line RS485 A (D1)
4		Not available in this application
5	0VM	Earth signal/isolated power supply
6		Not available in this application
7		Not connected
8	B (D0)	Line RS485 B (D0)
9		Not connected
frame	PE	Inverter earth

Table 28: DB9 connector

DIP-switch	Function	Factory setting	Notes
SW2-3, SW2-4 COM2 port terminators	COM2 RS485 terminator	Both ON: terminators on	ON: 120 Ω resistor between A (D1) and B (D0), 1500 Ω resistor between A (D1) and +5 VM, 1500 Ω resistor between B (D0) and 0 VM OFF: no termination and polarization resistor

Table 29: SW2 termination DIP-switches

NOTE

Incorrect setting of the terminators in a multidrop line may inhibit communication and lead to communication difficulties particularly at high baud rates. If more than the two prescribed terminators have been installed on a line some drivers may enter protection mode for thermal overload thus blocking the communication of some devices.

To access the SW2 DIP-switch, remove the protective front cover on the converter and dismantle the environmental sensors and field I/Os expansion board.

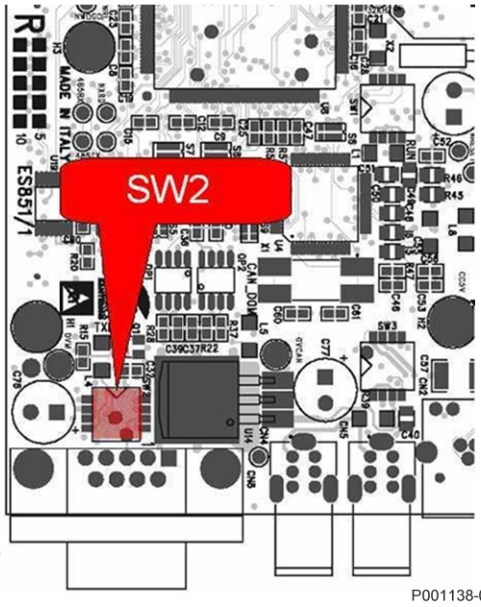


Figure 45: COM2 – Location of the SW2 termination DIP-switches

The factory settings of the DIP-switches are indicated in the following figure.

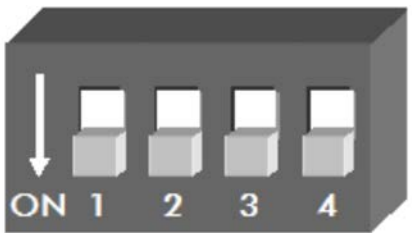


Figure 46: SW2 termination DIP-switches

In the event of serial communication problems, please consult heading “TROUBLESHOOTING”.

7.4.4. Ethernet Port

Port	Available with BASIC configuration	Available with Data Logger optional	Terminal and contacts
Ethernet	No	Yes	RJ45 on Data Logger board

Table 30: Ethernet port connection

The Data Logger board provides a standard RJ45 connector (IEEE 802) for 10/100 Ethernet connection (100Base-TX, 10Base-T). The layout of the pins is the same as that found on each network board serving the PC.

The pin layout is as follows:

NO.	Name	Description
1	TD+	Positive signal transmission line
2	TD-	Negative signal transmission line
3	RD+	Positive signal receiving line
4	Term	Terminated pair, not used
5	Term	Terminated pair, not used
6	RD-	Negative signal receiving line
7	Term	Terminated pair, not used
8	Term	Terminated pair, not used

Table 31: RJ45 connector

The Data Logger board can be connected via the Ethernet interface to an Ethernet control device with Modbus/TCP Master (PC) protocol in one of the following ways:

- through a LAN network (company or plant Ethernet network)
- with direct point-to-point connection

The connection via a LAN network can be carried out in the same way as for a PC. Use a standard connection cable to the Switch or Hub or a Straight-Through TIA/EIA.568-B cat. 5UTP cable (LAN patch cable).

NOTE

The interface board cannot be connected to old LAN networks made using Thin Ethernet coaxial cables (10base2). Connection to this type of network is only possible using a Hub with both Thin Ethernet (10base2) and 100Base-TX o 10Base-T connectors. The LAN uses a star topology with each member element connected to the Hub or Switch by its own cable.

The following figure illustrates the layout of the pairs in a cat. 5 UTP cable and the standard colour arrangement used for Straight-Through cables.

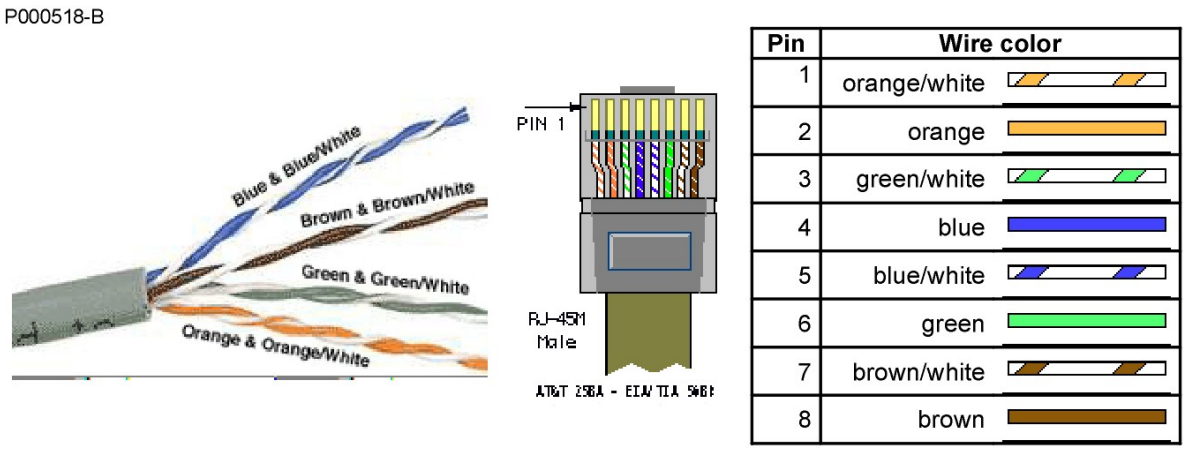


Figure 47: Layout of pairs in cat. 5 UTP cable

The direct point-to-point connections is carried out using a Cross-Over TIA/EIA-568-B cat. 5 cable. This type of cable crosses over the pairs so that the TD+/TD- pair on one side corresponds to the RD+/RD- pair on the other and vice versa.

The following table illustrates the colour matching on the connector pins for the Cross-Over cable and the cross-over diagram of the two pairs used by the 100Base-TX o 10Base-T connection.

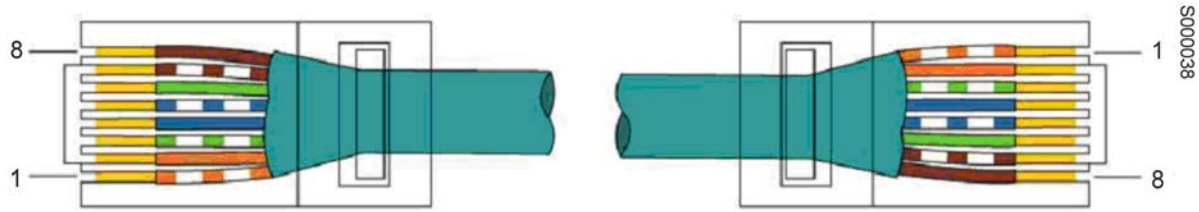


Figure 48: EIA/TIA 568 standard patch cable, UTP/STP cat.5

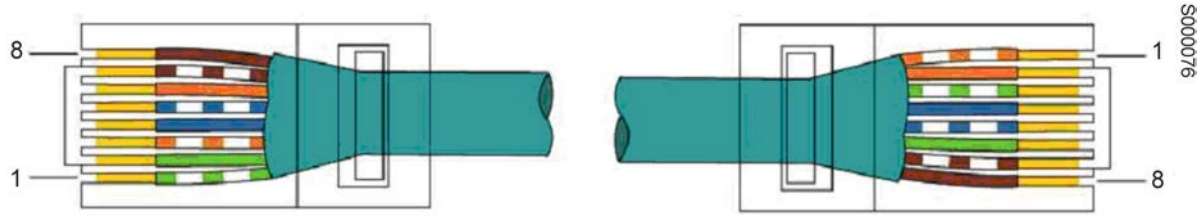


Figure 49: EIA/TIA 568 cross-over cable, UTP/STP cat.5

NOTE

The maximum length of the UTP cat. 5 cable envisaged by Standard IEEE 802 (calculated on the maximum transit time allowed by the protocol) is 100 m.

Use only and exclusively certified LAN cables, cat.5 UTP or higher, for Ethernet cabling. Unless otherwise dictated by length or particular cabling needs, use commercial cables with connectors.

In the event of Ethernet communication problems, please consult heading “TROUBLESHOOTING”.

8. OPTIONALS

8.1. Data Logger - Optional

The Data Logger board is available as an optional. This is a telecommunication unit which carries out the functions of local production data storage, inverter-inverter or inverter-Smart String Box connection, all in remote control connection with Santerno.

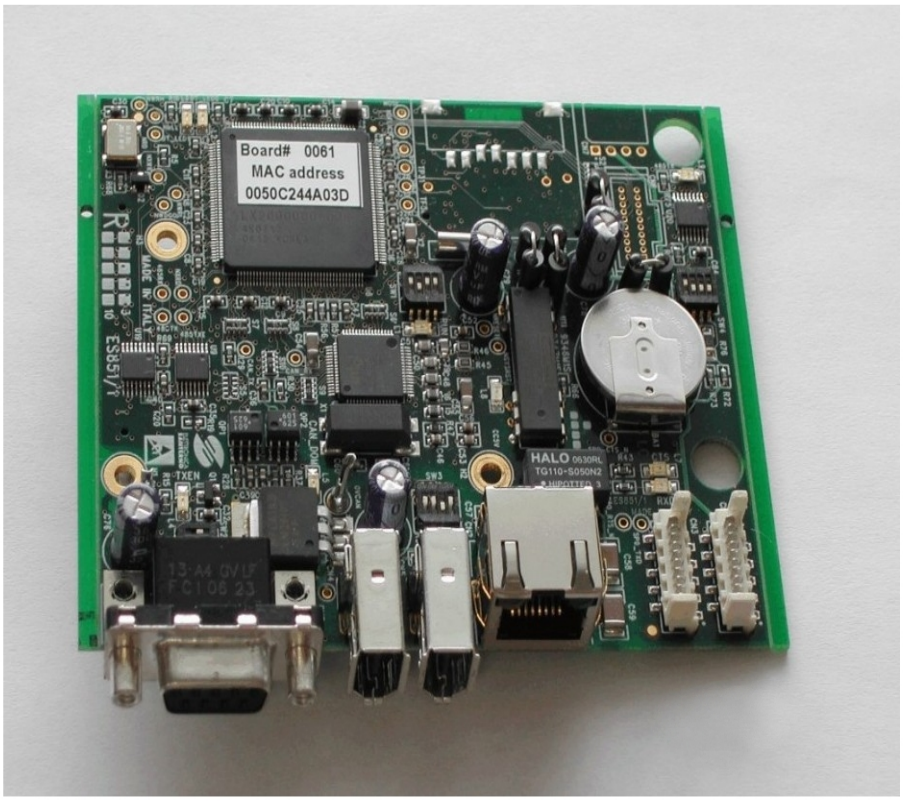


Figure 50: Data Logger board - Optional

NOTE

To be ordered at the same time as ordering the inverter.

The Data Logger board is installed on the converter control board which can be accessed by opening the front cover.

Figure 51: Location of the optional Data Logger board

Each Data Logger board is capable of monitoring up to a maximum of 40 devices which are multidrop connected on the RS485 bus. On the bus the Data Logger operates acts as Modbus Master while the other devices act as Modbus Slaves.

Should Santerno devices, such as SUNWAY M XS, SUNWAY M PLUS, SUNWAY TG, SUNWAY TG TE, Smart String Box, etc. be multidrop connected, for user ease it is possible to use pre-set log configurations. Using these settings, the maximum number of devices which can be monitored is 15 units.

It is always possible to increase the number of units monitored by reducing the number of variables present in each log.

For further details, please refer to the Data Logger's Programming Guide.

Two serial communication ports and an Ethernet port are available on the Data Logger board.

- COM1, COM2: RS485 Modbus/RTU serial links.
- Ethernet.

Please refer to “COMMUNICATION AND REMOTE MONITORING” under the heading "General Information".

8.1.1. Santerno Anti-theft System

The anti-theft function is designed to detect unauthorized removal of modules from the system. The system is based on the co-ordinated operation of the Smart String Boxes and the Data Logger boards.

When a theft of a module is detected, the information is stored in the Smart String Box status which is then acquired by the Data Logger board. The event is transmitted to the supervision system which immediately sends an alarm message to the user. To ensure security, the supervision systems is designed to check communication signals continuously. If communication fails for a time exceeding the set threshold, an alarm message is sent to the user.

If the Santerno anti-theft system is enabled, it is possible to provide the inverters with a back-up power supply. Please refer to the heading “UPS”.

8.2. Optional Field I/Os and Environmental Sensors Expansion Board

The Environmental Sensors and Field I/Os Expansion Board is available as an optional extra. This board performs the function of acquiring and measuring analog and digital signals.

In particular the board makes it possible to connect temperature, radiation and anemometric sensors. Furthermore it makes it possible to acquire pulsed digital signals for reading external energy meters and signals for four-wire production control (GPC), please refer to the "Programming Guide".

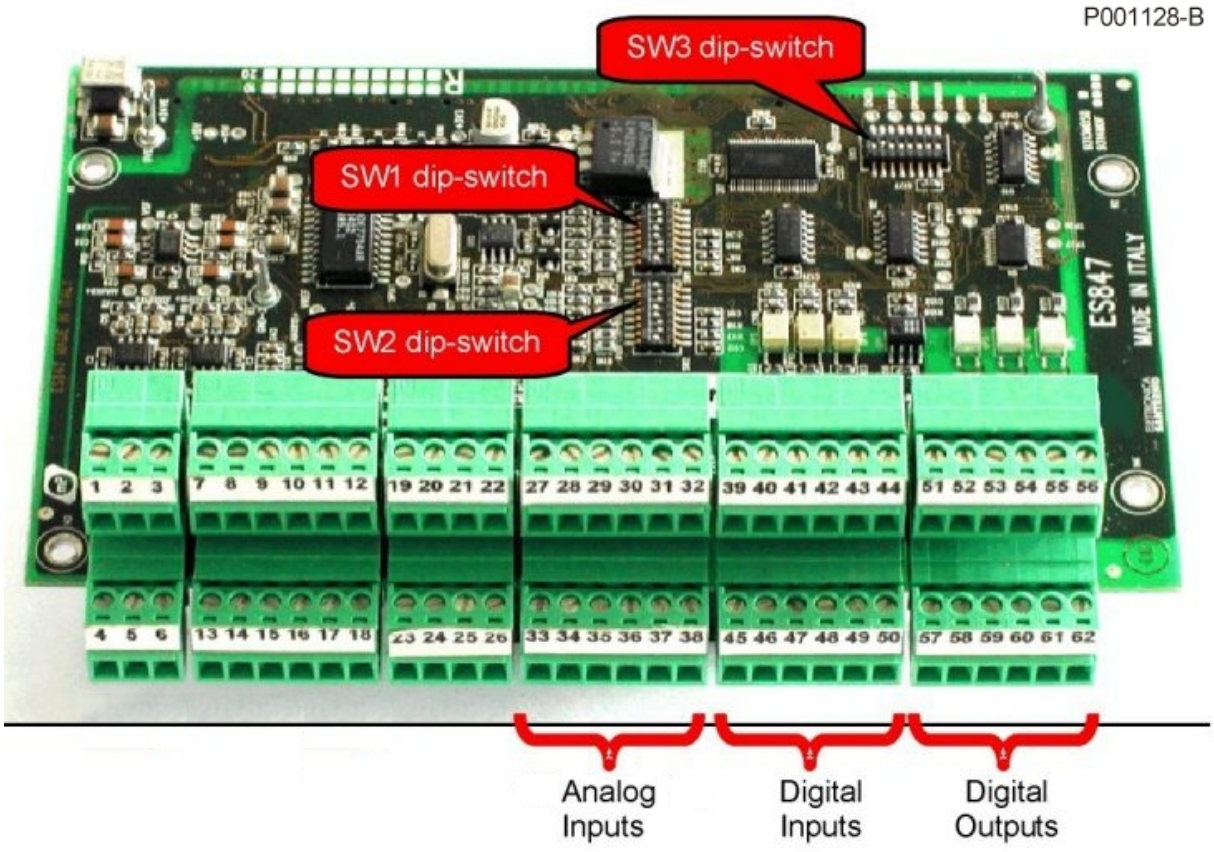


Figure 52: Environmental Sensors and Field I/Os Expansion Board Option

NOTE

To be ordered at the same time as ordering the inverter.

The Environmental Sensors and Field I/Os Expansion Board is installed on the converter control board which can be accessed by opening the front cover.

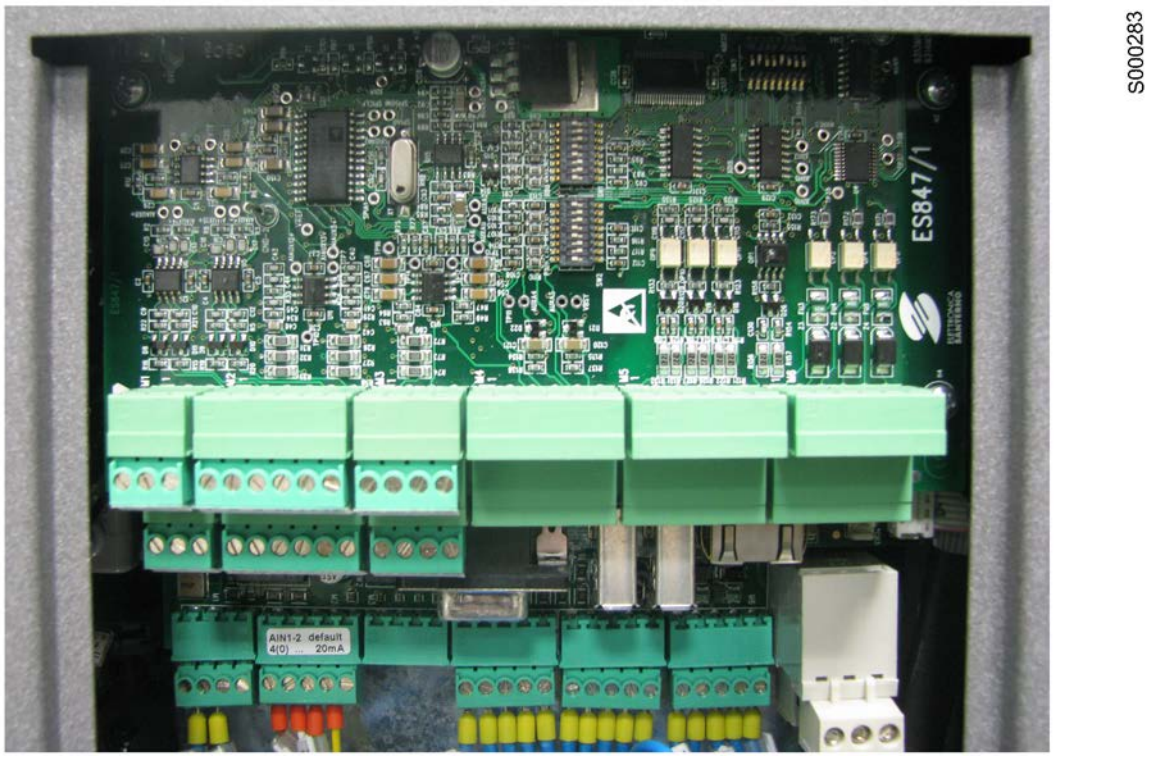


Figure 53: Positioning of the optional Environmental Sensors and Field I/Os Expansion Board Option

8.3. Earthed Option – Connection of the PV Field to Earth

Certain technologies used for PV modules require particular polarization of the field with regards to earth. This polarization is called:

- Positive Earthed, when the positive pole of the PV field must be earthed.
- Negative Earthed, when the negative pole of the PV field must be earthed.

Two corresponding options are available for SUNWAY TG inverters, the Positive Earthed option and the Negative Earthed option; both guarantee full compatibility with all PV modules available on the market.

All the live parts of SUNWAY TG inverters are floating in relation to the earth potential. By connecting a floating PV generator to the inverter, the overall low-frequency system upstream from the isolation transformer is consequently an IT type.

Please refer to the heading “Configuration of the IT/non-IT System" for an overview of IT/non-IT distribution.

NOTE

To be ordered at the same time as ordering the inverter.

SUNWAY TG inverters modified for use of SunPower modules therefore have a positive field pole connected to earth via a fuse. This device is NOT designed to protect the safety of persons but only to

protect the equipment from short circuits to earth of the negative pole which could cause overheating with consequent fire risk.

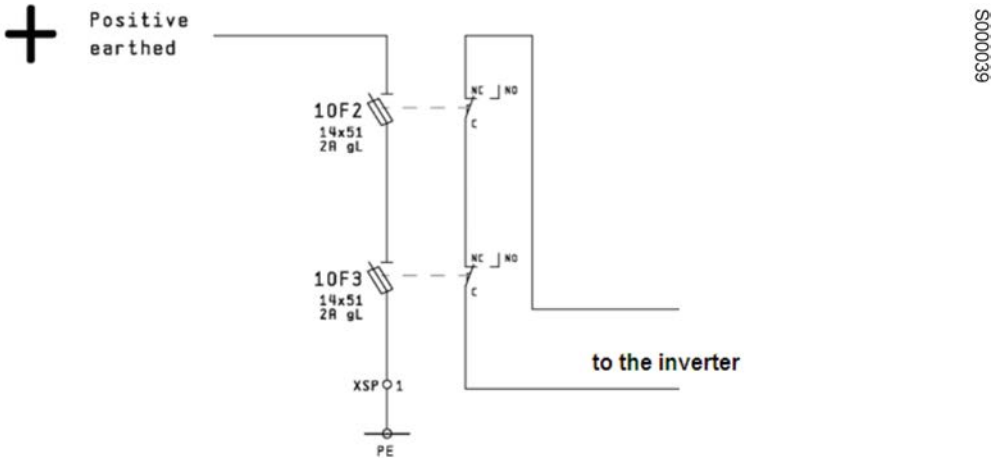


Figure 54: Positive Earthed option – connection of the positive pole to earth

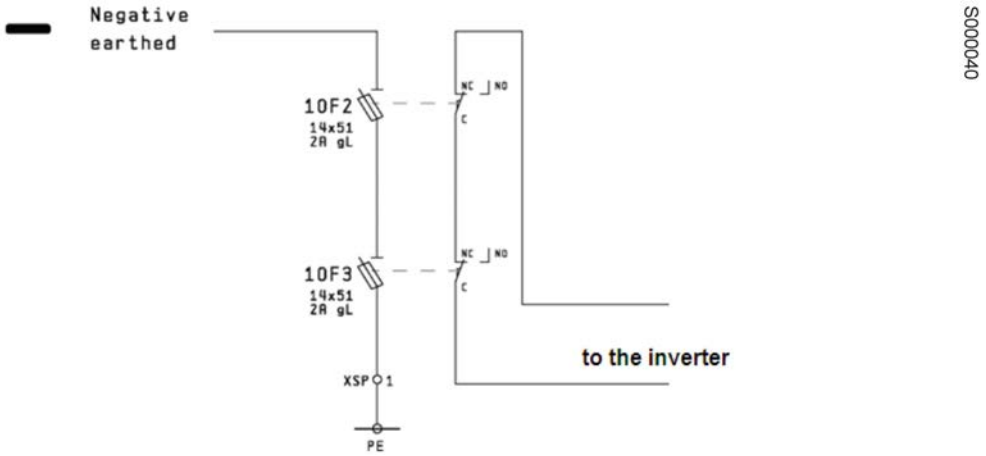


Figure 55: Negative option – connection of the negative pole to earth

Installation of the Earthed option on SUNWAY TG inverters inhibits continual isolation control.

If the fuses blow, an isolation loss alarm is triggered which is in fact a loss of polarization.

Please see the heading “Isolation Control Device”.

DANGER

Earthed-pole systems are NON IT systems.

The earth polarization fuse is not a safety device against direct contacts.

If the earth polarization fuse blows due to a fault, the field configuration may be floating. If the fault persists, the field configuration may be inverted in relation to the original configuration.

Do not earth any other point of the PV field.

Never earth the neutral (if present) on the inverter-side winding.

8.3.1. Additional Safety Warnings for the Earthed Option

The standard SUNWAY TG has a PV field connection separate from earth and incorporates a device for controlling field loss of isolation to earth.

Installation of the Earthed option modifies the electrical status of the field conductors which could therefore be at a hazardous potential regards earth. It is therefore necessary to adopt measures to guarantee personnel safety.

DANGER

Earthed-pole systems are NON-IT systems.

The earth polarization fuse is not a safety device against direct contacts. The fuse is NOT designed to safeguard human life but for operational purposes.

If the earth polarization fuse blows due to a fault, the field configuration may be floating. If the fault persists, the field configuration may be inverted in relation to the original configuration.

Example with Positive Earthed option:

In the event of inadvertent contact with the negative pole the fault current is limited only by the resistance of the operator's body.

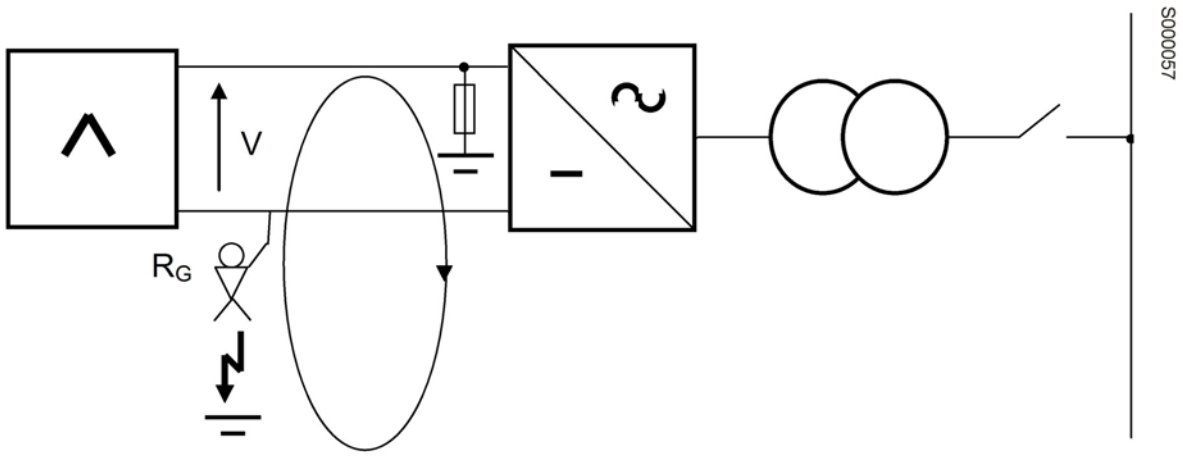


Figure 56: Direct contact with live pole

A fault loop occurs powered by the PV field which closes via the fuse and the operator.

WARNING

The isolation to earth control of the PV field poles is NOT active.

In the event of inadvertent contact with the positive pole the potential difference the operator is subject to is zero, hence the fault current is also zero.

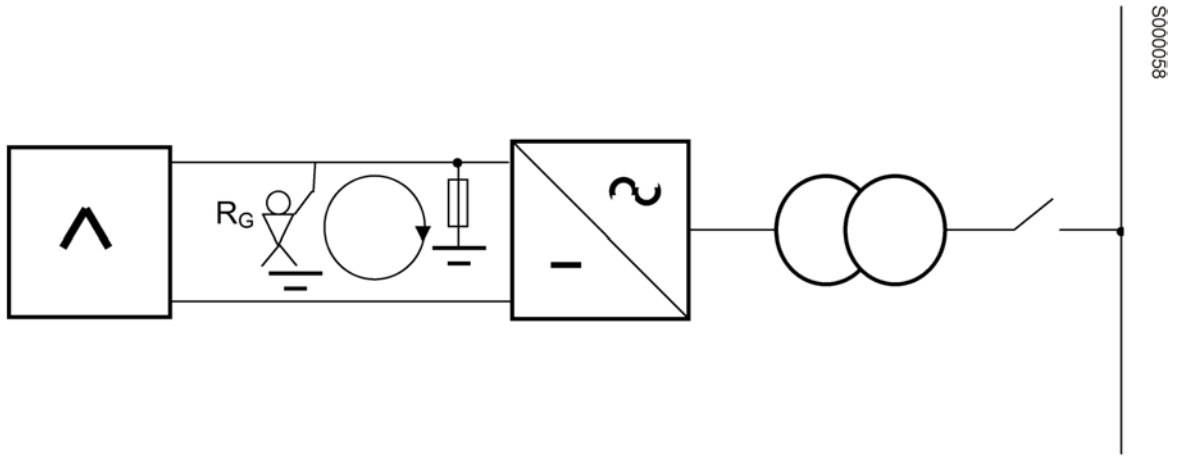


Figure 57: Direct contact with voltage-free pole

Opening of the connection fuse modifies the electrical status of the PV field. Inadvertent contact with the positive pole of the PV field is initially non-hazardous but becomes so once the fuse has blown.

In the event of a negative pole earth fault, the fuse is blown and opens.

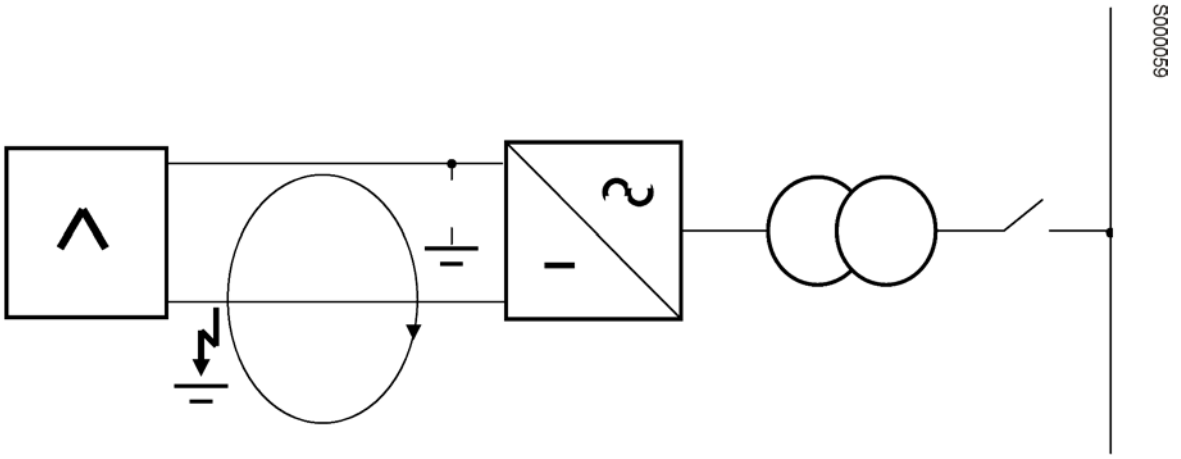


Figure 58: Dead short to earth and polarization fuse blowing

If the fault to earth of the negative pole persists, in the event of inadvertent contact with the positive pole the potential difference the operator is subject to is equal to the PV field voltage. The fault current is not zero.

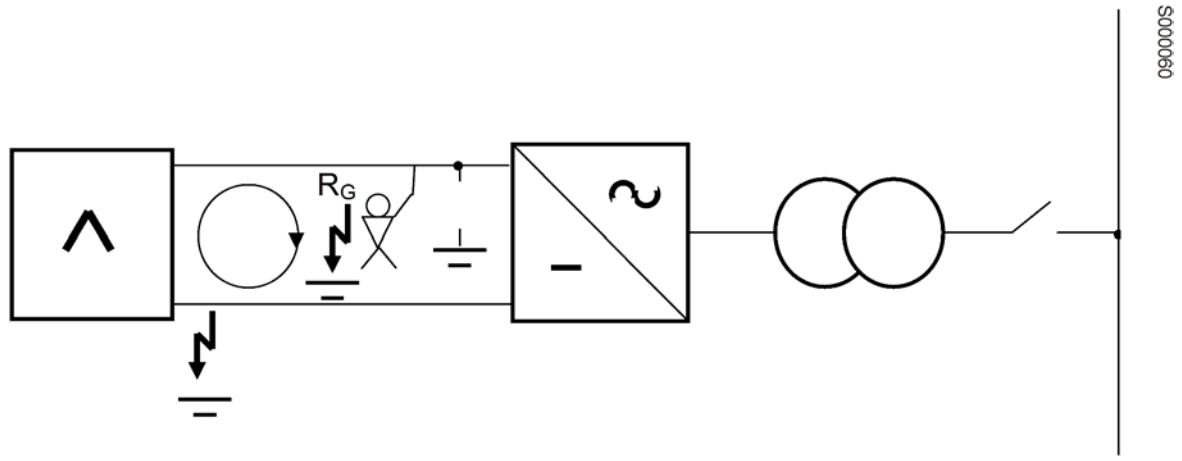


Figure 59: Direct contact with pole which is no longer voltage-free

8.4. GPRS Optional

A GPRS Router is available as an optional. It can be used only if the Data Logger optional is also installed.

The router, connected to the Ethernet port on the Data Logger board, is housed inside the inverter. The push-through router aerial is installed on the roof. For instructions on how to install the SIM card and programme the Router, see the manual provided with the device.

Please refer to the inverter Electrical and Mechanical Diagram.

8.5. Optional Anti-Condensation Heater

An anti-condensation heater is available as an optional.

The heater makes it possible to extend the bottom temperature range for inverter operation to -25°C. All the technical data is provided in the heading “Installation Specifications”.

Please refer to the inverter Electrical and Mechanical Diagram.

NOTE

To be ordered at the same time as ordering the inverter.

8.6. Optional Ventilation kit IP20

As an optional extra the ventilation kit IP20 is available to optimize ventilation for inverters installed indoors.

In particular, the ventilation kit IP20 reduces electricity consumption and the sound pressure in the installation environment.

The degree of protection for an inverter with this optional extra installed becomes IP20. Please refer to the heading "Inverter Ventilation System".

9. MAINTENANCE

Adequate maintenance ensures conversion performance and inverter reliability is maintained over time.

This heading describes all the activities required to keep machine parts which are subject to wear and deterioration and/or components which are essential for guaranteeing safety and optimum performance in good condition.

Access to products for the purpose of maintenance, modifications and management involves all persons responsible for production and maintenance. It must be carried out in observance of the health and safety regulations described in the heading “Execution of Work”.

The minimum maintenance interval is indicated in the "Maintenance Sheet".

Equipment installed in an environment where there is a high concentration of dust requires more frequent maintenance than generally indicated.

The activities described may involve stopping the inverter. Once the maintenance procedure has been completed restart the inverter by pressing the START button.

WARNING

Failure to observe the maintenance prescriptions may result in the product warranty conditions being nullified.

NOTE

In the event of any fault, please contact the Elettronica Santerno SpA CUSTOMER SERVICE for instructions on the necessary corrective action to be taken.

9.1. Maintenance Sheet

Maintenance tasks	Minimum Frequency
Read the stored data and Fault List	Every month
Checking the external/internal conditions of the electrical cabinet	Every 6 months
Air filter maintenance	Every 6 months
Check the emergency stop button	Every 12 months
Checking the door microswitches	Every 12 months
Check gaskets	Every 12 months
Check locks and hinges	Every 12 months
Check the fans	Every 6 months
Check control and auxiliary voltages (110 V and 24 V)	Every 6 months
Check fuses and disconnecting switches	Every 6 months
Check SPDs	Every 6 months
Check that cables and bars are securely tightened	Every 12 months
Calibrate environmental sensors	Every 12 months
Check the condition of dataplate and warning signs	Every 24 months
The frequency of scheduled maintenance may need to be increased depending on the location in which the equipment is installed and the relative ambient conditions.	

Table 32: Maintenance Sheet

9.2. Reading the Fault List Archives

To guarantee correct operation of the system all its components must be correctly matched up. Incorrect operation leads to lower yields with a subsequent reduction in system profitability.

The inverter includes functions to warn the user of failures or faults affecting the system. Periodical checks of system operation are in any case still necessary for the detection of minor operating faults which are not associated with an alarm. The inverter's alarm memory and the data stored in the Data Logger (if installed) must be analyzed at least once a month. To do this, proceed as described in the Programming Guide.

9.3. Checking the External/Internal Conditions of the Electrical Cabinet

To check the external/internal conditions of the electrical cabinet, proceed as follows:

OVERALL CONDITION OF THE CABINET:

- Check the external condition of the cabinet.
- Check the state of the insulating sheaths on the conductors.
- Check that there are no signs of overheating on the power conductors (especially near the connection points on the equipment).
- Check that there are no signs of cable gnawing caused by rodents.
- Check the state of all the signs/dataplates affixed to the equipment. Signs must always be in good condition and legible.

GENERAL CABINET CLEANING

- Check the interior of the cabinet for the build-up of dust, dirt, humidity and infiltration of water from the outside.
- Check that the ventilation ducts on the inductors and transformers are clear.

Should it be necessary to clean the SUNWAY TG, always adopt adequate measures. The electronic section in the SUNWAY TG inverter series is well protected and hence does not require any maintenance.

Carry out a visual inspection only and clean the printed circuit board with a soft brush or a vacuum cleaner fitted with a soft cleaning tool. The cleaning accessories used must be antistatic tools in compliance with ESD specifications.

Do not use heavy brushes or brushes with coarse bristles.

NEVER use compressed air for cleaning operations.

DANGER

Electric shock and burns hazard: coming into contact with live PV field or grid components can lead to serious injury and even death!

NEVER work on the equipment unless it is switched off and disconnected from the power supply.

DANGER

Electric shock and burns hazard: coming into contact with live PV field or grid components can lead to serious injury and even death!

Do not touch any components other than those specifically indicated in the instructions.

9.4. Air Filter Maintenance

DANGER

Electric shock and burns hazard: coming into contact with live PV field or grid components can lead to serious injury and even death!

NEVER work on the equipment unless it is switched off and disconnected from the power supply.

Inverters of the SUNWAY TG line are equipped with air intake grilles fitted with felt filters. Maintenance activities consist of replacing the felt filters.

The front air intake grille can be removed by inserting a screwdriver in the point indicated (Figure 60:) and gently levering it out . The filter is held in a cavity in the air intake grille which is securely fastened to the cabinet door.

All air intake grille filters should be replaced at the same time, both passive filters and those installed on the fan units. The type of felt filters used must be suitable for the application.

For the relative technical specifications, please refer to the chapter "TECHNICAL DATA". Replacement filters can be ordered from Elettronica Santerno.

NOTE

In the event of any fault, please contact the CUSTOMER SERVICE of Elettronica Santerno SpA for instructions on the necessary corrective action to be taken.

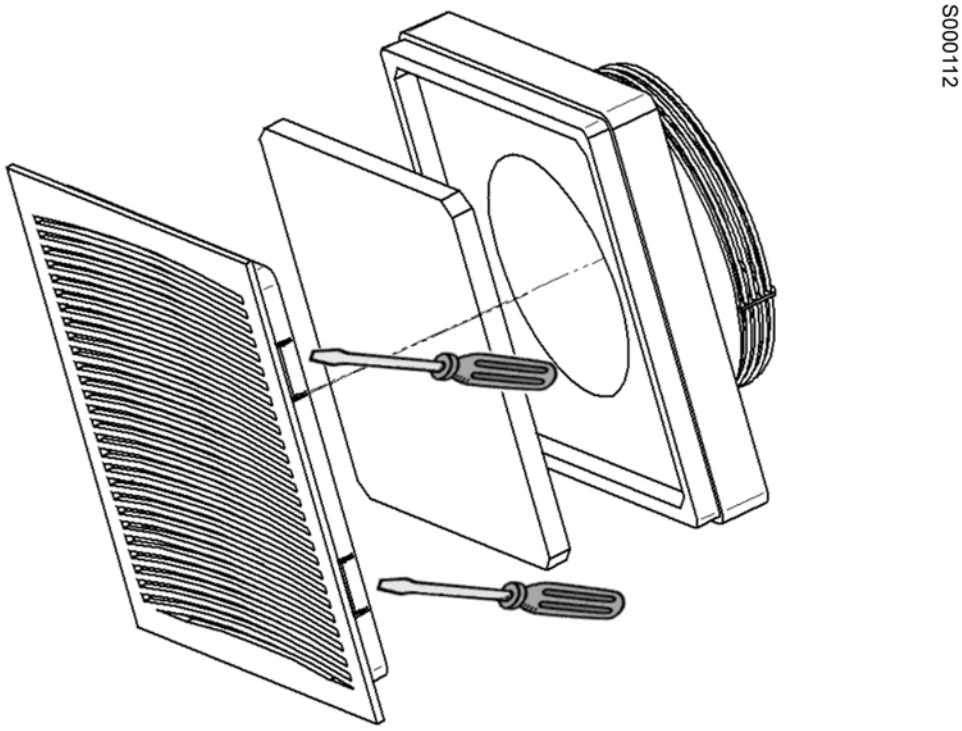


Figure 60: Filter replacement

9.5. Checking the Emergency Stop Button

DANGER

Electric shock and burns hazard: coming into contact with live PV field or grid components can lead to serious injury and even death!

Do not touch any components other than those specifically indicated in the instructions.

To check correct operation of the emergency stop switch, proceed as follows:

- STOP the inverter.
- Make sure that key-operated selector switch 18SA2 is turned to DISABLED.
- Open the doors.
- Make sure that the inverter is connected to both supply voltages (DC and AC) and that it is powered.
- Check that the external emergency stop button has not been activated.
- Press the emergency stop button.
- Check that the AC and DC control devices on the inverter are correctly opened.
- Release the emergency stop button.
- Close the AC and DC control devices on the inverter.
- Close electrical cabinet doors.
- Turn key-operated selector switch 18SA2 to ENABLED.

9.6. Checking the Door Microswitches

DANGER

Electric shock and burns hazard: coming into contact with live PV field or grid components can lead to serious injury and even death!

Do not touch any components other than those specifically indicated in the instructions.

To check correct operation of the door opening safety microswitches, proceed as follows:

- STOP the inverter.
- Make sure that the inverter is connected to both supply voltages (DC and AC) and that it is powered.
- Make sure that key-operated selector switch 18SA2 is turned to ENABLED.
- Open the doors.
- Check that the AC and DC control devices on the inverter are correctly opened.
- Turn key-operated selector switch 18SA2 to DISABLED.
- Close the AC and DC control devices on the inverter.
- Close electrical cabinet doors.
- Turn key-operated selector switch 18SA2 to ENABLED.

9.7. Checking the Seals, Locks and Hinges

DANGER

Electric shock and burns hazard: coming into contact with live PV field or grid components can lead to serious injury and even death!

NEVER work on the equipment unless it is switched off and disconnected from the power supply.

To check the cabinet door seals, locks and hinges, proceed as follows:

- Visually inspect the cabinet seals for any signs of cracking or damage. Any seals showing signs of damage in the areas of door contact must be completely replaced.
- It is suggested to use talc to stop the seals from sticking to the sheet metal of the cabinet over time.
- Check correct operation of the inverter cabinet and compartment locks by locking and unlocking the doors.
- Check the door hinges operate smoothly.
- Spray all movable parts and parts subject to wear with a water-free lubricant.

9.8. Checking the Fans

DANGER

Electric shock and burns hazard: coming into contact with live PV field or grid components can lead to serious injury and even death!

Do not touch any components other than those specifically indicated in the instructions.

Check operation and noisiness of all the fans. Depending on the size of the inverter, there may by fans on the cabinet doors (please refer to the table "Clearance values for SUNWAY TG").

If it is necessary to open the doors to carry out this inspection, proceed as follows:

- STOP the inverter.
- Make sure that the inverter is connected to both supply voltages (DC and AC) and that it is powered.
- Make sure that key-operated selector switch 18SA2 is turned to DISABLED.
- Open the doors.

The fans can be started up by gently heating the temperature sensor with a hairdryer.

At the end of inspection:

- Close electrical cabinet doors.
- Turn key-operated selector switch 18SA2 to ENABLED.

9.9. Checking Control and Auxiliary Voltages (110 V and 24 V)

DANGER

Electric shock and burns hazard: coming into contact with live PV field or grid components can lead to serious injury and even death!

Do not touch any components other than those specifically indicated in the instructions.

To check the cabinet control and auxiliary voltages, follow the instructions provided below.

The exact position of the control points can be seen on the Electrical and Mechanical Diagram.

To check the 24 Vdc power supply proceed as follows:

- STOP the inverter.
- Make sure that the inverter is connected to both supply voltages (DC and AC) and that it is powered.
- Make sure that key-operated selector switch 18SA2 is turned to DISABLED.
- Open the doors.
- Check the presence of 24 Vdc control voltage on the terminals referring to fuse holder 16F3 (see Figure 61: Checking the 24 Vdc control power supply).

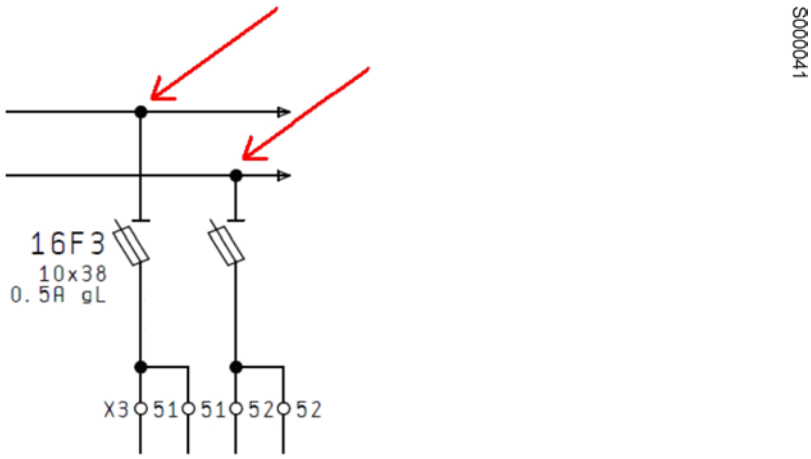


Figure 61: Checking the 24 Vdc control power supply

- Open the PV generator DC switch (10QM1).
- Check the presence of 24 Vdc control voltage on the terminals referring to fuse holder 16F3.
- Close the PV generator DC switch (10QM1).
- Open the electric grid AC switch (16QM2).
- Check the presence of 24 Vdc control voltage on the terminals referring to fuse holder 16F3.
- Close the electric grid AC switch (16QM2).
- Close electrical cabinet doors.
- Turn key-operated selector switch -operated selector switch to ENABLED.

To check the 110 Vac power supply proceed as follows:

- STOP the inverter.
- Make sure that the inverter is connected to the AC supply voltage and that it is powered.
- Make sure that key-operated selector switch 18SA2 is turned to DISABLED.
- Open the doors.
- Check the presence of 110 Vac voltage on the terminals referring to fuse holder 16F3 (see Figure 62: Checking the 110 Vac control power supply).

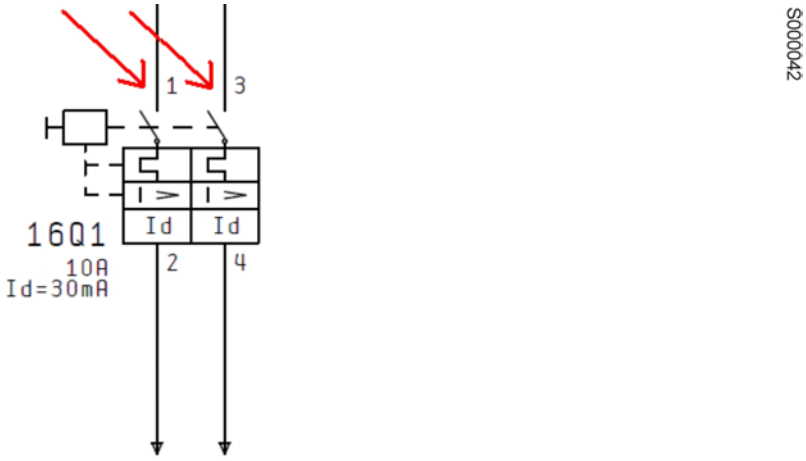


Figure 62: Checking the 110 Vac control power supply

- Close electrical cabinet doors.
- Turn key-operated selector switch 18SA2 to ENABLED.

9.10. Checking the Relays, Fuses and Disconnecting Switches

DANGER

Electric shock and burns hazard: coming into contact with live PV field or grid components can lead to serious injury and even death!

NEVER work on the equipment unless it is switched off and disconnected from the power supply.

This section refers to relays, fuses and fuse holders/disconnecting switches located inside the cabinet.

- Visually inspect the installed fuses and the fixing springs on the fuse holders.
- If necessary, grease the contact points on the holders.
- Visually inspect the installed relays, checking that they fit well into their holders.

9.11. Checking the SPDs

DANGER

Electric shock and burns hazard: coming into contact with live PV field or grid components can lead to serious injury and even death!

NEVER work on the equipment unless it is switched off and disconnected from the power supply.

Inspect the state of the SPDs (Surge Protective Devices) by checking the status of the button/slot on the discharger.

The exact position of the SPDs can be seen on the Electrical and Mechanical Diagram.

Figure 63: Surge Protective Device

Button/slot status	SPD Status
Button/slot with green indicator visible	SPD ready for use
Button/slot with red indicator visible	SPD faulty

Please refer to the table “SPD technical specifications".

9.12. Calibration of Environmental Sensors

SUNWAY TG inverters have special calibration parameters for each channel relative to the environmental measures. Please refer to the Programming Guide.

9.13. Checking the Tightening Torque

SUNWAY TG have special Belleville springs in all the internal tightening points for the copper bars and power cables. Usually no maintenance on these points is required.

However, for all tightening works carried out in the field, in order to guarantee correct tightness of the electrical contacts, periodical checking of the tightening torques is to be carried out over the equipment's life cycle.

- Check the tightness of all the terminal clamps for connecting the power wiring and tighten if necessary.
- Pay particular attention to any colour variations or anomalies concerning the insulation and the terminals.

Please refer to the tables "Technical Data for DC input cables", "Technical Data for AC output cables", "Documentation supplied with the product" and the inverter's Electrical and Mechanical Diagram.

10. TROUBLESHOOTING

SUNWAY TG products are completely protected against short-circuits and overvoltage caused by system failure or temporary phenomena. Furthermore, the control system performs complete self-diagnosis operations to help personnel solve any problems which may occasionally arise. The modular design of Elettronica Santerno inverters makes repair and/or reset operations quick and easy to perform.

This chapter indicates the most likely causes of the most common problems. The steps to be taken to remove these causes are also described.

NOTE

If the problem persists, please contact the Elettronica Santerno SpA CUSTOMER SERVICE.

10.1. Self-Diagnostics

The inverter's self-diagnostics system detects and records most malfunctions and provides technical support elements which are useful for problem solving.

The elements providing support for diagnostic functions are as follows:

- Display/keypad, thanks to the messages which appear on the display and the indicator LEDs.
- Indicator LEDs on the RS485 galvanic isolation board.
- Indicator LEDs on the Data Logger board.
- Indicator LEDs on the control board.
- Mxxx measures relative to inverter functions, accessible from the display/keypad, in remote and/or local remote control.
- Inverter Fault List, accessible from the display/keypad, in remote and/or local remote control.

When a protection device trips or an alarm is given, the inverter stops and the ALARM LED comes on. The corresponding alarm is displayed on the display/keypad.

When an alarm occurs, the inverter records it in the Alarms list together with the time of occurrence (Supply Time and Operation Time), the status of the inverter and the value of certain sampling measurements taken at the time of alarm tripping. The stored data is very useful in helping to determine the cause which triggered the alarm and consequent removal of the alarm condition.

All the details relative to the alarms can be found in the Programming Guide.

10.2. Malfunctioning at Start-up

10.2.1. The Inverter has Stopped by Itself

- Check the inverter Enabling/Disabling key-operated selector switch (12SA1).
- Check the AC switch return contact MD18 (please refer to the Programming Guide).
- Check the status of the digital inputs, M032 measure (please refer to the Programming Guide).

10.2.2. The Inverter Does Not Start When the START Button is Pressed

- Check that the PV OK LED is ON.
- Check that the GRID OK LED is ON.
- Check the status of the digital inputs, M032 measure (please refer to the Programming Guide).
- Check that the C004 Remote Command parameter is not active (please refer to the Programming Guide).

10.2.3. The PV OK LED is OFF

- Check if the inverter disconnecting switch is closed.
- Check the DC voltage value read by the inverter, Measures Menu (please refer to the Programming Guide).
- Check that the set P020 value is compatible with the configuration of the strings (please refer to the Programming Guide).

10.2.4. The GRID OK LED is OFF

- Check if the grid AC switch is closed.
- Check the AC voltage value read by the inverter, Measures Menu (please refer to the Programming Guide).
- Check the value of the C020 and C021 grid parameters (please refer to the Programming Guide).
- Check the state of the external Interface Protection (if installed).

10.2.5. Isolation Loss Detected

- Check if the inverter disconnecting switch is closed.
- If the Earthed optional is not installed, with the DC disconnecting switch closed, check if voltages are balanced in relation to earth (max. allowable margin = 5%).
- Open the DC disconnecting switch.
- With the DC disconnecting switch open, check if voltages are balanced in relation to earth (max. allowable margin = 10%) and that neither is near 0V.
- If the Earthed optional is installed, check the state of fuses 10F2 and 10F3.
- Check the status of the digital inputs, M032 measure (please refer to the Programming Guide).

10.3. Malfunctioning During Operation

10.3.1. Isolation Loss Detected

Please refer to the heading “Malfunction at Start-up”.

10.3.2. The Inverter Does Not Produce the Power Expected

- Check that the air inlet filters are clean.
- Check that disconnecting switches are closed on all String Boxes.
- Check MPPT is enabled (MPPT LED = ON, please refer to the Programming Guide).
- Check the P020 value (please refer to the Programming Guide).
- In the event of overheating, the inverter protects itself by derating its output power. Check the temperature measurements (please refer to the Programming Guide).

10.4. Malfunction of Communication Ports

10.4.1. Serial Communication Problems

- Check that all the programming parameters are correct.
- Check that terminators are correctly configured.
- Check that the voltage values for the bus in standby correspond with those indicated in the heading "Connection Topologies".

10.4.2. Ethernet Communication Problems

- Check that all the programming parameters are correct.
- Check the Ethernet port self-diagnosis LEDs on the Data Logger board.

10.5. Safety Devices Tripped

10.5.1. AC Switch Tripped

- Check if the emergency stop button has been pressed.
- Check the status of the digital inputs, M032 measure (please refer to the Programming Guide), in particular:
    - Check the contacts of the key-operated selector switches on the inverter door.
    - Check the status of the AC output switch feedback signal contacts.
- When the switch is open RUN status is lost. Press START.

10.5.2. DC Disconnection Switch Tripped

- Check the polarity of the PV field poles.
- Check if the emergency stop button has been pressed.
- Check the status of the digital inputs, M032 measure (please refer to the Programming Guide), in particular:
    - Check the contacts of the key-operated selector switches on the inverter door.
    - Check the status of the AC output switch feedback signal contacts.
- When the switch is open RUN status is lost. Press START.

10.5.3. SPDS Tripped or Fuses Blown

- Make sure the DC disconnecting switch is closed.
- If the inverter is NOT equipped with the Earthed Optional: check that voltages are balanced in relation to earth (max. allowable margin; 5% - 10%).
- If the inverter is equipped with the Positive Earthed Optional: check that the positive pole voltage is close to 0V.
- If the inverter is equipped with the Negative Earthed Optional: check that the negative pole voltage is close to 0V.
- Open the DC disconnecting switch.
- If the inverter is NOT equipped with the Earthed Optional: check that voltages are balanced in relation to earth (max. allowable margin; 5% - 10%).
- If the inverter is equipped with the Positive Earthed Optional: check that the positive pole voltage is close to 0V.
- If the inverter is equipped with the Negative Earthed Optional: check that the negative pole voltage is close to 0V.
- If the inverter is equipped with the Earthed Optional check the earth polarization fuses. Please refer to the heading “Earthed Option – Connection of the PV Field to Earth”.

10.5.4. Blown Earth Fuses for Negative or Positive earthed Options

- Check for any earth faults on the PV field. Proceed as described in heading "Tripped SPDs or Relative Fuses Blown".
- Check for any earth faults downstream from the AC output.

10.6. General Principles in the Event of Failure

Access to the PV system components for the purpose of maintenance, modifications and management involves all persons responsible for production and maintenance. It must be carried out in observance of the health and safety regulations described in the heading “Execution of Work”.

10.6.1. Fault Containment

The following prescriptions are of a general nature.

- Place the equipment affected by the fault in safety conditions. This operation may involve stopping and disconnecting all the up- and downstream devices. Please refer to the chapter “IMPORTANT SAFETY WARNINGS” under the heading “Specific Dangers Linked to PV Systems".
- If the fault has occurred inside an inverter, press an emergency stop button to cut the inverter off up- and downstream. Open the disconnecting switches of all the string boxes so that the entire DC input section is safe, including the DC-Parallel (if installed).
- In multi-inverter systems it is usually sufficient to cut off the inverter affected by the fault both up- and downstream so that the other inverters can remain in operation.
- If the fault has occurred in one of the components downstream from the inverter (AC parallel cabinet, external transformer, metering cabinet etc.) STOP all the machines and then press the emergency stop button to cut off the inverter both up- and downstream.
- If the fault has occurred in one of the components upstream from the inverter (DC-parallel, String Box, etc.) STOP all the machines and then press the emergency stop button to cut off the inverter both up- and downstream. Open the disconnecting switches of all the String Boxes so that the entire DC input section is safe, including the DC-Parallel (if installed).
- If the fault has occurred in one of the String Boxes, open all the strings connected in input and open the disconnecting switches of all the String Boxes in order to place all the equipment in safety conditions, including the cable output section.
- Proceed with analysis of the causes and consequences of the fault.

NOTE

If necessary, please contact the Elettronica Santerno SpA CUSTOMER SERVICE.

10.6.2. Fault Analysis

This section covers the main principles to be observed when analysing the causes and consequences of faults.

A PV inverter usually operates as part of an overall system. All the components adopt various protective measures therefore, in general, the consequences of a generic fault affecting an upstream component or element does not extend to other components downstream.

However, the causes and the consequences of any faults which may arise need investigating on the plant as a whole.

Fault investigation and analysis activities represent one of the most hazardous tasks assigned to maintenance technicians. This manual only provides indications of an extremely generic nature concerning the precautions which must be adopted when fault investigation and analysis activities need to be carried out on live components.

In the event of a fault, before proceeding to resolve the problem, the following tasks must be performed to evaluate:

- The state of components and the system as a whole:
  - Check the state of the contacts.
  - Check the state of cables.
  - Check the status of any interface protection installed in the system.
  - Check the state of all protective elements installed in the system.
  - Check the state of any auxiliary power supplies.
  - Check the level of humidity present on system components.
- If faults have occurred on each box, inverter and/or the system:
  - Check for any earth faults on the DC side and the AC side.
  - Make sure all prescriptions have been observed relative to the neutral connection or those relative to field configuration (floating, Positive Earthed, Negative Earthed).
  - Check the state of the SPDs and relative fuses.

Once all the aforementioned steps have been performed, proceed with evaluating:

- The causes of faults.
- The consequences of faults on the electrical, electromechanical and electronic components.
- The steps to be taken to remove the cause of the fault.

Once all the aforementioned steps have been performed, proceed with rectifying the causes of the fault.

NOTE

If necessary, please contact the Elettronica Santerno SpA CUSTOMER SERVICE.

10.7. How to Contact the CUSTOMER SERVICE

Should it be necessary to contact the Elettronica Santerno SpA CUSTOMER SERVICE, please provide the following data:

- Equipment model
- Serial Number
- Date of commissioning
- Order confirmation reference, if available

If the equipment in question is an inverter, it is advisable to recover the following information from the memory:

- Number of operating hours (please refer to the Programming Guide)
- Fault list (please refer to the Programming Guide)

This operation can be carried out using the display/keypad or by using the Remote Sunway program with local or remote connection.

Should it be necessary to send the equipment in for repair or to return the equipment, contact the Elettronica Santerno SpA CUSTOMER SERVICE, to agree upon the terms.

11. TECHNICAL DATA

11.1. Dataplate

Each dataplate indicates the product's technical data and identification details.

- Name of the product.
- Part number assigned to the product by Elettronica Santerno.
- Technical data (rated input/output voltage and current, rated power, etc.)
- CE marking and indications of the relative reference Standards applied in the construction of the equipment (CE is a registered collective trademark).
- Product revision index.
- Serial Number: identifies the product serial number

The dataplate measures 100 x 70 mm and is silver in colour.

11.1.1. SUNWAY TG

SUNWAY TG dataplates are affixed to each individual inverter. They indicate all the data relative to the inverter.

Example of a dataplate on a SUNWAY TG inverter:

S000067-00EE

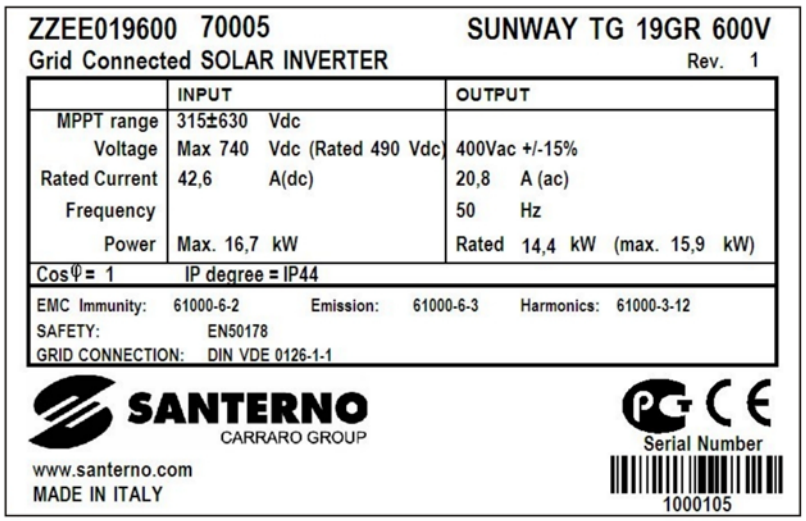


Figure 64: SUNWAY TG dataplate

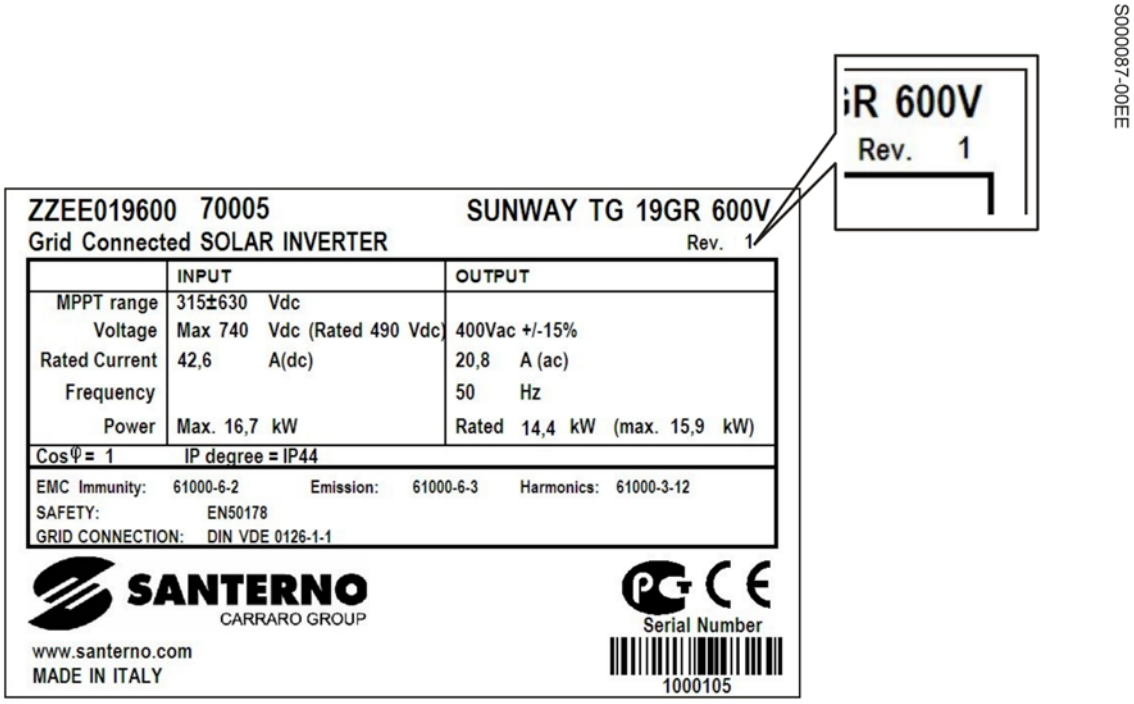


Figure 65: Inverter revision index

Other examples of the dataplate affixed to SUNWAY TG inverters for various geographical locations:

S000108-00EE

Figure 66: Examples of SUNWAY TG dataplates

11.2. Installation Specifications

Installation specifications for SUNWAY TG	
Operating ambient temperature	-10 °C - +40 °C -25 °C – +40 °C with optional anti-condensation heater
Operating ambient humidity	From 5% – 95%, from 1 g/m^3 – 25 g/m^3, with no condensation or ice formation (category 3k3 in compliance with EN50178)
Altitude	Up to 1000 m ASL For higher altitudes please refer to the headings “Maximum Voltage Derating” and “Rated current derating”
Installation site	Do not install the equipment where it is exposed to direct sunlight. Do not install where it is exposed to conductive dust, corrosive gases, vibrations, water spray or dripping or saline environments.
Degree of protection	IP 44 IP 20 with optional ventilation kit IP20
Degree of pollution	Class 3S2 or higher, according to IEC 60721-3-3

Table 33: Installation specifications for SUNWAY TG

Name of the inverter	Noise emissions [dBA]	Name of the inverter	Noise emissions [dBA]
SUNWAY TG14 - 600V	62	SUNWAY TG35 800V	72
SUNWAY TG19 - 600V	62	SUNWAY TG57 800V	72
SUNWAY TG26 - 600V	62	SUNWAY TG82 800V	75
SUNWAY TG42 - 600V	65	SUNWAY TG120 800V	77
SUNWAY TG61 - 600V	75	SUNWAY TG145 800V	82
SUNWAY TG90 - 600V	75		
SUNWAY TG110 - 600V	77		
SUNWAY TG135 - 600V	82		

Table 34: SUNWAY TG noise emissions

Name of the inverter	Noise emissions [dBA]	Name of the inverter	Noise emissions [dBA]
SUNWAY TG14 - 600V	51	SUNWAY TG35 800V	51
SUNWAY TG19 - 600V	51	SUNWAY TG120 800V	55.5
SUNWAY TG26 - 600V	51		
SUNWAY TG42 - 600V	51		
SUNWAY TG90 - 600V	55.5		
SUNWAY TG110 - 600V	55.5		

Table 35: SUNWAY TG noise emissions with optional ventilation kit IP20

11.3. Electrical Specifications

SUNWAY TG (*)	U.M.	600 V	800 V
Maximum DC input voltage	V	740 Vdc	880 Vdc
MPPT range	V	315 V – 630 V	415 V – 760 V
AC output voltage	V	400 Vac +/-15%	400 Vac +/-15%
Output frequency	Hz	50/60	
Residual ripple voltage on the PV field		<1%	
Total distortion of grid current		≤3%	
Power factor		1	
Uc Pulse withstanding voltage	kV	4 kV: DC input	
		4 kV: AC output	

Table 36: SUNWAY TG electrical specifications

(*) Values susceptible to change for specific applications.

11.3.1. SUNWAY TG 600V

	UNIT OF MEASURE	SUNWAY TG 14 600V	SUNWAY TG 19 600V	SUNWAY TG 26 600V	SUNWAY TG 42 600V	SUNWAY TG 61 600V	SUNWAY TG 90 600V	SUNWAY TG 110 600V	SUNWAY TG 135 600V
INPUT (*)									
PV field recommended peak power	kWp	13	17	24	39	55	80	100	116
Maximum input power (DC)	kW	12.4	16.7	23.2	37.7	54.4	79.5	98.2	115.0
Rated input power (DC)	kW	11.2	15.1	21.1	34.4	49.4	72.2	89.2	104.5
Maximum input current (**)	A	31.4	42.6	60.6	97.4	140.1	204.0	251.4	304.5
OUTPUT (*)									
Maximum output power	kW	11.7	15.9	22	36	51.8	75.6	93.2	110
Rated output power	kW	10.6	14.4	20.0	32.8	47.1	68.7	84.7	100.0
Rated output current (AC)	A	15.3	20.8	28.9	47.3	68.0	99.2	122.3	144.4
Maximum efficiency	%	95.3	96.0	95.9	96.1	96.0	95.9	96.0	96.4
European efficiency	%	93.8	94.8	94.5	94.8	94.7	94.6	94.7	95.1

Table 37: Technical data for SUNWAY TG 600V models

(*) Values susceptible to change for specific applications. The efficiency is calculated excluding auxiliary consumption.

(**) Maximum DC current which the inverter can take in the input stage. It is however possible to connect a PV generator sized for a higher current without any risk of damaging the inverter. In this case the inverter will limit the output power so as to take the input current to a value not exceeding the one indicated.

11.3.2. SUNWAY TG 800V

	UNIT OF MEASURE	SUNWAY TG 35 800V	SUNWAY TG 57 800V	SUNWAY TG 82 800V	SUNWAY TG 120 800V	SUNWAY TG 145 800V
INPUT (*)						
PV field recommended peak power	kWp	32	51	72	106	118
Maximum input power (DC)	kW	31.6	50.3	71.9	105.6	117.3
Rated input power (DC)	kW	28.5	45.7	65.4	96.0	106.5
Maximum input current (**)	A	60.6	97.4	140.1	204.0	251.4
OUTPUT (*)						
Maximum output power	kW	29.9	48.0	69.0	100.5	112.8
Rated output power	kW	27.2	43.6	62.7	91.4	102.5
Rated output current (AC)	A	39.2	63.0	90.5	131.9	148.0
Maximum efficiency	%	96.1	96.1	96.6	96.2	96.2
European efficiency	%	94.6	94.6	95.5	94.8	94.9

Table 38: Technical data for SUNWAY TG 800V models

(*) Values susceptible to change for specific applications. The efficiency is calculated excluding auxiliary consumption.

(**) Maximum DC current which the inverter can take in the input stage. It is however possible to connect a PV generator sized for a higher current without any risk of damaging the inverter. In this case the inverter will limit the output power so as to take the input current to a value not exceeding the one indicated.

11.3.3. Interface Device

Model	Interface Device (Contactor)		Generator device
	Make and type	Nominal specifications	Nominal specifications
SUNWAY TG 14 600V	ABB A 16-30-10	30A (AC-1) Coil110Vac	25A “C” 25kA
SUNWAY TG 19 600V	ABB A 16-30-10	30A (AC-1) Coil110Vac	25A “C” 25kA
SUNWAY TG 26 600V	ABB A 30-30-10	55A (AC-1) Coil110Vac	40A “C” 15kA
SUNWAY TG 42 600V	ABB A 40-30-10	60A (AC-1) Coil110Vac	63A “C” 15kA
SUNWAY TG 61 600V	ABB A 50-30-00	100A (AC-1) Coil110Vac	80A 16kA
SUNWAY TG 90 600V	ABB A 75-30-00	125A (AC-1) Coil110Vac	125A 16kA
SUNWAY TG 110 600V	ABB A 95-30-00	145A (AC-1) Coil110Vac	160A 16kA
SUNWAY TG 135 800V	ABB A145-30-11	250A (AC-1) Coil110Vac	160A 16kA
SUNWAY TG 35 800V	ABB A 30-30-10	55A (AC-1) Coil110Vac	50A “C” 15kA
SUNWAY TG 57 800V	ABB A 50-30-10	100A (AC-1) Coil110Vac	80A 16kA
SUNWAY TG 63 800V	ABB A 50-30-10	100A (AC-1) Coil110Vac	80A 16kA
SUNWAY TG 82 800V	ABB A 50-30-00	100A (AC-1) Coil110Vac	100A 16kA
SUNWAY TG 120 800V	ABB A95-30-00	145A (AC-1) Coil110Vac	125A 16kA
SUNWAY TG 145 800V	ABB A145-30-00	250A (AC-1) Coil110Vac	160A 16kA

Table 39: Interface Device

11.3.4. Maximum Voltage Derating

When equipment is installed at a high altitude, the maximum DC voltage, i.e. the maximum Voc value applicable to the product in accordance with heading “Electrical Specifications” must be derated as indicated in the table:

Altitude [m]	Maximum DC voltage/max. Voc
0-2000	Unchanged
2001-3000	Do not exceed 846 V

Table 40: Maximum DC voltage based on altitude

If equipment is to be installed at over 3000 m, please contact Elettronica Santerno SpA.

11.3.5. Rated Current Derating

If the ambient temperature exceeds the maximum allowable temperature (40°C), the inverter limits its output current in order to protect its internal components from overheating. Figure 67 shows the graph indicating the maximum power delivered based on ambient temperatures (valid for equipment installed at sea level).

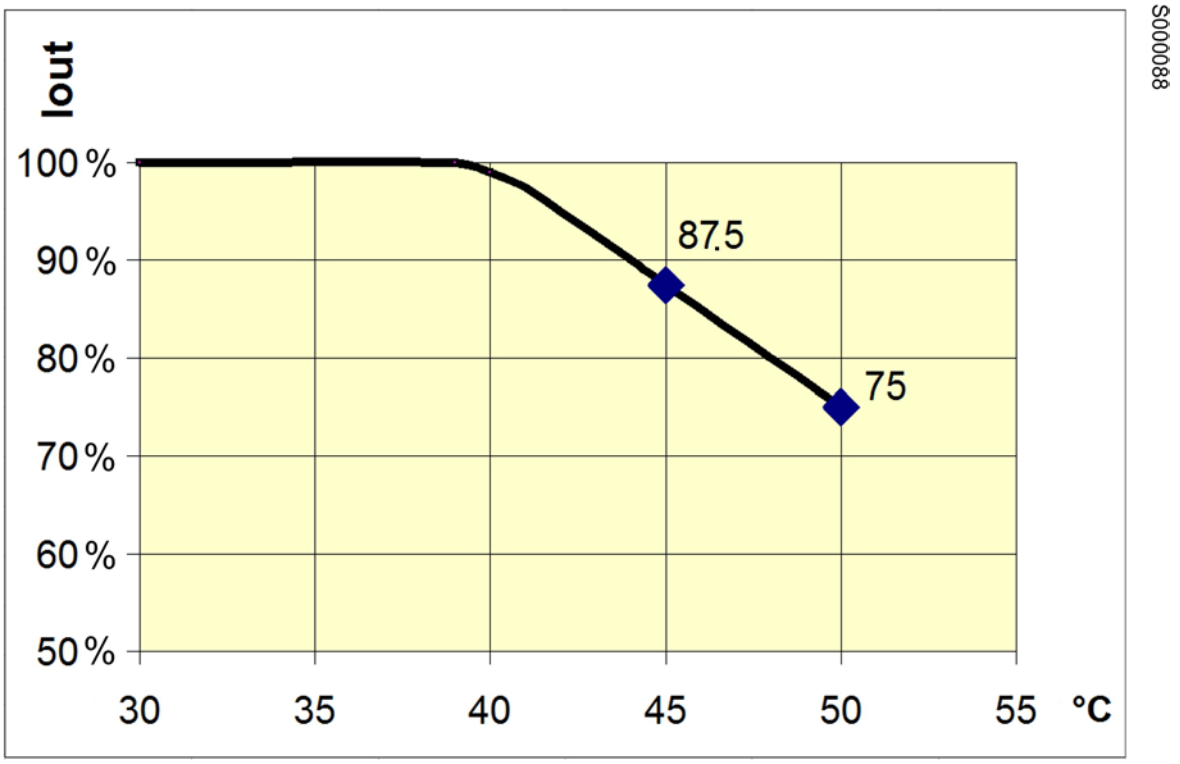


Figure 67: Temperature derating (at sea level)

Generally speaking, both temperature and altitude affect the continuous power output of the inverter.

To calculate the rated current, coefficient **'Kt'** is assigned to temperature while coefficient **'Ka'** is assigned to altitude. Please refer to Figure 68 and Figure 69.

(The values in the figure may be changed to suit special applications.)

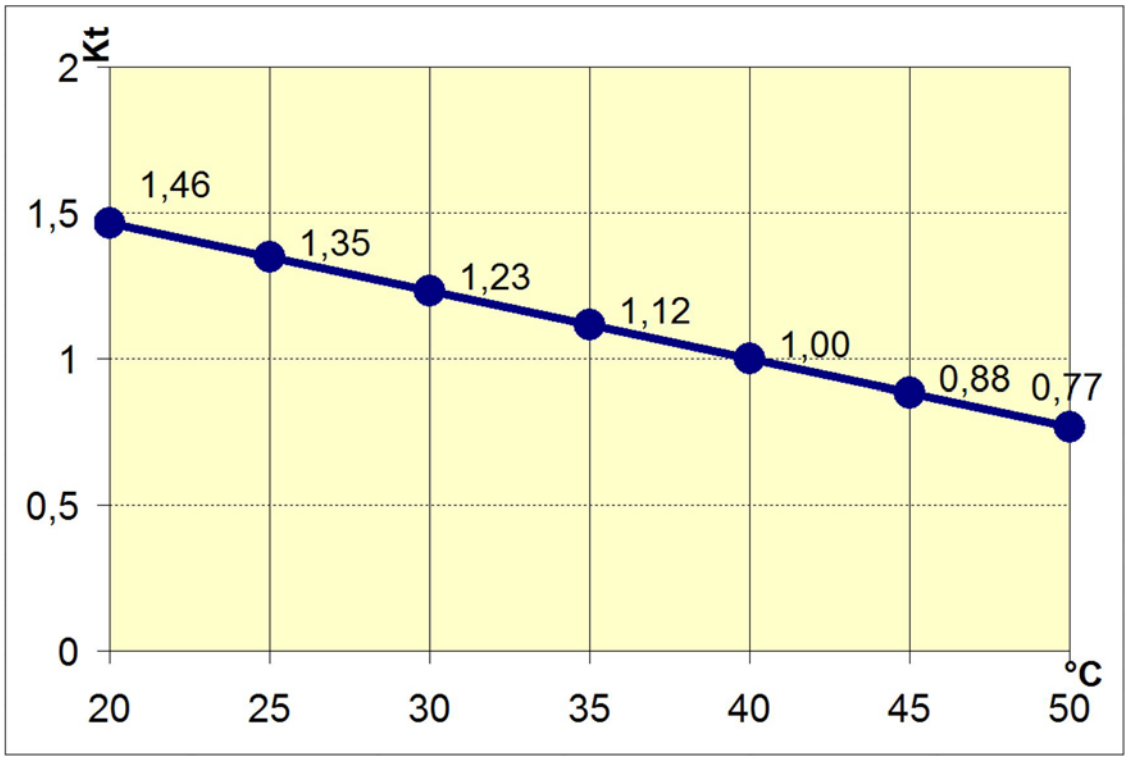


Figure 68: Coefficient Kt for temperature derating (at sea level)

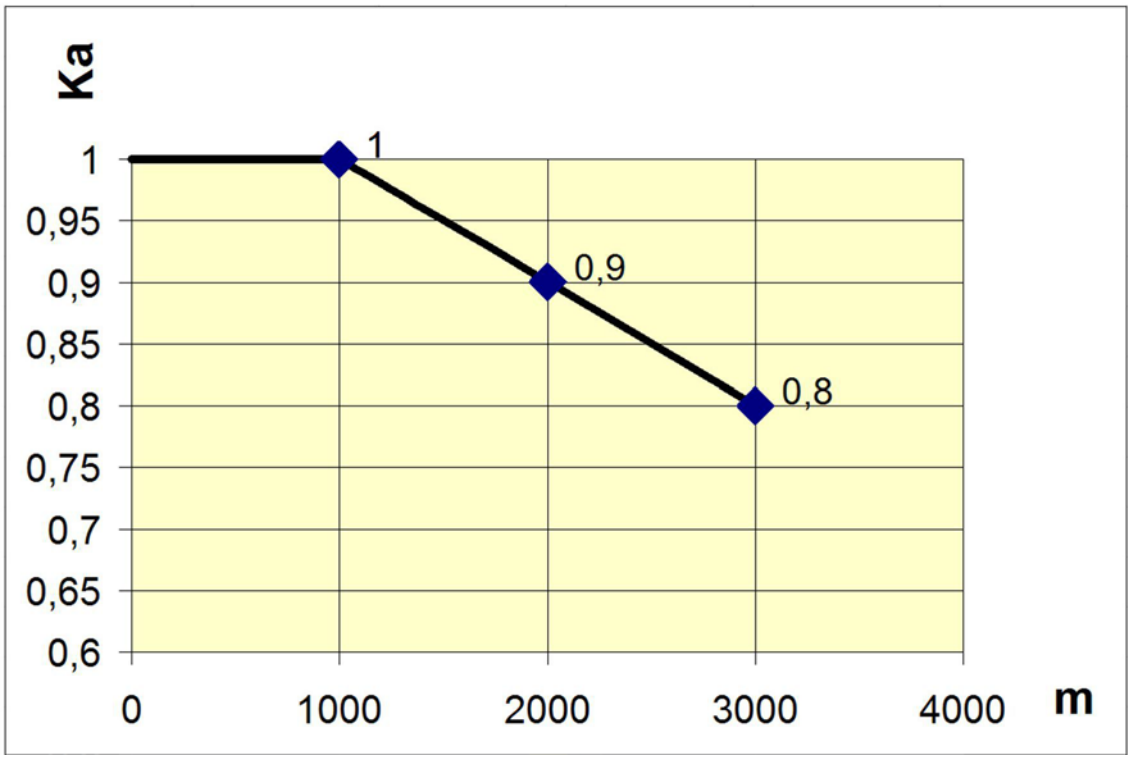


Figure 69: Coefficient Ka for altitude derating

To calculate rated current derating the following method of calculation is used:

Calculation of coefficients	Condition	Calculation of the rated output current
Ktot = Kt x Ka	If Ktot ≥ 1	Unchanged
Ktot = Kt x Ka	If Ktot < 1	Rated output current reduced by a Ktot factor

Table 41: Calculation of the rated current reduction coefficient

Example: the installation of a SUNWAY TG 145 800V inverter with Pnom = 102.5 kW:

altitude = 800 m
Max. ambient temp. = 35 ° C
Ktot = Kt x Ka = 1.12 * 1.0 = 1.12, the rated power remains unchanged

altitude = 2500 m
Max. ambient temp. = 35 ° C
Ktot = Kt x Ka = 1.12 * 0.85 = 0.95, the rated power is reduced to 97.4 kW

altitude = 2500 m
Max. ambient temp. = 30 ° C
Ktot = Kt x Ka = 1.23 * 0.85 = 1.04, the rated power remains unchanged

11.4. Inverter Views

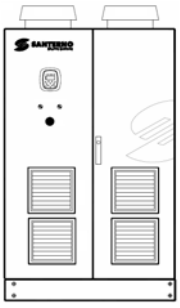
SUNWAY TG 600V	SUNWAY TG 800V	
SUNWAY TG 14 600V	SUNWAY TG 35 800V	
SUNWAY TG 19 600V		
SUNWAY TG 26 600V		
SUNWAY TG 42 600V	SUNWAY TG 57 800V	
SUNWAY TG 61 600V	SUNWAY TG 82 800V	
SUNWAY TG 90 600V	SUNWAY TG 120 800V	
SUNWAY TG 110 600V		
SUNWAY TG 135 600V	SUNWAY TG 145 800V	

Table 42: Inverter Views

11.5. Installed Converter Module

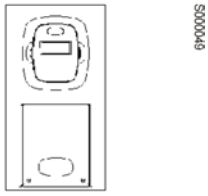
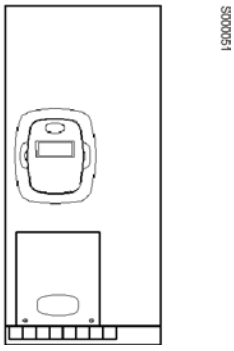
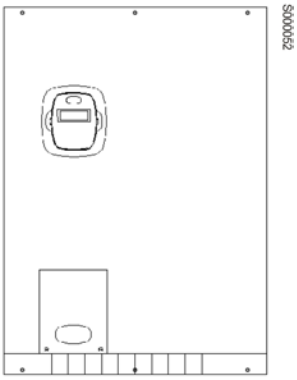
Name of the inverter	Converter installed	Converter layout
SUNWAY TG 14 600V	SUNWAY 14	
SUNWAY TG 19 600V	SUNWAY 19	
SUNWAY TG 26 600V	SUNWAY 26	
SUNWAY TG 35 800V	SUNWAY 35	
SUNWAY TG 42 600V	SUNWAY 42	
SUNWAY TG 57 800V	SUNWAY 57	
SUNWAY TG 61 600V	SUNWAY 61	
SUNWAY TG 90 600V	SUNWAY 90	
SUNWAY TG 82 800V	SUNWAY 82	
SUNWAY TG 110 600V	SUNWAY 110	
SUNWAY TG 120 800V	SUNWAY 120	
SUNWAY TG 145 800V	SUNWAY 145	
SUNWAY TG 135 600V	SUNWAY 135	

Table 43: Converter Module

11.6. Inverter Ventilation System

Ventilation system absorption and flow rate data for SUNWAY TG inverters is provided below. The technical data of the felt filter in accordance with EN 779 and EUROVENT classification is also provided.

Name of the inverter	Ventilation flow rate [m^3/h]	Ventilation system absorption [W]
SUNWAY TG 14 600V	500	70
SUNWAY TG 19 600V	500	70
SUNWAY TG 26 600V	500	70
SUNWAY TG 42 600V	700	120
SUNWAY TG 61 600V	1250	155
SUNWAY TG 90 600V	1500	170
SUNWAY TG 110 600V	2100	360
SUNWAY TG 135 600V	2500	566
SUNWAY TG 35 800V	700	120
SUNWAY TG 57 800V	1250	155
SUNWAY TG 82 800V	1250	155
SUNWAY TG 120 800V	2100	360
SUNWAY TG 145 800V	2500	310

Table 44: SUNWAY TG ventilation technical data

Name of the inverter	Ventilation flow rate [m^3/h]	Ventilation system absorption [W]
SUNWAY TG 14 600V	1560	66
SUNWAY TG 19 600V	1560	66
SUNWAY TG 26 600V	1560	66
SUNWAY TG 42 600V	1560	66
SUNWAY TG 90 600V	2340	99
SUNWAY TG 110 600V	2340	99
SUNWAY TG 35 800V	1560	66
SUNWAY TG 120 800V	2340	99

Table 45: SUNWAY TG ventilation technical data with optional IP20

	EN 779	EUROVENT
Type of felt filter	G3	EU 3

Table 46: Classification of the felt filter installed in the air intake grilles

WARNING

The air ventilation outlet must not be obstructed in any way by walls or other objects standing in front of it at a distance less than prescribed in the heading "Technical Room".

No ducting structure of any kind is allowed unless expressly authorized by Elettronica Santerno.

11.7. Dimensions and Weights

Name of the inverter	Dimensions WxHxD [mm]	Weight [Kg]
SUNWAY TG 14 600V	800x1616x600	260
SUNWAY TG 19 600V	800x1616x600	280
SUNWAY TG 26 600V	800x1616x600	340
SUNWAY TG 42 600V	800x1866x600	450
SUNWAY TG 61 600V	800x1920x600	518
SUNWAY TG 90 600V	1000x2066x800	785
SUNWAY TG 110 600V	1000x2066x800	827
SUNWAY TG 135 600V	1200x2120x800	953
SUNWAY TG 35 800V	800x1616x600	380
SUNWAY TG 57 800V	800x1920x600	543
SUNWAY TG 82 800V	800x1920x600	670
SUNWAY TG 120 800V	1000x2066x800	827
SUNWAY TG 145 800V	1200x2066x800	900

Table 47: SUNWAY TG dimensions and weights

Name of the inverter	Hoisting with cables from above	Hoisting with forklift from below
SUNWAY TG 14 600V	Yes	Yes
SUNWAY TG 19 600V	Yes	Yes
SUNWAY TG 26 600V	Yes	Yes
SUNWAY TG 42 600V	No	Yes
SUNWAY TG 61 600V	No	Yes
SUNWAY TG 90 600V	No	Yes
SUNWAY TG 110 600V	No	Yes
SUNWAY TG 135 600V	No	Yes
SUNWAY TG 35 800V	Yes	Yes
SUNWAY TG 57 800V	No	Yes
SUNWAY TG 82 800V	No	Yes
SUNWAY TG 120 800V	No	Yes
SUNWAY TG 145 800V	No	Yes

Table 48: Handling methods

11.8. Connection of Power and Signal Cables

11.8.1. DC Connection - Input Cables

Name of the inverter	Terminal	No. of cables per pole	Max. cable section [mm²]	Screws provided	Tightening torque[Nm]	Cable lug max. width [mm]
SUNWAY TG 14 600V	X2	1	25	--	min 3 max 4	--
SUNWAY TG 19 600V	X2	1	25	--	min 3 max 4	--
SUNWAY TG 26 600V	X2	1	120	M8	9	20
SUNWAY TG 42 600V	X2	1	120	M8	9	20
SUNWAY TG 61 600V	X2	4	120	M8	25	20
SUNWAY TG 90 600V	X2	4	240	M8	25	39
SUNWAY TG 110 600V	X2	4	240	M8	25	39
SUNWAY TG 135 600V	X2	4	240	M10	50	39
SUNWAY TG 35 800V	X2	1	70	M5	4	16
SUNWAY TG 57 800V	X2	1	70	M5	4	16
SUNWAY TG 82 800V	X2	4	120	M8	25	20
SUNWAY TG 120 800V	X2	4	240	M8	25	39
SUNWAY TG 145 800V	X2	4	240	M8	25	39

Table 49: Technical data for DC input cables

11.8.2. AC Connection - Output Cables

Name of the inverter	Terminal	No. of cables per pole	Max. cable section [mm²]	Screws provided	Tightening torque [Nm]	Cable lug max. width [mm]
SUNWAY TG 14 600V	X1	1	25	--	2.8	--
SUNWAY TG 19 600V	X1	1	25	--	2.8	--
SUNWAY TG 26 600V	X1	1	25	--	2.8	--
SUNWAY TG 42 600V	X1	1	25	--	2.8	--
SUNWAY TG 61 600V	X1	1	50	--	7	--
SUNWAY TG 90 600V	X1	1	120	M6	6	20
SUNWAY TG 110 600V	X1	1	120	M6	6	20
SUNWAY TG 135 600V	X1	1	120	M6	6	20
SUNWAY TG 35 800V	X1	1	25	--	2.8	--
SUNWAY TG 57 800V	X1	1	50	--	7	--
SUNWAY TG 82 800V	X1	1	50	--	7	--
SUNWAY TG 120 800V	X1	1	120	M6	6	20
SUNWAY TG 145 800V	X1	1	150	M8	8	24

Table 50: Technical data for AC output cables

11.8.3. Connection of Earth Cables

Name of the inverter	No. of cables for connection	Screws provided	Minimum conductor section
SUNWAY TG 14 600V	1	M5	10
SUNWAY TG 19 600V	1	M5	10
SUNWAY TG 26 600V	1	M5	10
SUNWAY TG 42 600V	1	M5	10
SUNWAY TG 61 600V	1	M6	10
SUNWAY TG 90 600V	1	M6	10
SUNWAY TG 110 600V	1	M6	10
SUNWAY TG 135 600V	1	M8	10
SUNWAY TG 35 800V	1	M5	10
SUNWAY TG 57 800V	1	M6	10
SUNWAY TG 82 800V	1	M6	10
SUNWAY TG 120 800V	1	M6	10
SUNWAY TG 145 800V	1	M8	10

Table 51: Technical data for earth cables

In observance of safety regulations, never use earth connection cables which have a smaller section than indicated in the table above.

11.8.4. Connection of Signal and Auxiliary Power Supply Cables

Name of the inverter	Terminal	Min. cable section [mm^2]	Max. cable section [mm^2]
ALL	X3	0.5	2.5
ALL	X4	0.5	2.5
ALL	X7	0.5	6

Table 52: Technical data for signal cables

11.9. SPD

Technical specifications for SPDs are provided in the table below.

Technical Specifications	
Rated voltage of system	1000 V
Maximum voltage of system	1120 V
Back-up power supply	4 A
Rated discharge current	20 kA
Response time	25 ns
Residual current	< 1 mA
Configuration	Y connection of three SPDs to varistor
UP level of protection (L-L / L-PE)	3.8 kV
L tightening torque	2.8 Nm
Remote signal contact	
Type	1 NO/NC
Minimum range	12Vdc - 10 mA
Maximum range	250 Vac - 1 A
Cable section	1.5 [mm^2]
Ambient conditions	
Operating temperature	-40 ... +80
Maximum altitude	2000
General specifications	
Removable cartridges	Yes
UL94 Fire resistance	V0

Table 53: SPD technical specifications

11.10. Technical Room

NOTE

SUNWAY TG 14 600V, TG 19 600V and TG 26 600V inverters are fitted with an air intake opening on the left-hand side: leave a clearance of 600 mm to allow air to circulate freely and provide easy access to clean the filters.

The inverters can be positioned with their backs right up against the cabinet wall, as long as care is taken not to obstruct any of the air intakes on the cabinet itself.

Name of the inverter	Air cooling towers	Air ventilation unit with front filter	Grilles with front filters	Grilles with side filters	Clearance values [mm]		
					Front	Front	Front
SUNWAY TG 14 600V	YES	NO	NO	YES	800	600	200
SUNWAY TG 19 600V	YES	NO	NO	YES	800	600	200
SUNWAY TG 26 600V	YES	NO	NO	YES	800	600	200
SUNWAY TG 42 600V	YES	NO	YES	NO	800	--	200
SUNWAY TG 61 600V	YES	NO	YES	NO	800	--	200
SUNWAY TG 90 600V	YES	NO	YES	NO	1000	--	200
SUNWAY TG 110 600V	YES	NO	YES	NO	1000	--	200
SUNWAY TG 135 600V	YES	YES	YES	NO	800	--	200
SUNWAY TG 35 800V	YES	NO	YES	NO	800	--	200
SUNWAY TG 57 800V	YES	NO	YES	NO	800	--	200
SUNWAY TG 82 800V	YES	NO	YES	NO	800	--	200
SUNWAY TG 120 800V	YES	NO	YES	NO	1000	--	200
SUNWAY TG 145 800V	YES	NO	YES	NO	800	--	200

Table 54: Clearance values for SUNWAY TG:

The clearance values may be reduced only if explicitly agreed upon with Elettronica Santerno, depending on the product application conditions and on the presence of air-conditioning systems in the technical room.

NOTE

If necessary, please contact the Elettronica Santerno SpA CUSTOMER SERVICE.

11.10.1. Air Exchange and Flow Rate

Inverters dissipate heat into the surrounding environment which must be removed. Make sure an adequate ventilation or air conditioning system is in place.

The technical room must be equipped with an adequate system for removing excess heat (air conditioning or forced ventilation). The system must be able to keep the air temperature below 40°C.

Calculate heat dissipation at around 5% of the rated power for each inverter installed.

Pdmax = 5% Pnom AC

For example:

System made up of:

2 SUNWAY TG 145 800V

Pnom AC = 102.5 kW

Consider dissipation equal to 2 x 5% x 102.5 kW = 10.25 kW

11.11. Control Board

Screw terminal board with 6 separate removable sections suitable for 0.08 - 1.5 mm^2 (AWG 28-16) cables.

No.	Name	Description	I/O Features	DIP-switch
1	CMA	0V for main reference (connected to control 0V).	0V control board	
2	REF	Analogue input which can be configured as a voltage input or current input Analogue input available for the Power Control function if configured as a voltage input.	Vfs = ±10 V Rin: 50 kΩ Resolution: 12 bits	SW1-1: Off
			0 (4) – 20 mA Rin = 250 Ω Resolution: 11 bits	SW1-1: On
3	-10VR	Negative -10 V power supply output	-10 V Imax: 10 mA	
4	+10VR	Positive +10 V power supply output	+10V Imax: 10 mA	
5	AIN1+	Analogue grid voltage input.	Vfs = ±10 V Rin: 50 kΩ Resolution: 12 bits	SW1-2: Off
6	AIN1-		n.o.	SW1-2: On
7	AIN2+	Analogue grid voltage input.	Vfs = ±10 V Rin: 50 kΩ Resolution: 12 bits	SW1-3: Off SW1-4.5: Off
8	AIN2-		n.o.	SW1-3: On SW1-4.5: Off
9	CMA	0V for auxiliary inputs (connected to control 0V).		
10	AO1	Delivered active power fed back to AO1 analogue output. Please refer to the Programming Guide.	Vout = ±10 V Ioutmax = 5 mA Resolution: 11 bits	SW2-1: On SW2-2: Off
			0 (4) – 20 mA Voutmax = 10 V Resolution: 10 bits	SW2-1: Off SW2-2: On
11	AO2	Field voltage fed back to AO2 analogue output. Please refer to the Programming Guide.	Vout = ±10 V Ioutmax = 5 mA Resolution: 11 bits	SW2-3: On SW2-4: Off
			0 (4) – 20 mA Voutmax = 10 V Resolution: 10 bits	SW2-3: Off SW2-4: On

No.	Name	Description	I/O Features	DIP-switch
12	AO3	Field current fed back to AO3 analogue output. Please refer to the Programming Guide.	Vout = ±10 V Ioutmax = 5 mA Resolution: 11 bits	SW2-5: On SW2-6: Off
			0 (4) – 20 mA Voutmax = 10 V Resolution: 10 bits	SW2-5: Off W2-6: On
13	CMA	0V for analogue outputs (connected to control 0V).		

Table 55: Terminals 1 - 13 available on the control board

No.	Name	Description	I/O features	DIP-switch
14	**MDI1**	Digital input Please refer to the Electrical and Mechanical diagram	Optoisolated digital inputs 24 Vdc: positive logic (PNP type) active with high signal in relation to CMD (terminal 22)	
15	**MDI2 (ENABLE)**	Input active: inverter enabled to run Input not active: inverter disabled		
16	**MDI3**	Digital input Please refer to the Electrical and Mechanical diagram		
17	**MDI4**	Digital input Please refer to the Electrical and Mechanical diagram		
18	**MDI5**	Digital input Please refer to the Electrical and Mechanical diagram		
19	**MDI6**	Digital input Please refer to the Electrical and Mechanical diagram		
20	**MDI7**	Digital input Please refer to the Electrical and Mechanical diagram		
21	**MDI8**	Not used		
22	**CMD**	Not used	Not used	
23	**+24V**	Auxiliary power supply output for digital inputs	+24 V±15% Imax: 100 mA Protected by resettable fuse	
24	**+VMDO1**	Not used	Not used	
25	**MDO1 /FOUT**	Not used	Not used	
26	**CMDO1**	Not used	Not used	
27	**MDO2**	Digital output Please refer to the Electrical and Mechanical diagram	Isolated digital output ; open collector type; Vomax = 48 V Iomax = 50 mA	
28	**CMDO2**	MDO2 common digital output	Common multifunction output 2	

No.	Name	Description	I/O features	DIP-switch
29	**MDO3-NC**	Digital relay output 3 (NC contact) Please refer to the Electrical and Mechanical diagram	Switch contact: with low level logic the common terminal is closed with NC terminal, with high level logic common terminal is closed with NO Vomax = 250 Vac Iomax = 3 A Vomax = 30 Vdc Iomax = 3 A	
30	**MDO3-C**	Digital relay output 3 (common) Please refer to the Electrical and Mechanical diagram		
31	**MDO3-NO**	Digital relay output 3 (NO contact) Please refer to the Electrical and Mechanical diagram		
32	**MDO4-NC**	Not used		
33	**MDO4-C**	Not used		
34	**MDO4-NO**	Not used		

Table 56: Terminals 14-34 available on the control board

11.12. Environmental Sensors and Field I/Os Expansion Board

11.12.1. List of Signals to Terminal Board

Screw terminal board with 12 separate removable sections suitable for 0.08 - 1.5 mm^2 (AWG 28-16) cables.

No.	Name	Description	I/O Features	DIP-switch
1-2		NOT USED – DO NOT CONNECT		
3	**CMA**	Analogue inputs 0 V (common with control 0V)	0V control board	
4-5	**+15VM-15VM**	Stabilized bipolar power supply output protected against short-circuit by external sensors	+15 V -15 V Iout max: 100 mA	
6	**CMA**	Analogue inputs 0 V (common with control 0V)	0V control board	
7-26		NOT USED – DO NOT CONNECT		
27	**XAIN8/T1+**	ENVIRONMENTAL MEASURE 1 auxiliary analogue input	Vfs = 10 V Rin = 30 kΩ	SW1.3 = ON SW1.1-2-4 = OFF
			Vfs = 100 Mv Rin = 1 MΩ	SW1.4 = ON SW1.1-2-3 = OFF
			Ifs = 20 mA Rin = 124,5 Ω	SW1.2 = ON SW1.1-3-4 = OFF
		Thermistor 1 temperature measure	PT100 Temperature measure	SW1.1-4 = ON SW1.2-3 = OFF
28	**CMA/T1-**	Analogue inputs 0V for XAIN8 feedback	0V control board	
29	**XAIN9/T2+**	ENVIRONMENTAL MEASURE 2 auxiliary analogue input	Vfs = 10 V Rin = 30 kΩ	SW1.7 = ON SW1.5-6-8 = OFF
			Vfs = 100 mV Rin = 1 MΩ	SW1.8 = ON SW1.5-6-7 = OFF
			Ifs = 20 mA Rin = 124,5 Ω	SW1.6 = ON SW1.5-7-8 = OFF
		Thermistor 2 temperature measure	PT100 Temperature measure	SW1.5-8 = ON SW1.6-7 = OFF
30	**CMA/T2-**	Analogue inputs 0V for XAIN9 feedback	Vfs = 10 V Rin = 30 kΩ	SW2.3 = ON SW2.1-2-4 = OFF

No.	Name	Description	I/O Features	DIP-switch
31	XAIN10/T3+	ENVIRONMENTAL MEASURE 3 auxiliary analogue input	Vfs = 100 mV Rin = 1 MΩ	SW2.4 = ON SW2.1-2-3 = OFF
			Ifs = 20 mA Rin = 124,5 Ω	SW2.2 = ON SW2.1-3-4 = OFF
		Thermistor 3 temperature measure	PT100 Temperature measure	SW2.1-4 = ON SW2.2-3 = OFF
32	CMA/T3-	Analogue inputs 0V for XAIN10 feedback	0V control board	
33	XAIN11/T4+	ENVIRONMENTAL MEASURE 4 auxiliary analogue input	Vfs = 10 V Rin = 30 kΩ	SW2.7 = ON SW2.5-6-8 = OFF
			Vfs = 100 mV Rin = 1 MΩ	SW2.8 = ON SW2.5-6-7 = OFF
			Ifs = 20 mA Rin = 124,5 Ω	SW2.6 = ON SW2.5-7-8 = OFF
		Thermistor 4 temperature measure	PT100 Temperature measure	SW2.5-8 = ON SW2.6-7 = OFF
34	CMA/T4-	Analogue inputs 0V for XAIN11 feedback	0V control board	
35	XAIN12	Auxiliary analogue input 10 V f.s. ENVIRONMENTAL MEASURE 5	Fs = 10 V Rin= 30 kΩ	
36	CMA	Analogue inputs 0V for XAIN12 feedback	0V control board	
37	XAIN13	Auxiliary analogue input 10 V f.s. ENVIRONMENTAL MEASURE 6	Fs = 10 V Rin= 30 kΩ	
38	CMA	Analogue inputs 0V for XAIN13 feedback	0V control board	
39	XMDI1	Multifunction auxiliary digital input 1	Used for controlling the output power by a device outside the inverter.	
40	XMDI2	Multifunction auxiliary digital input 2	Used for controlling the output power by a device outside the inverter.	
41	XMDI3	Multifunction auxiliary digital input 3	Energy delivered from external meter	
42	XMDI4	Multifunction auxiliary digital input 4	Energy absorbed by external meter	

No.	Name	Description	I/O Features	DIP-switch
43	**CMD**	0V digital input isolated in relation to control 0V	Common	
44	**+24V**	Auxiliary power supply output for optoisolated multifunction digital inputs.	+24 V	
45	**XMDI5**	Multifunction auxiliary digital input 5	Used for controlling the output power by a device outside the inverter.	
46	**XMDI6**	NOT USED – DO NOT CONNECT		
47	**XMDI7**	Multifunction auxiliary digital input 7	Used for controlling the output power by a device outside the inverter.	
48-62		NOT USED – DO NOT CONNECT		

Table 57: Terminals available on the environmental sensors and field I/O board

11.12.2. Electrical Specifications

ANALOGUE INPUTS

Analogue inputs configured in 0-10 V mode	Rating			
	Min	Typ	Max	Unit
Input impedance		40		kΩ
Cumulative offset and gain error in relation to full scale value		0.5		%
Temperature coefficient of the offset and gain error			200	ppm/°C
Digital resolution			12	bits
Voltage LSB value		2.44		mV/LSB
Permanent overload on the inputs without causing damage	-30		+30	V
Input filter cut-off frequency (low-pass first order filter)		1		Hz
Sampling period (depending on the application SW in use)	10		1000	ms

Table 58: Analogue inputs configured in 0 - 10 V mode

Analogue inputs configured in 0-20 mA mode	Rating			
	Min	Typ	Max	Unit
Input impedance		40		kΩ
Cumulative offset and gain error in relation to full scale value		0.5		%
Temperature coefficient of the offset and gain error			200	ppm/°C
Digital resolution			12	bits
Voltage LSB value		2.44		mV/LSB
Permanent overload on the inputs without causing damage	-3.7		+30	V
Input filter cut-off frequency (low-pass first order filter)		1		Hz
Sampling period (depending on the application SW in use)	10		1000	ms

Table 59: Analogue inputs configured in 0 - 20 mA mode

Analogue inputs configured in 0-100 mV mode	Rating			
	Min	Typ	Max	Unit
Input impedance	1			MΩ
Cumulative offset and gain error in relation to full scale value		0.2		%
Temperature coefficient of the offset and gain error			50	ppm/°C
Digital resolution			12	bits
Voltage LSB value		24.7		µV/LSB
Permanent overload on the inputs without causing damage	-30		+30	V
Input filter cut-off frequency (low-pass first order filter)		1		Hz
Sampling period (depending on the application SW in use)	10		1000	ms

Table 60: Analogue inputs configured in 0 - 100 mV mode

Analogue inputs configured as temperature measurement with PT100	Rating			
	Min	Typ	Max	Unit
Type of probe	2-wire connection PT100 thermistor			
Measurement range	-50		125	°C
PT100 element polarization current		0.67		mA
Temperature measurement coefficient			50	ppm/°C
Digital resolution			12	bits
Maximum cumulative measurement error over -40 °C ÷ +50 °C temperature range		0.5	1.5	°C
Mean value of temperature LSB (SW linearization function)		0.098		°C/LSB
Permanent overload on the inputs without causing damage	-10		+10	V
Input filter cut-off frequency (low-pass first order filter)		1		Hz
Sampling period (depending on the application SW in use)	10		1000	ms

Table 61: Analogue inputs configured as temperature measurement with PT100

POWER SUPPLY OUTPUTS

Specifications of the analogue power supply outputs	Rating			
	Min	Typ	Max	Unit
Voltage available at terminal +15 V (4) with respect to CMA (6)	14.25	15	15.75	V
Voltage available at terminal -15 V (5) with respect to CMA (6)	-15.75	-15	-14.25	V
Maximum current which can be delivered from output +15 V and be absorbed by output -15 V			100	mA

Table 62: Specifications of the analogue power supply outputs

Specifications of the digital power supply outputs	Rating			
	Min	Typ	Max	Unit
Voltage available at terminals +24 V (44 + 49) with respect to CMA (43 and 50)	21	24	27	V
Maximum current which can be delivered from output +24 V			200	mA

Table 63: Specifications of the digital power supply outputs

WARNING

If the maximum/minimum input or output voltage ratings are exceeded, irreparable damage to the equipment may occur.

NOTE

The isolated power supply output and the analogue auxiliary output are protected by a resettable fuse capable of protecting the power supply unit inside the inverter against faults following a short circuit, but it cannot be guaranteed that the inverter will temporarily cease operation in the event of a short circuit.

12. DECLARATION OF CONFORMITY

Please refer to the “CERTIFICATION AND GRID INTERFACE FILE”.

13. ANNEXES

13.1. Index of revisions

Revision 03

- Error corrected relative to the COM1 port in heading 7.3.2 "SUNWAY TG with optional Data Logger Board", Figure 38.
- The RS485 bus default rate has been corrected (now 38400 baud) in heading 7.3.5 "Multidrop Connection".
- "Environmental Sensors and Field I/Os Expansion Board Option" added to heading 8.2.
- IP20 ventilation kit option added in heading 8.6 "Optional Ventilation Kit IP20" together with relative technical data.
- Annexes inserted.