CARLO GAVAZZI
Automation Components

CARLO GAVAZZI

ISMG1xx

Smart MPPT Inverter

Grid Connected Solar Inverter

User Manual

EcoEnergy

CARLO GAVAZZI
Automation Components

CARLO GAVAZZI LOGISTICS SpA
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CE Declaration of Conformity

We, Manufacturer, CARLO GAVAZZI LOGISTICS S.p.A., located at Via Milano,13 20020 Lainate (ITALY), declare that the products here listed

***ISMG 145, ISMG 150, ISMG 160* series of solar Inverters**

are in conformity with

The Low-Voltage Directive 73/23/EEC, as amended by 93/68/EEC,

The EMC Directive 89/336/EEC, as amended by 92/31/EEC

referring to the below listed standards

EN 61000-3-2/3: Limits for harmonic current emissions.
EN 61000-4-2: Electrostatic discharge immunity tests.
EN 61000-4-3: Radiated, radio-frequency, electromagnetic field immunity test.
EN 61000-4-4: Electrical fast transient/burst immunity test.
EN 61000-4-5: Surge immunity test.
EN 61000-4-6: Immunity to conducted disturbances, induced by radio-frequency fields.
EN 61000-6-2/3: EMC -Emission standard for residential, commercial and industrial environments.
EN 55022: Radio disturbances characteristics – Limits and methods of measurement.
EN 50178: Electronic equipment for use in power installations.
EN DIN VDE 0126-1-1: Automatic disconnection device between a generator and the public low-voltage grid.

CE marking

Design and manufacturing follows the provisions of the Low Voltage Directive of the European Communities as of February 19. 1973 as changed by 93 / 68 / EEC and the EMC Directive 89 / 336 / EEC as changed by 92 / 31 / EEC and 93 / 68 / EEC.

Manufacturer

Place / Date : Lainate , March 12th / 2008

Signature :

Name : Graziano Padovan

C E R T I F I C A T E
of Conformity

TÜVRheinland®

Registration No.: AK 60021812 0001

Report No.: 28101598 001

Holder:
Carlo Gavazzi Logistics Spa
Via Milano 13
20020 Lainate MI
Italia

Product:
Electrical Equipment
Static Conversion Device for Photovoltaic Plants

Identification:

	ISMG160IT	ISMG150IT	ISMG145IT
DC Input:	500V	500V	500V
Max.current:	3x10A	2x10A	2x10A
AC Output:			
Nominal power:	4600W	3800W	3300W

For Model description see Attachment 1

Tested acc. to: STU ENEL DK5940 ed. 2.2:2007

The certificate of conformity refers to the above mentioned product. This is to certify that the specimen is in conformity with the assessment requirement mentioned above. This certificate does not imply assessment of the production of the product and does not permit the use of a TÜV Rheinland mark of conformity.

Certification Body

Cologne, 19.06.2008

Dipl.-Ing. M. Leone

TÜV Rheinland Product Safety GmbH - Am Grauen Stein - D-51105 Köln

Attachment 1

TÜVRheinland®

OGGETTO: Dichiarazione di conformità alla specifica ENEL Distribuzione S.p.A. DK 5940 (Ed. 2.2 dell'Aprile 2007).
***SUBJECT**: Declaration of Conformity to ENEL Distribuzione S.p.A. Specification DK 5940 (Ed. 2.2, April 2007).*

Certificate No.: AK 60021812 0001

TIPOLOGIA DI APPARATO A CUI SI RIFERISCE LA DICHIARAZIONE:
TYPE OF APPARATUS WHICH THE DECLARATION IS REFERRED TO:

DISPOSITIVO DI INTERFACCIA Interface Device	PROTEZIONE DI INTERFACCIA Interface Protection Device	DISPOSITIVO DI CONVERSIONE STATICA Static Conversion Device
☒	☒	☒

Costruttore *Manufacturer*	CARLO GAVAZZI LOGISTICS S.p.A. Via Milano, 13 I-20020 Lainate (MI)
Modello/Tipo *Model/Type*	ISMG160IT, ISMG150IT, ISMG145IT
Firmware release	SEQ version 1.12 CUR version 1.02
Laboratorio di Prova *Test Laboratory*	EuroTest Laboratori S.r.l., Via dell'Industria, 18 I-35020 Brugine (PD) Accreditamento SINAL N. 0192 ETC Electronic Testing Center, Taiwan, No. 8 Lane 29, Wen-Ming RD., Lo-Shan Tsun, Kui-Shan Hsiang, Taoyuan Hsien, Taiwan, R.O.C. Accreditation NVLAP Lab Code: 200133-0

Esaminati i Fascicoli Prove n° DK 01 CdO 07C300001 emessi da EuroTest Laboratori S.r.l. e n° 07-05-MAS-176-02 e 06-05-MAS-107 emessi da ETC Electronic Testing Center, Taiwan.
Having assessed the Test Files no. DK 01 CdO 07C300 issued by EuroTest Laboratori S.r.l. and no. 07-05-MAS-176-02 AND no. 06-05-MAS-107 issued by ETC Electronic Testing Center, Taiwan.

si dichiara che i prodotti indicati soddisfano i requisiti della specifica Enel Distribuzione S.p.A. DK 5940 (Ed. 2.2 dell'Aprile 2007).
we declare that the products indicated meet the requirements laid down by Enel Distribuzione S.p.A. Specification DK 5940 (Ed. 2.2, April 2007).

Validità della Dichiarazione
Validity of the Declaration

Questa Dichiarazione è valida per i prodotti indicati, così come descritti nei Fascicoli citati. Nuovi requisiti o emendamenti a requisiti esistenti, così come modifiche ai prodotti, possono implicare nuove verifiche e certificazioni.
This Declaration is valid only for the products indicated herein, as described in the Files mentioned. New requirements or amendment to existing ones, or modifications to the product, may imply re-verification and re-certification.

Cologne, 19.06.2008

Signature :

TÜV Rheinland Product Safety GmbH

TÜV Rheinland Product Safety GmbH – Am Grauen Stein – D-51115 Köln
TÜV Rheinland Product Safety GmbH is accredited according to EN 45011, Accreditation no. ZLS-ZE-402/03 by ZLS.
Reference: http://www.zls-muenchen.de/de/left/akkreditierte_stellen/akkreditierte_stellen-ix.htm

Bureau Veritas Consumer Product Services GmbH
Businesspark A96
86842 Türkheim
Germany
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Certificate of compliance

Applicant: **Carlo Gavazzi Logistics SpA**
Via Milano 13
20020 Lainate (MI)
Italy

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

Model: **ISMG 1 60 DE, ISMG 1 50 DE, ISMG 1 45 DE**
ISMG 1 60 EN, ISMG 1 50 EN, ISMG 1 45 EN

Use in accordance with regulations:

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

Applied rules and standards :

DIN V VDE V 0126-1-1 (VDE V 0126-1-1):2006-02

The safety concept of an aforementioned representative product corresponds at the time of issue of this certificate of valid safety specifications for the specified use in accordance with regulations.

Report number: **08TH0110-VDE0126**
Certificate nummer: **U10-025**
Date of issue: **2010-02-04** **Valid until:** **2010-12-31**

Andreas Aufmuth

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Certificado de conformidad

Solicitante: **Carlo Gavazzi Logistics SpA**
Via Milano 13
20020 Lainate (MI)
Italia

Producto: **Inversor fotovoltaico**

Modelo: **ISMG 1 60 ES, ISMG 1 50 ES, ISMG 1 45 ES**

Uso conforme a lo prescrito:

Punto de conmutación automático con control monofásico de la red conforme al Real Decreto 1663/2000 sobre instalaciones fotovoltaicas con una alimentación paralela monofásica por inversor en la red de suministro público.
Las funciones de protección de máxima y mínima frecuencia y máxima y mínima tensión a que se refiere el Articulo 11 del RD 1663/2000 están integradas en el equipo inversor.
La protección para la interconexión de máxima y mínima frecuencia está dentro de los valores 51Hz y 49Hz, respectivamente y los de máxima y mínima tensión entre 1,1 y 0,85 U_m, respectivamente.
En vez de un transformador de aislamiento entre la red de distribución y la instalación fotovoltaica, la unidad proporciona una corriente interna residual que supervisa la unidad (RCMU), tipo B para proteger contra corrientes de fallo causadas por el generador PV. Esta característica es probada y certificada según el Borrador DIN V VDE V 0126-1-1:2006:02. Un RCMU proporciona una protección adecuada que permite descartar un transformador de aislamiento entre la corriente continua y la corriente alterna ya que los relés de corriente alterna del inversor desconectan de la rejilla en la condición de fallo y no se vuelve a conectar. Así se asegura la separación galvánica.
El tiempo de reconexión del o de los inversores es como máximo de tres minutos conforme a la norma IEC 61727:2001.

Bases de certificación:

RD 1663/2000 y DIN V VDE V 0126-1-1:2006-02 (redundancia, alimentación CC, fiscalización de aislamiento, detección activa del funcionamiento aislado y control de corriente de defecto).

El concepto de seguridad verificado en la semana 18/2008 del producto arriba mencionado corresponde a las especificaciones en razón de la seguridad para el uso conforme a lo prescrito aquí expuesto, válidas en el momento de la emisión del presente certificado.

Número de informe: **08TH0110-RD1663**
Número de certificado: **U08-078**

Fecha: **2008-06-05** **Valedero hasta:** **2011-06-05**

Achim Hänchen

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Unbedenklichkeitsbescheinigung

Antragsteller: **Carlo Gavazzi Logistics SpA**
Via Milano 13
20020 Lainate (MI)
Italien

Erzeugnis: **Selbsttätige Schaltstelle zwischen einer netzparallelen Eigenerzeugungsanlage und dem öffentlichen Niederspannungsnetz**

Modell: **ISMG 1 60 DE, ISMG 1 50 DE, ISMG 1 45 DE**

Bestimmungsgemäße Verwendung:

Selbsttätige Schaltstelle mit einphasiger Netzüberwachung gemäß DIN V VDE V 0126-1-1:2006-02 für Photovoltaikanlagen mit einer einphasigen Paralleleinspeisung über Wechselrichter in das Netz der öffentlichen Versorgung. Die selbsttätige Schaltstelle ist integraler Bestandteil der oben angeführten trafolosen Wechselrichter. Diese dient als Ersatz für eine jederzeit dem Verteilungsnetzbetreiber (VNB) zugängliche Schaltstelle mit Trennfunktion.

Prüfgrundlagen:

DIN V VDE V 0126-1-1 (VDE V 0126-1-1):2006-02

Ein repräsentatives Testmuster der oben genannten Erzeugnisses entspricht den zum Zeitpunkt der Ausstellung dieser Bescheinigung geltenden sicherheitstechnischen Anforderungen der aufgeführten Prüfgrundlagen für die bestimmungsgemäße Verwendung.

Bericht Nummer: **08TH0110-VDE0126**
Zertifikat Nummer: **U08-083**
Datum: **2008-06-16** **Gültig bis:** **2010-12-31**

Achim Hänchen

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Index of manual revision

Revision	Date	Description	Executor
Rev_00	18/12/08	First Release	AT
Rev_02	January 2010	Pictures Reprint	AS
Rev_03	March 2010	Pictures Reprint	AS

Glossary

PTV = Preset Threshold Value

FV o PV = Solar Cell or Solar Module that converts solar energy into electrical energy

DC = Direct Current

AC = Alternative Current

EMC = Electro Magnetic Compatibility

MPP = Maximum Power Point : is the point of the current-voltage diagram of a solar cell or module at whitch the largest power can be tapped off i.e. the point at which the production of current and voltage has its maximum value.

MPPT = Maximum Power Point Tracking : it's the algoritms in order to reach the MPP.

PE = Power Earth , grounding wire .

IP xy = Protection degree, powders (x) liquids (y).

1. Introduction

1.1 General

The Carlo Gavazzi ISMG product family is a series of grid-connected photovoltaic inverters with a smart and flexible method of MPPT management. ISMG inverters utilize the smart MPPT technology to efficiently absorb more energy from the PV panels. The inverter is designed to convert DC power produced by photovoltaic arrays to AC voltage that is then fed into the 230V/50Hz or 230V/60Hz mains utility. The ISMG family currently contains three (3) members which are ISMG45xx, ISMG150xx and ISMG160xx (xx could be IT according to Italian DK5940 ed 2.2. April 2008 standard, ES according to Spanish Real Decreto RD1663/2000 standard, DE according to German VDE0126-1-1 standard, EN is still with the VDE0126-1-1 Approval even if the display text and the documentation are in English). The overview of the grid-tied solar energy system with a three (3) panel strings inverter is shown in Figure 1.1.1. ISMG inverters comply with all VDEW (Association of German Electricity Producers) regulations for supplementary grid feeding to low voltage electricity grid of the utility. Additionally, ISMG inverters are also certified to comply with the latest European regulations i.e. the German DIN VDE 0126-1-1, the Italian DK5940 ed 2.2. April 2008 standard, the Spanish Real Decreto RD1663/2000 standard and according to the harmonized standards and the low voltage regulations described in the CE declaration.

The ISMG inverter is designed to support up to three (3) PV strings and operate automatically without any configuration once it is installed and commissioned according to the technical specifications. When at least one of the DC input voltages generated by the photovoltaic module goes above the minimum MPP voltage setting and under the pre-set threshold value, the embedded controller is then waked up and goes through the system check mode and then stay at monitoring mode because the pre-set threshold value is not reached yet. At this time, the ISMG inverter would not feed the AC power to the mains utility; instead, it keeps watching the input DC voltage. Once the input DC voltage goes up above the pre-set threshold value and all other conditions necessary for grid connection are checked and fulfilled for a certain period of time, the ISMG inverter goes into the grid feeding mode that turns the AC relays on and begins feeding the AC voltage into the grid steadily. When all of the input DC voltages fall below the minimum MPP voltage setting which is 100Vdc, the ISMG inverter will then shut itself down. The ISMG inverter will be waked up automatically when one or more of the input DC voltages go up above the minimum MPP voltage setting.

It is very much appreciated that you choose Carlo Gavazzi Solar inverters as your power conversion devices in the solar power system. This document contains the information you need for the installation and settings of the ISMG inverters. Therefore, it is strongly recommended to read this manual carefully before the ISMG inverter installations and settings.

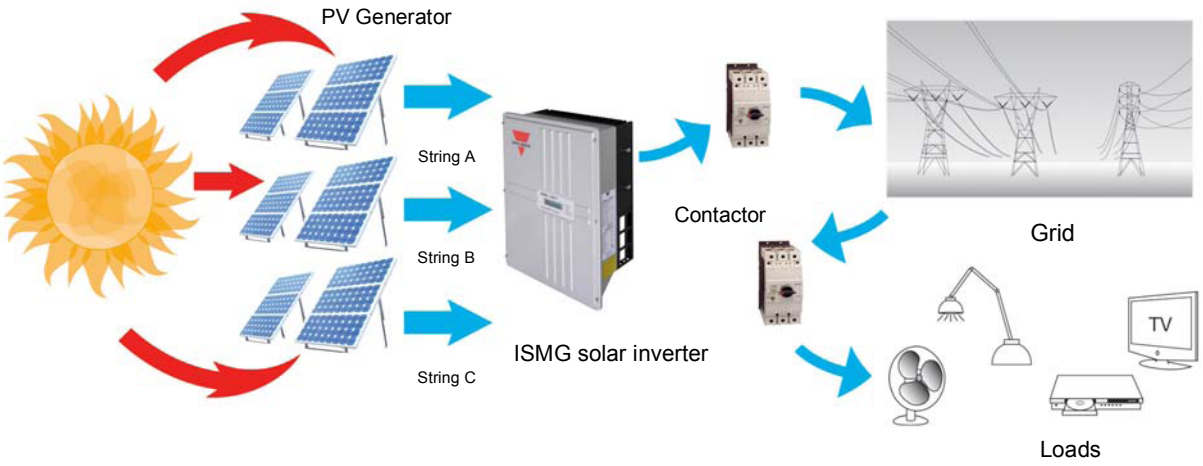


Fig1.1.1 Grid Connected Solar System Overview

1.2 Specifications

The ISMG solar inverter is designed in order to be connected up to 3 independent PV generator and it could run automatically without any kind of preliminary configuration.
When one of the DC input supplied by a string of modules is higher that the minimum MPP voltage value (100Vdc) and it is lower than the threshood value of PTV (130Vdc) the device start up and run in the Control System Mode, if the voltage value is lower than 130Vdc the inverter is in the Monitor Mode and it supply no energy to the grid. If the DC input voltage get over the PTV value and all the conditions of the system are under control, the inverter run in the Power Supply Mode so it supply energy to the public grid
If the DC input run under the min value of MPP voltage, 100Vdc, the solar inverter automatically switches it off. The device will switch it on automatically when the input voltage increase over the upper minimun MPP voltage.

Congratulations on the purchase of this technically high-quality solar inverter.
These directions will help you become familiar with this product. Please read it with maximum accuracy.
Please consider the safety regulations (EN61000-4-2 and technical connection conditions for local utility company). Careful handling with your product will contribute to its service life durability and reliability. These are essential prerequisites for maximum yield.

Please consider the following notes on safety:

- During operation of electrical devices, certain parts are under dangerous voltage.
- Inappropriate handling can lead to physical injury and material damage!
- Adhere to the installation regulations.
- Installation and operational startup work may be implemented only through qualified electrical experts.
- Repair work on the device may be carried out by the manufacturer only.

- Please consider all points in the operating and installation manual!
- Isolate the device from the mains and the PV modules before carrying out any work on it.
- As a result of very high temperatures, the device surface area can become hot.
- Sufficient cooling is necessary.

Do not open the solar inverter. No user serviceable parts. Risk of electrical hazard and invalidated warranty.

Dangerous voltage present for 5 minutes after disconnecting all sources of power.

1.3 Accessories

Operation Manual	1 pc
AC Connector IP65	1 pc
RJ-45 plug IP65	2 pc
DC Connector Sealing Cap (female)	2 pc
DC Connector Sealing Cap (male)	2 pc
CD containing user manual and PV designer SW tool	1 pc
Deep Switch for M/S string selection	1 pc
Warranty Certificate	1 pc
Warranty extension Certificate	1 pc

2. Safety

2.1 Safety Precautions/Safety Notes

Only the trained qualified electrical personnel are allowed to perform the electrical installation, wiring, opening, repair, and/or modification of the ISMG inverters. Even when no external voltage is present, the ISMG inverters can still contain high voltages and the risk of electrical shock.

The temperature of the heat sinks outside of the device can reach over 70 degree C in normal operation. There is the risk of burn injury when these parts are touched.

The following general safety precautions must be observed during all phases of operation, service, installation, modification, and repair of this device. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the device. The manufacturer assumes no liability for the customer's failure to comply with these requirements.

2.2 Safety Symbols

To reduce the risk of injury and to ensure the continued safe operation of this product, the following safety instructions and warnings are marked in this manual.

Warning, risk of electric shock
Presents safety information to prevent injury or death to users and/or installers.

Earth ground symbol

Caution (refer to accompanying documents)
Presents information to prevent damage to this product.

2.3 Intended Use

ISMG inverters shall be installed according to the safety regulations applied for installations to meet the following qualifications:

- Electrical installation must be carried out correctly to meet the applicable regulations and standards;
- ISMG inverters shall be mounted in an enclosed and well ventilated environment to against rain, condensation, moisture and dust;
- ISMG inverters shall be able to be permanently installed;
- ISMG inverters shall be installed according to the instructions stated in this manual;
- ISMG inverters shall operate according to the technical specifications as stated in chapter 6.2;

2.4 General Safety Precautions

- Personnel must remove all conductive jewelry or personal equipment prior to installation or service of the device, parts, connectors, and/or wiring.
- Trained qualified personnel are required to mount, operate, correct and/or repair this device.
- Licensed electrician are required to install permanently wired equipment.
- Stand on an insulated surface when working on the operating device (i.e., ensure that there is no grounding).
- Instructions in this manual must be precisely followed and all information on cautions or warnings must be adhered to.
- The list does not contain all measures pertinent to the safe operation of the device. If special problems arise which are not described in sufficient detail for the purposes of the buyer, contact your specialized dealer or technician.
- Use proper lifting techniques whenever handling enclosure, equipment or parts.
- The inverter must be provided with an equipment-grounding conductor connected to the AC ground.

2.5 Safe Installation and Operation

- Installation of the device must be in accordance with the safety regulations (e.g., DIN, VDE) and all other relevant national or local regulations. Correct grounding and short circuit protection must be provided to ensure operational safety.
- Read all instructions and cautionary marks in the manual before installation of this device.
- Switch off the circuit breakers before installation and wirings. Never stand on a wet location when work on installation and wirings.
- Check both of the AC and DC connections with a volt meter prior to any installation or removal procedures.
- Enclose the outer covering well before switch on the circuit breakers.
- Place the inverter in an environment with well ventilation and protection against rain, condensation, moisture and dust.
- Even no external voltage is present, the ISMG inverter can still contain high voltages and the risk of electrical shock. Allow 5 minutes for the inverter to discharge completely after disconnecting the AC and DC sources from the inverter.
- Temperature of the heat sinks outside of the device can reach over 70 degree C in normal operation. There is the risk of burn injury when these parts are touched. Pay attention on the high temperature components and sharp edges.
- Allow changes in your electrical system to be carried out only by qualified electricians.

2.6 Repair and Maintenance

The ISMG inverter contains no spare parts. Only Carlo Gavazzi-trained service staffs are authorized to carry out for repairs and maintenance of the unit. Please return the device for repair and maintenance.

In order to disconnect the DC cables from the unit we strongly recommend to unplug them by using the proper key: Multi-contact PV-SSH4 (as shown in the below photos).

Avoiding to do so can seriously damage the connectors. Please be aware that Carlo Gavazzi Warranty does not cover such intentional damages.

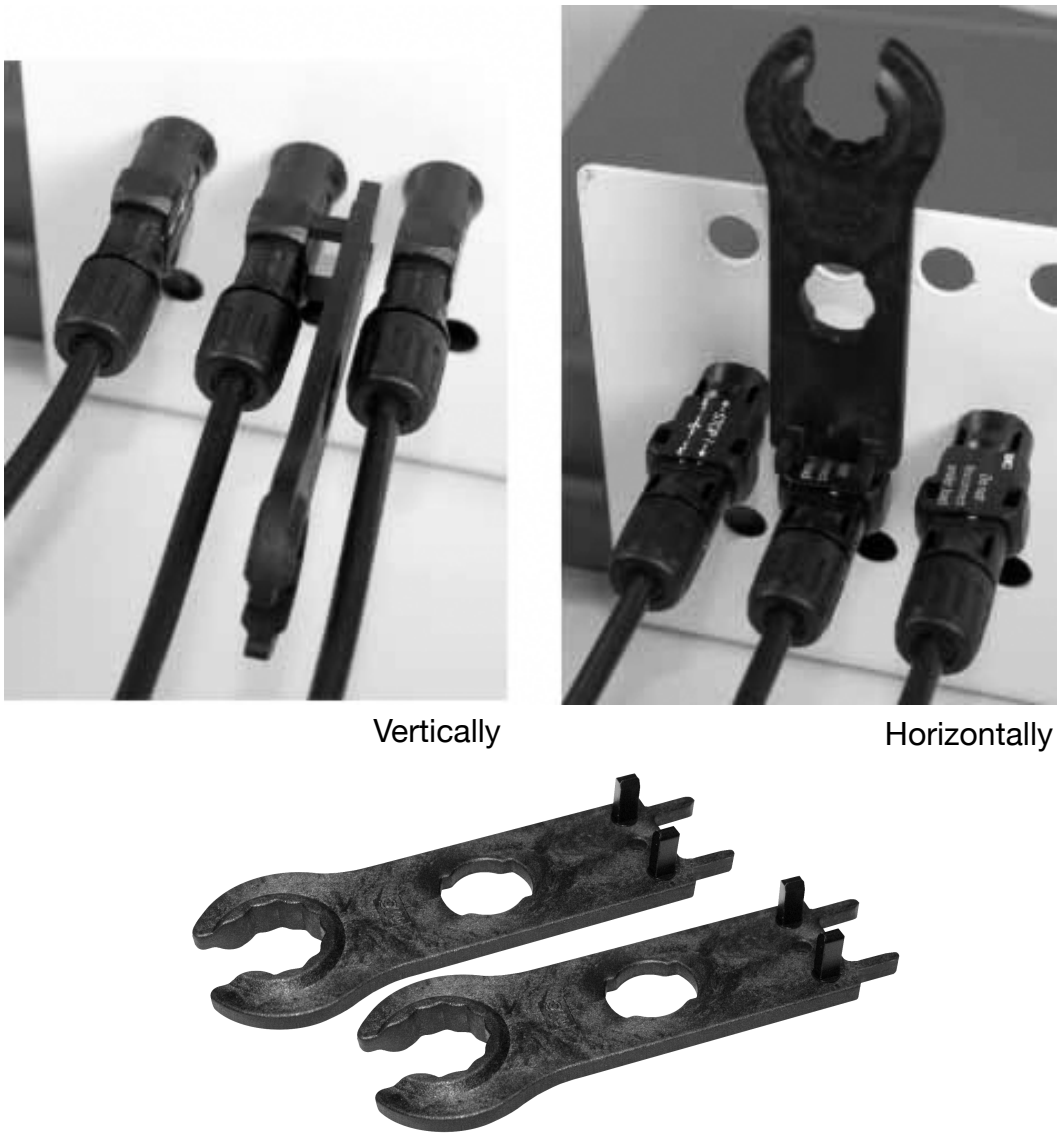


Fig. 2.6.1 Unplugging with safety lock clip PV-SSH4

3. Installation

3.1 Placement

- ISMG inverters may be located indoors or outdoors, according to protection class IP65.
- Avoid mounting the inverter on a location where is directly exposed to rains.
- Leave at least 50 cm of free space above and below the inverter for better ventilation (see Figure 3.1.1).
- Mount the inverter on a wall that shall be firm enough to sustain the inverter with 24Kg in weight.
- Avoid mounting the inverter on a location directly exposed to the sunshine to keep the ambient temperature of the inverter within -20 and 55 ℃.

WARNING!

Some parts of the cooling surface can reach temperature over 70℃. Keep the flammable and explosive materials an appropriate distance away from the inverter!

WARNING!

Do not expose the inverter to the corrosive liquids and/or gases.

- Humidity shall be within 0% and 95%.
- Keep DC wiring as short as possible to minimize power loss.
- Mount bracket should be fastened on a concrete or a masonry wall with the accessory anchors.

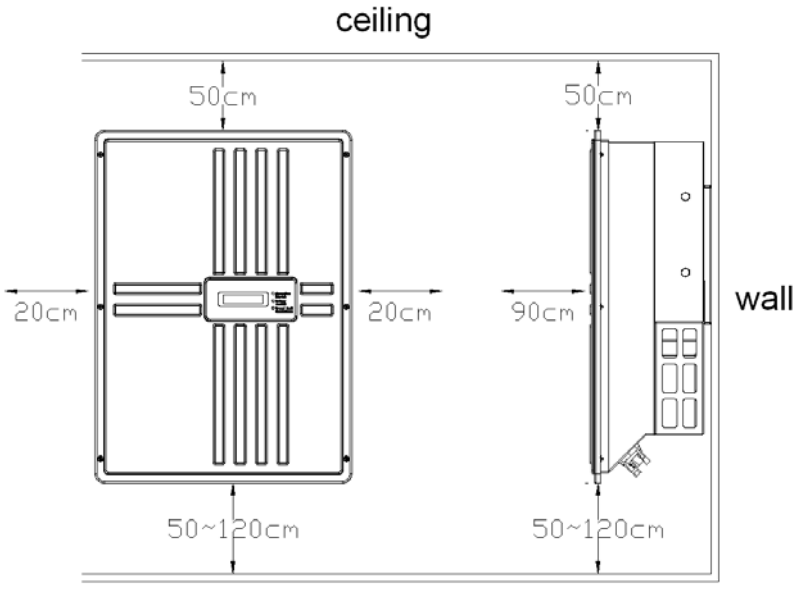


Fig3.1.1 Clearances required for ISMG inverter installation

3.2 Mount

There are five main steps to mount the inverter on the wall:

0. First, loosen the two (2) side screws and take the bracket apart from the inverter as shown in the figure 3.2.1 below.

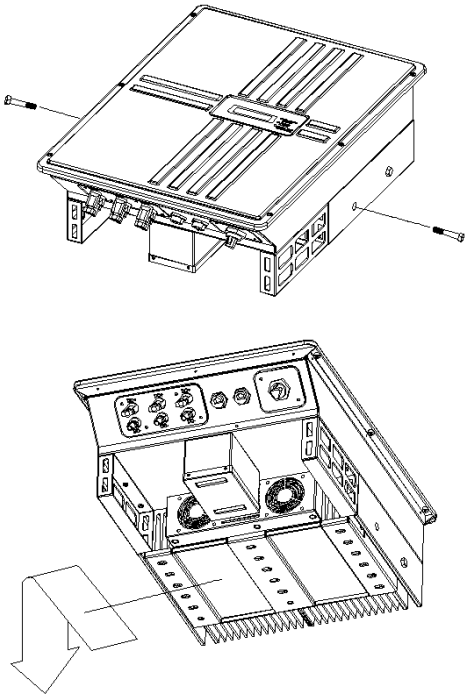


Fig 3.2.1 Remove side screws and bracket

1. Use the mount bracket (Fig3.2.2) as a template to mark the locations where holes shall be drilled. The holes shall be 50 mm depth into the wall with diameter of 8 mm.

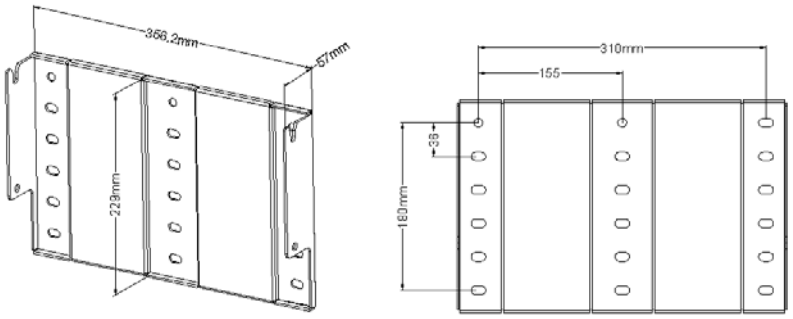


Fig 3.2.2 Mount bracket

2. After drill the holes, the mount bracket is then held against the wall and fastened on the wall with the anchors as shown in Figure 3.2.3.

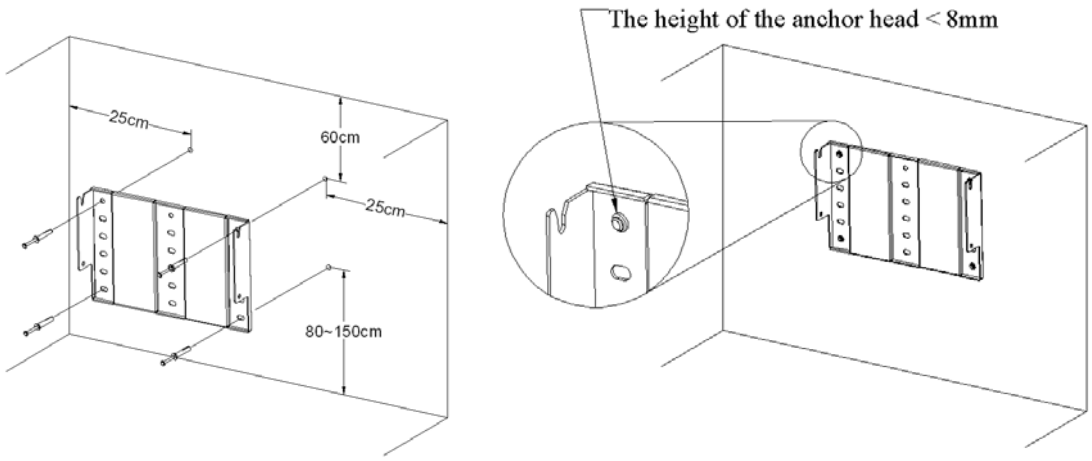


Fig 3.2.3 Fasten the mount bracket

3. Once the mount bracket is fastened, the inverter may be lifted up and hooked onto the bracket as shown in Figure 3.2.4.

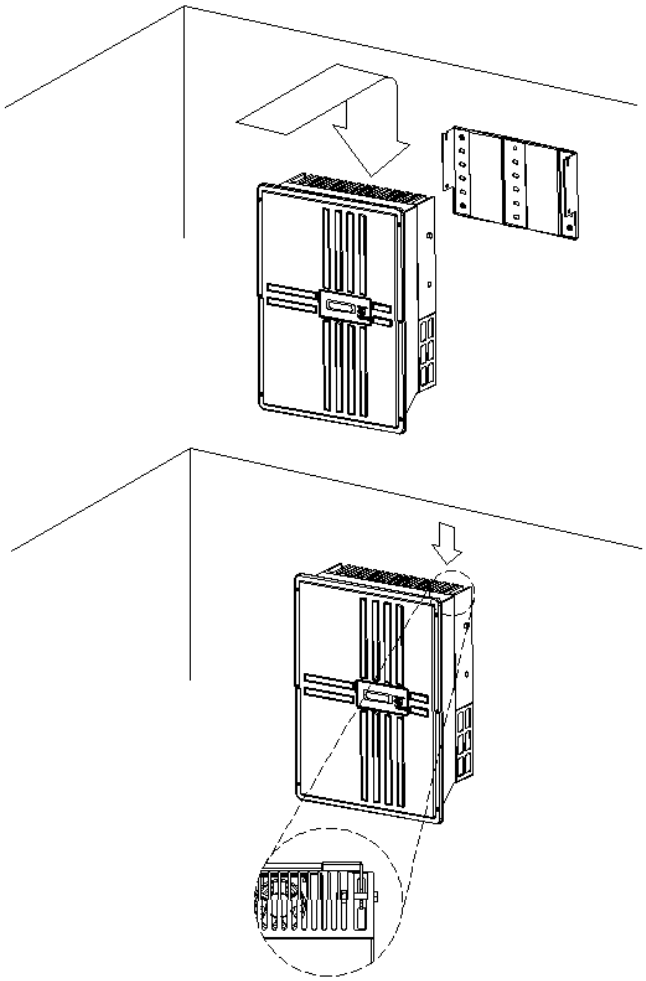


Fig 3.2.4 Hooking inverter onto the bracket

4. After the inverter is hooked on the bracket, it needs to fasten the inverter on the bracket with two side screws (see Figure 3.2.5) to prevent the inverter from pulling away from the bracket.

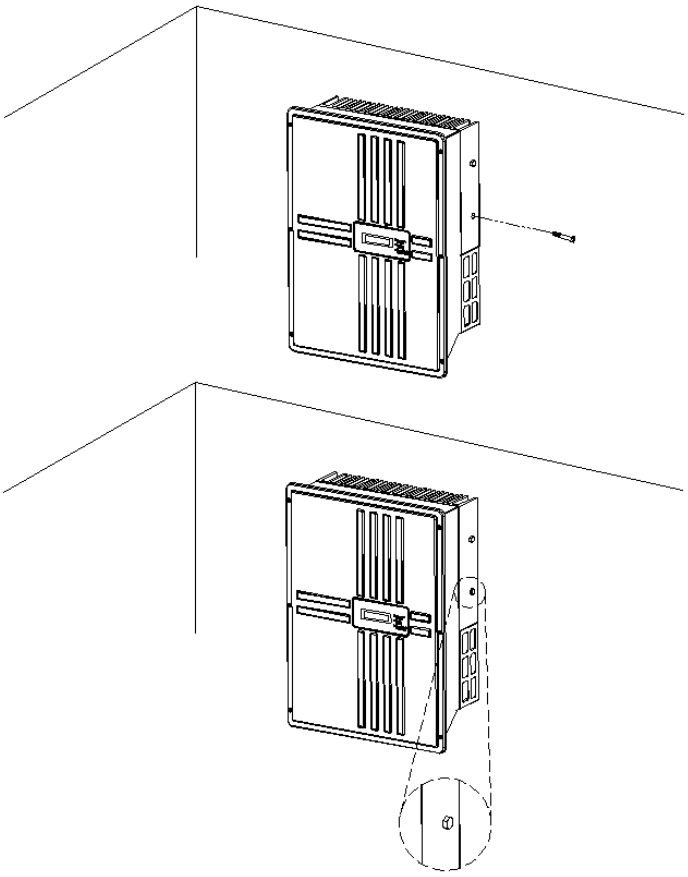


Fig 3.2.5 Fasten the inverter with two side screws

3.3 Wiring the inverter

The following three sections describe the connections of wirings for the AC, DC, and communication ports. ISMG160DE has three (3) pairs of DC connection terminals, string A, B, and C, while ISMG150DE and ISMG145DE have only two (2) pairs of DC connection terminals, string A and C. All three models have two (2) RJ-45 connectors, and one (1) AC connection terminal on the bottom of the inverter shown in the Figure 3.3.1 and Figure 3.3.2. DC connection terminals are used to connect to PV strings through circuit breakers that shall be placed close to the inverter. RJ-45 connectors are used for external communication to a remote computer or terminal. AC connection terminal is used to connect to the mains utility through a circuit breaker that shall be closed to the distribution panel. Each pair of the DC connection terminals shall be connected to one PV string with the maximum rating listed in section 1.2. It is recommended to supply 350 VDC to each string although the MPP voltage range is within 100 and 450 VDC.

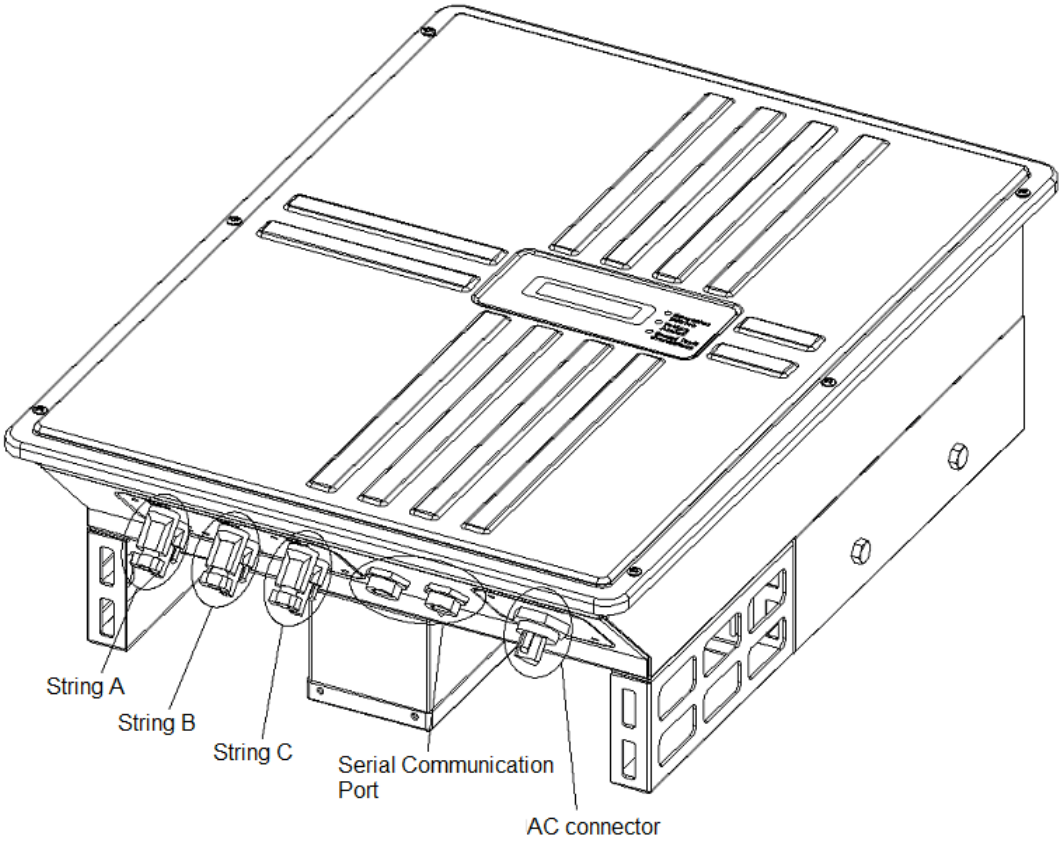


Fig 3.3.1 Wiring compartment front view

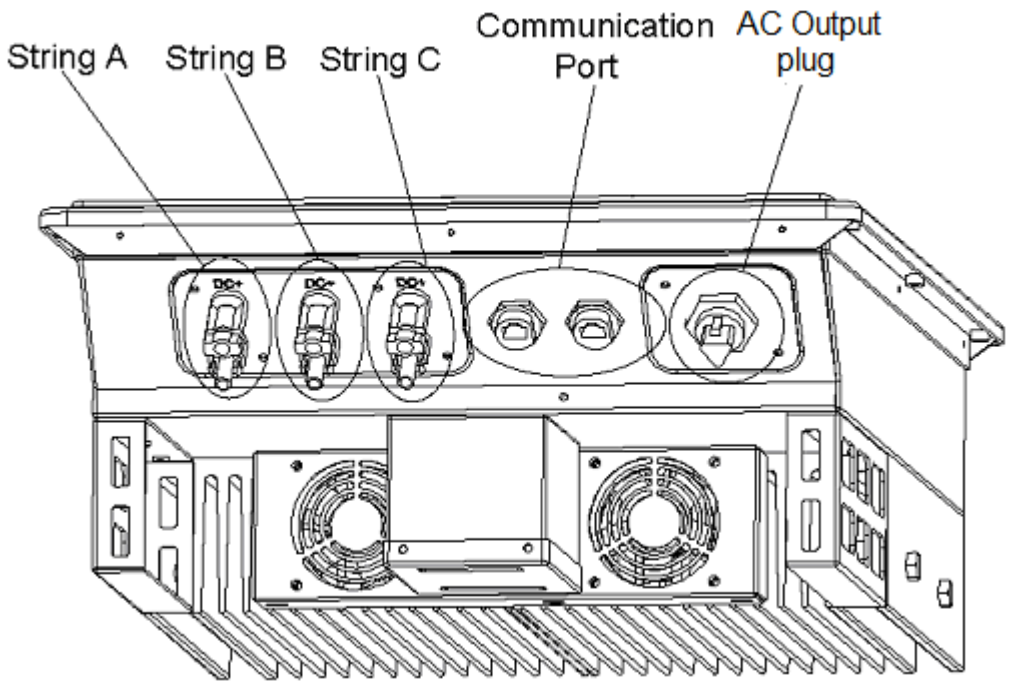


Fig 3.3.2 Wiring compartment bottom view

WARNING!

All electrical work shall be done in accordance with the local and national electrical codes and should follow the important safety instructions in this manual.

WARNING!

Make sure that you use suitable connecting cables for both the AC and DC wirings. The cable must be adequately dimensioned and suitably inert to temperature fluctuation, UV radiation and other possible hazards.

CAUTION!

If some DC input connectors are not used please cover them with the proper cover.

3.3.1 Connection of the AC cable

· Open the Fuse Box and switch off the circuit breaker used to connect the inverter to the grid.

WARNING!
Reconfirm that the circuit breaker to the main utility is switched OFF before connect the power cable from the breaker to the AC connector.

· Use the AC connector that was included in the shipping package to connect the AC power cable as illustrated in the figure 3.3.1.1 below.

Fig 3.3.1.1 Assembly of the AC cable and the AC connector

CAUTION!
To ensure that the total impedance of the grid plus the interconnection AC power cable shall be less than 1.25Ω.

- The AC connector is suitable for cables with a cross-section of up to 4 mm^2.
- Connect the cable GND to the screw labeled ⏚ of the AC connector.
- Connect the cable N to the screw labeled N of the AC connector.
- Connect the cable L to the screw labeled L of the AC connector.
- Tighten the screws with a torque of 0.9Nm.

WARNING!
Each connection to a ISMG inverter must be installed with a separate circuit breaker with 25A type B. No other appliances may be connected to the circuit breaker.

- Reconfirm that all connections have been performed properly as described above and all screws are properly tightened.
- Plug the AC connector into the AC terminal to complete AC cable connection for the inverter.

3.3.2 Connection of the DC cable

There are three models of the ISMG inverters. The ISMG160DE is designed to support up to three (3) independent PV strings, string A, B, and C, while ISMG150DE and ISMG145DE are made to support up to two (2) PV strings, string A and C.

Each PV string shall provide a DC input voltage with maximum power of 4500W and maximum current of 10A. There are two (2) terminals, labeled "+" and "-", per DC voltage input located on the bottom of the inverter used for the DC cable connections, shown in Figure 3.3.2.1, Figure 3.3.2.2 and Figure 3.3.2.3.

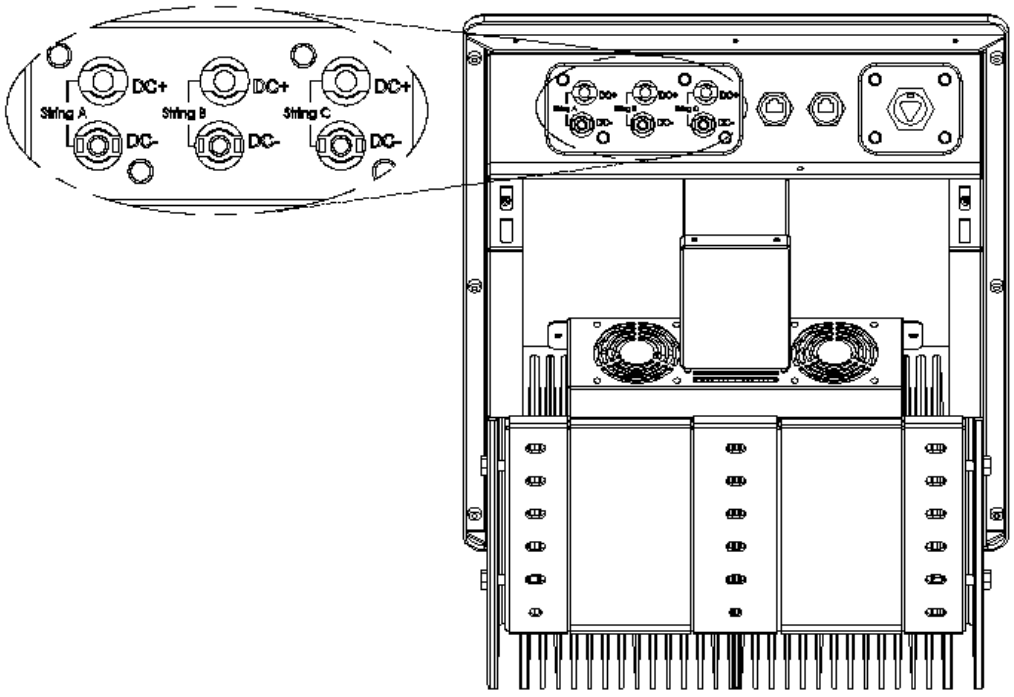


Fig 3.3.2.1 DC terminals for DC cable connection

CAUTION!

Polarities of each DC input voltage from a PV string shall be precisely correctly connected to the "+" (positive) and "–" (negative) terminals of a pair respectively. The DC voltage must be less than 500V in any condition.

· The "+" cable of the DC input voltage shall be connected to the terminal labeled "+" and the "-" cable of the DC input voltage shall be connected to the terminal labeled "-".

WARNING!

Route the DC connection cables to the ISMG inverters away from any possible hazards that could damage the cables.

WARNING!

Hazardous voltage is still present on the device after disconnection of all PV DC inputs. Allow 5 minutes for the inverter to discharge the energy completely.

Fig 3.3.2.2 PV- terminal connection

Fig 3.3.2.3 PV+ terminal connection

3.3.3 Connection of the Communication cable

The ISMG inverter supports two common data interface standards, RS-232 and RS-485 that will be used to communicate to the remote computer or terminal. Only one of the communication interfaces can work at a time. If the RS485 interface is selected and the inverter is the last device within the RS485 communication protocol, then the sixth (6^{th}) dipswitches of S202 (Figure 3.3.3.1)

shall be put to ON position. Users shall open the front lid of the inverter to select the right dipswitch and switch to ON position.

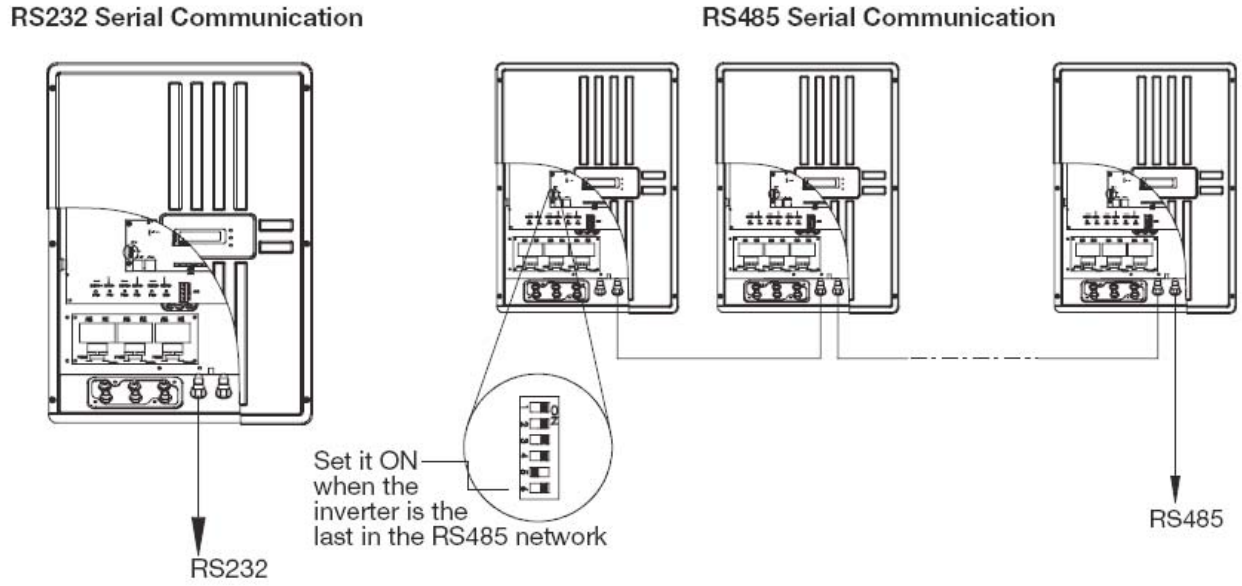


Fig 3.3.3.1 Communication wiring

CAUTION!

Hazardous and even lethal voltages can occur within the enclosure of the ISMG inverter. The communication cables within the enclosure of the ISMG inverter must be routed away from the transformers to prevent the lethal voltages are conducted out side the enclosure into other devices through the communication cables.

As shown in the Figure 3.3.3.2 below, there are two RJ-45 connectors, RJ45-R and RJ45-L that are located on the bottom of the inverter and respectively connected to JP203 and JP207 through two communication cables which are routed away from the transformers within the enclosure. The insulation voltage of the cables shall be more than 500Vdc.

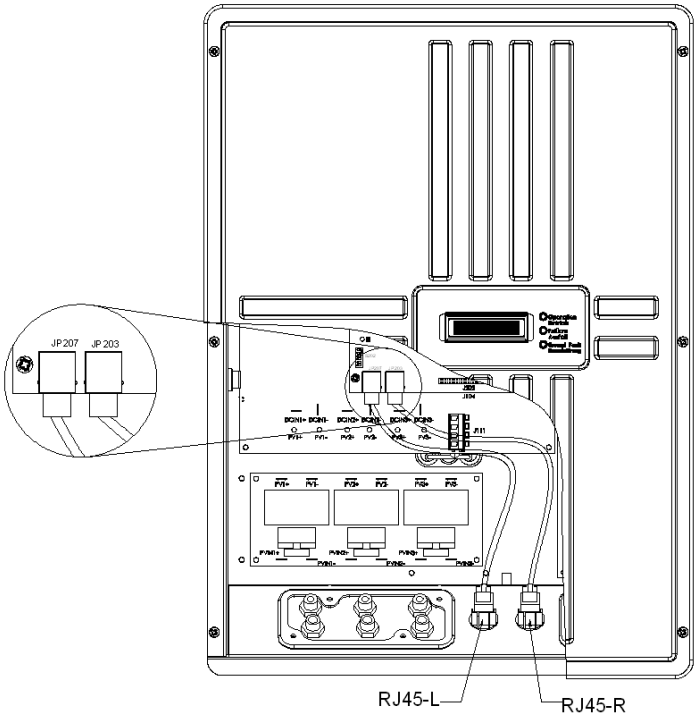


Fig 3.3.3.2 Communication cable inside the tube

The pin numbers of the RJ-45 connectors and the corresponding signals are described in the Figure 3.3.3.3 below.

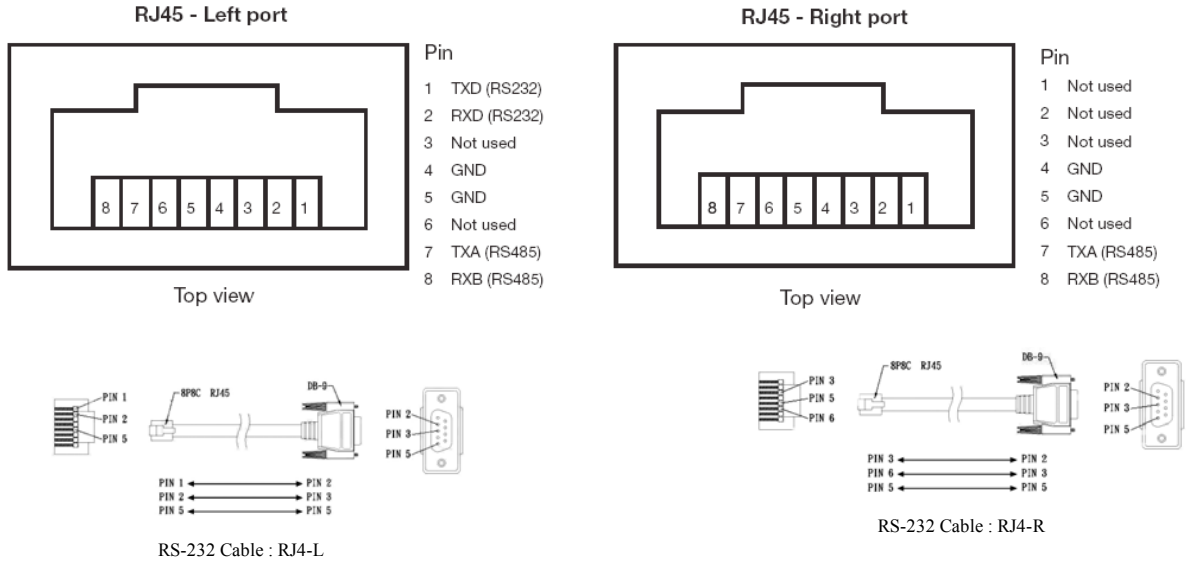


Fig 3.3.3.3 RJ-45 Pins and Signals

As shown in the Figure 3.3.3.3, the RS-232 signal pins, TXD and RXD, are only on the RJ45-L. Therefore, as shown in the Figure 3.3.3.4 below, the RJ45-L is used to connect to the remote PC or terminal when the RS-232 interface is selected.

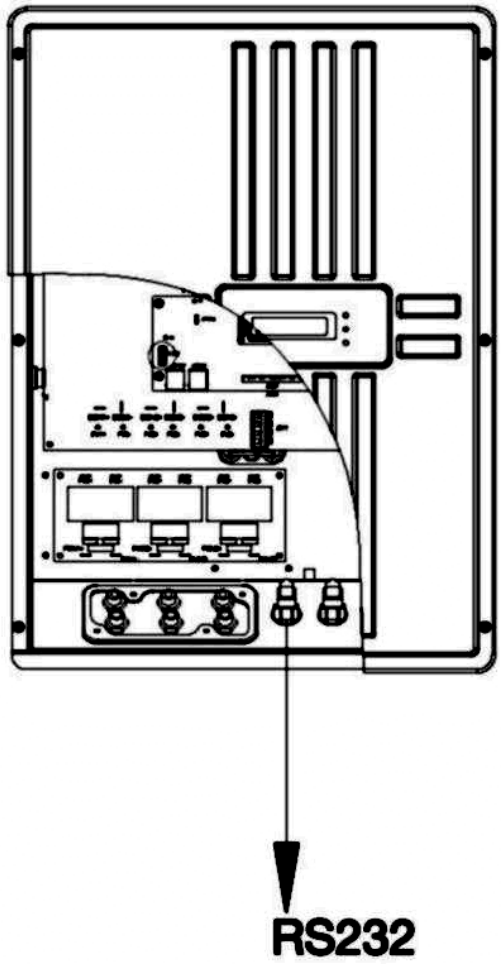


Fig 3.3.3.4 RS-232 connection

If RS-485 interface is selected, both RJ-45 connectors will be used for the cascaded RS-485 connections shown in the Figure 3.3.3.5.

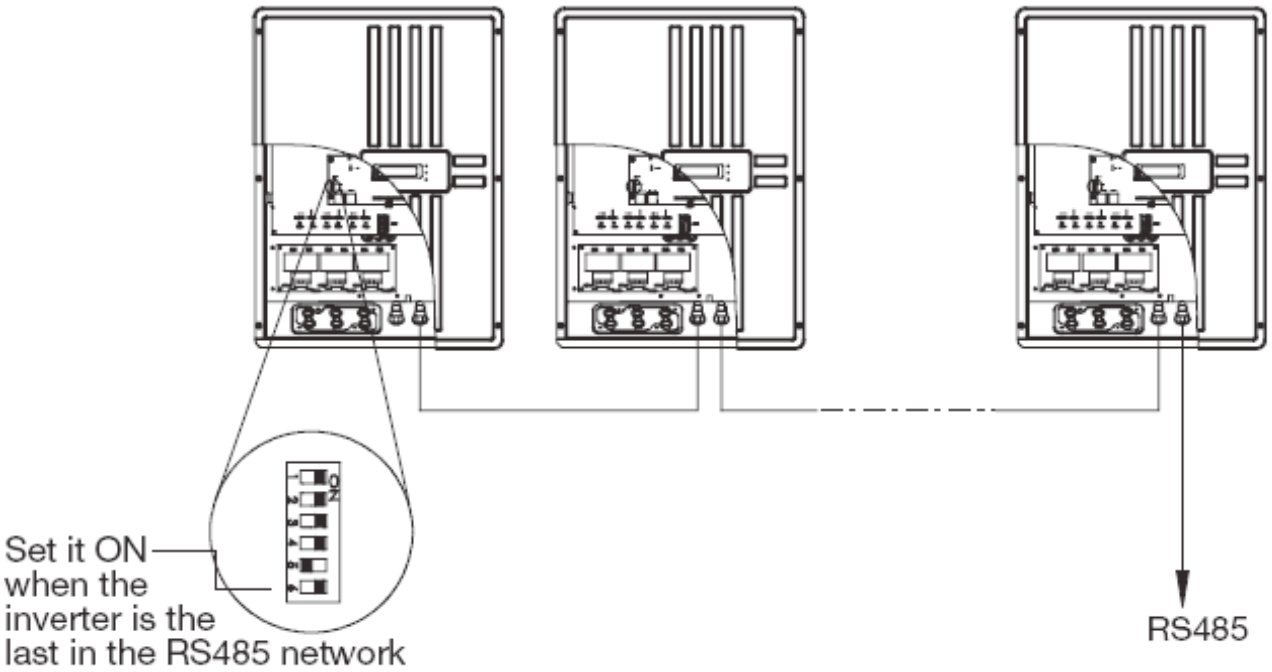


Fig 3.3.3.5 RS-485 connection

There are two waterproof RJ-45 plugs attached to the inverter. The assembly of the plug is shown in the figure 3.3.3.7 and the pin numbers are shown in the figure 3.3.3.6. The cable of the RJ-45 plug and its corresponding connector on the PC (or terminal) end are left for user's preference.

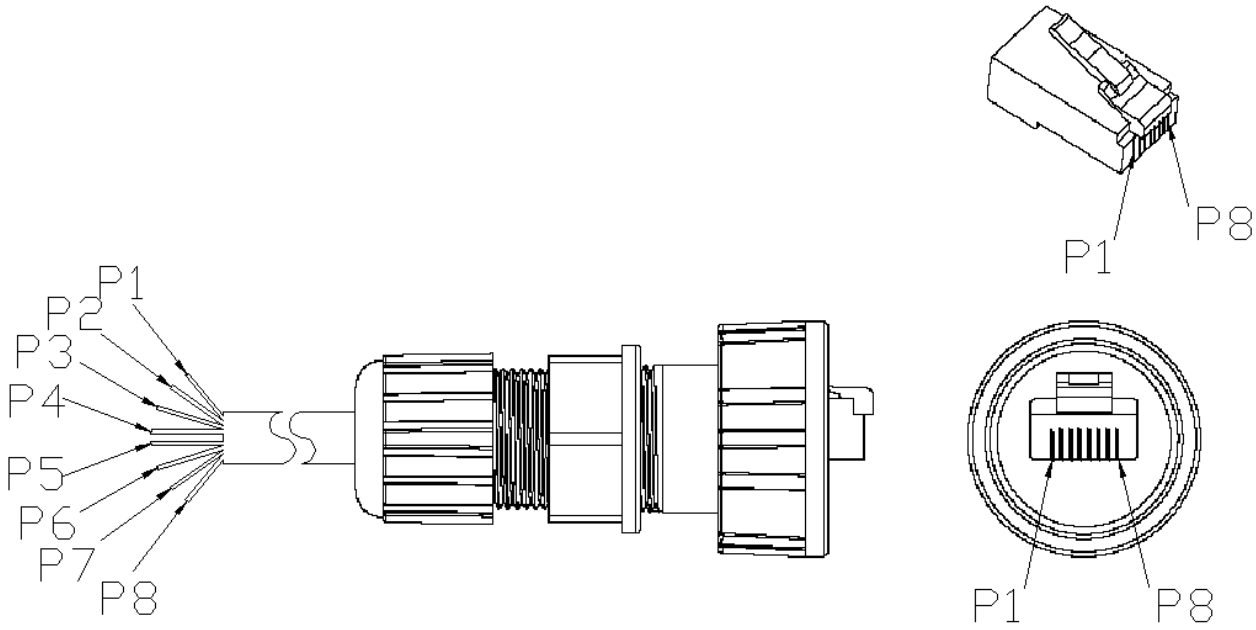


Fig 3.3.3.6 Pin number of the Waterproof RJ-45 plug

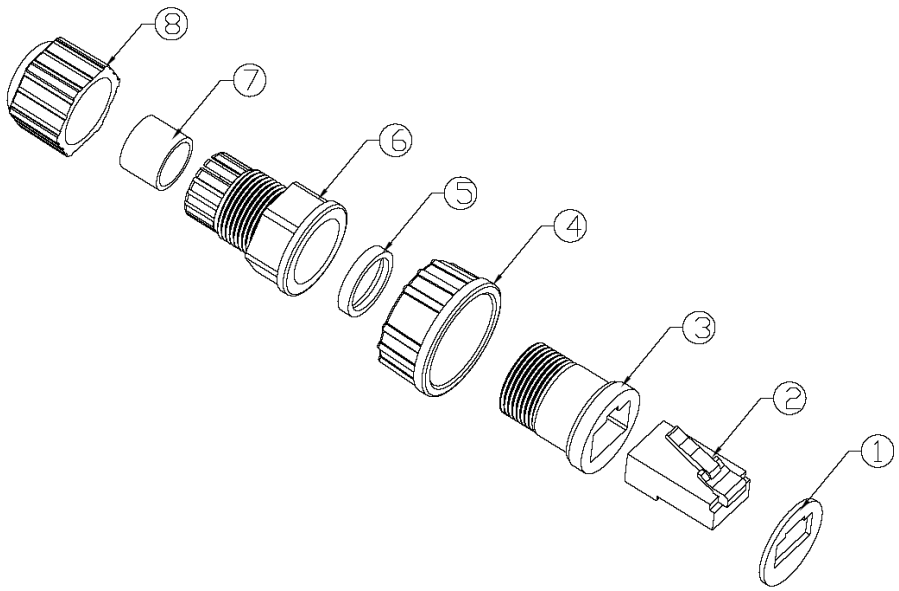


Fig 3.3.3.7 Assembly of the waterproof RJ-45 plug

3.4 Wiring inverter in parallel

ISMG inverters can be connected in parallel when more power is requested. In the parallel configuration, each inverter shall connect to its own PV array. It is not recommended to connect one PV array to more than one inverter. This may cause the inverter to work abnormally. The Figure 3.4.1 below shows the connections between inverters and PV arrays in parallel configuration.

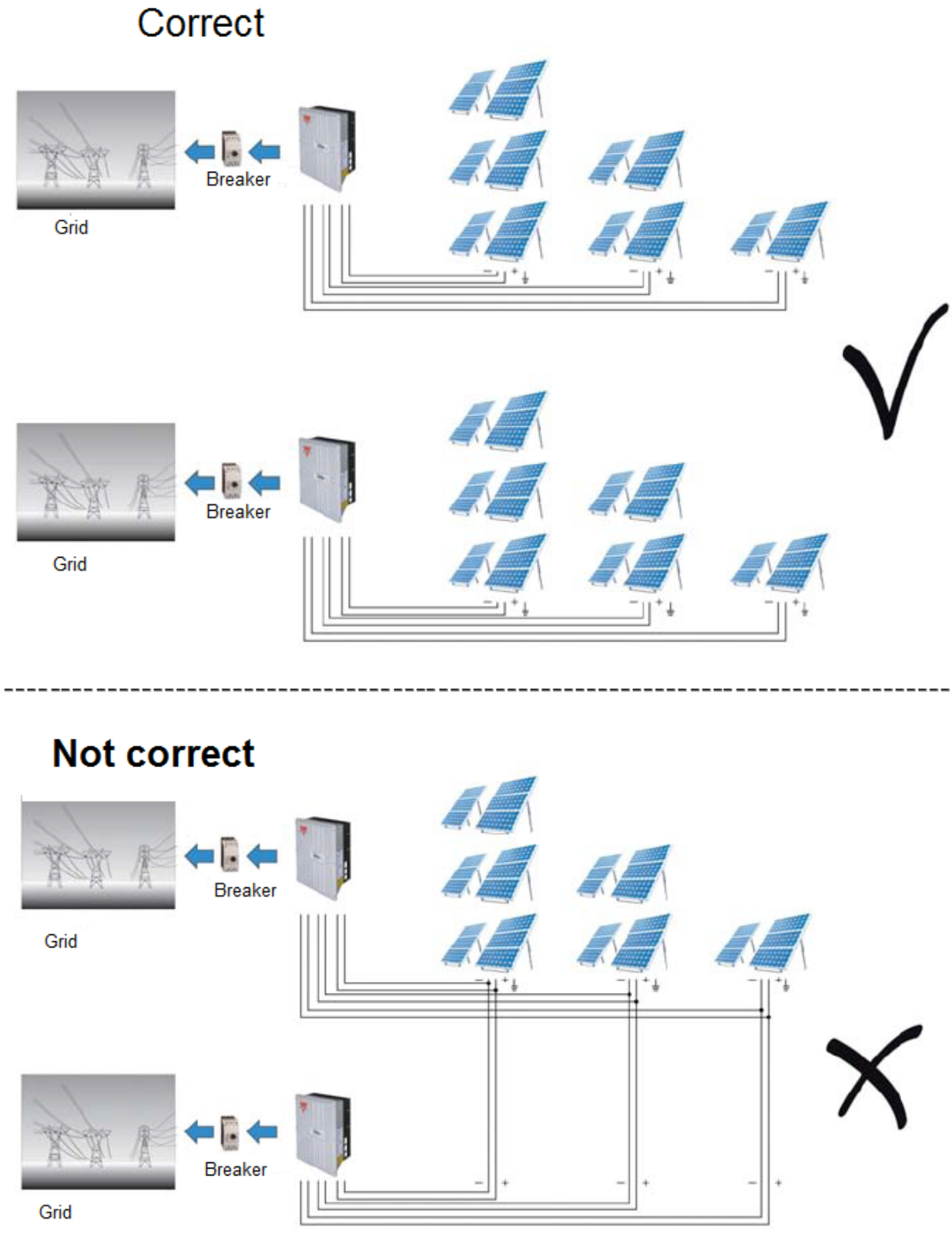
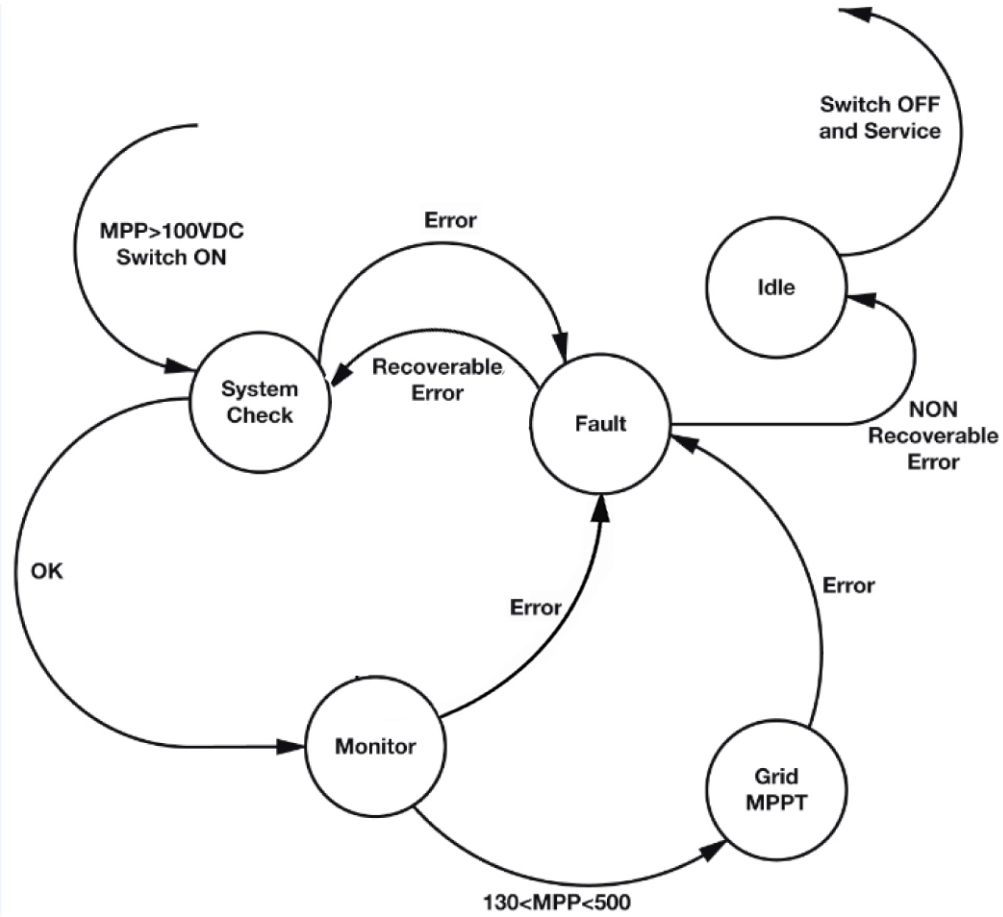


Fig 3.4.1 Parallel configuration of inverter

4. Operation

4.1 Overview

The ISMG inverter shall operate automatically. Once the solar radiation is strong enough to make the PV array generate DC input voltage that goes up and over the pre-set threshold value, the inverter turns itself on and feeds power into the mains after all necessary conditions are checked and fulfilled. The inverter goes into monitoring mode from the grid feeding mode if the DC input voltage is under the pre-set threshold value but above the minimum MPP voltage. Once the DC input voltage falls below the minimum MPP voltage, the inverter will shut down itself. There are five main operating modes described in detail below.



System Check : When the DC input voltage goes above the minimum MPP voltage, the inverter is powered-up, and enters the system check mode. In this operating mode, the inverter sets the initial values, runs diagnostic, and detects all parameters that will be stored for future use. This stage takes only a few seconds.

Monitoring : After system check is done the inverter enters the monitoring mode. In this operating mode, the inverter monitors all parameters on both AC and DC sides in

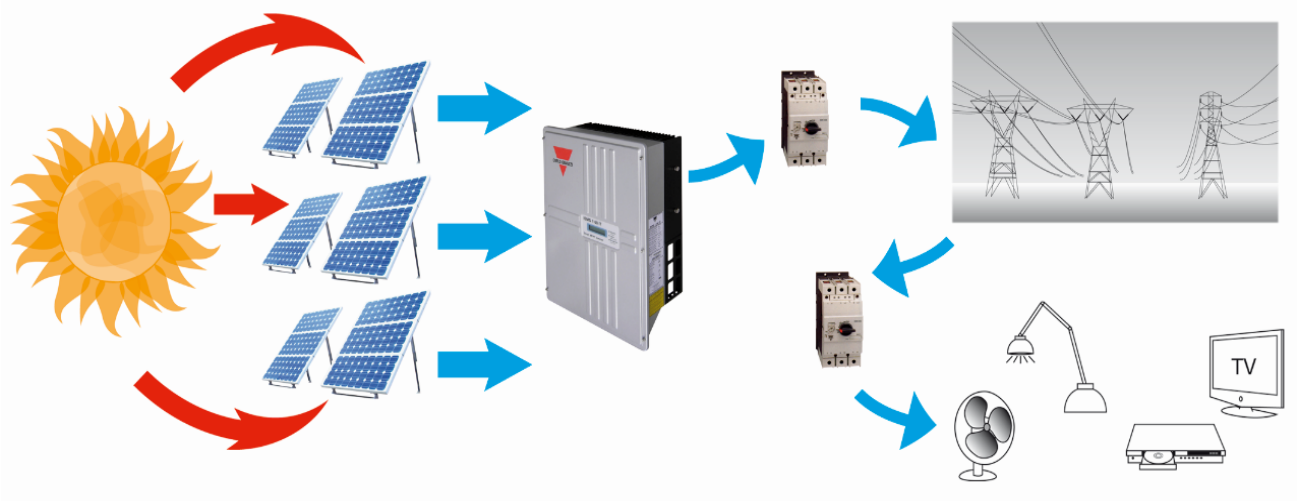
order to insure that connecting to the mains is safe. All conditions must be fulfilled and last for a certain period of time, then the system will enter the grid feeding mode. It takes around 20 seconds to complete the monitoring mode. If any parameter except the DC input voltage that is under the threshold value does not meet the criteria, the inverter goes to Fault mode.

Grid/MPPT **:** After the monitoring mode, the ISMG inverter confirms that all conditions necessary for feeding the power into the mains utility are fulfilled. The inverter will turn on the AC relays and start feeding the AC power into the mains. In this operating mode, the inverter continues to convert the DC power generated by the PV array to the AC power that is then fed into the grid. The inverter may stop feeding the power and go back to monitoring mode once any condition for grid feeding mode is found not fulfilled.

Fault **:** When fault(s) occurs and been detected in the operating mode described above, the inverter will terminate the present state, stop feeding power to the grid, and then jump into the fault mode that executes preset sequence. When the faults have been cleared for certain period of time, the inverter will leave fault mode and enter system check mode. Some faults, like component failure, will cause the inverter go into the idle mode that will need service staff to clean the errors.

Idle : Once the inverter jumps into this operating mode, the inverter has detected a malfunction of the ENS and has stopped feeding the power to the grid for safety reason. Normally this is a failure that can not be removed on field. It needs service personnel coming to remove the problems and put the system back to operation.

4.2 Operation Feature



1. Flexible connection of PV Strings:

   Through the Flexible connection of PV Strings feature, the ISMG inverters may manage the PV strings in either the independent mode or the master/slave mode or both. The ISMG inverter is designed to support up to three independent PV strings. If each PV string is exposed and obtains the sun light enough to generate DC power and the DC voltages are different, then it is prefer to select independent mode that each PV string is tracked by its own MPPT. If any two or all three PV strings may be able to get same intensity of the sunshine and generate the same DC voltage, users can then, through the internal jumper (see Figure 4.2.1), select the Master/Slave mode that any two PV or all three PV strings can be connected in parallel internally. Through this feature, users can obtain a better efficient way of utilizing the solar energy during the weak sunshine. As shown in the Figure 4.2.1, if a jumper is placed between string A and B, the PV string A and B will be connected in parallel internally. If all three PV strings are requested to connect in parallel, it needs two jumpers that shall be placed between A and B as well as B and C. For the models of ISMG150DE and ISMG145DE, there are only two (2) strings, string A and C, supported. Two jumpers, placed between A and B as well as B and C, are needed to put string A and C in parallel. The jumper shall be made of the wire with cross section of 2.5 mm^2.

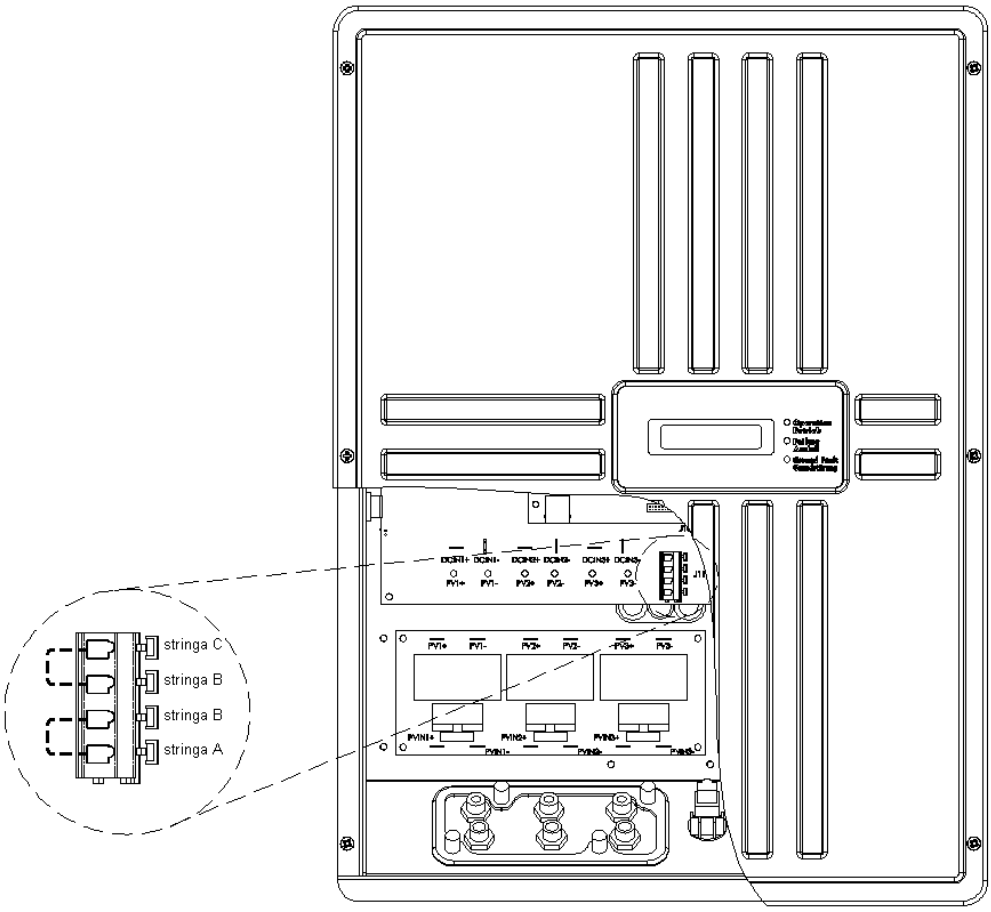


Fig 4.2.1 Master/Slave Mode Wirings

2. Anti-Island:

When an “island” condition is detected, the inverter will stop feeding the power to the grid and/or the load. The “island” is defined as a grid tied inverter maintaining operation and feeding power to a load that has been isolated from the utility power source. This refers to the automatic shutdown of the inverter when there is an electrical disturbance on the utility grid. This is a safety feature which is primarily meant to prevent staffs who might be working on the grid wires from the electrical shock.

3. Unit Power Factor:

The ISMG inverter intents to feed the power with unit power factor (PF = 1) to the utility during operation. The inverter continues sensing the phase of the utility voltage, and constructs the output current waveform in phase with the utility voltage.

4. Maximum Power Point Tracking:

In order to find the best efficient way of utilizing the solar energy, ISMG inverters are designed to track and absorb the maximum power from the PV array. The Maximum Power Point Tracking (MPPT) function is employed in the embedded control software to achieve this intent purpose.

4.3 LED indication

It may be needed to show the operating status during the operation. There are three LED's on the front panel of the ISMG (ISMG145IT in this example) shown in Figure 4.3.1, used to indicate the operating status of the inverter. The detail explanations of the status and the corresponding LED indicators are described in the following table.

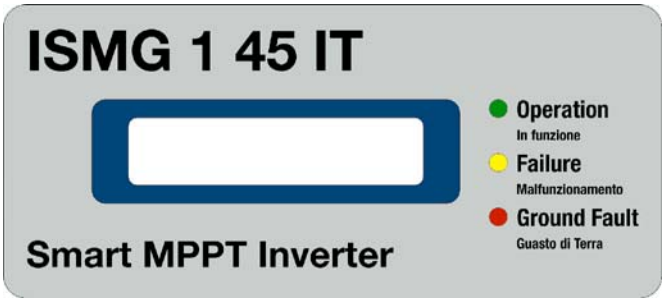


Fig 4.3.1 Front panel of the ISMG inverter

LED Indication Table

LED indicators		Operating status	Description
Green Yellow Red	☼ ☼ ☼	Initialization	The ISMG inverter is in initialization.
Green Yellow Red	¤ ● ●	System Check mode	The inverter is in System Check mode.
Green Yellow Red	¤ ● ●	No AC connection	The inverter has no AC connection or the AC source is out of range.
Green Yellow Red	¤ ● ●	Monitor mode	The inverter is in Monitoring mode.
Green Yellow Red	○ x ●	Grid/MPP mode	The inverter is in Grid Feeding mode.
Green Yellow Red	● ○ x	Fault mode	The inverter is in Fault mode.
Green Yellow Red	○ ○ x	Idle mode	The inverter is in Idle mode.
Green Yellow Red	● ● ●	Night Time	There is no DC power coming from PV array. System is powered off.
Green Yellow Red	x x ○	Ground Fault	Ground fault detected.
Green Yellow Red	x ☼ ●	Warning	Warning is detected.
Green Yellow Red	☼ x ●	De-rating	Power de-rating is performed.

○ : LED ON ● : LED OFF x : DON'T CARE

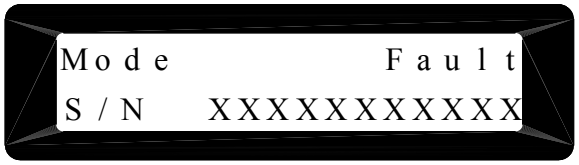
☼ : LED ON/OFF 0.9/0.1 Sec ¤ : LED ON/OFF 0.1/0.9Sec

4.4 LCD display

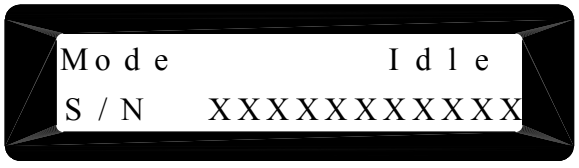
The ISMG inverter has a 16 x 2 LCD to show the operating status, input/output data, and error messages. As long as the DC input voltage is above the minimum MPP voltage, the LCD keeps display the information follow the process flow illustrated in the Figure 4.4.1.

The process flow could be the regular procedure, fault procedure, and idle procedure. The regular procedure is that the system goes from power-on, system check, monitoring, and then grid feeding mode without any fault condition detected. The inverter is supposed to work as the regular procedure and eventually feeds the power to the grid. During the system check and monitoring mode, if a fault condition that could be cleared automatically is detected, then the system will go into the fault procedure that the system could return to regular procedure once the fault condition goes away. One obvious example is that an "island" condition is detected due to the grid lost its power and later the fault condition is cleared when the power comes back. If a fault that cannot be removed by its own occurs, then the system will enter the idle procedure that needs a service staff to clean the fault and reset the system. These three procedures are illustrated in the Figure 4.4.1.

The messages for the fault procedure are as follows. It shows the fault mode, serial number of the inverter, software versions of the sequential and current controllers and then the error messages which are listed in the Error Message Table on section 4.6.



The messages for the idle procedure are as follows. It shows the operating mode, serial number of the inverter, software versions of the sequential and current controllers and then the error messages which are listed in the Error Message Table on section 4.6.



The following figures explain how the display works for the regular procedure.

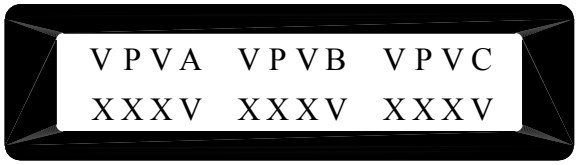
When the DC input voltage goes above the minimum MPP voltage, the ISMG inverter is powered up and will show the company name and model name (ISMG160DE in this example) on the LCD as shown below.

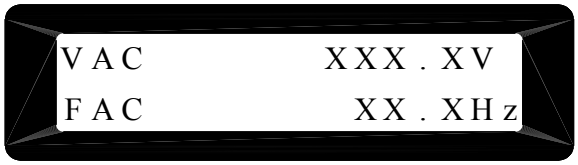
After 3 seconds, software versions of two embedded CPU, Sequential and Current controllers, will be displayed on the LCD. And then the serial number of the inverter and the address for the RS-485 communication are displayed.

After the basic information of the inverter is displayed, the system enters the System Check mode that is then indicated on the LCD.

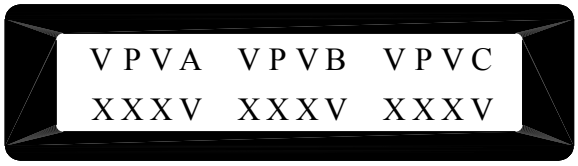
During the system checking, if the grid is not connected to the inverter, then the following message will be shown on the LCD and the system will stay at this step.

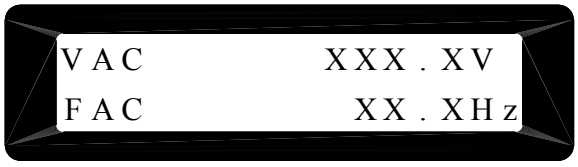
Once the system check is done, the inverter goes into the monitoring mode. If all data needed for grid feeding is in the acceptable range, the system will keep monitoring those data for a period of time. The following information tells users that the system will go into the grid feeding mode in XXX seconds and then show the measured data of the three DC input voltages and the existing voltage and frequency on the grid side.





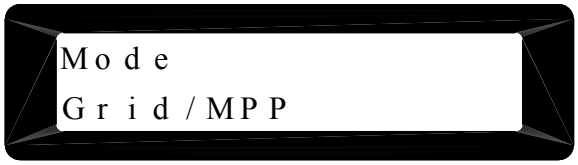
During the monitoring mode, if all three DC input voltages fall under the threshold value, the system stays in this mode and shows the information as follows. The system will still keep measuring the parameters of both DC and AC and display on the LCD.





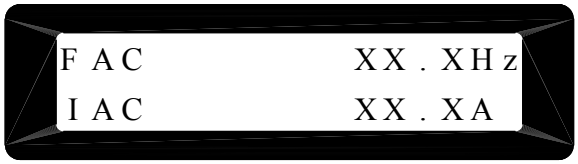
After the system enters the grid feeding mode, it will show the following information in order and repeatedly until the system goes to other operating mode.

The first screen shows the current operation mode.

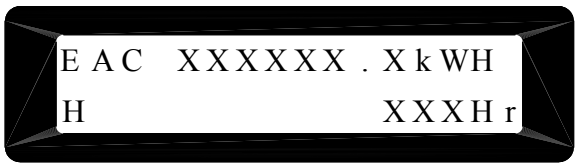


There are four possible de-rating information will be shown if power de-rating is detected. Only one occasion that causes de-rating could be detected at a time. Therefore, only one of the following messages will be displayed if power de-rating occurs. When Temp message is presented, the power de-rating is caused by the over temperature. The IpvA, B, and/or C message shows that the power de-rating is caused by restricting the DC input current to the maximum limit which is 10A per each PV string. The Iac and Pac messages illustrate the power de-rating is caused due to restriction of the maximum output AC current and power.

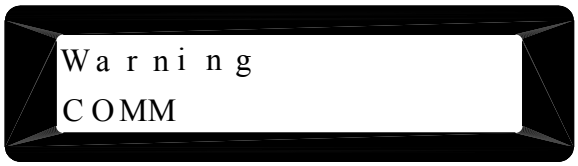
Next messages are the up-to-minute data of the DC input voltages and the AC output voltage. First two messages are for the PV arrays and the other two messages are for the output power. VPVA, VPVB, and VPVC are the incoming voltages from PV array A, B and C respectively. WPVA, WPVB, and WPVC are the incoming power of PV array A, B, and C in watts. VAC, PAC, IAC, and FAC are the voltage, power, current, and frequency that the inverter feeds to the grid.



The next message shows the cumulated energy in KWH and period of time in hours for the inverter delivering the power to the grid up-to-date since the inverter has been installed and operated.



There are three possible warning messages could be shown when occasions occur. When EEPROM message is presented, the system has encountered a failure access to the EEPROM. If over current has been detected on one and/or two DC input sources, IPVX and/or IPVY OC message will be presented, where X and Y could be string A, B, or C. For the COMM message, it presents the failure communication function. These warnings could be happening simultaneously.



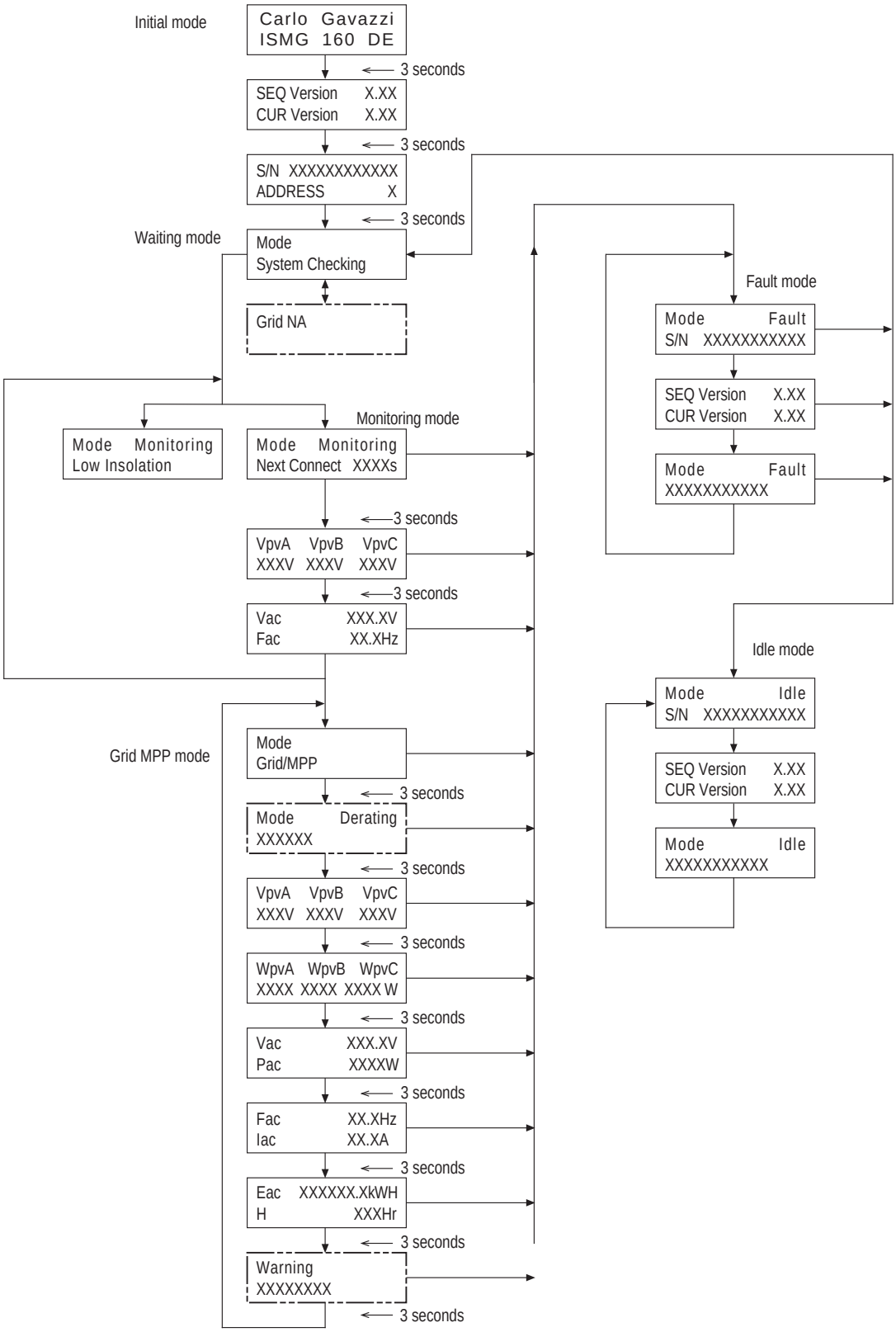


Fig. 4.4.1. ISMG inverter LCD display lay-out

4.5 Communication

There are two types of communication methods, RS232 and RS-485 supported in the ISMG inverters that may be communicated to the external computer or terminal with RS-232 and/or RS-485 equipped. There is only one type of the communication can be used at a time. User shall open the front lid to do the selection for the communication function. Figure 3.3.3.1 shows the selection of the communication type by place a jumper in correspondent position on the control board. User should affirm that the jumper is in the correct positions before using the communication function.

4.6 Explanations of Error Messages

In the event of a fault, the inverter will stop feeding the AC voltage to the mains utility and display the error message on the LCD. Qualified service personnel shall do the analysis, measurement, and debug if needed according to the error message in order to resume normal conditions. It is recommended to screen out the fault condition(s) by referring to the table below and then remove the fault condition(s) to put the inverter return to normal condition and continue to feed AC voltage to the utility steadily. Please contact Carlo Gavazzi representative or Distributor if the same error message is persistent.

Error Message Table

Error Message	Description
GridNA	No AC voltage is detected on the grid side.
Drift Fac	Islanding is detected.
VacH	The AC voltage of mains utility is over the upper limit.
VacL	The AC voltage of mains utility is under the lower limit.
FacH	The frequency of AC voltage of the utility is over the upper limit.
FacL	The frequency of AC voltage of the utility is under the lower limit.
VpvH	The DC voltage of PV array is over the upper limit.
Imax_AC	Over current on the AC side.

DeltaZ	The rate of change of the AC grid impedance is higher than setting value.
Zac	The AC impedance of the grid is out of range.
InvTempMax	The internal temperature of the inverter exceeded the safe operating limit.
COMM	External communication failed.
EEPROM	EEPROM failed.
RelayX(X=1~4)	Grid connection relay failed.
FastEarthCurrent	The drastic change of the leakage current has been detected.
SlowEarthCurrent	The leakage current has exceeded a safe operating limit.
DCInjectCurH	Over DC current injected into the AC grid is detected.
Riso	The insulation resistance between PV array and the ground is below the safe operating limit.
VdcbusH	Internal DC bus voltage is over the upper limit.
VdcbusL	Internal DC bus voltage is under the lower limit.
Internal COMM	Internal communication failed.
Watchdog	Internal watchdog function triggered.
Idc Test	The DC injection current measurement function failed.
RCMA	The leakage current exceeded standard value.
RCMA Test	The leakage current measurement function failed.
IR Test	The insulation resistance measurement function failed.
Offset	Offset check for grid monitoring failed.

Temp. Sensor	The internal temperature sensor failed.
RAM Test	Memory failed
System Error	The system failed.
Version Error	The firmware version is not correct.
Delta Fac Delta Vac Delta Zac Delta If Delta Riso Delta Idc	Internal measurement comparison error or defective hardware
IpvA,IpvB,IpvC	Over current on the DC side
CalDataError	Calibration data is out of range
CalDataLoss	Calibration data is lost.

5. Warranty information

Warranty

Carlo Gavazzi provides the Limited Warranty of ISMG solar inverter. Any required service labor and component replacement costs during such period are covered by this warranty. If your product requires warranty service, contact your merchant. If you are unable to contact your merchant, or the merchant is unable to provide service, please contact Carlo Gavazzi directly.

Warranty period

Carlo Gavazzi warrants a period of 5 years from the date of purchasing the device.

Warranty proof

We will only render warranty service to the device that is sent back together with a copy of the original purchasing invoice. Besides, the type label at the device must be legible.

Exclusion of Liability

The Limited Warranty claims and liabilities shall be excluded for direct or consequential damages to the product if:

1. It has been improperly transported, installed, or misused, physically damaged or altered, or used device out of the specification.
2. It is damaged due to the overpowering force like lightning strikes, surge voltage, storm, and/or fire.
3. It has been repaired by unauthorized personnel.
4. Its original identification label has been defaced, altered, or removed.

Factory service

Once the product is diagnosed requiring a Factory Service, the product could be sent back using the original shipping box and the packing materials. A copy of the purchase invoice is also required to be included in the package. Before send back the fault inverter please contact Carlo Gavazzi or loacal distributor for the RMA number authorization.

Document : There are some documents must be attached with the return product. Please write as detail as possible.

1. Serial number and machine type of the inverter
2. Brief descriptions of connected system
3. Fault message on front panel or fault condition
4. Can the failure be reproduced? How to reproduce it?

6. Technical Documentation

6.1 Outline Drawing

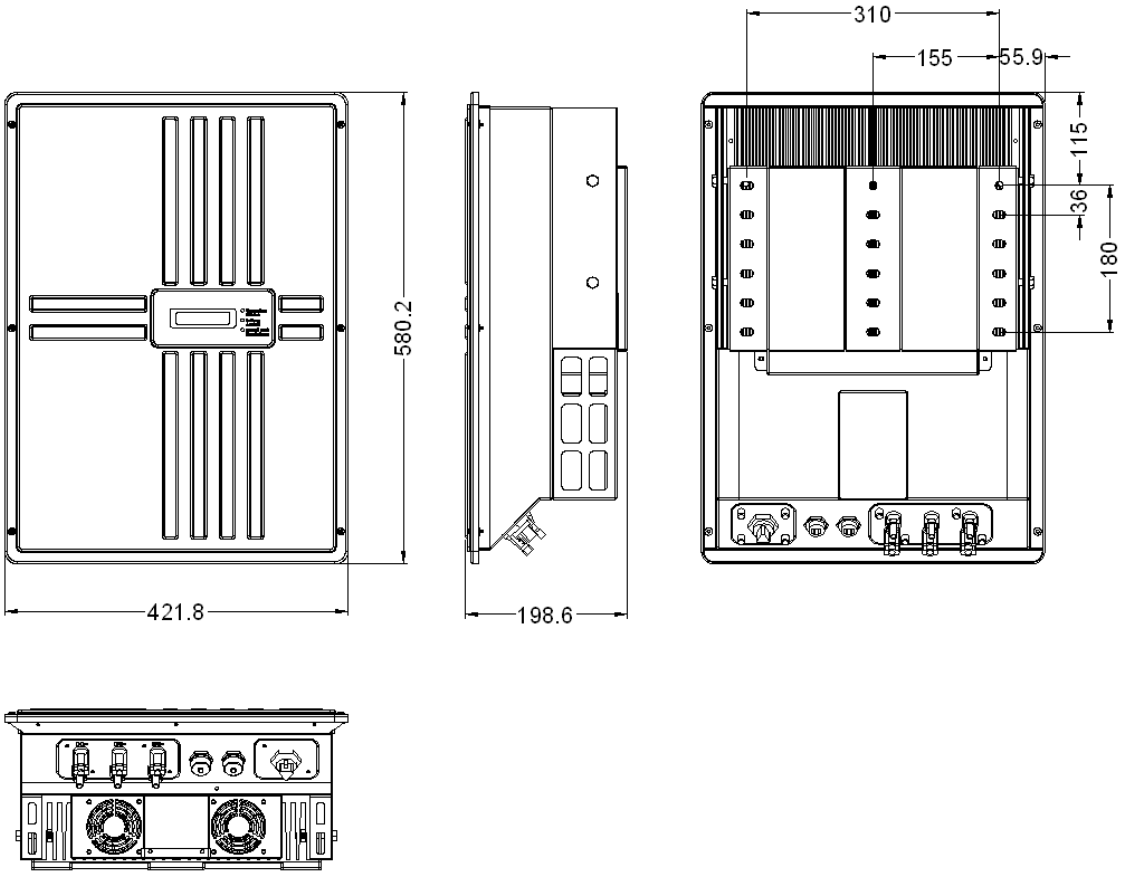


Fig 6.1.1 Outline Drawing

6.2 Technical Specifications

Model Name	ISMG160DE	ISMG150DE	ISMG145DE
Grid Side (AC output)			
Grid Voltage, Nominal	230 VAC		
Grid Voltage, Operating Range	180 ~ 260 VAC Spain: 196 ~ 253 VAC - Italy: 184 ~ 276 VAC – Germany: 184 ~ 264 VAC		
Grid Frequency, Nominal	45.5 ~ 54.5Hz Default Value: $f_{nom.}$: 50Hz Spain: 48 ~ 51 Hz - Italy: 49.7 ~ 50.3Hz – Germany: 47.5 ~ 50.2Hz		
Nominal Output Power	4600 W	3800 W	3300 W
Maximum Output Power	5100 W	4400 W	3800 W
Nominal Output Current	20 A	16.52A	14.34A
Maximum Output Current	22 A	19.13 A	16.52 A
Waveform	True sine		
Power Factor	>0.99		
THD	<3		
DC Component	<0.5%		
Phase	Single		
PV Side (DC input)			
Maximum DC Power	4500W per input port		
MPP Voltage Range	100 ~ 450 V		
Maximum Input Voltage	500 VDC		
Maximum DC Current	10A per input port		
No. of DC Input Port	3	2	2
No. of MPP Tracker	1 ~ 3	1 ~ 2	1 ~ 2
General			
Maximum Efficiency	96.3% @350VDC	96.3% @350VDC	96.3% @350VDC
European Efficiency	95.4% @350VDC	95.1% @350VDC	95.1% @350VDC
Operating Ambient Temperature	-20°C ~ 55°C		
Relative Humidity	Max. 95		
Mechanical			
Enclosure	IP65 (ref. DIN EN60529)		
Cooling	Cooling Fan		
Weight	23kg	22.5kg	22.5kg
Dimensions	580 x 422 x 182 (mm)		
Display	LED / LCD		
Interface			
Communication	RS232 and RS485		
Certifications			
EMC	EN 61000-6-2, EN 61000-6-3, EN 61000-3-11, EN 61000-3-12, EN 61000-3-2, EN 61000-3-3		
Low Voltage Regulation	EN 50178		
Network Monitoring	Germany: VDE 0126-1-1; Italy: DK5940 ed.2.2 Apr 07; Spain RD1663/2000 RD661/2007		

This is ISMG1xx inverter settings

Control Description	Range	Default	Precision
Over voltage, VacH (VAC)	230~300	262	±2
Under voltage, VacL (VAC)	160~230	188	±2
Upper frequency, ΔFacH (Hz)	50.1~54.5	50.3	±0.02
Lower frequency, ΔFacL (Hz)	49.9~45.5	49.7	±0.02
Over voltage delay, VacH (cycles)	3~250	5	±1
Under voltage delay, VacL (cycles)	3~250	10	±1
Upper frequency delay, FacH (cycles)	3~250	3	±1
Lower frequency delay, FacL (cycles)	3~250	3	±1
Restart delay, Switch on Time (s)	20~600	20	±0.01
PV Start up voltage, Vpv Start (VDC)	120~500	130	±3
Isolation Resistence, Riso (MΩ)	0.5~100	1.0	Nd
Grid impedance variation, ΔZac (Ω)	0.3 ~20	0.8	Nd
Grid impedance, Zac (Ω)	0.3 ~20.0	2.5	Nd
Fast Current, $I_{\Delta N}$_FAST (mA)	5~300	25	±4
Slow Current, $I_{\Delta N}$_SLOW (mA)	5~300	120	±4
VacH Limit (VAC)	253.0~300	253.0	±2
VacH Limit Time (s)	30~600	300	±0.01
Impedance value, Zac_SW (enable/disable)	0/1	0	na

6.3 Efficiency

Efficiency of the ISMG inverters

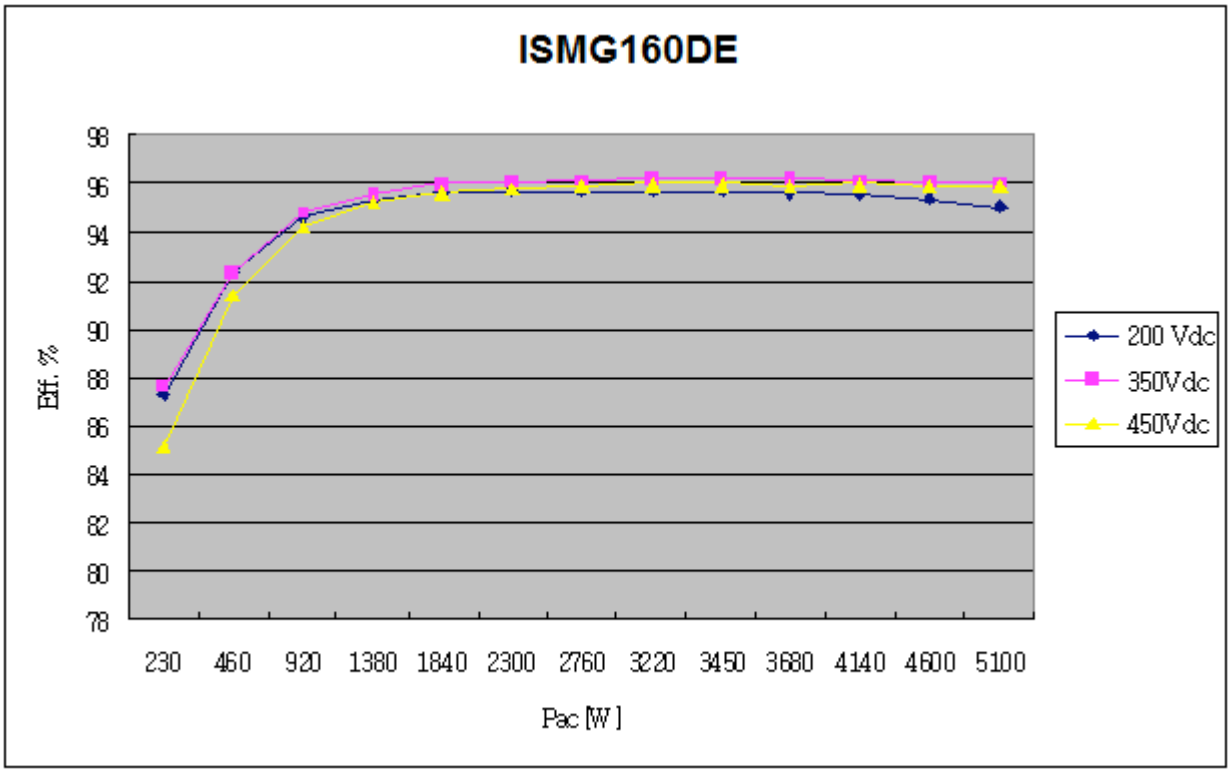


Fig 6.3.1 Efficiency of the ISMG160DE

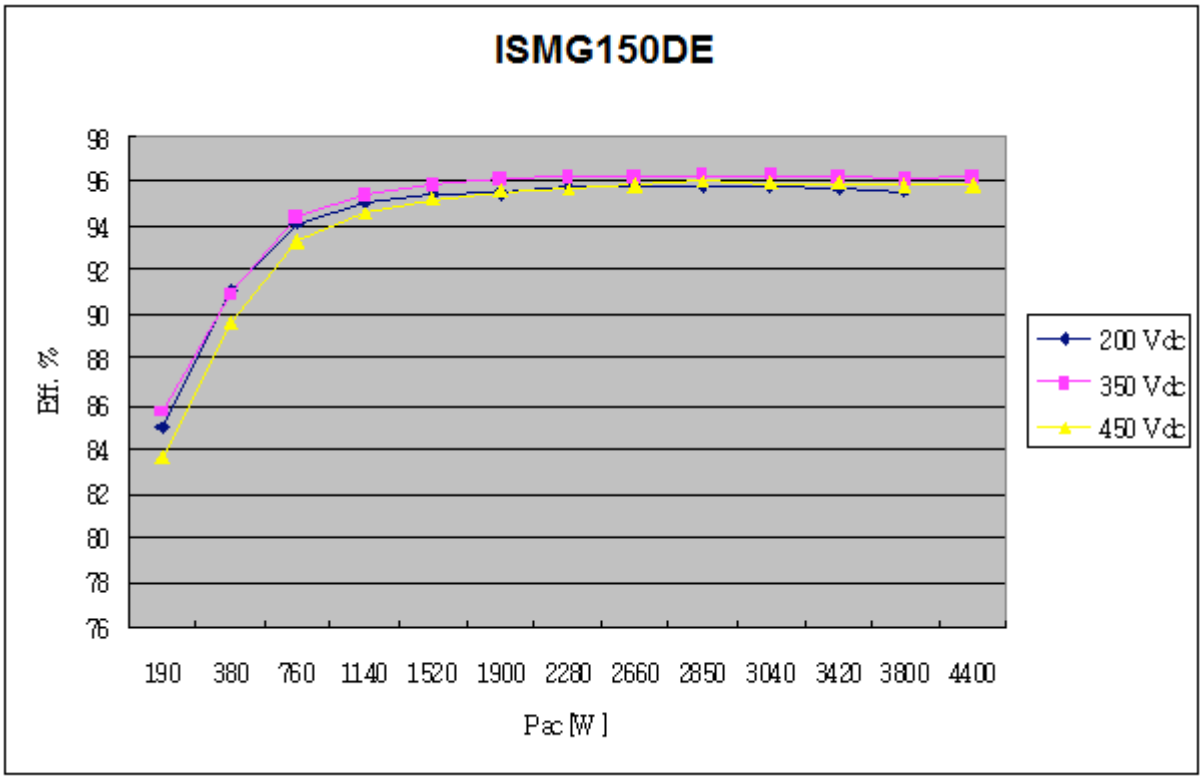


Fig 6.3.2 Efficiency of the ISMG150DE

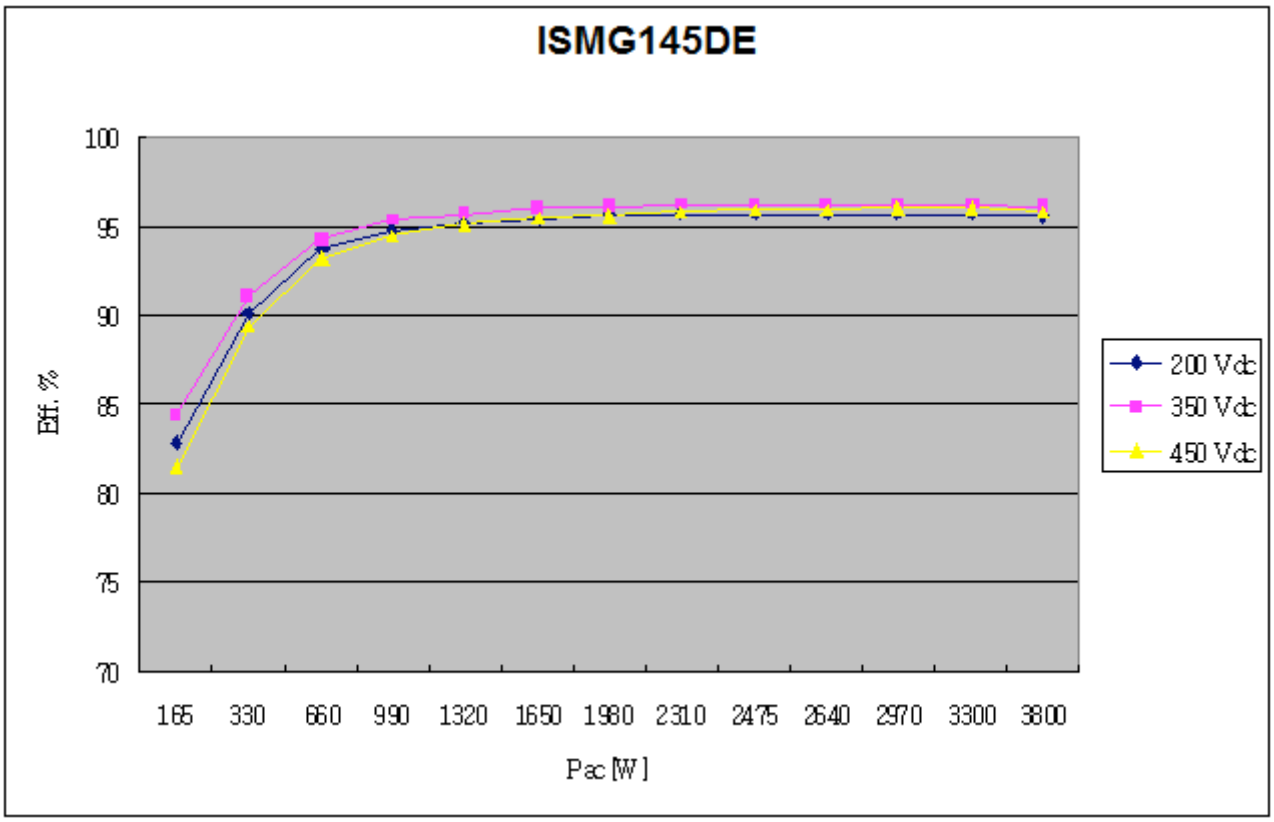


Fig 6.3.3 Efficiency of the ISMG145DE

6.4 De-rating Operation

The occasions that the ISMG inverter will take into account and then regulate the output and/or restrict the input power to ensure the system is in a safe operation are described in detail below.

Temperature

The ISMG inverter will monitor the temperature on the heatsink. Once the temperature exceeds 70°C, the system will reduce the output power until the temperature drops under the critical value. The ISMG inverter will shut down the power output to the grid if the temperature reaches 80°C. If this occasion happens often, it needs to check whether the inverter is mounted at an appropriate place with good ventilation and not directly exposure to the sunshine.

Input DC current

When any input current from the PV strings is about to exceed 10A, the ISMG inverter will restrict it to the operating limit which is 10A per string in order to prevent damages to the inverter. If this occasion happens frequently, it needs to check whether the PV arrays are configured properly to supply the DC current within the maximum limit which is 10A to the inverter.

Output AC power

The maximum power that the ISMG inverter feeds to the grid is limited according to the specifications listed in Section 1.2. Even the output current does not reach the maximum current limit, the ISMG inverter will still automatically restrict the delivery output current to keep the output power within the maximum power limit when the output voltage is too high.

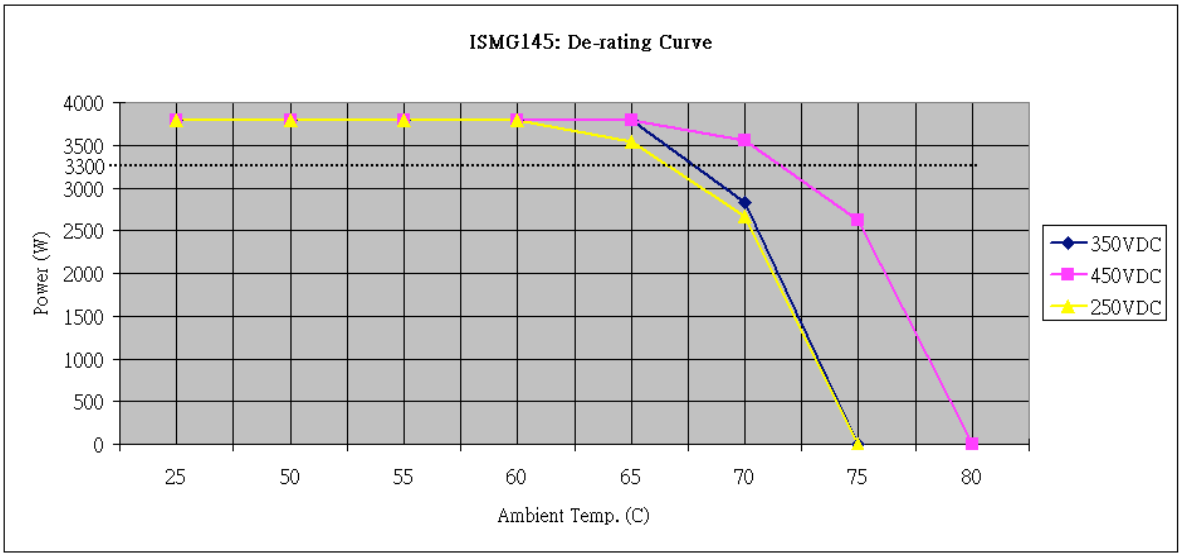
Output AC current

The maximum current that the ISMG inverter feeds to the grid is limited according to the specifications listed in Section 1.2. Even the output power does not reach the maximum power limit the ISMG inverter will still restrict the delivery output current within the maximum current limit when the output voltage is too low.

De-rating curve

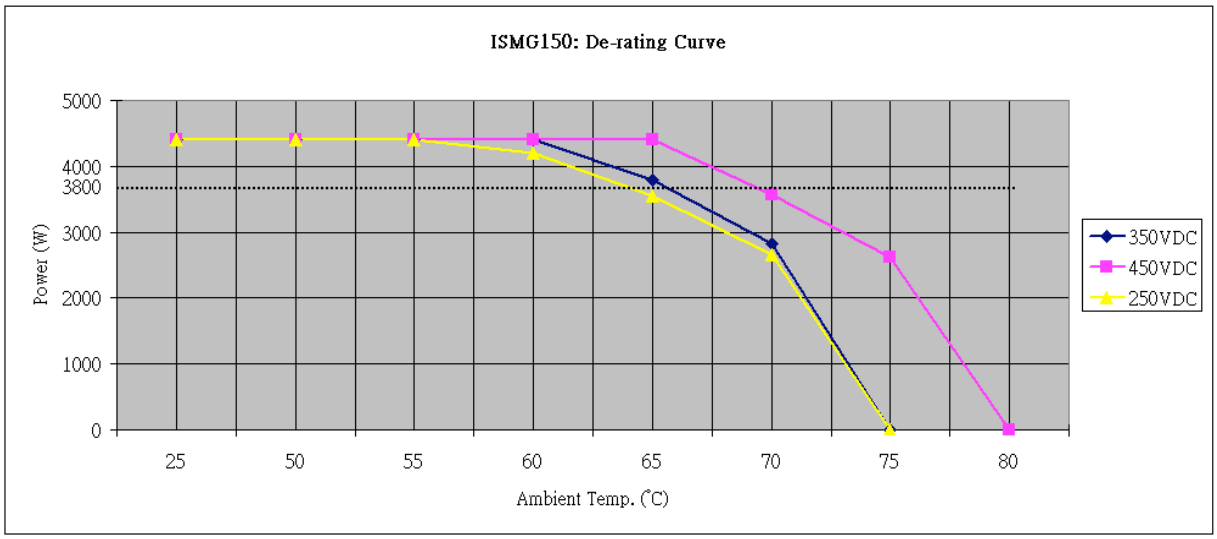
ISMG 145

	350VDC		450VDC		250VDC	
Ambient Temp. (°C)	Heat-sink Temp. (°C)	Power (W)	Heat-sink Temp. (°C)	Power (W)	Heat-sink Temp. (°C)	Power (W)
25	NA	3800	NA	3800	NA	3800
50	66	3800	NA	3800	NA	3800
55	71,4	3800	63,7	3800	72,5	3800
60	73	3800	69,8	3800	73,5	3800
65	74,1	3791	72,9	3800	74,5	3546
70	75,7	2825	74,5	3560	76	2666
75	Over Temp	0	76	2620	NA	0
80				0		



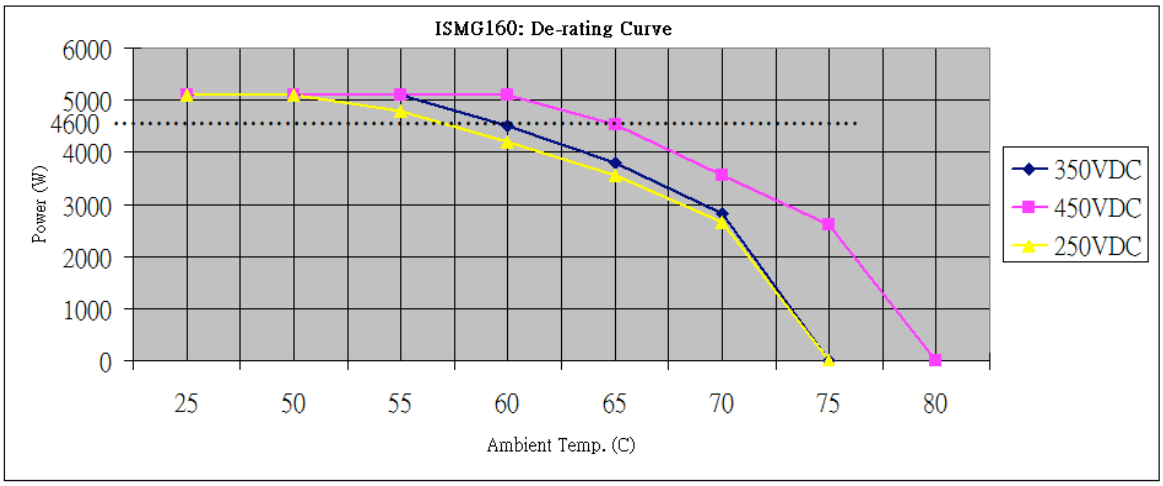
ISMG 150

	350VDC		450VDC		250VDC	
Ambient Temp. (°C)	Heat-sink Temp. (°C)	Power (W)	Heat-sink Temp. (°C)	Power (W)	Heat-sink Temp. (°C)	Power (W)
25	NA	4400	NA	4400	NA	4400
50	66	4400	NA	4400	NA	4400
55	71,4	4400	63,7	4400	72,5	4400
60	73	4400	69,8	4400	73,5	4200
65	74,1	3791	72,9	4400	74,5	3546
70	75,7	2825	74,5	3560	76	2666
75	Over Temp	0	76	2620	NA	0
80				0		



ISMG 160

	350VDC		450VDC		250VDC	
Ambient Temp. (℃)	Heat-sink Temp. (℃)	Power (W)	Heat-sink Temp. (℃)	Power (W)	Heat-sink Temp. (℃)	Power (W)
25	NA	5100	NA	5100	NA	5100
50	66	5100	NA	5100	NA	5100
55	71,4	5100	63,7	5100	72,5	4800
60	73	4500	69,8	5100	73,5	4200
65	74,1	3791	72,9	4533	74,5	3546
70	75,7	2825	74,5	3560	76	2666
75	Over Temp	0	76	2620	NA	0
80				0		



External cooling funs of the inverter

Command	Heat-sink temp (℃)
Start FUNs	50
Stop FUNs	45
Temp De-rating	72
Switch off Temp.	80

6.5 Environmental Statement

The grid connected PV inverter of Carlo Gavazzi reduce raw material consumption and scrap throughout their long working lifetime. In typical applications, these positive environmental effects far outweigh the negative impacts of product manufacture and end-of-life disposal.
Nevertheless, when the products eventually reach the end of their useful life, they can very easily be dismantled into their major component parts for efficient recycling. Many parts snap together and can be separated without the use of tools, while other parts are secured with conventional screws.
Virtually all parts of the product are suitable for recycling.
Product packaging is of good quality and can be re-used. All the products come in strong cardboard cartons which themselves have a high recycled fibre content. If not re-used, these containers can be recycled. Polythene, used on the protective film and bags from wrapping product, can be recycled in the same way. Carlo Gavazzi' packaging strategy favours easily recyclable materials of low environmental impact, and regular reviews identify opportunities for improvement.
When preparing to recycle or dispose of any product or packaging, please observe local legislation and best practice.

involved in the creation and the production of this manual. Carlo Gavazzi reserves the right to make design or functional modifications, without prior notice and at any time; picture are just an example.

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Carlo Gavazzi Controls SpA
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