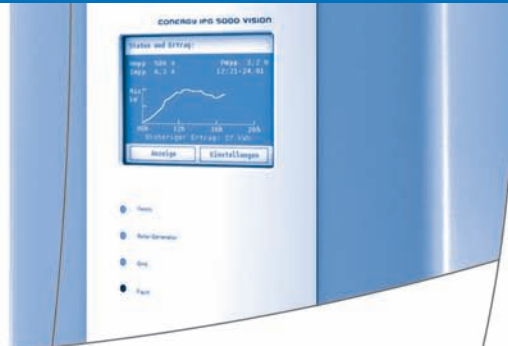




CONERGY

## Conergy IPG string inverter series

Operating manual



# Table of contents

<b>1</b>	<b>Introduction</b>	<b>3</b>
1.1	Short description	3
1.2	Additional products	4
1.3	User group	4
1.4	Signposts	5
1.5	Environmental information	5
1.6	Manufacturer information	6
1.7	Standards and technical directives	6
<b>2</b>	<b>Safety</b>	<b>9</b>
2.1	Intended use	9
2.2	Responsibilities of the owner/operator	9
2.3	Basic safety instructions	10
2.4	Warnings	11
<b>3</b>	<b>Product description</b>	<b>13</b>
3.1	General information on photovoltaic systems	13
3.2	Block diagram	15
3.3	Functions	17
<b>4</b>	<b>Conergy IPG string vision inverter series</b>	<b>19</b>
<b>5</b>	<b>Transport and installation</b>	<b>25</b>
5.1	Included in delivery	25
5.2	Transportation	25
5.3	Installation	26
5.3.1	Prerequisites for the installation location	26
5.3.2	Wall mounting	30

<b>6</b>	<b>Installation and commissioning</b>	<b>33</b>
6.1	Basic safety instructions	33
6.2	Preparation for installation	34
6.3	Connections	35
6.4	Connecting the mains cable	36
6.5	Connecting the solar system	40
6.6	Connecting the Conergy SunReader:	44
6.7	Connecting the 230-V power supply	45
6.8	Connecting Easyconnect	45
6.9	Connecting further string inverters	46
6.10	Connecting the terminator	46
6.11	Commissioning	47
<b>7</b>	<b>Troubleshooting</b>	<b>49</b>
7.1	LED indicator fault messages	50
7.2	Fault warnings on the display	52
<b>8</b>	<b>Removal</b>	<b>55</b>
<b>9</b>	<b>Appendix</b>	<b>57</b>
9.1	Specifications	57
9.2	Index	59

# 1 Introduction

## 1.1 Short description

The string inverters of the Conergy IPG string inverter series convert the direct current from the solar power system to grid-compatible alternating current and supply this to the public power grid. The string inverters of the Conergy IPG series are transformerless units for single-phase power feed to the grid.

This instruction manual relates to the string inverters of the Conergy IPG series:

- | Conergy IPG 4000 vision string inverter,
- | Conergy IPG 4000 string inverter,
- | Conergy IPG 5000 vision string inverter,
- | Conergy IPG 5000 string inverter,

The designation "vision" represents the product version with a display. The number represents the performance level, corresponding to the nominal DC input power of 4,000 or 5,000 Wp.

The string inverters belong to the Conergy IPG string inverter series product group, which in turn is part of the Conergy IPG series (IPG = Inverter Power on Grid).

## 1.2 Additional products

String inverters of the Conergy IPG series can optimally be used with the Conergy IPG easyconnect generator junction box. These devices are designed to work together and allow for simple, time-saving installation. Conergy IPG series string inverters and the Conergy IPG easyconnect are connected to one another by means of prepared connections. The Conergy IPG easyconnect generator junction boxes also offer, for example, integrated lightning protection and automatic DC disconnection.

String inverters of the Conergy IPG series can also optimally be used with the internet-based **Conergy SunReader monitoring system**. If you have already opted for the Conergy IPG easyconnect generator junction box, Conergy has already integrated the Conergy SunReader into the individual monitoring system components.

With the help of the **Conergy IPG sizer system dimensioning program** you can determine the optimum combination of the solar power system with the Conergy inverters.

You can find further information at:

| [www.conergy.com](http://www.conergy.com)

| [www.sunreader.de](http://www.sunreader.de)

## 1.3 User group

This instruction manual is intended for an electrical specialist appointed by the owner/operator. Basic knowledge of electrics and electronics is necessary for the monitoring of the inverter by means of the LED indicators or display.

## 1.4 Signposts

The following aids will help orientation when using this instruction manual:

**Headers** The headers display the heading of the current chapter.

**Footers** The footers display the name of the product, the name of the document, and the page number.

**Text markups** The wording of the LED indicators and the connections are shown in **bold**. Item numbers are shown in the form **1** and **2**. Display messages are shown in a different font. The names of companies other than Conergy are shown in italics.

### Symbols



Denotes the start of an operation with a description of its objective.

Individually numbered steps follow, which may be interspersed with background information, illustrations, or warnings.



Denotes background and additional information for operational procedures.

## 1.5 Environmental information

The Conergy IPG series string inverters are made from materials, almost all of which can be used again through raw materials recycling. The device, its accessories, and its packaging should therefore be recycled in an environmentally responsible manner.

## 1.6 Manufacturer information

**Manufacturer** Conergy AG  
www.conergy.com

**Copyright information** All rights to this document are reserved by the product manufacturer (publisher). The document may not be reproduced or passed on as a whole or in part without the express written consent of the publisher. All illustrations, drawings and other integrated media are subject to copyright. The manufacturer reserves the right to make technical modifications to the product.

Conergy AG, 2006

## 1.7 Standards and technical directives

The string inverters of the Conergy IPG string inverter series comply with the following standards and directives:

- | 89/336/EEC: Council Directive on the approximation of the laws of Member States relating to electromagnetic compatibility (amended by 93/97/EEC)
- | 73/23/EEC: Council Directive on the approximation of the laws of Member States relating to electrical equipment for use within certain voltage limits (amended by 93/68/EEC)
- | Electromagnetic Compatibility (EMC) Generic standards – Immunity for industrial environments (IEC 61000-6-2: 1999, mod.); German version EN 61000-6-2: 2001
- | Electromagnetic Compatibility (EMC) Generic standards – Emission standard for residential, commercial and light industrial environments (IEC 61000-6-3: 1996, mod.); German version EN 61000-6-3:2001 + A11: 2004
- | Electromagnetic Compatibility (EMC); Limits for harmonic current emissions (equipment input current  $\leq 16$  A per phase) (IEC 61000-3-2: 2000, mod.); German version EN 61000-3-2: 2000
- | Electromagnetic Compatibility (EMC); Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current 16 A per phase and not subject to conditional connection (IEC 61000-3-3: 1994 + A1: 2001 + A2: 2005); German version EN 61000-3-3:1995 + A1: 2001 + A2: 2005

- | Electronic equipment for use in power installations (IEC 62103: 2003); German version EN 50178: 1997
- | Safety of power converters for use in photovoltaic power systems – Part 1 – General requirements (IEC 62109-1: 2005)
- | Safety of power converters for use in photovoltaic power systems – Part 2 – Particular requirements for inverters (IEC 62109-2: 2005)
- | Information technology equipment - Safety - Part 1: General requirements (IEC 60950-1:2005-12)
- | Automatic disconnection device between a generator and the public low-voltage grid; DIN VDE 0126-1-1
- | Guidelines of the VDEW (German Electricity Association) governing the parallel operation of in-plant generating systems with the low-voltage grid of the power supply company



Please note that the above legal regulations may have been modified since completion of this instruction manual.

Please also note that countries outside the Federal Republic of Germany may have their own national directives, laws and safety regulations.





## 2 Safety

### 2.1 Intended use

String inverters of the Conergy IPG Series are designed exclusively for the conversion of direct current from solar modules to alternating current. Any other use is deemed not to be as intended.

The inverter may only be installed within acceptable environmental conditions.

Intended use also includes compliance with the specifications of this instruction manual.

### 2.2 Responsibilities of the owner/operator

The owner/operator must ensure the safe operation of the Conergy IPG string inverter series inverter in accordance with legal regulations and the safety instructions specified in this instruction manual and displayed on the device. The specialist electrician employed by the owner/operator must observe and follow all the safety instructions specified in this instruction manual. Prior to assembling, installing, commissioning and removing an Conergy IPG string inverter series inverter, the electrician must have read and understood this instruction manual in full.

Conversion work on Conergy AG equipment and devices may only be performed by service technicians from Conergy AG.

The instruction manual is a part of the product. If the contents and in particular the safety instructions and operating instructions in this instruction manual are not observed, the product warranty and liability for any damage shall be invalidated. Conergy shall not be held liable for damages arising from a failure to observe and follow the instruction manual or the safety instructions posted on the device itself, or from any improper use of the device.

### 2.3 Basic safety instructions

- | Work on the device may only be carried out by qualified electricians.
- | Photovoltaic systems are electrical systems in which the connected power source is always **active!** Depending on the operating status, voltage from the solar power system may be supplied to the inverter. This must be noted in particular when disconnecting from the mains.
- | There are high DC voltages present and these may cause arcing if a malfunction occurs or if plugs or safety devices are improperly used.
- | Cover nearby live parts.
- | A second person must be present during all work on live system parts and leads. In the event of an unforeseen electrical accident, that person must be able to switch off the power supply and provide aid.
- | Damage due to improper transportation. When slewing and depositing the load, electronic equipment can be damaged by the force of impact. During transportation, electronic equipment can be damaged by temperature fluctuations and air humidity.
- | Do not remove any safety devices and do not disable any safety devices.
- | Observe the warnings posted on the device itself.
- | You must immediately renew any warning signs fitted on the system which have become illegible. Where appropriate, inform Conergy Service.
- | If the inverter is opened, the warranty of the system is invalidated.
- | Keep a copy of this instruction manual directly at the device.

## 2.4 Warnings

Warning signs provide information relating to safety. They consist of the following:

- | Warning symbol (pictograph),
- | Indicator word to denote the level of risk,
- | Details of the nature and source of the risk
- | Information on the possible consequences of disregarding the risk

Instructions on what to do to avert the risk and prevent injuries or damage to property

The indicator word on the warning signs denotes one of the following risk levels:



### **DANGER!**

Denotes a major extraordinary risk from electrical current, failure to observe which could lead to serious injury or death



### **WARNING!**

Denotes a potentially dangerous situation which may lead to serious or moderate physical injury and material damage.



### **CAUTION!**

Denotes a potential risk which may lead to slight physical injury and material damage.



## 3 Product description

### 3.1 General information on photovoltaic systems

A grid-connected photovoltaic system essentially consists of the following components:

| Solar power system 1

The solar power system consists of several photovoltaic modules connected in sequence or in parallel.

| Safety system

| DC wiring 2

| DC disconnect 3

| Inverter 4

| AC wiring

| AC disconnect 5

| Meter cabinet with circuit allocation, consumption and feed-in meter and house connection 6

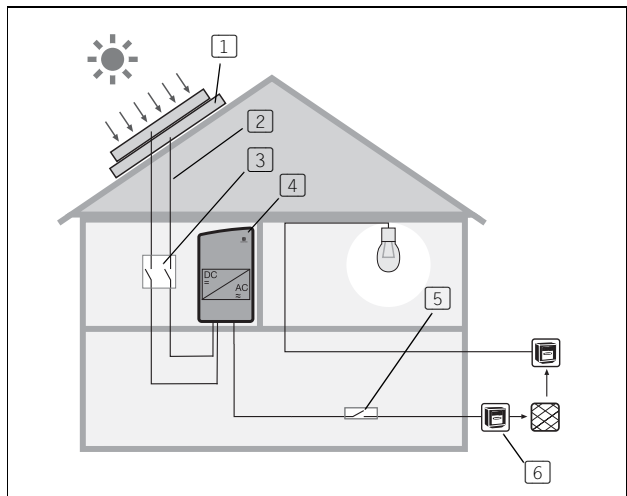


Fig. 3-1: House with photovoltaic system

**Solar power system** 1 You can connect up to two photovoltaic module strings (photovoltaic modules connected in series) to each string inverter of the Conergy IPG series. If you wish to connect more strings, use the Multi-Contact branch connector plugs and sockets. Note the specifications on the string inverter (see chapter 9.1, page 57).

Check whether the desired string configuration complies with the voltage and current ranges of your inverter.

**Safety system** In general, a photovoltaic system does not affect the risk of a lightning strike on the building; apart from the solar power system with a roof structure which stands out and is a more likely strike point. In such cases a lightning conductor system must be installed. Discuss this with a specialist, who will be pleased to help you with the selection and installation of a lightning conductor system.

Regardless of whether or not the photovoltaic system has a lightning conductor system, the solar power system must be earthed. Among other things, the earthing provides protection of persons.

**DC wiring** 2 Connect the solar power system modules with one another using solar wiring. Solar wiring generally consists of single-pole cables with double insulation. They are UV and weather-resistant. Conergy recommends the use of sheathed cables. This type of cable can also be used to connect the module to the string inverter of the Conergy IPG series.

When choosing the cables, check what cable section can be connected to the connection boxes of your module. The section varies from 2.5 to 6.0 mm<sup>2</sup>. Connect the solar cables to the string inverter using *Multi-Contact* MC4 connector plugs and sockets.

**DC disconnect** 3 Before working on the inverter, and also in the case of fire, the device must always be disconnected from the solar power system. To disconnect, actuate the DC disconnect (DC power circuit breaker). The circuit breaker must be capable of switching the DC rated current of the solar power system under full load.

**Inverter** 4 The question of what inverter types you should install depends both on the system size and the local circumstances. With the help of the Conergy IPG sizer system planning program (see [www.conergy.com](http://www.conergy.com)) you can determine the optimum combination of solar power system and Conergy inverters.

**AC disconnect** 5 It must be possible to disconnect the AC supply from the grid (on the AC side) by means of a disconnector. This is a prerequisite for ensuring the absence of current to the unit, e.g. during maintenance work. The disconnection device must be secured against being switched back on.

**Integration with the grid** 6 For power feed to the grid, connect the inverter to the low-voltage mains.

For systems with AC output up to 4.6 kW, a single inverter is generally used. For the operation of systems with higher outputs, several string inverters are used and connected in several phases.

### 3.2 Block diagram

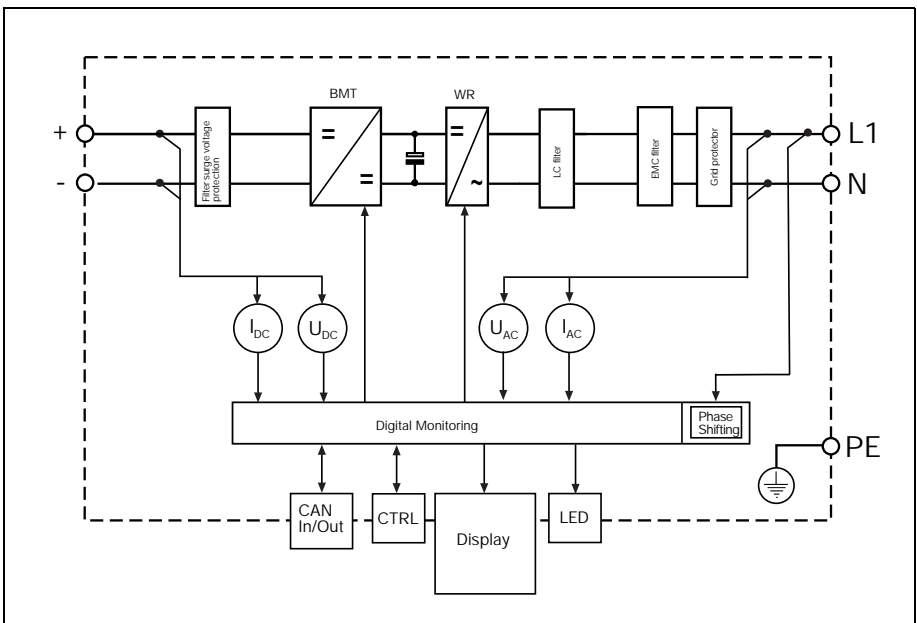


Fig. 3-2: Schematic block diagram

The electrical energy of the solar power system is conducted via a sheathed filter. The filter prevents the penetration of high-frequency line-bound interference. Varistors act as surge voltage protection. The downstream switching of the



Conergy Balanced Mode Technology (BMT) of the string inverter provides for a wide input voltage range. After the voltage equalisation by the capacitor, the string inverter converts the direct current from the solar power system into single-phase alternating current (230 V nominal voltage). The downstream LC filter has the purpose of equalising the current for feeding to the grid. Finally, the current flows through the EMC filter and a grid protector.

The whole process is monitored by a digital control system. This integrates both MPP tracking and fault current monitoring.

For safety reasons every photovoltaic system must be disconnected from the public power grid in various circumstances such as mains interruption. For this reason, the string inverters of the Conergy IPG series monitor the public power grid by means of the phase-shifting process.

Every string inverter has the following data interfaces:

- | **CTRL**  
to the Conergy IPG easyconnect (exchange of signals including DC disconnect, surge voltage protection)
- | **CAN In**  
to the Conergy SunReader or  
to the previous string inverter
- | **CAN Out**  
to the next string inverter

The digital control system controls

- | the display (only for inverters of the Conergy IPG string vision inverter series),
- | the LED indicators.

The digital control of the inverter evaluates the following internal measurements:

- | On the solar power system side (DC): U and I
- | On the grid side (AC): U, I, P and energy

### 3.3 Functions

The core of each string inverter of the Conergy IPG series is formed by the patented Conergy Balanced Mode Technology (BMT) circuit concept. The circuit consists of a combination of Insulated Gate Bipolar Transistors (IGBT), diodes and chokes. The Conergy Balanced Mode Technology ensures a wide voltage range ( $U_{DC} = 220\text{--}800\text{ V}$ ) and reduces leakage current to below the limit values provided for in the building services.

<b>Wide input voltage range</b>	Based on the wide input voltage range $U_{DC} = 220\text{--}800\text{ V}$ there is a wide range of ways to connect to photovoltaic modules. You can use the space you have available to optimum effect and at the same time reduce installation costs.
<b>Module protection</b>	On the basis of the Conergy Balanced Mode Technology (BMT), the photovoltaic modules are also protected from other electrical components of the photovoltaic system. This technology effects, among other things, that you can install the string inverters of the Conergy IPG series as transformerless inverters in photovoltaic systems with special photovoltaic modules such as thin-film modules.
<b>Maximum Power Point</b>	You increase the yield of your photovoltaic system by optimum tuning of the string inverter to the photovoltaic modules. Your system will reach its optimum level of efficiency when it is working at the Maximum Power Point (MPP). All string inverters of the Conergy IPG series work according to the principle of MPP tracking. This ensures that the system yield is optimised according to the relevant irradiation conditions. At regular intervals, this process searches for and inserts the optimum operating point in the curve of the solar power system.
<b>Display</b>	Each string inverter of the Conergy IPG string vision inverter series has a high resolution display. The display is operated by touch, and shows all the important information for the string inverter and the solar power system in a clear overview. In the case of faults in the string inverter, diagnostic information and fault warnings are shown on the display.
<b>Surge voltage protection</b>	The inputs of the solar power system and the outputs to the public grid are fitted with Category D surge voltage protection.

#### **Monitoring of the public grid**

For safety reasons, each photovoltaic system must be disconnected from the public power grid in various circumstances:

- | In the case of disconnection or failure of the electricity grid
- | In the case of electricity grid faults such as voltage fluctuations, fault currents or frequency changes

The grid monitoring must be carried out via an independent, automatic disconnect point or a switch point with disconnect function, accessible at all times for the utilities. The permitted type of automatic disconnection depends on the regulations of the individual countries.

Inverters of the Conergy IPG string inverter series monitor the grid using the phase-shifting process.

#### **Phase Shifting**

If there is a fault of the public power grid, each string inverter of the Conergy IPG series detects this fault on the basis of the change in frequency of the current.

The frequency of the public grid is at 50 Hz (nominal frequency). The digital control system of the string inverters of the Conergy IPG series ensures that the inverter continuously seeks to increase the input frequency. As long as the public grid (with nominal frequency 50 Hz) is present, the inverter cannot increase the input frequency. In the case of a power outage, the frequency changes, as in this case the inverter is in a position to increase the input frequency. The frequency change is monitored by the inverter. It reads a deviation from 50 Hz as an indication that the public grid is not available, and automatically disconnects.

## 4 Conergy IPG string vision inverter series

Every string inverter of the Conergy IPG string vision inverter series is equipped with a display. The display is a touch screen, i.e. you operate the menu by touching the display. The touch areas Cancel, Diagram, Settings and Diagnostics are available for navigation through the display menu. By touching the appropriate touch areas you will reach the required menu item. If you change settings you must first confirm the change. By touching the Cancel area, you will always be returned to the status and output screen.

In order to be able to operate the display at any time of the day or night, Conergy recommends the connection of an external 230 V power supply. If you have chosen combination with the Conergy IPG easyconnect generator junction box, you will not need an external power supply, as this is already integrated in the generator junction box.

The string inverters of the Conergy IPG series work automatically and require no maintenance. However, should malfunctions arise, these will be shown immediately on the display.

When commissioning the inverter, the display automatically switches on. The first thing to appear is the question in which language the display text should be shown. The display then shows the yield of the photovoltaic system. You can call up updated data for today, the values from the previous day and photovoltaic system data for the last 7 days via the display.

**Language** You can call up the display text in German, English, Italian or Spanish.



### Selecting the language

1. Select the desired language by touching the relevant button.
2. Confirm your selection by touching OK.

Decide whether you want to choose the language every time an inverter is commissioned.

3. Confirm your selection by touching the button Yes or No.

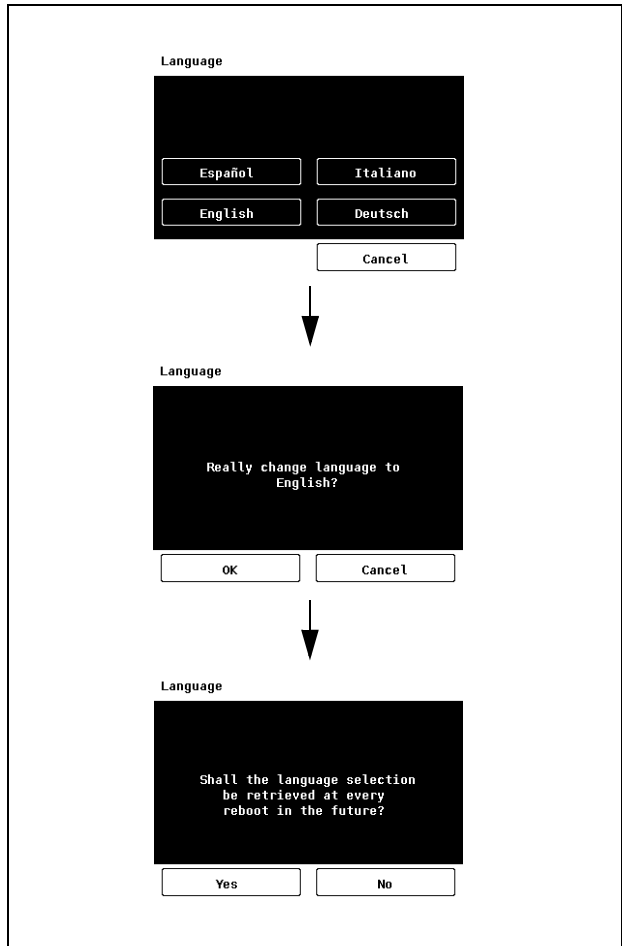


Fig. 4-1: Selecting the language

**Display** You can call up updated data for today, the values from the previous day and photovoltaic system data for the last 7 days via the display. The default setting displays current status and yield. If you want to see the values for the previous day or the data for the last 7 days, select the Diagram menu and then the desired display (Previous day; Week).



**Selecting the display type**

1. Select the menu Settings by touching the appropriate area.
2. Select the desired display type by touching the appropriate area.

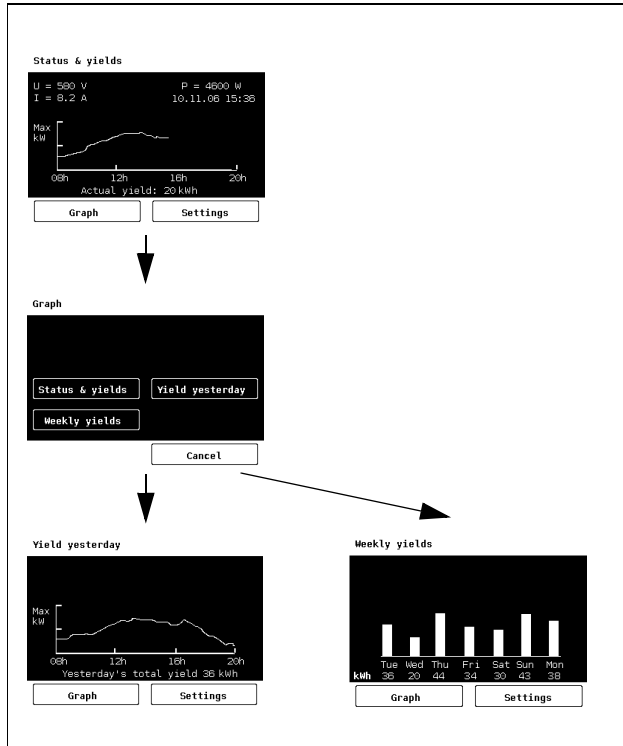


Fig. 4-2: Selecting the display types

- Settings** In the Settings menu you can change the following:
- | the language,
  - | the date,
  - | the time,
  - | the calibration,
  - | the display contrast.

In the Diagnostics submenu you will find fault messages and diagnostic information for the inverter.

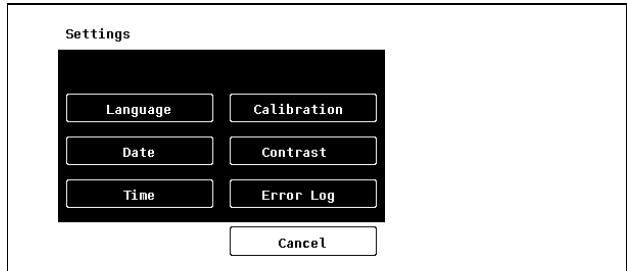


Fig. 4-3: Settings menu



### Changing the settings

1. Select the menu Settings by touching the appropriate area.
2. Select the setting to be changed by touching the appropriate area.

If you want to change the date or the time, the individual figures will be highlighted in sequence and you can change them.

3. Change the highlighted figures by touching the appropriate area on the number pad.

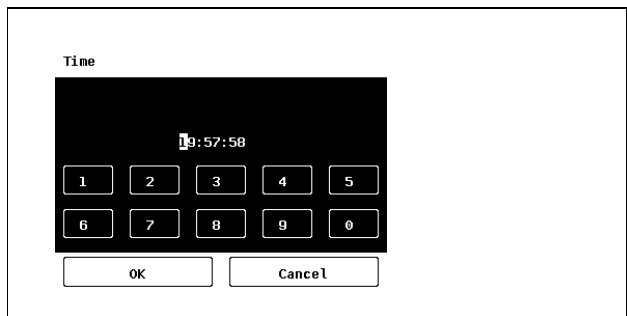


Fig. 4-4: Time Submenu

4. Confirm your change.

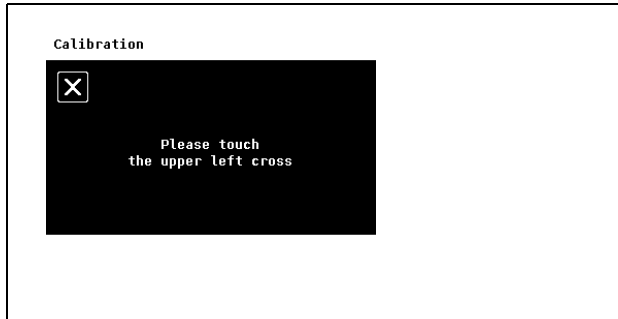


**Calibration** You can calibrate the display. If you detect that the touch areas have moved, re-calibrate the display.



### Calibrating the display

1. Select the Calibration submenu by touching the appropriate area.
2. Touch the exact centre of the crosses shown in sequence.



*Fig. 4-5: Calibration Submenu*

## 5 Transport and installation

### 5.1 Included in delivery

- | 2 MC4 Plus connector sockets with contact socket
  - | 2 MC4 Minus connector plugs with contact socket
  - | Mains plug (5-pin)
  - | Drill template
  - | Wall bracket
  - | Basic installation equipment
  - | Warranty card
  - | Instruction manual
- Conergy IPG string vision inverter series
- | 230 V power supply cable

### 5.2 Transportation



#### **CAUTION!**

#### **Damage due to improper transportation.**

When slewing and depositing the load, electronic equipment can be damaged by the forces of impact. During transportation, electronic equipment can be damaged by high temperature fluctuations and air humidity.

- | Ensure the device does not suffer impact during transportation.
- | When transporting, do not expose the device to high temperature fluctuations or air humidity.



**CAUTION!**  
**Damage due to condensate**

If the device is brought to the installation location from cold surroundings, condensation may form, which can lead to damage to the electronic equipment. The device must be dry before commissioning.

| Allow two hours after transportation before commissioning the device.

### 5.3 Installation

#### 5.3.1 Prerequisites for the installation location

During installation, observe the following:

**Weight** The Conergy IPG 4000 string inverter weighs 27 kg, the Conergy IPG 5000 string inverter 28 kg.

The foundation for installation must be firm and capable of bearing the weight permanently.

**Temperature** During operation the cooling unit of the inverter can reach a max. temperature of up to 90 °C.

The foundation for installation must be temperature-resistant.

**IP 65** Inverters of the Conergy IPG string inverter series may be installed both indoors and outdoors due to the IP 65 protection system. If installing outdoors, take care to ensure that the string inverter is not exposed to wet weather or direct solar irradiation without protection. For example, it may be advantageous to install the inverter beneath a canopy, in order to protect it from unnecessary heat and wetness. If you have chosen an inverter with display, note that direct sunlight may make reading more difficult.

**Ambient temperature** Ideally, the ambient temperature should be between –10 and 40 °C. The inverters of the Conergy IPG string inverter series achieve the quoted nominal capacity within this temperature range. In the case of temperatures between 40 and 60 °C, the output of the inverter may be reduced (derating).

**WARNING!**  
**Risk of fire.**

- | Do not expose the inverter to highly inflammable gases.
- | No highly inflammable liquids should be stored in the vicinity of the inverter.
- | The foundation for installation must be made from a flame-retardant material.

**CAUTION**  
**Air circulation**

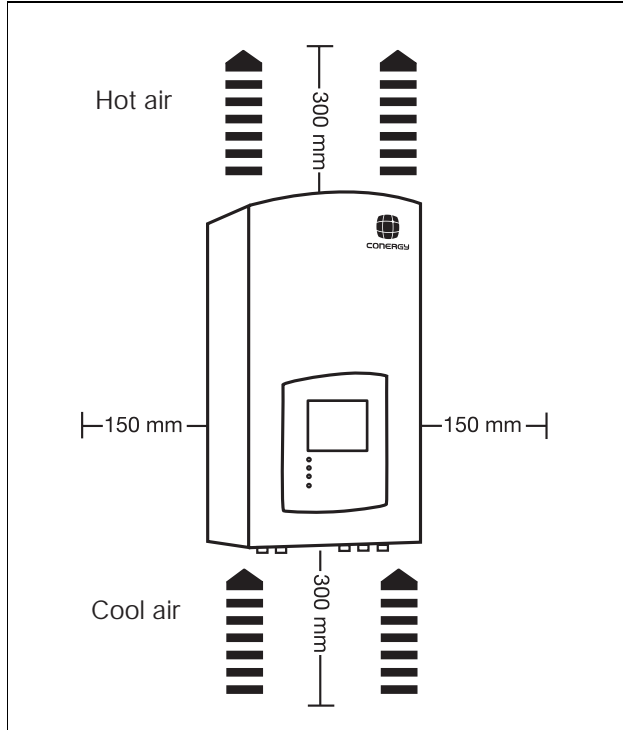
In order to enable the inverter to be cooled by the ambient air, it must be installed vertically. **No equipment** may be installed above or below the inverter.

- | Do **not** install string inverters one above the other.

**Distances** Observe the following distances during installation:

- | 300 mm above
- | 300 mm below
- | 150 mm to the side
- | 40 mm from the wall

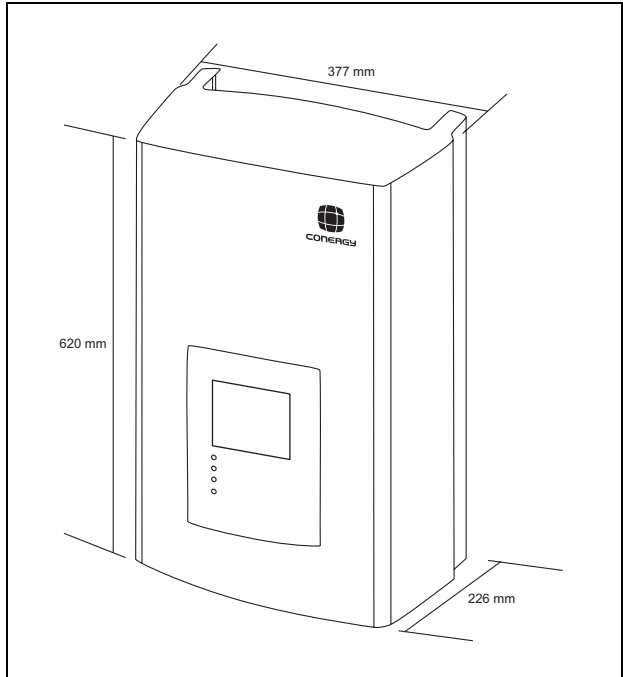
The 40 mm distance from the wall is ensured by using the wall bracket supplied.



*Fig. 5-1: Air circulation around string inverter*

If you wish to install a Conergy IPG series string inverter in a switch cabinet, take care to ensure sufficient air circulation. Do not cover the front of the unit.

**External dimensions** The external dimensions of the string inverter are:  
W x H x D 377 x 620 x 226 mm



*Fig. 5-2: External dimensions of the string inverter*

### 5.3.2 Wall mounting

Conergy IPG string inverter series inverters are intended to be wall mounted. In order to facilitate installation they are supplied with a wall bracket, a drilling template and a basic installation equipment pack with wall plugs and screws.



#### **CAUTION!** **Top-heaviness**

| Take the considerable top-heaviness of the device into consideration during installation.

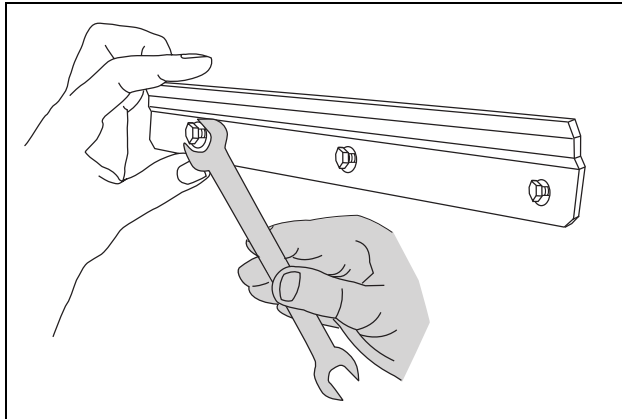
For wall mounting you will need

- | wall bracket,
- | drill template,
- | wall plugs and screws from the basic installation equipment pack,
- | drill bit (8 mm),
- | appropriate open-ended spanner.



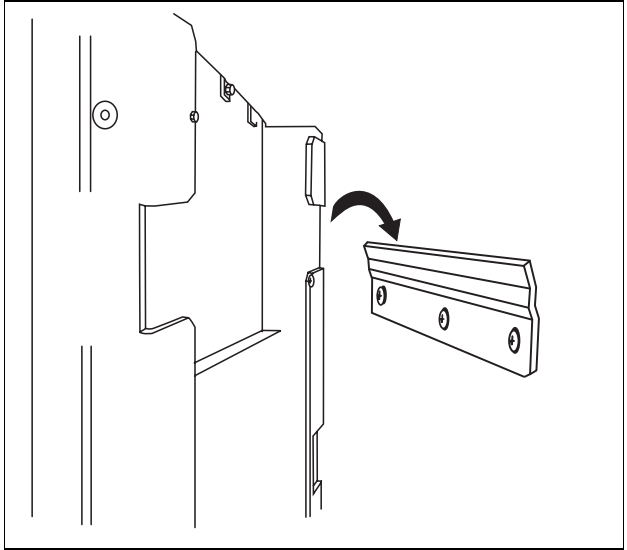
#### **Wall mounting**

1. Drill the holes in accordance with the drilling template supplied.
2. Screw the wall bracket firmly in place.



*Fig. 5-3: Wall bracket installation*

3. Fit the string inverter in place on the wall bracket.



*Fig. 5-4: Fitting the string inverter*

4. Screw the bottom of the string inverter firmly in place.

The bottom fixings of the string inverter are both to fix the device in place and also to ensure that it cannot accidentally be pushed off the wall bracket.





## 6 Installation and commissioning

### 6.1 Basic safety instructions

Before starting any work on electrical installations please observe the following safety rules:

- | Disconnecting from the mains

Disconnect the voltage from the device.

- | Secure against being switched back on
- | Make sure power is disconnected

Make sure power is disconnected from all poles, i.e. check all phases against zero/earth.

- | Earthing and short-circuiting

The background to earthing and short-circuiting is that disconnected sections of wiring which do not run in parallel can recharge.

- | Cover nearby live parts.



#### **DANGER!**

A second person must be present during all work on live system parts and leads. In the event of an unforeseen electrical accident, that person must be able to switch off the power supply and provide aid.



#### **WARNING!**

##### **Risks from electrical installations!**

When commissioning, there may be risks from electrical installations despite careful installation and compliance with the basic safety instructions. These include:

- | Direct contact with live system parts
- | Electrostatic processes
- | Short circuits and overloading

### 6.2 Preparation for installation

- Solar system** By voltage metering on the solar system, you can determine possible causes of faults (cabling, solar cells in partial shadow or defective modules) and rectify these prior to commissioning of the inverter.
- Wiring** As a single-phase inverter, the string inverter only supplies power via phase L1. If you operate several inverters of the Conergy IPG string inverter series in parallel, the feed phase of the string inverter must be equally distributed over phases L1, L2 and L3 of the grid.
- Sealing plugs** Before connecting the cables, remove the sealing plugs from the Conergy IPG series string inverter. Leave all connections which are not needed sealed, as otherwise the string inverter will no longer conform to the requirements of IP 65 protection. Keep the sealing plugs. When a service is required, you can seal the connections off again with the sealing plugs.
- CAN connection** If you have chosen the Internet-based Conergy SunReader monitoring system, connect the Conergy data logger to the string inverter using a CAN cable. If you are using more than one string inverter, connect these with a further CAN cable. If you use a CAN connection, you must always install a terminator (120  $\Omega$ ) on the last element of the connector. The terminator is included in delivery of the Conergy SunReader.
- Tools required** For the electrical installation of the Conergy IPG string inverter series inverter, you need the following tools:
- | Wire stripper (4–25 mm<sup>2</sup>)
  - | *Multi-Contact* crimping tool (for MC4 plug)
  - | *Multi-Contact* key set (for MC4 plug)
  - | PZ1 screwdriver

### 6.3 Connections

All connections of the Conergy IPG string inverter series inverters are accessible externally and protected against accidental contact.

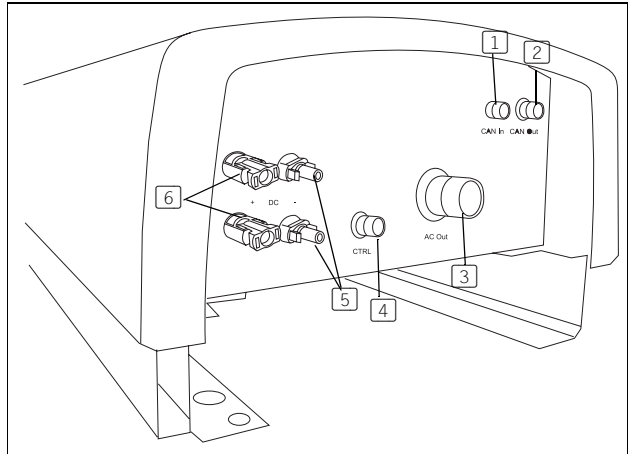


Fig. 6-1: Connections of the string inverter

- 1 **CAN In**  
Connection of previous inverter or to Conergy SunReader
- 2 **CAN Out**  
Connection of next inverter  
A 120 Ω terminator must be installed at the end of a CAN connection.
- 3 **AC Out**  
Grid connection
- 4 **CTRL**  
Connection for Conergy IPG easyconnect or external 230 V power supply for the Conergy IPG string vision inverter series inverter display.
- 5 **DC-**  
Solar system connections
- 6 **DC+**  
Solar system connections

All connections are provided with sealing plugs on delivery.

### 6.4 Connecting the mains cable



Do not connect any consumers between the Conergy IPG string inverter series inverter and the utility's meter. The consumers will otherwise be supplied with electricity which is not paid for by the utility.

Each inverter of the Conergy IPG string inverter series has a 5-pole **AC out** socket (see Fig. 6-1, page 35, pos. ③) for the connection to the grid. Use a PZ1 screwdriver and tighten the screws to 0.5–1 Nm. The mains cable must have a cable section of 4 mm<sup>2</sup>.

For devices with AC output of up to 4.6 kW a single string inverter of the Conergy IPG series is used. For the operation of systems with higher outputs, several string inverters are used. These are to be connected so that they are distributed over several phases. The wiring of several string inverters is shown in the following diagram.

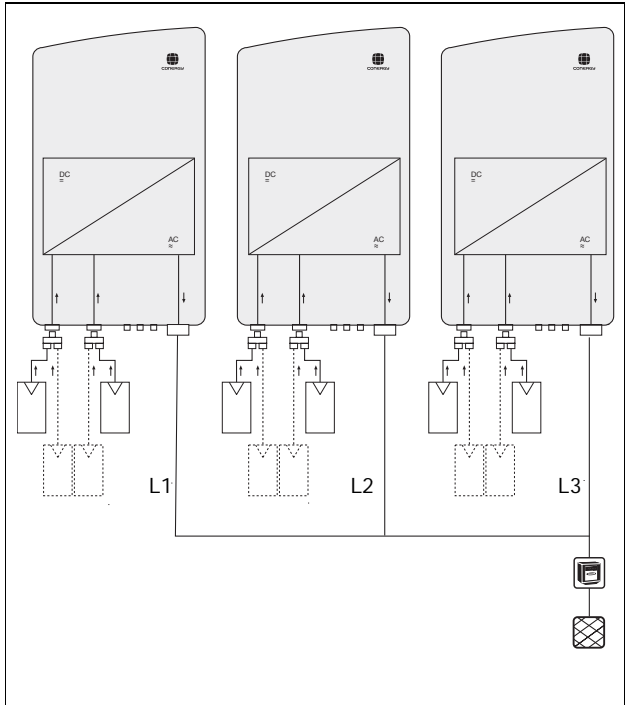


Fig. 6-2: Combination of several string inverters



Inverter



3-phase energy meter of the utility



Public power grid



**Connecting the mains cable**

1. Remove the sheathing from the cable to a length of 35 mm.
2. Strip the cable for a length of 9 mm with a wire stripper.
3. Guide the cable through the nut **1** and the cap **2**.

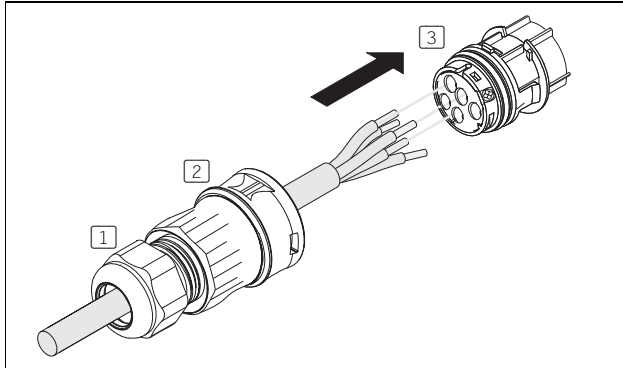


Fig. 6-3: Connecting to the end piece

4. Connect the ends of the wire strands to the sockets of the end piece in accordance with the terminal connecting plan **3**.

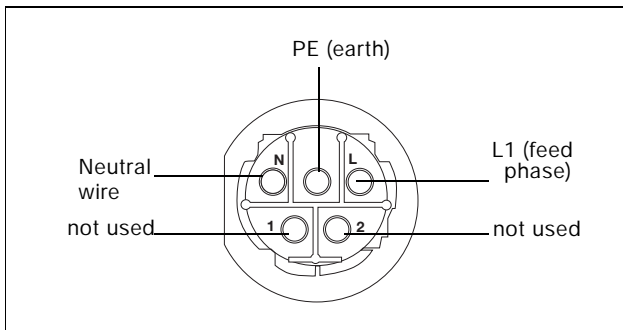


Fig. 6-4: End piece terminal connecting plan **3** for stripped cable

5. Tighten the screws on the end piece 3

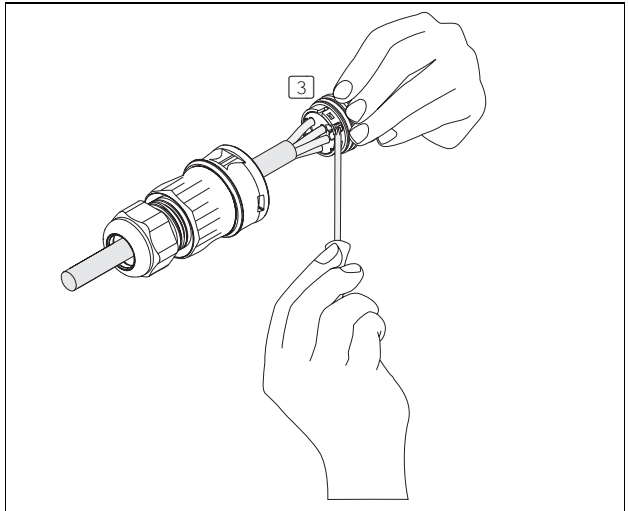


Fig. 6-5: Tightening the screws on end piece

6. Connect the end piece 3 to the connector cap 2.

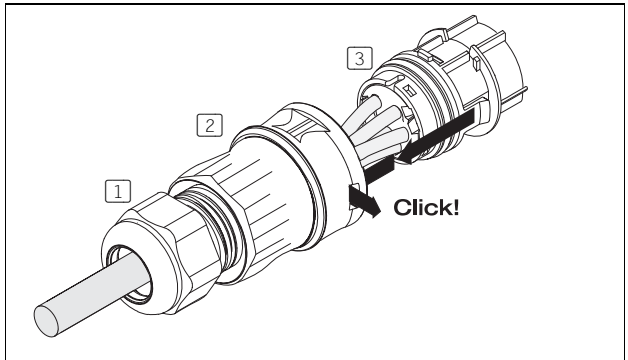


Fig. 6-6: Connecting the end piece to the connector cap

A clicking sound confirms that the components are correctly connected.

7. Screw the nut 1 tightly in place.



8. Connect the mains plug **1** into the socket **2** of the Conergy IPG series string inverter.

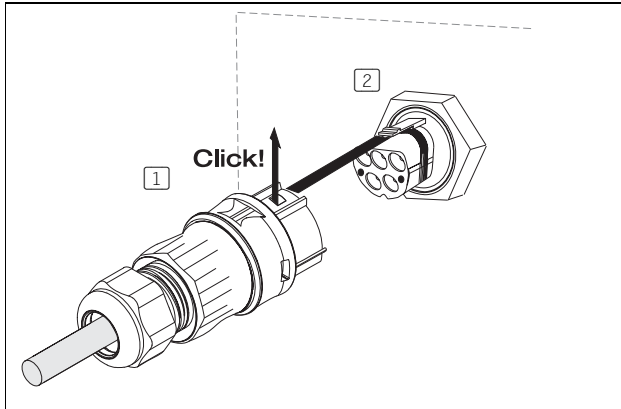


Fig. 6-7: Connecting the mains plug to the socket

A clicking sound confirms that the components are correctly connected.

### 6.5 Connecting the solar system

The solar system connections are made using MC4 connector plugs and sockets. The string inverter is equipped for 2 photovoltaic strings. If you want to connect more photovoltaic strings, use *Multi-Contact* branch connector plugs and sockets. Note the specifications of the string inverter.

The MC4 connector plugs and sockets are intended for a cable section of 4 to 6 mm<sup>2</sup> and an average cable section of 5.5 to 9 mm. To connect the solar system to the inverter you can use pre-assembled cables or crimp the cables to the connector plugs and sockets.

If you use pre-assembled cables, you can by-pass the next stage and connect the cables directly to the string inverter plugs and sockets (see Fig. 6-12, page 44).



**DANGER!**  
**Risk of electric shock!**

| Disconnect all cables and the plug-and-socket connection from the power supply.

**Tinned cable** If copper strands are oxidised, the permitted limit values of the crimp connection contact resistance may be exceeded.

| Therefore you must **only** use tinned cables!

**Tools required** For the crimping you need:

| *Multi-Contact* crimping tool (for MC4 plug)

| *Multi-Contact* key set (for MC4 plug)



**Connecting the solar power system**

1. Remove the sheathing from the solar cables along max. 25 mm.
2. Strip each wire for a length of 7 mm with a wire stripper.



**CAUTION!**  
**Material damage due to damaged wires!**

| When stripping take care **not** to cut the wire strands and **not** to damage them, as otherwise the strands may later overheat or break.

3. Connect in sequence the cap of the connector plug or connector socket [2], the contact socket [3] and the connector plug [4] or the connector socket [5] to the stripped wire [1].

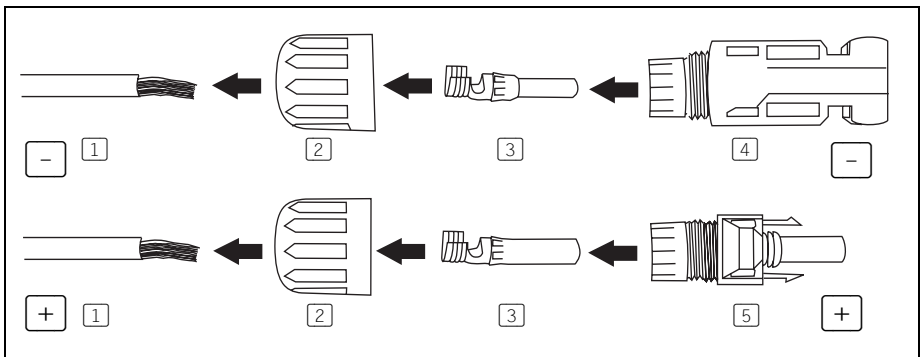


Fig. 6-8: Wires with connector plug and socket

- 1 Stripped wire
- 2 Cap of the connector plug or socket
- 3 Contact socket
- 4 Connector plug
- 5 Connector socket

4. Lay the contact socket in the Multi-Contact crimping tool.



The contact socket fits in the Diameter 4 guide of the crimping tool.

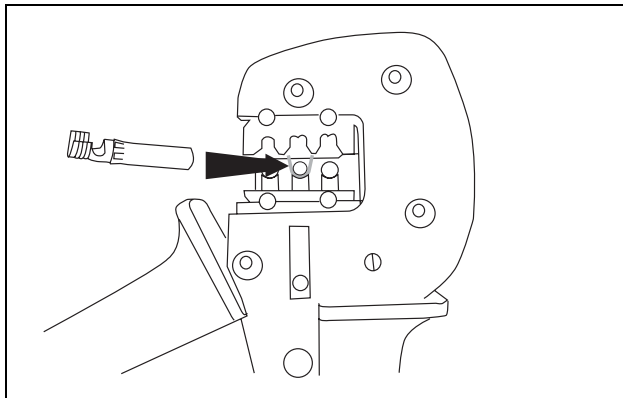
5. Guide the end of the stripped wire through the slot of the crimping tool and into the contact socket.



**CAUTION!**  
**Risk of short circuit!**

| Guide all the wire strands into the contact socket. Otherwise a short circuit may occur later.

6. Turn the contact socket so that the crimping lugs are aligned against the upper crimping jaw.

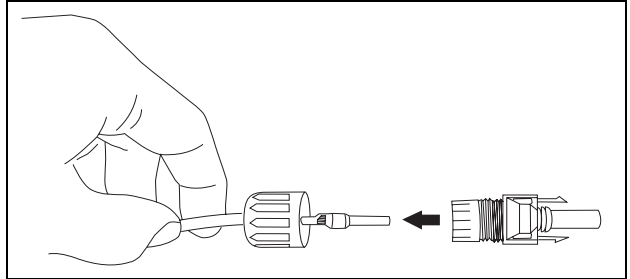


*Fig. 6-9: Introducing the contact socket to the crimping tool*

7. Press the crimping tool firmly together and then open it.

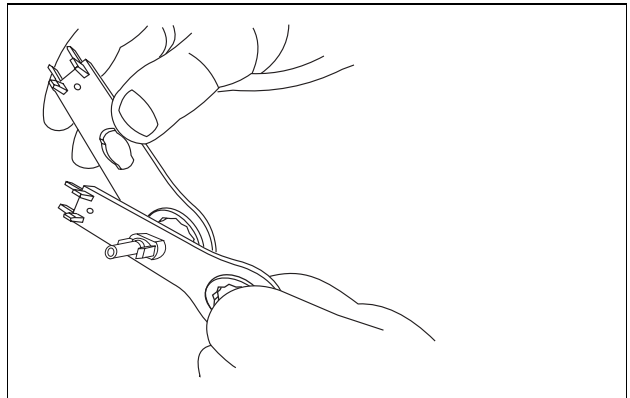
The contact socket is crimped to the wire. Check the socket is firmly in place.

8. Guide the wire through the connector cap and place the connector socket or connector plug onto the wire.



*Fig. 6-10: Connecting the connector socket to the crimped wire*

9. Screw the connector cap and the connector socket or connector plug together.
10. Tighten the screwed cable gland using the *Multi-Contact* installation wrench.



*Fig. 6-11: Tightening the screwed element*

11. Repeat the crimping procedure for all wires.

12. Place the connector sockets and connector plugs onto the plugs and sockets of the string inverter.

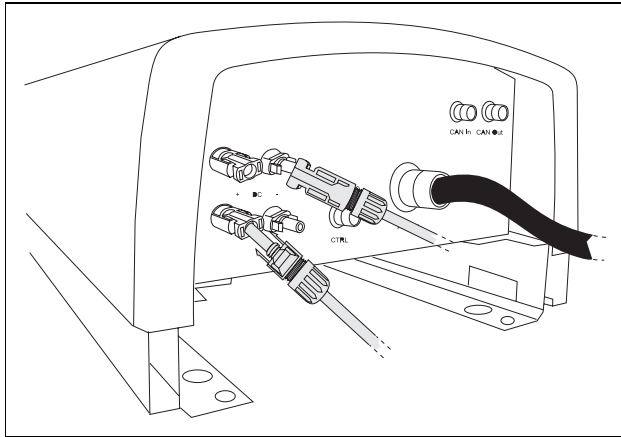


Fig. 6-12: Connecting the solar system

**Junction box** If you have chosen to combine the Conergy IPG series inverter with the Conergy IPG easyconnect generator junction box, you will save valuable installation time. The solar system is connected to the Conergy IPG easyconnect and from there to the inverter. Connection cables for this purpose are provided behind the generator junction box. All you need to do is draw the cables out to the required length (max. 5 m) and connect them to the connector socket or connector plug of the inverter. Please see the Conergy IPG easyconnect generator junction box instruction manual for further information.

## 6.6 Connecting the Conergy SunReader:

If you have chosen to use the Internet-based Conergy SunReader monitoring system, connect the Conergy IPG series string inverter to the Conergy data logger. Each Conergy IPG series string inverter has a **CAN In** connection (see Fig. 6-1, page 35, pos. 1). The CAN cable is included in delivery of the Conergy SunReader. Please see the Conergy SunReader instruction manual for further information.



### Connecting the Conergy SunReader

1. Connect the CAN cable to the **CAN In** connection.
2. Tighten the plug by turning manually.

You must install a 120  $\Omega$  terminator at the end of a CAN connection (see chapter 6.10, page 46).

If you do not use a Conergy SunReader, leave the sealing plugs in place on the connector.

## 6.7 Connecting the 230-V power supply

If you have an inverter with display, you can connect an external 230-V power supply to the **CTRL** connection (see Fig. 6-1, page 35, pos. [4]). You will then be able to operate the display of your inverter at any time of day or night.



### Connecting the 230-V power supply

1. Plug the 230-V power supply cable supplied into the **CTRL** connection.
2. Tighten the plug by turning manually.

If you have chosen the combination with the Conergy IPG easyconnect generator junction box, you will not need an external power supply, as this is already integrated in the generator junction box.

If you do not want to connect an external 230-V power supply, please leave the sealing plugs in place on the connector.

## 6.8 Connecting Easyconnect

If you have decided to use the Conergy IPG easyconnect generator junction box, connect the string inverter to this via the **CTRL** connection (see Fig. 6-1, page 35, pos. [4]) of the inverter. The CTRL cable is on the back of the generator junction box. Please see the generator junction box Conergy IPG easyconnect instruction manual for further information.



### Connecting Easyconnect

1. Connect the CTRL cable to the **CTRL** connection.
2. Tighten the plug by turning manually.

If you do not use a generator junction box, leave the sealing plugs in place on the connector.

### 6.9 Connecting further string inverters

If you have chosen to use the Internet-based Conergy SunReader monitoring system, connect the Conergy IPG series string inverters to one another with a CAN cable. Connect the first inverter to the Conergy SunReader (**CAN In**) (see Fig. 6-1, page 35, pos. 1). Fit a terminator to the last inverter (see chapter 6.10, page 46). The terminator is included in delivery of the Conergy SunReader.



#### Connecting further string inverters

1. Screw one end of the CAN cable to the first string inverter (**CAN In**).
2. Screw the other end of the CAN cable to the next string inverter (**CAN Out**).

If you do not use a Conergy SunReader, leave the sealing plugs in place on the connectors

### 6.10 Connecting the terminator

You must install a 120  $\Omega$  terminator at the end of a CAN connection. The terminator is included in delivery of the Conergy SunReader. The terminator is installed as a bus connector between pin 4 (CAN-high) and pin 5 (CAN-low) in an adapter.



#### CAUTION!

##### Short circuit due to inadequate terminator.

An inadequate terminator can cause damage from a short circuit.



#### Connecting the terminator

1. Connect the adapter with the integrated terminator to the **CAN Out** connection.
2. Tighten the plug by turning manually.

## 6.11 Commissioning

You can commission the string inverter once you have installed

- | the device (see chapter 5.3, page 26) on the wall
- | and correctly connected up the solar power system (see chapter 6.5, page 40) and
- | the supply main (AC) (see chapter 6.4, page 36).



### **WARNING!**

#### **Risks from electrical installations.**

When commissioning, despite careful installation and compliance with the general safety instructions, there may still be risks from electrical installations. These include:

- | Direct contact with live system parts
- | Electrostatic processes
- | Short circuits and overloading



#### **Commissioning the inverter:**





















1. Switch on the mains power supply by switching the external safety disconnecter
2. Switch on the solar system via the DC disconnect.





If the solar power system provides sufficient output, the Conergy IPG string inverter series inverter will switch on. If the DC input voltage has reached  $250 V_{DC}$ , the string inverter will supply its internal electronic systems with electric current. If the solar irradiation is not sufficient to supply sufficient voltage for the power feed to the grid, the Conergy IPG series string inverter automatically reduces its output. If there is a fault during commissioning, you will find further information in chapter 7, page 49.

Illumination or flashing of the LED indicators show the status of the inverter and the current stage of commissioning.



**LED indicators during commissioning**

Ready	Solar system	Grid	Fault	Meaning
After switching on, approx. 10 seconds may elapse before the LED indicators are illuminated.				
				$U_{SG} \geq 250 V_{DC}$ , internal electronic systems are supplied
30-40 seconds may elapse before test of the LED indicators.				
				Internal test of the LEDs
Preparation for the power feed to the grid may last 2-3 minutes.				
				Preparation of the power feed to the grid connection: Audible clicking of the relay
				Power feed to the grid
				Grid power available, stand-by operation of the inverter

-  LED is illuminated
-  LED is flashing (LED lights up regularly)
-  The status of this LED indicator has no significance for the current information displayed.
-  LED is off

## 7 Troubleshooting

The Conergy IPG string inverter series inverter works automatically and without maintenance. However, should malfunctions arise, these will be indicated by the LED indicators and/or the Conergy SunReader (see [www.sunreader.de](http://www.sunreader.de)).

The inverter may switch off temporarily in the following cases:





























- |                                 |  |
|---------------------------------|--|
| <b>Grid failure</b>             | The Conergy IPG string inverter series inverter monitors the single-phase power feed to the grid by means of the phase-shifting process. If the inverter detects a frequency change in the public power grid, it interrupts the power feed to the grid. It switches off. The inverter waits 2 minutes before switching back on after a grid failure.                                   |
| <b>DC overvoltage</b>           | If the DC input voltage exceeds the limit value of $800 V_{DC}$ , the inverter interrupts the power feed to the grid. It switches off.   |
| <b>Overheating</b>              | The Conergy IPG string inverter series inverter is designed to operate at an ambient temperature of up to $60^{\circ}\text{C}$ . If this temperature is exceeded, the inverter interrupts the power feed to the grid and switches off. Once the temperature sinks back to below the limit value of $60^{\circ}\text{C}$ , the inverter automatically switches back on after 4 minutes. |
| <b>Fault current monitoring</b> | The fault current monitoring system automatically switches the inverter off when a fault arises. Once the fault is rectified, the inverter automatically switches on again after 4 minutes.  |

- Conergy Service** Please contact Conergy Service in the event of faults. To enable Conergy Service to respond quickly and accurately, please provide the following information:
- | Invoice number (delivery note if applicable)
  - | Serial Number of the inverter
  - | Brief description of the fault
  - | What is the LED indicator or the display showing?
  - | Is the fault reproducible?
  - | Information about the PV system such as module type, circuitry, solar generator voltage.
  - | How long is the mains cable and what is its cross-section?
  - | What are the irradiation conditions?

### 7.1 LED indicator fault messages

The three LED indicators **Ready**, **Solar Generator** and **Grid** may be illuminated, flashing or flashing blue; the LED indicator **Fault** may be illuminated, flashing or flashing red. A flashing LED indicator indicates that the inverter is in stand-by mode or there is a fault.



## Meaning of the LED indicators

Ready	Solar Generator	Grid	Fault	Meaning
				Reversible temporary fault (e. g. grid failure, excess temperature).
				Diagnostic information, e. g. temperature warning, power feed to the grid during output reduction
				Grid fault, inverter is in stand-by mode
				The inverter waits 2 minutes before switching back on after a grid failure. Connection: audible clicking of the relay
				Internal electronics systems will not be supplied due to insufficient solar generator voltage. Inverter is not supplying power.
				Insulation fault, e.g. earth leakage
				Internal fault: The inverter switches off. If the fault arises again the next day, it switches itself off again. The inverter notes that it is a critical fault and remains switched off permanently. Please contact Conergy Service.



LED is illuminated

LED is flashing  
(LED lights up regularly)LED is flashing  
(brief illumination of the LED every 2 seconds)

-  LED is off
-  The status of this LED indicator has no significance for the current information displayed.

## 7.2 Fault warnings on the display

If you have chosen a Conergy IPG string vision inverter series inverter, your inverter will have a high-resolution display.

The inverter differentiates between faults and diagnostic information. Diagnostic information relates to temporary faults. If a fault arises, please contact Conergy Service. If a fault arises, a notice will immediately appear on the Status and Yield screen. Under Diagnostics you will find all previous faults and diagnostics information.

The following faults may arise and can be rectified as described. If you have any queries, please contact Conergy Service.

Display	Possible cause	Remedy
Overheating	Ambient temperature is too high, $T > 60^{\circ}\text{C}$	The inverter needs cool ambient air. Check the installation conditions.
	Temperature of the output stage is too high	Check the installation conditions.
DC overvoltage	DC overvoltage	Check the idling voltage of the solar system.
Insulation fault	Earth leakage of the solar system	Check the solar system for earth leakage.
Grid fault	Grid frequency is out of tolerance	Check the mains voltage.
	AC overvoltage	Check the mains voltage.

Display	Possible cause	Remedy
Grid impedance	Grid impedance is too high	Check the mains voltage and the grid connection.
Internal fault	e.g. fault with the electronics	Please contact Conergy Service.



## 8 Removal

If you discover a fault to a string inverter of the Conergy IPG Series, please contact Conergy Service. If they tell you that Conergy will replace the unit, please remove it. First, switch off the public power supply and the solar system. Next, disconnect the various cables from the inverter.



### Switching off the inverter

1. Switch off the public power supply by means of an external disconnect device.
2. Switch off the solar system via an external DC disconnecter.
3. Secure the disconnecter devices against being switching back on.



### **WARNING!** Unintentional removal of the plug!

If the plug is removed while under load, it may be damaged and also cause **personal injury**.

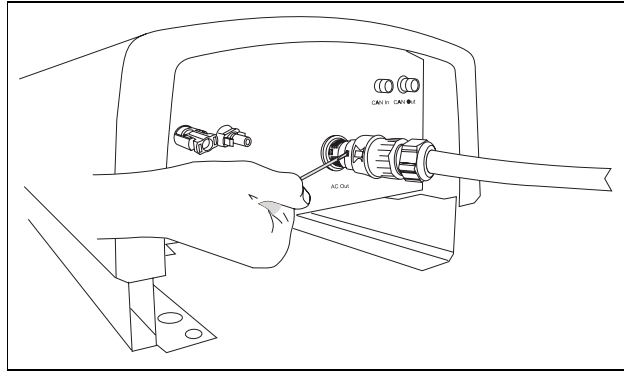


### Disconnecting the cables

1. Unscrew the connector pieces of the CAN cable.
2. Remove the connector cables.



3. Release the mains connector cable by inserting a screwdriver into the connector socket.



*Fig. 8-1: Releasing the mains cable*

4. Turn the screwdriver slightly.
5. Pull the connector from the socket.
6. Release the solar cables by pressing the locking clip of the connector plug manually or by using the Multi-Contact key.
7. Remove the solar cables.
8. Seal all connections with sealing plugs.



Take care to ensure that the sealing plugs are correctly in place. Otherwise, the connections will not be protected against humidity.

9. Release the two fixing screws on the bottom of the string inverter.



**CAUTION!**  
**Risk of burn!**

The cooling unit can heat up to 90°C.

| Allow a few minutes before removing the inverter from the wall.

10. Remove the string inverter from the wall.

## 9 Appendix

### 9.1 Specifications

	Conergy IPG 4000 and IPG 4000 vision	Conergy IPG 5000 and IPG 5000 vision
<b>Solar system</b>		
Nominal solar system power	4,000 W	5,000 W
Max. solar system power	5,000 Wp	6,000 Wp
<b>DC connection data</b>		
MPP voltage range	220–750 V	220–750 V
Output in night mode	0 W	0 W
Idling voltage	800 V	800 V
Switch-on voltage	250 V	250 V
Max. input current	15.2 A	16.2 A
<b>Conversion</b>		
Max. efficiency level	96.5	96.7
European efficiency level	95.0	96.0
<b>AC network output data</b>		
Nominal output	3,400 W	4,600 W
Maximum output	3,800 W	5,000 W
Rated current	14.8 A	20.0 A
Max. current	16.5 A	21.7 A
Frequency	49.8–50.2 Hz	49.8–50.2 Hz
Mains voltage	230 V	230 V
Mains voltage tolerance range	± 15%	± 15%
Distortion factor	< 3%	< 3%
Reactive factor $\cos \varphi$	1	1

Conergy IPG 4000 and IPG 4000 vision	Conergy IPG 5000 and IPG 5000 vision
--	--

Installation and location data		
Weight	27 kg	28 kg
Protection type against environmental factors	IP 65	
Ambient temperature	-10 to 60 °C 40 to 60 °C with derating	
Cooling	Convection	
Relative atmospheric humidity, max.	95% (non-condensing)	
Mounting type	Wall mounted with wall bracket	
External dimensions (W x H x D)	377 x 620 x 226 mm	
Only Conergy IPG string inverter vision series		
Display type	Touch screen	
Display size (W x H)	118 x 88 mm	

Every transformerless string inverter of the Conergy IPG string inverter series has:

- |   |  |
|---|--|
| 2 DC inputs   | MPP tracking with 99% accuracy   |
| CAN interfaces                                      |  |
| 1 input phase (230 V, single-phase)                 | Patented Conergy Balanced Mode Technology circuitry concept              |
| Grid connection                                     |  |
| Grid monitoring in accordance with DIN VDE 0126-1-1 | Reverse battery protection by short circuit diodes on the DC side        |
| Sinusoidal current form                             | Varistors and spark gaps as AC and DC surge voltage protection (Class D) |

Please check that the Conergy IPG Series string inverter complies with the requirements of your utility. Requirements may vary between utilities, e.g. voltage limit values may vary. If you become aware of any differences, please contact Conergy Service.

## 9.2 Index

### A

Air circulation 27

Ambient temperature 26

### B

Balanced Mode Technology 16, 17

Block diagram 15

### C

Conergy IPG easyconnect 4, 40, 45

Conergy IPG sizer 4, 14

Conergy IPG string vision inverter 19, 52

Conergy Service 50

Crimping 36

### D

DC 14

Directives 6

Display 17, 19, 52

### E

Electrical installation 33

External dimensions 29, 60

### F

Fault current monitoring 49

Fault message 49

### H

Hotline 50

### I

Included in delivery 25

Installation 30

### J

Junction box 4, 40, 45

### L

LED 47, 50

Lightning 14

### M

Maximum Power Point 17

Monitoring grid 18

MPP tracking 16

### O

Overheating 49

Overvoltage 49

### P

Phase Shifting 16, 18

### **R**

Removal 55

### **S**

Specifications 59

Standards 6

Surge protection 17

System planning program 4

### **W**

Wall mounting 30

Weight 26



[www.conergy.com](http://www.conergy.com)

**Subject to technical modifications without notice.**  
2006 © Conergy AG