Communication Accessories
Installation Manual
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This document is subject to change.
Important safety precautions

General warnings

The operations described in the manual may be performed only by qualified personnel. All applicable safety-related for electrical work must be complied with. Danger of electric shock. The entire manual must be read and understood in full prior to manipulating, installing or operating the unit.

The status of qualified personnel referred to in this manual will be, as a minimum, that which meets all the standards, regulations and laws regarding safety applicable to the tasks of installing and operating this unit.

The responsibility for designating qualified personnel will always fall to the company to which the personnel belong. It is necessary to decide which workers are suitable or not for carrying out specific work to preserve their safety at the same time as complying with occupational safety legislation. These companies are responsible for providing appropriate training in electrical equipment to their personnel and for familiarising them with the contents of this manual.

The risk of electric shock exists even after disconnecting from the grid, the PV array and the auxiliary supplies.

Compliance with the safety instructions set out in this manual or in the suggested legislation does not imply exemption from other specific standards for the installation, place, country or other circumstances that affect the inverter.

Carry out all control and handling without voltage.

As a minimum security measure in this operation, the so-called five golden rules should always be followed:

1. Disconnect
2. Prevent any possible resupply
3. Check there is no voltage
4. Ground and short circuit the equipment
5. Protect from live elements, if any, and put up safety signs around the work zone.

Until these five steps are completed, the work area cannot be considered voltage-free and any work performed will be considered to be work on live equipment.

Following is a list of the basic obligatory safety standards for each country:

- CEI 11-27 in Italy.
- DIN VDE 0105-100 and DIN VDE 1000-10 in Germany.
- UTE C15-400 in France.
Category III - 1000-Volt measuring instruments must be used for checking for the absence of voltage. Ingeteam Energy, S.A. is not liable for any damages caused by improper use of their equipment.

Potential hazards for people
Bear in mind the following warnings concerning personal safety.

DANGER: Electric Shock.
The equipment may remain charged after disconnecting the PV array and mains power. Carefully follow the mandatory steps in the manual for removing the voltage.

Potential hazards for the equipment
Bear in mind the following warnings for the protection of your equipment.

CAUTION: Electrical damage.
Do not touch boards or electronic components. The most sensitive components can be damaged or destroyed by static electricity.

CAUTION: Operation.
Do not disconnect or connect any terminal while the unit is operating. Disconnect and check for absence of voltage first.

Personal protection equipment (PPE)
Use all items comprising the personal protection equipment.

CAUTION: The standard personal protective equipment is:
- Safety goggles for mechanical hazards
- Safety goggles for electrical hazards
- Safety footwear
- Helmet
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1. Introduction
The Ingecon® Sun units can be monitored through connectors J11 and J12 on the inverter control electronics board. The control board is located inside the electronics block.

Before inserting or removing a communications board, the equipment should first be disconnected from the power supply. Please read section “8. List of accessories” and always refer to the installation manual for the Ingecon® Sun unit in which the communication accessory is to be installed.

Accessory codes for the Ingecon® Sun based on the type of communication desired

<table>
<thead>
<tr>
<th>Ingecon® Sun Lite</th>
<th>Ingecon® Sun Smart TL</th>
<th>Ingecon® Sun Smart</th>
<th>Ingecon® Sun Power</th>
<th>Ingecon® Sun Power Max</th>
<th>ComBox</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS-485</td>
<td>Supplied as standard</td>
<td>Supplied as standard</td>
<td>AAX7002</td>
<td>Supplied as standard</td>
<td></td>
</tr>
<tr>
<td>Ethernet</td>
<td>AAX7023(1)</td>
<td>AAX7023(1)</td>
<td>AAX7004(1)</td>
<td>Please enquire</td>
<td></td>
</tr>
<tr>
<td>GPRS</td>
<td>AAX7022(1)</td>
<td>AAX7022(1)</td>
<td>AAX7001(1)</td>
<td>AAX7014</td>
<td></td>
</tr>
<tr>
<td>Radio ISM 868</td>
<td>AAX7019(1)</td>
<td>AAX7019(1)</td>
<td>AAX7009(1)</td>
<td>AAX7013</td>
<td></td>
</tr>
</tbody>
</table>

(1). Includes an additional RS-485 output

Additional requirements based on the desired type of communication

<table>
<thead>
<tr>
<th>RS-485</th>
<th>Converter to RS-485</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet</td>
<td>Local network connection</td>
</tr>
<tr>
<td>GPRS</td>
<td>Access to Internet</td>
</tr>
<tr>
<td>Radio ISM 868</td>
<td>ComBox</td>
</tr>
</tbody>
</table>

2. Inverter identification
It is absolutely essential to use a different identifier number for each and every inverter with which communication is to be established. To change the inverter node number, please refer to the appropriate installation manual.

- Ingecon® Sun Lite single phase models. Refer to document AAY2000IKI01.
- Ingecon® Sun Smart (10-30 kW) three phase models. Refer to document AAS2000IKI02.
- Ingecon® Sun Power (50-100 kW with transformer) three phase models. Refer to document AAS2000IKI01.
• Ingecon® Sun Power Max (Modular, 100TL and 125TL) three phase models. Refer to document AAV2000IKI01.
• Ingecon® Sun String Control box. Refer to document AAS2002IKI01.
• Single phase models prior to 2009. Refer to document AAP2000IKI01.
• Three phase models of 100 kW or more, prior to 2009. Refer to document AAV2000IKI01 supplied with the equipment.
• Other three phase models prior to 2009. Refer to document AAS2000IKI01 supplied with the equipment.

3. Local communication

3.1. Communication through the RS-485 serial line

The RS-485 local communication schema is as follows:

With inverters B and A connected by bus and media converter C connected to a local PC - D. E represents the RS-485 cabling whilst, depending on converter C, the F cabling can either be RS-232, USB or Ethernet.

3.1.1. General comments

RS-485, as the EIA-485 standard is generally known, defines the electrical characteristics of transmitters and receivers in an inexpensive, digital communications system in hostile electromagnetic environments. Its high noise immunity is due to the fact that it operates in a differential communication mode, in other words the data is transmitted over a single two wire, normally twisted pair in which the signal carried in one wire is inverted whilst the signal carried in the other wire is non-inverted. The EIA-485 standard defines the B signal as the “non-inverting” or positive pin (+), whilst the A signal is the inverting or negative (-) pin.

Solar PV plant cabling generally carries high energy flows which can negatively affect communication. Ingeteam recommends a careful plant design to ensure that the data lines are as far apart as possible from the power lines and that the total cabling length is kept to a minimum.

Topology

The recommended cabling arrangement is a series of consecutive nodes, also called a bus or line configuration. A star, ring or multiply connected network is not recommended. Ingeteam Energy also advises you not to be conservative in the number of nodes in each bus, by not connecting more than 30 items of equipment.

In a bus topology, it is best to have the master centrally located in the bus, in order to ensure optimum signal strength to as many slaves as possible.
Speed

The communication speed in the Ingecon® Sun units is 9600 bps. In addition, the serial communication uses 8 data bits, with no parity bit, and 1 stop bit.

Half Duplex

In the Ingecon® Sun units, communication via the RS-485 line is made with two wires in the Half Duplex mode. In this configuration, the same pair of wires is used for the data sent and that received, with the Ingecon® Sun Manager software being responsible for ensuring that two devices do not simultaneously access the bus.

Cabling

A “shielded twisted pair” type cable is recommended, with a characteristic impedance of 100 - 120 Ohm, for example the Unitronic Bus IBS 2x2x0.22, made by LappKabel. A twisted pair should be used for the B (+) and A (-) signal pair, and another for the GND.

Although the data is transmitted over a two-wire pair, a GND also needs to be wired, in order to provide a common voltage reference for all the devices connected to the bus. Some manufacturers forget this point and only supply two wires, which can create communication problems.

End of line

The standard recommends that, at either end of the RS-485 cabling, in this case the inverters marked as B, some 120 ohm end of line resistors should be installed. All the models in the Ingecon® Sun range are fitted with these resistors.

- Ingecon® Sun Lite – The installation is made at the Harting connector of Kit AAY0013.
- Single phase units prior to 2009, refer to section “AAP0034”.
- Other equipment, refer to section “AAX7002”.

Protective shield

The cable shield is intended to protect the communications from electromagnetic noise. Initially, and for each cable section installed, we would recommend grounding the mesh at just one of the section ends.

3.1.2. RS-485 accessories for Ingecon® Sun

AAP0034

Reference AAX0034, comprising communications board AAX7002 and an internal cable with a Harting type push-pull connector, is required for the RS-485 serial line communication in single phase equipment prior to 2009. The Harting connector pins correspond to:

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RS-485 B (+)</td>
</tr>
<tr>
<td>2</td>
<td>RS-485 A (-)</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
</tr>
</tbody>
</table>

The end of line resistor (120 Ohm) is supplied for mounting with no need to open the equipment. Mount between Harting connector pins 1 and 2 on the units located at the end of the RS-485 bus.
AAX7002

Reference AAX7002 corresponds to the supply of the communications board required for the RS-485 serial line communication.

The terminals of the cable connector correspond to:

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RS-485 B (+)</td>
</tr>
<tr>
<td>2</td>
<td>RS-485 A (-)</td>
</tr>
<tr>
<td>6</td>
<td>GND</td>
</tr>
</tbody>
</table>

Jumper JP3 is the end of line resistor. This P3 Jumper must be closed on the end of line inverter.

3.1.3. RS-485 communication in the Ingecon® Sun units

Ingecon® Sun Lite

The Ingecon® Sun Lite offers RS-485 communication with no need to install the additional RS-485 AAX0022 board or open the unit.

To connect the Ingecon® Sun Lite to a RS-485 bus, remove the protective cover from the connector and mount the push-pull Harting type connector. The pins for this connector are:
<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RS-485 B (+)</td>
</tr>
<tr>
<td>2</td>
<td>RS-485 A (-)</td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
</tr>
<tr>
<td>4</td>
<td>Earth</td>
</tr>
</tbody>
</table>

Ingeteam Energy will supply this connector with your Ingecon® Sun Lite, if you include reference AAY0013 with the equipment order.

**Ingecon® Sun Smart, Power and Power Max**

The communications board must be mounted on the specific communications connector on the control board (see section “1. Introduction”).

Read section “8. List of accessories” and always refer to the installation manual for the Ingecon® Sun inverter in which a communications accessory is to be installed.

The cabling shall be made directly to the flying lead connector on board AAX7002. There is no defined position on the equipment housing for bring out the cabling, however there are a number of ports available to do so.

**Ingecon® Sun String Control**

Communications card AAX7002 must be mounted on the String Control electronics board specific communications connector and the cabling shall be made to the board push-pull connector. The RS-485 cabling shall be passed through the PG cable gland available for this purpose. Please refer to the Ingecon® Sun String Control manual.

**Models prior to 2009**

Refer to the previous version of this document: AAX2002IKI01_.

**3.1.4. Connection of the local PC and RS-485 PC accessories**

Given the fact that the PC does not incorporate an RS-485 port, a converter is required to connect the bus formed by the Ingecon® Sun equipment.

To connect the group of inverters to the PC, use an off-the-shelf RS-485 to RS-232 or USB converter, configured in the «Multipoint» mode and «Two wire, Half Duplex» or else the «AAP0057» and «AAP0058» supplied by Ingeteam Energy.

**AAP0057. USB to RS-485 converter**

Reference AAP0057 has been discontinued. Kit AAX7030 is now supplied.

**Settings**

The settings of the side switches must always remain as shown in the following figure:

<table>
<thead>
<tr>
<th>PIN 1</th>
<th>PIN 2</th>
<th>PIN 3</th>
<th>PIN 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
</tbody>
</table>

**Connections**

1. Connect the two terminals on the terminal strip to the communications board, by pairing converter terminal 2 to pin 1 of the communications board, and terminal 1 to pin 2.

2. The monitor program is configured in Opciones -> Configuración comunicaciones (options - communications configuration) by selecting the port number corresponding to the converter.
AAP0058 - RS-485 to RS-232 Converter

Reference AAP0058 corresponds to the supply of an RS-232 to RS-485 converter for connection to a PC serial port.

Settings

Set the converter switches as follows:
- Left to “T-RTS, R-/RTS” (central position)
- Right to DCE (top position)

Connections

1. Connect the converter to the PC.
2. Configure it for half duplex communication by connecting converter pins 1(T+) and 4(R+) to communications board pin 1 and terminals 2(T-) and 3(R-) to pin 2.
3. Power-up the converter.

AAX7030 - Kit RS-485-USB for Ingecon® Sun

Reference AAX7030 corresponds to the supply of a USB to RS-485 converter and the appropriate connectors, for either three phase inverters or the Ingecon® Sun Lite units.

For the three phase inverters, the pin settings are as described in the table above.

For the Ingecon® Sun Lite, discard the cable with a push-pull connector to PCB on one end and a Harting connector on the other. The pin settings are as described in the table on the next page.

The driver required for the kit is available at: www.ftdichip.com/Drivers/VCP.htm.

Installing the driver

2. Connect the converter to the computer USB port. The installation will start automatically, although you will have to select the location where you saved the driver.
3. The installation will prompt for the drivers again, and the same source should be indicated.
4. Once completed, open the device manager (Administrador de dispositivos) from either the control panel or from the Start Menu -> Execute (Menú de Inicio -> Ejecutar)... and type in devmgmt.msc.
5. On port element Puertos (COM & LPT) you will see the new COMx port that the system has associated with the converter, called USB Serial Port or FTDI USB Serial Port (depending on the driver version). Its port number will be used in the configuration of the Ingecon® Sun Manager.

**Ingecon® Sun ComBox**

The Ingecon® Sun ComBox can be used as shown in the following figure:

- A. Ingecon® Sun ComBox.
- B. Ingecon® Sun units connected to the bus
- C. Local PC
- D. USB or RS-485, or Ethernet Cable
- E. RS-485 cabling

Refer to section “5. Ingecon® Sun ComBox” for further information on the Ingecon® Sun ComBox Centralised communication hardware.
3.2. Local Ethernet communication

All the Ingecon® Sun Ethernet communication accessories incorporate Ethernet to serial port conversion hardware and have a similar operation, set by default.

They have a fixed IP address assigned and are programmed as TCP servers to accept a connection from the Ingecon® Sun Manager client software. The default port number through which connections are received is 7218. Only one client at a time is accepted.

For local communication, the following is required:

- The serial Ethernet converter in equipment A and local computers D must be in the same sub-network.
- The number of the TCP port in which the converter accepts connections.
- There are not two or more devices with the same IP address.

A. Ingecon® Sun with AAX7004 (Ethernet and RS-485 communications card), or Ingecon® Sun Lite with AAX0023 (Ethernet and RS-485 communications card), or Ingecon® Sun Smart 15 UL with kit AAS0173, or Ingecon® Sun Smart 25 UL with kit AAS0173, or Ingecon® Sun Power 100 UL with kit AAS0174.

B. Ingecon® Sun units connected to the same bus as A.

C. Ingecon® Sun units with AAP0067 (Ethernet communications card).

D. Local PCs.

E. RS-485 cabling.

F. Ethernet cabling.

G. Network switch.
3.2.1. Ingecon® Sun Ethernet accessories

**AAX7023**

Reference AAX0023 corresponds to the supply of board AAX7004, communications cable RS-485 AQL0089, flat cable AQL0090, and the PG cable gland required to guarantee the leak tightness of the equipment at the Ethernet cable inlet connection.

**AAX7004**

Communications board AAX7004 / AAX0023 RS-485 interface permits Ethernet communication with a number of Ingecon® Sun units connected in a bus configuration. It is factory set with IP address IP 192.168.127.253. This accessory does not incorporate the alarm or report sending functions.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RS-485 B (+)</td>
</tr>
<tr>
<td>2</td>
<td>RS-485 A (-)</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
</tr>
</tbody>
</table>

**Settings**

Should you wish to change this address, once connected to the equipment sub-network (by default 192.168.127.0/24), you need to open the Internet browser and type in http://192.168.127.253. A Log-in prompt will appear in which neither the user name or password need to be entered. This takes you to the following page:

The IP address can be changed in the “Network” section. Once a change has been made, remember to click on “Apply Settings”. Remember that all the equipment must be in the same sub-network.
Restoring the IP

The AAX004 board incorporates the Ethernet series TTL XPORT-03 manufactured by Lantronix. If you do not know the IP address configured in the converter, you can use the “Device Installer” software provided by Lantronix to make a MAC level search.

The ‘deviceinstaller’ search on the Lantronix web returns links to the software download page. Install and proceed as shown in the following photos.

Clicking on ‘Search’ shows the items of equipment and their IP addresses.

AAP0067

Board AAP0067 offers Ethernet to serial conversion for a single Ingecon® Sun unit. It is factory set with IP address 192.168.127.254.

Settings

Should you wish to change this address, once connected to the equipment sub-network, you need to open your Internet browser and enter http://192.168.127.254. This takes you to the following page:
To change the IP address, access the Network Settings folder and click on the “Submit” button to apply the changes.

**IP restoration**

Board AAP0067 incorporates the Ethernet - serial converter TTL NE-4100T manufactured by MOXA. If you do not know the IP address configured for the converter, you can use the "NPort Search Utility" software supplied by Moxa to make a MAC level search.

The ‘NPort Search Utility 4100’ on the Moxa website returns the link to the installation file. Install and proceed as shown in the following images:

Click on ‘Search’: 
A dialogue will be displayed and there will be an approximate 10 second search for devices:

And will finally present the results.

AAS0173
The 25-15 kW UL units can optionally be supplied with kit AAS0173 for Ethernet communication. It incorporates an Ethernet - RS-485 converter to be used like the AAX7004, providing Ethernet connectivity to all the units connected in a bus configuration.

AAS0174
The 100 kW UL can optionally be supplied with kit AAS0174 for Ethernet communication. It incorporates an Ethernet - RS-485 converter to be used like the AAX7004, providing Ethernet connectivity to all the units connected in a bus configuration.

3.2.2. Ethernet communication with the Ingecon® Sun units

Ingecon® Sun Lite
In order to install an Ethernet communication card in the Ingecon® Sun Lite units, you first need to disable the RS-485 communication, installed as standard. To do so, proceed as described in “How to disable the factory set RS-485 communication”. You can then install the accessory.
How to disable the factory set RS-485 communication

The following photo, taken with the inverter control card removed, shows the location of lead AQL0053 which must be replaced in order to disable the RS-485 communication through connector J19 on the power board.

This must be replaced by cable AQL0090 supplied with the Ingecon® Sun Lite communication accessories.

Installation

Remove the blank shown in the photo from the Ingecon® Sun Lite housing and fit a 20 diameter PG cable gland through which the Ethernet cabling will pass.
**Ingecon® Sun Smart, Power and Power Max**

Communications board AAP0067/AAX7004 must be mounted on the control board specific communications connector.

Read section “8. List of accessories” and always refer to the installation manual for the Ingecon® Sun inverter in which a communications accessory is to be installed.

The cabling shall be made directly to the flying lead connector on board AAX7002. There is no defined position on the equipment housing for bring out the cabling, however there are a number of ports available to do so.

**Ingecon® Sun Power UL and Power Max UL**

For these units, Ethernet communication is available, to order, through an off-the-shelf Ethernet to serial converter which is factory set with the IP address IP 192.168.127.254 and, like the rest of the Ethernet communication accessories, it receives TCP connections at port 7128.

**Ingecon® Sun String Control**

Communications board AAP0067 or AAX7004 must be mounted on the specific communications connector on the String Control electronics board, and the cabling shall be made to the board push-pull connector. The RS-485 cabling shall be taken out through the PG cable gland designed for this purpose.

**Models prior to 2009**

Use the earlier version of this document, AAX2002IKI01...
3.2.3. Local PC connection

Configure the local PC so that it is in the same sub-network as the equipment. Open the Ingecon® Sun Manager software on the PC and, on the right hand communication settings panel, select Ethernet as the means of communication and enter the IP address for the communication accessory and the port number.

Then connect by clicking on button “Conectar”.
**Ingecon® Sun ComBox**

The ComBox Ethernet interface offers an Ethernet to serial gateway similar to the one offered by the AAX7004. Its IP address by default is 192.168.127.253 and, like the other Ethernet communication accessories, it accepts TCP connections at port 7128.

Please refer to section “5. Ingecon® Sun ComBox” for further information on the Ingecon® Sun ComBox Centralised communication hardware.
3.3. Wireless communication

For a typical wireless communication schema, a PC F monitors a group of inverters B, C and D that share a wireless network with the Ingecon® Sun ComBox accessory A.

A. Ingecon® Sun ComBox.
B. Ingecon® Sun units with radio AAX7019.
C. Ingecon® Sun units with radio AAX7009.
D. Ingecon® Sun units connected to RS-485 bus of C.
E. RS-485 cabling.
F. PC local.
G. Cabling from PC to ComBox: USB or Ethernet.

3.3.1. General comments

Communication by radio means that there is no need to install communications cabling, thereby avoiding the risk of voltage surges caused by the said cabling.

Radios AAX7019 and AAX7009, together with the master radio installed in the Ingecon® Sun ComBox communications equipment, form a totally transparent wireless serial bus for the Ingecon® Sun Manager software. The bus characteristics are:

<table>
<thead>
<tr>
<th>Features</th>
<th>Communication on band ISM 868</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiated power</td>
<td>500 mW (27 dBm)</td>
</tr>
</tbody>
</table>
### Features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radio interface</td>
<td>19200 bps</td>
</tr>
<tr>
<td>Serial interface</td>
<td>9600 bps</td>
</tr>
</tbody>
</table>

Communication between the ComBox and the inverter radios is established in point - multipoint mode. The ComBox transmits by broadcast the requests received from a PC and, in the same way as for a cabled system, only the inverter whose node number coincides with the request contents will respond to the request.

Radio communication between the ComBox and the various Ingecon® Sun accessories is organized into what have been termed “Logical Zones”, such that if the radio in a ComBox cannot cover the entire plant area, then a second Logical Zone is configured.

In ideal conditions of direct visibility and high antennas, the radiated power of 500 mW permits a range of various kilometers. However in practice this distance is drastically reduced by the environmental conditions.

By default, all accessories operate in Logical Zone number 1 and ignore any communication outside their Logical Zone.

All logical zones share the same radio-electric channel and therefore, simultaneous communication in various zones is not possible.

For example:

In the following communications schema, two ComBox A and B, connected to the same local network, each control a Logical Zone.

As the radios ignore any communications outside their Zone, it is possible to repeat a node number which is already being used in another zone.

Monitoring is through Ethernet from a local PC and the ComBox network address cannot be the same.
3.3.2. Wireless communication accessories for Ingecon® Sun

AAX7009
For wireless communication on the ISM 868 MHz waveband with Ingecon® Sun Smart, Ingecon® Sun Power, Ingecon® Sun Power Max units and three phase inverter models prior to 2009. Including the additional RS-485 interface

AAX7019
For wireless communication on the ISM 868 MHz waveband with Ingecon® Sun Lite.

AAX0011
Indicate this kit in your order in order to configure a radio AAX7019 or AAX7009 in a Logical Zone other than 1.

AAX0012
Indicate this kit in your order in order to configure a ComBox in a Logical Zone other than 1.

3.3.3. Wireless communication ISM 868 in the Ingecon® Sun units

Ingecon® Sun Lite
In order to install a wireless communication card in the Ingecon® Sun Lite unit, it is first necessary to disable the RS-485 communication installed as standard. The procedure to do so is described in “How to disable the factory set RS-485 communication”. Once this has been disabled, the accessory can be installed.

Ingecon® Sun Smart, Power and Power Max, and Ingecon® Sun String Control
The wireless communication board must be mounted on the specific communications connector on the control board and the RS-485 cabling should be made to the board push-pull connector. There is no defined position on the equipment casing to serve as an inlet port for the antenna and the RS-485 cabling, if present, but there are a number of auxiliary ports available.

3.3.4. Local PC connection – Ingecon® Sun ComBox
As shown in the figure above, the local PC can be connected by USB or by Ethernet.

Please refer to section “5. Ingecon® Sun ComBox” for further information on the Ingecon® Sun ComBox Centralised communication hardware.
4. Remote communication system

This section describes the Ingecon® Sun accessories and the equipment settings required, the remote PCs and the possible network equipment that could be present in a remote communication system, which is understood to be the communication with one or several Ingecon® Sun units from a remote PC.

You are advised to ensure that the local communication is functioning correctly before undertaking the installation of the remote communication system.

Ingeteam supplies accessories for remote communication via a GPRS network and via Ethernet.

4.1. Communication via GPRS

In the typical schema for GPRS communication, an Ingecon® Sun unit A is equipped with a GPRS modem and this is accessed from a remote computer which can either be a computer G in an ADSL network or a computer I with a 3G/GPRS card.

The other items are:

B. Ingecon® Sun units connected to the RS-485 bus of Ingecon® Sun unit A.
C. Media converter (RS-232, USB, ...).
D. Local PC
E. RS-485 cabling.
F. Cable from the PC up to converter C.
G. Remote computer in a network.
H. Remote local network firewall.
I. Remote computer with a GPRS/3G connection.
E1 is the RS-485 cabling section from the media converter to the Ingecon® Sun unit equipped with a modem. You are advised to keep the length to a minimum.

In a bus topology, you are recommended to centrally locate the master in order to ensure optimum signal strength to as many slaves as possible.

In a GPRS communication, the bus master is the modem in unit A, in charge of transmitting the requests from and to the remote PC.

However, when there is no active GPRS communication, the bus master can be the local PC. Depending on the local PC location and the length of the bus, on occasion it may be recommendable to locate the modem at one end of the bus.

4.1.1. General comments

The GPRS communication is made through the mobile phone operator communication networks. Access to these networks is a service which must be subscribed to by the customer. Likewise, the customer should ensure that the installation has network coverage.

The M2M (Machine 2 Machine) rates are adequate for devices such as the modems in the Ingecon® Sun units, which are permanently connected to the network but which have a very low data traffic.

Apart from these rates, each operator uses its own criteria to bill the GPRS communication, which can be based on data volume, connection time or even both.

For this reason, and to avoid unpleasant surprises, it is advisable to monitor consumption during the first few days after installing a communication system of this type.

Alternatively, it is possible to disable the GPRS communication in a modem and it will then perform like a GSM modem. However, a missed phone call is sufficient for the modem to connect to GPRS and wait for a connection during the following hour. Once this hour has passed, it will return to the GSM mode.

The Ingecon® Sun modems are supplied as standard with parameters APN (APNSERV, APNUN y APNPW) and which are necessary for M2M communications with the leading cell phone operators in Spain, France and Italy.

It is also possible to establish customized APN parameter, which makes it possible to work with new operators or VPN network services.

4.1.2. Ingecon® Sun GPRS accessories

AAX0007

Reference AAX0007 corresponds to the supply of modem AAX7001 together with the internal cable and fast-on connector required for the RS-485 serial line communication in single phase equipment prior to 2009.

AAX7022

Reference AAX0022 corresponds to the supply of modem AAX7001 together with flat cable AQL0089 and RS-485 cable AQL0089. This reference is adequate for the GPRS communication in the Ingecon® Sun Lite units.

AAX0018

The various references incorporating the GPRS modem are configured to function in Europe. Request this kit to enable the modem to function in the United States.

AAX7001

Reference AAX7001 corresponds to the modem for three phase units, a basic component for the rest of the GPRS accessories. It comprises a motherboard and superimposed GPRS modem card, the corresponding antenna with its...
cable and three status indicator LEDs. The antenna is equipped with a magnetic base to secure it in place. The SIM card, which is not included, must be released from its PIN access code.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RS-485 B (+)</td>
</tr>
<tr>
<td>2</td>
<td>RS-485 A (-)</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
</tr>
</tbody>
</table>

It is mandatory for the inverter fitted with modem AAX7001 to be identified as number 1.

The arrangement of the jumpers on the boards in the other inverters is identical to the arrangement given for the RS-485 line communication, for the intermediate and the end inverters.

**Status LEDs**

- **Green LED**
- **Yellow LED**
- **Red LED**

**LED flashing**

<table>
<thead>
<tr>
<th>Description</th>
<th>LED flashing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Searching for a network</td>
<td></td>
</tr>
<tr>
<td>Busy receiving a call</td>
<td></td>
</tr>
<tr>
<td>Connected to the GSM network, awaiting calls</td>
<td></td>
</tr>
<tr>
<td>Awaiting log onto network</td>
<td></td>
</tr>
<tr>
<td>Awaiting SIM card</td>
<td></td>
</tr>
<tr>
<td>Logged on to the GSM network, not yet initialized</td>
<td></td>
</tr>
<tr>
<td>Initialized, not yet logged on to the GSM network</td>
<td></td>
</tr>
<tr>
<td>Checking modem configuration</td>
<td></td>
</tr>
</tbody>
</table>
4.1.3. Local communication through the modem

In a group of interconnected inverters, the communication of a local PC with the whole group must be made through the J3 connector of the modem used.

Note: For simultaneous communications, telephone communications have priority over communication with the PC, as the modem is fitted with a relay which opens the connection at the J3 connector.

4.1.4. GPRS communication in the Ingecon® Sun units

Ingecon® Sun Lite Units

In order to install a GPRS modem in the Ingecon® Sun Lite equipment, the RS-485 communication, installed as standard, first needs to be disabled. To do so, the procedure is detailed in section “How to disable the factory set RS-485 communication”.

Then locate cable AQL0055.
The location of cable AQL0055 is shown in the following photo. In the installation, the cable connection with the Harting on the equipment casing shall be maintained, however it should be disconnected from the power board printed circuit.

Finally, the accessory should be installed.

1. Disconnect the AQL0055 cable RS-485 connector from the power board.
2. Connect the modem.
3. Connect cable AQL0089 to the free end of AQL0055.
4. Connect AQL0089 to the modem. As described in the section corresponding to modem AAX7001, selecting the appropriate one to either connect a local PC or a bus of inverters.
**Ingecon® Sun Smart, Power and Power Max**

The modem must be mounted on the specific communications connector on the control board, and the cabling should be made to the board push-pull connector. There is no defined position on the equipment casing for bringing in the antenna and the RS-485 cabling, if present, however there are a number of auxiliary ports available.

**Pre-2009 versions of the equipment**

The AAX0007 should be mounted. The communications modem must be mounted on the specific communications connector on the control board, and the cabling should be made to the board push-pull connector. There is no defined position on the equipment casing for bringing in the antenna and the RS-485 cabling, if present, however there are a number of auxiliary ports available. The appropriate PG diameter should be used for the cabling port in order to maintain the equipment leak tightness.

**Ingecon® Sun ComBox**

Optionally, the ComBox can include a GPRS modem.

Please refer to section “5.4.1. GPRS” for further information.
4.2. Remote communication via Ethernet

The following figure shows a typical remote communication set-up in order to communicate with equipment units A, B and C from computer J.

A. Inverter with card AAX7004 or AAX0023 or Ingecon® Sun Power UL unit.
B. Ingecon® Sun units on the same RS-485 bus as unit A.
C. Ingecon® Sun units with board AAP0067.
D. Local PCs
E. RS-485 cabling.
F. Ethernet cabling.
G. Local switch.
H. Local firewall.
I. Remote firewall.
J. Remote computer.
4.2.1. Remote communication via Ethernet to the Ingecon® Sun units

Taking for granted that the local communication via Ethernet from computer D is correct, as far as the Ingecon® Sun equipment is concerned, the only thing to be configured is the Default Gateway of the converter installed in unit A.

If there are several devices, it will be necessary to change the TCP port number in which the connections are received, so that the same number is not repeated. For example, for three devices, the first would be configured on port 7128, the second on 7129 and the third on 7130.

4.2.2. Connection of the remote PC

For the remote PC, you need to know the public address of router/firewall H in order to enter it in the plant communications configuration in the Ingecon® Sun Manager software.

Router/firewall H must also be correctly configured:

- Configure the NAT or port redirecting of router H to accept incoming connection at the TCP port specified on the converter.
- Redirect the incoming connections through the said port to the private IP of the converter at A.
- If there are several converters, repeat the NAT configuration process with its TCP port and corresponding address.

And at router I, you need to permit outgoing connections at the corresponding port.

4.3. GSM Communication

4.3.1. Ingecon® Sun GSM accessories

The hardware to be used is as described in section Modem AAX7001 with the GPRS option disabled.

4.3.2. GSM communication with the Ingecon® Sun units

As this is the same hardware, section “4.1.4. GPRS communication in the Ingecon® Sun units” is applicable.
4.3.3. Connection of the remote PC and GSM accessories for PC

Modem AAP0059

- The modems are pre-set and, to operate them, they simply need to be connected to the computer serial port.
- In Opciones -> Configuración comunicaciones (options - communication setting) select the port number to which the modem is connected.

Enter the phone number and click on connect ‘Conectar’.

Wait until status “Estado” shows connected ‘Conectado’.

5. Ingecon® Sun ComBox

5.1. Introduction

The Ingecon® Sun ComBox Centralised communication hardware, with reference AAX7006, is a multi-purpose accessory offering the following possibilities:

- Local connection of a PC to one or several inverters.
- Centralised local wireless communication in one installation.
- Centralised GPRS communication in one installation.
- To capture meteorological variables (probes not included).
- To capture the power setpoint imposed by the electricity company and transmit it to the inverters.
- To record the historical data for the meteorological variables and power setpoint.
5.2. Connections and indicators

1. Ethernet Connector
2. USB connector (B type)
3. RS-485 input connector
4. RS-485 output connector
5. 230 VAC power supply
6. Sensor inputs
7. Power setpoint input
8. Antenna input
9. Power supply LED
10. Data transmission / reception LEDs
11. Modem connection and coverage LEDs
12. Modem power supply LED
13. Radiofrequency transmission / reception LEDs
14. Radiofrequency power supply LED
5.3. Local communications

A general example of a local communication schema is as follows:

A. Ingecon® Sun ComBox
B. Ingecon® Sun inverters connected to the bus
C. Ingecon® Sun inverters connected to the bus with an end-of-line resistor
D. Local monitoring system (PC, PLC, ...)
E. RS-485 wiring
F. USB, RS-485 or Ethernet Cable
G. Ingecon® Sun inverter with radio and end-of-line resistor
H. Ingecon® Sun inverter with radio

5.3.1. Connection to a local master

Ingecon® Sun ComBox connectors 1, 2 and 3 are directly connected to the RS-485 output (connector 4) except when the ComBox needs to send the power setpoint.

RS-485

The following figures shows the connector for the RS-485 output to the Ingecon units.

USB
Use a type A to type B USB cable (not supplied by Ingeteam).

Ethernet
An Ethernet network cable should be used (not supplied by Ingeteam). For further information on the remote use of Ethernet, please refer to section “3.2. Local Ethernet communication”.

Ingeteam Energy, S.A.
5.3.2. Connection with the Ingecon® Sun units

RS-485

The following figures shows the connector for the RS-485 output to the Ingecon units.

Wireless connection

Instead of the RS-485, the Ingecon® Sun ComBox can communicate with the inverters through radiofrequency accessories on waveband ISM 868 MHz.

The connection of the radiofrequency accessory to the Ingecon® Sun ComBox device is detailed in section “5.6. AAX7013 - Radio Kit for the Ingecon® Sun ComBox”.

5.4. Remote communication

5.4.1. GPRS

Optionally, the ComBox can include a GPRS modem. A typical schema for this is indicated below:

A. Ingecon® Sun ComBox with GPRS modem and radio
B. Ingecon® Sun units connected to the RS-485 bus
C. Ingecon® Sun units connected to the RS-485 bus and end-of-line resistor
D. Ingecon® Sun unit with radio and end-of-line resistor
E. RS-485 Bus
F. Ingecon® Sun unit with radio
The connection of the GPRS modem accessory to the Ingecon® Sun ComBox is detailed in section “5.5. AAX7014 - GPRS Modem Kit for the Ingecon® Sun ComBox”.

For further information as to the operation of modem AAX7001 go to section “AAX7001”.

5.4.2. Ethernet

A. Ingecon® Sun ComBox with radio
B. Ingecon® Sun units connected to the RS-485 bus
C. Ingecon® Sun unit with an Ethernet card
D. Local PCs
E. RS-485 cabling.
F. Ethernet cabling.
G. Local switch.
H. Local firewall.
I. Ingecon® Sun units connected to the RS-485 bus and end-of-line resistor
J. Ingecon® Sun unit with radio and end-of-line resistor
K. Ingecon® Sun unit with radio
For further information on the remote use of Ethernet, please refer to section “4.2. Remote communication via Ethernet”.

### 5.5. AAX7014 - GPRS Modem Kit for the Ingecon® Sun ComBox

Optionally, the ComBox can be equipped with a GPRS modem. Refer to section “4.1. Communication via GPRS” for further details on the functioning of the GPRS modem.

#### 5.5.1. Connection of the GPRS modem

The ComBox motherboard has a slot specifically designed for inserting a GPRS modem. The bridge normally wired to connector J11 on the motherboard, must be disconnected at one end and reconnected as indicated in the following figure, together with additional cable AQL0103 included in kit AAX7014.

Finally, insert the antenna through port 8 and connect it to the modem.

### 5.6. AAX7013 - Radio Kit for the Ingecon® Sun ComBox
Optionally, the ComBox can be equipped with a radio on waveband ISM 868 for local communication with the Ingecon® Sun units.

### 5.6.1. Radio connection

The ComBox motherboard, with a slot specifically designed for inserting the radio. The AQL0103 cable included in radio kit AAX7013 must be connected as shown in the following figure:

<table>
<thead>
<tr>
<th>Motherboard</th>
<th>Radio</th>
<th>AQL0103 Cables</th>
</tr>
</thead>
<tbody>
<tr>
<td>J10.4</td>
<td>J4.4</td>
<td>Brown</td>
</tr>
<tr>
<td>J10.2</td>
<td>J4.2</td>
<td>Blue</td>
</tr>
<tr>
<td>J10.1</td>
<td>J4.1</td>
<td>Green</td>
</tr>
</tbody>
</table>

Finally, connect radio antenna through input 8.

### 5.7. Monitoring of the Ingecon® Sun ComBox

The ComBox status and datalogger can be monitored from an external system. Ingeteam can supply the Ingecon® Sun Manager monitoring software to perform this function.

Document AAX2005 explains how the Ingecon® Sun Manager software operates. The non-modifiable Modbus node number for the ComBox is 247.

The ComBox must share the RS-485 bus with the Ingecon installation number, as the ComBox is not equipped with an internal clock and gets its date and time by querying the mentioned Ingecon.
5.8. Analog inputs
The Ingecon® Sun ComBox has six analog inputs designed to connect sensors for a number of variables.

- 2 inputs 0...10 V or 0...20 mA (EA1 and EA2)
- 1 input 0...2 V or 0...20 mA (EA3)
- 1 input 0...400 mV or 0...20 mA (EA4)
- 2 inputs for a 3-wire PT100. (PT100_1 and PT100_2)

Use jumpers JP1, JP2, JP5 and JP6 to configure the voltage or current of inputs EA1, EA2, EA3 and EA4 respectively. Close the contact to use the current input. Open the contact to use the voltage input or when the input is not to be used.

Before connecting the sensors, ensure that these are off, so as not to damage the ComBox.
5.8.1. Monitoring of the analog inputs

To monitor the analog inputs with the Ingecon® Sun Manager, you first need to connect to the plant where the ComBox is installed and have node 247 created.

In this status, right click on node 247 and then click on the configuration of additional data “configuración datos extra”.

This opens another screen which then allows you to select the analog input to be monitored.
To configure one of the PT100 inputs, you should enter the following.

On the label (Etiqueta) enter the name of the variable being measured and the unit for the variable on “Unidades”. The range (Rango) can be modified if the PT100 used is different from the default one. Finally click on save “Guardar”.

For the remaining inputs, you should select the input and configure it according to the sensor that is connected, then click on save “Guardar” at the end of the process.
Once the analog inputs have been configured, these can then be viewed on the Online data screen.
5.9. Power setpoint

There are 4 digital inputs enabled on the motherboard to control the power delivered by the inverters to the grid. The configuration of these inputs is monitored every 30 seconds and, if there are any changes, the ComBox broadcasts a power change frame to the inverters. This power control function can be disabled and the inputs can then be used for another application. These inputs are accessible through connector (J12).

These inputs are prepared for a voltage of +15 V/0 V. Their value can be observed on the Ingecon® Sun Manager online data screen.

The digital input cables must be routed through Ingecon® Sun ComBox input number 7.

The Ingecon® Sun Manager online data screen displays, by default, the status of these inputs and the corresponding setpoint value as shown in the table below.

<table>
<thead>
<tr>
<th>Input</th>
<th>Setpoint</th>
</tr>
</thead>
<tbody>
<tr>
<td>All at “0”</td>
<td>100%</td>
</tr>
<tr>
<td>Two or more at “1”</td>
<td>100%</td>
</tr>
<tr>
<td>D1</td>
<td>0%</td>
</tr>
<tr>
<td>D2</td>
<td>30%</td>
</tr>
<tr>
<td>D3</td>
<td>60%</td>
</tr>
<tr>
<td>D4</td>
<td>100%</td>
</tr>
</tbody>
</table>
5.9.1. Configuration of the power setpoint function

The power setpoint function can be enabled or disabled from the Ingecon® Sun Manager. When disabled, the ComBox will not send the setpoint to the inverters connected.

By right clicking on node 247 and then on the Ingecon® Sun configuration button “configuración del Ingecon® Sun”, you can access a screen which will then allow you to click on read button “leer” to check whether the power control function is enabled or not.

![Configuration Screen](image)

The image above shows the function to be disabled, but this can be changed to “Germany” and then click on send “Enviar” to enable the function.

5.10. Historical data

The ComBox device records historical data at given time intervals and stores the data in its memory, provided that its time has been set. The data collection intervals are configurable and each time this interval is changed, then the historical data saved during the previous period are deleted.

5.10.1. Setting the ComBox time

To synchronize the Ingecon® Sun ComBox and all the Ingecon devices connected to the ComBox, with the computer, you need to right-click on the plant and click on “Sincronización de los equipos Ingecon® Sun” (Synchronisation of the Ingecon® Sun devices). A confirmation message will be displayed.

![Synchronisation Screen](image)

The ComBox must share the RS-485 bus with the Ingecon installation number, as the ComBox is not equipped with an internal clock and gets its date and time by querying the mentioned Ingecon.
5.10.2. Configuring the monitoring time

To configure the time during which the Ingecon® Sun ComBox is to record the Historical Data, right click on node 247 and then on the Ingecon® Sun configuration button “configuración del Ingecon® Sun”. A screen will appear to allow you to click on read button “leer” to view the monitoring period configured.

This time can be changed, according to the different options available, then click on send “Enviar” for the Ingecon® Sun ComBox to start to record the historical data for that period.

When this monitoring time is changed, all the historical data recorded for the previous period are deleted.

5.10.3. Historical data memory

Depending on the monitoring time configured, more or less historical data can be saved. The ComBox has 93 Kbyte reserved for the historical data, for example with a 15 minute period there is sufficient memory for 31 days.

The following graph shows the various options available.
5.10.4. Downloading the historical data

To download the historical data from the Ingecon® Sun Manager you need to access the read screen “Lectura”. Once connected, select the day and click on download “descargar”.

The historical data are then downloaded to your computer.

To view the data downloaded, access the lists screen “Listados”, select the day for which the data have been downloaded (days in black) and then click on “Ok”. The data will then be displayed on the screen.
6. Troubleshooting

Check that you are using the latest version of the Ingecon® Sun Manager software. This is available at ftp://ftp.ingeraspv.ingeras.es

Check that the Ingecon inverter number matches the one indicated on the Ingecon® Sun Manager.

6.1. The local communication isn’t functioning

Check the configuration and connections of the converter to the RS-485, check that each device has a different identifier and inspect the RS-485 wiring at each of the inverters on the bus, and also the end of line resistors.

6.1.1. Via the RS-232 to RS-485 converter

Check that the COM port indicated on the Ingecon® Sun Manager is the right one. Check that the converter is powered, if it requires a power supply to operate.

6.1.2. Via the USB to RS-485 converter

Check that the COM port indicated on the Ingecon® Sun Manager is the right one and that its drivers are installed correctly. Check that the converter is powered, if it requires a power supply to operate.

6.2. The remote communication system isn’t functioning

6.2.1. Via GPRS

The software indicates: “El fichero con la dirección IP no existe en el servidor” (the file with the IP address does not exist on the server).

This indicates that the modem has either been switched off or that it has not connected to the GPRS. It could be that the GPRS connection option has been disabled or there is no GPRS coverage.

The remote communication is established, but the Ingecon does not respond.

Check whether the modem is returning its SMS configuration:

- The modem doesn’t respond: wait a few minutes and then try again.
- The modem responds: check the RS-485 wiring. Check the inverter number. If the inverter number is correct and there’s no RS-485 bus, then send the modem for repair.

6.2.2. Via Ethernet

Check that the local communication is correct.

Correctly configure the port redirection, check that the port used (7128 by default) is not blocked by the firewall.
6.3. No alarm SMS received

Check that the SIM card has a credit balance or that you are up-to-date with your invoice payments.
Check that the validity period parameter "Intervalo de vigilancia" is not set to zero.

Additionally, set it so that 3 - 4 minutes are dedicated to each inverter (for example, a value of 30 minutes is adequate for a system with 9 inverters).

6.4. Full-screen synoptic overview

1. The calculation of the CO$_2$ not emitted per year assumes that the production of 1 kWh of energy using non-renewable fuels generates 0.589 kg of CO$_2$.
2. The calculation of the number of trees needed to absorb by photosynthesis the CO$_2$ not emitted during the useful life of the Ingecon® Sun equipment at the plant assumes that one tree absorbs 5 kg of CO$_2$ per year.
3. What is the size required for the image? Any image is valid, however it will be resized if its size isn't suitable for the screen resolution.

6.5. ComBox

6.5.1. The ComBox experiences communication errors

Check that the Ingecon number 1 unit is accessible, so that the ComBox can get its time and date. If it does not get this information, then the ComBox will continue to query the Ingecon with a possible data collision occurring if another device accesses the communication bus.

6.6. Telephone technical support service

Before contacting the Telephone Technical Support Service, have the following data available and check to ensure that you are using the latest version of the Ingecon® Sun Manager software:

- Company and person to contact.
- Name of the plant or system.
- Description of the problem and actions taken.
- Connection details: IP address, GPRS serial number, phone number …
- Serial number and, if possible, firmware version of the equipment involved.
7. Frequently Asked Questions

Is it possible to remotely reconfigure the firmware of a more advanced version in order to optimize the inverter operation?

Firmware reconfiguration must be performed by Ingeteam Energy personnel. In any case, a more advanced version of the firmware installed in an item of equipment does not necessarily mean an improvement in operation. Each firmware version is optimized for a specific topology.

Does the string box communication require a special configuration? Does the inverter have to function as a gateway when string boxes are connected to the RS-485 network?

No. The string boxes are connected to the RS-485 network in the same way as the inverters, and function as yet another node. The inverter, therefore, does not function as a gateway for communications with the string boxes.

Is there a restriction on the number of nodes to be included in a RS-485 network?

Yes. Due to the Modbus protocol design, the greatest number of nodes is 247, although in practice the environment conditions will make it difficult to establish correct communications with this number of machines and installations are frequently planned with various independent buses.

Is it possible to view the inverter data via the remote connection when the inverter is switched off?

Yes, provided that the inverter is powered through an uninterrupted power system (UPS). Obviously in these circumstances any instantaneous variables such as production, power or output current will be shown with value of zero.

Can a GSM modem be configured as a GPRS modem?

Modems manufactured later than January 2007 have this GSM or GPRS configuration option. This configuration is made through the Ingecon® Sun MANAGER application. The units manufactured prior to this date are only for GSM communication and cannot be configured for GPRS.

What is Modbus/TCP?

This is a variant of the MODBUS protocol family for network environment communication.

Do the inverters use Modbus/TCP to communicate?

No, the inverters only respond to the Modbus/RTU protocol. If you want to monitor an Ingecon® Sun unit from a device that is only equipped with Modbus/TCP, you need to install a protocol converter in between.

What should be done if there is no connection with the equipment via GSM/GPRS?

You first need to check whether the installation has coverage. The coverage status can be determined through the status of the corresponding LED (see page 27 of the manual).

With the red LED continually on, the modem has no coverage (it is looking for a network).

In order to view the LEDs, the equipment needs to be opened. This should be done following the general safety conditions included in this manual.

Should you have any doubts with regard to whether the SIM card is operating correctly, disconnect the equipment, wait 10 minutes and then remove the SIM card and test it in another unit in which you are sure that communications are correct.

Should you detect a SIM card malfunction, contact the Phone Company supplying the card, which should confirm whether the card needs reconfiguring or is damaged.

Never remove the SIM card with the equipment connected to the power supply. In addition to the obvious risk to persons, you are very likely to damage the SIM card.

If the SIM card is shown to function OK, then repeat the operation with the modem to check that this is not damaged.

8. List of accessories

The accessories for the Ingecon® Sun, accessories for the PC and modification kits are as follows:

<table>
<thead>
<tr>
<th>Accessories</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAX7002</td>
<td>For RS-485 communication with the Ingecon® Sun Smart, Ingecon® Sun Power, Ingecon® Sun Power Max units and three phase inverter models prior to 2009.</td>
</tr>
<tr>
<td>AAX0034</td>
<td>For RS-485 communication with single phase models prior to 2009.</td>
</tr>
</tbody>
</table>
## Accessories

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAP0057</td>
<td>USB to RS-485 Converter.</td>
</tr>
<tr>
<td>AAP0058</td>
<td>RS-232 to RS-485 Converter.</td>
</tr>
<tr>
<td>AAP0059</td>
<td>GSM external modem.</td>
</tr>
<tr>
<td>AAS0173</td>
<td>For Ethernet communication with the Ingecon® Sun Smart 15 UL and Ingecon® Sun smart 25 UL units.</td>
</tr>
<tr>
<td>AAS0174</td>
<td>For Ethernet communication with the Ingecon® Sun Power 100 UL Units</td>
</tr>
<tr>
<td>AAX7022</td>
<td>For GPRS communication with the Ingecon® Sun Lite units.</td>
</tr>
<tr>
<td>AAX7001</td>
<td>For GPRS communication with Ingecon® Sun Smart, Ingecon® Sun Power, Ingecon® Sun Power Max and three phase inverter models prior to 2009.</td>
</tr>
<tr>
<td>AAX7023</td>
<td>For Ethernet communication with the Ingecon® Sun Lite units.</td>
</tr>
<tr>
<td>AAX7004</td>
<td>For Ethernet communication with Ingecon® Sun Smart, Ingecon® Sun Power, Ingecon® Sun Power Max and three phase inverter models prior to 2009. Including the additional RS-485 interface.</td>
</tr>
<tr>
<td>AAX7006</td>
<td>Ingecon® Sun ComBox communications centre hardware.</td>
</tr>
<tr>
<td>AAX7019</td>
<td>For wireless communication on the ISM 868 MHz waveband with Ingecon® Sun Lite.</td>
</tr>
<tr>
<td>AAX7009</td>
<td>For wireless communication on the ISM 868 MHz waveband with Ingecon® Sun Smart, Ingecon® Sun Power, Ingecon® Sun Power Max units and three phase inverter models prior to 2009. Including the additional RS-485 interface.</td>
</tr>
<tr>
<td>AAX0007</td>
<td>For GSM communication with single phase inverter models prior to 2009.</td>
</tr>
<tr>
<td>AAX0011</td>
<td>Logical Zone Modification Kit for radio AAX7019.</td>
</tr>
<tr>
<td>AAX0012</td>
<td>Logical Zone Modification Kit for radio AAX7009 for AAX7006.</td>
</tr>
<tr>
<td>AAX7013</td>
<td>Radio Kit for the ComBox</td>
</tr>
<tr>
<td>AAX7014</td>
<td>GPRS modem kit for the ComBox.</td>
</tr>
<tr>
<td>AAX0018</td>
<td>1900 MHz band conversion kit for the GPRS modem.</td>
</tr>
<tr>
<td>AAY0013</td>
<td>Harting type flying lead connector for the Ingecon® Sun Lite units.</td>
</tr>
<tr>
<td>AAX7030</td>
<td>Kit RS-485-USB for Ingecon® Sun</td>
</tr>
</tbody>
</table>
9. Waste handling

During the various processes for installation, start-up and maintenance, waste is generated which must be handled appropriately according to the regulations in the corresponding country.

At the end of the unit’s life, the waste must be processed by an authorised waste management company.

Ingeteam Energy S.A., in accordance with its policy of respect for the environment, will inform the authorised manager, via this Section, of the location of components to be decontaminated.

The elements within the unit that must be handled individually are:

1. Printed circuit cards.
2. Electrolytic condensers or condensers containing PCB.

Waste that can be handled by conventional waste collection means

Most of this waste is from the unit’s packaging, which must be properly separated and processed.

All the packaging can be delivered to a non-hazardous waste management company.

In any event, each part of the packaging may be recycled as follows:

- Plastic (polystyrene, bag and bubble wrap): Yellow municipal container (plastic and bottles).
- Cardboard: Municipal blue container (paper and cardboard).