

INGECON SUN Lite U

Installation manual

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This document may be changed.

About This Manual

Purpose

The purpose of this manual is to describe the INGECON SUN 5 U and INGECON SUN 5TL U and to provide the information required for its correct operation, from reception to start-up, in addition to the preventive maintenance during operation.

Scope

This manual provides safety guidelines, equipment information and requirements and procedures for installation and operation.

Audience

Any installer who plans to use our equipment in a PV installation according to the requirements of the "National Electrical Code. ANSI/NFPA70" and any other local codes or laws. The installer itself must meet all local and state code requirements.

Scheme

Please read this manual carefully and follow the installation instructions precisely.

Symbol Identifications in this Manual

The following symbols are used in this manual:



WARNING

Warnings advise about situations that could cause personal injury or death.



CAUTION

Cautions advise about situations that could cause damage to the unit or the environment.

Important safety instructions

This manual contains important instructions for models:

- INGECON SUN 3.6TL U
- INGECON SUN 5 U
- INGECON SUN 5TL U
- INGECON SUN 6TL U

that shall be followed during installation and maintenance of the INGECON SUN U.

Save these instructions. Do not discard.



WARNING

The operations detailed below should only be carried out by suitably qualified personnel, trained to work with electrical equipment, familiar with this manual and the electrical drawings associated with the control panel (hereinafter referred to as qualified personnel). You are reminded that it is compulsory to comply with applicable legislation in terms of security for electrical work. There is an electrical discharge hazard.

It is essential to read the manual before operating the equipment.



WARNING

The opening of the various compartment enclosures in no way implies that no voltage is present inside. Access is therefore restricted to qualified personnel following the safety conditions set out in this document.



WARNING

The set of conditions detailed below should be considered to be the minimum requirements. It is always preferable to disconnect from the mains and check that no voltage is present. Faults in the installation could produce undesirable voltage returns. There is an electrical discharge hazard.



WARNING

In addition to the safety measures indicated in this manual, it is also necessary to observe the general measures applicable to this field (specific to the installation, country, etc).



WARNING

Compulsory to verify that no voltage is present: Use CAT III - 600 V measuring equipment.



WARNING

Work always without voltage.

To consider an installation without voltage, at least the following five steps must be executed:

- 1. Disconnect both DC and AC connections.
- 2. Prevent any other feed.
- 3. Verify that the installation is without voltage.

4. Short-circuit AC connection and DC connection and connect it to Ground on the side without voltage.

5. Guard the installation from electric active elements physically close, and establish security signals to limit the work zone and protect from any danger present in that zone.

Potential risks to persons

Here we detail the main hazards that an incorrect use of the inverter can cause on persons. Inside the manual they are better explained.



WARNING: Electric Shock

The inverter can be charged even after being disconnected from Grid and PV Array for 5 minutes.

Be sure that the 5 steps needed to work without voltage have been completed.



WARNING: Explosion

There is a very low risk of explosion in case of a major malfunction.

Enclosure will protect persons and goods from explosions, but only if it is correctly closed.



WARNING: Crush

Follow always the instructions for moving the equipment and placing it. The heavy weight of this equipment can cause severe damage or death if it is not manipulated correctly.



WARNING: Injures caused by Moving parts Don't touch or manipulate fans when inverter is working.



WARNING: High Temperature

Radiators and some parts inside the enclosure reach high temperatures that can be a burn hazard to persons.

Respect advisory marks and instructions.

Potential risks for the equipment

Here we describe the main hazards that an incorrect use of the inverter can cause on itself. Inside the manual they are better explained.



WARNING: Ventilation

The inverter needs a flow of quality air to work in all working conditions.



WARNING: Connections

After an authorized manipulation, make sure that the inverter is completely fit to start to work before connecting.



WARNING: Electronics Damage

Avoid touching or electrostatically charging electronics. Sensitive components can be damaged or destroyed.



WARNING: Operating

Don't connect or disconnect any terminal while the inverter is working. Disconnect and check that the equipment is without voltage first.

Service personnel



WARNING

These servicing instructions are for use by qualified personnel only. To reduce the risk of electric shock, do not perform any servicing other than specified in the operating instructions unless you are qualified to do so.

Ingeteam Inc doesn't assume any responsibility derived from not observance of this statement.

Personal Safety Equipment (PSE)

The minimal required Safety Equipment will be:



- Safety glasses against mechanical risk damage.
- Safety gloves approved for electrical risk.
- Safety footwear.
- Helmet.
- CAT III 600 V measuring equipment.



Wiring requirements

The correct wiring of the equipment to any PV installation will be done with the following types of wire:

AC Terminals INGECON SUN LITE U

Use 6 AWG (maximum), 90 °C (194 °F), copper wire for all AC wiring connections:

The wiring must comply with the provisions of the National Electrical Code ANSI/NFPA70, Canadian Electrical Code CEC and other Local or State Codes.

DC Terminals INGECON SUN LITE U

Use 16 to 6 AWG (maximum), 90 °C (194 °F), copper wire for all DC wiring connections.

The wiring must comply with the provisions of the National Electrical Code ANSI/NFPA70, Canadian Electrical Code CEC and other Local or State Codes.

Tightening torques

AC Terminals INGECON SUN LITE U

With 6/AWG, maximum tightening torque of 18.6 Nm.

DC Terminals INGECON SUN LITE U

Maximum tightening torque depending on the wiring:

Wiring	Maximum tightening torque
16/AWG	9 Nm
10/AWG	9 Nm
8/AWG	9 Nm
6/AWG	18.6 Nm

Spare parts

During the life of the INGECON SUN Lite, it might be needed to perform some maintenance that could require replacing some parts. The parts must be the same as specified in the following list: manufacturer, model and technical specifications:

Name	Manufacturer / trademark	Type / model	Technical data and securement means	Mark(s) of conformity
	LITTLEFUSE	KLKD001.T	AC/DC Fast-acting 1 A 600 V	сUЯus
Fuse F1, F2	FERRAZ	ATM1	AC/DC Fast-acting 1 A 600 V	сUЯus
	BUSSMAN	DCM-1	AC/DC Fast-acting 1 A 600 V	сUЯus

Inverter Marking

The advisory marks of the inverter are:





RISK OF ELECTRIC SHOCK



HOT SURFACES To Reduce the risk of burns Do not touch.



Read carefully the manual until manipulate the equipment.



🔥 WARNING

For continued protection against risk of fire, replace only with same type and ratings of fuse.

TL units

Screw the cables in the terminal board according to the following tables:

	Neutral	utral AC Line 2		AC Line 1	
Marking	Ν	L2		L1	
				AC out	put
	Positiv towards e	ve pole lectronics	Neg toward	gative pole Is electronics	
Marking	g +	-6 -6		-6	
	TL equ	TL equipment electronics poles connection		oles connection	
	DC gro	unding	AC	grounding	
Marking	g G	1		G2	
				Grounding	

U units

Screw down the cables that are inserted in the connection box with this considerations:

	N	eutral	AC Lin	e 2	AC Line	1
Marking		Ν	L2		L1	
					AC c	utput
		Positiv towards e	ve pole lectronics	Neg toward	ative pole s electronics	5
Mark	ing	+	-6		-6	
	Tra	nsformer eq	uipment elect	tronics po	les connectio	ı
		DC gro	unding	AC g	grounding	
Mark	ing	G	61		G2	
					Groundin	g
		Primary co	onnection	Second	ary connect	ion
Markin	g	P1	P2	S1	S2	
				Transfo	ormer connect	ion

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1. Overview

1.1. Introduction

The purpose of this manual is to describe the INGECON SUN Lite equipment and to provide adequate information for its correct location, installation, start-up, maintenance and operation.

1.2. Description of the equipment

An inverter is a circuit used to convert direct current into alternating current. INGECON SUN Lite equipment therefore serves to convert the direct current generated by the PV solar panels into alternating current to be delivered to the electric grid.



The main models included in the INGECON SUN Lite U family are as follows:

INGECON SUN 3.6TL U mode 208 INGECON SUN 3.6TL U mode 240 INGECON SUN 3.6TL U mode 277

INGECON SUN 5TL U mode 208 INGECON SUN 5TL U mode 240 INGECON SUN 5TL U mode 277 INGECON SUN 5 U mode 208 INGECON SUN 5 U mode 240 INGECON SUN 5 U mode 277 INGECON SUN 6TL U mode 208 INGECON SUN 6TL U mode 240 INGECON SUN 6TL U mode 277

1.3. Technical data of the equipment

DC Input Ratings

INGECON SUN		3.6TL U 5TL U			6TL U			
Mode	208	240	277	208	240	277	240	277
Maximum input voltage	550 Vdc							
Range of input operating voltage	150 - 450 Vdc							
Peak Power tracking voltage	200 - 450 Vdc							
Maximum input source backfeed current to input source	45.6 A							
Total input maximum current	22 A 30 A 32 A							
Fused inputs maximum current				12.	5 A			

AC Output

INGECON SUN		3.6TL U			5 U 5TL U		6Т	LU
Mode	208	240	277	208	240	277	240	277
Output power factor rating				>0.	.99			
Operating frequency range				59.7 - 6	60.5 Hz			
Normal output frequency				60	Hz			
Maximum continuous output power (AC)		3600 W 5000 W 6000			0 W			
Maximum output current	17 A 25 A 26.2 A			2 A				
Maximum output fault current (AC) and duration				200 A @	0.6 ms			
Maximum output overcurrent protection $^{\scriptscriptstyle (1)}$	25 A	20 A	20 A	35 A	30 A	25 A	35 A	30 A
Synchronization in-rush current				5	A			
Operating voltage range	183.04 - 228.8 V	211.2 - 264 V	243.76 - 304.7 V	183.04 - 228.8 V	211.2 - 264 V	243.76 - 304.7 V	211.2 - 264 V	243.76 - 304.7 V
Nominal output voltage (AC)	208 V	240 V	277 V	208 V	240 V	277 V	240 V	277 V
Maximum continuous output current	17 A	15 A	13 A	24 A	20.83 A	18.05 A	25	21.66 A
Mode	208	240	277	208	240	277	240	277

 ${}^{\scriptscriptstyle (1)}$ Must be provided by installer.

Output variables, trip limits and trip times:

Nominal frequency (Hz)	Trip limit (Hz)	Trip Times (s)
60	> 60.5	max 0.16
80	< 59.3	max 0.16
Nominal voltage (V)	Trip limit (V)	Trip Times (s)
	104 (50%)	max 0.16
208	183 (88%)	max 2
208	228.8 (110%)	max 1
	249.6 (120%)	max 0.16
	120 (50%)	max 0.16
240	211.2 (88%)	max 2
240	264 (110%)	max 1
	288 (120%)	max 0.16
	138.5 (50%)	max 0.16
077	243.76 (88%)	max 2
277	304.7 (110%)	max 1
	332.4 (120%)	max 0.16

Output variables accuracy:

Output variable	Accuracy
Voltage	1%
Frequency	0.1 Hz
Time	1%

Temperature characteristics	
Normal operation temperature range	-4 °F (-20 °C) / 113 °F (45 °C)
Maximum full power operating ambient	113 °F (45 °C)
Temperature power derating	For T > 113 °F (45 °C) output power may decrease

1.4. Compliance with standards and regulations

These units are adapted to the standards and regulations in the United States and Canada.

1.4.1. ETL Marking

The Marking of a NRTL is essential for marketing any product in the USA and Canada, without prejudice to all applicable standards and regulations. The INGECON SUN Lite U units bear the ETL Marking and, therefore, are compliant with this requirement.

2. System description

2.1. Location

This section provides guidelines for selecting and correctly adapting the equipment to a suitable site.

2.1.1. Site



Locate the units in a place which is easily accessible for installation and maintenance work, with room to operate the keyboard and to read the front LED indicators.

Do not leave any object on the equipment.



CAUTION

The radiator can reach temperatures of 185 °F (85 °C). Do not leave any material susceptible to the high temperatures of the surrounding air in the proximity of the inverter.



Avoid corrosive environments.

2.1.2. NEMA Rating

The INGECON SUN Lite U inverters have an NEMA rating for outdoor elements, permitting outdoor installation.



NEMA 3R means that the equipment is fully dust-tight and is also protected against water jets in any direction, as defined for this protection rating in U standards.

Despite this, excessive humidity may cause a safety shutdown for equipment auto-protection: We would therefore recommend:



Locating the equipment in a place which is sheltered from the rain.

2.1.3. Ambient temperature

The INGECON SUN Lite U inverters are designed to operate between -4 °F (-20 °C) and 158 °F (70 °C).

To operate at nominal power, the maximum ambient temperature must not be above 113 °F (45 °C).

2.1.4. Atmospheric conditions

The surrounding air must be clean and the relative humidity must not exceed 50% at more than 104 °F (40 °C). Higher percentages of relative humidity, up to 95%, are tolerable at temperatures below 86 °F (30 °C).

It should be taken into account that, occasionally, moderate condensation may occur as a result of temperature variations. For this reason, in addition to the inverter's own protection system, the equipment should also be monitored when operating at sites whose atmospheric conditions may be outside of those described above.

2.1.5. Contamination rating

The inverters have been designed for a grade 3 contamination rating.

2.1.6. Noise contamination

When operating, the inverters emit a slight buzzing sound.

Do not locate the inverters in an occupied room or on lightweight supports which could amplify this noise. The mounting surface must be firm and adequate for the weight of the equipment.

2.1.7. Ventilation

There must be a 11.81 inches (30 cm) clearance over the inverters and 7.87 inches (20 cm) at the sides and base. This is to ensure that the inverter cooling system operates correctly.



INGECON SUN Lite U are cooled by forced air convection.

In all cases, incoming and outgoing air should be allowed to circulate freely through the grids or openings at the base, top and sides.

2.1.8. Mounting surface

In order to ensure correct heat evacuation and airtightness, the inverter must be mounted on a perfectly vertical wall or, failing this, with a maximum angle of inclination of 176 °F (80°) or -112 °F (- 80°).



Never position the inverter horizontally. The air circulation channels through the radiator must be vertical.

The inverter should be mounted on a solid wall. Bear in mind that holes need to be drilled into the wall, inserting plugs and lag screws capable of withstanding the inverter weight.

For the TL models, the space between the drill holes shall be as follows:



For transformer based models, the transformer is first secured to the wall and then the inverter is attached to the transformer.

First, the three holes should be drilled in the top. The figure provides the hole dimensions. The lower hole should be made when the unit is hung on the wall, as explained in section *"5.2. Wall mounting the equipment"*. The figure shows the approximate distances between the horizontal line comprising the three top holes and the position of the lower hole. The approximate vertical distance to the upper edge of the inverter which will subsequently be attached to the transformer secured to the wall.



2.2. Environmental characteristics

The environmental operating conditions are:

- Minimum temperature: -4 °F (-20 °C).
- Minimum temperature of the surrounding air: -4 °F (-20 °C).
- Maximum temperature of the surrounding air: 158 °F (70 °C).
- Maximum relative humidity without condensation at 95 %.

Further information in "3. Operating, storage and transport conditions".

2.3. EMC Requirements

The INGECON SUN Lite U system is equipped with the necessary filter devices to ensure that it complies with the EMC requirements for industrial applications, thereby preventing disturbances in external equipment.

3. Operating, storage and transport conditions



Failure to comply with the instructions provided in this section could cause damage to the equipment.

Ingeteam Inc assumes no liability whatsoever for any damage derived from non-compliance with these instructions.

3.1. Reception and Unpacking the equipment

Reception

On reception, please check the terms indicated in the Delivery Note, sign the box: FIRMA RECEPTOR MERCANCIA (signature goods consignee) and return the signed copy to the consignor's address.

Do not unpack the inverter until just before it is to be installed. Once unpacked, the inverter must remain upright at all times, in order to ensure that it remains air-tight.

For transformer based models, the inverter and the connection box are packed in separate boxes. The serial number on the shipping label affixed to all the boxes can be used to identify the specific connection box for each particular unit.



INGECON SUN 5TL U unit and connection box label



INGETEAM INC Ingeteam 3550 W. Canal St. 53208 Milwaukee, WI www.ingeteam.com **INGECON SUN LITE INGECON SUN 5 U** Type/Model Cod. I+D AAY155 100010060001 S/N DEMO 100010060001 TRANSFORMER NEMA 3R 2011

INGECON SUN 5 U unit and transformer label

The equipment packing dimensions are as follows:

INGECON SUN	3.6TL U	5TL U, 6TL U and 5 U without transformer	Transformer of 5 U
Packing type		Cardboard box	
Weight	44.10 lb (20 kg)	52.91 lb (24 kg)	91.93 lb (41.7 kg)
Height/Width/Length		9.84/15.74/23.62 in (25/40/60 cm)	

Unpacking the equipment

The inverter is clearly identified by its own specific serial number, which should be indicated in all communications with Ingeteam Inc.



European pallet packaging

	INGECON SUN 5 U	INGECON SUN 3.6TL U, 5TL U and 6TL U
First row	4 connection boxes	4 inverters
Second row	4 connection boxes 4 inverters	
Third row	2 connection boxes 2 inverters	4 inverters
Fourth row	4 inverters	6 connection boxes
Fifth row	4 inverters 6 connection boxes	
Overall	10 complete equipment	12 complete equipment

Damage during transport

Should the inverter sustain damage during transport:

- 1. Do not install it.
- 2. Immediately notify your distributor of this situation within a 5 day period from the reception date.

Should it be finally necessary to return the equipment to the manufacturer, the original packing should be used.

Packaging disposal

All the packaging can be given to an authorised non hazardous waste manager.

In any case, each part of the packaging should be disposed of as follows:

- Plastic (polystyrene, bag and bubble wrap): the appropriate container.
- Cardboard: the appropriate container.

3.2. Handling

It is exceedingly important to correctly handle the inverters at all times, in order to ensure that:

- The packaging remains intact and the inverters are maintained in optimum condition right from shipment until unpacking.
- The inverters are not knocked and/or dropped, which could affect their mechanical characteristics, such as poor door closure, loss of NEMA rating etc.
- Every effort is made to avoid vibrations, which could lead to subsequent malfunctioning.

Should any anomaly be observed, Ingeteam Inc must be contacted immediately.

3.3. Transport

Correct inverter transport and storage are the first steps required for correct use and operation. Considering the indications given in section *"3.2. Handling"*, and as a preventive measure, Ingeteam Inc would recommend working with haulers specializing in the transport of special and/or fragile equipment. All equipment packed in accordance with section *"3.2. Handling"* must be handled with tools that will not damage the packaging.

During transport and storage the equipment should be protected from mechanical impacts, vibrations, water projections (rain) and any other product or situation which could damage or alter its performance.

When moving the equipment over a distance of more than 16.4 ft (5 m), a pallet jack or fork-lift truck should be used, whenever possible.

Moving the equipment with a pallet jack

At least the following points should be observed:

- Ensure that the packed equipment is centred over the forks.
- Try to ensure that the equipment is positioned as close as possible to the connection between the fork and handle.
- In any event, observe the instructions provided in the pallet jack manual.

Moving the equipment with a fork-lift truck

At least the following points should be observed:

- Ensure that the packed equipment is centred over the forks.
- Try to ensure that the equipment is positioned as close as possible to the connection between the fork and the carriage.
- Ensure that the forks are perfectly level, in order to prevent the inverter package from being tipped off.
- In any event, observe the instructions provided in the fork-lift truck manual.

Once the equipment has been moved to its place of installation, it should be left in the packaging until you are ready to install it. Then, keeping it upright, you can move it a short distance without the packaging. The following points should be observed, with regard to the inverter and the connection box.

Moving the equipment once the packaging has been removed

At least the following points should be observed:

- Use the side grips to grasp the equipment with both hands.
- Follow the ergonomic advice given for lifting heavy objects. The equipment weighs 52.91 lb (24 kg) and the connection box of the 5U equipment.
- Do not release the equipment until it is perfectly fixed in position or is firmly in place.
- Ask another person to direct the movements to be made.

3.4. Storage

If the equipment is not to be installed immediately after reception, the following points should be taken into account in order to avoid deterioration:

- The package should be stored upright.
- Keep the equipment free from dirt (dust, shavings, grease ...) and out of the reach of rodents.
- Avoid contact with water jets, welding sparks etc.
- Cover the equipment with a breathable, protective material in order to avoid condensation caused by ambient humidity.
- It is extremely important to protect the equipment from contact with chemicals, which could cause corrosion, and also from saline atmospheres.

3.5. Conservation

In order to conserve the equipment correctly, the original packing should not be removed until just before the equipment is to be installed.

In the event of prolonged storage, we would recommend doing so in a dry place, avoiding abrupt temperature changes, as far as possible.

When the packaging is damaged (cuts, holes etc) the equipment will not be maintained in optimum condition before installation.

Ingeteam Inc assumes no liability if this condition is not complied with.

3.6. Waste disposal

During the installation, start-up and maintenance procedures, the waste generated must be adequately treated in compliance with the country-specific regulations. At the end of the equipment useful life, the waste must be given to an authorised manager.

In this section, Ingeteam Inc, in its commitment to an environmentally friendly policy, provides Authorised Managers with information on the location of the components to be decontaminated.

Those equipment components which must be specifically treated are:

- 1. Electrolytic capacitors or capacitors with a PCB.
- 2. Batteries or accumulators.
- 3. Printed circuit boards.
- 4. Liquid crystal displays.





4. Safety instructions

4.1. Contents

This section contains the safety instructions to be followed when installing, operating and accessing the equipment.

Failure to comply with these safety instructions may result in physical injury or even death, or cause damage to the equipment.

Before operating the equipment, please read these safety instructions carefully.

4.2. Symbols

Safety warnings, classified by colour according to their importance, provide information on conditions that could cause serious bodily injury or death and/or damage to the equipment. Together with the warning sign, instructions are given as to how to avoid such hazards.

These symbols are listed below, with an explanation of their meaning.



DANGER: High Voltage. Keep Away!

A warning that the high voltage present in the equipment could cause physical injury or even death and/or damage to the equipment.



General warning regarding conditions that could result in physical injury and/or damage to the equipment.



CAUTION: hot surface. Warning about the presence of hot parts that could cause serious burns.

All work-specific safety warnings and notes are included in each corresponding chapter and are also repeated and completed at the critical points in that chapter.

Please read this information carefully. It has been written with your personal safety in mind, whilst ensuring the maximum service life for the equipment itself and for any devices connected to it.

4.3. Types of work to be performed



Installation, commissioning, inspection and maintenance operations may only be performed by suitably qualified personnel, trained to work with electrical equipment (hereinafter qualified personnel). You are reminded that it is mandatory to comply with USA and Canada regulations.



The opening of the different compartment enclosures in no way implies that no voltage is present inside. Access is therefore restricted to qualified personnel, observing the operating safety conditions established in this document.



The set of conditions detailed below should be considered to be the minimum requirements. It is always advisable to disconnect from the mains. The installation could be faulty, causing undesirable voltage returns. There is an electrical discharge hazard.



In addition to the safety measures indicated in this manual, any general measures that may be applicable should also be observed (installation-specific, country-specific, etc).



According to USA and Canada regulations, the electrical installation must not entail fire or explosion hazards. Workers must be properly protected against the risk of accidents caused by direct or indirect contact.

The electrical installation and the safety devices must take account of the voltage, all external conditioning factors and the competence of those people having access to the installation parts.



According to USA and Canada regulations, on Electrical Hazards, for high voltage work, all workers performing work in the open air shall stop work in the event of storms, heavy rainfall, strong winds, snow or any other unfavorable environmental condition that hinders visibility or the handling of tools. Work on indoor installations directly connected to overhead electricity lines must be interrupted in the event of a storm.



According to USA and Canada regulations, all work equipment must be adequate for protecting exposed workers against the risk of direct or indirect contact with electricity. At any event, the work equipment electrical parts must comply with the provisions of the corresponding regulations.



Ingeteam Inc assumes no liability for damages caused by the improper use of the equipment.

Any work on any of this equipment involving a change in the original electrical layout, must first be proposed to Ingeteam Inc. This proposed new layout must then be studied and authorised by Ingeteam Inc.



The necessary safety measures must be in place to prevent unauthorized persons from handling the equipment and to keep them away from the vicinity of the equipment.

Warning signs to indicate the presence of personnel at work. (Authorized personnel only).

Lockout mechanisms or mechanical locking, by padlocks with keys, for circuit breakers of an appropriate type.



These instructions must be easily accessible, close to the equipment and within easy reach of all users.

Before installing and starting up the equipment, please read these safety instructions and warnings carefully and all the warning signs placed on the equipment. Ensure that all warning signs are perfectly legible and that any damaged or missing signs are replaced.

4.3.1. Inspection work

It can involve opening the enclosure of the connection box for visual inspection. It will never involve opening the enclosure of the equipment.

4.3.2. Operation work

Communication devices installation using RS485 communications terminal. It will never involve opening the enclosure of the equipment or the connection box.

4.3.3. Manipulation work

It includes:

- Replacement of short circuit protection fuses.
- Replacement of grounding fuses (only in equipment with transformer).

Any work not classified as Inspection or Operation work may be consider Manipulation work.

4.4. General observations

This section defines the preventive measures to be adopted when performing all types of work on the equipment, in order to work safely and to control unavoidable hazards.

Protection against direct contact is provided by enclosures of the appropriate protection rating.

These cabinets have been tested to the applicable standards to ensure that they comply with the safety requirements in force. The following tests have been performed: leakage current, continuity, insulation measurements, dielectric strength, insulation and equipment operating tests.

The compartments have different forms of interlocking, depending on the devices located in the housing interior.

The tools and/or equipment used for the equipment manipulation tasks, must have double reinforced insulation (class II).

4.4.1. Hazards present and general preventive measures

Crash with fixed elements

- Inform workers of the hazard.
- Adequate lighting.
- Work carefully.
- Keep an adequate distance to avoid contact with this elements.

Blows, jabs and cuts with objects and/or tools

- Keep the doors closed when not working in the cubicle.
- Adequate lighting.
- Clean and tidy.
- Mandatory use of a helmet, safety footwear and gloves when required.

Particle projection (fan):

• It is advisable to use anti-impact glasses (face screen).

Electric risk

- Observe indications from PPE's and *"Important safety instructions"* sections.
- Inform workers of the hazard.
- Comply with laws and security standards applicable to the installation where is located the inverter because of the type of installation and the country.
- Hazards and additional preventive measures for Manipulation works.

Thermal contact

- Inform the workers of the hazard.
- It is advisable to wear gloves.

• Disconnect the power supply and wait 10 minutes to allow the hot parts in the equipment interior to cool down.

4.4.2. Personal Protective Equipment

Inspection



Preventive maintenance tasks on the electric panels involve Inspection, Operation and Manipulation tasks, depending on the case.

The use of safety footwear complying with the EN 345-1:1992 standard is mandatory. It is also mandatory to wear security gloves or similar.

Operation

The use of a helmet compliant with EN 397:1995 is mandatory, and safety footwear complying with the EN 345-1:1992 standard. It is also mandatory to wear kid gloves or similar.

Manipulation

The use of a helmet compliant with EN 397:1995 is mandatory, and safety footwear complying with the EN 345-1:1992 standard.

It is also mandatory to use protective gloves made of insulating material for live working and compliant with the *EN-60903-1992* standard and the use of a face mask compliant with standard *EN-168-1994*, to provide protection against electric shocks.

4.5. Inspection, Operation and Manipulation works

This section defines the mandatory preventive measures to be adopted when performing all types of work on the equipment, in order to work safely and to control unavoidable hazards:

4.5.1. Inspection works



Opening system: a tool is necessary to remove the screws that close the frontal door.



It is strictly forbidden to access the enclosure from a part other than the one indicated in this manual. Before opening any of the enclosure cover, it is first necessary to cut off the mains power supply to the panel.

4.5.2. Operation works

The only operation work that can be done of this equipment is the upload of software to the RJ45 communication connector.



Opening system: a tool is necessary to remove the screws that close the frontal door.



Operation works have the same preventive measures than Inspection works.

4.5.3. Manipulation works

Any work that is not Inspection or Operation work, is a Manipulation work.



Opening system: A tool is necessary to remove the screws that close the frontal door of the connection box. Never open the inverter.

Always check that no voltage is present before starting manipulation work.

Mandatory compliance:

- 1. Open any potential voltage sources.
- 2. Disconnect Vdc-PV wiring, isolate and signal it, and prevent accidental reconnection.
- 3. Disconnect grid Vac wiring.
- 4. Wait 10 minutes for the internal capacitors to discharge and for the internal resistors to cool down.

5. Open the door, and discharge Vbus with a suitable resistance between +VBUS and -VBUS. Check that no voltage is present.

For 2, 3, 4, and 5 steps, use the Personal Protective Equipment described in section "4.4.2. Personal Protective Equipment".



Any intervention that involves a change in the equipment has to be previously proposed to Ingeteam Inc, and Ingeteam Inc has to approve it.



It is strictly forbidden to access the enclosure from a part other than the one indicated in this manual. Before opening any of the enclosure cover, it is first necessary to cut off the mains power supply to the panel.

5. Installation

Before installing the INGECON SUN Lite U, the packaging should be removed, taking particular care not to damage the housing.

Check to ensure that there is no humidity inside the cabinet. If there are signs of humidity, the equipment should not be installed until it has been completely dried out.

Before commencing the steps described in this point, it is important to identify each part described in this section and to ensure that the right tools are on hand for the installation work.



All installation works have to comply with applicable Electric Security Laws.

5.1. General installation requirements

The equipment environment must be adequate and must comply with the guidelines set out in section *"2. System description"*. In addition, the items used in the rest of the installation must be compatible with the equipment and comply with the applicable legislation.

Pay particular attention to the following:

- The ventilation and work space must be adequate for maintenance tasks, in accordance with the applicable regulations in force.
- The external connection devices must be adequate and must be sufficiently close, as set out in the regulations in force.

The lead-in cable cross-section must be adequate for the maximum current.

Particular care should be taken in order to ensure that there are no external items close to the air inlets and outlets, which could prevent the correct ventilation of the equipment.

5.2. Wall mounting the equipment

The INGECON SUN Lite U units are equipped with a wall mounting system.

TL units

It provides a clamping plate attached to the equipment by a screw. This screw must be released in order to remove the plate which should then be secured to the wall where the unit is to be mounted.

Once the plate has been removed, follow the steps detailed below:

1. Mark the 5 holes on the wall using the template supplied with the unit.

2. Drill holes in the wall with a recommended bit for the screw which will then be used to secure the plate to the wall.

3. Secure the plate with rawl plugs and stainless steel screws, to prevent corrosion, in the 1 and 2 marked holes.



4. We would recommend using appropriate lag screws for the wall construction material, washers and plugs for fixing the plate to the wall.

5. Hang the unit onto the plate.

6. Install the lag screws in the holes marked as 3 and 4 in the template, leaving a distance of 0.16" between the wall and the lag screw's head.

- 7. Check that the unit is firmly in position.
- 8. Remove the cable lead through's nuts.



9. Hang the connection box onto the 3 and 4 lag screws. Cross the pendant cables through the cable lead throughs.

10. Screw the cable lead throughs inside the connection box. The sealing washer have to be installed **on the** external side of both enclosures.





- 11. Screw down a screw lag in the hole marked as 5.
- 12. Screw the cables in the terminal board according to the following tables:

	Neutral	eutral AC Line 2		AC Line 1	
Marking	Ν	N L2		L1	
				AC ou	tput
	Positiv towards e	ve pole lectronics	Neg toward	gative pole Is electronics	
Marking	g +	+6 -6		-6	
	TL eq	uipment elect	tronics p	oles connection	
	DC gro	unding	AC	grounding	
Marking	g G	61		G2	
				Grounding	



U models

The upper anchor bar supports the equipment weight.

The lower point secures the transformer to the wall and prevents vibrations.

To secure the transformer to the wall, follow the steps detailed below:

1. Mark the bar anchor points on the wall.

2. Drill holes in the wall with a bit recommended for the screw subsequently to be used to secure the bar to the wall.

3. Secure the bar with rawl plugs and stainless steel screws in order to prevent rust.



4. You are recommended to use lag screws, washers and rawl plugs appropriate for securing the bar.

- 5. Hang the transformer from the bar. This operation should be performed by two people together.
- 6. Tighten the bottom anchor.
- 7. Check that the transformer is firmly anchored.



To secure the transformer to the inverter, follow the steps detailed below:

1. Hang the inverter on the transformer, by inserting the tabs located on the top of the transformer into the corresponding holes on the inverter.



2. Adjust the two casings so that their edges are parallel to each other and the rear bottom right of the inverter and the rear front right of the transformer come into contact and the drilled holes coincide.

3. The inverter can be secured to the transformer by either a screw and washer or else a padlock.

- Concentrations
- 4. Remove the PGs nuts and introduce the cables through the transformer box holes.

5. Fasten the PGs inside the connection box.

6. Fix the equipment to the connection box with this screw:



7. Screw down the cables that are inserted in the connection box with this considerations:

	Neutral	eutral AC Line		AC Line 1	
Marking	Ν	L2		L1	
				AC outp	out
	Positiv towards e	ve pole lectronics	Neg toward	ative pole s electronics	
Marking	ç +	6		-6	
	Transformer equ	uipment elect	tronics po	oles connection	
	DC gro	unding	AC	grounding	
Marking	g G	G1		G2	
				Grounding	_
	Primary co	nnection	Second	lary connection	
Marking	P1	P2	S1	S2	
			Transf	ormer connection	



- 8. Make the field connections as are detailed in this manual.
- 9. Close the transformer box cover.
- 10. Check that the transformer is securely in place.

5.3. Electrical connection

Once the unit has been mounted in its definitive location and is firmly secured, the next step is to make the electrical connections.

The INGECON SUN Lite U cable access ports are located in the lower part of the casing. Each type is described below.

5.3.1. Terminals for the DC connection

DC connection is made by screw terminals.

There are four pairs of terminals available that allow installer to design the installation with one to four strings for each pole. This terminal are protected by a DC fuse. It is another terminal available but, in this case, the overcurrent protection has to be provide by the installer.



The wiring have to comply with the provisions of the National Electrical Code ANSI/NFPA70, Canadian Electrical Code CEC and other Local or State Codes.



The INGECON SUN Lite U with transformer have to be installed with one of the of the two poles connected to ground through a fuse.

In following lines it's explained how to make correctly DC connection for INGECON SUN Lite U with and without transformer.

Terminals for the DC connection in TL inverter

The equipment involved are:

INGECON SUN 3.6TL U mode 208	INGECON SUN 5TL U mode 208	INGECON SUN 6TL U mode 208
INGECON SUN 3.6TL U mode 240	INGECON SUN 5TL U mode 240	INGECON SUN 6TL U mode 240
INGECON SUN 3.6TL U mode 277	INGECON SUN 5TL U mode 277	INGECON SUN 6TL U mode 277
	INGECON SUN 5 U mode 208	
	INGECON SUN 5 U mode 240	
	INGECON SUN 5 U mode 277	

DC connection is made by screw terminals.

The connection can be made through fuses in positive pole, or without them.

Ingeteam Inc recommends the use of through-fuses connection in positive pole. If the installer decides not to use them, it's compulsory to comply with the provisions of the National Electrical Code ANSI/NFPA70, Canadian Electrical Code CEC and other Local or State Codes.

Negative pole connection

Negative pole is connected by 1 to 4 strings depending on the characteristics of the installation to the terminal strip with the connectors 1-, 2-, 3- and 4-.

Positive pole connection

Positive pole can be connected through fuses ore without them.

If the connection is made through fuses, positive pole have to be connected to the terminal strip with the connectors 1+, 2+, 3+ and 4+. The maximum current trough this connection has to be 16 A.



If the connection is made without fuses, positive pole have to be connected to the terminal on the left of the fuse holders, marked as 5+. If this option is selected, input fuses of the inverter cannot be used.



Terminals for the DC connection for inverters with transformer

The equipment involved are:

INGECON SUN 3.6TL U mode 208 INGECON SUN 3.6TL U mode 240 INGECON SUN 3.6TL U mode 277 INGECON SUN 5TL U mode 208 INGECON SUN 5TL U mode 240 INGECON SUN 5TL U mode 277 INGECON SUN 5 U mode 208 INGECON SUN 5 U mode 240 INGECON SUN 5 U mode 277 INGECON SUN 6TL U mode 208 INGECON SUN 6TL U mode 240 INGECON SUN 6TL U mode 277

DC connection is made by screw terminals.

One of the two poles of DC connections have to be grounded, as one of the mandatory requirements to comply with the provisions of the National Electrical Code ANSI/NFPA70, Canadian Electrical Code CEC and other Local or State Codes.

One to four strings can be use in DC input connection, and any of the two poles can be selected to ground, but each different configuration requires different connections, so BE CAREFUL to follow correctly the instructions for each configuration.

DC Input terminal strips are marked with A1, A2, A3 and A4 for one of the poles and with B1, B2, B3, B4, and B5 for the other pole.

Positive or negative pole can be chosen to connect to ground; depending of this election, DC connection will be made in one way or another.

Negative pole grounded

This is the default configuration.

Negative pole has to be connected with 1 to 4 strings to A1, A2, A3 and A4 terminals, it doesn't matter the order.

Positive pole has to be connected with 1 to 4 strings to B1, B2, B3, B4 and B5 terminals. If 2 to 4 strings are used, wires have to be connected to B1, B2, B3 and B4 terminals, it doesn't matter the order. String cannot exceed 16 A of current each one nor 30 A together.



If only one string is used, connection will be made by B5 terminal. This terminal doesn't use the fuses that protect this pole, so installer must provide the fuse protection of this pole complying with the provisions of the National Electrical Code ANSI/NFPA70, Canadian Electrical Code CEC and other Local or State Codes.



Positive pole grounded

This configuration will need a different wiring.

Positive pole has to be connected with 1 to 4 strings to A1, A2, A3 and A4 terminals, it doesn't matter the order.

Negative pole has to be connected with 1 to 4 strings to B1, B2, B3, B4 and B5 terminals. If 2 to 4 strings are used, wires have to be connected to B1, B2, B3 and B4 terminals, it doesn't matter the order. String cannot exceed 16 A of current each one nor 33 A together.



If only one string is used, connection will be made by B5 terminal. This terminal doesn't use the fuses that protect this pole, so installer must provide the fuse protection of this pole complying with the provisions of the National Electrical Code ANSI/NFPA70, Canadian Electrical Code CEC and other Local or State Codes.



In addition to this connection, it's necessary to change of the order of connection in the low side of the + and - terminals. The cable marked as A has to be connected to the + terminal and B to the - one.

In the following picture this change is shown:



DC grounding

DC grounding terminal has to be connected. It can be connected to the terminal marked as G1 or the copper plate.





5.3.2. AC connection terminal strip

AC grounding terminal has to be connected.

Three or four wires have to be connected depending on the voltage configuration:

- Grounding wire. G2 connector. Must be connected in all configurations.
- Neutral wire. N connector.
- Line 1. L1 connector.
- Line 2. L2 connector.





480 Delta: 277 WYE

Chose this configuration in the display. A phase has to be connected to L1. Neutral has to be connected to L2.



208 Delta: 120 WYE

Chose this configuration in the display. A phase has to be connected to L1.

Neutral has to be connected to N.



240: 120 Split Phase

Chose this configuration in the display.

Connect L1, L2 and N as shown in the picture:



240 Delta: 120 Stinger

Chose this configuration in the display. Connect L1, L2 and N as shown in the picture:



240 Delta

Chose this configuration in the display.

Connect L1 and L2 as shown in the picture:



208 Delta

Chose this configuration in the display. Connect L1 and L2 as shown in the picture:



240 Delta: Corner grounded

Chose this configuration in the display.

Connect L1 and L2 as shown in the picture:



208 Delta: Corner grounded

Chose this configuration in the display.

Connect L1 and L2 as shown in the picture:



Harting communications connector

This is a female quick connector Harting HANQ/5 connector.

Electrical scheme equipment TL



PV Modules

Inverter

Transformer

Utility grid cabinet

Multi-purpose packing gland

Multipurpose packing glands can optionally be supplied. If not requested, then the casing will be supplied with a pre-cut hole which can then be opened. If the hole is opened and the Packing Gland (PG) is not correctly installed for NEMA 3R equipment, then the unit will lose its NEMA 3R protection rating.



The installer has to provide the packing gland of these holes complying with the provisions of the National Electrical Code ANSI/NFPA70, Canadian Electrical Code CEL and other local or states codes.



Use 16 to 6 AWG (maximum), 194 °F (90 °C), copper wire for all DC wiring connections.

Hole	Measure
DC1	3⁄4"
DC2	1"
AC	3⁄4"

DC circuit breaker

Optionally, the INGECON SUN Lite U is equipped with a DC circuit breaker. A number of different models are available, although they all have the same electrical properties.

The advantage of this circuit breaker is that it can break a circuit under load. All the same, whenever there is an emergency, we would always advise you to shutdown the equipment from the display before operating the breaker.



CAUTION

Whilst the panels are receiving sunlight, the DC cables will be subject to high voltages that could be hazardous.

Never manipulate the connections without first disconnecting the inverter from the grid and the PV array.

5.3.3. System diagram

The system diagram corresponds to the configurations found in the majority of installations.

The regulations applicable to each installation and to each country in which the inverter is to be located, shall always be observed.

5.3.4. Connection for the RS485 serial communication

All the INGECON SUN Lite U are equipped with 485 serial communications. Given the fact that the RS485 communication card is ready wired to the Harting Han 4 A connector female, you simply need to connect a male connector of the same type. Refer to the «AAX2002IKH01 Communication accessory installation manual» to correctly wire the male connectors which need to be plugged into the inverter connector.

This connector can be supplied by Ingeteam Inc, if requested when ordering the equipment.

5.3.5. Connection for other types of communication

At the installer's request, optionally the inverters can be fitted with hardware for communication via:

- GSM/GPRS phone line.
- Fibre optics.
- Ethernet.

In all cases, the auxiliary signals are connected directly to the corresponding communications card.

Refer to the «AAX2002IKH01 Communication accessory installation manual».

5.3.6. Ground and pole connections to the electric grid

The metal parts of the inverter (equipment ground) are electrically connected to the ground point of the electric grid.

In order to guarantee personal safety, this point must be connected to the installation ground.

The connection of the Neutral and Phase cables from the Grid to the inverter is performed through a hole and there are connected to screw terminals.

The cables must comply with the provisions of the National Electrical Code ANSI/NFPA70, Canadian Electrical Code CEL and other local or states codes.

If the distance between the inverter and the Grid connection point is such that cables with a larger cross section are required, then we would recommend the use of an external distribution box, located close to the inverter, to change from one section to another.

Ingeteam can optionally supply this box.

Protection of the Connection to the electric grid

Protective devices need to be installed in the inverter connection to the Electricity Grid.

Thermal-magnetic breaker

This breaker must comply with the provisions of the National Electrical Code ANSI/NFPA70, Canadian Electrical Code CEL and other local or states codes.

It should always be ensured that the device cut-off power is higher than the short-circuit current at the grid connection point.

Account should also be taken of the fact that the operating ambient temperature affects the maximum current admitted by the said protective device; this will be indicated by the manufacturer.

Differential circuit breaker

In the grid connection of the TL units (transformer-less) never install a differential circuit breaker with a current limit that is less than the maximum default current that could occur in the PV installation as a whole, in all operating conditions.

The grounding capacity of the PV modules varies and depends on the manufacturing technology (for example, thin film modules with cells on a metal carrier).

The PV modules used with the INGECON SUN Lite U must have a coupling capacity of less than 50 nF/kWp.

During power to grid delivery, the value of the resultant derived current from the cells to ground depends on the module mounting configuration and also on the atmospheric conditions (rain, snow).

This derived current, conditioned by service, must not exceed the differential circuit breaker cut-off current value. Otherwise the inverter grid connection could cause the inverter external differential to trip.

The unit should be started up manually, given the fact that the Start or Stop status does not change, even if the equipment power is cut-off.

In the main menu, highlight the option Start/Stop and click to move from one status to the other.

5.3.7. Connection to the PV array

The connection of the inverter to the PV array is made through a hole and are connected to a screw terminal dock.

Never forget that, whenever panels are exposed to solar radiation, voltage is generated at the terminals.

Therefore, the inverter interior may hold voltages of up to 550 volts even when not connected to the Grid.

The inverter has a maximum system voltage of 550 Vdc. Check that the PV array configuration will never be capable of supplying this voltage to the inverter, not even in the most adverse situations such as at an ambient temperature of 14 °F (-10 °C).

Ingeteam Inc will accept no liability for any damage caused by a DC voltage of more than 550 Vdc.



CAUTION

Connect the positive pole of the string of panels to the terminals marked "+" and the negative pole to the terminals marked "-".

The inverter factory-supplied terminals can withstand a maximum current of 20 amps.

5.4. Electrical disconnection

To disconnect the inverter, follow the steps indicated in section "5.3. Electrical connection" hereof, but in reverse order.

Pay particular heed to the following warning notice:



CAUTION

The inverter contains electric capacitors which can maintain high voltages even after disconnection from the panels and grid.

And remember:



CAUTION

The INGECON SUN Lite U unit's connection box may only be opened by qualified personnel.

During the equipment installation and maintenance operations, it is mandatory to use personal protective equipment (PPE): safety helmet, gloves and footwear.



CAUTION

Do not touch the inverter sides and rear, which can reach high temperatures.

Any installation work requiring the unit to be opened must be performed in a dry atmosphere, to prevent the ingress of moisture that could condense and damage the electronics.

Ingeteam Inc assumes no liability for damages caused by the improper use of its equipment.

5.5. Disassembling

To disassemble the inverter, follow the steps indicated in section "5.2. Wall mounting the equipment" hereof, but in reverse order.

6. Commissioning

6.1. Equipment inspection

This section contains the instructions for operating the equipment once it is correctly wired and sealed.

When an INGECON SUN Lite U unit is to manage all or part of a generating plant, a check should be made to ensure that the plant status is correct before starting up the unit.

Each plant has its own particular characteristics, depending on the country of location and other specific conditions. In any event, before start-up, it should be ensured that the installation is compliant with all applicable legislation and regulations and that at least the part which is to be powered up, has been completed.

6.1.1. Inspection

Prior to the inverter power-up, a general inspection of the equipment should be made, primarily consisting in:

Cabling inspection:

- Check that the cables are firmly connected to their connectors.
- Check that the cables are in good condition and that there are no nearby hazards which could lead to the deterioration of the cables, such as intense heat sources, sharp objects or devices which could impact against or pull on the cables.

Check that the equipment is firmly secured

• Check that the unit is firmly anchored and runs no risk of falling.

DC Circuit breaker

• Check that the circuit breaker is in the ON position.

6.1.2. Hermetic seal

During installation, a check should be made to ensure that the equipment connection operations have not altered the unit's NEMA rating.

Ensure that the connectors are correctly tightened and that the enclosure, and any cable glands, are correctly sealed.

Cover

If the front cover has been opened at any time, anchor it to the unit with its four Allen screws, following the guidelines indicated below:

- Lubricate the screws.
- Manually insert the four screws into their threaded holes.
- Screw down the screws to a maximum torque per screw of 5 Nm (Newton meter) using a calibrated tool.
- Check for airtightness.



CAUTION

The guarantee does not cover damage caused by the inadequate sealing of the equipment.

Whenever the equipment is opened, it is mandatory to lubricate the screws before re-closing in order to prevent the screws from jamming or seizing.

Use the keypad and flat screen to check that the variables monitored have coherent values. It is necessary to adjust the date, time, grid configuration and the grounding type of the equipment.

6.2. Power-up

Once you have made a general visual inspection, checked the cabling and ensured that the unit is sealed correctly, you can then proceed to power up the equipment, whilst maintaining it in the stop position. Follow the guidelines set out in the equipment-specific instruction manual.

When performing the tasks indicated in this point, it is mandatory to ensure that the equipment is sealed, thereby avoiding any possible contacts with live parts without NEMA 3R protection.

6.2.1. Adjusting the settings

To change the date:

- Go to the CHANGE DATE menu.
- Adjust the date and time on the unit's internal clock.

Section "9.7. Change date" explains how to adjust all settings.

7. Preventive maintenance

The recommended preventive maintenance tasks should be performed on an ANNUAL basis, unless otherwise indicated.



CAUTION

Maintenance operations must be carried out by qualified personnel. There is an electrical shock hazard.

All the maintenance checks indicated here must be made with no voltage present in the inverter and in safe handling conditions.



CAUTION

When accessing the various compartments, attention should be paid to the safety recommendations provided in chapter "4. Safety instructions".

7.1. Maintenance tasks

Check the housing condition

A visual inspection should be made of the housing condition, checking the condition of the seals, and cover. A check should also be made to ensure that the equipment is firmly secured to the wall and also to the transformer, if present. Likewise, the housing should be checked for knocks or scratches which could degrade the cabinet and lower its Protection Rating. Should any defects of this nature be observed, then the parts affected should be repaired or replaced.

Check the condition of the cables and terminals

- Check that the cables are laid correctly in order to ensure that they are not in contact with live parts.
- Check the insulation for damage and hot points, inspecting the colour of the insulation and terminals.
- Visually check that the connections are firmly secured.

Check that there is no humidity in the cabinet interior

If moisture is detected, it is essential to dry it up before making the electrical connections.

Check the cabinet anchors

Check that the cabinet components are correctly secured to their corresponding anchors.

Check that the unit is correctly ventilated

To do so:

- Check the condition of the air extraction fans and clean and replace if necessary.
- Clean the radiator fins.
- Clean the ventilation grids.

Check the characteristics of the surroundings to ensure that the buzzing noise is not amplified or transmitted.

Install the equipment in a place that is easily accessible for installation and maintenance work and which offers sufficient space for personnel to operate the keypad, read the display and access the inverter interior.

8. Troubleshooting

This is a guide to help resolve any problems which may arise when installing and operating the INGECON SUN Lite U. You will also find information on how to perform simple component replacement tasks or adjust equipment settings.



CAUTION

Any problems occurring in the INGECON SUN Lite U should be resolved by qualified personnel, observing the general safety conditions set out in this manual.

8.1. LED indications

Some LED indicate a particular problem in the PV installation.

8.1.1. Green LED

This LED should be on when the start-up process and operation is normal, whilst the other LEDs should be off. There are three ON modes.

Flashing every 1 second

This flashing indicates that the PV array is providing sufficient voltage to the inverter for delivering energy, and it is preparing to start-up. In this situation, the inverter checks the grid parameters in order to deliver current to the grid at the exact grid voltage and frequency. This process lasts about 5 minutes.

Flashing every 3 seconds

Flashing every 3 seconds indicates on-hold status due to low radiation. This alarm is triggered when the PV array is not receiving sufficient radiation to provide the inverter with the minimum voltage required to deliver energy to the grid. This situation is typical between sunset and sunrise or at a time when rain, clouds or other atmospheric phenomena cast a dark shadow over the PV array area.

If this situation occurs on a day which is not particularly dark, check that the panels are clean and correctly connected.

LED remains on

The inverter is connected to the grid.

8.1.2. Orange LED

This LED indicates that an inverter alarm has been triggered.

Flashing every 0.5 seconds

The external fan is not functioning correctly.

Check that no foreign bodies have got into the fan and are preventing it from rotating. Check that the air supply to the fan is sufficient.

Flashing every 1 second

The internal fun is not functioning correctly.

Contact Ingeteam Inc

Flashing every 3 seconds

Inverter auto-limitation, due to the fact that it has reached the maximum allowable temperature.

In this situation, check that the fans are operating, that the air inlets and outlets are free from obstacles and that there are no intense heat sources close to the inverter. If the error persists, contact Ingeteam Inc

LED remains on

This LED indicates that an alarm has been triggered in the inverter. Listed below are some of the alarms which could indicate a problem in the inverter and which can be checked and/or corrected:

0400H Manual Stop

The inverter has been manually stopped. Check that the manual shutdown has not been enabled and, if it has, go to the display and remove it.

0001H Vin out of range

0002H Grid frequency out of range

0004H Grid voltage out of range

The most likely reason is a Grid power failure. Account should be taken of the fact that the alarms are added together. Therefore, when this failure occurs, the alarm shown will be 0006H, resulting from the sum of 0002H + 0004H.

When it returns to normal, the inverter will start functioning again. If this is not the case, check the Grid connection lines.

If the grid quality parameters are adequate, then check the grid connection lines.

If the error persists, contact Ingeteam Inc

OO2OH DC circuit insulation failure

This can be due to one of three causes:

- Insulation failure in the panel circuit.
- The thermal fuse varistor has been triggered.
- The differential current or default current protective device has been triggered.



CAUTION

An insulation failure can be life threatening.

An Insulation Failure must be repaired by qualified personnel.

Procedure to determine the exact cause of the insulation failure:

• Check that the insulation failure is not in the panel circuit by disconnecting the various panel strings from the circuit.

- If feasible, connect the inverter to another panel circuit which is functioning correctly.
- If the failure persists, measure the voltage between each string in the panel array and ground.

• If the voltage measured is constant and approximately coincides with the open circuit voltage, then there is an ground fault in that string. This needs to be checked for each string.

• If the failure persists after correcting the ground faulty, then the thermal fuse - varistor protection needs to be checked.

For the following check, pay particular heed to the following warning notice:



CAUTION

The inverter houses electric capacitors which can maintain high temperatures, even after the inverter has been disconnected from the panels and grid. After disconnection, always wait 30 minutes before opening the unit.

Procedure for determining the cause of the insulation failure:

1. Disconnect the panel circuit from the inverter.

2. Open the inverter, heeding the safety warnings contained in this section, and treating the operation as a Manipulation procedure by applying the rules for Manipulation operations set out in section *"4. Safety instructions"*.

3. Remove the varistors.

4. Use a multi-purpose tester to check that there is a high impedance at the varistor terminals and continuity at the thermal fuse terminals. Should this not be the case, any thermal fuse - varistors which are not compliant, should be replaced.

- 5. If the problem persists and the check is correct, then contact Ingeteam Inc
- 6. Correctly mount the three varistors in position before closing the equipment.

8.1.3. Red LED

When this LED remains on, it indicates that the inverter is in manual stop status.

To change to start, make it manually, because the Start or Stop status will not change even if there is an inverter power failure.

Select *Start/Stop* option and press OK to change between start and stop.

17:32	06/05/12
MAIN MENU	
Change date	
Start/Stop	
Partial Data Reset	
Change inv number	

The display shows the following message:

17:32	06/05/12
START/STOP	
Change to Start (OK) Cancel (ESC)	

Click again OK to confirm the option selected.

9. Operating the display

The INGECON SUN Lite U inverters are equipped with a <code>«Screen + Keypad»</code> unit for communication with the installer and user.

This interface displays the principal internal parameters and the settings for adjusting the entire system during installation.

The parameters, variables and commands are organized into a structure of menus and sub-menus.



9.1. Keypad and LEDs

The keypad comprises the following four keys:

- **ESC Escape.** To exit the parameter edit mode, to exit a menu and return to a higher level, to cancel a change or cancel a proposal.
- \wedge

Up. To scroll up a list of parameters or folders within the same level, or to increase the value of an editable parameter by one basic unit.



OK

Down. To scroll down a list of parameters of folders within the same level, or to decrease the value of an editable parameter by one basic unit.

OK. To validate a parameter change, to access a lower level menu, to confirm a change or accept a proposal.

There are three LEDs on the faceplate, as follows:



Green LED

- Flashing every 1 second: start-up process.
- Flashing every 3 seconds: on-hold status due to low radiation.
- On: inverter connected to the grid.

Orange LED

- Flashing very 0.5 seconds: the external fan is not functioning correctly.
- Flashing every 1 second: the internal fan is not functioning correctly.
- Flashing every 3 seconds: the inverter is limiting the power due to high temperature.
- On: an alarm has been triggered.

Red LED

On: manual stop.

9.2. Display

The top line shows the current date and time. The internal clock automatically makes the change from summer to winter time.

The central lines display the instant values for the solar array voltage, power delivered by the inverter and the grid voltage and frequency.



9.3. Main menu

The main menu is structured into the following sub-menus:

17:32	06/05/12	17:32	06/05/12
MAIN MENU		MAIN MENU	
Monitoring Configuration Language Change date		Change date Start/Stop Partial Data Reset Change inv number	

Monitoring	Displaying the values for the principal parameters and internal variables, providing details as to the equipment operating status.
Configuration	This menu offers the possibility of changing various firmware parameters in order to adapt the inverter to different operating conditions.
Language	This menu allows the user to select an available language.
Change date	To change the inverter date and time.
Start/Stop	This menu serves to manually run or stop the inverter operation.
Partial Data Reset	To zero the data stored in Part E, Tp con and Npcon.
Change inv number	This menu makes it possible to assign an identification number to the inverter within the PV array.

9.4. Monitoring

Access is by selecting and then clicking on OK the *Monitoring* menu:

The variables displayed in this menu are organized into seven screens. You can move from one screen to another using the \frown and \frown keys.

17:32 06/05/1	2	17:32		06/05/12
MAIN MENU		MONITORIN	G	
Monitoring Configuration Language Change date		Pout Vac Iac Fac PhiCos	5000 W 239 V 21.83 A 49.89 Hz 0.998	

Listed below is a description of the variables in each particular screen.

Screen 1

Pout	Power (W) delivered by the inverter to the Electric Grid.
Vac	Output voltage (V) of the inverter at the Electric Grid connection.
lac	Inverter output current (A).
Fac	Current output frequency to the Electric Grid (Hz).
PhiCos	Cosine of phi. This is the cosine of the phase angle existing between the grid voltage and the current delivered by the inverter.
	If there is no phase angle (0°), the cosine of phi is 1; $\cos 0^\circ = 1$.

Screen 2

Vdc	Voltage delivered by the solar panels to the inverter.
ldc	Current delivered by the solar panels to the inverter.

Screen 3

Alarm Inverter alarm status. The installer has all the instructions for how to act for each specific alarm. Only the alarms mentioned in this manual can be of use to the user.

	0000H	No alarms.		
	0001H	Insufficient input voltage.		
	0002H	Grid frequency out of range.		
	0004H	Grid voltage out of range.		
	0008H	Overcurrent at the Inverter Bridge.		
	0010H	Overcurrent at the DC/DC converter.		
	0020H	Insulation failure.		
	0040H	Grid overcurrent.		
	0080H	Over heating		
	0100H	Bus over voltage.		
	0200H	Configuration change.		
	0400H	Manual Stop.		
	0800H	HW bug.		
	1000H	Grid instantaneous over-current.		
	2000H	Detection of islanding.		
	4000H	Grid impedance out of range.		
	8000H	Hardware Failure Alert.		
	The value displayed for this inverter alarm variable can be the result of the (hexadecimal) sum of two or more of the variables listed above.			
	For examı (0002H +	ble: alarm inverter 0006H means that the Grid Frequency and Voltage are out of range 0004H).		
InvNum	The numb to identify	mber assigned to the inverter through the menu that can be accessed from the display in order tify the communications.		
Code1	The equip	ipment operating code. It may be requested by the Ingeteam customer service.		
Code2	The equip	e equipment operating code. It may be requested by the Ingeteam customer service.		
SN	The serial number.			
Screen 4				
TotE	Total energy (kWh) delivered by the inverter to the Power grid since it was shipped from the factory. The recording of the inverter serial number marks the start of the energy log.			

T con The number of hours that the inverter has been connected to the Power grid.

NumCon The number of grid connections made during operating hours.

Screen 5

Screen 6	
Npcon	The number of grid connections made since the last counter reset.
Tp con	The number of hours that the inverter has been connected to the Power grid since the last counter reset.
Part E	Total energy (kWh) delivered by the inverter to the Power grid since the last counter reset.

FW Ver	Inverter firmware version.
DFWVer	Inverter display firmware version.
D. Boot	Firmware boot version.

9.5. Configuration

Enables verification of certain parameters for which the inverter has been configured. Access restricted to installer.

Press OK on the *Configuration* option in the *Main menu*. Giving access to the following screen:

17:32	06/05/12
MAIN MENU	
Monitoring Configuration	
Language Change date	

17:32	06/05/12
CONFIGURATION	
Country/Normative Grid voltage	
Grounding Other adjustments	



CAUTION

Do not change any of these parameters if you are not the installer and you are not completely sure. Ingeteam Inc accepts no liability for damage to the unit or the installation due to configuration changes.

The menu will display only the configurations corresponding to the device hardware.

The various available configuration changes are described below.

9.5.1. Country/Normative



17:3206/05/12COUNTRY/NORMATIVECountryNORTH-AMERICAStandardU1741

In this equipment this setting is not configurable.

9.5.2. Grid voltage

17:32	06/05/12
CONFIGURATION	
Country/Normative Grid voltage Grounding Other adjustments	_

17:32		06/05/12
GRID	VOLTAGE	
277 208 240 240 240	WYE D. 120 WYE SPLIT PHASE D. 120 STINGER DELTA	

This menu serves to modify the configuration of the voltage output to the terminal strips.

Access is by selecting and then clicking on OK the *Grid voltage* menu.

The variables displayed in this menu are organized into two screens.

17:32		06/05/12
GRID	VOLTAGE	
240 208 240 208	DELTA DELTA DELTA CG DELTA CG	

You can move from one setting to another using the keys. Then, press ok to confirm your selection.

17:32	06/05/12
GRID VOLTAGE	
208 D. 120 WYE CONTINUE?	
Confirm (OK) Cancel (ESC)	

Press \fbox{OK} again to confirm your selection or \fbox{ESC} to cancel it.

9.5.3. Grounding (only units with a transformer)

This menu is used to configure the status of the positive and negative poles with respect to ground. It allows three options, which are:

- Positive pole grounded, negative pole insulated.
- Negative pole grounded, positive pole insulated.
- Positive and negative poles insulated.

Press OK on the *Grounding* option from the *Configuration* submenu.

The following screen will appear showing the three available options. Select the desired option using the \frown and \frown keys, then press OK.

17:32	06/05/12
GROUNDING	
> Ungrounded PV+ Ground PV- Ground	

The next screen will request the password to make the change. Enter it and press OK.

The configuration in process screen will appear for a few seconds and then the configuration completed screen.

Finally, the following screen will be shown advising of the need to check that the necessary measures on the wiring have been taken for the new configuration.



17:32 06/05/12
GROUNDING
WARNING Be sure to make the neces sary wiring connections
QUIT (ESC)

9.5.4. Other adjustments

This option it is not available in this equipment.

06/05/12

CONFIGURATION

17:32

Country/Normative Grid voltage Grounding Other adjustments

9.6. Language

Once the monitoring menu *Language* has been selected, click on OK to access the language menu:

The language can be changed through this menu. The and keys can be used to select the desired language. To select, position the cursor over the desired language and click once on OK

Click on OK once more, to confirm the language selected.





LANGUAGE SEL	ECTION
Language Continue?	ENGLISH
	ОК

9.7. Change date

This menu can be used to change the current time and date. The internal clock automatically changes between summer and winter time.

Each time the OK key is pressed, the top of the display flashes in the following order: hour; minutes; day; month; and year, to show the present value.

Use the up and down keys \frown and \frown respectively, to change the value of any part of the time or date. By clicking on $\bigcirc K$ when the year is flashing, the new date and time are changed. The following message is then displayed:

Click on OK once more, to confirm the selection.

17:32 06/05/12 MAIN MENU Monitoring Configuration Language Change date

17:32 CHANGE DATE

Confirm (OK) Cancel (ESC)

9.8. Start/Stop

This menu can be used to manually start or stop the operation of the inverter.

The Start or Stop status will not change even if the power supply to the inverter is cut off.

06/05/12

MAIN MENU

17:32

Change date

Start/Stop Partial Data Reset Change inv number

Click on OK to change from one status to the other. The following message will be displayed:

Select the desired option and click again on OK.

The stop status is maintained until the menu is accessed once more.

	06/05/12
(OK)	
	(OK)

9.9. Partial Data Reset

This menu serves to zero the partial counters: Part E, Tp con and Npcon.

Click on OK to zero the counters. The following message will be displayed:

17:32	06/05/12
MAIN MENU	
Change date Start/Stop	
Partial Data Reset	
Change inv number	

Click on OK once more, to confirm the selection.

17:32		06/05/12
PARTIAL DAT	A RESET	
Confirm (O Cancel (ES)	K) C)	

9.10. Change inv number

This menu is used to assign a number to the inverter. This is necessary during the configuration of the communications.

Use the up and down keys and respectively, to change the inverter number.

Click on \bigcirc to confirm the number selected.

This menu serves to assign a number to each inverter phase. This is required to configure the communications.

Click on \bigcirc for the phase whose number is to be changed.

17:32	06/05/12
MAIN MENU	
Change date Start/Stop Partial Data Reset	
Change inv number	

17:32	06/05/12
CHANGE INV NUMBER	
Inverter number 101 Confirm (OK) Cancel (ESC)	

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