Ingeteam

# INGECON® SUN STORAGE 100TL

Technical guide for installations

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# 1 INGECON SUN STORAGE 100TL

The INGECON® SUN STORAGE 100TL, hereinafter ISS 100TL, is a bidirectional battery inverter that presents the same technology as photovoltaic devices. It is designed for commercial, industrial and large-scale storage systems.

### Lower operational costs

Thanks to the Wireless communication network that can be established with the ISS 100TL, the storage system can be commissioned, monitored and controlled without cables. In addition, it can be replaced fast and easy and without qualified technicians assistance.

### Greater flexibility and power density

High maximum DC voltage ratings (1100V) and wide input voltage range (570-850 V). High power density, with 100kW in only 75 kg inverter.

### Robust and durable design

Aluminium enclosure specially designed for indoor and outdoor installations (IP65). The design of the 3Play family guarantees maximum durability over time and the best performance, even in extreme temperatures.

### Ethernet and Wi-Fi

This battery inverter features Ethernet and Wi-Fi communications by default. These communications, together with the webserver that integrates the equipment, allow a fast and reliable start-up using a mobile phone, a Tablet or a laptop PC. In addition, it is compatible with external Cloud Connect.

### Hybrid systems solar + batteries

This inverter can be used in the following types of installations:

- Industrial self-consumption
- Electrical vehicle charging point
- External manager

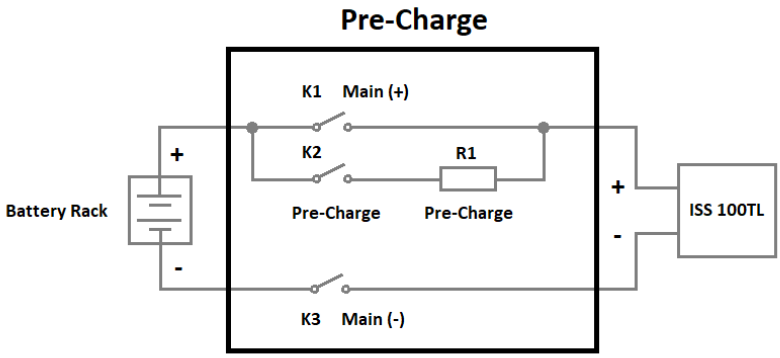
This document shows the recommended diagrams for these installations, as well as explanations related to each one.

Figure 1: INGECON SUN STORAGE 100TL (ISS 100TL)

### Connection batteries-inverter

A pre-charge is needed to be connected between this inverter and the batteries.

This pre-charge circuit limits the current necessary to charge the bus capacitor during the start up process, avoiding peaks of current that could damage the internal electronics of the inverter. The circuit is disabled after 2 seconds by closing contactor K1, time to charge the bus capacitor. The recommended values of the pre-charge resistance R1 is 100Ω 250W.




### Technical notes

This device can´t be used in Stand Alone installations.

# 2 Functionalities

## 2.1 EMS Inside

Starting with FW version ABS1009_J, INGECON SUN STORAGE 100TL devices have the EMS functionality available in their own FW. In this way, for new installations it will not be necessary to have the INGECON SUN EMS device. Their functionality and control strategies are the same.

### 2.1.1 EMS Basic strategy parameters

#### Public Grid Profile

- **Standard.** This option sets the exchange power with the grid stablished on Grid Power Target Parameter.
- **Phase compensation.** With this option, the consumption of the installation is computed, as the sum of the consumption measured in the three phases, and the photovoltaic inverters will try to generate power to compensate this consumption. This may generate exporting power in one phase, while consuming in other.
- **RD244/2019 Annexed 1.** This option must be selected only in Spain, in case the installation must fulfil the Cero Exporting regulation RD244/2019 Annexed 1.

#### Photovoltaic limitation

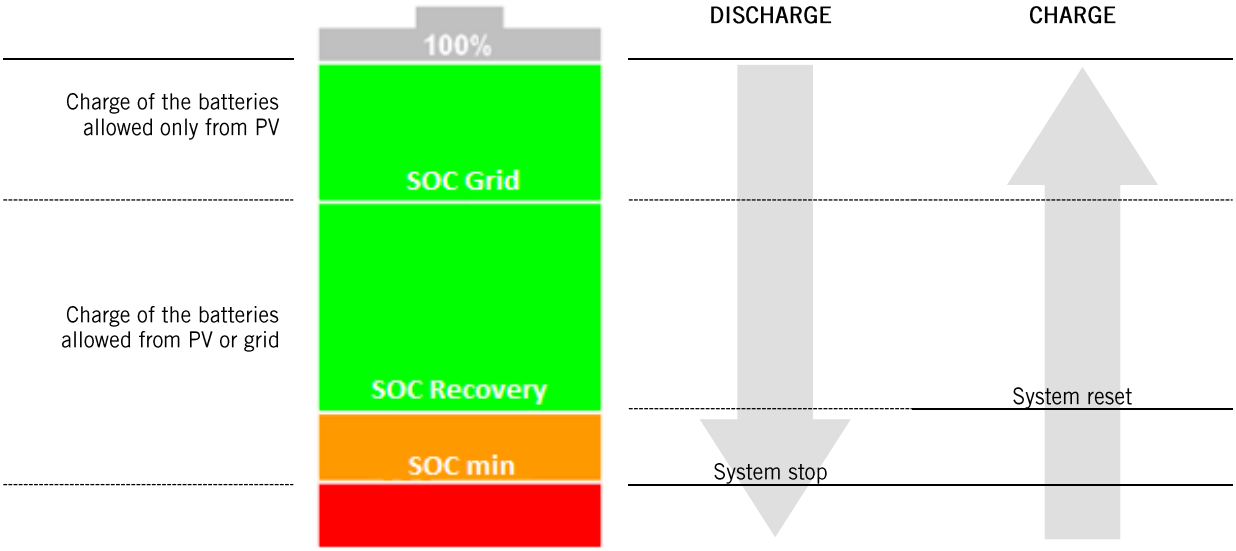
If no limit photovoltaic production according to the grid profile, the photovoltaic production will be the maximum available i.e. MPPT mode.

#### Peak-shaving

Minimum grid consumption value to activate the battery discharge. The battery discharge setpoint will be set as the difference of this parameter and the grid peak consumption.

## Battery SOC levels

- **SOC Minimum (%)**
  Minimum battery level. This value will be the minimum state-of-charge percent value. Once reached, the battery stops being discharged. See manufacturer recommendation.
- **SOC Maximum (%)**
  Maximum battery level. This value will be the maximum state-of-charge percent value. Once reached, the battery stops being recharged.
- **SOC Grid (%)**
  Maximum level that the battery can reach when charging only from grid. Once reached, the battery will only continue charging from photovoltaic energy until it reaches the level of maximum SOC.
- **SOC Recovery (%)**
  Once SOC minimum is reached, the energy supply from the battery is not restarted until this level is reached. This prevents excessive battery cycling, extending their working life.




## Charge from grid schedule

To ensure the battery SoC level, the user can define one or two charging periods.

## Discharge schedule

To save storage energy, the user can define one or two discharging periods. The battery will only be discharged during those periods.

# 3 Accesories

## 3.1 INGECON SUN EMS

INGECON SUN EMS is a control and communication device that manages the energy flow in the installation. It sends instructions to the different inverters based on the values read in a wattmeter placed at the connection point.

Figure 2 INGECON SUN EMS

The configuration of the device through INGECON SUN Monitor allows choosing the control strategy, as well as configure the different elements of the installation.

In an installation of several devices, the communication between the inverters and the INGECON SUN EMS recommended to be done by Ethernet. The INGECON SUN EMS communicate by Ethernet with the wattmeter.

Commercial Reference in Attachment II. References.

# 4 Types of installations

## 4.1 Industrial self-consumption

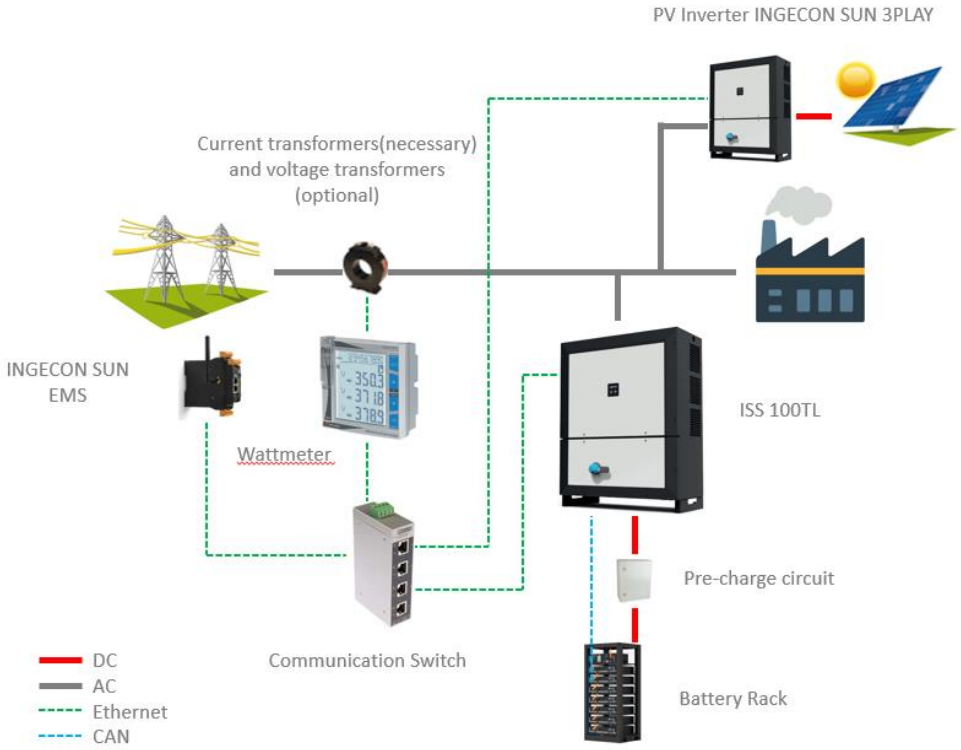
An industrial self-consumption is a system connected to the grid that seeks to minimize grid consumption and to increase self-supply. To do so, it is fitted with photovoltaic generation and storage components.

These kinds of installations allow the parallelization of ISS 100TL devices (check the parallelization section).

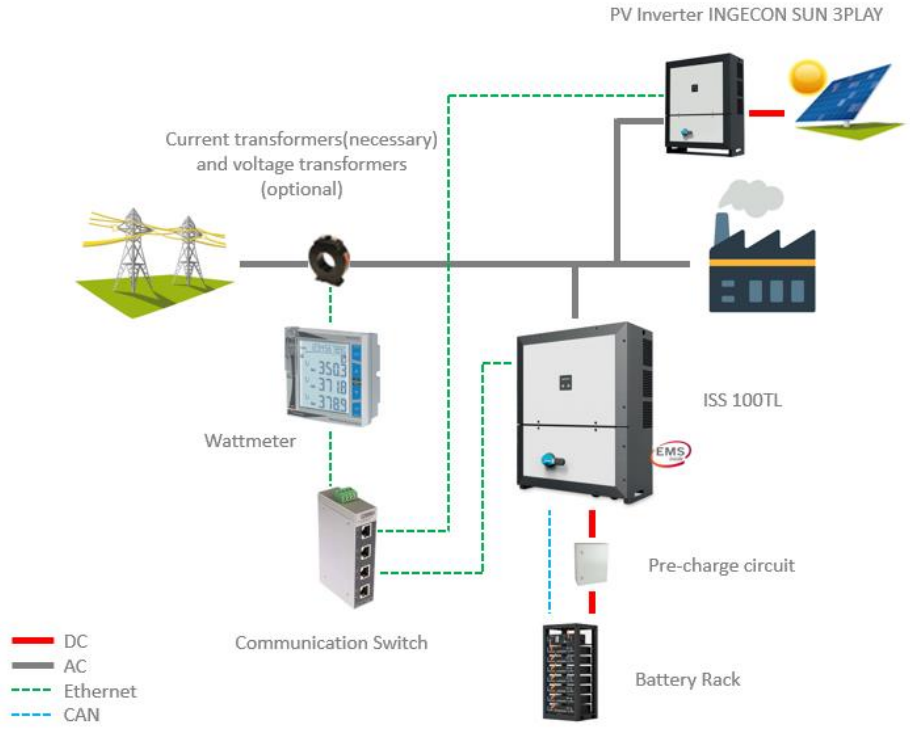
Installation components:

- Rack of batteries
- Pre-charge circuit, it should be incorporated in the battery or between the battery and the inverter (not supplied by Ingeteam)
- Inverter INGECON SUN 100TL
- INGECON SUN EMS for 100TL or ISS 100TL with EMS Inside
- Power meter (check the approved power meter list)
- Current transformers (necessary) and voltage transformers (optional)
- Inverter(s) INGECON SUN 3Play Photovoltaic (optional, up to a maximum of seventy-five devices in the installation between photovoltaic and storage inverters)

Current transformers are necessary for the wattmeter to perform an indirect measurement because currents are greater than 65A. Voltage transformers will be necessary in facilities that want to measure incoming and outgoing currents directly at medium voltage. Ingeteam does not supply these transformers.




Industrial self-consumption installation with INGECON SUN EMS




Industrial self-consumption installation with INGECON SUN EMS Inside

## Operating mode

Photovoltaic energy is used as a priority to supply consumption and charge the battery. Injection to the grid of photovoltaic surpluses is configurable by the user.

If the photovoltaic energy is not enough to supply consumptions, the battery provides the rest.

If the sum of photovoltaic and batteries energy is not enough, the grid provides the rest.

The time schedule for charging batteries from grid is configurable by the user. During this schedule, the battery will be charged from grid until it reaches SOC Grid. Once reached, if there are photovoltaic surpluses, the battery will keep charging and once it reaches SOC maximum, battery charge will be disable.

In the same way, the time schedule for discharging the battery is configurable by the user. During this schedule, once the system reaches SOC Min, power supply from the battery will not be resumed until SOC Recovery state is reached. In this way, excessive cycling of the battery is avoided, extending the useful life of the batteries.

This operating mode also allows installations without photovoltaic generation. It means, installations that only include energy storage in batteries.

## 4.2 Electric vehicle charging point

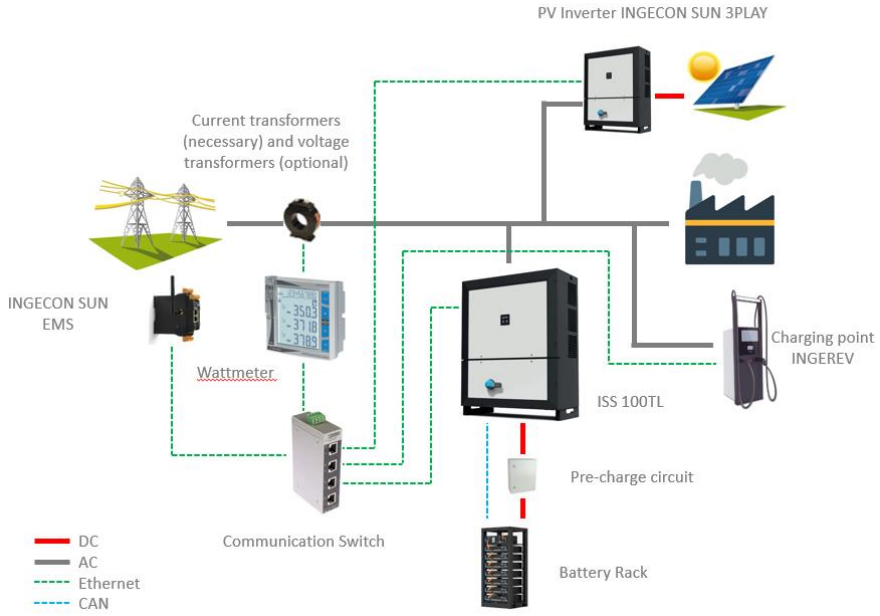
An electric vehicle recharging point is that system connected to the grid whose main objective is to reduce the consumption produced by electric vehicles charging point.

These kinds of installations allow the parallelization of ISS 100TL devices (check the parallelization section).

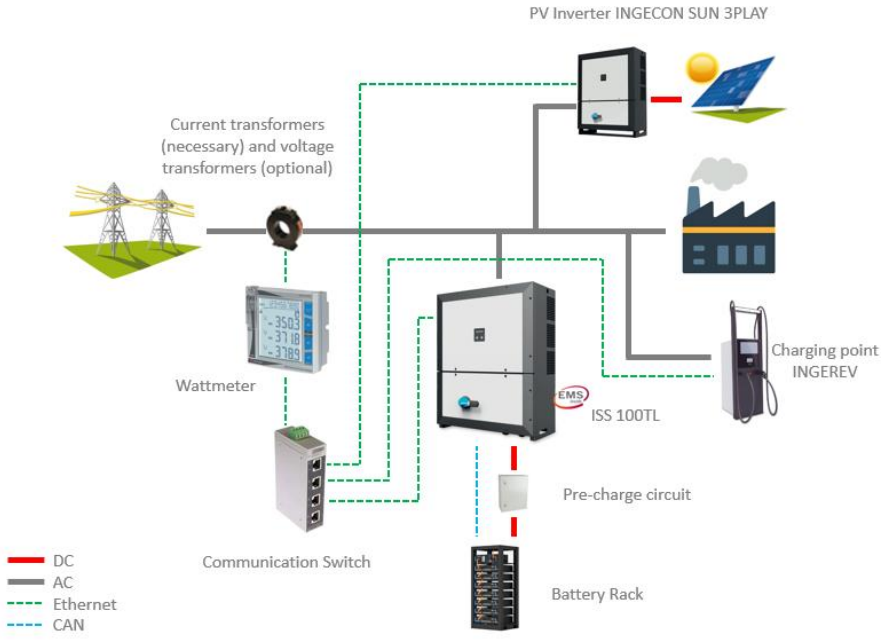
Installation components:

In addition to the elements described in the previous point, we must add:

- Charging point INGEREV




Electric vehicle Charging Point with INGECON SUN EMS




Electric vehicle Charging Point with INGECON SUN EMS Inside

## Operating mode

In this type of installations, the electric vehicle charging control strategy is based on sending to the charging point the power available that can use to distribute among the vehicles that are connected. This limit is the result of subtracting from the maximum power value that can be consumed from the grid, the power that is currently being consumed (discounting the part of consumption that is due to charging electric vehicles) and adding the available battery power (if its SOC is above SOC Min).

**Available Power sent by EMS =**

**(1) Maximum Power available for Vehicle Charger**

**-**

**(2) Plant Consumption (Excluding Vehicle Charger Consumption)**

The charging point takes this available power, that distributes, based on its programming parameters, between the electric vehicles that are connected.

The management of photovoltaic production (if there is installed) and storage follows the basic strategy known as optimization of the self-consumption ratio. This strategy prioritizes the use of photovoltaics to power local loads and then the electric vehicle. Injection to the grid of photovoltaic surpluses is configurable by the user.

This strategy uses the stored energy to feed all the consumption of the local loads that are not fed by the photovoltaic inverter. This is true if the power of the battery inverter is enough, and there is power left in the batteries.

If the installation has energy available, photovoltaic or batteries, the power consumed from the grid will be reduced, leaving most of the grid power available for recharging the electric vehicle. Therefore, the strategy gives higher priority to recharging the electric vehicle than to save stored energy for later use.

This operating mode is only available with INGEREV recharging points.

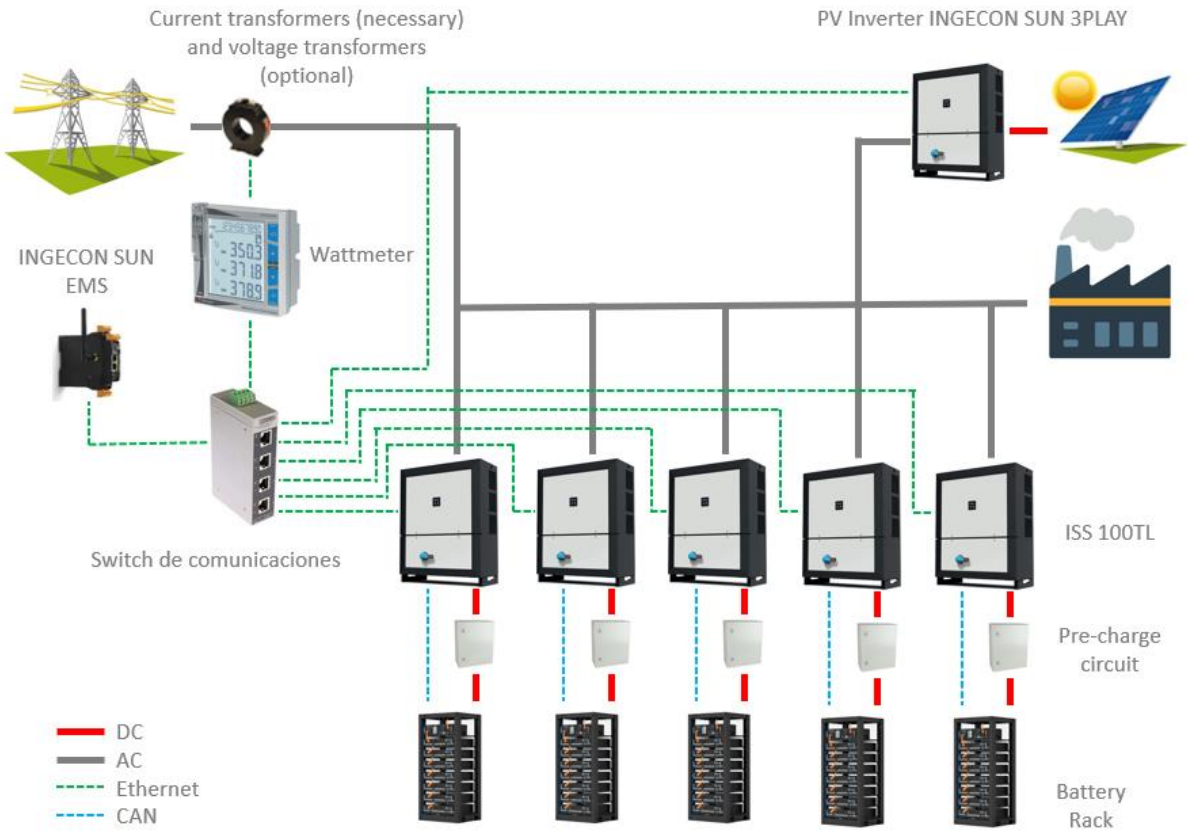
# 5 Parallelization

This section describes the operation, as well as the requirements to carry out an installation with several INGECON SUN STORAGE 100TL devices (hereinafter ISS 100TL).

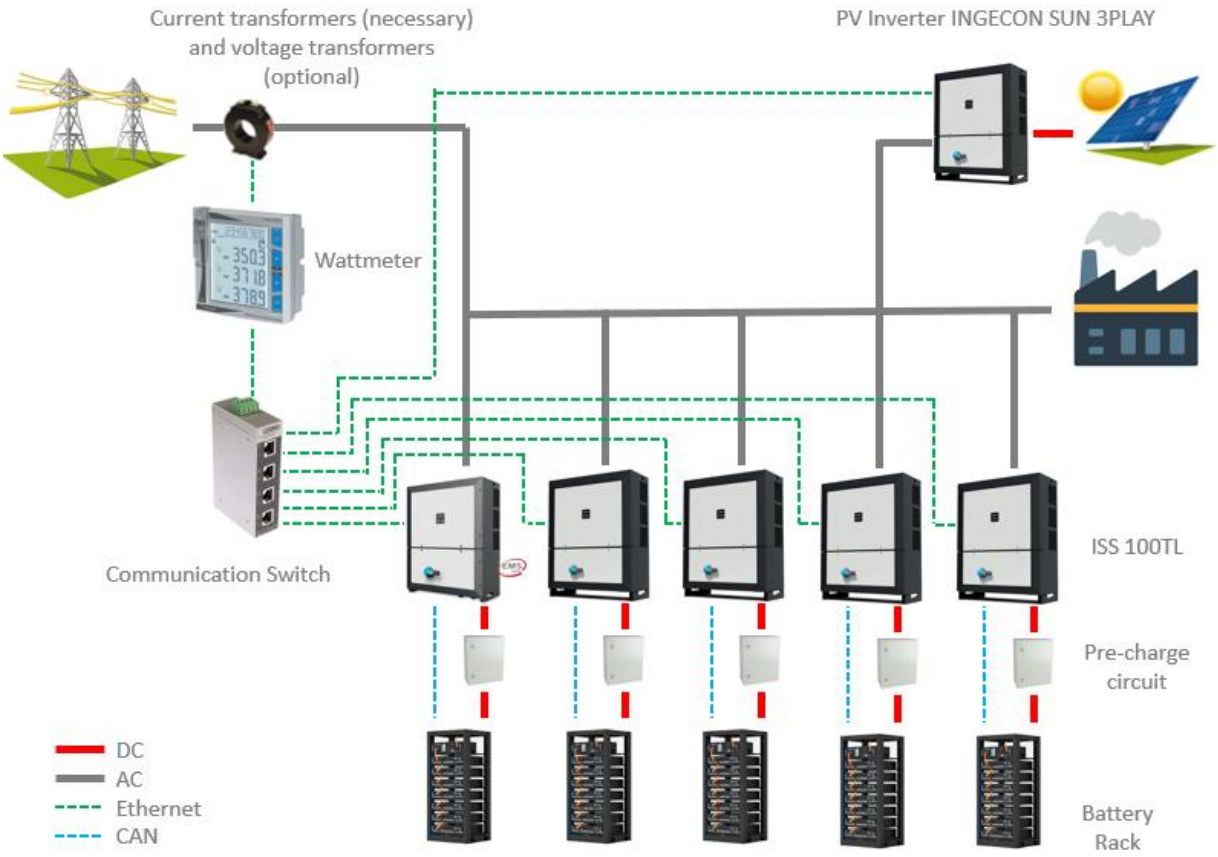
Installation components:

- Rack of batteries (one for each ISS 100TL)
- Pre-charge circuit, it should be incorporated in the battery or between the battery and the inverter (one for each ISS 100TL, not supplied by Ingeteam)
- Inverter INGECON SUN 100TL (up to a maximum of twelve)
- INGECON SUN EMS
- Power meter (check the approved power meter list in the web)
- Current transformers (necessary) and voltage transformers (optional)
- Inverter(s) INGECON SUN 3Play Photovoltaic (optional, up to a maximum of seventy-five devices in the installation between photovoltaic and storage inverters))

Current transformers are necessary for the wattmeter to perform an indirect measurement because currents are greater than 65A. Voltage transformers will be necessary in facilities that require measure at medium voltage. Ingeteam does not supply these transformers.




Industrial self-consumption with INGECON SUN EMS (example with five inverters ISS 100TL)




Industrial self-consumption with INGECON SUN EMS Inside (example with five inverters ISS 100TL, one with EMS Inside functionality activated)

## Operation mode

The operation mode is the same as the previous one, where the photovoltaic energy is used as a priority to supply consumption and then charge the battery. Injection to the grid of photovoltaic surpluses is configurable by the user.

If the photovoltaic energy is not enough to supply consumptions, the battery provides the rest. In case, the sum of photovoltaic and batteries energy is not enough, the grid provides the rest.

Parallelization of ISS 100TL inverters allows the management of a maximum of twelve battery inverters in the same installation. The algorithm divides the setpoint between the battery inverters to optimize the system and maintain the batteries with the same percentage of SOC (state of charge).

The configurable parameters apply to each of the inverters one by one. If one of the batteries reaches the maximum SOC but the rest do not, charging will stop only for the battery that has reached it, allowing each of the batteries to be optimized. In the same way, if one of the batteries reaches its minimum SOC and the rest do not, only the battery that has reached it will stop.

This operating mode also allows installations without photovoltaic generation. It means, installations that only include energy storage in batteries.

## 5.1 Limitations

### Maximum number of devices

- The algorithm can manage up to a maximum of seventy-five devices per installation (sum of photovoltaic and storage devices.
- The maximum number of ISS 100TL per installation is twelve.

### Batteries characteristics

All the batteries of the installation must meet the following characteristics:

- Same capacity

### Operating specifications

- It is only available for On Grid installations.
- It can´t be done in installations with diesel groups.
- The parallelization is made in AC side, it is not possible to connect more than one battery to the same ISS 100TL.
- The strategy parameters will be the same for all the inverters in the installation. It is not possible to configure different schedules for each of the inverters.
- The sense of the current of all the inverters will always be the same. It is not possible for one inverter to be discharging it battery and another charging it. All the ISS 100TL will be either charging or discharging the batteries.

# 6 Attachment I. Links

Detailed wiring diagrams and further information about the operation modes can be downloaded at the following link:

https://www.ingeconsuntraining.info/?page_id=30541

# 7 Attachment II. References

Commercial references of the products:

- Self-consumption KIT INGECON SUN EMS + Wattmeter AAX5018