INGECON SUN STORAGE 1PLAY TL M

Technical guide for installations with

INGECON SUN STORAGE 1Play TL M

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1 INGECON SUN STORAGE 1Play TL M

The INGECON® SUN STORAGE 1Play TL M hybrid inverter makes it possible to combine photovoltaic generation and energy storage with no need for any additional PV inverters.

Dual MPPT system

This inverter features a dual maximum power point tracking (MPPT) system, that allows it to draw the maximum power from the PV array, including roofmounted installations with different orientations or with partial shading.

EMS Inside

The inverter is equipped as standard with an energy management system (EMS). The EMS permits more advanced functionalities, such as self-consumption. Thanks to the built-in EMS, the installation can be monitored at all times via a PC or mobile phone with the free INGECON®SUN Monitor application, available at Play Store and App Store.

Start-up and monitoring

Fast and easy start-up and display of data and graphics through the integrated user interface. Furthermore, users can easily upgrade the inverter firmware from the application, through a PC, tablet or mobile. The inverter is equipped by default with Wi-Fi and Ethernet communication.

PV + battery hybrid systems, grid-connected and stand-alone

This equipment can be used in the following type of installations:

- Self-Consumption installations
- UPS installations
- Stand Alone installations

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

The ISS 1Play TL M inverter doesn´t allow for active poles (positive or negative) to be grounded in PV panels or batteries. It is compatible with TT and TN grounding system.

Figure 1: INGECON SUN STORAGE 1Play TL M

2 Types of installations

2.1 Self-consumption installations

A self-consumption installation 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. The inverter has the possibility of operating just from the PV array and of adding the storage system at a later date.

An additional *Battery-Backup* function can be activated in this type of installation, to activate the *Battery-Backup* function it is necessary to have a battery bank or PV panels. Although, it is possible to activate the backup function from PV (without battery); however, it is recommended the use of batteries to ensure the supply of the critical loads. The INGECON SUN photovoltaic inverter is disconnected to the grid and it doesn't supply energy. The non-critical loads are not fed. For TT installations, the inverter connects the neutral of the critical loads to ground through its internal grounding relay.

Installation components:

- Photovoltaic panels.
- Battery bank. Recommended for *Battery-Backup.*
- ISS 1Play TL M inverter.
- External wattmeter. Check the "List of approved Power Meter for ISS 1Play TL M", available in the Ingeteam webpage. (In case of use the internal wattmeter of the inverter, consult the "Installation and Operation Manual" of ISS 1Play TL M, available in the Ingeteam webpage).
- INGECON SUN photovoltaic inverter (optional). To increase the photovoltaic power of the installation.
- Electric vehicle charger (optional). Consult the "List of EV chargers compatible with the ISS 1Play TL M", available on the Ingeteam webpage.

This inverter is equipped with the *AC Bypass* functionality, it is only available when the PV panels or the battery bank supply the inverter. With this functionality if the grid is available and the *Battery-Backup* function activated, in the event of an alarm or firmware update, the loads will be powered from the grid (*AC Bypass* closed). In case of manual stop, through the button of the inverter, the *AC Bypass* will be opened. The inverter must be supplied from the DC side, battery or PV.

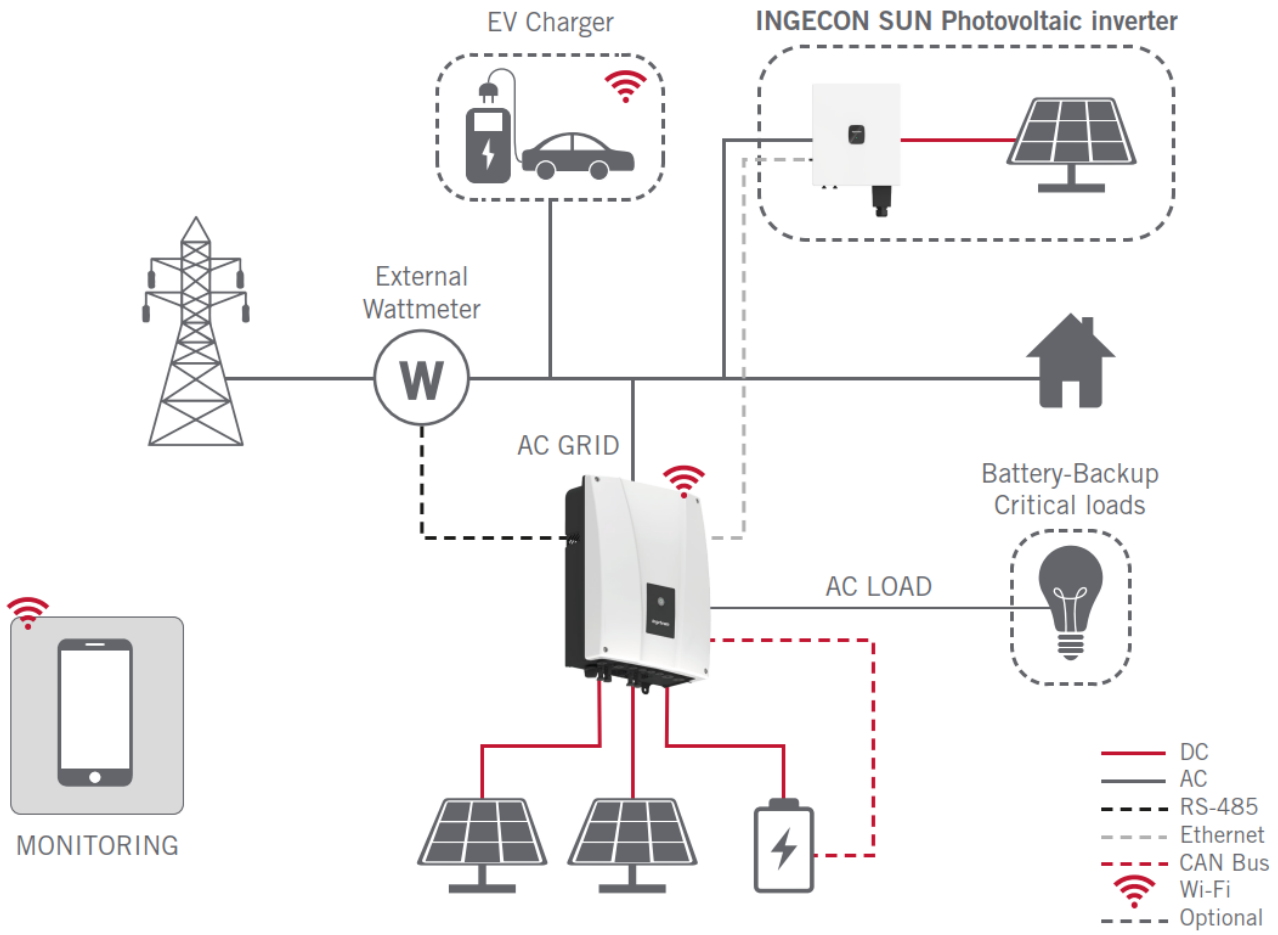


Figure 2: Self-consumption installation

Multi-Battery AC Coupling

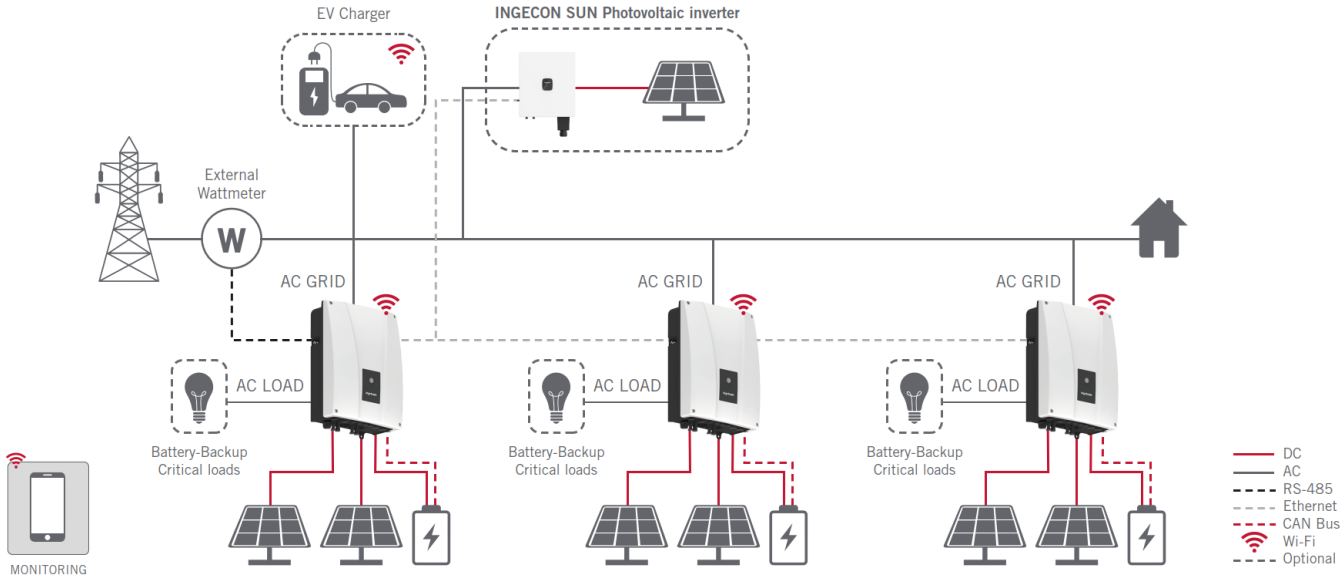
Now, with the innovative multi-battery management incorporated in the EMS Inside, it is possible connecting up to **3 ISS 1Play TL M units** in an AC coupling, with a total of 18 kW of single-phase AC power.

Each ISS 1Play TL M manages its own battery, which can be combined with low-voltage (LV) and high-voltage (HV) batteries in a single installation. This provides great flexibility when expanding the installation's storage capacity.

Thanks to the artificial intelligence (AI) incorporated in the EMS Inside, it is possible to manage batteries of different capacities (kWh) in a single installation. The EMS will decide the optimal way to charge each battery, either from its own solar system or even by taking advantage of the surplus solar energy from other existing ISS 1Play TL M and IS 1Play units.

The charging and discharging rate of each battery will depend on the SOC, the battery capacity (kWh), and the solar power available at the facility, this ensures that all batteries perform similarly optimizing their lifespan.

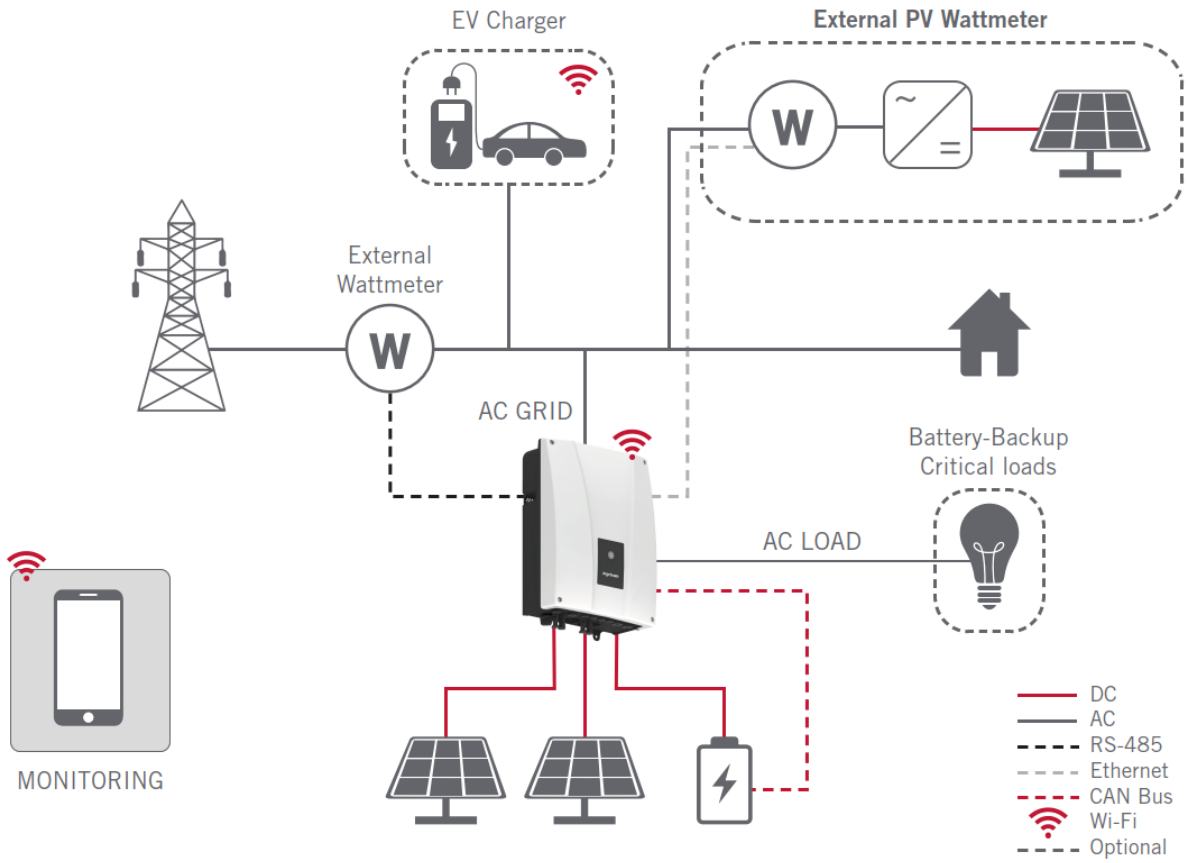
In the event of a grid failure, the **Battery-Backup** function must be activated **individually** on each desired ISS 1Play TL M, with **independent** critical load circuits (parallelizing backup outputs is not possible).



External PV Wattmeter

In situations where a non-Ingeteam solar installation already exists and the ISS 1Play TL M is desired to be incorporated to manage the self-consumption installation with battery, it is possible to leverage the existing solar generation to charge the batteries and monitor it in conjunction with the ISS 1Play TL M.

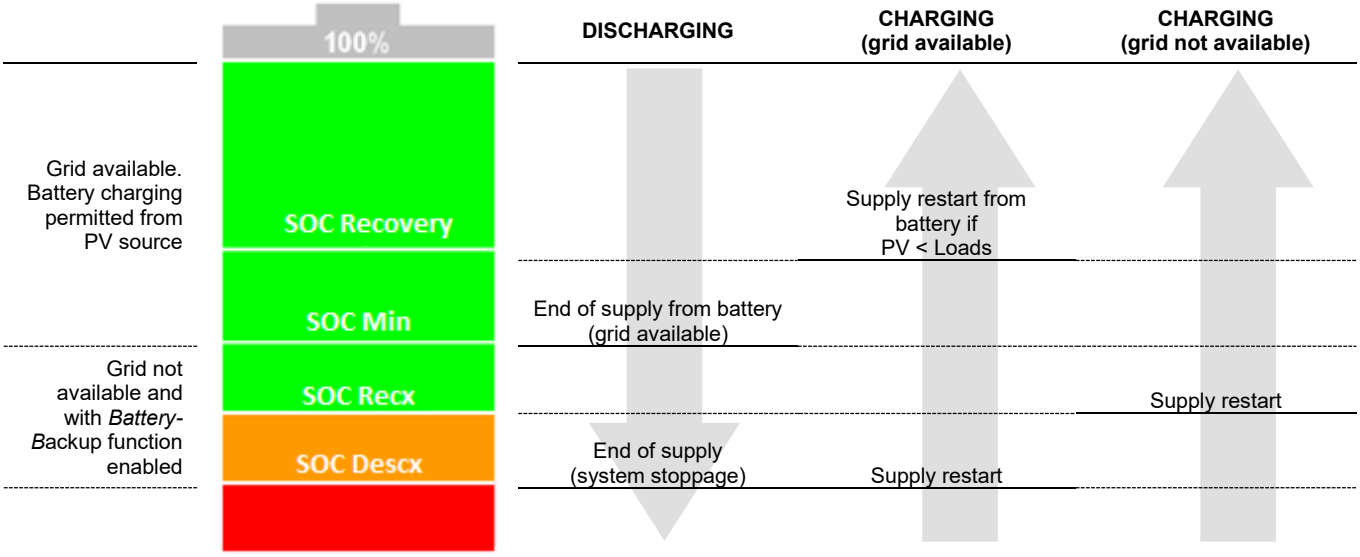
To do this, it is necessary to add a compatible meter to the non-Ingeteam solar installation that communicates via Ethernet with the ISS 1Play TL M.



Operating mode

The EMS of the ISS 1Play TL M manages the energy flows in the installation in line with the following principles:

- If the grid is available, it operates in the same manner as a self-consumption installation:
    - Photovoltaic energy is used as a priority to supply loads and to charge the battery. Grid supply of photovoltaic surplus is user configurable.
    - If the photovoltaic energy is insufficient to power loads, the battery provides the remainder.
    - If the sum of photovoltaic and battery energy is not enough to power the loads, the grid provides the remaining power.
    - Once the SOC Min value set by the user has been reached, the energy supply from the battery is not restarted until SOC Recovery is reached. This prevents excessive battery cycling, extending their working life.
    - The schedule for battery charging/discharging from the grid is user configurable.
    - The schedule for battery charging from the PV is user configurable. This allows the battery charge to be shifted during peak production hours photovoltaic and thus optimize the injection of surpluses into the grid.
    - Using an inverter compatible EV charger allows the user to configure from where you want to charge the car: only from photovoltaic or from the residential battery more photovoltaic.
- If the grid is not operational and the *Battery-Backup* function is activated, only the ISS 1Play TL M powers the critical loads until the battery is completely flat (SOC Descx). At this point, the critical loads are no longer powered until the grid is available once again of until SOC Recx is reached using photovoltaic energy of the ISS 1Play TL M. The INGECON SUN photovoltaic inverter is disconnected to the grid and it doesn't supply energy.


100%
SOC Recovery
SOC Min
SOC Recx
SOC Descx
DISCHARGING
CHARGING (grid available)
CHARGING (grid not available)
Grid available. Battery charging permitted from PV source
Grid not available and with Battery-Backup function enabled
Supply restart from battery if PV < Loads
End of supply from battery (grid available)
Supply restart
End of supply (system stoppage)
Supply restart

2.2 UPS installations

A UPS (Uninterruptible Power Supply) installation is a system connected to the public grid that is used as back up in the event of a power cut. In this case, the installation acts in a similar manner to an uninterrupted power supply system.

This type of installation is typical in grids that present frequent interruptions or in the case of critical loads for which the power supply cannot be interrupted.

In the case of a power cut, the ISS 1Play TL M inverter internally disconnects the installation from the grid and provides the necessary power for the critical loads from the batteries. For TT installations, the inverter connects the neutral of the critical loads to ground through its internal grounding relay.

The batteries remain charged while grid electricity is available and the photovoltaic energy is used to supply the loads, reducing energy consumption from the grid. Grid supply of photovoltaic surplus is user configurable.

The response time of the system to a power cut is 10ms, which means that a power cut is imperceptible for most loads.

Installation components:

- Photovoltaic panels (optional).
- Battery bank.
- ISS 1Play TL M inverter.
- Non-critical loads. These are loads that, in the event of a power cut, do not need an uninterrupted power supply. These loads are connected upstream from the ISS 1Play TL M. Hence, in the event of a power cut, they are disconnected to increase the number of hours of autonomy. Even with photovoltaic surplus and charged batteries, these loads will not be powered by the ISS 1Play TL M. In installations where the power of the loads is lower than that of the ISS 1Play TL M, the non-critical load installation is optional. In installations where the power of the loads is higher than that of the ISS 1Play TL M, non-critical loads must be disconnected until the remaining loads are below the power of the ISS 1Play TL M.

This inverter is equipped with the *AC Bypass* functionality, it is only available when the PV panels or the battery bank supply the inverter. With this functionality if the grid is available, in the event of an alarm or firmware update, the loads will be powered from the grid (*AC Bypass* closed). In case of manual stop, through the button of the inverter, the *AC Bypass* will be opened. The inverter must be supplied from the DC side, battery or PV.

Although the INGECON SUN STORAGE 1Play TL M provides an extra current during load connection transients such as motors, INGETEAM recommends the use of frequency drives with this type of load for the installation to work properly in UPS mode.

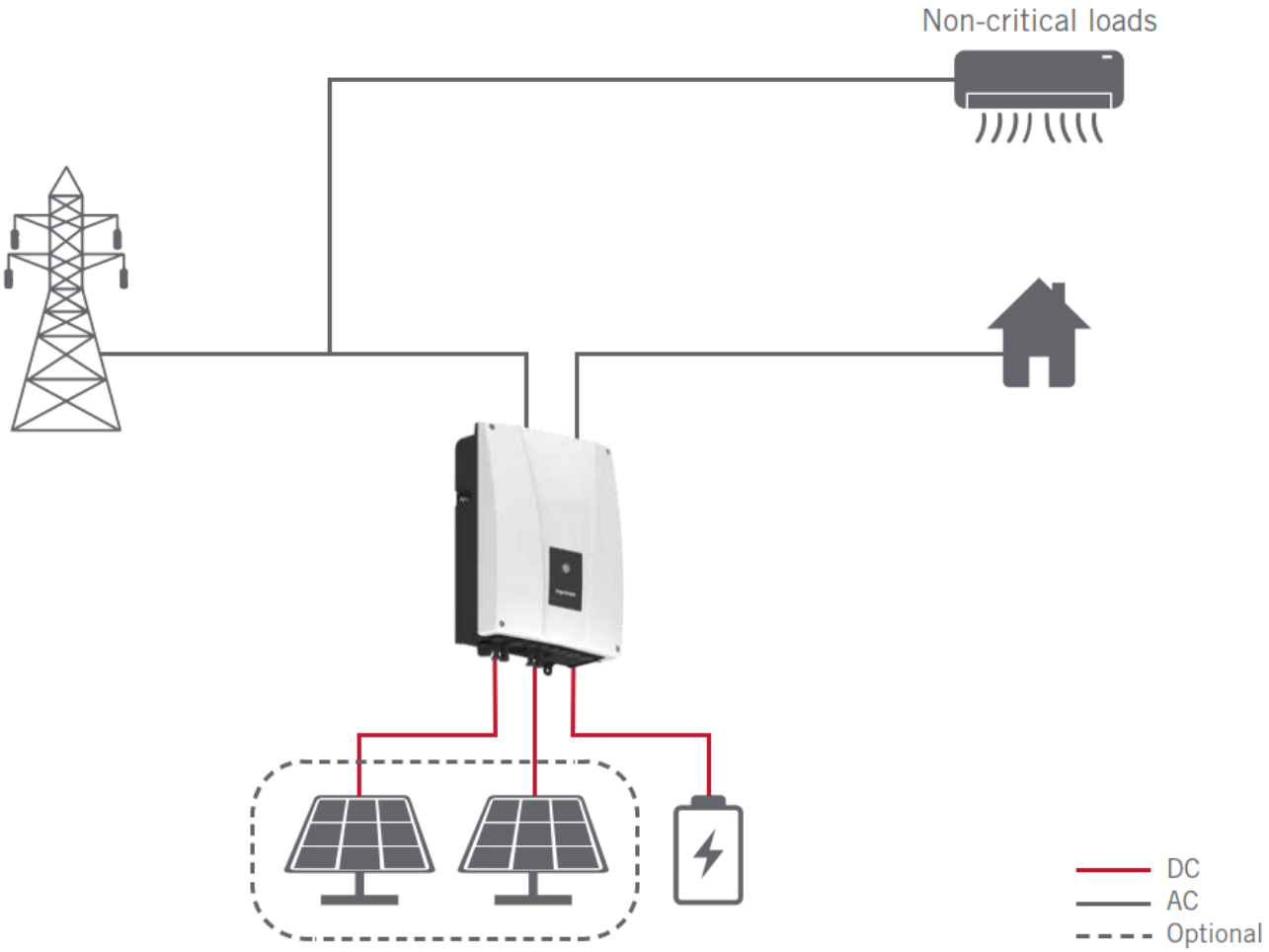
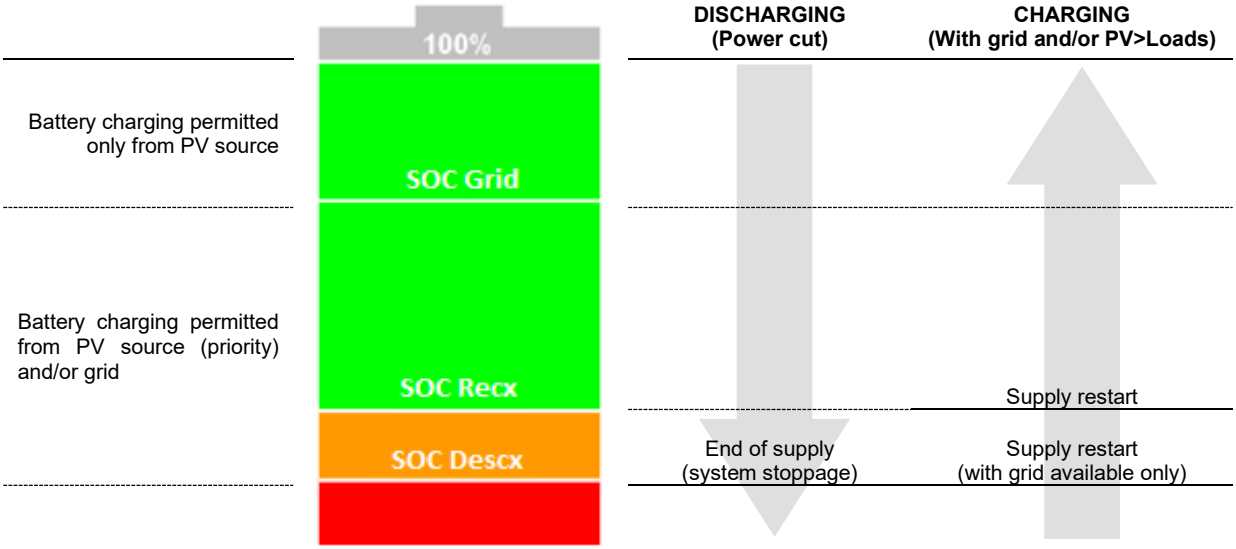


Figure 3: UPS installation

Operating mode

The ISS 1Play TL M manages the energy flows in the installation in line with the following principles:

- When the grid is operational, the priority is to keep the batteries fully charged SOC Grid so that they can be used as back-up when required. Loads and the battery, if it must be charged, are supplied with photovoltaic energy as a priority.
    - When photovoltaic energy is used to supply the loads or charge the batteries, there is a reduction in grid consumption.
    - In the event of surplus photovoltaic energy, the user can decide whether to supply the grid or limit photovoltaic production through the configuration.
- If the grid is out of service, the ISS 1Play TL M disconnects the installation from the grid and provides energy to the loads from the batteries until they get discharged SOC Descx. At this point, the loads are no longer powered until the grid is available once again of until SOC Recx is reached using photovoltaic energy of the ISS 1Play TL M.


100%
SOC Grid
SOC Recx
SOC Descx
Battery charging permitted only from PV source
Battery charging permitted from PV source (priority) and/or grid
DISCHARGING (Power cut)
CHARGING (With grid and/or PV>Loads)
Supply restart
End of supply (system stoppage)
Supply restart (with grid available only)

2.3 Stand-alone installations

A stand-alone installation is a system disconnected from the public grid that provides AC. energy to a set of loads.

Installation components:

- Photovoltaic panels.
- Battery bank.
- ISS 1Play TL M inverter.
- Support diesel genset (optional) 6500W max, that is connected in the case of an energy deficit.

This inverter is equipped with the AC bypass functionality, it is only available when the PV panels or the battery bank supply the inverter. With this functionality if the diesel genset is available, in the event of an alarm or firmware update, the loads will be powered from the diesel genset (AC bypass closed). In case of manual stop of the inverter, the AC bypass will be opened.

Although the INGECON SUN STORAGE 1Play TL M provides an extra current during load connection transients such as motors, INGETEAM recommends the use of frequency drives with this type of load to avoid transient voltage drops (2-3 seconds) during their connection.

Technical notes:

- The power of the loads must under no circumstances be above the rated power of the inverter.
- If the battery is lead-acid, the capacity must be at least C10 ≥ 5x P_{PV}/V_{batt} to ensure stable operation of the system. For lithium batteries, consult the capacity limitation with the battery manufacturer.

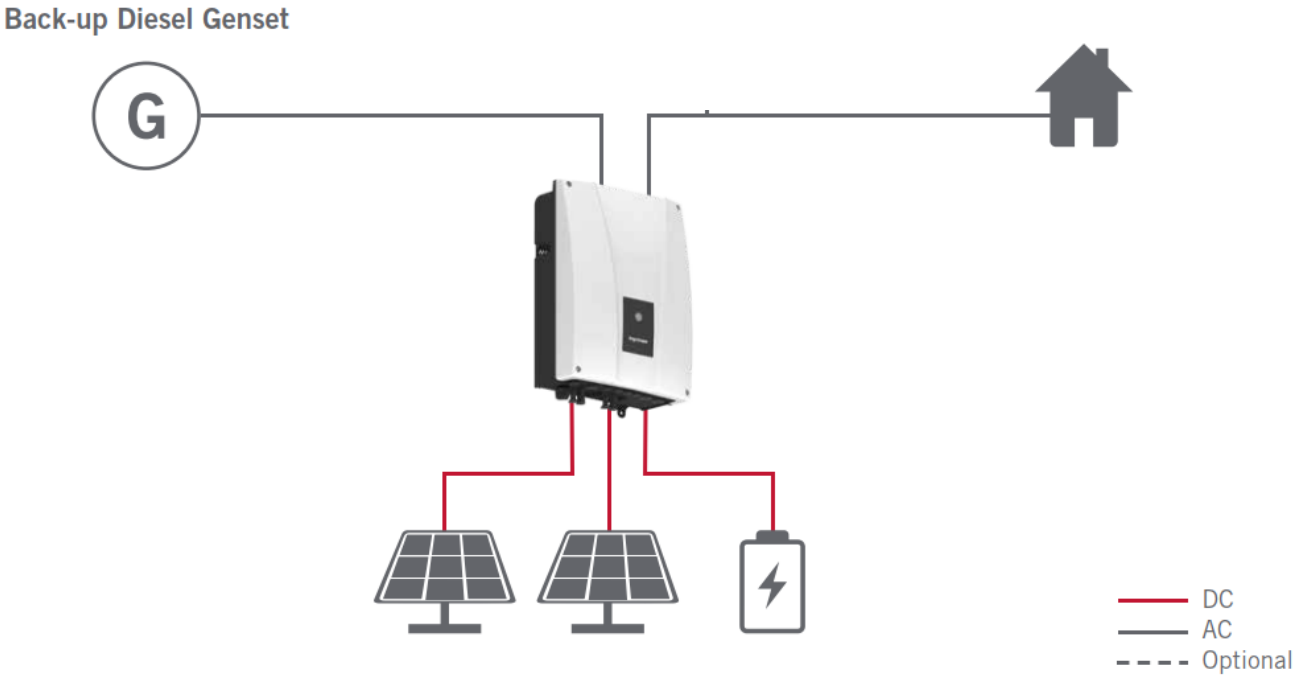
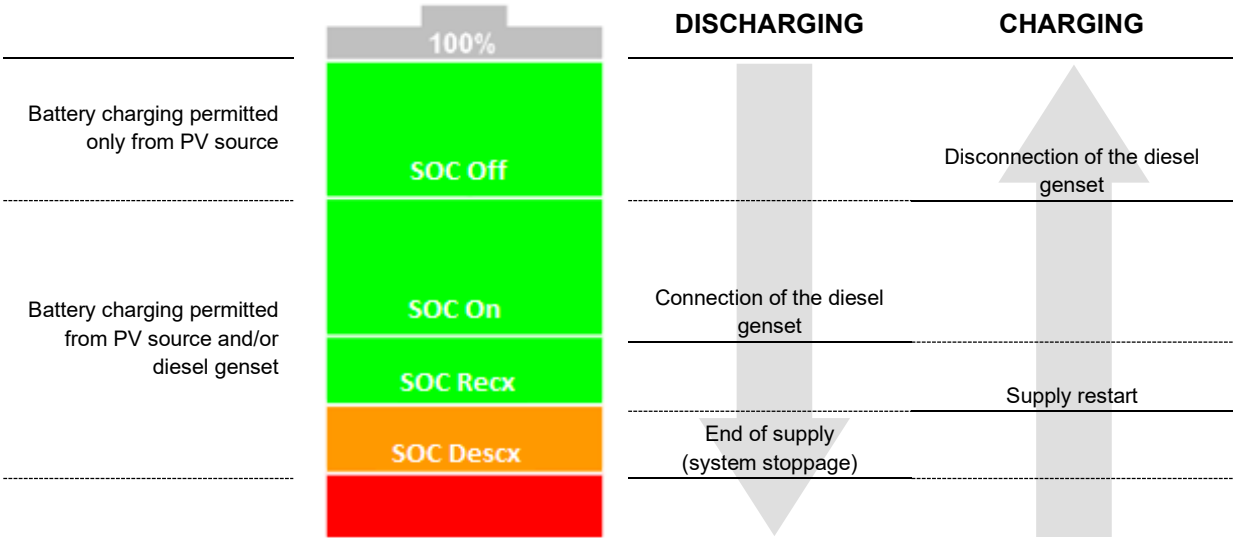


Figure 4: Stand-alone installation

Operating mode

The ISS 1Play TL M manages the energy flows in the installation in line with the following principles:

- Photovoltaic energy is used as a priority to supply loads and to charge the battery.
- If the photovoltaic energy is insufficient to power loads, the battery provides the remainder.
- If the state of charge (SOC) of the battery reaches a minimum value established by the user SOC On, the diesel genset will be connected. It will remain connected until the battery reaches the SOC Off.
- If the diesel genset is not operational, the ISS 1Play TL M powers loads until the battery is completely flat (SOC Descx). At this point, the loads are no longer powered until SOC Recx is reached using photovoltaic energy of the ISS 1Play TL M.