



Feed-in management with Fronius Tauro

How to regulate and control PV systems while taking account of feed-in limits and external control

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Solar Energy

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1 FEED-IN MANAGEMENT WITH MULTIPLE INVERTERS

If the grid operator requests a feed-in limit (e.g. maximum power of feeding in must not exceed 70% of the total PV generator output), appropriate output control measures must be put in place to ensure that the corresponding parameters are adhered to at the grid feed-in point.

To provide the optimum levels of feed-in management for a PV system with multiple inverters, it is essential that communication between the installed system components is functioning correctly. What is especially important in terms of the specifications issued by grid operators (e.g. zero feed-in) is that the control response of the inverter is precise.

Fronius Tauro inverters have an integrated energy and feed-in management system, paving the way for efficient system design. Power reduction is implemented in both the software and hardware and provides a straightforward way of satisfying and implementing the grid operator's specifications.

Automatic communication between individual inverters (I2I) does not exist at market launch.

PV systems with multiple Fronius inverters are designed and controlled differently according to the type of requirement of the grid operator.

This document examines the various scenarios and requirements of grid operators, and the interaction between multiple inverters of the same product family and within mixed systems (e.g. Fronius Tauro + Fronius SnapINverter). The following sections offer solutions for a variety of grid requirements.



1.1 SOLUTION A – Simple power reduction of an individual inverter

In systems containing multiple Fronius inverters, just reducing the power of a single inverter by installing a **Fronius Smart Meter** at the grid connection point may, under certain circumstances, suffice to meet the power limitation requirements.

The requirements will be met if the following formula applies:

$$0\% \text{ of } P_{INV1} + 100\% \text{ of } P_{INV2} + 100\% \text{ of } P_{INV3...} \leq \text{feed-in limit}$$

This means that if it is possible to reach the specified feed-in limit by reducing the power of a single inverter in the system to $\geq 0\%$, solution A can be used.

Example: A system contains 3 inverters: one Fronius Tauro 100 kW and two Fronius Tauro 50 kW
The specified feed-in limit at the transfer point must not exceed 100 kW

Solution: The output power of the Fronius Tauro 100 kW can be lowered to 0% to meet the feed-in limit requirement. The power levels of the two other inverters are not reduced and can continue to feed-in without any restrictions.

If reducing the power of a single inverter to 0% of the output power is not enough for the system to meet the feed-in limit, then solution B (see page 6) must be used.

1.1.1 Feed-in limiting according to PV generator output

The following scenario involves a PV system with two inverters. The grid operator has issued strict instructions regarding the maximum permitted power that can be fed into the grid.

PV generator output: 200 kWp

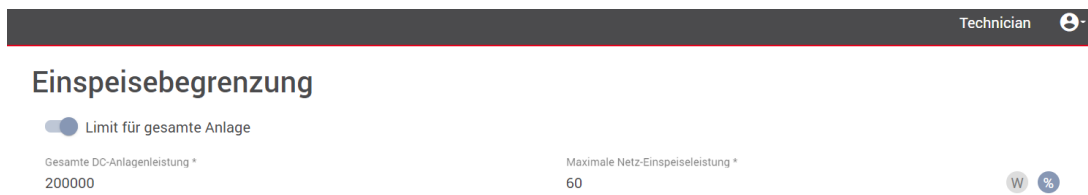
Overdimensioning: 0%

Nominal inverter output: Inverter 1 = 100 kWac, Inverter 2 = 100 kWac

Feed-in limit: max. 60% of PV generator output

Solution:

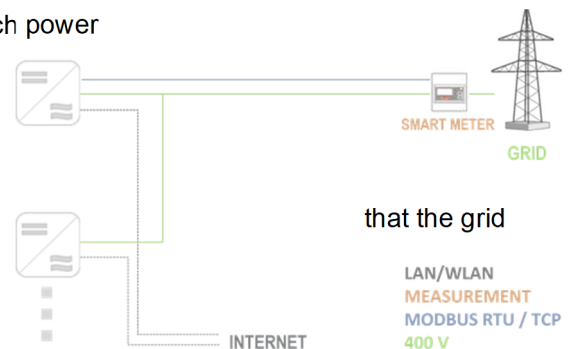
- / With maximum irradiation and at full power, only 120 kWp (200 kWp x 60%) may be fed into the grid
- / Setting on inverter 1: max. feed-in 120 kWp at transfer point



- / Setting on inverter 2: no special settings

Once this setting has been made, inverter 2 can feed in as much power as required, whereas inverter 1 is limited by a Fronius Smart Meter at the grid connection point and, when inverter 2 is operating at full power, would feed in 20 kWp.

This simple control algorithm in the Fronius inverters ensures operator's specifications can be satisfied.



1.1.2 Feed-in limit according to nominal inverter output

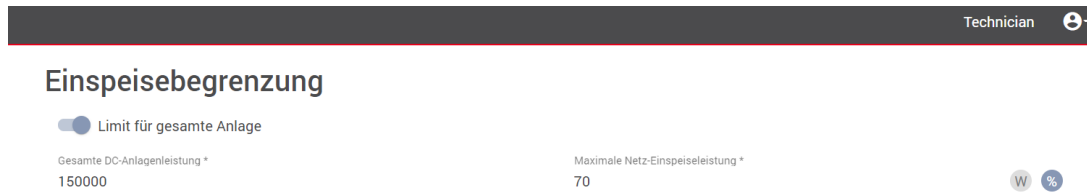
The following scenario involves a PV system with two inverters. The grid operator has issued strict instructions regarding the maximum permitted power that can be fed into the grid.

Nominal inverter output: Inverter 1 = 50 kWac, Inverter 2 = 100 kWac

Feed-in limit: max. 70% of nominal inverter output

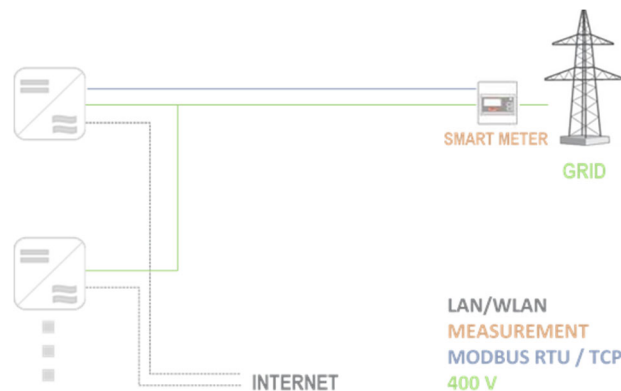
Solution:

- / With maximum irradiation and at full power, only 105 kWac (150 kWac x 70%) may be fed into the grid
- / Setting on inverter 1: max. feed-in 105 kWac at transfer point



- / Setting on inverter 2: no special settings

Once this setting has been made, inverter 2 can feed in as much power as required, whereas inverter 1 is limited by a Fronius Smart Meter at the grid connection point and, when inverter 2 is operating at full power, would feed in 5 kWac.



This simple control algorithm in the Fronius inverters ensures that the grid operator's specifications can be satisfied.

1.1.3 System monitoring with Fronius Solar.web

The multidirectional communication ability of the inverters enables Fronius Solar.web to analyse and monitor not only the functions of an individual device, but also the complete system. If a system contains inverters from different product families (e.g. Fronius Tauro + Fronius SnapINverter), the system will be developed on the basis of one of the two communication units integrated in Solar.web. The second inverter in the configuration is added as an additional data source.

1.2 SOLUTION B – INTEGRATION OF A PLANT CONTROLLER

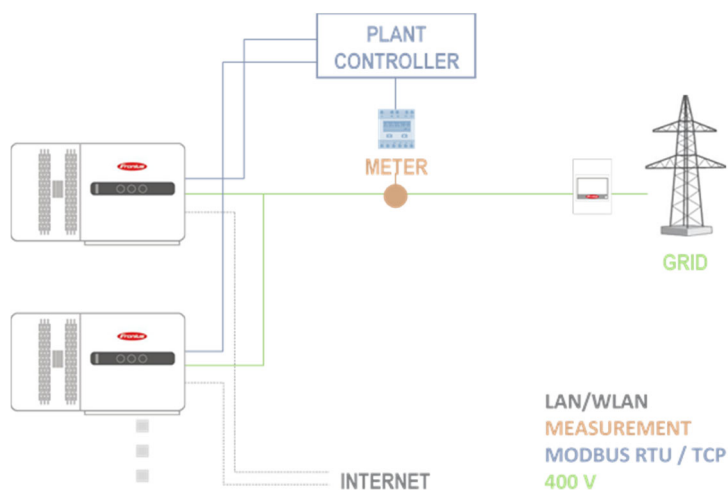
Situations where the grid operator demands more than just the usual power reduction require the use of a plant controller.

This solution is used if the specifications set out by the grid operator cannot be met by limiting a single inverter and/or permanent access (e.g. remote shutdown or remote control) is required. In such instances we recommend the integration of a plant controller from *SolarLog*, *Meteocontrol* or *Gantner*.

Plant controllers allow tailored solutions to be developed for commercial systems. In addition to satisfying the requirements of the grid operator and the fact that these plant controllers can be easily integrated into Fronius systems, this solution offers the system operator the following advantages:

- / Ability to centrally control and monitor the commercial system
- / Grid-compliant feed-in management
- / Communication possible with grid operator
- / Guaranteed safety functions (e.g. remote shutdown)
- / Secure data communication to direct marketers (e.g. in Germany)

Solution:



You will find a detailed technical summary of this solution in the *plant controller solution sheet*



1.2.1 System monitoring with Solar.web

A Fronius Smart Meter can be installed to take advantage of the benefits of Fronius Solar.web in addition to those of the monitoring function offered by the plant controller system. Integrating a Fronius Smart Meter ensures that the consumption and feed-in data of the PV system is visualised in Fronius Solar.web and is available for analysis purposes.

2 SAMPLE SCENARIOS

The following sections look at various sample scenarios involving one or more inverters and reveal the most appropriate solution in each case. These scenarios are restricted to PV systems with one or more inverters from the same product family. They also explain how to proceed in the case of mixed systems using inverters from different Fronius series.

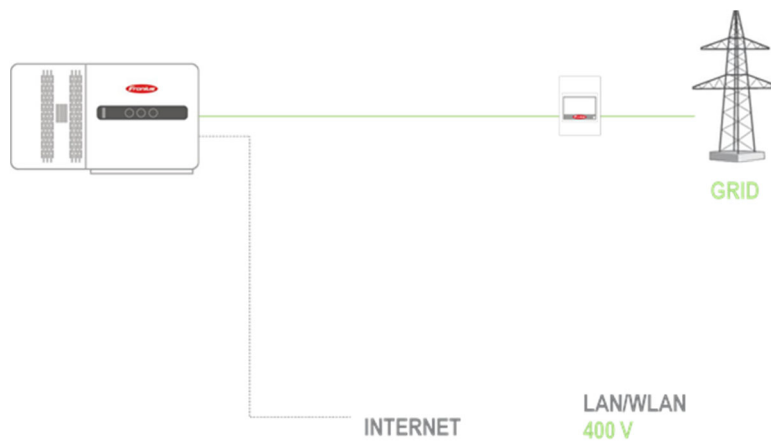
2.1 Systems with inverters from the same product family

The following sample scenarios look at PV systems using inverters from the same series (e.g. Tauro + Tauro) where particular requirements exist.

2.1.1 Single Fronius Tauro

✗ External control

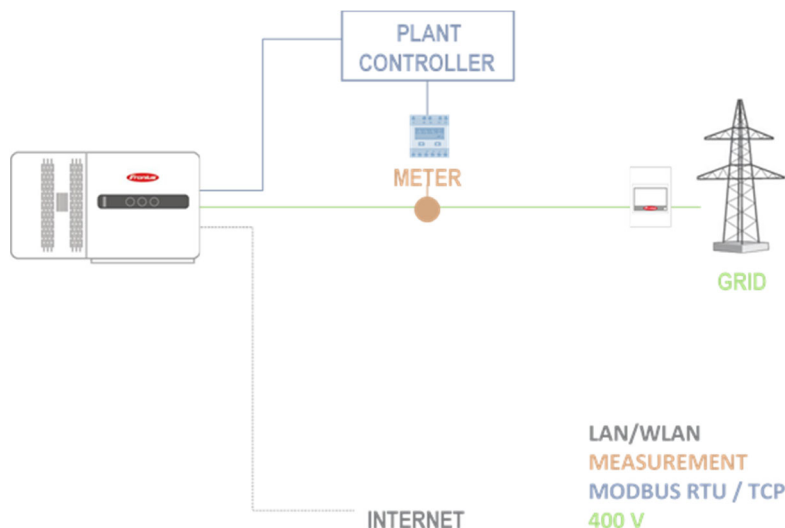
There is just one Fronius Tauro in a PV system and the grid operator is not expected to impose any particular requirements. In this case, no additional equipment needs to be added or settings made on the inverter. The installation proceeds **as normal**.



2.1.2 Single Fronius Tauro

✓ External control

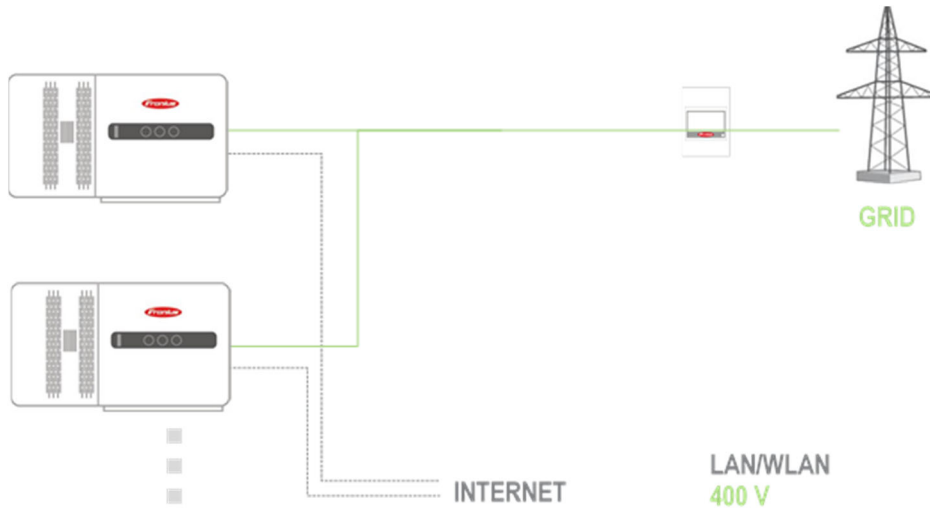
If the grid operator wants to be able to control the system externally, and the PV system only contains one Fronius Tauro inverter, then a **plant controller** will have to be added to the system. (see page 6 SOLUTION B – INTEGRATION OF A PLANT CONTROLLER)



2.1.3 Multiple Fronius Tauro

✗ External control

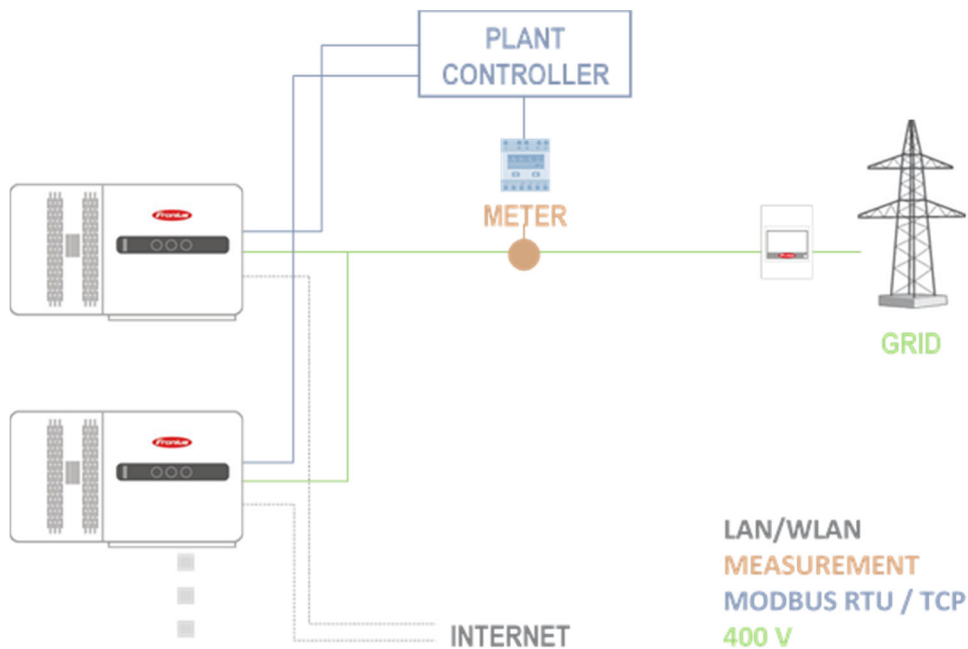
If the grid operator has not imposed any constraints or external control requirements, the PV system can be installed **as normal** without having to make any additional settings on the inverter. This also applies to systems consisting of more than one Fronius Tauro.



2.1.4 Multiple Fronius Tauro

✓ External control

In situations where a PV system contains more than one Tauro device and the grid operator requires external control, a **plant controller** will have to be added to the system. (see page 6 SOLUTION B – INTEGRATION OF A PLANT CONTROLLER)



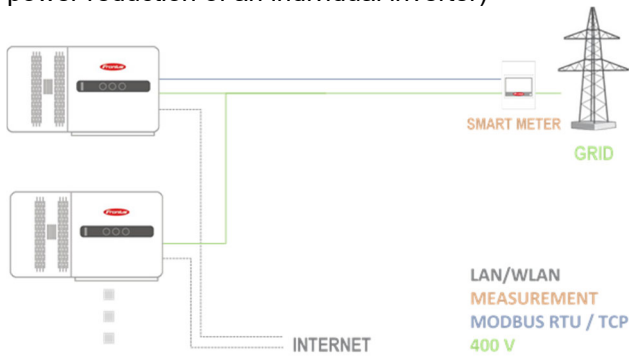
2.1.5 Multiple Fronius Tauro

- ✗ External control
- ✓ Feed-in limit

Two ways of implementing a PV system containing more than one Fronius Tauro exist if the grid operator does not require external control, but has specified a feed-in limit:

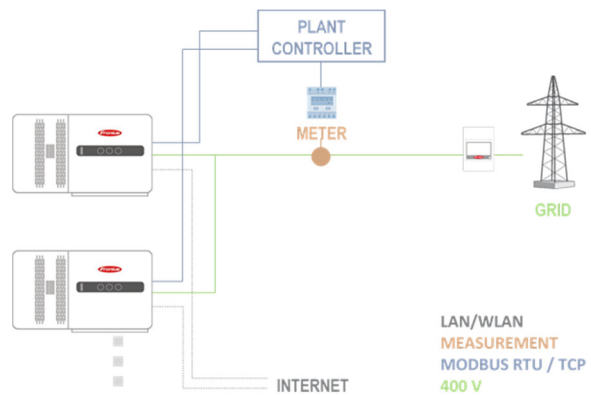
Option 1 – Power limitation of one inverter

If the maximum permitted power fed into the grid can be achieved mathematically by reducing the power of one of the inverters in the system ($0\% \text{ of } P_{INV1} + 100\% \text{ of } P_{INV2} \dots \leq \text{feed-in limit}$), then solution A can be used. (see page 4 SOLUTION A – Simple power reduction of an individual inverter)



Option 2 – Power regulation with plant controller

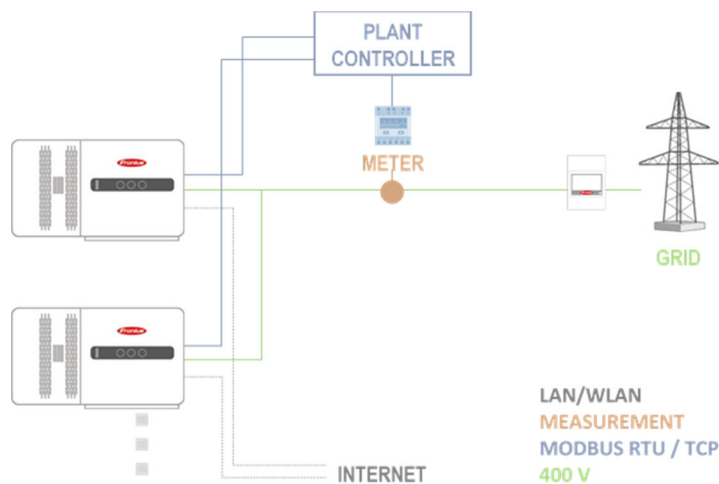
If limiting the power of one of the inverters in the system is not sufficient ($0\% \text{ of } P_{INV1} + 100\% \text{ of } P_{INV2} > \text{feed-in limit}$) to meet the specified feed-in limit (e.g. **zero feed-in**), the second option is to install a plant controller. (see page 6 SOLUTION B – INTEGRATION OF A PLANT CONTROLLER)



2.1.6 Multiple Fronius Tauro

- ✓ External control
- ✓ Feed-in limit

If a system has multiple inverters from the same product family and external control as well as a feed-in limit is specified, the system will have to be designed around a plant controller. (see page 6 SOLUTION B – INTEGRATION OF A PLANT CONTROLLER)

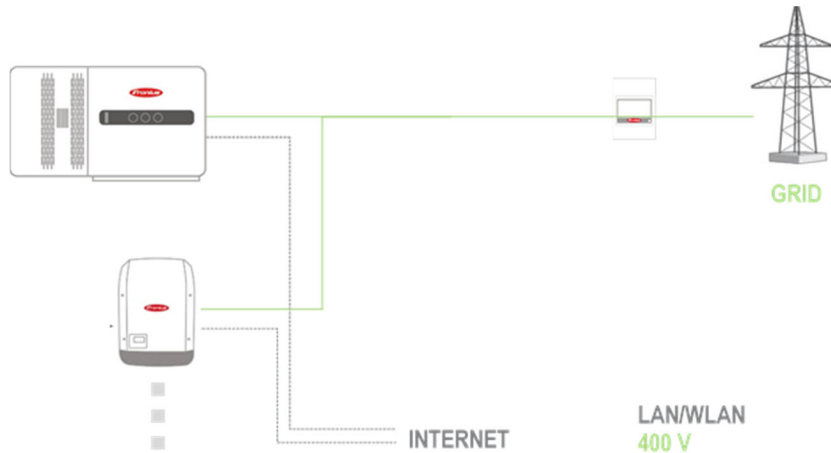


2.2 Systems with inverters from different product series

The following sample scenarios look at PV systems using inverters of different types (e.g. Tauro + SnapINverter) where particular requirements exist.

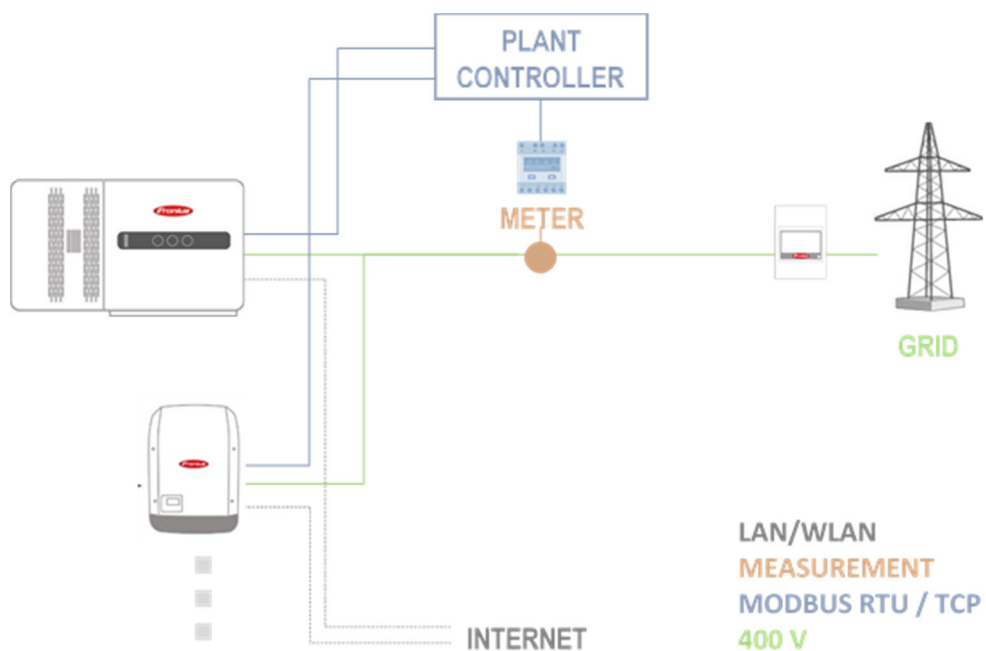
2.2.1 Tauro/SnapINverter combination ✗ External control

If a PV system uses a combination of inverters from the Fronius Tauro series and Fronius SnapINverter devices, particular attention should be paid to any possible limits set by the grid operator. In this example, the grid operator has not imposed any requirements, so the system can be installed **as normal**, without any additional equipment or settings.



2.2.2 Tauro/SnapINverter combination ✓ External control

In mixed systems where the grid operator requires the ability to control the system externally, a PV system with multiple devices from different Fronius product series will need a plant controller in order to satisfy the grid operator's requirements. (see page 6 SOLUTION B – INTEGRATION OF A PLANT CONTROLLER)



2.2.3 Tauro/SnapINverter combination

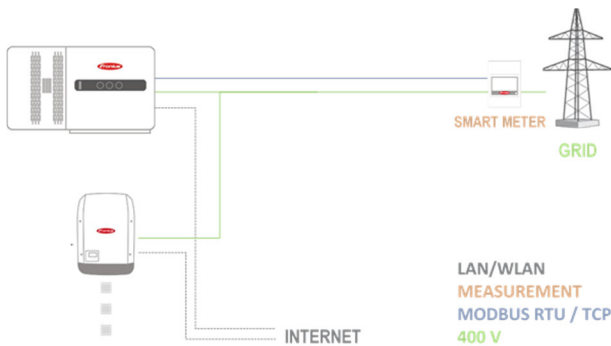
✗ External control

✓ Feed-in limit

There are two ways of implementing a system where the external control of a PV system with multiple devices from different product families is not required, but there is a feed-in limit. The choice depends on the system in question.

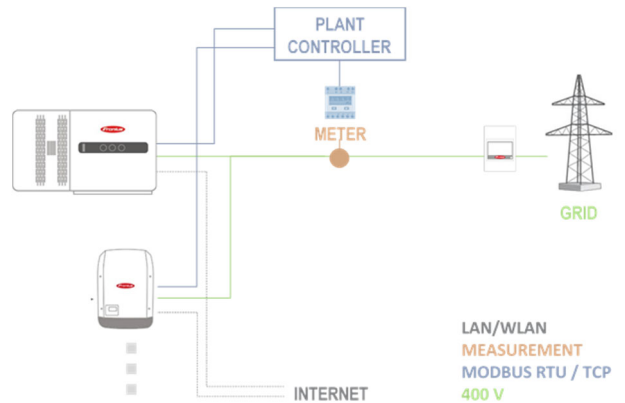
Option 1 – Power limitation of one inverter

If the maximum permitted power fed into the grid can be achieved mathematically by reducing the power of one of the inverters in the system ($0\% \text{ of } P_{INV1} + 100\% \text{ of } P_{INV2} \leq \text{feed-in limit}$), then solution A can be used. (see page 4 SOLUTION A – Simple power reduction of an individual inverter)



Option 2 – Power regulation with plant controller

If limiting the power of one of the inverters in the system is not sufficient ($0\% \text{ of } P_{INV1} + 100\% \text{ of } P_{INV2} > \text{feed-in limit}$) to meet the specified limit (e.g. in the case of **zero feed-in**), the second option is to install a plant controller. (see page 6 SOLUTION B – INTEGRATION OF A PLANT CONTROLLER)



2.2.4 Tauro/SnapINverter combination

✓ External control

✓ Feed-in limit

If a system has multiple inverters from different product families and external control as well as a feed-in limit is specified, the system will have to be designed around a plant controller. (See page 6 SOLUTION B – INTEGRATION OF A PLANT CONTROLLER)

