



SMA Export Control Solution

1 System Description

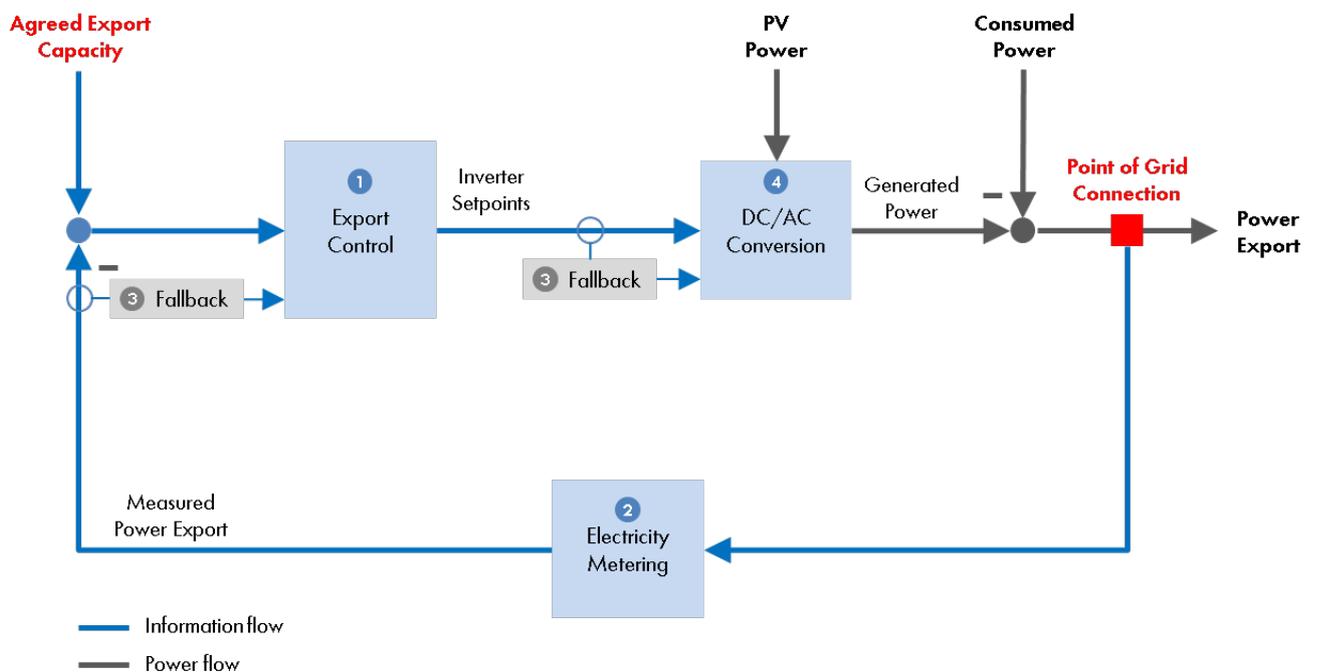
The SMA export control solution measures the active power at the point where the customer’s installation is connected to the distribution system (point of grid connection) and then uses this information to either restrict generation output and/or balance the customers demand in order to prevent the export to the distribution system from exceeding the agreed export capacity.

The agreed export capacity may be configured as an active power value (in kW or MW) and applied as limit for the net export amount across all phases.

The SMA export control solution is designed fail-safe. If one component fails, the active power exported across the point of grid connection will remain at the agreed export capacity or less. Therefore the fallback function monitors every communication path within the control circuit and controls the behavior in the event of a communication failure.

In addition to this agreed export capacity, the distribution network operator will specify an export power factor or power factor range at the point of grid connection, as applicable. The export control solution is designed to measure and limit the active power only since the power factor and hence the apparent power and reactive power should be controlled by the customer to satisfy the requirements of the connection agreement.

The following diagram illustrates the export control scheme.



2 Solution Configurations

The SMA export control solution consists of an SMA power controller, a compatible meter at the point of grid connection and compatible SMA inverters.

The following table gives an overview of possible system solutions. Please refer to section 3 for block diagrams of the referenced system schemes and section 4 for a description of the system components.

#	Scheme	Power Controller	Electricity Meter	Inverters
1	A	No additional hardware, export control function is integrated in inverter	EMETER-20	SMA Solar Inverter with integrated export control function. E.g.: SB 3600SE-10/SB 5000SE-10 STP 50-40 SB 3.0-1AV-40/SB 3.6-1AV-40 SB 4.0-1AV-40/SB 5.0-1AV-40 SB 1.5-1VL-40/SB 2.5-1VL-40 (see section 4.3).
2	B	HM-20	No additional hardware, electricity metering function is integrated in HM-20.	Up to 4 SMA Solar Inverters with Speedwire/Webconnect interface (see section 4.3).
3	C	EDMM-10	EMETER-10, EMETER-20 or Janitza UMG 604	Up to 25 SMA Solar Inverters with Speedwire/Webconnect interface (see section 4.3).
4	C	IM-20	Janitza UMG 604	Up to 42 SMA Solar Inverters of the following types: STP 60-10 SHP 75-10 (see section 4.3).

Abbreviations:

EDMM = SMA Data Manager; **HM** = Sunny Home Manager;

IM = Inverter Manager

SB = Sunny Boy; **STP** = Sunny Tripower; **SHP** = Sunny Highpower

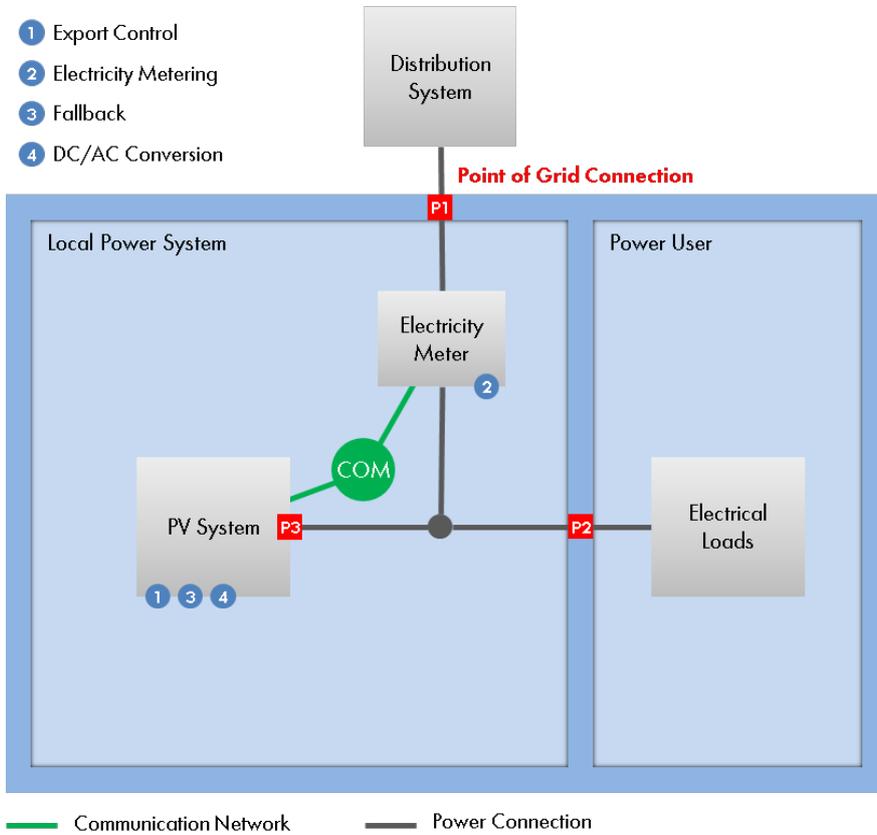
E-METER = SMA Energy Meter

3 System Schemes

Scheme A - Inverter integrated export control

Features

- 1 Export Control
- 2 Electricity Metering
- 3 Fallback
- 4 DC/AC Conversion

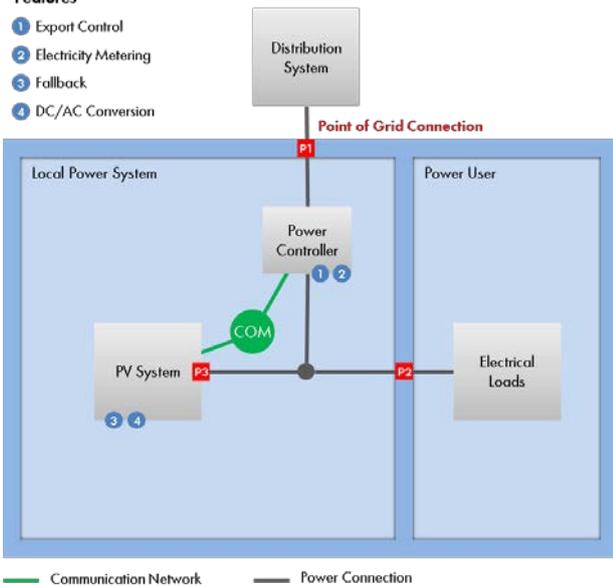


Scheme B - Meter integrated export control

Scheme C - External power controller

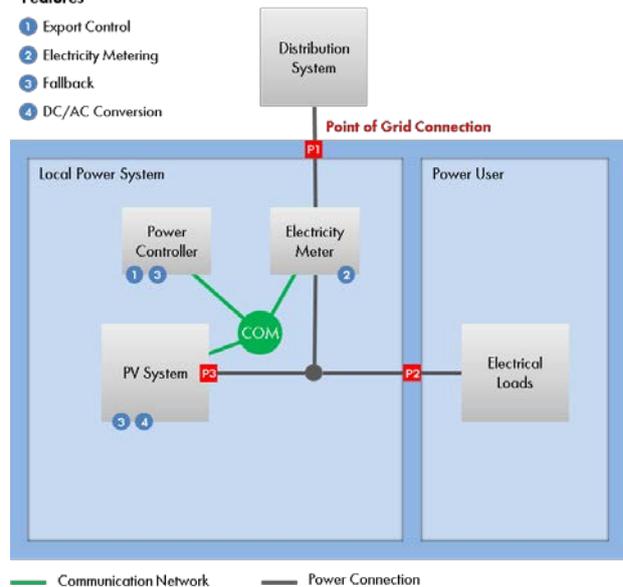
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4 System Components

4.1 The Electricity Meter

The Electricity Meter measures and calculates phase-exact and balanced electrical measured values and makes them available via Ethernet in the local network. In this way, the export controller has access to precisely and fast sampled data on grid feed-in (export) and purchased electricity (import). Please refer to the appropriate data sheets of the meter to make sure that the meter is suitable for your application.

E.g. The SMA Energy Meter EMETER-20 is a bidirectional meter that communicates the measured values to the export controller via Speedwire (Ethernet cable) every second. This meter can be used for single-phase or three-phase systems and its maximum current is 63A (external current transformers may be used when the current exceeds this value).

Note: The HM-20 has built in functionality of EMETER-20.

4.2 The Power Controller

If the balance between generation and consumption reaches a point where the system might export more than the agreed export capacity, then the export control function de-rates the inverters and turns down their production (PV inverters regulate the MPP to match new AC output power level limit). With this solution the amount of power that the PV system generates is maximized matching exactly the local power demand plus the maximum export power. If required, the export controller can be configured to limit the exported power down to 0%.

This export control function is implemented by various SMA products, e.g. HM-20, EDMM-10 and some solar inverters (see section 4.3).

4.3 The Solar Inverter

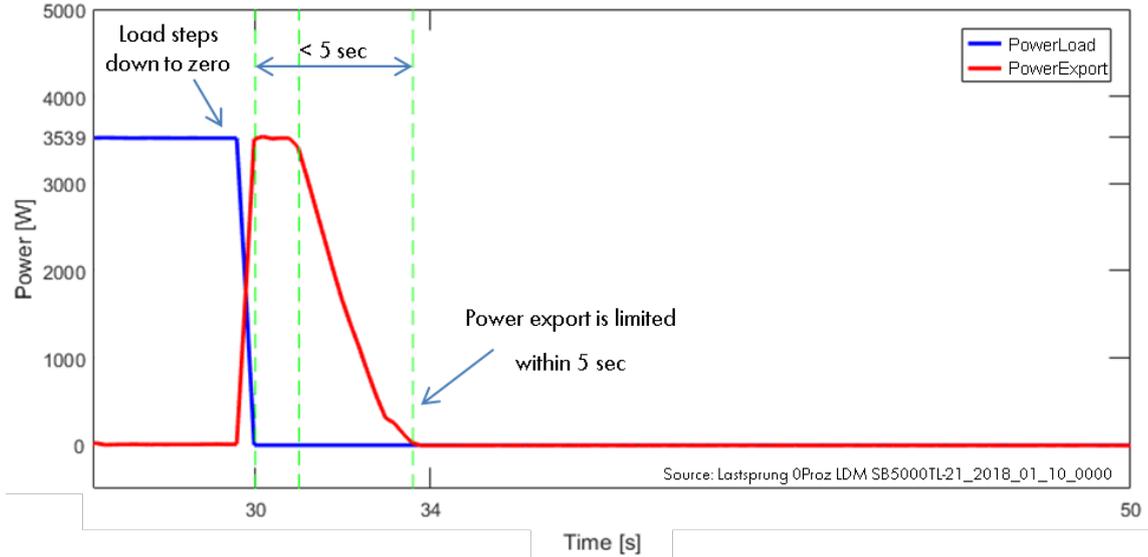
The inverters with "Fallback" function and Speedwire/Webconnect interface and therefore compatible with export limitation are the following:

Solar Inverter	Firmware	Speedwire/Webconnect	Integrated export control
STP 5000TL-20 STP 6000TL-20 STP 7000TL-20 STP 8000TL-20 STP 9000TL-20 STP 10000TL-20 STP 12000TL-20	from V2.52.02.R	Yes	No
STP 20000TL-30 STP 25000TL-30	-	Yes, with SWDM-10	No
STP 50-40	-	Yes	Yes
SB3.0-1AV-40 SB3.6-1AV-40 SB4.0-1AV-40 SB5.0-1AV-40	-	Yes	Yes
SB1.5-1VL-40 SB2.5-1VL-40	-	Yes	Yes
STP 60-10 SHP 75-10	-	No, for use with IM-20 only.	No, for use with IM-20 only.

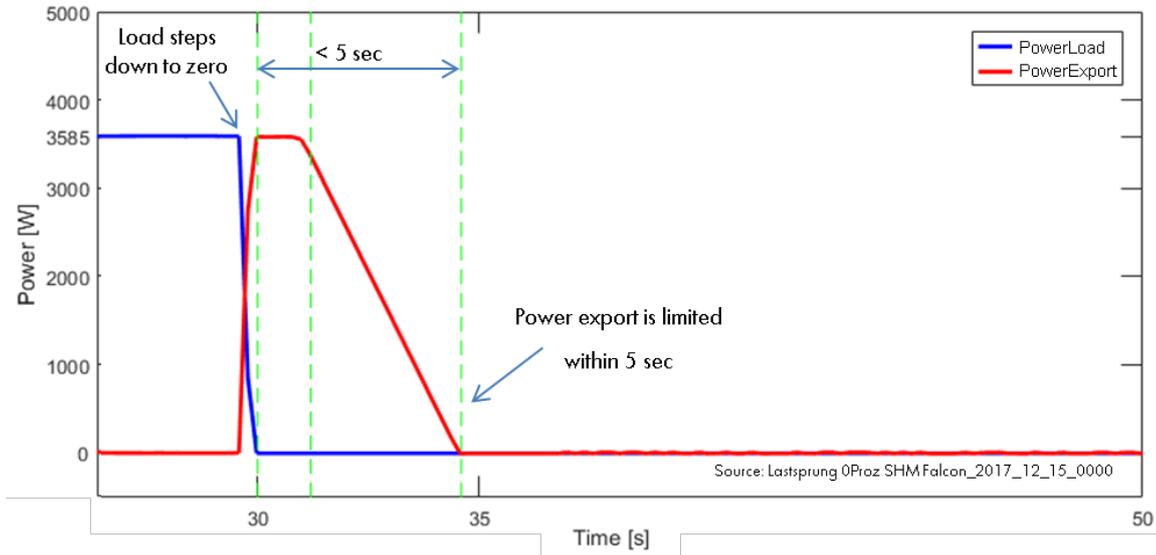
5 Test Results

The following charts illustrate the typical power export response to load steps for several system configurations. The results are applicable to other system configurations expecting the same results as the limitation is done following the same procedure.

5.1 Test Results for EDMM-10, EMETER-20 and SB 5000TL-21



5.2 Test Results for HM-20 and SB3.6-1AV-40





Manufacturer's Declaration

Compliance with ENA EREC G100 requirements

UK DNO's require a fail-safe system, hard wired communications between the components of the export limiter system, specific power quality and operational time.

Requirement: The scheme has hard wired communication links between the various component parts of the export limitation scheme.

Compliance: The communication between the different components (Inverters, electricity meter and power controller) is via Speedwire (Ethernet cable RJ45). Not wireless connections.

Requirement: The export limitation scheme operates signals to the generation to reduce output within 1 second.

Compliance: The electricity meters listed under section 4.1 transmit measurement values, one averaged value per second to the power controller listed under section 4.2. The power controller sends new set-points for the AC power output to connected inverters.

Requirement: The scheme is fail-safe and limits export if the export limiter fails or it loses its power supply.

Compliance: The SMA export control solution is designed fail-safe. If the electricity meter or the power controller fails, the active power exported across the point of grid connection will remain at the agreed export capacity or less. Therefore the fallback function monitors every relevant communication path within the control circuit and controls the behavior in the event of a communication failure. The fallback function is realized by the power controller and all inverters listed in section 4.3.

Requirement: The scheme complies with ENA Engineering Recommendation G5 for harmonics, P28 for flicker and P29 for voltage unbalance.

Compliance: same as a system which is not limited. Please, check specific G83 and G59 certificates of our SMA inverters in our website www.SMA-UK.com in Downloads area.

Requirement: When the export limitation scheme operates it will reduce the exported active power to a value equal to, or less than, the Agreed Export capacity.

Compliance: power export peaks of typical load steps are limited by the export control circuit within 5 sec. See test results in section 5.

Note: In order to operate a 0-watt closed-loop control with the PV system, it is required to operate a base load (self-consumption) of at least 0.5 % of the rated output power of the solar inverters.

Niestetal, 27.04.2018

SMA Solar Technology AG

A handwritten signature in black ink, appearing to read 'ppa. Johannes Kneip', is written over a light blue horizontal line.

ppa. Dr.-Ing. Johannes Kneip
EVP Development Center