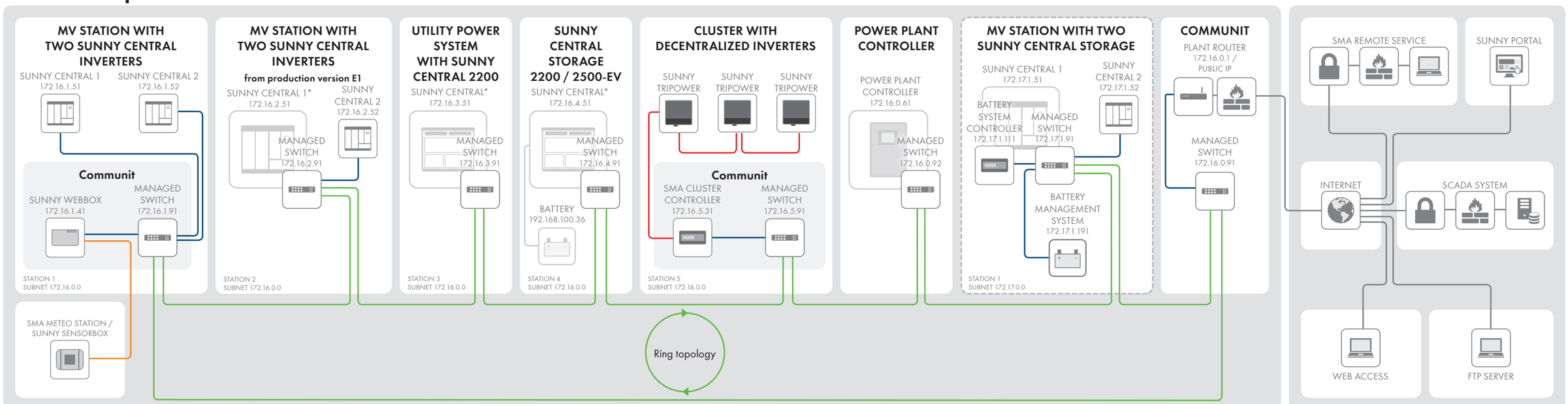
Technical Information

Plant Communication in Large-Scale PV Power Plants

This document shows the requirements and possibilities of plant communication with SMA products.
It is supposed to provide you with information when planning a plant communication concept for large-scale PV power plants.

Basic Principle of Plant Communication



Internet Connection

Settings of the Plant Network

IP addresses

Structure: 172.[16-31].[Location designation].[Device class|Meter]

Location designation	Device class	Meter
Station number 0 = Control room then consecutively numbered	1 = Router	Consecutively numbered
	2 = Power Reducer Box	
	3 = SMA Cluster Controller	
	4 = Sunny WebBox	
	5 = Inverter (SC-COM)	
	6 = Power Plant Controller	
	7 = Power Analyzer	
	8 = Other device (e.g. computer)	
	9 = Network components (e.g. network switch)	
	10 = SMA Fuel Save Controller	
	11 = Battery System Controller	
	12 = Danfoss Inverter Manager	
	13 = Genset	
	19 = Accessories by third-party manufacturers	

Examples for IP-Addresses

First station, first Sunny Central (location designation)	172.16.**1**.51
First station, first Sunny Central (device class)	172.16.1.**5**1
First station, second Sunny Central (meter)	172.16.1.5**2**

* with integrated managed switch

Public Ports for Web Access

Web access to the PV system can be realized via public ports or VPN. If the PV system has many stations, SMA Solar Technology AG recommends using VPN.

Public port

Structure: [Device type|Report|Station|Meter]

Device type	Report	Station	Meter
1 = SMA products	0 = HTTP TCP port: 80	1n = Station n	Consecutively numbered
2 = Network component	1 = Modbus TCP port: 502	9n = Special device n	
3 = Customer device	2 = SSH TCP port: 22		

Examples for web access

Device	IP address	Public port
Plant router (device type)	172.16.0.1	**1**0001
SMA Power Plant Controller (report)	172.16.0.61	1**0**001
Second station, managed switch (station)	172.16.2.91	20**12**1
Sixth station, second Sunny Central (meter)	172.16.6.52	10162

Selecting the Best Internet Connection

The indicated device numbers are recommended values for optimum data transmission to Sunny Portal. The maximum device number depends on the data transfer rate of the Internet connection.

Types of connection and router	Number of devices	
DSL Router: HAP-RDSH	Sunny Central	178
	SB / STP [3]	615
DSLoSAT [1] Router: HAP-R	Sunny Central	44
	SB / STP [3]	153
UMTS [2] Router: HAP-RU-V4	Sunny Central	26
	SB / STP [3]	92
EDGE / GPRS Router: HAP-RU-V4	Sunny Central	11
	SB / STP [3]	38

[1]) Satellite system is not included in the SMA scope of delivery.
[2]) Without HSUPA (High Speed Uplink Packet Access)
[3]) Sunny Boy / Sunny Tripower

Upload Volume to Sunny Portal

Device	Maximum upload volume per month
Sunny Central	40 MB over a 15-minute average value
Sunny Boy / Sunny Tripower	6.4 MB over a 15-minute average value

Connection	Explanation
Sunny Portal	Data transmission for evaluation and e-mail transmission
FTP server	Data transmission for evaluation at the customer's computer
Web access*	Access to the devices via Internet
SCADA system	Data transmission for monitoring and controlling the PV system via a customer system
VPN	Coded access to the complete network

* see table "Öffentliche Ports für den Web-Zugriff"

Key

- Plant network (Cu-Cat.5)
- Plant network (optical fiber)
- Speedwire (Cu-Cat.5)
- RS485 bus

Plant Network

Network address:	172.16.0.0
Subnet mask:	255.255.0.0
DNS server	172.16.0.1
Gateway	172.16.0.1

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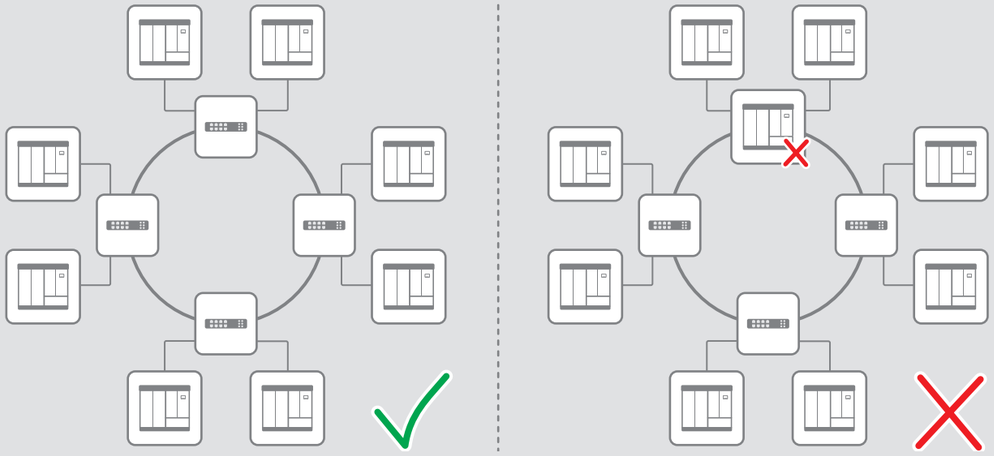
Rules for Network Planning

1. Use managed switches in redundant networks

To increase the availability of your network, a redundant network is required (ring or mesh topology) in which all managed switches support the redundancy protocol.
You can connect devices (e.g. SC-COM of the central inverter, SMA Cluster Controller) to the managed switches in the ring using a star or string topology.



2. Observe the maximum possible number of managed switches

The number of managed switches depends on the redundancy protocol used:

Redundancy protocol	Explanation
Media Redundancy Protocol (MRP)*	Max. 50 managed switches in one ring Several rings are permitted in one network.
Rapid Spanning Tree Protocol (RSTP)**	Max. 40 managed switches in one network section, depending on the manufacturer

* Only with *Hirschmann*™ managed switches (standard equipment of SMA Solar Technology AG)
** Open standard (can be optionally configured for *Hirschmann*™ managed switches)

3. Plan a small number of devices in one string

The smaller the number of devices planned in one string, the higher will be the availability of the entire network. If several devices are switched in series, the failure of one device will affect all the upstream devices. SMA Solar Technology AG recommends a design with a maximum of two devices per string.

4. When using various SMA products, plan different subnets

A plant with different plant controls can be realized by separating the devices into different subnets. Thus, the SMA Fuel Save Controller and the Power Plant Controller, for example, can be operated separately in a ring. The devices to be controlled must be in the same subnet as the plant control.

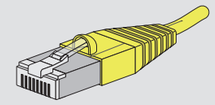
5. Keep monitoring/control networks separate from networks for safety devices

Due to the separate network interfaces on the SC-COM, the central inverters from SMA Solar Technology AG provide the option of routing monitoring data and control commands via separate networks. Experience has shown that only when data volumes are exceptionally high is it necessary to route the control commands via a separate network.
Safety devices (e.g. CCTV surveillance or intruder detection systems) must be routed in a separate network.

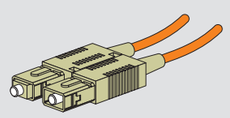
6. Observe the maximum cable lengths and quality of the cables

The cable lengths given here are maximum values for a data transmission of 100 Mbit/s. The cable lengths indicate the distance between two active devices. If several patch cables are used, the maximum cable length will be reduced due to their signal attenuation.

Copper cable

Standard	Cable length	RJ-45 plug with CAT-5e cable
100BASE-T	100 m	

Optical fiber

Type	Standard	Cable length	Subscriber connector (duplex)
Multi-mode	100BASE-FX	2000 m	
Single-mode	100BASE-FX	32500 m	

7. Allow for sufficient reserve of fibers

When selecting suitable optical fibers, you should allow for an adequate reserve of fibers. This will help avoid cost-intensive repair work in case of fiber fracture. SMA Solar Technology AG recommends the double number of fibers.

8. Assure electromagnetic compatibility

During installation, ensure that the distance between data and energy cables is adequate. This will help prevent communication failures.

9. Have your network checked or certified

To guarantee reliable communication in the long term, have your network checked after installation as follows:

- Physical test with measurement report
- Bandwidth measurement (data throughput throughout the entire network)

Contact

SMA Solar Technology AG will support you when planning your plant communication concept. For detailed information on the products, contact the SMA Sales Department.

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