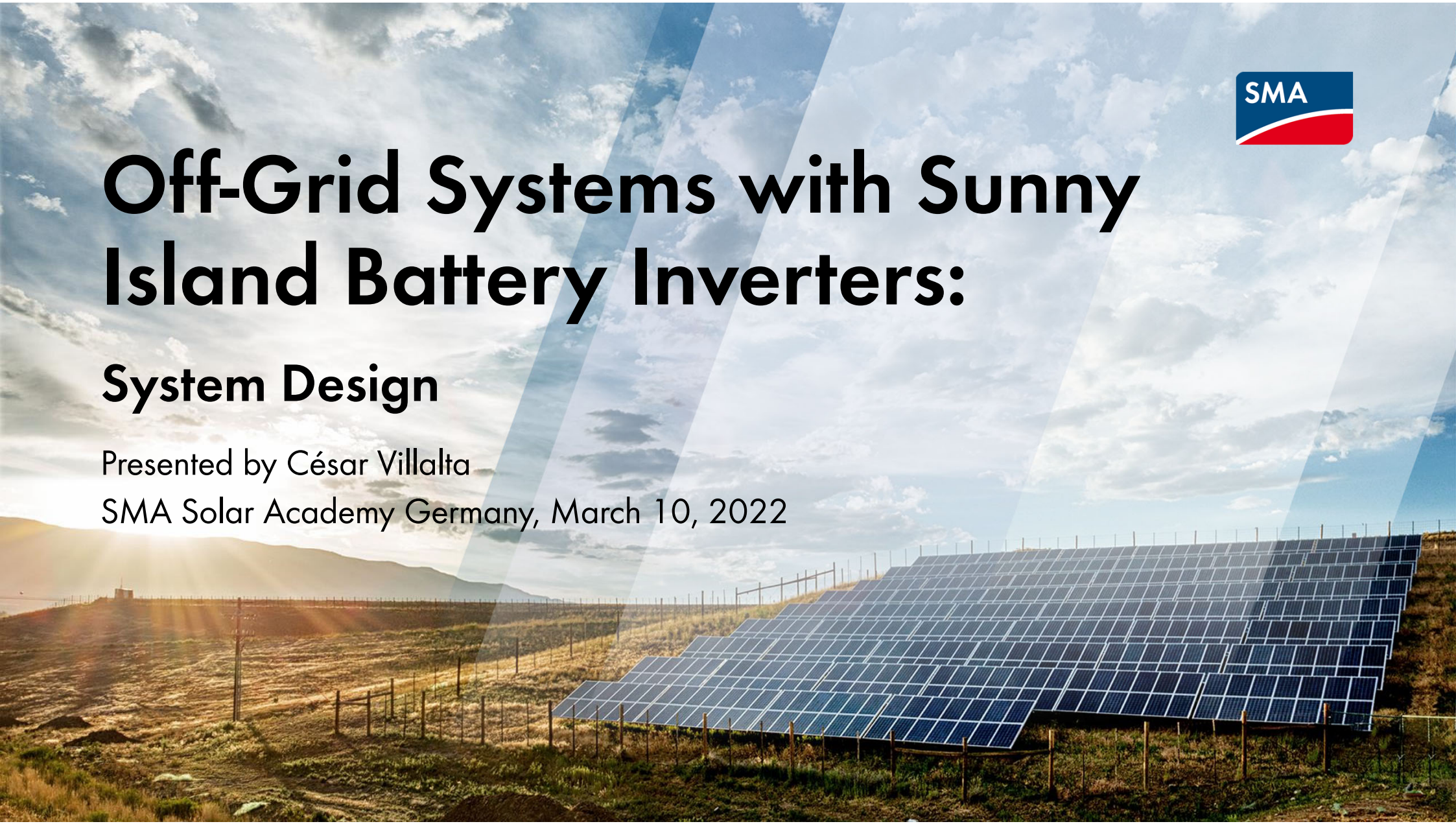


Off-Grid Systems with Sunny Island Battery Inverters:

System Design

Presented by César Villalta

SMA Solar Academy Germany, March 10, 2022

WHO IS PRESENTING?

César Villalta

Technical Training Specialist

SMA Solar Academy
Germany

MAIN GOAL

1 After these webinar you can understand much better the main applications of Sunny Island inverters for off-grid projects

MAIN TOPICS

1. SMA Solutions
2. Sunny Island inverters
3. Main applications in Off-grid mode for single-cluster systems

SMA SOLAR ACADEMY STANDARD WEBINARS

FREE

Webinar

10:00 Thu, 10.3.22 – 12:15 Thu, 10.3.22 CET

Off-Grid Systems with Sunny Island Battery Inverters: System Design

Germany

FREE

Webinar

10:00 Fri, 11.3.22 – 12:15 Fri, 11.3.22 CET

Off-Grid Systems with Sunny Island Battery Inverters: Communication

Germany

SMA SOLAR ACADEMY PREMIUM TRAINING IN GERMANY

767.55 EUR

09:00 Tue, 3.5.22 – 17:00 Fri, 6.5.22 CET

Designing of Off-Grid Systems with SMA Sunny Island Battery Inverters

Sonnenallee 1, 34266 Niestetal , Germany

1,779.05 EUR

09:00 Mon, 9.5.22 – 17:00 Tue, 10.5.22 CET

Commissioning of Off-Grid Systems with Sunny Island battery inverters

Sonnenallee 1, 34266 Niestetal , Germany

SECURITY ADVICE AND LIABILITY

Our aim is to provide you with technical accurate information and thus help you to setup and maintain your SMA products and solutions in the most correct and efficient way possible.

However, before beginning the training, we have to advise you that we provide the events as-is without warranty of any kind. SMA disclaims all warranties, conditions and obligations of any kind whatsoever, expressed or implied, whether statutory (not mandatory) or otherwise, including for greater certainty, and implied warranties of merchantable quality, merchantability, or fitness for a particular purpose. (Please consult our Terms & Conditions: https://www.sma.de/solar-academy/termsandconditions for more information.)

For your own safety during the training, we remind you to follow the instructions of the trainer at any time and apply reasonable caution when approaching any technical device. For participation in the practical hands-on parts of the training we expect you to be an electrically qualified person, aware of the risks associated with the handling of electric devices.

Please also note, that the training content provided to you may only be valid for a limited period of time. When working on your own SMA products and solutions after the training, we expect you to always consult the latest technical documentation, e.g. installation manuals, maintenance manuals, etc., in case there have been updates in the meantime.

If you have any questions or comments regarding safety or security regulations and provisions, we expect you to voice these immediately.

We wish you a successful training!

SMA Solutions

HOME

WORLD WIDE

Generate solar power

USE CASES

HARDWARE


SUNNY BOY 1.5/2.0/2.5


SUNNY BOY 3.0/3.6/4.0/5.0/6.0


SUNNY TRIPOWER 3.0/4.0/5.0/6.0


SUNNY TRIPOWER 8.0/10.0


SUNNY BOY 5.5-LV-JP


SUNNY BOY US 3.0/3.8/5.0/6.0/7.0/7.7


SUNSPEC RAPID SHUTDOWN (US ONLY)

Store solar power


SUNNY BOY STORAGE 2.5


SUNNY BOY STORAGE 3.7/5.0/6.0


SUNNY BOY STORAGE US 3.8/5.0/6.0


SUNNY ISLAND 4.4M/6.0H/8.0H

Manage energy


SUNNY HOME MANAGER 2.0


SMA ENERGY METER


SMA DATA MANAGER M LITE


SMA POWER LIMITER

Refuel with solar power


SMA EV CHARGER 7.4 / 22

Be your own grid


SUNNY ISLAND 4.4M/6.0H/8.0H


SUNNY ISLAND US 6048


SUNNY ISLAND US 6048 SPLITPHASE

SOFTWARE

SUNNY DESIGN powered by ennexOS · SUNNY PORTAL powered by ennexOS · SUNNY PLACES · SMA 360° Professional Support · SMA ENERGY The energy transition in your hand. · SMA ShadeFix STRING LEVEL OPTIMIZATION

SERVICES

Smart Connected · Extended Warranty · Remote Service · Repowering · Solar Academy Training

BUSINESS

WORLD WIDE

Generate solar power

USE CASES

HARDWARE

Store solar power


SUNNY TRIPOWER STORAGE 60


SMA STORAGE BUSINESS (76 kWh)

Manage energy


SMA DATA MANAGER M


SMA DATA MANAGER M LITE


SMA ENERGY METER

Be your own grid


SUNNY ISLAND 4.4M/6.0H/8.0H


SUNNY ISLAND US 6048 120/208V


MULTICLUSTER 6/12/36

MULTICLUSTER-BOX 12U

SOFTWARE

SUNNY DESIGN powered by ennexOS · SUNNY PORTAL powered by ennexOS · SMA 360° Professional Support · SMA ENERGY The energy transition in your hand. · SMA ShadeFix STRING LEVEL OPTIMIZATION

SERVICES

Smart Connected · Commissioning Support · Extended Warranty · Operation & Maintenance · Repowering · Solar Academy Training · SMA SPOT More Solar Power on Trade

LARGE SCALE

WORLD WIDE

Generate solar power

USE CASES

HARDWARE

Store power


SMA DC-DC CONVERTER


SUNNY CENTRAL STORAGE UP (2200 - 4600 kW)


MEDIUM VOLTAGE POWER STATION

Manage energy


SMA DATA MANAGER L


HYBRID CONTROLLER


POWER PLANT MANAGER

SOFTWARE

PV VIRTUAL SUPPORT · SUNNY PORTAL powered by ennexOS

SERVICES

Smart Connected · Commissioning Support · Extended Warranty · Response Time · Virtual Support · Engineering Services · Operation & Maintenance · Repowering · Remote Service · Solar Academy Training

Sunny Island battery inverter

APPLICATIONS

SMA
Sunny Island
inverters

Functions for Grid Operation

Functions for Off-grid Operation

FUNCTIONS FOR GRID OPERATION

SMA
Sunny Island
inverters

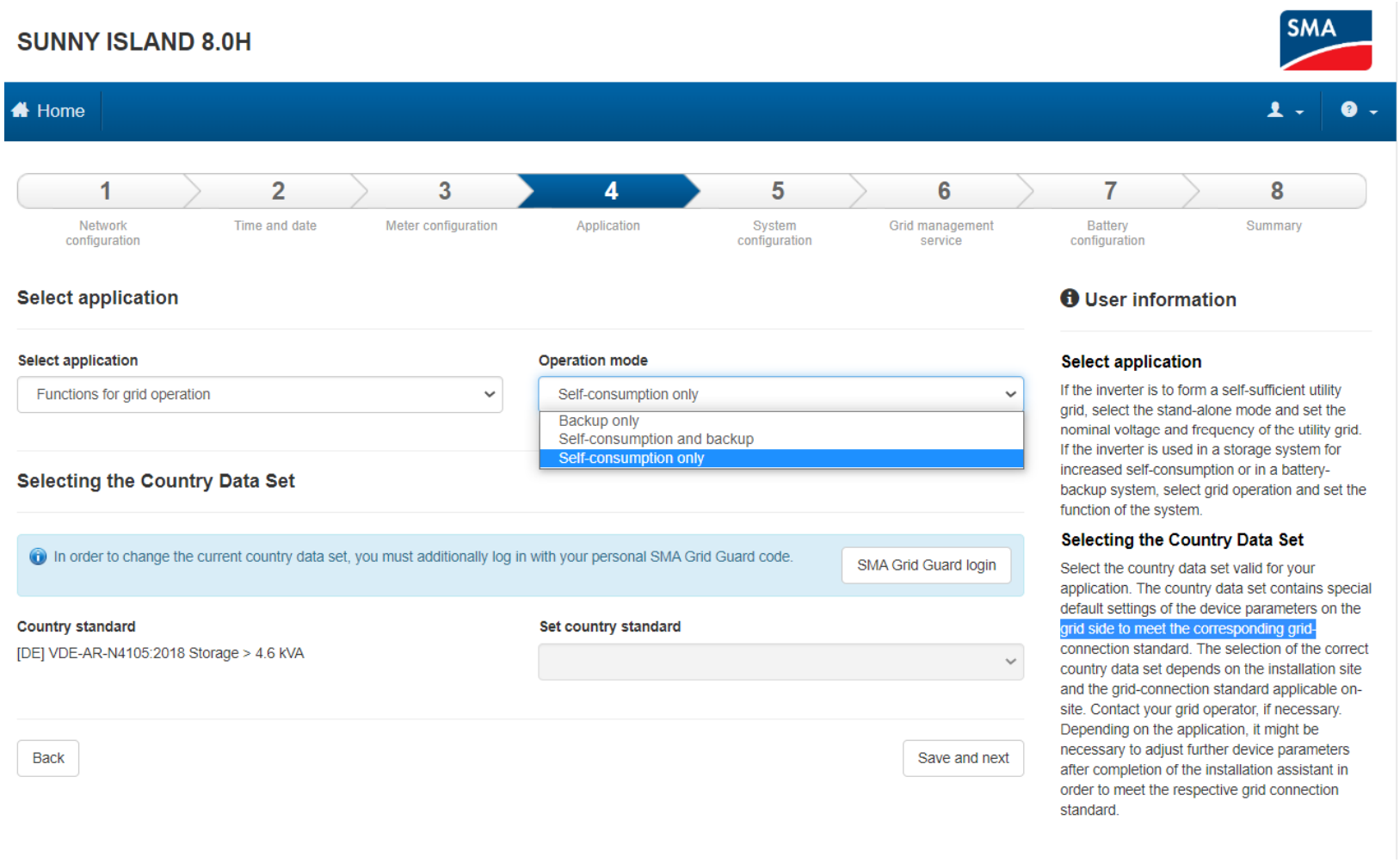
Functions for Grid Operation

(self-consumption systems) → Public grid

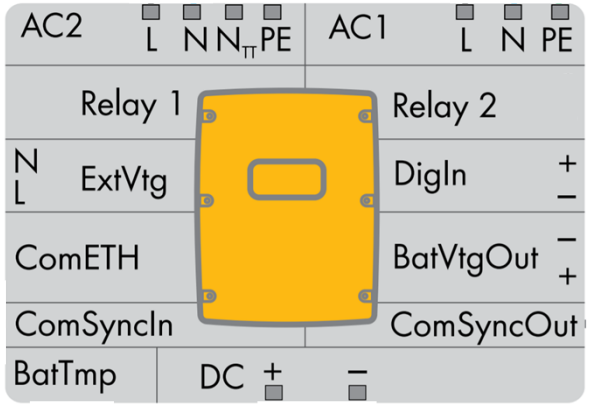
Country Standard

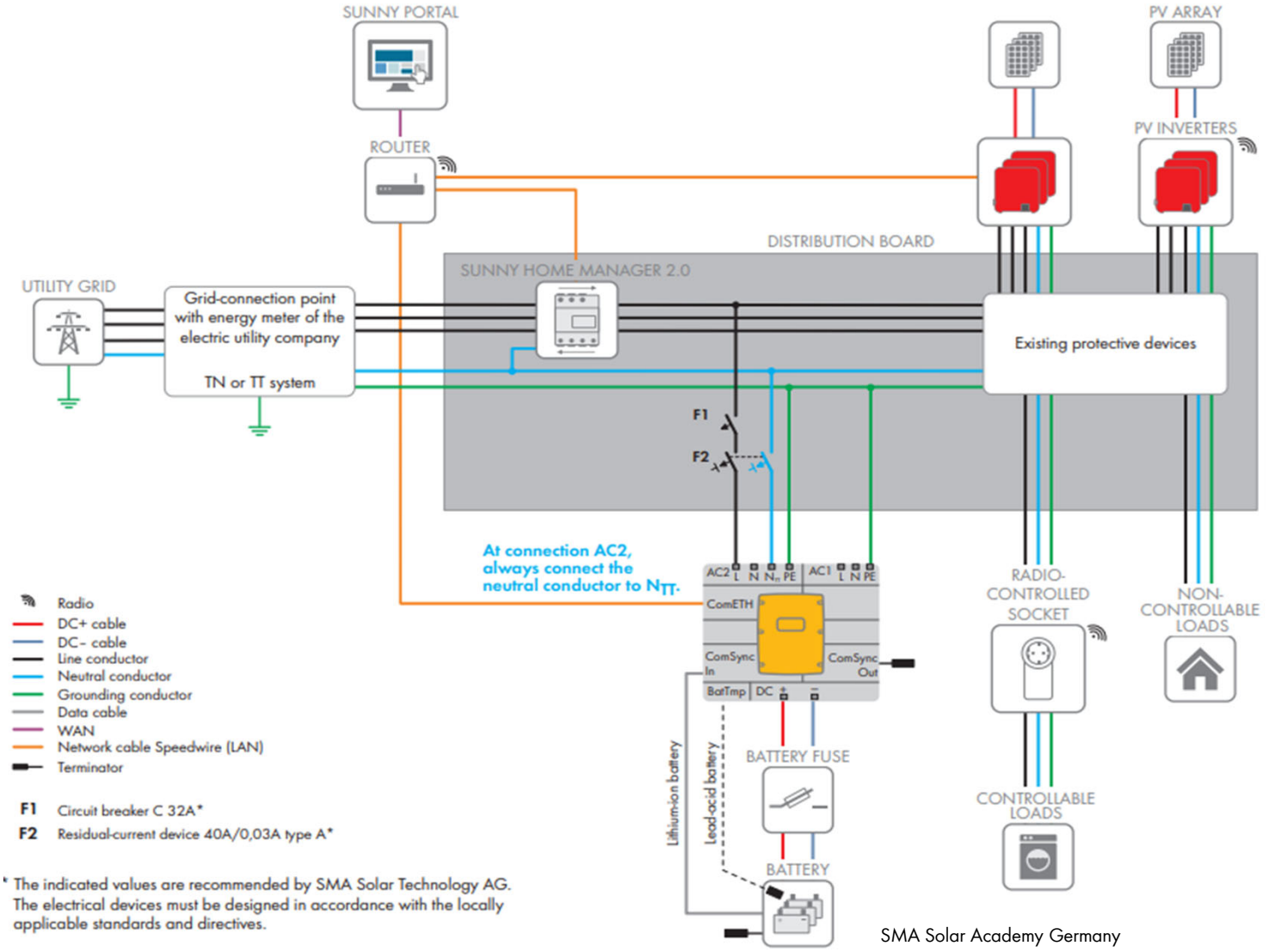
Operation
mode

FUNCTIONS FOR GRID OPERATION

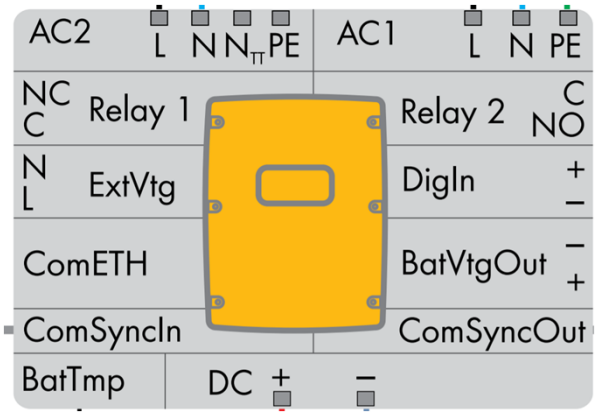


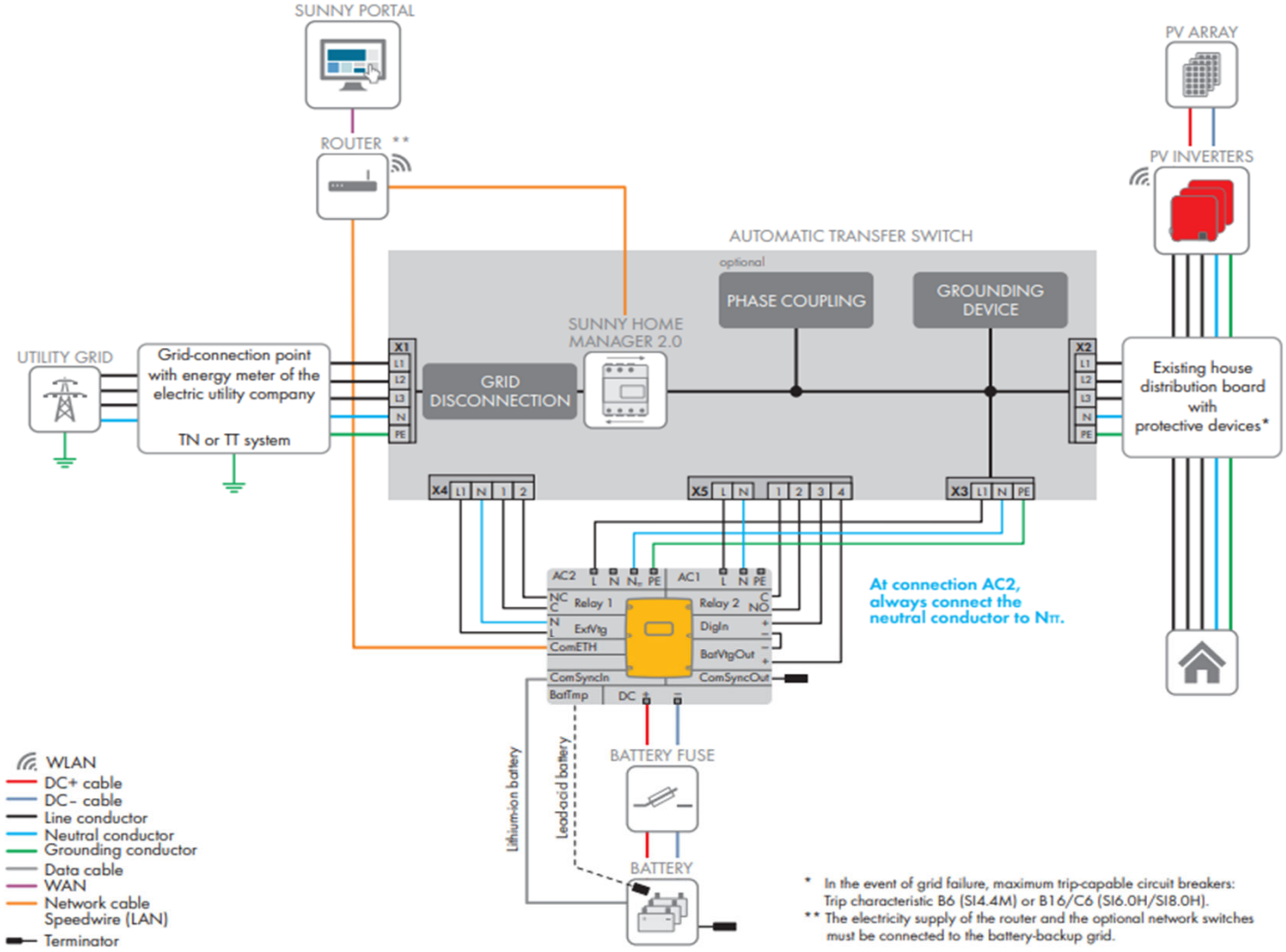
EXAMPLE 1


AC2
L N N$_{TT}$ PE
AC1
L N PE
Relay 1
Relay 2
N
L
ExtVtg
DigIn
+
−
ComETH
BatVtgOut
−
+
ComSyncIn
ComSyncOut
BatTmp
DC
+
−


SUNNY PORTAL
ROUTER
PV ARRAY
PV INVERTERS
DISTRIBUTION BOARD
SUNNY HOME MANAGER 2.0
UTILITY GRID
Grid-connection point with energy meter of the electric utility company
TN or TT system
Existing protective devices
F1
F2
At connection AC2, always connect the neutral conductor to N$_{TT}$.
AC2 L N N$_{TT}$ PE
AC1 L N PE
ComETH
ComSync In
ComSync Out
BatTmp
DC
RADIO-CONTROLLED SOCKET
NON-CONTROLLABLE LOADS
CONTROLLABLE LOADS
BATTERY FUSE
BATTERY
Lithium-ion battery
Lead-acid battery
Radio
DC+ cable
DC- cable
Line conductor
Neutral conductor
Grounding conductor
Data cable
WAN
Network cable Speedwire (LAN)
Terminator
F1 Circuit breaker C 32A*
F2 Residual-current device 40A/0,03A type A*
* The indicated values are recommended by SMA Solar Technology AG. The electrical devices must be designed in accordance with the locally applicable standards and directives.

EXAMPLE 2


AC2
L
N
N_TT
PE
AC1
L
N
PE
NC
C
Relay 1
Relay 2
C
NO
N
L
ExtVtg
DigIn
+
–
ComETH
BatVtgOut
–
+
ComSyncIn
ComSyncOut
BatTmp
DC
+
–


SUNNY PORTAL
ROUTER **
PV ARRAY
PV INVERTERS
AUTOMATIC TRANSFER SWITCH
optional
PHASE COUPLING
GROUNDING DEVICE
SUNNY HOME MANAGER 2.0
UTILITY GRID
Grid-connection point with energy meter of the electric utility company
TN or TT system
GRID DISCONNECTION
X1
X2
X3
X4
X5
Existing house distribution board with protective devices*
At connection AC2, always connect the neutral conductor to NTT.
BATTERY FUSE
BATTERY
Lithium-ion battery
Lead-acid battery
WLAN
DC+ cable
DC- cable
Line conductor
Neutral conductor
Grounding conductor
Data cable
WAN
Network cable
Speedwire (LAN)
Terminator
* In the event of grid failure, maximum trip-capable circuit breakers: Trip characteristic B6 (SI4.4M) or B16/C6 (SI6.0H/SI8.0H).
** The electricity supply of the router and the optional network switches must be connected to the battery-backup grid.

FUNCTIONS FOR OFF-GRID OPERATION

SMA
Sunny Island
inverters

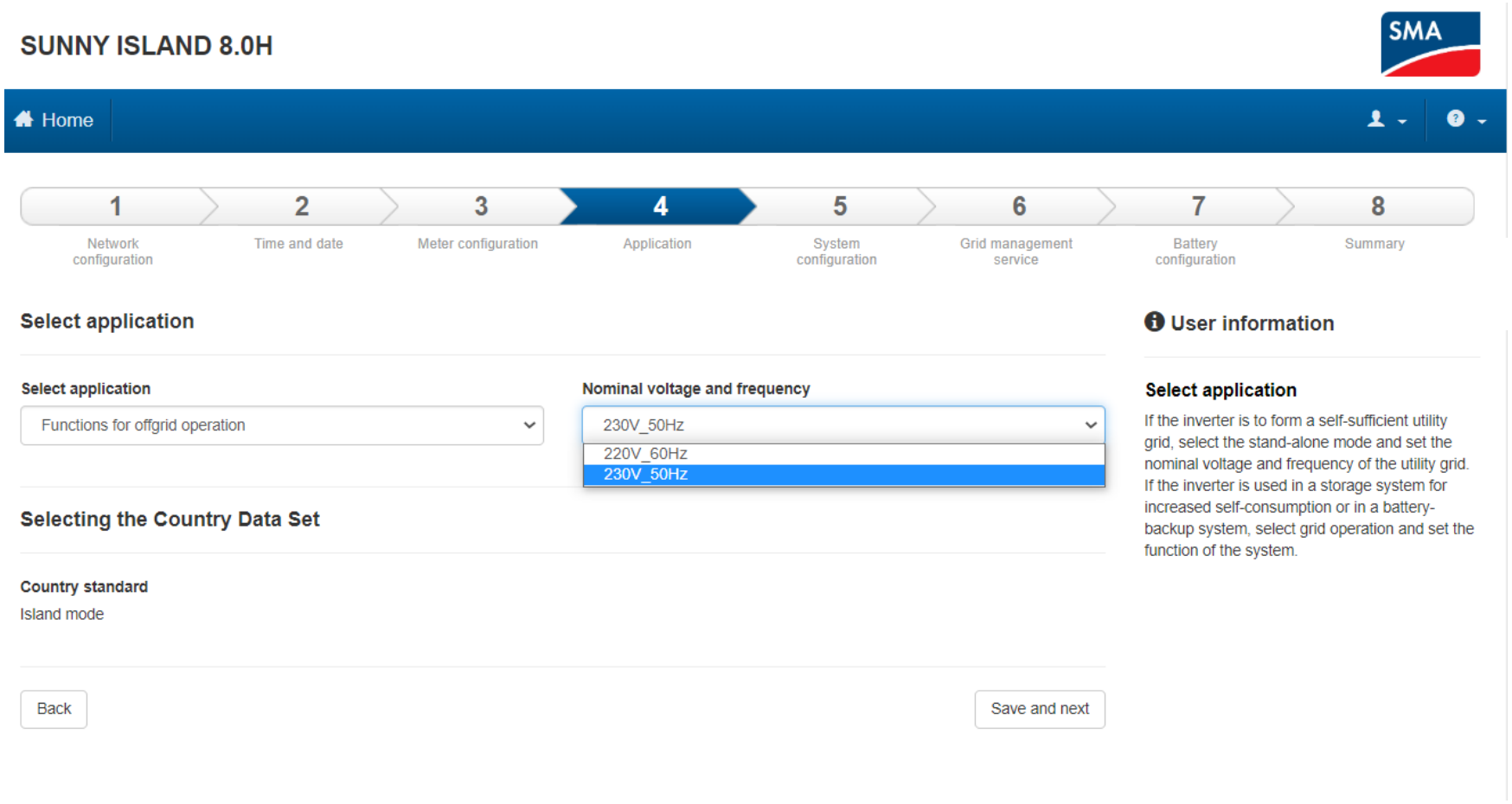
Functions for Off-grid Operation

(off-grid systems) → Autonomous grid

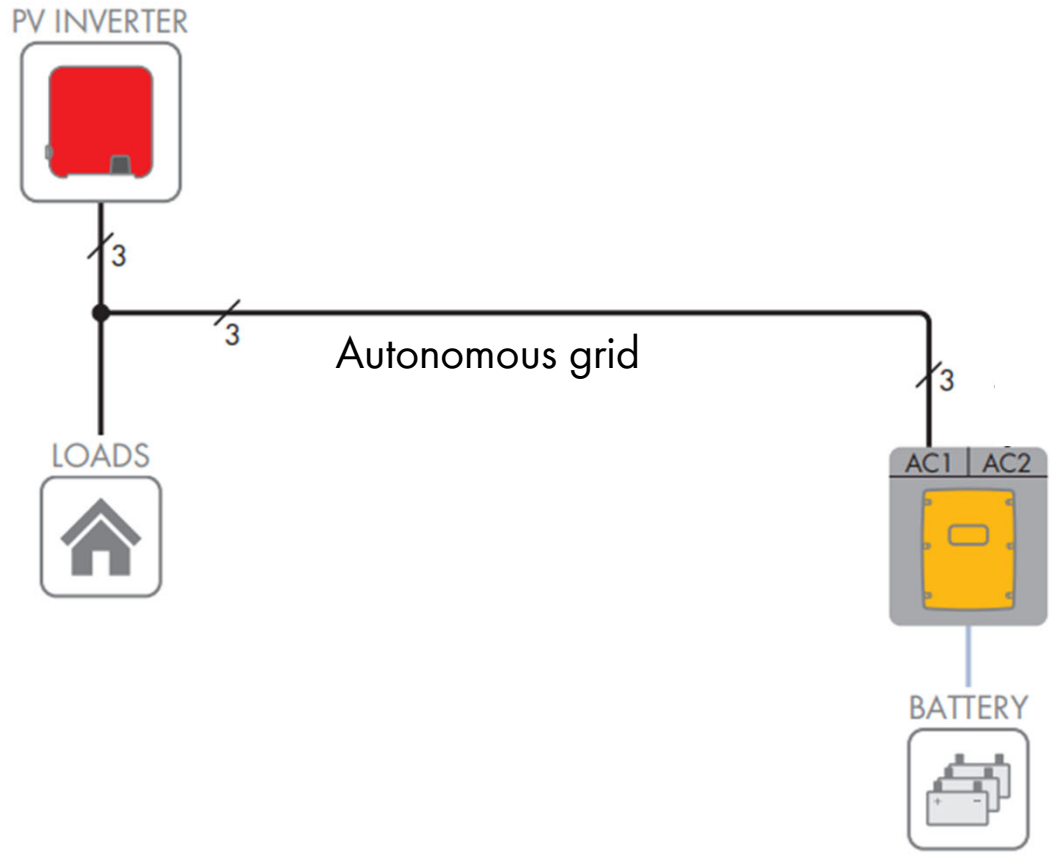
Nominal voltage and frequency

Island mode

FUNCTIONS FOR OFF-GRID OPERATION



FUNCTIONS FOR OFF-GRID OPERATION
OFF-GRID WITHOUT AN EXTERNAL SOURCE

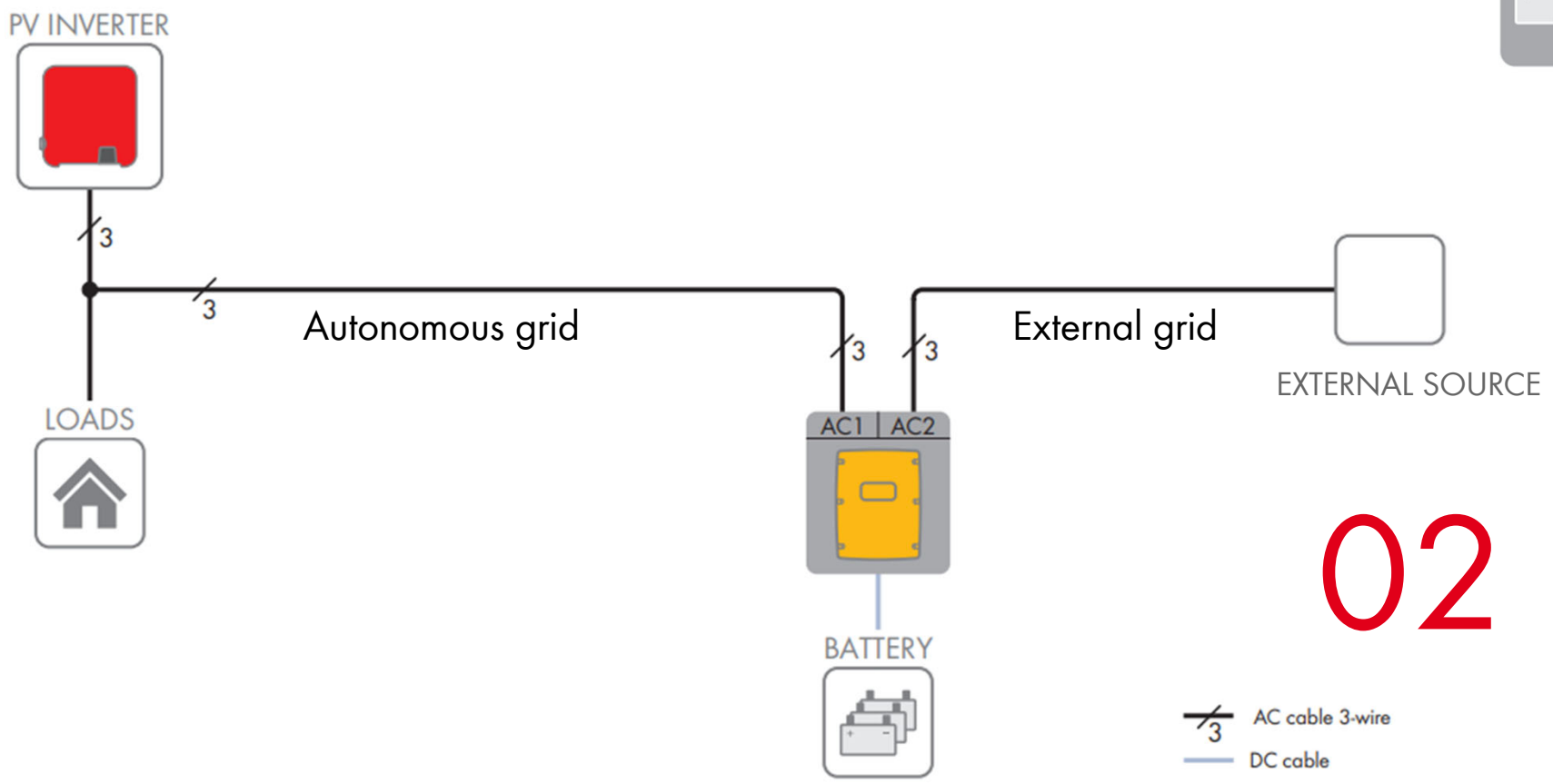


01

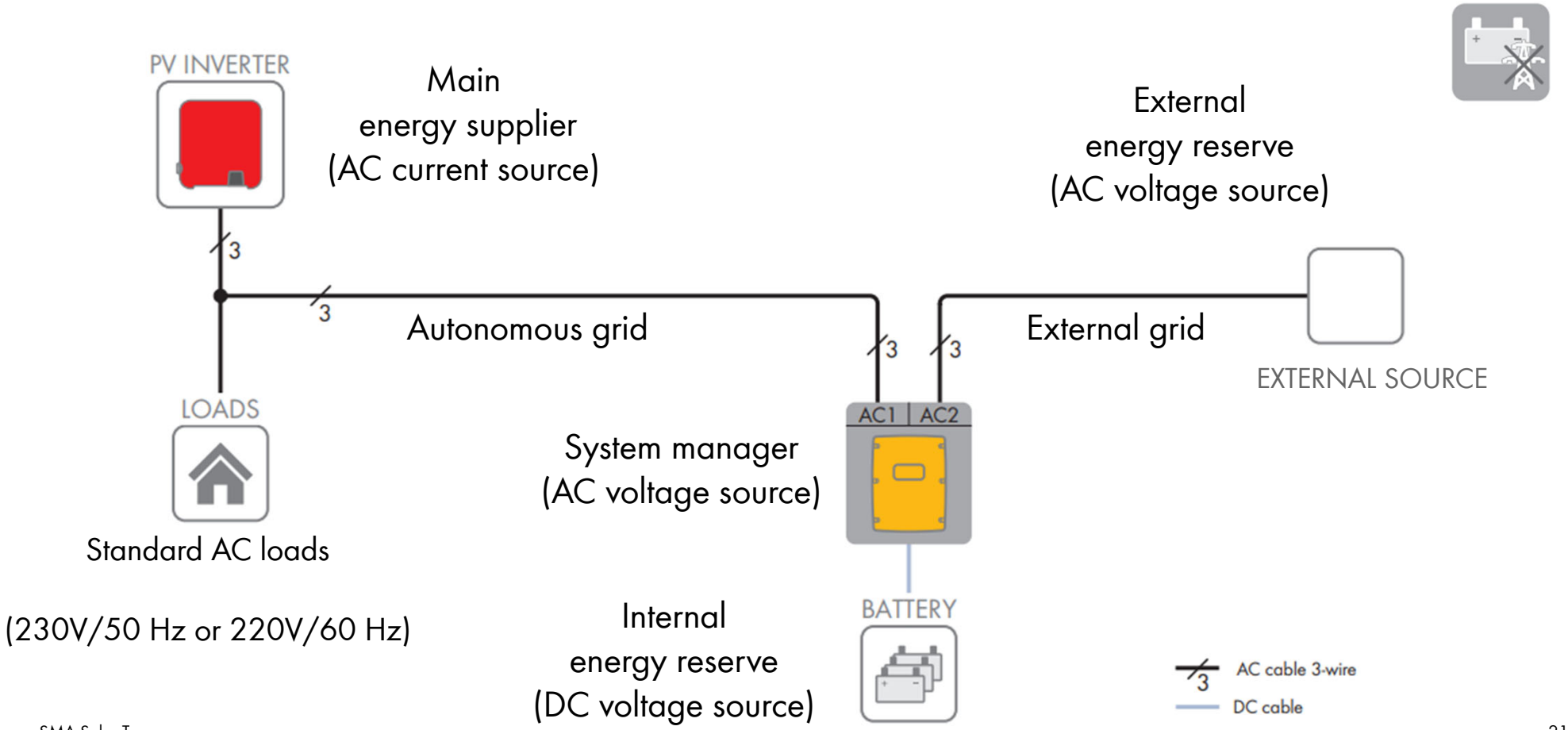
AC cable 3-wire

DC cable

FUNCTIONS FOR OFF-GRID OPERATION
OFF-GRID WITH AN EXTERNAL SOURCE



FUNCTIONS FOR OFF-GRID OPERATION
SUB–SYSTEMS



FUNCTIONS FOR OFF-GRID OPERATION
SUB – TOPOLOGIES

- Off-Grid Operation
  - Without Multicluster Box
    - Single-device systems
    - Single-cluster systems
      - Single-phase
      - Three-phase
  - With Multicluster Box

FUNCTIONS FOR OFF-GRID OPERATION
SUB – TOPOLOGIES

- Off-Grid Operation
  - Multi-Cluster systems
    - MC- Box 6.3-11 / 36.3-11
    - MC- Box 12.3-20


SMA

SUNNY ISLAND BATTERY INVERTER (IEC)
MAIN FEATURES

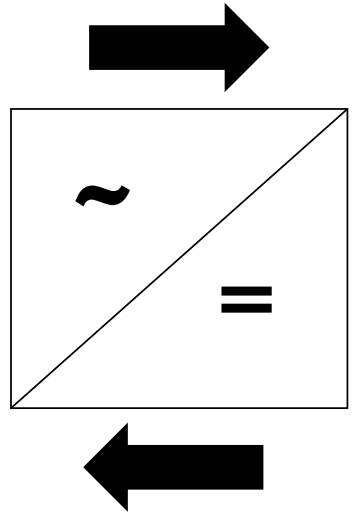
ennexOS ready

SUNNY ISLAND 4.4M / 6.0H / 8.0H

The most reliable all-purpose solution – easier than ever

SUNNY ISLAND BATTERY INVERTER (IEC)
MAIN FEATURES

- The Sunny Island battery inverter is a bidirectional DC/AC converter which supports a wide range of applications



SUNNY ISLAND BATTERY INVERTER (IEC)
MAIN FEATURES

SUNNY ISLAND 6.0H / 8.0H-13
(IEC)

SUNNY ISLAND 4.4M-13
(IEC)

IEC: International Electrotechnical Commission

SUNNY ISLAND BATTERY INVERTER (IEC) [1]
MAIN FEATURES


SI 4.4M-13

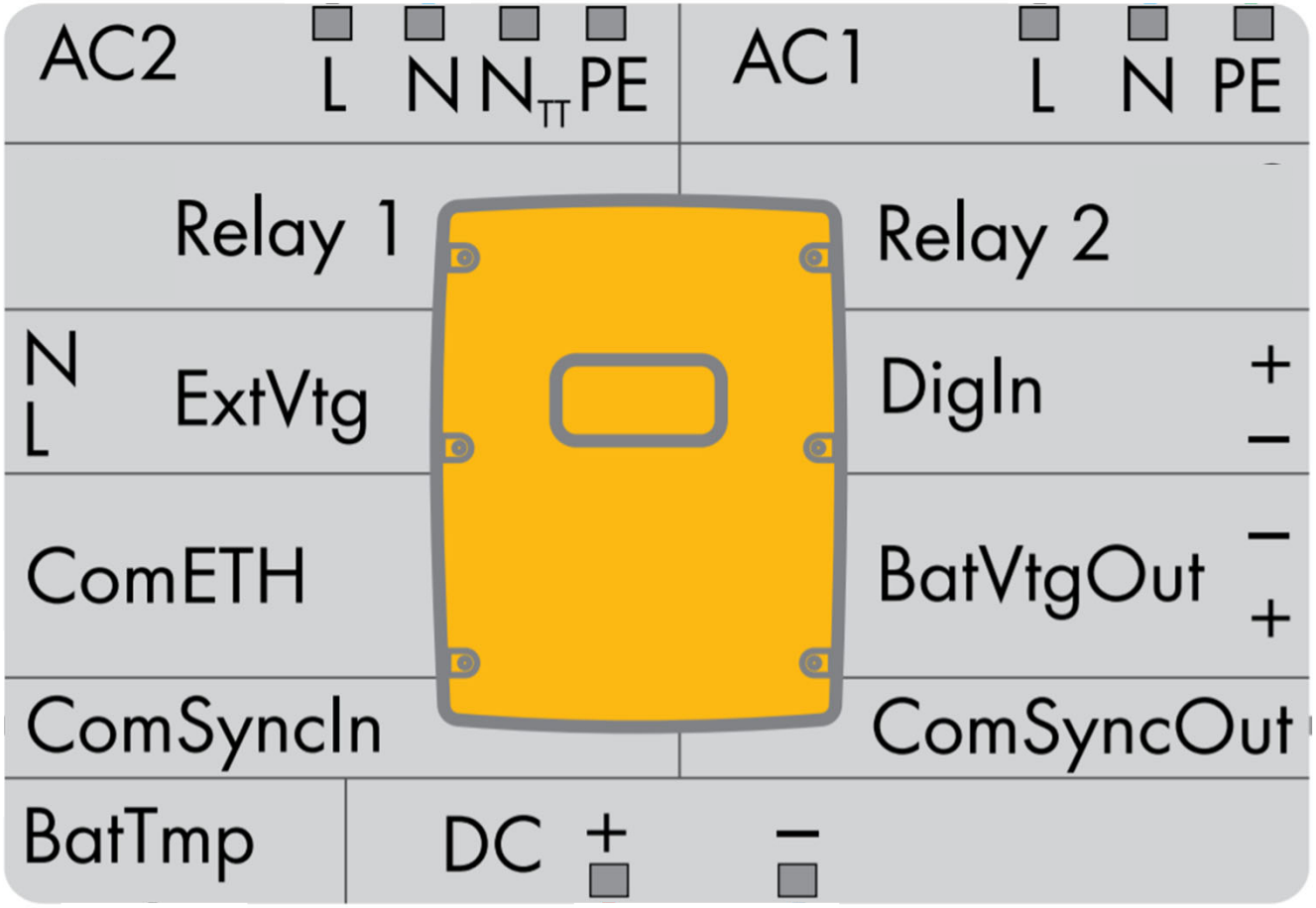

SI 6.0H-13


SI 8.0H-13

AC power: 25 °C /continuously/cos φ =1	3300	4600	**6000**	W
AC power: 25 °C / 30 min / cos φ =1	4400	6000	**8000**	W
AC power: 25 °C / 5 min / cos φ =1	4600	6800	**9100**	W
AC power: 25 °C / 3 s / cos φ =1	5500	11000	**11000**	W

Note 1: AC power at AC1- terminals

SUNNY ISLAND BATTERY INVERTER (IEC)



SUNNY ISLAND BATTERY INVERTER (IEC)
MAIN FEATURES

- SMA offers the Sunny Island inverter M for small systems :

SI 4.4M-13

- Maximum 1 x SI 4.4 M-13 per single-phase system
- Maximum 3 x SI 4.4 M-13 per three-phase system
- I-loop

1. Single-device System (Single-phase)

2. Single-Cluster System (Three-phase)

SUNNY ISLAND BATTERY INVERTER (IEC)
MAIN FEATURES

- SMA offers the Sunny Island inverters H for medium- and large systems :

SI 8.0H-13 & SI 6.0H-13

- Maximum 3 x SI 8.0/6.0H-13 per single-phase system
- Maximum 36 x SI 8.0/6.0H-13 per three-phase system
- Only same Sunny Island type in each cluster supported
- Different cluster types in an multi-cluster system supported
- V-loop

1. Single-device System (Single-phase)

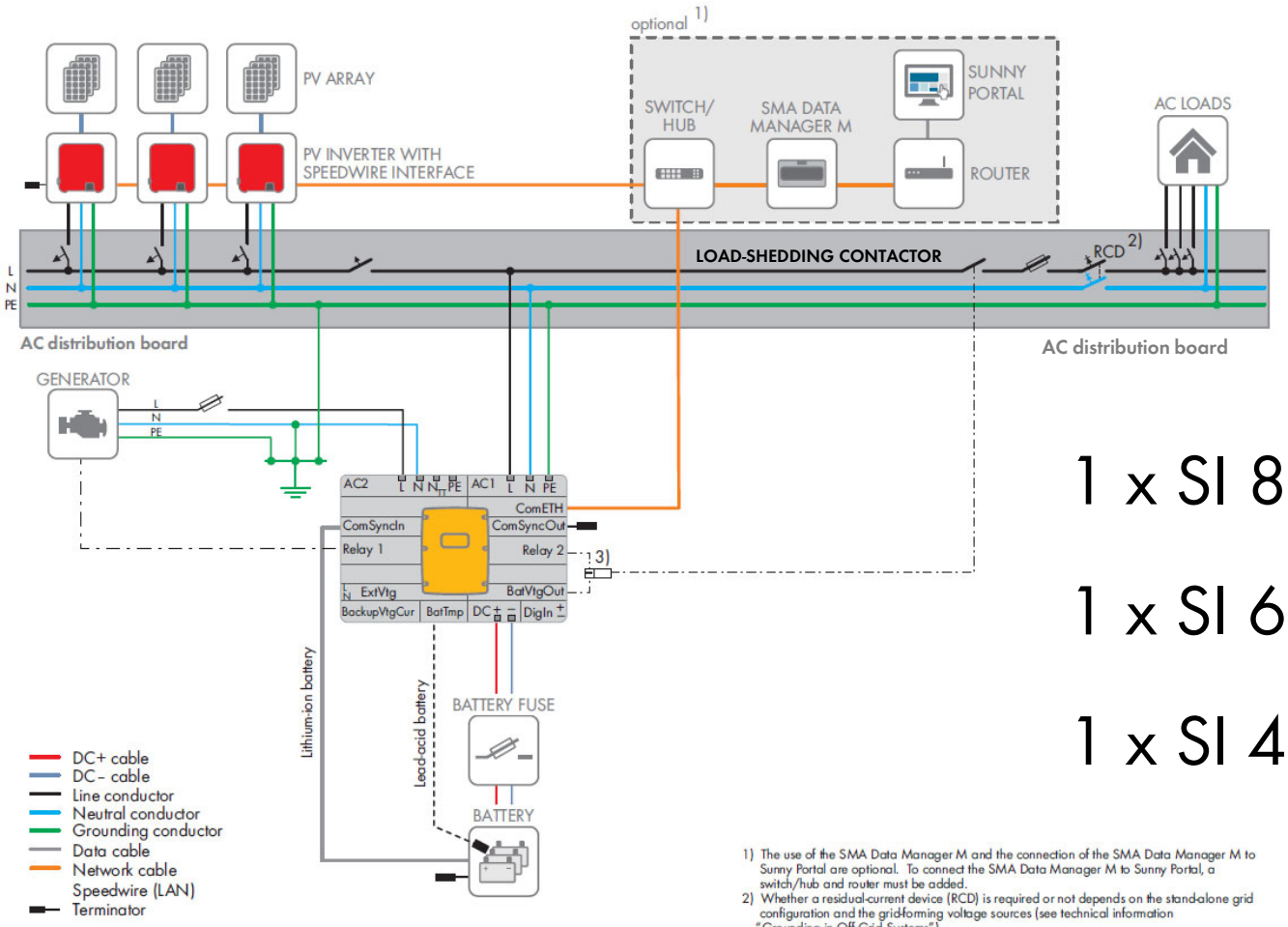
2. Single-Cluster System (Single-phase)

3. Single-Cluster System (Three-phase)

4. Multi-Cluster System (Three-phase)

1. SINGLE-DEVICE SYSTEM

01



1 x SI 8.0 H-13 or

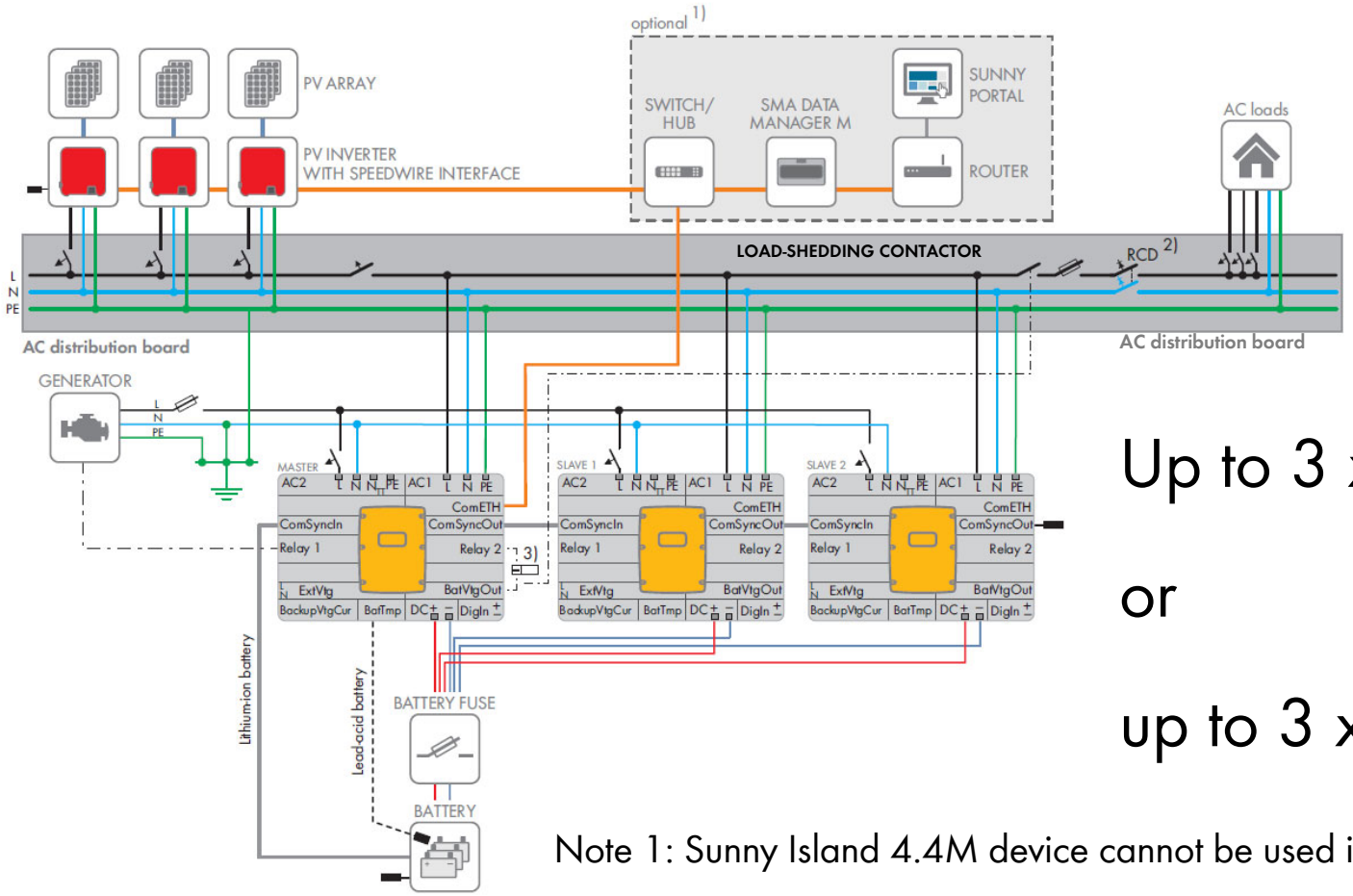
1 x SI 6.0 H-13 or

1 x SI 4.4 M-13

1) The use of the SMA Data Manager M and the connection of the SMA Data Manager M to Sunny Portal are optional. To connect the SMA Data Manager M to Sunny Portal, a switch/hub and router must be added.
2) Whether a residual-current device (RCD) is required or not depends on the stand-alone grid configuration and the grid-forming voltage sources (see technical information "Grounding in Off-Grid Systems").
3) DC-supplied contactor

2. SINGLE-PHASE SINGLE-CLUSTER SYSTEM [1]

02



Up to 3 x SI 8.0 H-13

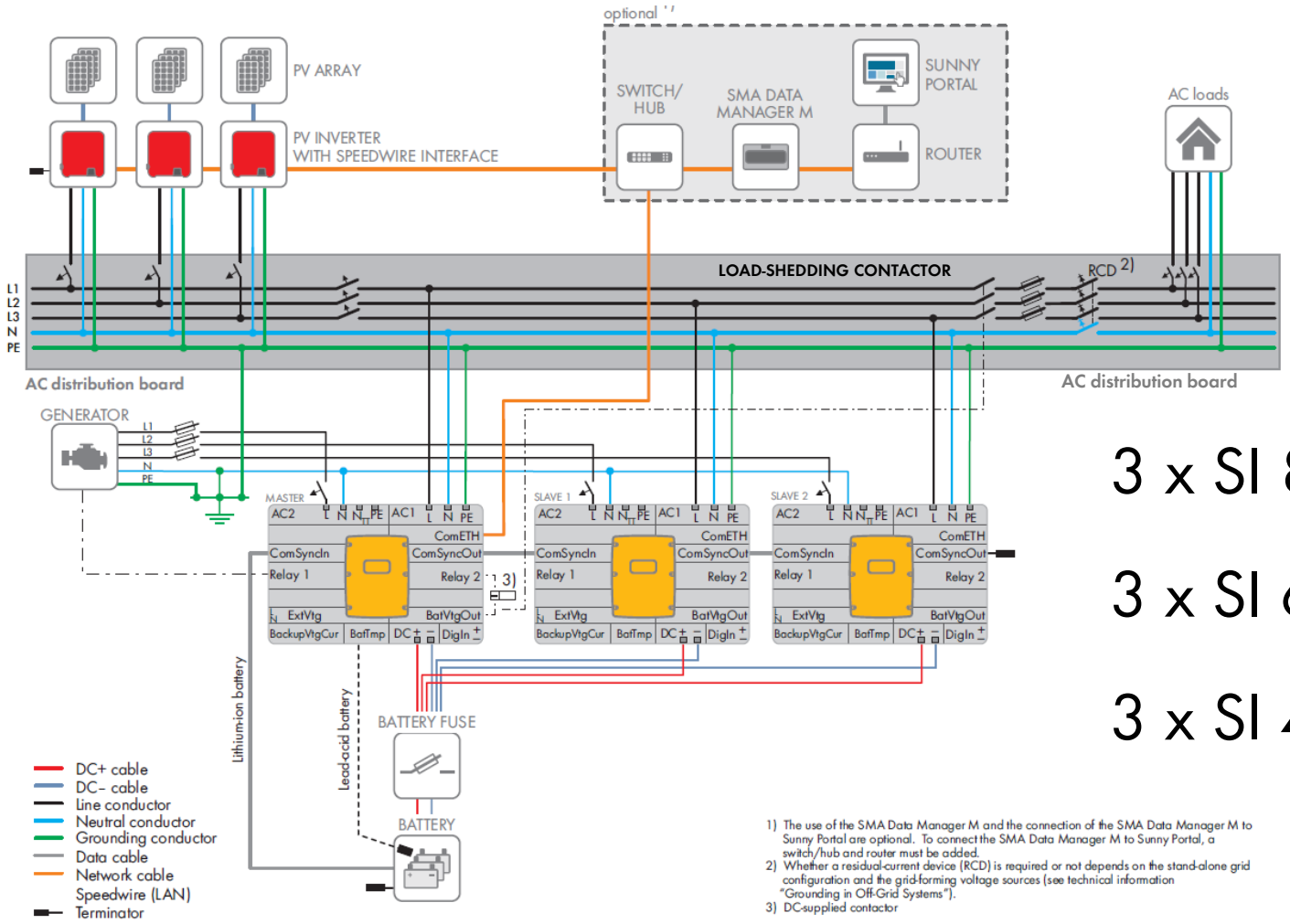
or

up to 3 x SI 6.0 H-13

Note 1: Sunny Island 4.4M device cannot be used in single-phase single-cluster systems

3. THREE-PHASE SINGLE-CLUSTER SYSTEM

03



3 x SI 8.0 H-13 or

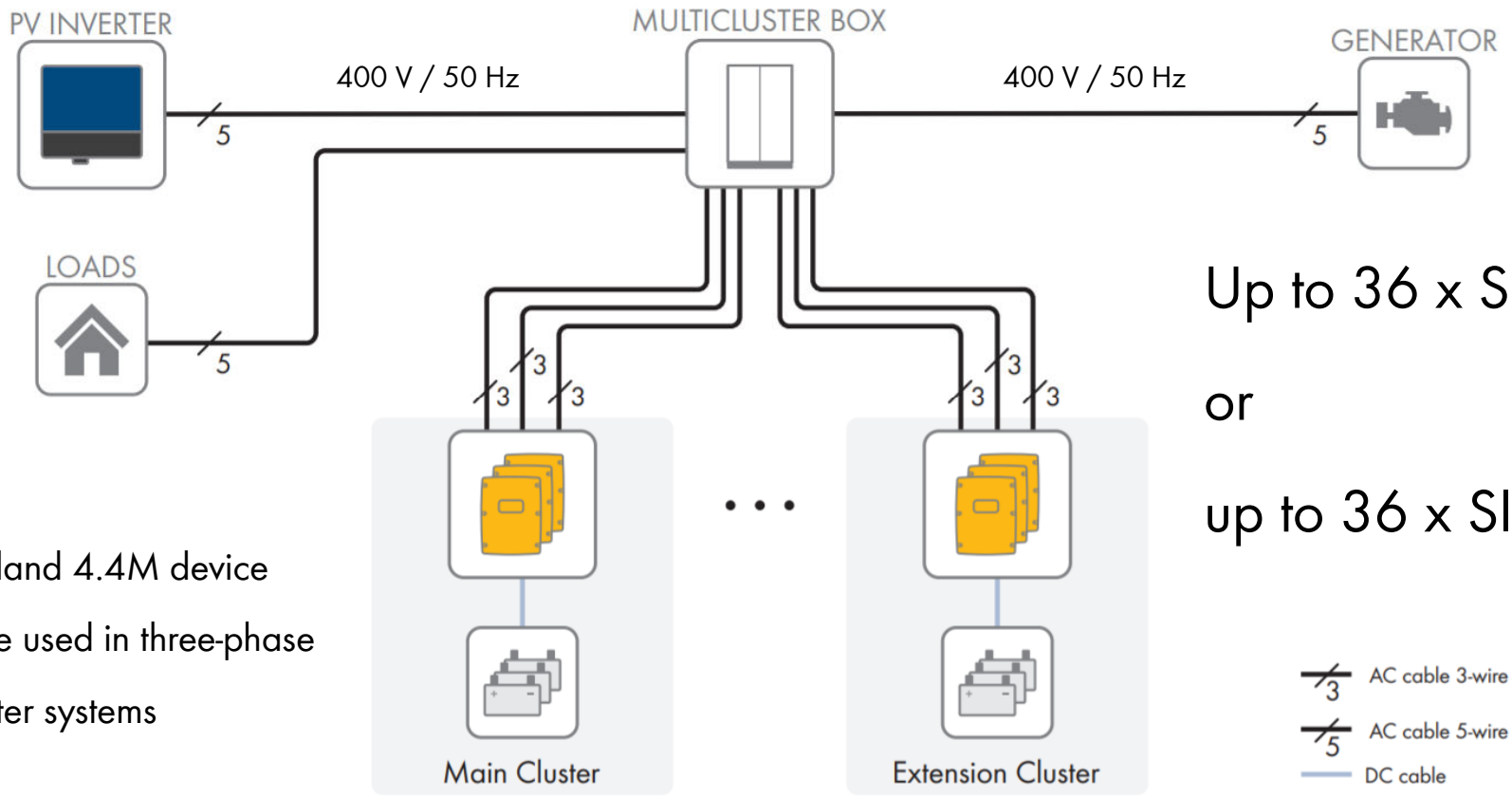
3 x SI 6.0 H-13 or

3 x SI 4.4 M-13

1) The use of the SMA Data Manager M and the connection of the SMA Data Manager M to Sunny Portal are optional. To connect the SMA Data Manager M to Sunny Portal, a switch/hub and router must be added.
2) Whether a residual-current device (RCD) is required or not depends on the stand-alone grid configuration and the grid-forming voltage sources (see technical information "Grounding in Off-Grid Systems").
3) DC-supplied contactor

4. THREE-PHASE MULTI-CLUSTER SYSTEM [2]

04



Up to 36 x SI 8.0 H-13

or

up to 36 x SI 6.0 H-13

Note 2: Sunny Island 4.4M device cannot be used in three-phase multi-cluster systems

MULTI-CLUSTER BOXES

04

MC-Box 36.3-11

MC-Box 12.3-20

MC-Box 6.3-11

Single-device and single-cluster systems

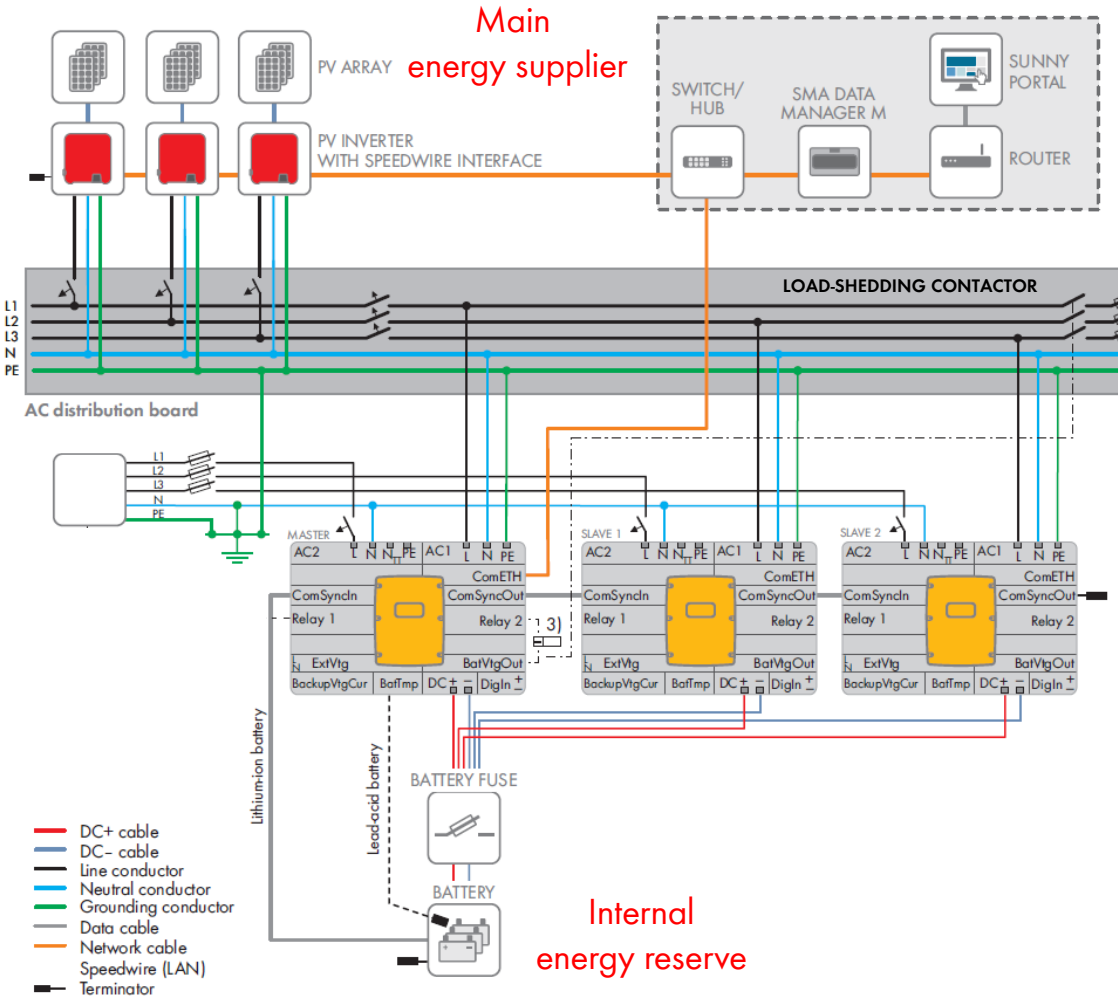
MAIN APPLICATIONS WITHOUT THE MULTICLUSTER BOX

Off-Grid Operation

- Without Multicluster Box
  - 01 PV plant without external source
  - 02 PV plant and Diesel generator
  - 03 PV plant and utility grid
  - 04 Utility grid
  - 05 Utility grid and PV plant
- With Multicluster Box

01 PV PLANT WITHOUT AN EXTERNAL SOURCE [1]

01



Load-shedding contactor highly recommended

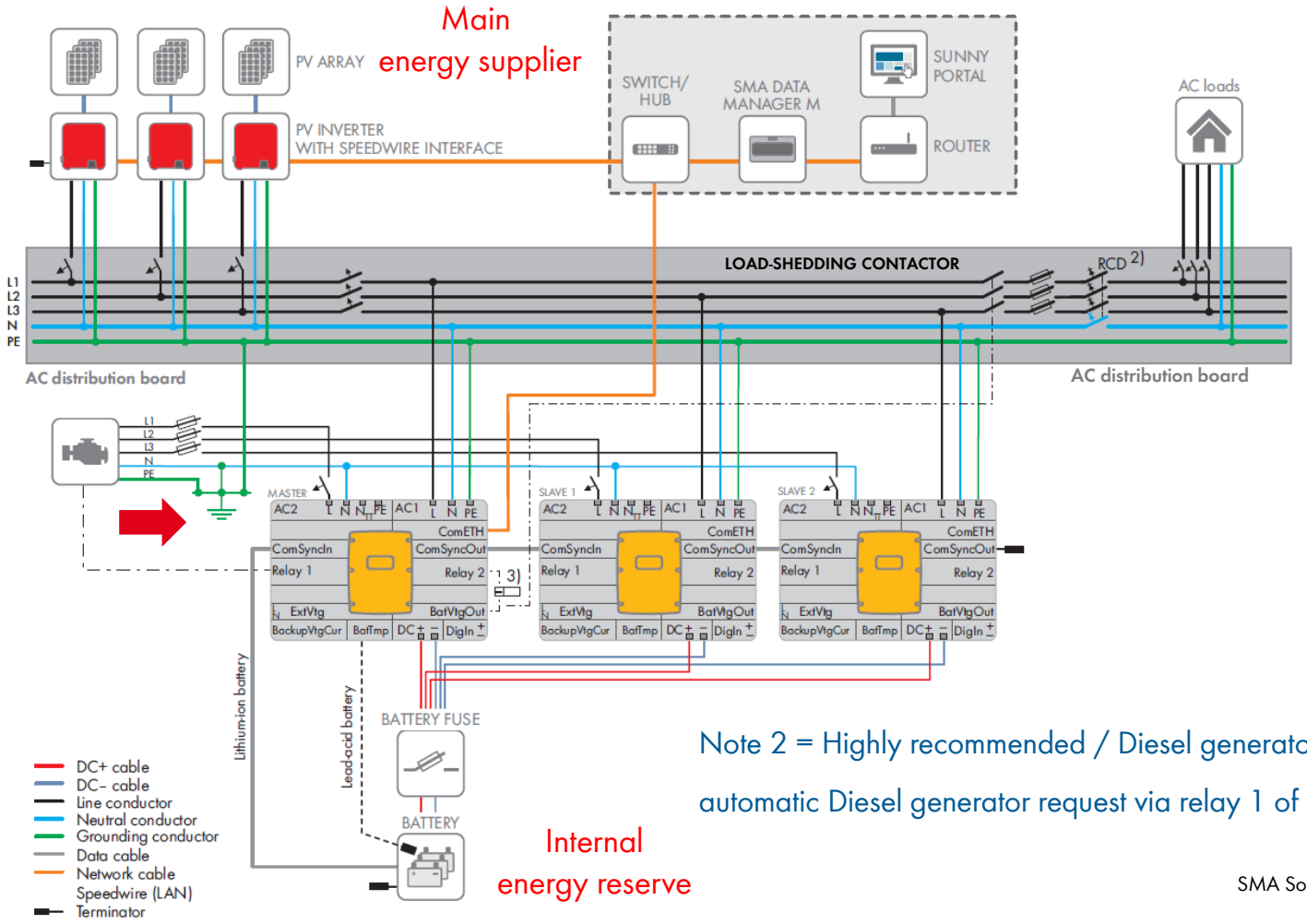
Note 1 = Autonomous grid is connected to AC1 / external load-shedding contactor controlled by relay 2 of Master / not recommended because the battery cannot be charged by an external source in case of emergency (worst weather, PV strings failures, too high demand,...)

02 PV PLANT AND DIESEL GENERATOR [2]

02

External energy reserve

Diesel generator start / stop depending on State of Charge (SoC) of battery



Internal energy reserve

Load-shedding contactor recommended

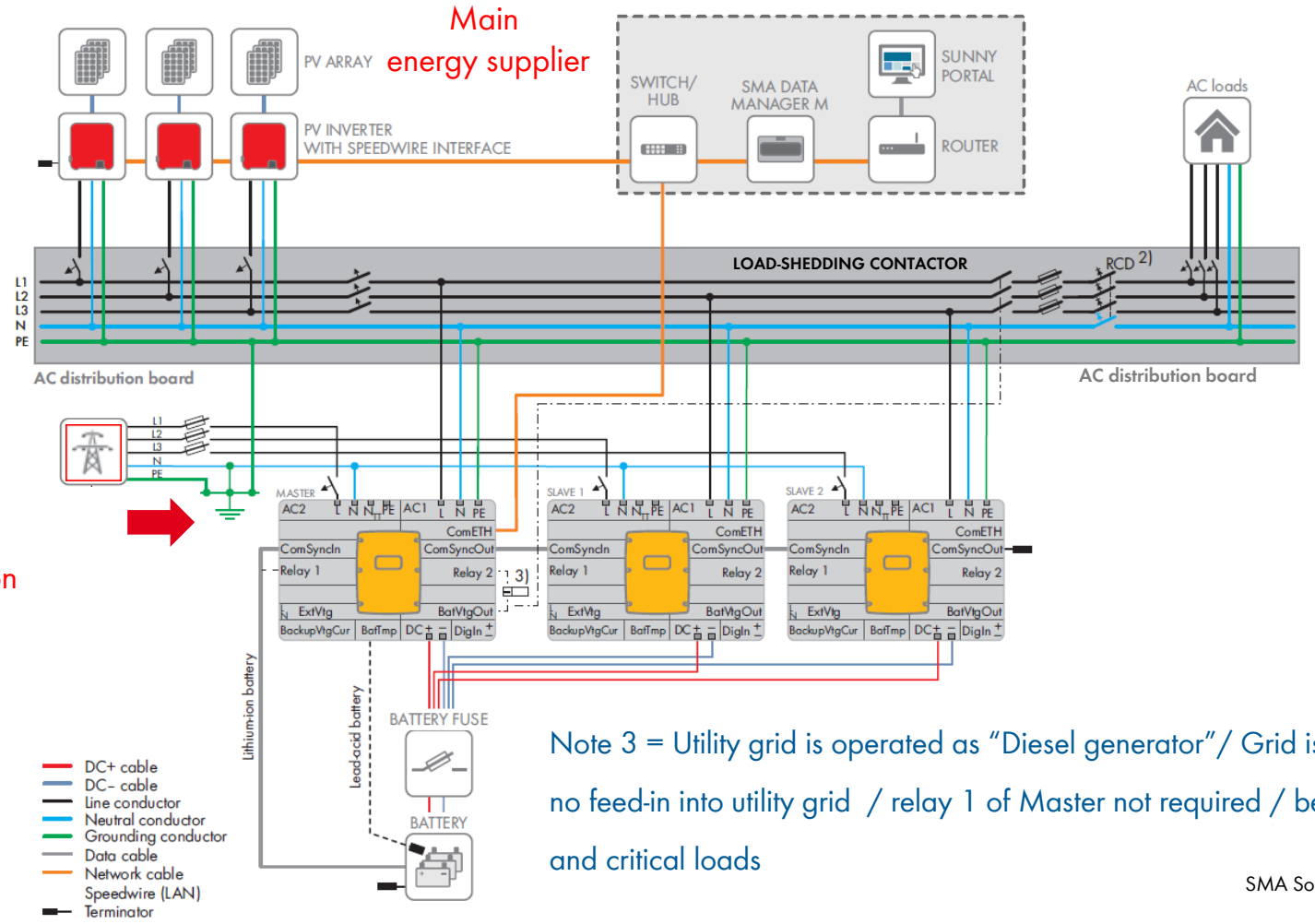
Note 2 = Highly recommended / Diesel generator is connected to AC2 / automatic Diesel generator request via relay 1 of Master / no reverse power

03 PV PLANT AND UTILITY GRID [3]

03

External energy reserve

Utility grid connection/disconnection depending on State of Charge (SoC) of battery



Load-shedding contactor optional

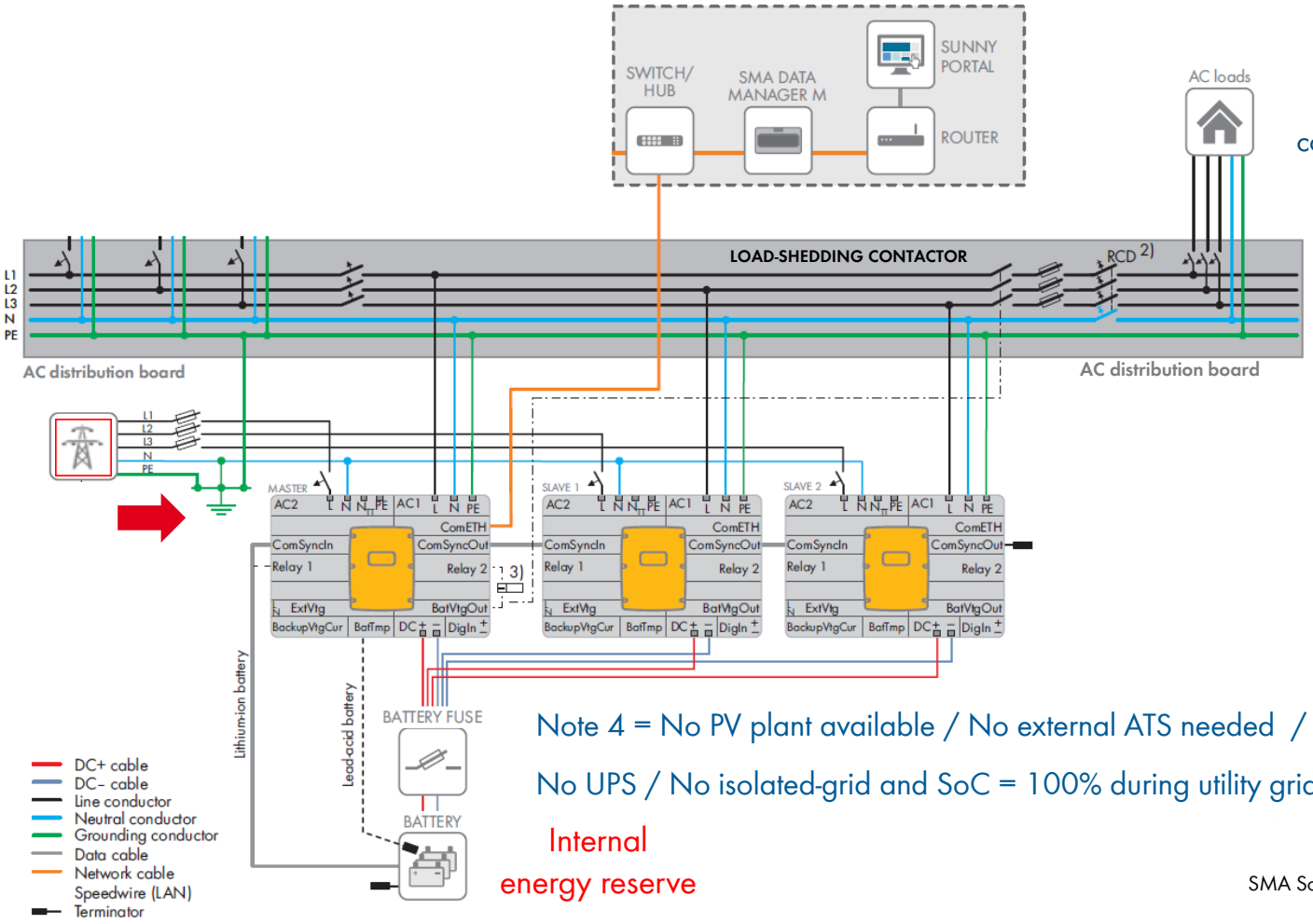
Note 3 = Utility grid is operated as “Diesel generator”/ Grid is connected to AC2 / no feed-in into utility grid / relay 1 of Master not required / best solution for weak grids and critical loads

04 UTILITY GRID [4]

04

Main
energy supplier

Utility grid
permanently connected



Load-shedding
contactor highly recommended

Note 4 = No PV plant available / No external ATS needed / short-term storage system /
No UPS / No isolated-grid and SoC = 100% during utility grid operation

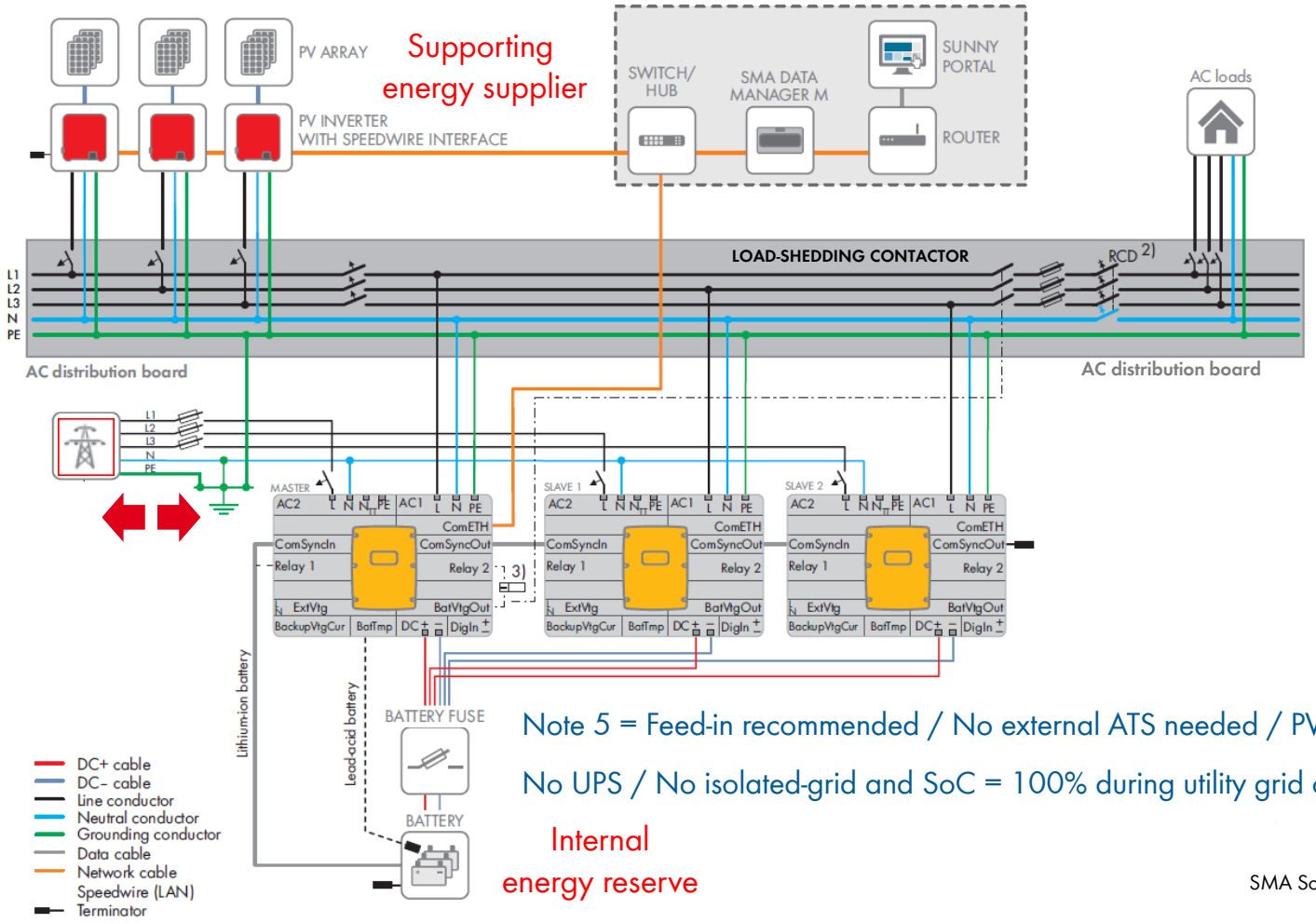
Internal
energy reserve

05 UTILITY GRID AND PV PLANT [5]

05

Main
energy supplier

Utility grid
permanently connected



Load-shedding
contactor optional

Note 5 = Feed-in recommended / No external ATS needed / PV plant as supporting system /
No UPS / No isolated-grid and SoC = 100% during utility grid operation

Internal
energy reserve

SMA Solar Technology AG

Sonnenallee 1
34266 Niestetal, Germany

Tel. +49 561 9522 0
Fax +49 561 9522 100

SMA.de
info@SMA.de