Technical Information

SUNNY TRIPOWER CORE1

Simplified Implementation of Grid and PV System Protection in PV Systems in accordance with VDE AR-N 4105:2018-11

ENGLISH

STP50-40-NA-TI-en-11 | Version 1.1

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1 Introduction

SMA Solar Technology AG will release a new firmware version for the Sunny Tripower CORE1 in August 2019. This considerably simplifies the grid and PV system protection required by the application guide VDE-AR-N 4105. For PV systems with Sunny Tripower CORE1 (> 30 kW to 135 kW), this means it is now possible to replace the external tie switch for disconnection from the grid with the disconnection units already integrated into the inverter. Additional costs for the external tie switch can therefore be omitted.

This technical information describes, in addition to the basic principles, the necessary steps and requirements for implementing integrated grid and PV system protection in PV systems with Sunny Tripower CORE1 for installers and system planners.

2 Basic Information

The grid and PV system protection is a "type-tested protective device with a certificate of compliance" as per application guide VDE-AR-N 4105. This type-tested protective device with a certificate of compliance constantly monitors the voltage and frequency of the transmission line for compliance with the specified tolerances and prevents the formation of stand-alone grids.

For generating systems < 30 kW, the grid and PV system protection that is integrated into the inverters as standard is sufficient in Germany. For generating systems > 30 kW, however, external grid and PV system protection is required. Here it is absolutely necessary that an external monitoring unit with an integrated system protection relay is implemented. Whereas for systems up to 135 kW, the tie switch that disconnects the PV system from the utility grid does not necessarily have to be implemented externally, provided the standard requirements are complied with. Thus, the external grid and PV system protection consists of two components:

- Monitoring unit with a grid and system protection relay
- Tie switch that is switched via the system protection relay of the monitoring unit and disconnects the PV system in the event of a grid failure.

Up until now, when using a Sunny Tripower CORE1, the tie switch had to be realized externally, i.e. outside the inverter. Consequently, additional costs of up to €2,000 were incurred, depending on the size of the system.

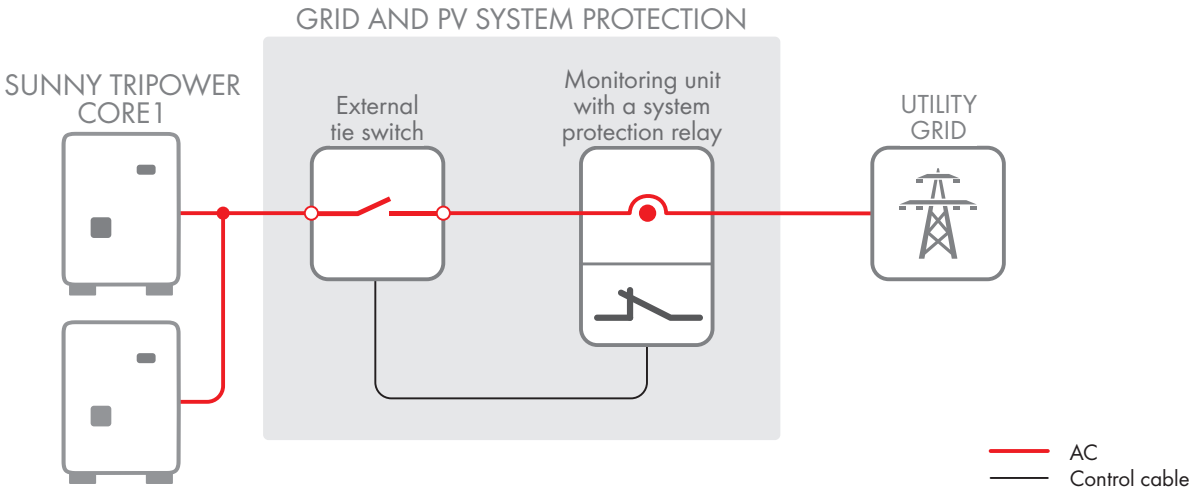


Figure 1: PV system with external tie switch

As the the Sunny Tripower CORE1 already includes redundant and monitored switching elements for disconnection from the utility grid, these can now be connected to the system protection relay of the external monitoring unit electrically by making appropriate changes in the firmware of the inverter and providing an interface (use of the optional SMA I/O module (MD.IO-40)). Thus, the tie switch prescribed by applicable standards is implemented in the inverter. The expensive external tie switch can therefore be omitted in the future.

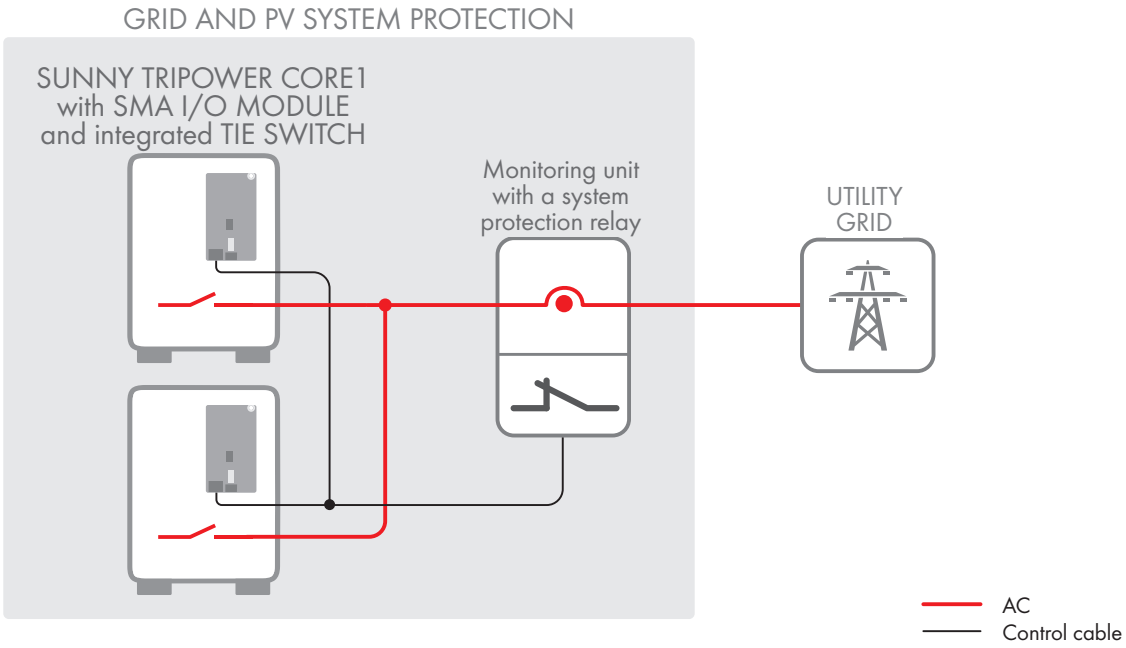


Figure 2: PV system with tie switch integrated in the inverter.

SMA Solar Technology AG provides a corresponding manufacturer's declaration for download regarding the use of the internal tie switch of the Sunny Tripower CORE1 for the above-mentioned application.

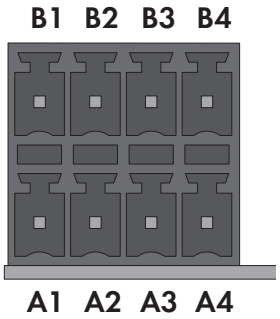
3 Requirements

The following requirements must be met to be able to use the function:

- The Sunny Tripower CORE1 must be equipped with firmware version ≥ 3.01.00.R. The function can be upgraded for inverters that have already been delivered. A manufacturer's declaration is available for download on the product page at www.SMA.de.
- All Sunny Tripower CORE1 devices in a system must be equipped with an SMA I/O-Module (MD.IO-40), available as an accessory.
- As before, the system must contain a certified monitoring unit (e.g. Ziehl, Bender or similar) with an integrated potential-free system protection relay. The alarm contact must be a break contact.
- Connection cable:
  - Conductor cross-section: 0.5 mm² to 0.75 mm²
  - UV resistance required
  - Maximum cable length: 200 m (between inverter and grid and PV system protection)

4 Installation

Only the most important installation steps are shown here. Observe the manuals of the installed components. The following figure shows the pin assignment scheme of the I/O Module (MD.IO-40) that must be installed in all Sunny Tripower CORE1 devices.



B1 = 24 V
B2 = digital input 1
B3 = digital input 2
B4 = digital input 3

A1 = 24 V
A2 = digital input 4
A3 = digital input 5
A4 = digital input 6

Figure 3: Pin assignment of the SMA I/O Module

Pin **A4** and Pin **A1 (+24 V)** are provided for connection to the system protection relay of the external monitoring unit (break contact). Observe that the digital input signals in SMA communication devices (e.g. SMA Data Manager, Sunny Portal) are marked **DI1 to DI6**. Figure 3 shows the reference of pin to digital input. The following figure shows a wiring example including two Sunny Tripower CORE1 devices with installed SMA I/O Module and system protection relay of the monitoring unit.

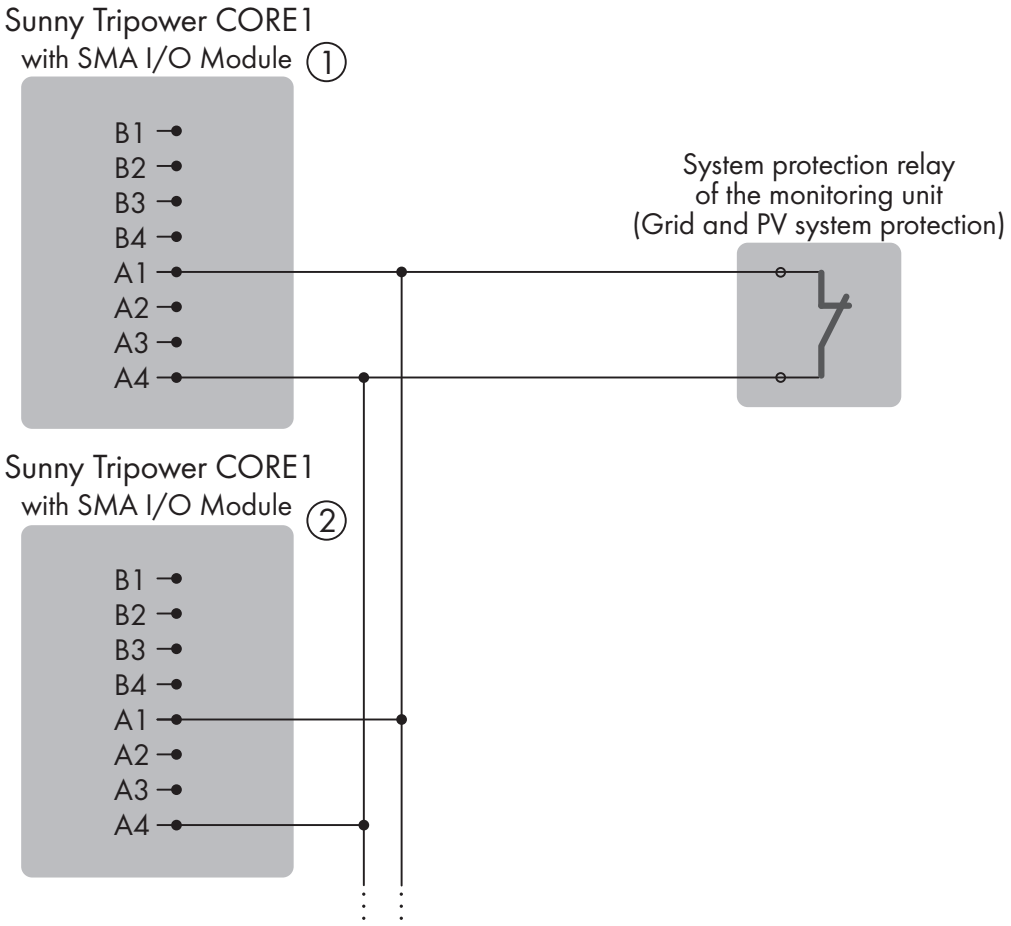


Figure 4: Wiring example for grid and PV system protection without active power setpoint

In order to use the grid and system protection function for several devices, each inverter must be equipped with its own SMA I/O module. In addition to grid and PV system protection, it is also possible to implement an active power setpoint for the entire system (4 digital inputs) via an I/O module. The wiring scheme is shown in the following figure.

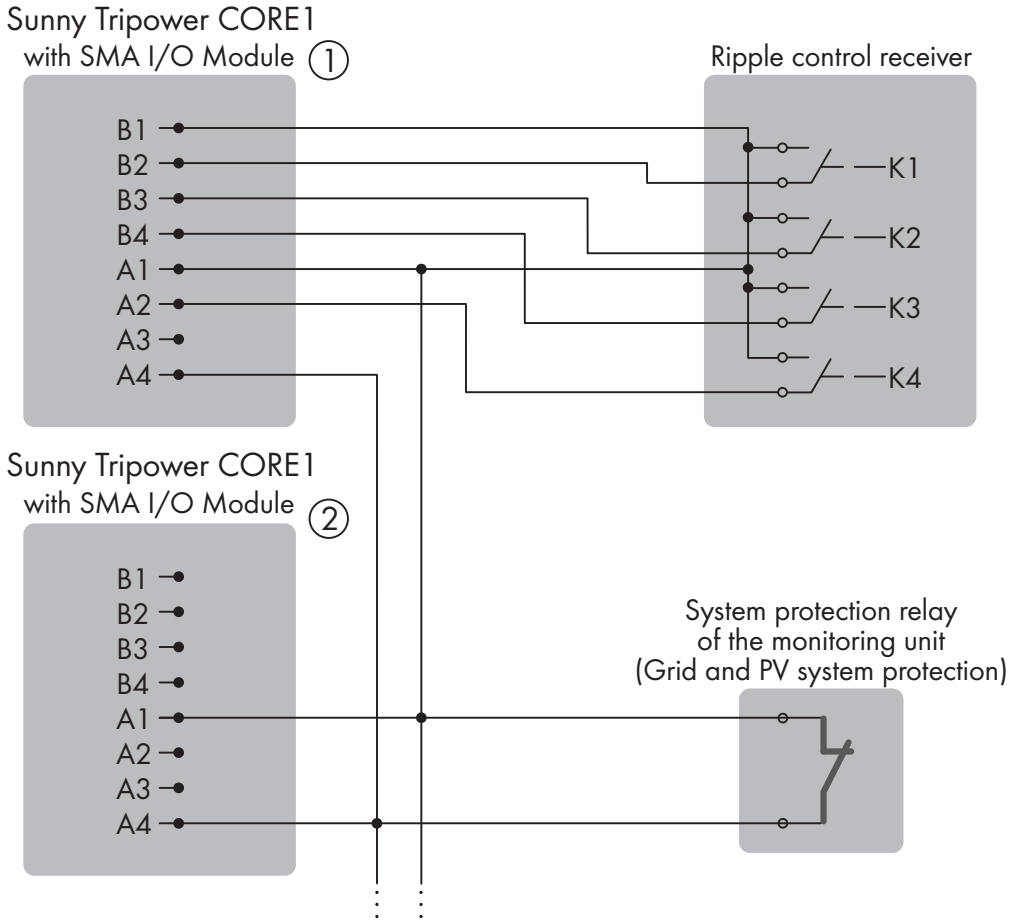


Figure 5: Wiring example for grid and PV system protection with active power setpoint

In the use case show here, with forwarding of the signal to reduce active power, the inverters are connected via Speedwire (Ethernet). In this case, the ripple control receiver for setting the active power setpoint only has to be connected directly to one inverter's SMA I/O Module. In this case, the curtailment signals are forwarded via the existing Speedwire communication to the inverters, which are connected to each other via the network.

5 Commissioning and Testing

The prerequisite for enabling the grid and system protection function is that the country data set of the inverters is set to **VDE-AR-N 4105:2018-11**.

The following steps must be carried out on the inverter to commission the grid and system protection:

- Install the SMA I/O Module and connect it to the external monitoring unit.
- Update the firmware to version ≥ 3.01.XX.R. for all Sunny Tripower CORE1 devices in the system.
- Enable the grid and PV system protection function in all Sunny Tripower CORE1 devices. There are the following possibilities:
  - Activation via the User Interface

    All Sunny Tripower CORE1 devices must complete this step. You can make the setting via the installation wizard or via the **Device parameters** menu.
  - Activation via the User Interface of a Communication Device

    If you enable the function via a communication device, the setting data is transferred to all registered inverters.

Setting via the installation assistant on the inverter's user interface

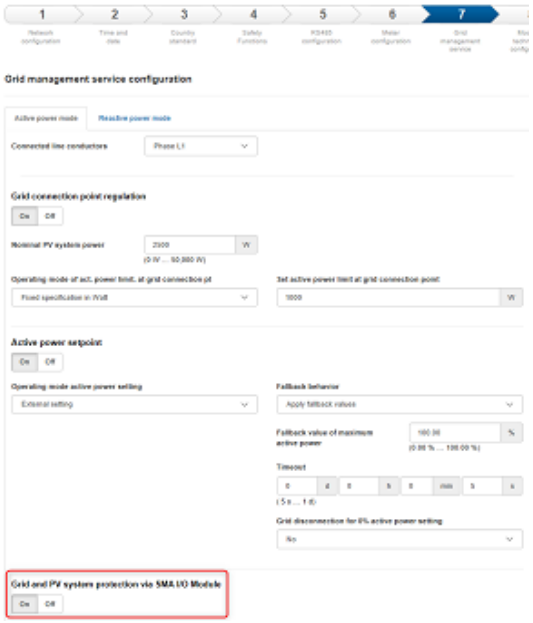


Figure 6: Activating the grid and PV system protection in the installation assistant

Procedure:

1. Access the user interface.
2. Start the installation assistant.
3. Select [**Save and continue**] until the step **Grid management service**.
4. Select the field **On** in the **Active power setpoint** section under **Grid and PV system protection via SMA I/O Module**.

Setting via the device parameters on the inverter's user interface

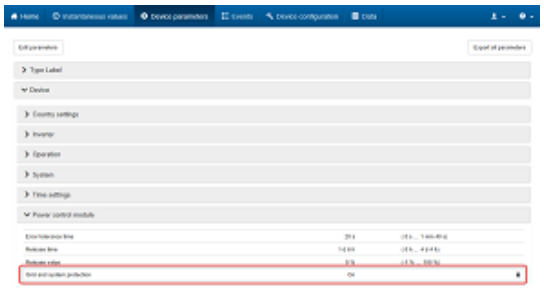


Figure 7: Activating the grid and PV system protection in the **Device parameters** menu

Procedure:

- Select **Device parameters > System and device control > Power control modules > Grid and PV system protection** and enable the **On** button.

Activation via the User Interface of a Communication Device

- Use the search function to find the object name **PwrCtlMdul.GriSysPro** and set the parameter to **On**.

Disconnection test

- To test the disconnection of the system, interrupt the signal cables for external grid and PV system protection or trigger a disconnection test via the external monitoring unit.

6 Event Messages

When the grid and system protection function is enabled, the inverter can generate the following event messages:

Event number	Message and Cause
10513	**GMS fast stop: Stop through PV system control is executed** This event is generated by the monitoring relay of the monitoring unit when the grid and PV system protection device is triggered. The inverter disconnects from the utility grid.
7622	**No communication with the I/O module** This event is displayed during a device-internal communication error with the SMA I/O Module. For safety reasons, the inverter disconnects from the utility grid.

7 Frequently Asked Questions

Is simplified grid and PV system protection approved for all systems from 30 kW to 135 kW?

Yes. The solution conforms to standards. However, it should be taken into account that the overall solution (Sunny Tripower CORE1 with SMA I/O Module (IO.MD-40) and an external monitoring unit) must be approved by the electric utility company in advance.

Is it possible to use the solution in systems > 135 kW?

No. At > 135 kW, the system is within the scope of VDE-AR-N 4105:2018-11. Here, an external tie switch is required in the standard.

Under which country settings can the simplified grid and PV system protection be implemented?

This function is available for all country data sets ≥ 2018, e.g. **DE VDE-AR-N4105:2018-11 Generators > 4.6 kVA**. The country data set can be set via the user interface of the inverter or via the SMA Data Manager in Sunny Portal.

Can the grid and PV system protection also be implemented by an Ethernet connection between the inverters?

No. The grid and PV system protection always requires a separate line due to safety reasons as well as 1 SMA I/O Module per inverter.

Can the integrated grid and PV system protection also be used in mixed systems, e.g. with other Sunny Tripower inverters?

No. The implementation of simplified grid and PV system protection is currently approved only for the Sunny Tripower CORE1 in conjunction with the SMA I/O Module (MD.IO-40).

How many Sunny Tripower CORE1 devices can be combined?

It is technically possible to combine up to 11 Sunny Tripower CORE1 inverters. Only 2 Sunny Tripower CORE1 devices are necessary for the use case described in this document.

Which external monitoring units are compatible?

At the moment, many systems are, for example, implemented with monitoring units from the manufacturers Ziehl (ZIEHL industrie-elektronik GmbH + Co KG) and Bender (Bender GmbH & Co. KG). In the appendix, a connection example with an external monitoring unit from Ziehl is shown.

Does a feedback contact for the grid and PV system protection has to be implemented?

No. There is no need for additional feedback because the tie switch in the inverter is already monitored internally.

Is an additional voltage supply required, for example, during dynamic grid support?

No. The Sunny Tripower CORE1 provides an AC- and DC-supplied 24 V output voltage via the SMA I/O Module for reading the system protection relay of the external grid and PV system monitoring unit. The external monitoring unit usually contains a wide-range power supply unit that supplies the monitoring unit with sufficient power even with dynamic grid support.

Can an SMA I/O Module also be used for active power supply in parallel to grid and PV system protection?

Yes. For this, the SMA I/O Module can be used (see Section 4 "Installation", page 5).

Can cable lengths > 200 m also be implemented between the monitoring unit and the inverter?

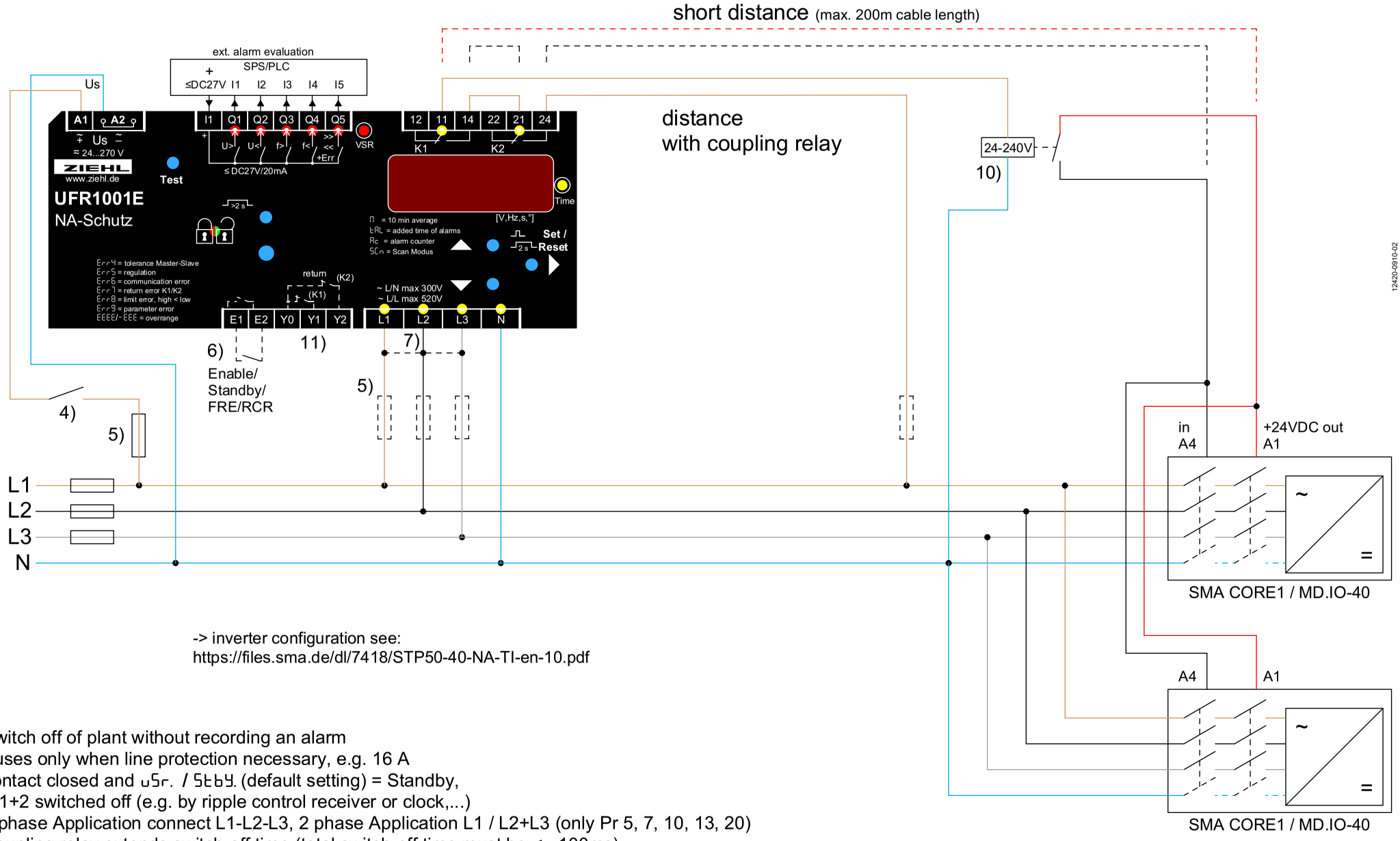
Yes. There is a simple implementation with an additional relay in the communication line. In the appendix, you will find an application example from Ziehl.

8 Appendix

The following application example shows how the simplified grid and PV system protection is implemented with Sunny Tripower CORE1 and an external monitoring unit from Ziehl (ZIEHL industrie-elektronik GmbH + Co KG, https://www.ziehl.com/en/AllProducts/detail/UFR1001E-54, 2019-12-06).

Kurzbezeichnung: UFR1001E	Bezeichnung: Example connection plans VDE-AR-N 4105:2018-11			ZIEHL
bearbeitet: 2019-12-16/Ba	**SMA Core1 using integrated switches** over SMA I/O Module MD.IO-40 (required for each inverter)	Maßstab: -	Ers. für: 12420-0911-02	Zeichnungsnummer: **12420-0911-03**
		EA-Nr.: 15390	Blatt: 8 of 8	

VDE-AR-N 4105:2018-11



-> inverter configuration see:
https://files.sma.de/dl/7418/STP50-40-NA-TI-en-10.pdf

4) Switch off of plant without recording an alarm
5) Fuses only when line protection necessary, e.g. 16 A
6) contact closed and uSr. / StbY. (default setting) = Standby,
K1+2 switched off (e.g. by ripple control receiver or clock,...)
7) 1 phase Application connect L1-L2-L3, 2 phase Application L1 / L2+L3 (only Pr 5, 7, 10, 13, 20)
10) Coupling relay extends switch-off time (total switch-off time must be <= 100ms)
11) set trEL = oFF to deactivate feedback-contacts

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