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ENEAS design study

Photovoltaic power plant – highest voltage 22 kV

General description

Photovoltaic park with inverter containers of two megawatts each and one medium-voltage (MV) substation situated at the photovoltaic plant. The photovoltaic power plant is expected to generate power without disruptions after installation.

A system is only as strong as its weakest link. That's why only proven components are used along the chain from the sun to the grid. A photovoltaic plant that does not work one hundred percent means a loss of revenue. A fast and accurate detection of faults helps minimize losses and provides investment protection to the photovoltaic plant owner.

System overview

Main parts:

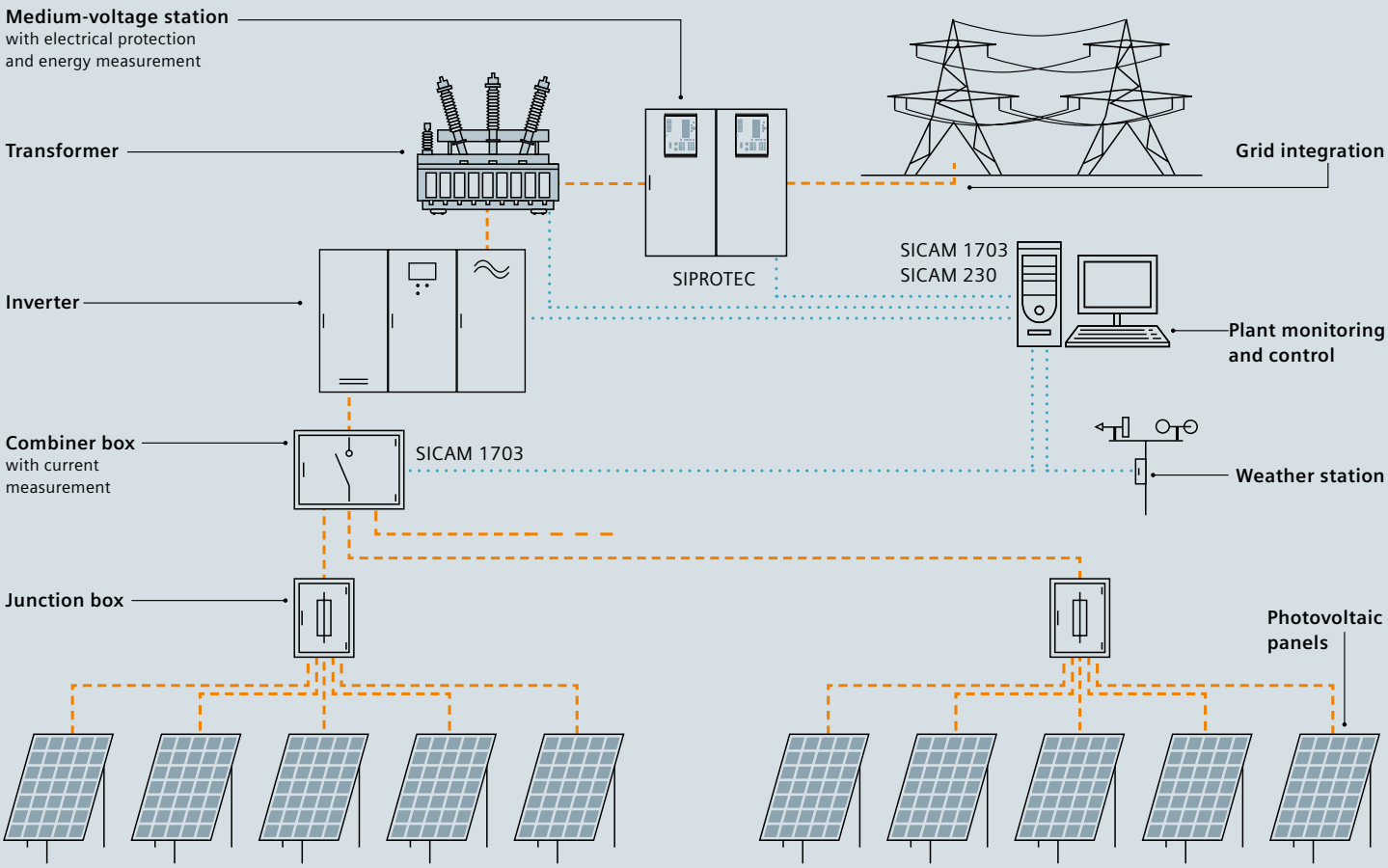
- Photovoltaic panels
- Junction boxes
- Combiner boxes, equipped with SICAM 1703 current measurement
- Power inverter, equipped with communication interface to the SICAM monitoring and control system
- Step-up transformer
- MV switchgear, controlled and protected by SIPROTEC devices
- Monitoring and control system SICAM 1703 and SICAM 230

A photovoltaic string consists of 20 photovoltaic panels connected together, and five photovoltaic strings are connected to a junction box. A junction box contains a photovoltaic fuse and a surge arrester for each string and one miniature circuit breaker (MCB) for the connection to the superordinate level (see configuration schematic on page 2 for details).

Seven junction boxes are connected to a combiner box, which contains a direct current (DC) isolator for each junction box, along with a measuring device for the current from each junction box and another DC isolator for the connection to the next level.

On this level, three combiner boxes are connected to one inverter. Four inverters are combined in an inverter container, which is equipped with step-up transformers.

The inverter containers are connected to the MV switchgear in the control building through an MV ring. From there, the power is fed into the MV distribution grid.



Specifications

The monitoring and control system is one of the most important parts of the system. It performs:

- Registration, reporting, and recording of faults
- Registration and recording of measurements (statistics)
- Execution of commands from the utility, such as power limitation and reactive power compensation
- Control and monitoring of the power inverter
- Analysis and remote diagnosis of faults
- Fast identification and location of defects
- Long-term analyses

SICAM 1703 and SICAM 230 cover all tasks of the monitoring and control system. SICAM can be used for current measurement in the DC combiner boxes, control and monitoring of the inverter container and the transformers up to the joint controller, and control of auxiliary services and the weather station. The entire control and monitoring part of the photovoltaic plant, including the HMI, can be parameterized and maintained with a single tool.

Core benefits

- Each photovoltaic string equipped with individual fuse protection
- Two-stage combiner box concept minimizes power loss due to increased cable cross-sections
- Container system simplifies the general layout of the installation and reduces overall costs of the photovoltaic plant
- All control and monitoring devices can be parameterized with a single tool
- Local know-how everywhere around the world
- Faults or performance weaknesses in the photovoltaic field are immediately identified
- Remote real-time monitoring of the photovoltaic plant
- Successful application in MV plants for over ten years
- Open standard data interface for the utility

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