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Power Conditioning for Photovoltaic Power Systems

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In PV systems, power conditioning units are used to provide a match between the specific characteristics of the PV generator and the connected balance of system (BOS) components. Furthermore, they take over the control of other BOS components, for example, batteries or back-up generators.

In general, the characteristic curve of a PV generator varying with solar radiation and temperature does not match the characteristic curve of the load. In those cases, the power conditioning unit effects a transformation of the load's voltage and current in such a way, that the PV generator is operated at its optimum operation voltage V_{MPP} even under changing boundary conditions.

In the following chapter, the characteristics of the most common power conditioning units – charge controllers, DC/DC converters and inverters – are described.

In almost every stand-alone system, a charge controller is required to optimally operate the storage battery within safe limits as prescribed by the manufacturer.

The matching of PV generator and the load can be achieved by means of DC/DC converters which can be integral part of a charge controller, an inverter or a DC pump, but can also be a separate BOS component.

If in stand-alone systems the load requires an AC voltage, inverters are used to convert the DC power supplied by the PV generator or the storage battery into AC power. Inverters are mandatory in grid-connected PV systems. Here, besides high efficiency, reliability and power quality, safety is an important issue and has to be dealt with.

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