The charge controller is the link between the solar generator, the battery and the load. It prevents both overcharging and deep discharging of the battery. A list of the most important requirements of the charge controller follows.

- Low internal consumption (<5 mA).
- High efficiency value (96 to 98%).
- Load disconnection if deep discharge occurs (current-dependent, discharge cut-off voltage, if possible).
- Regular charging at a higher voltage to promote gassing.
- Temperature compensation of the charging cut-off voltage (4 to 6 mV/K).
- Reverse poling impossible.
- Breakdown voltage of the semiconductor components at least twice the open circuit voltage of the solar generator.
- Integrated overvoltage protection (conducting capacity limit by a 8/20 norm impulse: 3 kA per installed kWp of the solar generator).
- Ambient temperature (0 to 50°C standard model).

When system complexity increases, then other aspects have to be considered in designing a stand-alone PV system: with appropriate energy management schemes, the use of the electricity generated and the lifetime of sensitive system components can be further optimised, for example, switching off less priority loads, switching on water pumps to access energy to fill a water storage, starting the back-up generator to avoid critical situations for the battery. These energy management units have to be designed specifically for the foreseen application. As described earlier, it is highly recommended that the system displays units that inform the user about the current status of the system and give them advice about how to react in an appropriate way.

17.3.3 Inverters

Inverters are power electronic devices used in various photovoltaic (PV) system configurations:

- grid-connected systems
- stand-alone systems with rechargeable batteries
- pumping systems without storage batteries.

17.3.3.1 Inverters for grid-connected systems

The planning of a grid-connected photovoltaic system begins with the choice of a suitable inverter. This determines the system voltage on the DC side, and the solar generator can then be configured according to the input characteristics of the solar inverter. The inverter is the second most important component of a grid-connected photovoltaic system (after the solar generator). Its task is to convert the direct current generated by the solar cells to a 50-Hz alternating current conforming to the grid. In contrast to inverters intended only for stand-alone operation, those intended for parallel operation must respond just as