

Compatibility between inverter and module technologies

Revised: 22 September 2011

Due to the growing number of new module technologies (e.g. thin-film technology), it is becoming increasingly important to take special module and inverter features into account during the planning phase for a solar system. This document provides information on known restrictions and suitable combinations. On the last page you will find a list of combinations that have been approved by module manufacturers.

Inverters from Sunways AG

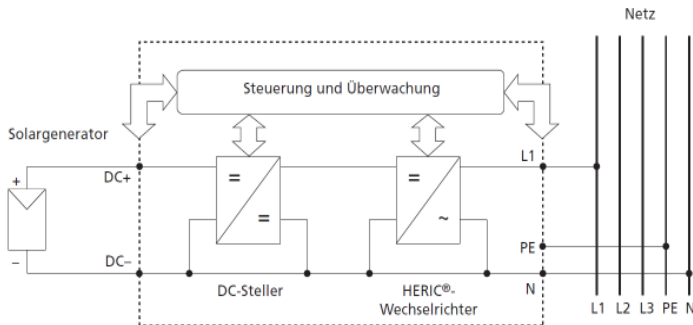
A key factor for deciding whether certain solar modules may be operated with a particular inverter is the voltage curve between the solar generator poles and the earth potential. This voltage curve is determined by the inverter circuitry. The following section contains a description of the individual inverter topologies including block diagrams and solar generator voltage curves.



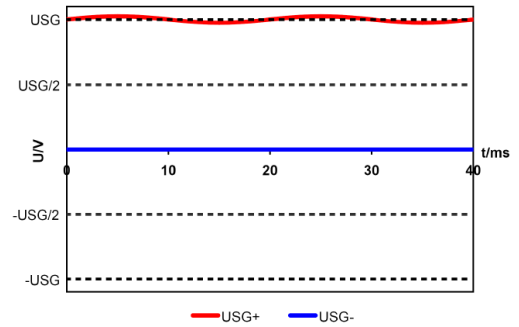
AT series

Consisting of a DC actuator with downstream HERIC inverter. The negative pole of the solar generator is connected to mains N. Single-phase feed, single-phase mains monitoring.

block diagram



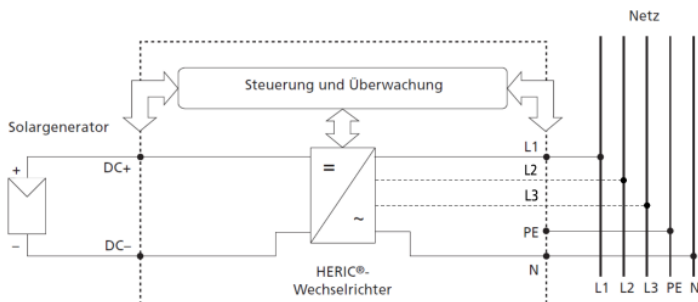
Voltage curve



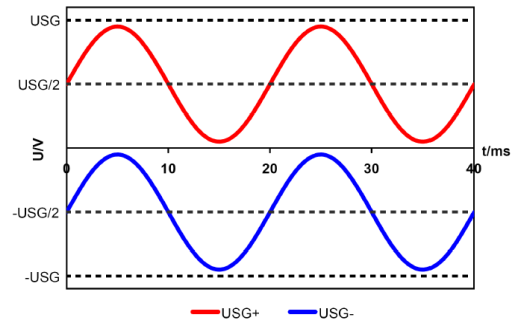
NT-series

Consisting of a direct feed HERIC inverter. The Solar Inverters NT 2500, NT 3700, NT 4200 and NT 5000 have a single-phase feed-in and monitoring. The Solar Inverters NT 10000, NT 11000 and NT 12 000 consist of three independently controlled inverters, with each power unit feeding to a separate phase. The grid voltage monitoring of these devices is three-phase.

block diagram



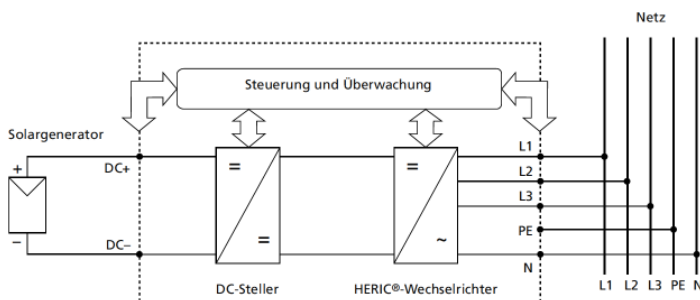
Voltage curve



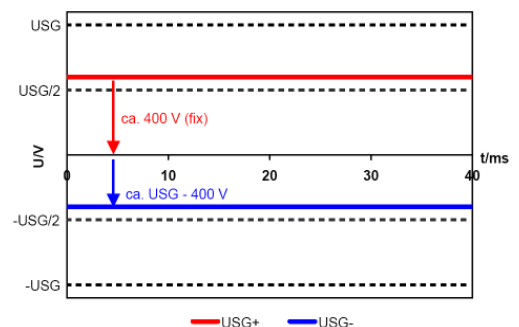
PT-series

Consisting of a DC actuator with downstream HERIC inverter. The positive pole of the solar generator is always fixed at approx. 400 V. The voltage of the negative pole depends on the solar generator voltage (system voltage). Three-phase, symmetric feed, three-phase mains monitoring.

Block diagram



Voltage curve



Compatibility of inverter to solar module

If you are planning a PV system please ask your module manufacturer for the required solar generator voltage curve. Then determine the possible applications based on the following information.

This section describes the different module technologies and the associated inverter requirements. A distinction can be made between five basic cases:

- 1.) Conventional silicon-based solar modules generally have no special inverter requirements. In this case any Sunways solar inverters can be used.
- 2.) In some thin-film or silicon modules the output may be reduced when negative voltages are present on the solar generator. Depending on the module technology, this degradation can be permanent or reversible. Modules of this type require earthing of the negative solar generator pole, as is the case in the AT series.
- 3.) With Sunpower cell technology reversible power degradation may occur as a result of positive solar generator voltages. Modules with this cell type require earthing of the positive solar generator pole. In this case a positively earthed transformer unit should be used. Sunways AG currently does not offer a suitable inverter for this configuration.
- 4.) Certain solar modules generate high leakage currents in the presence of alternating voltage on the generator side, which may lead to the inverter shutting down. These leakage currents are primarily caused by metallic back panels and alternating voltage on the solar generator. In this case the AT series can be used.
- 5.) If the module manufacturer insists on an inverter with galvanic isolation (transformer), please ask for the underlying voltage curve specified by the manufacturer for the module. In addition, the module manufacturer should specify which solar generator pole should be earthed where required.

Solar module manufacturer requirement	Suitable Sunways inverter technology
1.) No requirement	AT series, NT series, PT series
2.) No negative voltages on solar generator	AT series
3.) No positive voltages on solar generator	None
4.) No alternating voltage on solar generator	AT series, PT series
5.) Only transformer unit	Possibly AT series*

* Ask the module manufacturer for the allowed voltage levels at the solar generator

Approval list

Sunways AG is currently in discussions with several module manufacturers with a view of obtaining general approvals for use of the AT, NT or PT series with the respective modules.

Please note that any module/inverter combination must be approved by the module manufacturer.

Combinations approved by module manufacturers:

Company	Solar module	Approved	Additional information
Avancis	Powermax	AT series	see Installation Manual Mat. No. 1000257 (Nov. 2009)
Calyxo	CX-42-60	AT series	With single approval from module manufacturer
ecoTec	DS30V	AT series	
Evergreen Solar	ES-xxx-RL-T ES-xxx-SL-K xxx=170...195)	AT series	See Evergreen Solar Application Guide, Edition 1, October 2007
Evergreen Solar	ES-xxx-RL-TU ES-xxx-SL-KU xxx=170...195)	AT series NT series PT series	Additional identification on the "U" rating plate is required. See document "Evergreen introduces polarisation-free modules", January 2008
First Solar	FS-260 ... FS-277	AT series NT series PT series	NT 8000 / NT 10000: approval list PD-5-429 Rev 1.1 Other Inverters: Project-specific approvals are granted via SDAs submitted by the First Solar customer.
Inventux	X79-a...X94-a X105... X130	AT series	With single approval from module manufacturer
Nexpower	NH-100 Series	AT series	
Q-Cells	Q.SMART, Q.SMART UF, Q.SMART UF L	AT-Series NT-Series PT-Series AT-Series	No earth connection necessary, operation with transformerless and transformer inverters in the following countries: Belgium, Denmark, Germany, Estonia, Finland, France, Great Britain, Iceland, Croatia, Latvia, Lithuania, Luxembourg, Moldavia, Netherlands, Norway, Austria, Poland, Romania, Sweden, Switzerland, Slovakia, Slovenia, Czech Republic, Ukraine, Hungary, Republic of Belarus Functional earth connection required in: Albania, Andorra, Bosnia and Herzegovina, Bulgaria, Greece, Italy, Kazakhstan, Malta, Macedonia, Monaco, Montenegro, Portugal, Russia, San Marino, Serbia, Spain, Turkey, Vatican
Solar Frontier	SF130L ... SF150L	AT-Serie NT-Serie PT-Serie	See letter from Solar Frontier. Plants up to 125 kW power to limit leakage current to 300 mA, otherwise external RCD is required. Please comply with local regulations!
Schott Solar	ASI TM series	AT series	See Schott Solar approval list of 18 March 2009
Sharp	NA-Serie	AT series	Sharp Datenblatt NA-Serie Versionskennzeichnung: SolarNA_142_RD0509

Processed by:
Christian Buchholz
Direct line phone +49 (0)7531 996 77-211
Direct line fax +49 (0)7531 996 77-444
Email: christian.buchholz@sunways.de

Sunways AG Macairestraße 3-5 D-78467 Constance,
Germany
Phone +49 (0)7531 996 77-0 Fax +49 (0)7531 996 77-10
info@sunways.de www.sunways.de

Registered in the District Court Commercial Register
Freiburg HRB 381661 Registered office: Constance, Germany
Chairman of the Supervisory Board: Otto Mayer
Managing Board: Michael Wilhelm (Chairman), Roland
Burkhardt, Jörg von Strom, Jürgen Frei

Company	Solar module	Approved	Additional information
Solibro	SL1/SL1-F	AT series NT series PT series	General approval for transformerless inverters (see installation instruction Solibro_SL1_IM_Rev_B1_2009_10_DE.pdf)
Sulfurcell	SCG-HV-F SCG-LV-F SCG-HV-L SCG-LV-L SCG-HV-RI	AT series	See User Information of the relevant module: SP-09001 Rev. 1 SP-09003 Rev. 1 SP-09004 Rev 0
Uni-Solar	PVL-68 PVL-124 PVL-136	AT series	Earthing of the DC side is not allowed. Assembly system, substrates and conductive material near the PV generator must be earthed. The DC cables must not form loops. Please note the initial module values for DC voltage (+11%), DC current (+4%) and DC power (+15%). See document "Operation of Sunways Transformer-less Inverters with United Solar Ovonix PV Modules and Laminates" of 12 June 2008

If you are a module manufacturer and require additional information please contact Mr. Christian Buchholz (+49 (0)7531 996 77-211 christian.buchholz@sunways.de). If you are a planner or system owner, our Technical Hotline will be happy to answer any questions you may have on +49 (0)7531 996 77-577.

Processed by:
Christian Buchholz
Direct line phone +49 (0)7531 996 77-211
Direct line fax +49 (0)7531 996 77-444
Email: christian.buchholz@sunways.de

Sunways AG Macairestraße 3-5 D-78467 Constance,
Germany
Phone +49 (0)7531 996 77-0 Fax +49 (0)7531 996 77-10
info@sunways.de www.sunways.de

Registered in the District Court Commercial Register
Freiburg HRB 381661 Registered office: Constance, Germany
Chairman of the Supervisory Board: Otto Mayer
Managing Board: Michael Wilhelm (Chairman), Roland
Burkhardt, Jörg von Strom, Jürgen Frei