Electronic Load ESL-Solar 500

Test and characteristic of crystalline and thin film solar modules

Fraunhofer ISE Institut Solare Energiesysteme

PV module test easily made

- **V-, R- and C-constant, MPP Track, MPP Scan, U_{OC}, I_{SC}, P_{mpp}, U_{mpp}, I_{mpp}**
- **Standard 0..100VDC /0...10ADC / 500W**
- **Table and system devices available**
- **USB and RS 232 Interface**
- **Software include**

The electronic load ESL-Solar 500 was developed particularly for the test of crystalline and thin film solar modules and solar cells. All necessary load tests of the solar modules can be accomplished with the ESL-Solar 500. The load has constant current, resistance and voltage as well as the mode MPP (**M**aximum **P**ower **P**oint) tracking and MPP scaning. All functions are shown over the clear multi-function display or over in series existing interfaces USB and RS232. The interface IEEE 488 is optionally available.

While the mode MPP TRACK, released by push of a button or bus instruction, adjusts continuously the MPP, then can be regarded with the MPP Scan an individual capacity range of the solar module. This is for example necessary, if one liked to regard the behavior of unfavorably installed solar modules such a case were the assembly with some hard shadow develops. Here develops not only one MPP (maximum power POINT), but for two or even more than two MPP. With the MPP the TRACKs and Scan won data can be selected over the interfaces. Voltage, current and power are constantly indicated in the display. To get an accurate power curve, voltage and current value are measured and the same time. The use of the ESL-Solar 500 is suitable not onlyby the development of solar cells and modules, but also in the production of the modules, in the incoming inspection of dealers and solar system installer. The ESL-Solar 500 is accommodated in a portable housing (235x135x435 mm). As dual equipment it is implemented in 19" housings (ESL-Solar 500D). For applications of systems it is available as dual equipment, i.e. two loads in a housing (19" , 2HE, 380mm), without manual operation and desplay, type ESL-Solar 500D-ENC.
Optionally the ESL-Solar 500 is available with an visible light power and temperature measuring sensor. The visible light power measuring has an range of 0….1200W/m ² and a temperature measuring range of -20°C to +80 °C. The option designation is "**S**". Over the software the peak power of the PV-modules can calculated according the standard DIN EN 60891 to 1000W/m ².

Frontal view
ESL-Solar 500D ; 19", 3U, 490mm case

Back side
ESL-Solar 500; 235x135x435mm case with standard carrying handle

Frontal and back side
ESL-Solar 500D-ENC; 19", 2U, 380mm case

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Unit Desciption ESL-Solar

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LCD-Display : The electronic load ESL solar possesses an LCD display. Here all set and measured values are indicated. The measured values achievement, voltage, current and power indicated at the same time.

Adjustments : All adjustments take place with a rotary button incremental giver. Changing between the different adjustments takes place through pressures of the rotary button.

Operating Mode : The load works in constant voltage, constant current and constant resistance mode, and in the MPP Tracking and MPP Scan mode. UOC, ISC, Pmpp, Umpp and MPP can be read easily on the LCD display and/or over the software transferred via interface.

Interface : As interfaces USB and RS232 are available, optionally are available the IEEE 488. All adjustments and measurements can be done with the interfaces. The resolution of programming and measuring is 12 bits. Programming takes place with SCPI format.

Power Outlet : The output of all types is on the backside and is implemented as screw connection clamp. The types ESL-Solar 500 and ESL-Solar 500D has an additional output on the front panel. The measurement of the output voltage (sense ±) is at separate inputs on the back side.

Software : The software for control and measurement is include. The par allel test of two solar modules with comparison is possible. Here also solar modules can compare with a refe-rence solar module

System engineering : <u>Precision Monitoring System</u>

For precision or long-term measurements the Fraunhofer ISE in Freiburg Germany has developed an LabView based software system, which makes power measurements pos sible (IU characteristic curves) by means of reference cell or Pyranometer during inter ruption of the Mpp Trackings after set time intervals. The characteistics become with preselected resolution voltage-equidistantly measured and with irradiation, module temperature and from that knowing module characteristic values are archives. Optionally an comprehensive climatic data monitoring system can be integrated. If necessary also an spectroradiometer for the periodic collection of the spectral irradiati can be integrated.

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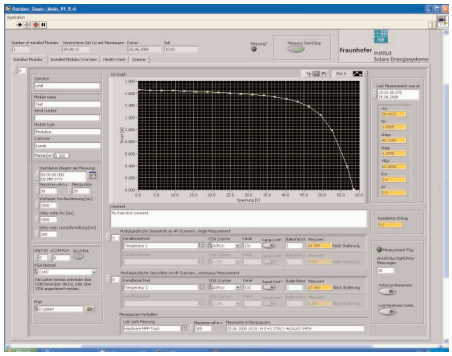
The picture shows a system for paralel test of 32 solar modules. The system includs 16 pieces of ESL-Solar 500D-ENC



Specification ESL-Solar

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Typ	ESL-Solar 500	ESL-Solar 500D	ESL-Solar 500D-ENC
Output data			
Power	500 W	2 x 500 W	2 x 500 W
Input Voltage	0 – 100 VDC	2 x 0 – 100 VDC	2 x 0 – 100 VDC
Current	0 – 10 ADC	2 x 0 – 10 ADC	2 x 0 – 10 ADC
Current rise time max. ms	1	1	1
Operating mode	CV, CC, CR,	CV, CC, CR,	CV, CC, CR
	MPP Track, MPP Scan	MPP Track, MPP Scan	MPP Track, MPP Scan
Programming Accuracy	0,2 %	0,2 %	0,2 %
Measurement			
Voltage / Current	0,2 %	0,2 %	0,2 %
MPP	0,4 %	0,4 %	0,4 %
Mains Input			
Line Input -10%/+15%	230VAC	230VAC	230VAC
Input Frequency	47-63 Hz	47-63 Hz	47-63 Hz
Insolation Voltage	2000Veff	2000Veff	2000Veff
Manuel operation and			
adjustment	available	available	not available
Interface			
USB and RS232	available	available	available
IEEE 488	optional	optional	not available
Resolution	12 Bit	12 Bit	12 Bit
Case	235x135x435 mm	19”, 3U, 490mm	19”, 2U, 380mm

Typ	ESL-Solar 500V150	ESL-Solar 500DV150	ESL-Solar 500DV150-ENC
Output data			
Power	500 W	2 x 500 W	2 x 500 W
Input Voltage	0 – 150 VDC	2 x 0 – 150 VDC	2 x 0 – 150 VDC
Current	0 – 7,5 ADC	2 x 0 – 7,5 ADC	2 x 0 – 7,5 ADC
Current rise time max. ms	1	1	1
Operating mode	CV, CC, CR,	CV, CC, CR,	CV, CC, CR
	MPP Track, MPP Scan	MPP Track, MPP Scan	MPP Track, MPP Scan
Programming Accuracy	0,2 %	0,2 %	0,2 %
Measurement			
Voltage / Current	0,2 %	0,2 %	0,2 %
MPP	0,4 %	0,4 %	0,4 %
Mains Input			
Line Input -10%/+15%	230VAC	230VAC	230VAC
Input Frequency	47-63 Hz	47-63 Hz	47-63 Hz
Insolation Voltage	2000Veff	2000Veff	2000Veff
Manuel operation and			
adjustment	available	available	not available
Interface			
USB and RS232	available	available	available
IEEE 488	optional	optional	not available
Resolution	12 Bit	12 Bit	12 Bit
Case	235x135x435 mm	19”, 3U, 490mm	19”, 2U, 380mm

Typ	ESL-Solar 500V250	ESL-Solar 500DV250	ESL-Solar 500DV250-ENC
Output data			
Power	500 W	2 x 500 W	2 x 500 W
Input Voltage	0 – 250 VDC	2 x 0 – 250 VDC	2 x 0 – 250 VDC
Current	0 – 5 ADC	2 x 0 – 5 ADC	2 x 0 – 5 ADC
Current rise time max. ms	1	1	1
Operating mode	CV, CC, CR,	CV, CC, CR,	CV, CC, CR
	MPP Track, MPP Scan	MPP Track, MPP Scan	MPP Track, MPP Scan
Programming Accuracy	0,2 %	0,2 %	0,2 %
Measurement			
Voltage / Current	0,2 %	0,2 %	0,2 %
MPP	0,4 %	0,4 %	0,4 %
Mains Input			
Line Input -10%/+15%	230VAC	230VAC	230VAC
Input Frequency	47-63 Hz	47-63 Hz	47-63 Hz
Insolation Voltage	2000Veff	2000Veff	2000Veff
Manuel operation and			
adjustment	available	available	not available
Interface			
USB and RS232	available	available	available
IEEE 488	optional	optional	not available
Resolution	12 Bit	12 Bit	12 Bit
Case	235x135x435 mm	19”, 3U, 490mm	19”, 2U, 380mm