

Certificate No. 0216 / FhG-ISE / 001

Manufacturer: phocos China Ltd.
Charge regulator type: MPPT 100/40

The above mentioned family of charge controllers have been subjected voluntarily to the qualification tests according to IEC 62 509 / 2010-12 Edition 1.0 "Battery Charge Controllers for Photovoltaic Systems – Performance and Functioning".

On the basis of the test results (MPPT 100/40) that are laid down in the measurement protocol (test report) dated 17.02.2016 herewith we confirm that the tested charge controller type fulfils or exceeds controller specifications required by IEC 62 509 / 2010-12 Edition 1.0.

Remarks

1. This certificate is only valid in combination with above mentioned test report.
2. Any change in the electronic design, materials, components or processing of the MPPT 100/40 charge controllers may require a repetition of some or all qualification tests to maintain type approval.

Freiburg,
February 24th, 2016

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original document*

Confirmed



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Test and Measurement Protocol - Charge Controllers -

Tests according to IEC 62 509:2010-12



Model/Type
Phocos MPPT 100/40

DuT	Serial Number	Reference number	Date	Update
1	151230 0015	MPPT401-phc-1901	17.02.2016	
2	151230 0016	MPPT402-phc-1901		



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Overview Evaluation / Summary, page 1/2

DuT: Phocos MPPT100/40
Ref. nr.: MPPT401-phc-1901

Tests based on standard / requirements: IEC 62 509 / 2010-12 Ed. 1.0

General remarks, recommendations

The charge controller family MPPT 100/40 of phocos AG are professional manufactured charge controllers. The performance in all areas (efficiency, protection features, self-consumption etc.) is very high. The charge controllers are protected against short circuit and reversed polarity PV module, short circuited and reversed polarity battery using a reliable electronic fuse.

tested?	not tested (see comment)	IEC 62 509 requirements	value / claim	tolerance	measured value / result	requirements fulfilled?	comments
Battery Lifetime Protection Tests							
<input checked="" type="checkbox"/>	<input type="checkbox"/>	PV leakage current test	$\leq 0.1 \% I_N$	---	50,8 μA	<input checked="" type="checkbox"/>	@ 12.6 V; $R_{PVLoop} = 36 \text{ Ohm}$
<input type="checkbox"/>	<input type="checkbox"/>						
<input type="checkbox"/>	<input type="checkbox"/>						
<input type="checkbox"/>	<input type="checkbox"/>	BCC Mode (battery)					Vented battery
<input checked="" type="checkbox"/>	<input type="checkbox"/>	end of charge voltage boost mode	14.4 V^{2,3}	$\pm 1 \%$	14,36 V	<input checked="" type="checkbox"/>	values are within $\pm 1 \%$ of manufact. statement
<input checked="" type="checkbox"/>	<input type="checkbox"/>	end of charge voltage overcharge / equalization mode	14.7 V² to 15.3 V² 14.7 V³	$\pm 1 \%$	14,76 V	<input checked="" type="checkbox"/>	values are within $\pm 1 \%$ of manufact. statement
<input checked="" type="checkbox"/>	<input type="checkbox"/>	end of charge voltage floating mode	14,1 V² 13.8 V³	$\pm 1 \%$	13,68 V	<input checked="" type="checkbox"/>	values are within $\pm 1 \%$ of manufact. statement
<input type="checkbox"/>	<input checked="" type="checkbox"/>	low voltage disconnect @ $0.1 \times I_{10}$	11.7 V to 12.0 V	$\pm 2 \%$			BCC has no load terminals.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	temperature compensation HVD	- 5 mV/cell/°C	n. d.	-3,1 to -3,4 mV/cell/°C	<input checked="" type="checkbox"/>	From ISE perspective a range of -3 to -6 mV/cell/°C is o.k.!
Energy Performance Tests							
<input checked="" type="checkbox"/>	<input type="checkbox"/>	self-consumption (including lights / LCD)	$0.1 \% I_N$	n. d.	2,43 mA	<input checked="" type="checkbox"/>	max. self consumption
<input checked="" type="checkbox"/>	<input type="checkbox"/>	charge efficiency	n. d.	n. d.	96,6 %	<input checked="" type="checkbox"/>	at max. current
<input checked="" type="checkbox"/>	<input type="checkbox"/>	discharge efficiency	n. d.	n. d.			BCC has no load terminals
<input type="checkbox"/>	<input type="checkbox"/>						
<input type="checkbox"/>	<input type="checkbox"/>						
<input type="checkbox"/>	<input type="checkbox"/>						
<input type="checkbox"/>	<input type="checkbox"/>	charging technology	MPPT				For information only

1) Values in **bold** are recommended values according to IEC 62 509

2) Vented battery

3) Sealed/VRLA battery

Overview Evaluation / Summary, page 2/2

tested?	not tested (see comment)	IEC 62 509 requirements	Value / claim	tolerance	measured value / result	requirements fulfilled?	comments
Protection and Fail Safe Tests							
<input checked="" type="checkbox"/>	<input type="checkbox"/>	protection against wrong polarity battery	compulsory	---	o.k.	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	battery open circuit test	compulsory	---			BCC has no load terminals.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	protection against wrong polarity module	compulsory	---	o.k.	<input checked="" type="checkbox"/>	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	protection against shorted load	compulsory	---			BCC has no load terminals.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	PV overcurrent protection test	$1.25 \times I_N @ 25^\circ C$	---	50 A	<input checked="" type="checkbox"/>	Remarks see 4.2.1
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Load overcurrent protection test	$1.25 \times I_N @ 25^\circ C$	---			BCC has no load terminals.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Thermal performance test	$I_{PVmax} @ T_{max}$ for 1 h	---	o.k.	<input checked="" type="checkbox"/>	test with max. currents at 45 °C ambient temperature for 1 hour
User Interface Tests							
<input checked="" type="checkbox"/>	<input type="checkbox"/>	display (charging, batt. charged, discharged)	charging	n. d.			Signalled by LED
<input checked="" type="checkbox"/>	<input type="checkbox"/>		batt. charged	n. d.			
<input checked="" type="checkbox"/>	<input type="checkbox"/>		discharg. batt.	n. d.			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	The following lettering / labelling should be available: manufacturer, model/type, serial no, rated voltage, max. charge current, max. load current, terminals, display, fuses	must be durable	---	o.k.	<input checked="" type="checkbox"/>	The availability of lettering/Labelling is not postulated by IEC 62 509. From Fraunhofer ISE perspective a labelling should be available. Visual test
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Complete documentation should be available: data sheet, user manual, installation instructions, operation instructions, trouble shooting guide, calibration instructions (if on site calibration is possible), safety instructions, warranty, information about spare parts	---	---	o.k.	<input checked="" type="checkbox"/>	The availability of documentation is not postulated by IEC 62 509. From Fraunhofer ISE perspective a documentation should be available. Visual test.

n.d. = not defined

 T_{max} = manufacturer's specified max. rated ambient operation temperature I_N = nominal current I_{PVmax} = manufacturer's specified max. PV current $I_{Loadmax}$ = manufacturer's specified max. load current

1 Pretests

1.1 Information given by the manufacturer

Manufacturer	phocos AG		
Country/Origin	Germany		
Model/Type	MPPT100/40		
Serial / Batch Nr.	1	151230 0015	
	2	151230 0016	

Mechanical data

Dimensions (l * w * h) [mm]	185*150*115		
Weight [g]	1600		
Case material	plastic		
Protection class (IP)	20		
Case mounting	DIN rail		
Connection type	screws		
Cable stress relief	n.a.		
Cable diameter [mm ²]	32		
Label	yes		

Electrical data

At ambient temperature of [°C]	25 °C		
Rated voltage	12V	24V	x 12 & 24V
Automatic adjustment 12/24V	x yes		no
Max. module power [W]	1200W 24V		
Max. charge current [A]	41		
Max. discharge current [A]	n.a.		
Type of controller	shunt	serial	x other: MPPT
Technique of regulation	two point	PWM	x other: MPPT
Self consumption [mA]	< 3 mA		
End of charge voltage [V]	13.8 / 27,6 (float voltage)		
return switch-on voltage (two point regulation) [V]	--		
load disconnect warning on [% SOC]	n.a.		
load disconnect voltage [V]	n.a.		
time delay at load shedding [s]	n.a.		
Reconnection voltage load [V]	n.a.		
time delay at reconnection [s]	n.a.		
load reconnection manually [V]	n.a.		
operation temperature range [°C]	-40 up to +45°C		
display	x LED	LCD	LED & LCD

Information given by the manufacturer (continued)

Additional functions

boost/gassing function	<input checked="" type="checkbox"/>	yes	<input type="checkbox"/>	no
boost activation voltage [V]	< 12.3 / 24.6			
final boost voltage [V]	14.4 / 28.8 (25°C), 2 h			
equalization activation voltage [V]	< 12.1 / 24.2			
final equalization (gassing) voltage [V]	14.8 / 29.6 (25°C) 2 h			
Temperature compensation	<input checked="" type="checkbox"/>	yes	<input type="checkbox"/>	no
temperature compensation [mV/K*cell]	4.0			
Battery voltage sensor	<input type="checkbox"/>	yes	<input checked="" type="checkbox"/>	no
DC/DC-Converter (e.g. USB-Port)	<input type="checkbox"/>	yes	<input checked="" type="checkbox"/>	no
adjustable for different battery types	<input checked="" type="checkbox"/>	yes	<input type="checkbox"/>	no
adjustable thresholds	<input type="checkbox"/>	yes	<input checked="" type="checkbox"/>	no
end of charge [V]	<input type="checkbox"/>	min.	<input type="checkbox"/>	max.
load disconnect [V]	<input type="checkbox"/>	min.	<input type="checkbox"/>	max.
selectable priority at load disconnection	<input type="checkbox"/>	yes	<input checked="" type="checkbox"/>	no
Protection against reversed battery polarity	<input checked="" type="checkbox"/>	yes ¹⁾	<input type="checkbox"/>	no
Protection against reversed PV polarity	<input checked="" type="checkbox"/>	yes ¹⁾	<input type="checkbox"/>	no
Others	Protection against Over-Current, Short-circuit and Over-Temperature.			
	DIP switches for Battery type and application			

¹⁾ Electronic protection

listed values rated for

12V

24V

Others

Interfaces	no information see MCU manual		
Price	not available		
Service	only manufacturer website		
Warranty	no information		

1 Pretests

1.2 Visual Inspection

Connection type	plug	x	screw		other:		
Cable stress relief	o.k.		not o.k.	x	not available		
Cable diameter stranded [mm ²]	2.5		4		6	x	32
Cable diameter solid [mm ²]	2.5		4		6	x	32
Case quality	very good	x	good		bad		
Connector quality	x	very good	good		bad		
Electronic quality	x	very good	good		bad		
Packing of charge controller	x	very good	good		bad		
Lettering of packing	x	very good	good		bad		
Fuse changing		very good	good		bad	x	n.a. ¹⁾
Mounting of charge contr.	x	very good	good		bad		
Others:							
Comment quality					very good quality		
Damages		yes		x	no		

Lettering of the charge controller

Manufacturer	x	yes		no		
Model / type	x	yes		no		
Serial / batch number	x	yes		no		
Nominal voltage	x	yes		no		
Connectors	x	yes		no		
Fuse		yes		no	x	n.a. ¹⁾
LED, displays	x	yes		no		
Comment labeling:				o.k.		

Documentation

Data sheet	x	o.k.		not o.k.		not available	
User manual							
Operating instructions	x	o.k.		not o.k.		not available	
Troubleshooting guide		o.k.		not o.k.	x	not available	
Safety instructions	x	o.k.		not o.k.		not available	
Installation instructions	x	o.k.		not o.k.		not available	
Calibration instructions		o.k.		not o.k.	x	not available	
Others		user manuals in different languages (german, english, french, spanish, portugese, chineese)					
Comment documentation				o.k.			

Spare parts

Fuse		availabe		x	not available	¹⁾
Mounting parts		availabe		x	not available	
Connectors		availabe		x	not available	
Others						
Comment spare parts				---		

Support

Repair / Service address		availabe		x	not available	
Warranty		availabe		x	not available	
Others						
Comment support		a support address should be given				

¹⁾ Electronic protection

Is it possible to test the charge controller?

IEC 62 509 requirements fulfilled?

If failed, reason?

x	yes		no
x	passed		failed
<hr/>			

2 Battery Lifetime Protection Tests

2.1 Leakage Current

Ambient temperature	25.5 °C
Rated voltage	12.0 V

DuT	1	
Reference	MPPT401-phc-1901	
Inspector	bg	

Test	Behaviour / results			
	Revers current [µA]			
Protection against night discharge of the battery (leakage current)	50.8	p	Vbatt: 12.6 V PV loop resistor: 36 Ohm	

Used measurement equipment:	Vbat:	Zimmer LMG95
	Ibat:	---
	Vpv:	---
	Ipv:	Fluke 87
	Vload:	---
	Iload:	---
	Ta:	Maxim DS18S20

DuT = device under test

p/f = passed / failed

IEC 62 509 requirements?

If failed, reason?

x	passed		failed

2 Battery Lifetime Protection Tests

2.2 Set-points

Ambient temperature	25.5 °C
Rated voltage	12.0 V

DuT	1	
Reference	MPPT401-phc-1901	
Inspector	bg	

Voltage thresholds	Specification (manufacturer) [V]	Measured [V]		p / f	Remarks
		DuT 1	DuT 2		
		reg. start	Cut-off		
End of charge voltage (floating)	13.8	13.67	13.68	p	
final voltage equalisation (gassing)	14.8	14.75	14.76	p	
final voltage boost	14.4	14.32	14.36	p	
		LVD	LVR		
Deep discharging cut- off voltage					DuT doesn't have load terminals
Reconnect voltage load					DuT doesn't have load terminals
Time delay load disconnect [s]					
Time delay load reconnect [s]					
Type of controller	MPPT				
equal to manufacturer data	x	yes		no	

Used measurement equipment:	Vbat:	Zimmer LMG 95
	Ibat:	Zimmer LMG 95
	Vpv:	Oscilloscope Agilent DSO-X-3014A
	Ipv:	Zimmer LMG 95
	Vload:	
	Iload:	
	Ta:	Maxim DS18S20

DuT = device under test

p/f = passed / failed

IEC 62 509 requirements / recommendations?

If failed, reason?

x	passed		failed

2 Battery Lifetime Protection Tests

2.3 Temperature Compensation of the Set-points

Ambient temperature	see below	°C
Rated voltage	12.0	V

DuT	1	
Reference	MPPT401-phc-1901	
Inspector	bg	

Voltage thresholds	ambient temperature [°C]			temp. comp [mV/K] / cell	DuT
	@ 25,0 °C		@ Temp. °C		
End of charge voltage (float) [V] ¹⁾ ²⁾	13.67	13.37	39.5	-3.4	1
	13.68	13.39	39.5	-3.3	1
Equalization voltage [V] ¹⁾ ²⁾	14.75	14.47	40.0	-3.1	1
	14.76	14.48	40.0	-3.1	1
Boost voltage [V] ¹⁾ ²⁾	14.32	14.05	38.5	-3.3	1
	14.36	14.09	38.5	-3.3	1
Deep discharging cut-off voltage [V]					
Reconnect voltage load [V]					

¹⁾ PWM start²⁾ cut off

Remarks		
Used measurement equipment:	Vbat:	Zimmer LMG 95
	Ibat:	Zimmer LMG 95
	Vpv:	Oscilloscope Agilent DSO-X-3014A
	Ipv:	Zimmer LMG 95
	Vload:	Zimmer LMG 95
	Iload:	Zimmer LMG 95
	Ta:	Maxim DS18S20

IEC 62 509 requirements?

x	passed		failed
---	--------	--	--------

If failed, reason?

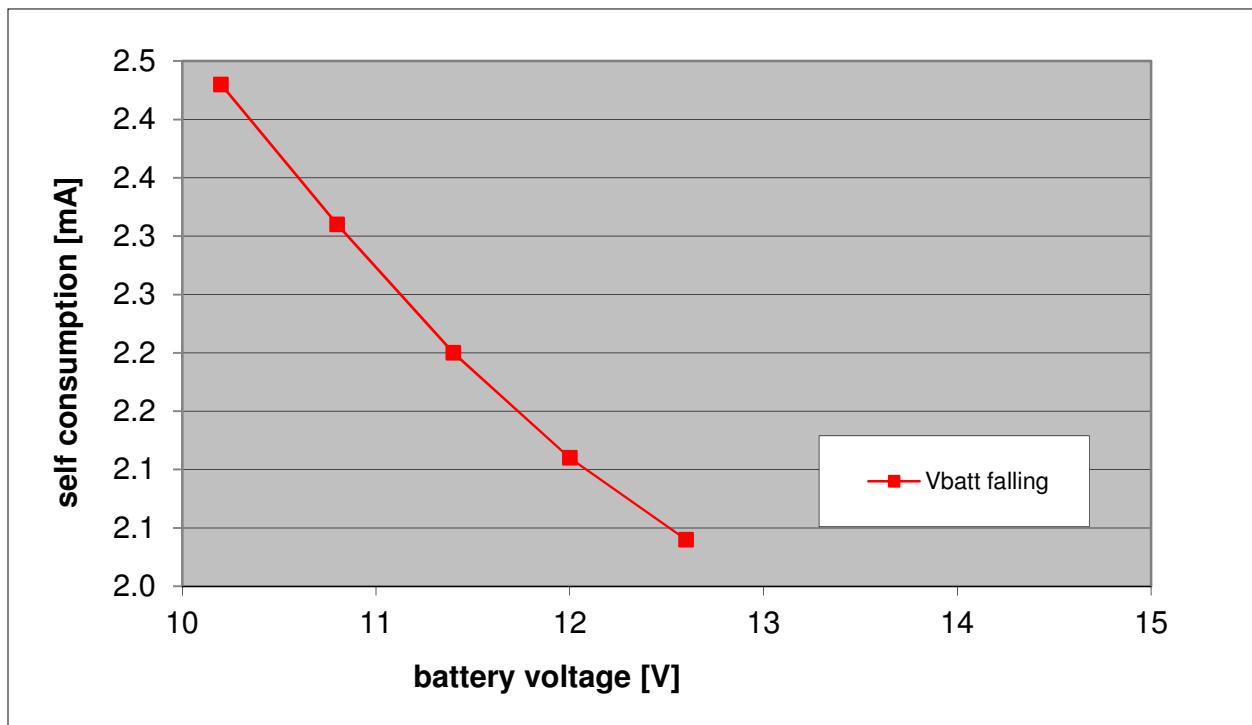
--

3 Energy Performance Tests

3.1 Self Consumption Tests

Ambient temperature	26.0	°C
Rated voltage	12.0	V

DuT	1	
Reference	MPPT401-phc-1901	
Inspector	bg	



	DuT		
max. selfconsumption	2.43	mA @ 10.2 V	1
average selfconsumption	2.22	mA @ 10.2 V to 12.6 V	1

Comment			
Used measurement equipment:	Ibat:	Fluke 87	
	Ubat:	Zimmer LMG 95	
	Ta:	Maxim DS18S20	

IEC 62 509 requirements?	x	passed	failed
If failed, reason?			

Measured data

Nr.	Batt. Volt. [V]	Self consumpt. [mA]	Self consumpt. [mW]	DuT	Comment
1	12.6	2.04	25.7	1	
2	12.0	2.11	25.3	1	
3	11.4	2.20	25.1	1	
4	10.8	2.31	24.9	1	
5	10.2	2.43	24.8	1	

3 Energy Performance Tests

3.2 Efficiency Tests

Ambient temperature:	25.5	°C
Rated voltage:	12.0	V
Rated max. charge current:	40.0	A
Rated max. discharge current:		A

DuT	1	
Reference	MPPT401-phc-1901	
Inspector:	bg	

3.2.1 Charging efficiency @ 10 % to 100 % rated charging current

PV-Module			Battery			efficiency	Vpv-Vbat	DuT
[V]	[A]	[W]	[V]	[A]	[W]	[%]	[V]	
16.70	4.2	70.3	13.20	5.1	67.3	95.8	3.50	1
16.78	8.2	137.3	13.20	10.1	133.2	97.0	3.58	1
16.32	12.5	203.5	13.20	15.0	197.9	97.2	3.12	1
16.45	16.2	266.5	13.20	19.6	258.7	97.1	3.25	1
16.46	20.2	332.8	13.20	24.4	322.3	96.9	3.26	1
16.87	23.2	391.7	13.20	28.8	379.6	96.9	3.67	1
16.13	28.3	456.6	13.20	33.3	439.7	96.3	2.93	1
16.58	31.4	520.8	13.20	37.9	499.8	96.0	3.38	1
15.41	35.2	542.0	13.19	39.7	523.6	96.6	2.22	1
								1

3.2.2 Discharging efficiency @ 100 % rated load current

Battery			Load			efficiency	Vbat-Vload	DuT		
[V]	[A]	[W]	[V]	[A]	[W]	[%]	[V]			
			DuT doesn't have load terminals							

min. discharge efficiency [%]:

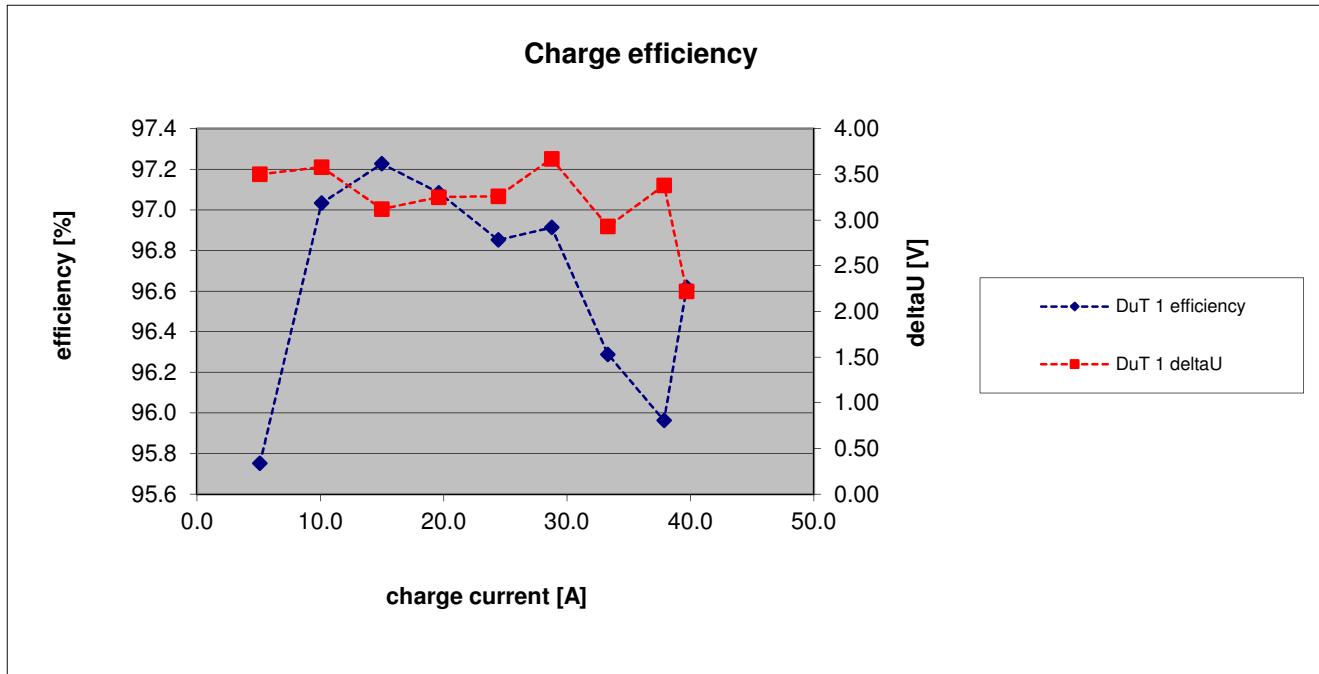
Remarks:	DuT doesn't have load output						
Used measurement equipment:	Vbat: Zimmer LMG 95 Ibat: Zimmer LMG 95 Vpv: Zimmer LMG 95 Ipv: Zimmer LMG 95 Vload: Zimmer LMG 95 Iload: Zimmer LMG 95 Ta: Maxim DS18S20						

IEC 62 509 requirements?

If failed, reason?

x	p		f

Charge and discharge efficiencies



4 Protection and Fail-Safe Tests

4.1 Thermal Performance Tests

Ambient temperature:	see below
Rated voltage:	12 V
Rated max. charge current:	40 A
Rated max. discharge current:	

DuT	1	
Reference	MPPT401-phc-1901	
Inspector:	bg	

Test at extented ambient temperature

time [min]	PV-module		Battery		Load		T _{heatsink} [°C]	T _{ambient} [°C]	DuT	Comment
	[V]	[A]	[V]	[A]	[V]	[A]				
1	15.27	36.2	13.86	38.3			44.5	45.0	1	
5	14.96	37.6	13.26	40.1			45.5	45.5	1	
10	15.05	37.1	13.27	40.2			46.0	45.5	1	
15	15.01	37.2	13.27	40.2			46.5	45.5	1	
20	14.92	37.6	13.27	40.3			46.5	45.5	1	
25	14.98	37.4	13.27	40.0			47.0	45.5	1	
30	14.86	37.8	13.28	40.5			47.0	46.0	1	
35	15.03	37.1	13.26	39.7			47.0	46.0	1	
40	15.14	36.6	13.27	40.0			47.0	46.0	1	
45	14.98	37.3	13.28	40.4			47.5	46.0	1	
50	14.94	37.6	13.28	40.4			47.5	46.0	1	
55	14.87	37.8	13.28	40.5			47.5	46.5	1	
60	14.91	37.6	13.27	40.2			47.5	46.5	1	

Remarks: DuT doesn't have load terminals

Used measurement equipment:	Vbat:	Zimmer LMG95
	Ibat:	Zimmer LMG95
	Vpv:	Zimmer LMG95
	Ipv:	Zimmer LMG95
	Vload:	Zimmer LMG95
	Iload:	Zimmer LMG95
	Ta:	Maxim DS18S20
	Tc:	Maxim DS18S20

IEC 62 509 requirements?

If failed, reason?

x	p		f

4 Protection and Fail-Safe Tests

4.2 Overcurrent protection tests

Ambient temperature:	see below °C
Rated voltage:	12,0 V
Rated max. charge current:	40.0 A
Rated max. discharge current:	A

DuT	1	
Reference	MPPT401-phc-1901	
Inspector:	bg	

4.2.1 PV overcurrent protection test

time	PV-module		Battery		Remark		T _{heatsink}	T _{ambient}	DuT
[min]	[V]	[A]	[V]	[A]			[°C]	[°C]	
1	27.31	21.2	13.33	35.0	V _{MPP} = 24 V I _{MPP} = 50 A The BCC limits the charge current to rated charge current.		29.0	27.0	1
15	27.09	24.0	13.88	40.8			34.5	27.5	1
30	26.97	24.3	13.88	40.8			39.0	28.0	1
45	27.03	24.2	13.85	40.5			40.5	28.5	1
60	27.02	24.3	13.88	40.8			43.5	28.5	1

4.2.2 Load overcurrent protection test

time	Remark	Battery		Load		T _{heatsink}	T _{ambient}	DuT
[min]		[V]	[A]	[V]	[A]	[°C]	[°C]	
1	DuT doesn't have load terminals							1
15								1
30								1
45								1
60								1

Remarks: DuT doesn't have load output

Used measurement equipment:	Vbat:	Zimmer LMG95
	Ibat:	Zimmer LMG95
	Vpv:	Zimmer LMG95
	Ipv:	Zimmer LMG95
	Vload:	Zimmer LMG95
	Iload:	Zimmer LMG95
	Ta:	Maxim DS18S20
	Tc:	Maxim DS18S20

IEC 62 509 requirements?

If failed, reason?

x	passed	failed

4 Protection and Fail-Safe Tests

4.3 Protection Against Reversed Polarity and Short Circuits

Ambient temperature	26.5	°C
Rated voltage	12.0	V

DuT	1	
Reference	MPPT401-phc-1901	
Inspector	bg	

Test	Behaviour / results		
	DuT 1	p/f	remarks
Protection against short circuited PV ¹⁾		p	V _{pv} = 16,87 V I _{pv} = 4,2 A
Protection against reversed polarity PV Module		p	DuT didn't suffer any damage
Protection against short circuited load ¹⁾		p	DuT doesn't have load terminals
Operation with reversed polarity battery		p	warning LED glows

p/f: passed/failed

¹⁾ Not mandatory according to IEC 62 509

Remarks	the charge controller is protected against short circuited PV, reversed polarity PV module, overload and reversed polarity battery	
Used measurement equipment:	Vbat:	Zimmer LMG95
	Ibat:	Zimmer LMG95
	V _{pv} :	Zimmer LMG95
	I _{pv} :	Zimmer LMG95
	V _{load} :	Zimmer LMG95
	I _{load} :	Zimmer LMG95
	T _a :	Maxim DS18S20

IEC 62 509 requirements?	x	passed		failed
If failed, reason?				

4 Protection and Fail-Safe Tests

4.4 Battery Open Circuit Test

Ambient temperature	27.0	°C
Rated voltage	12.0	V

DuT	1	
Reference	MPPT401-phc-1901	
Inspector	bg	

Test	Behaviour / results	DuT
operating with disconnected battery	DuT doesn't have load terminals V load = 0.0 V p Passed/failed	1
removing battery during normal operation	DuT didn't suffer any damage p Passed/failed	1

Remarks	
Used measurement equipment:	Vbat: Zimmer LMG95
	Ibat: Zimmer LMG95
	Vpv: Zimmer LMG95
	Ipv: Zimmer LMG95
	Vload: Zimmer LMG95
	Iload: Zimmer LMG95
	Ta: Maxim DS18S20

IEC 62 509 requirements?	x	p		f
If failed, reason?				

5 User Interface Tests

5.1 Display

Ambient temperature	
Rated voltage	

DuT	1	
Reference	MPPT401-phc-1901	
Inspector	bg	

	DuT
charging indication	no 1
battery charged indication (charge status)	no 1
load cut off warning	no 1
battery discharged indication (load disconnection)	no 1

Remarks:	warning indication 1 red LED irradiance indication 1 green LED
Used measurement equipment:	Vbat: Zimmer LMG95
	Ibat: Zimmer LMG95
	Vpv: Zimmer LMG95
	Ipv: Zimmer LMG95
	Vload: Zimmer LMG95
	Iload: Zimmer LMG95
	Ta: Maxim DS18S20

IEC 62 509 requirements?	x	p		f
If failed, reason?				

Overview of measurement equipment used (following DIN ISO 9001:2000)

device	type	measured dimensions	reference number following DIN EN ISO 9001:2000
HP 34401A	Precision system-multimeter	voltages, currents up to 3 A	421-DC-10 421-DC- 11
Zimmer LMG 95	Precision-wattmeter	voltages, currents up to 40 A, power	421-DC-16 421-DC-25 421-LI-5
Temperature sensors	Maxim DS18S20	temperatures	
Agilent DSO-X 3014A	4-channel-digital oszilloscope	control of PWM behaviour	
Fluke 87	multimeter	voltage, current, resistor	421-DC-17 / 421-DC-18

Zertifikat DE07/3874



Das Management-System vom

Fraunhofer-Institut für Solare Energiesysteme ISE

Heidenhofstraße 2
DE-79110 Freiburg



wurde auditiert und hat den Nachweis erbracht, dass die Anforderungen folgender Norm erfüllt werden

ISO 9001:2008

Die Zertifizierung umfasst

**Forschung, Entwicklung und Dienstleistungen auf den
Gebieten thermische und elektrische Solarenergienutzung,
Gebäudetechnik und Wasserstofftechnologie**

Weitere Einzelheiten zum Geltungsbereich dieses Zertifikats und der Anwendbarkeit der
Anforderungen der Norm ISO 9001:2008 können bei der Organisation erfragt werden

Dieses Zertifikat ist gültig vom 30/04/2013 bis 29/04/2016
Ausgabe 5. Zertifiziert seit März 2001


Mark Piekerit
Geschäftsführer

Freigegeben durch

Christian Rathje
Leiter der Zertifizierungsstelle


Deutscher
Akkreditierungs
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