

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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*This PDF-document
is identical to the
original document*



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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)		value / claim ¹⁾	tolerance	measured value / result	requirements fulfilled?	comments
		IEC 62 509 requirements					
Battery Lifetime Protection Tests							
<input checked="" type="checkbox"/>	<input type="checkbox"/>	PV leakage current test	$\leq 0.1 \% I_N$	---	50,8 μ A	<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 V 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 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"/>	<input type="checkbox"/>	protection against wrong polarity battery	compulsory	---	o.k.	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	battery open circuit test	compulsory	---		<input type="checkbox"/>	BCC has no load terminals.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	protection against wrong polarity module	compulsory	---	o.k.	<input checked="" type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	protection against shorted load	compulsory	---		<input type="checkbox"/>	BCC has no load terminals.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	PV overcurrent protection test	$1.25 \times I_N$ @ 25 °C	---	50 A	<input checked="" type="checkbox"/>	Remarks see 4.2.1
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Load overcurrent protection test	$1.25 \times I_N$ @ 25 °C	---		<input type="checkbox"/>	BCC has no load terminals.
<input checked="" type="checkbox"/>	<input 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"/>	<input type="checkbox"/>	display (charging, batt. charged, discharged)	charging	n. d.		<input type="checkbox"/>	Signalled by LED
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		batt. charged	n. d.		<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		discharg. batt.	n. d.		<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input 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"/>	<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	<input type="checkbox"/> 12V	<input type="checkbox"/> 24V	<input checked="" type="checkbox"/> 12 & 24V	
Automatic adjustment 12/24V	<input checked="" type="checkbox"/> yes		<input type="checkbox"/> no	
Max. module power [W]	1200W 24V			
Max. charge current [A]	41			
Max. discharge current [A]	n.a.			
Type of controller	<input type="checkbox"/> shunt	<input type="checkbox"/> serial	<input checked="" type="checkbox"/> other: MPPT	
Technique of regulation	<input type="checkbox"/> two point	<input type="checkbox"/> PWM	<input checked="" type="checkbox"/> 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	<input checked="" type="checkbox"/> LED	<input type="checkbox"/> LCD	<input type="checkbox"/> 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	<input type="checkbox"/>	not specified
Protection against reversed PV polarity	<input checked="" type="checkbox"/>	yes ¹⁾	<input type="checkbox"/>	no	<input type="checkbox"/>	not specified
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	<input checked="" type="checkbox"/>	screw		other:	
Cable stress relief		o.k.		not o.k.	<input checked="" type="checkbox"/>	not available	
Cable diameter stranded [mm ²]		2.5		4		6	<input checked="" type="checkbox"/> 32
Cable diameter solid [mm ²]		2.5		4		6	<input checked="" type="checkbox"/> 32
Case quality		very good	<input checked="" type="checkbox"/>	good		bad	
Connector quality	<input checked="" type="checkbox"/>	very good		good		bad	
Electronic quality	<input checked="" type="checkbox"/>	very good		good		bad	
Packing of charge controller	<input checked="" type="checkbox"/>	very good		good		bad	
Lettering of packing	<input checked="" type="checkbox"/>	very good		good		bad	
Fuse changing		very good		good		bad	<input checked="" type="checkbox"/> n.a. ¹⁾
Mounting of charge contr.	<input checked="" type="checkbox"/>	very good		good		bad	
Others:							
Comment quality	very good quality						
Damages		yes			<input checked="" type="checkbox"/>	no	

Lettering of the charge controller

Manufacturer	<input checked="" type="checkbox"/>	yes		no	
Model / type	<input checked="" type="checkbox"/>	yes		no	
Serial / batch number	<input checked="" type="checkbox"/>	yes		no	
Nominal voltage	<input checked="" type="checkbox"/>	yes		no	
Connectors	<input checked="" type="checkbox"/>	yes		no	
Fuse		yes		no	<input checked="" type="checkbox"/> n.a. ¹⁾
LED, displays	<input checked="" type="checkbox"/>	yes		no	
Comment labeling:	o.k.				

Documentation

Data sheet	<input checked="" type="checkbox"/>	o.k.		not o.k.		not available
User manual						
Operating instructions	<input checked="" type="checkbox"/>	o.k.		not o.k.		not available
Troubleshooting guide		o.k.		not o.k.	<input checked="" type="checkbox"/>	not available
Safety instructions	<input checked="" type="checkbox"/>	o.k.		not o.k.		not available
Installation instructions	<input checked="" type="checkbox"/>	o.k.		not o.k.		not available
Calibration instructions		o.k.		not o.k.	<input checked="" type="checkbox"/>	not available
Others	user manuals in different languages (german, english, french, spanish, portugese, chinese)					
Comment documentation	o.k.					

Spare parts

Fuse		availabe		<input checked="" type="checkbox"/>	not available ¹⁾
Mounting parts		availabe		<input checked="" type="checkbox"/>	not available
Connectors		availabe		<input checked="" type="checkbox"/>	not available
Others					
Comment spare parts	---				

Support

Repair / Service address		availabe		<input checked="" type="checkbox"/>	not available
Warranty		availabe		<input checked="" type="checkbox"/>	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?

<input checked="" type="checkbox"/>	yes	<input type="checkbox"/>	no
<input checked="" type="checkbox"/>	passed	<input type="checkbox"/>	failed

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 start

²⁾ 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?

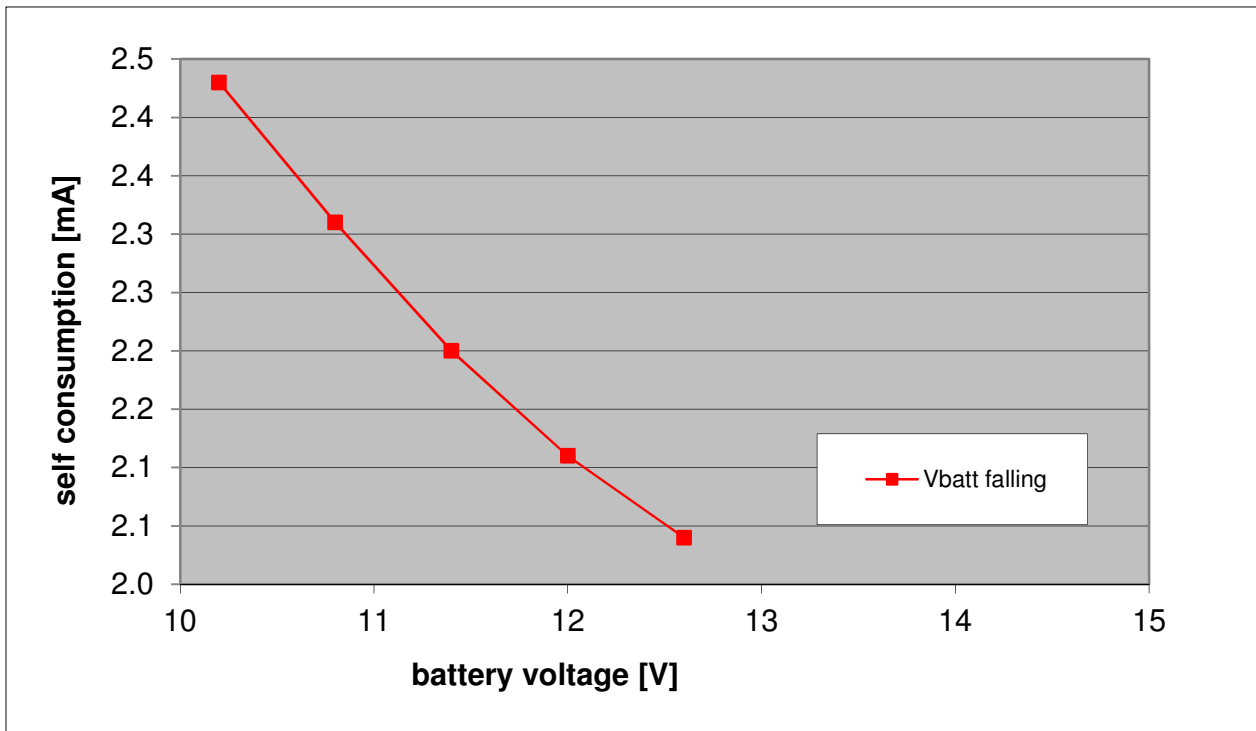
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3 Energy Performance Tests

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? 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					

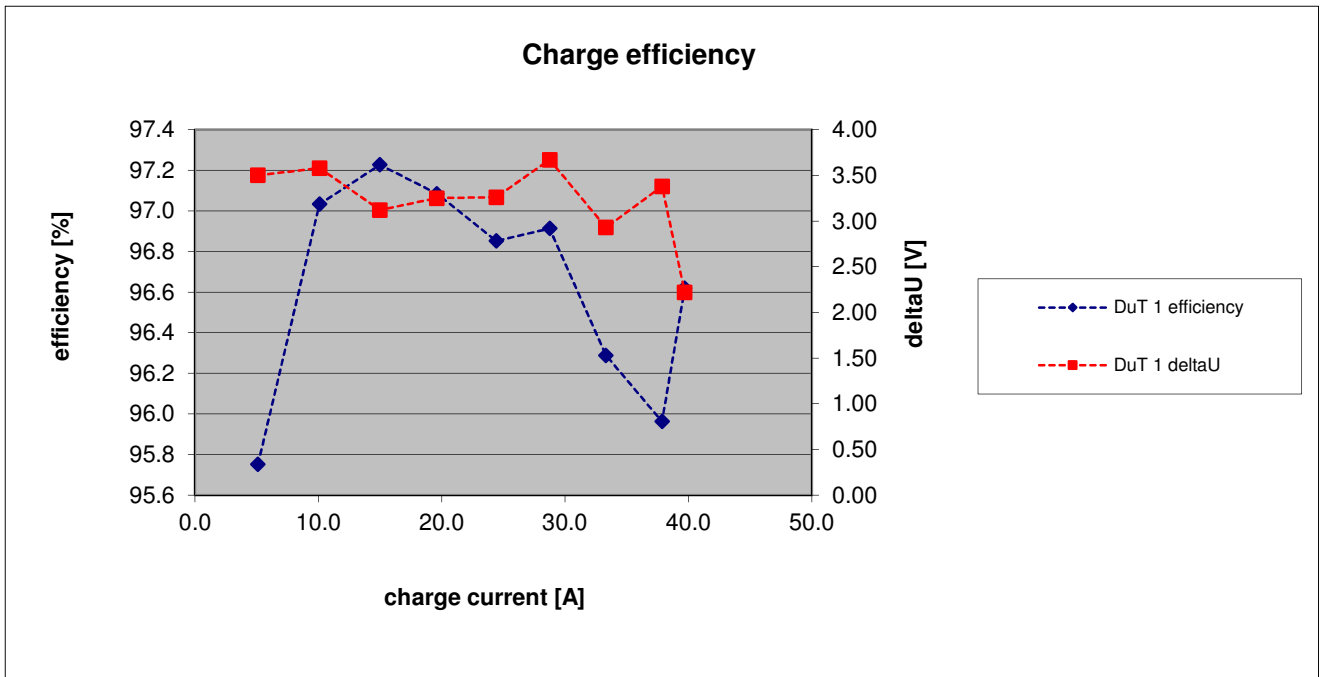
min. discharge efficiency [%]:

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?

x	p		f
If failed, reason?			

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 extended ambient temperature

time	PV-module		Battery		Load		T _{heatsink}	T _{ambient}	DuT	Comment
	[min]	[V]	[A]	[V]	[A]	[V]				
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 [min]	PV-module		Battery		Remark	T _{heatsink}	T _{ambient}	DuT
	[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 [min]	Remark	Battery		Load		T _{heatsink}	T _{ambient}	DuT
		[V]	[A]	[V]	[A]	[°C]	[°C]	
1								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	
	Vpv:	Zimmer LMG95	
	Ipv:	Zimmer LMG95	
	Vload:	Zimmer LMG95	
	Iload:	Zimmer LMG95	
	Ta:	Maxim DS18S20	

IEC 62 509 requirements?	<input checked="" type="checkbox"/>	passed	<input type="checkbox"/>	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	1
	V load = 0.0 V p Passed/failed	
removing battery during normal operation	DuT didn't suffer any damage	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 oscilloscope	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
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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

Freigegeben durch

Mark Piekereit
Geschäftsführer

Christian Rathje
Leiter der Zertifizierungsstelle



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