



Q.PS-ADB-2405-1

Single phase power supply with Intelligent Battery Charger

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0.1 Document-History

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Version	Published	Changed	Remarks
pEN01	2011-02-16	new	new
EN01	2011-03-07	Chapter 2	Added the table "technical data"
EN02	2013-10-02		Logo and company names changed

0.2 Trademarks

Saia PCD® is a registered trademark of Saia-Burgess Controls AG.

Technical changes are subject to the state of technology.

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1 General Description

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Thanks to the single phase power supply with intelligent battery charger (Q.PS-ADB-2405-1), it will be possible to optimise power management. We call "Battery Care" the concept base on algorithms that implement rapid and automatic charging, battery charge optimization during time, flat batteries recovery and real time diagnostic during installation and operation. The Real Time Auto-diagnostic system, monitoring battery faults such as, battery Sulfated, elements in short circuit, accidental reverse polarity connection, disconnection of the battery, they can easily be detected and removed by help of Blink Code of Diagnosis LED; during the installation and after sell. The continuous monitoring of battery efficiency reduces battery damage risk and allows a safe operation in permanent connection. Each device is suited for all battery types, by means of jumpers it is possible setting predefined curves for Open Lead Acid, Sealed Lead Acid, Gel ¹⁾.

Before starting with the operations of installation you should consult the manual.

1) Ni-Cd and Ni-MH on demand.

2 Main Characteristic

- Nominal Input Voltage : 115...230 VAC
- Output : 24 VDC / 5 A @ 50 °C also without mains
- OUTPUT 1: for connection to the battery
- OUTPUT 2: for connection to the load
- Suited for the following battery types: Open Lead Acid, Sealed Lead Acid, lead Gel and Ni-Cd (option)
- Automatic diagnostic of battery status. Battery Life Test function (Battery Care)
- Three charging levels: Boost, Trickle and Recovery
- Protected against short circuit, Over Load and inverted polarity
- Signaling: replace battery, low battery, mains or buffering
 - Signal output (contact free) for discharged or damaged battery
 - Signal output (contact free) for mains or Back-UP
- Protection degree IP20
- DIN rail; Space saving

2.1 Technical Datas

Input Data

Nominal input voltage (2 × VAC)	115...230 VAC
Input voltage range	90...264 VAC
Inrush current	≤11 A / ≤5 msec.
Frequency	47...63 Hz
Input current (nominal input voltage)	2.8...1.3 A
Internal fuse	F 4A
External fuse (recommended)	Fast 10 A

Output Data

Output voltage battery boost charge/ nominal current	Max 28.8 VDC/5 A
Output voltage battery trickle charge/ nominal current	Max 27.5 VDC/5 A
Adjustment range of charge (I _N adj)	20...100 % I _N
Output voltage in backup mode	27.5...22 VDC
Type of charging characteristic	IUoU
End of charging voltage (boost charge)	Max 28.8 VDC
End of charging current (boost charge)	0.3 A
Start up with capacity load	≤ 30.000 mF
Switching on after applying mains voltage	1 sec. max
Nominal current max.	1.1 × I _N ± 5 %
Continuous current (without battery) I _{LOAD} = I _N	5 A
Continuous current (with battery) I _{LOAD} = I _N + I _{BATT}	10 A
Max. current Output Load (Main) I _{LOAD} (4 sec.)	15 A max.
Max. current Output Load (Back Up) I _{LOAD} (4 sec.)	10 A max.
Residual ripple	≤ 60 mVpp
Minimum load	No
Efficiency (at 50% I _N)	≥ 90 %
Short-circuit protection	Yes
Over load protection	Yes
Over voltage output protection	Yes
Reverse battery protection	Yes

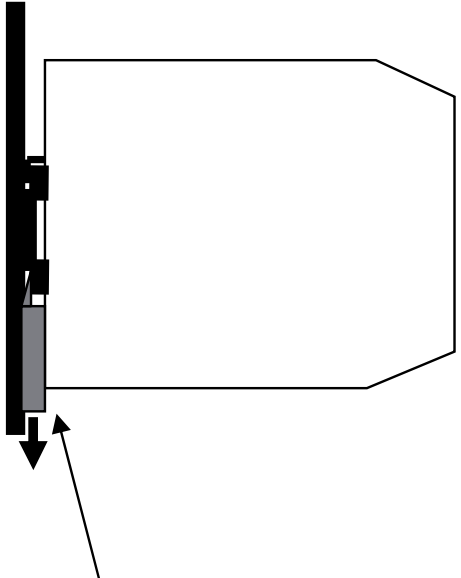
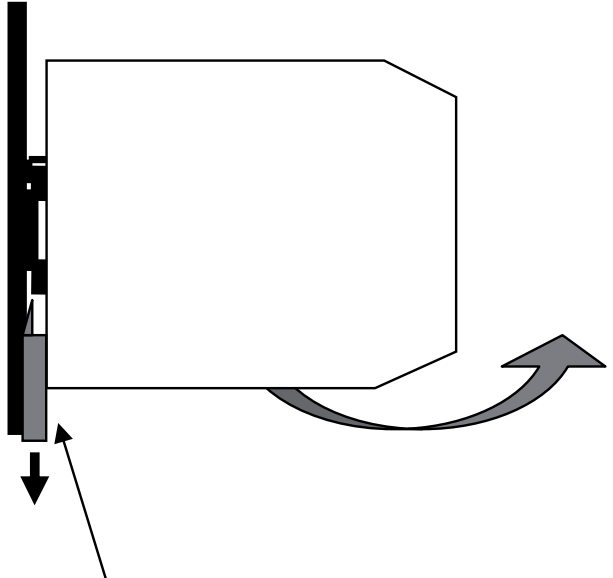
Climatic Data

Ambient temperature (operation)	-25...+70 °C
Ambient temperature (storage)	-40...+85 °C
Humidity; no moisture condensation	95% @ 25 °C

General Data

Isolation voltage (input/ output)	3000 VAC
Input ground insulation	1605 VAC
Electrical safety	EN60950
Degree of protection	IP20
Pollution Degree Environment	2
Protection class	I with PE connected
Dimension (w×h×d)	65×115×135
Connection Terminals Blocks: Screw Type	2.5 mm
Weight	0.6 kg approx

3 Rail Mounting

Mounting on the Rail	Dismounting from the Rail
	
<p>Assembly: pull down the plastic block with a screwdriver, place the Q.PS-ADB on the rail and release the plastic block. The Q.PS-ADB is now assembled on the rail.</p>	<p>Disassembly: pull down the plastic block and pullout the module like the arrow in the scheme</p>

3



All modules must have a minimum vertical and horizontal distance of 10 cm to this power supply in order to guarantee sufficient auto convection. Depending on the ambient temperature and load of the device, the temperature of the housing can become very high!

4 Cable Connection

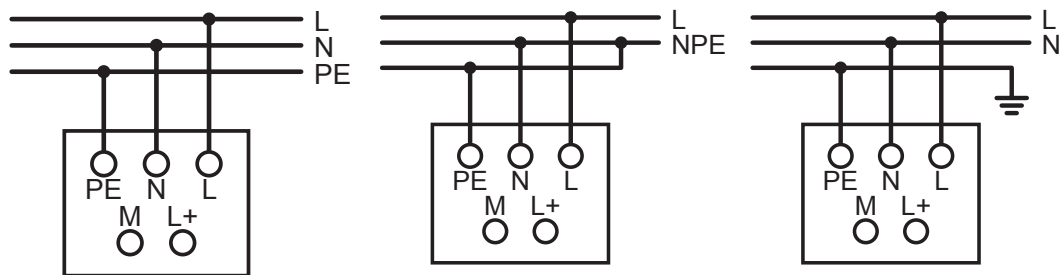
The following cable cross-sections may be used:

At the Input: 0.2...2.5 mm² solid / stranded wire

At the Output: 0.2...2.5 mm² solid / stranded wire

Strip the wire-ends 7 mm

Input: The input connection is made by the screw terminals L, N, ⊕.



5 Safety and Warning Notes



WARNING – Explosion Hazard. Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

WARNING – Explosion Hazard. Substitution of components may impair suitability for class I, Division 2.

WARNING – Switch off the system before connecting the module. Never work on the machine when it is live. The device must be installed in accordance with UL508 and EN60950. The device must have a suitable isolating facility outside the power supply unit, via which can be switched to idle. Danger of fatal injury!

6 Output Power Connections

Output Load (Main input ON)

The output Load in normal mode, when the main input Vac voltage is present, follow the charging battery dc output voltage. The minimum and maximum range stabilized are the following:

- ADB-2405-1: 22...28.8 VDC;
(Without battery connected out. Voltage fixed at 24 VDC)

Thanks to the intelligent battery charger units, it will be possible to manage the power. The available power is automatically allocated between load and battery: supplying power to the load is the first priority of the unit; thus it is not necessary to double the power, and also the power available for the battery will go to the load if the load requires so:

In Power Boost mode the maximum current on the load output is for continuous operation 2 times the rated current $2 \times I_n$ ($I_{load} = I_n + I_{batt}$) and 3 times the rated current $3 \times I_n$ ($I_{load} = 2I_n + I_{batt}$) for 4 seconds; after this parameter the device is electrically protected against overload and short circuit.

- If the Main Input Voltage falls below a Threshold level (50% of the Typ. VAC input) the battery it is immediately connected to the Output Load, without any interruption of voltage dips: In this situation the voltage in the output load it is the same of the battery.

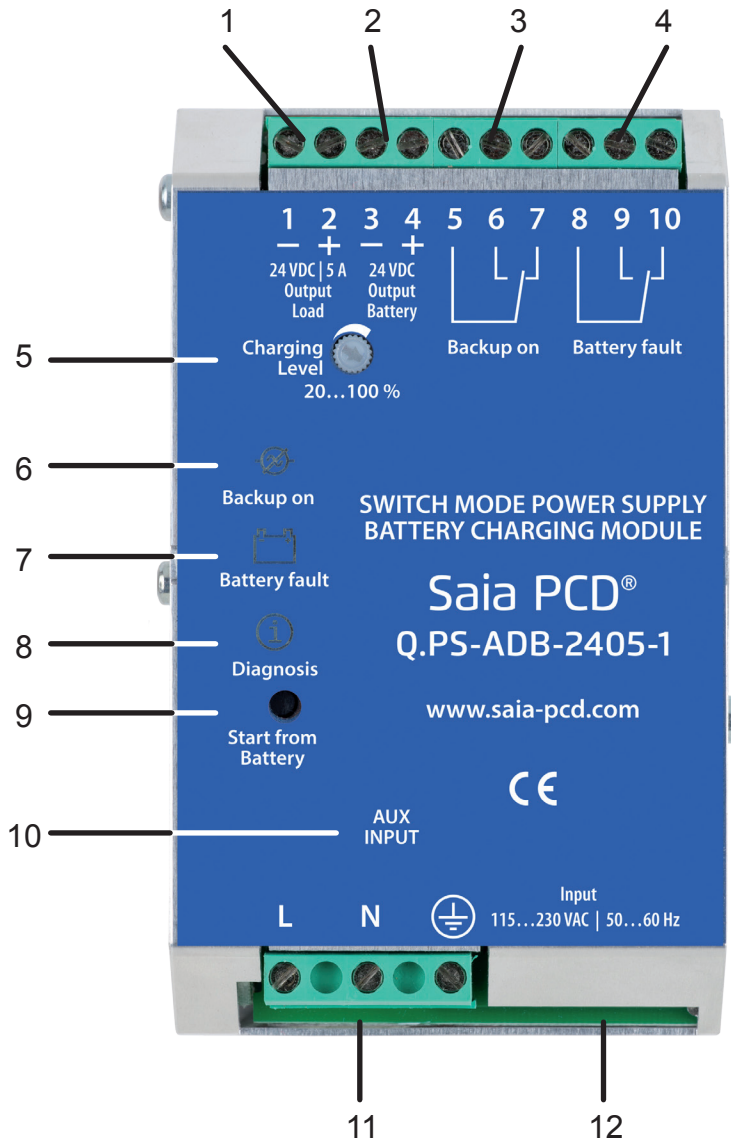
To Avoid deep battery discharge, the battery will supply the load supplied until battery voltage reaches 1.5 (1.5 V/cell). Below this level the device automatically switches off to prevent Deep discharge and battery damage.

Output Load in Buffer Mode (Main input OFF)

Some examples of buffering time depending on the output load in function to the Ah of the battery.

Buffering Time	BATT 1.2 Ah	BATT 3 Ah	BATT 7.2 Ah
Load 1.5 A	20 min	150 min	240 min
Load 3 A	8 min	30 min	120 min
Load 5 A	3 min	15 min	55 min

7 Operating and Display Elements



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7.1 No. 1: Output Load

Connect this Output to the load 1 (-) 2 (+).

With Main input ON:

If the Main Input Voltage falls below a Threshold level (50% of the Typ. Vac input) the battery it is immediately connected to the Output Load, without any interruption of voltage dips: In this situation the voltage in the output load it is the same of the battery.

To avoid deep battery discharge, the battery will supply the load supplied until battery voltage reaches 1.5 (1.5 V/cell). Below this level the device automatically switches off to prevent Deep discharge and battery damage.

7.2 No. 2: Battery Connection Port

Connect the battery between pin. 3 (–) and 4 (+)

7.3 No. 3, 4 Signal Ports (Isolated Outputs)

Connections for,

No. 3: Main/Back Up: Input Main On/Off. Contact: 5, 6, 7

No. 4: Low Battery, Fault connections systems, Battery replacement.
Contact: 8, 9, 10

Relay Contact Rating:

Max. DC1: 30 Vdc 1 A; AC1: 60 Vac 1 A: Resistive load (EN60947-4-1)

Min. 1 mA at 5 Vdc: Min. permissive load



Signal Output port true table:		Port N°3 - LED N°6 Main/Back-Up		Port N°4 - LED N°7 Fault Battery	
		5-6 Closed	5-7 Closed	8-9 Closed (OK)	8-10 Closed
Main Input Vac	ON	■ LED off		■ LED off	
	OFF		■ LED on (1)	■ LED off	
The battery in BackUP it is less than 30% cap?	YES		■ LED on		■ LED on
	NO		■ LED on	■ LED off	
Battery or system Fault?	YES	■ LED off			■ LED on (2)
	NO	■ LED off		■ LED off	

Note:

- (1) For better efficiency of the system, filter relay Main/Back up with a delay of at least 5 seconds before give alarm Main Lost, example: connection to PLC.
- (2) See Diagnosis LED

7.4 No. 6, 7 and 8 Display Signals

No.6: LED Main/Back Up: Input Main On/Off

No.7: LED Low Battery (capacity less than 30%), Fault connections systems and Battery replacement.

No.8: LED Battery charge mode or LED Diagnosis. Diagnosis of the system through “blinking code” signal

Monitor- ing Control Chart:	State	LED Dia- gnosis (No.8)	LED Battery Fault (No.7)
Charging Type	Trickle	1 Blink/sec	OFF
	Boost	2 Blink/sec	OFF
	Recovery	5 Blink/sec	OFF
Auto diag- nosis of the system	Reverse polarity or high battery Voltage	1 Blink/pause	ON
	Battery No connected	2 Blink/pause	ON
	Element in Short Circuit	3 Blink/pause	ON
	Over Load or short circuit on the load	4 Blink/pause	ON
	Bad battery; Internal impedance Bad or Bad battery wire connection.	5 Blink/pause	ON
	Life test not possible	6 Blink/pause	ON
	Bad thermal sensor	7 Blink/pause	ON
	Boost condition; battery discharge after 4 min. of overload.	8 Blink/pause	ON
	Internal fault	9 Blink/pause	ON
	Low battery. Only if started from battery with no Main input (Form Jumper N°5 or Push Bottom)	10 Blink/ pause	ON

7.5 No. 9, 12: Start from Battery, No Main Vac

No. 9: Push-bottom in the front panel (pressed for 3 sec.) for switch ON the system without the “Main input Vac” and only the battery is connected.

No.12: (Jumper n.5) It is also available the same function for remote start from the battery, via cable connected in the Push bottom mounted on front Panel of the external system.

Completely automatic, all devices are suitable to charge most batteries types thank to the user selectable charging curves. They can charge open lead acid, Sealed lead acid, and Gel ¹⁾).

Caution: Switch off the system before setting the jumper.



Battery Type Selection	Jumper Position	Trickle/Float charge (Volt/Cell)	Fast/Bulk charge (Volt/Cell)
Open Lead		2.23	2.40
Sealed Lead Low		2.25	2.40
Sealed Lead High		2.27	2.40
Gel Battery		2.30	2.40
Gel Battery ¹⁾		2.30	2.40
NiCd - NiMH ¹⁾		10% I _{max} Trimmer	1.50
Functional Setting	Function		
Battery Life test ON		Jumper present: Life test enabled.	
Fast Charge Enable		Jumper present: Fast charge enabled.	
Battery Start ²⁾		Via cable for connection to external Push bottom mounted on front Panel of the external system.	
	1) Option NiCd-NiMH on demand. Be careful, in NiCd-NiMH Option, the Sealed Lead High charging curve is deleted. In order to detect end-of-charge negative ΔV, charging current must be set at least at 30% of nominal battery capacity; with lower values of charging current negative ΔV detection is not guaranteed.		
	2) Do not leave the jumper in position 5; penalty discharge, in Back up mode, completely the battery close to Zero.		

7.6 No. 5: Charging Level Current:

It is possible to set the maximum recharging current for the batteries by the trimmer (Charging Level).

The current adjustment ranges from 20% to 100% of I_n . Set the maximum charging current between 10% and 20% of the battery capacity.

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7.7 No. 10: Auxiliary Output

The RJ 45 connector is located behind the front label; remove the window at AUX INPUT to find the connector.

It is possible to connect a temperature sensor, for ambient temperature charging compensation.

With this it is possible to achieve the specifications of the EN54-4 fire alarm norm.

8 Battery Care

The Battery Care philosophy is based on algorithms that implement rapid and automatic charging, battery charge optimization during time, flat batteries recovery and real time diagnostic during installation and operation. The Real Time Auto-diagnostic system monitors battery faults such as, elements in short circuit, accidental reverse polarity connection and disconnection of the battery. They can easily be detected and removed by help of Blink Code of Diagnosis LED; during the installation and in service. Each device is suited for all battery types, by means of jumpers it is possible to set predefined curves for Open Lead Acid, Sealed Lead Acid, Gel, (Ni-Cd → option). It guarantees battery reliability in time by continuously testing the internal impedance status, avoids any possible risk of damages and guarantees also a permanent, reliable and safe connection of the battery to the power supply. The system, through a battery stimulation circuit with algorithms of evaluation of the detected parameter, is able to recognize sulphated batteries or batteries with a short-circuited element.

The battery test will be executed automatic: Every 60 sec. check battery connection. Every 220 minute in trickle charge, make the test of the battery efficiency.

The fault is signalized with relay switching and diagnosis LED blinking.

8.1 Diagnostic Type Checks

1. Check for accidental disconnection of the battery cables:

The intelligent battery charger detects accidental disconnection and immediately switched off the output power.

2. Battery not connected:

If the battery is not connected there is no output power on the clamps.

3. Test of quality wire connections:

During trickle charge will be the quality (resistance) on the battery connection checked every 20 sec. This is for the detection if the cable connection has been properly made.

4. Battery in Open Circuit or Sulphated:

Every four hours the intelligent battery charger tests the internal impedance, in trickle charging mode.

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5. Reverse Polarity check:

The intelligent battery charger is protected against inversion of battery polarity.

6. Test of battery voltage connections:

Voltage check, to prevent connection of wrong battery types with higher or lower voltage than the nominal voltage.

7. End of Charge check:

When the battery it is completely full, the device automatically switches in trickle charging mode.

8. Check for Battery Cells in short circuit:

Thanks to a specific evaluation algorithm, the intelligent battery chargers recognize batteries with cells in internal short circuit.

In trickle charge every 2 hours test of element in short circuit.

9. Diagnosis of battery and device:

The intelligent battery charger supports the user during installation and operation. A Blink code of Diagnosis LED allows discriminating among various possible faults.

LED "Battery Fault" ON and LED "Diagnosis" blinking with sequence (see Display Signal section)

8.2 Charging Curve

Automatic multi-stage operation and real time diagnostic allows fast recharge and recovery of deep discharged batteries. The type of charging is voltage and current stabilized.

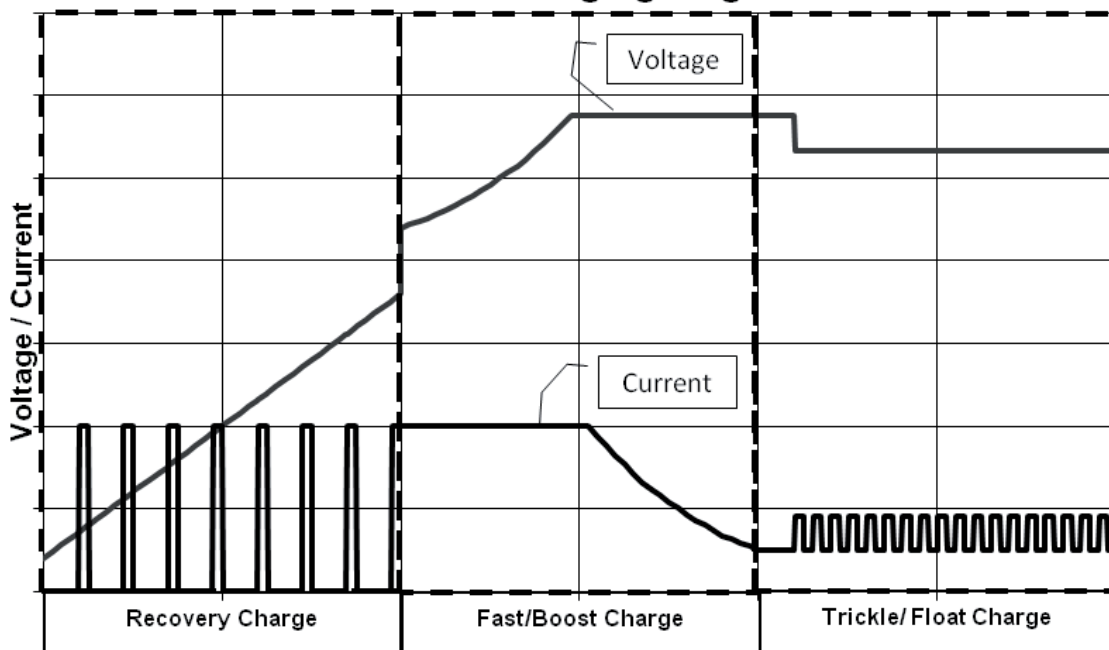
Three charging modes are identified by a flashing code on a Diagnosis LED.

To maintain the Output Load in lower Voltage state, don't put jumper in position 5, in this case no boost charge but only float charge.

	State	Diagnosis LED	Battery Fault LED
Charging Type	Trickle	1 Blink/sec	OFF
	Boost	2 Blink/sec	OFF
	Recovery	5 Blink/sec	OFF



CB Charging Diagram



8.3 Compensation Recharges in temperature

Connecting to the RJ45 Auxiliary input the temperature sensor cable (supplied separately), the intelligent battery charger will vary the voltage of battery charging in depending of the temperature:

Type	Fast Charge	Trickle charge
Q.PS-ADB-2405-1	-5 mV/°C	-3 mV/°C

The temperature sensor must be applied on the battery.

If the sensor is not connected or if the sensor is defective, the LED Battery fault is on and the LED Diagnosis continues to show the status of the battery: trickle charge, fast charge or recovery charge.



9 Protection Features

On the primary side: the device is equipped with an internal fuse. If the internal fuse blows, it is most probable that there is a fault in the device. If it happens, the device must be checked in the factory.

On the secondary side Battery and load: The device is electrically protected against short circuits and overload.

Inversion polarity: the module is automatically protected against inversion of battery polarity and connection of load inverted.

Over current and output short circuit: the unit limits the output current (see the technical data).

Deep discharge: A deep discharge is not possible. The unit disconnects the battery when a minimum voltage level is reached.

Battery Test: Automatic. Every 60 sec. check battery connection. Every 220 minutes in trickle charge, make the test of the battery efficiency (life test) if jumper position 4 is enabled; see Battery Management Configurations Section. The fault is signaled with relay switching and diagnosis LED blinking.

10 Thermal Behaviour

The rated maximal air temperature @ nominal current is 50 °C. For ambient temperature of above 50 °C, the output current must be reduced by 2.5% per Kelvin increase in temperature. At the temperature of 70 °C the output current will be $0.5 \times I_n$. The equipment does not switch off in case of ambient temperature up to 70 °C or thermal overload. The devices are protected for excess temperature conditions. In conditions where the power supply inside temperature is over 70 °C will the device shut-down the output and will automatically restarted when the temperature inside the power-supply is decreased.

11 Standards and Certification

11.1 Electrical Safety:

Assembling device:

UL508, IEC/EN60950 (VDE 0805) and EN50178 (VDE0160)

Installation according:

IEC/EN60950

Input / Output separation:

SELV EN60950-1 and PELV EN60204-1. Double or reinforced insulation

11.2 EMC Standards Immunity:

EN61000-4-2, EN61000-4-3, EN61000-4-4, EN61000-4-5

11.3 EMC Standards Emission:

EN61000-6-4, EN61000-3-2 (see data sheet for each device)

11.4 Standards Conformity:

Safety of Electrical Equipment Machines: EN60204-1.



The CE mark in According to EMC 2004/108/EC and Low voltage directive 2006/95/EEC






11.5 Norms

In Conformity to:

- IEC/EN60335-2-29 Battery chargers
- EN54-4 Fire Detection and fire alarm systems
- DIN41773 (Charging cycle)

A Appendix

A.1 Icons

	In manuals, this symbol refers the reader to further information in this manual or other manuals or technical information documents. As a rule there is no direct link to such documents.
	This symbol warns the reader of the risk to components from electrostatic discharges caused by touch. Recommendation: Before coming into contact with electrical components, you should at least touch the system's negative pole (cabinet of PGU connector). However, it is better to use a grounding wrist strap with its cable permanently attached to the system's negative pole.
	This sign accompanies instructions that must always be followed.
	Explanations beside this sign are valid only for the Saia PCD® Classic series.
	Explanations beside this sign are valid only for the Saia PCD® xx7 series.

A.2 Address of Saia-Burgess Controls AG**Saia-Burgess Controls AG**

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