Installation Manual REV:202310

Backup power supply PB7-485A/S

1 GENERAL DESCRIPTION

Thanks to All In One PB7 design it is possible to optimize the power management of your system with one single, extremely compact and cost-effective backup power supply connected directly to the mains. The available power is automatically distributed between load and battery giving priority to the load. Battery can supply the load even with mains so the output power to the load can be twice the nominal power if it is required (Power Boost). When mains failure occurs, the load continues to be supplied by the battery in backup mode. It is also possible to switch on the device with no mains directly from battery. The "Battery Care" algorithm performs rapid and automatic charging, battery charge optimization during time, flat batteries recovery and real time diagnosis during installation and operation. Temperature compensation is possible by connecting the temperature sensor probe. The real time auto-diagnostic system monitors battery faults such as sulphated battery, shorted cells, accidental reverse polarity connection or disconnection of the battery. Each fault is signaled by a blink code of Diagnosis Led. The continuous monitoring of battery efficiency reduces risk of battery damage and allows a safe operation in permanent connection. Predefined curves can be selected by jumpers or DIP switch to optimize the charge of different battery types: Open Lead Acid, AGM and Gel Lead Acid. Output dry contacts are used to signal both backup and fault conditions. A rugged casing with bracket for DIN rail mounting provides IP20 protection degree.

2 MAIN CHARACTERISTICS

- Universal input voltage: single-phase 115–230-277 VAC
- Load output: 48 VDC / 5 A
- Battery output: 48 VDC / 5 A
- ALL IN ONE - Power supply + battery charger + backup module
- Suited for Open Lead Acid, Sealed Lead Acid, AGM and Gel Lead Acid
- Four stage charging curve for Lead Acid batteries: 5-stage IUoU (Recovery, Bulk, Absorption, Float, Refresh Battery)
- Recovery stage for deeply discharged batteries
- Automatic diagnosis of battery status and battery Life Test function
- Switching technology with high efficiency
- Protected against short circuit, overload and inverted polarity
- Output dry contact for signalling Low/Fault Battery
- Output dry contact for signalling Mains or Backup
- IP20 protection degree
- Space saving on DIN rail

3 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 according with UL508 or UL60950. The device must have a suitable isolating facility outside the power supply unit, via which can be switched to idle. Danger of fatal Injury!

• WARNING - Residual voltage. Wait for 10 seconds before operating on the device PB7-485A/S.

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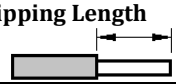
4 CONNECTION

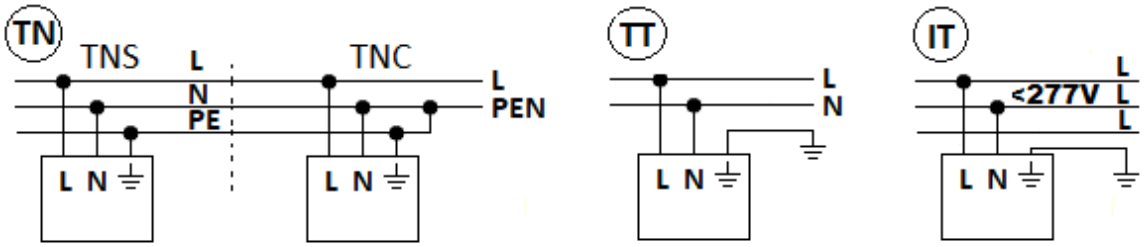
4.1 CONNECTION TERMINAL AND WIRING

The following cable cross-sections may be used:

	Solid (mm²)	Stranded (mm²)	AWG	Torque (Nm)	Stripping Length 
In:	0.2 – 2.5	0.2 – 2.5	24 – 14	0.5 – 0.6 Nm	7 mm
Out:	0.2 – 2.5	0.2 – 2.5	24 – 14	0.5 – 0.6 Nm	7 mm
Signal :	0.2 – 2.5	0.2 – 2.5	24 – 14	0.5 – 0.6 Nm	7 mm

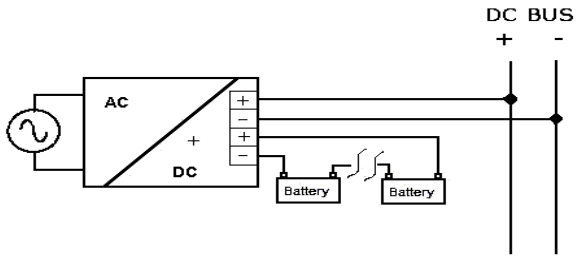
Connection by the screw, type 2.5 mm² or 4.0 mm² terminal blocks. Wiring terminal shall be marked to indicate the proper connection for the power supply. Use copper cables only, for supply connections, use wires suitable for at least 75°C.

4.2 INPUT LINE SYSTEM



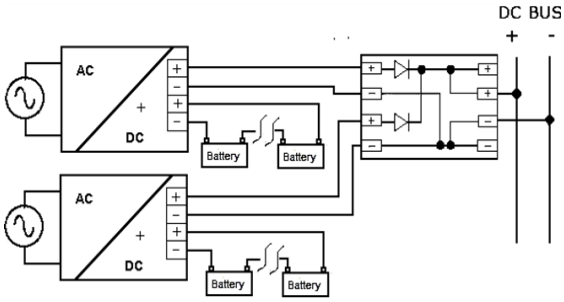
4.3 OUTPUT POWER CONNECTIONS – LOAD AND BATTERY

4.3.1 Basic connection



In basic connection PB7-485A/S requires 4pcs of 12 VDC batteries connected in series.

4.3.2 Parallel connection "Redundancy"



Power supplies can be paralleled in case of redundancy concept, to obtain a higher system reliability. Redundant systems may support N+1 redundancy to safeguard against single-point failures, or to enable hot-swapping of a failed supply without system impact. The simplest way is to put two PB7 in parallel. In case one power supply unit fails, the other one is automatically able to support the load current without any interruption. To separate completely a hypothetical device failure, it is necessary add the decoupling diodes module.

Recommendations for building redundant power systems:

a) Use separate input fuses for each PB7.

b) Monitor the individual PB7 units by three LED. Each unit has two relays: Mains or backup and Low Battery or Battery Replacement (faulty situation). This feature reports a faulty unit; see Relay Contact Rating for any technical detail.

c) When possible, connect each power supply to different phases or circuits

4.4 OUTPUT LOAD (MAINS INPUT ON)

When is Mains Input VAC Voltage present, 48VDC Output (OUT LOAD terminals) follows the charging battery DC output voltage:

- The minimum and maximum range stabilized 44 – 57.6 VDC.
- Without battery connected out is voltage fixed at 48VDC.

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 it.

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

- In "Power Boost Mode", if the battery provides current to the load for longer than 4 minutes, the device outputs a message (8 Blink) to warn that the battery is discharging.
- If the Mains Input Voltage fall below a Threshold level (50% of the Typ. VAC input) the battery is immediately connected to the Output Load, without any interruption.
- Voltage dips: In this situation the voltage in the output load is the same of the battery.
- **To Avoid deep battery discharge**, the battery will supply the load until battery voltage reaches the minimum V/cell. Below this level the device automatically switches off to prevent Deep discharge and battery damage.

4.5 OUTPUT LOAD: TIME BUFFERING MODE (MAINS INPUT OFF)

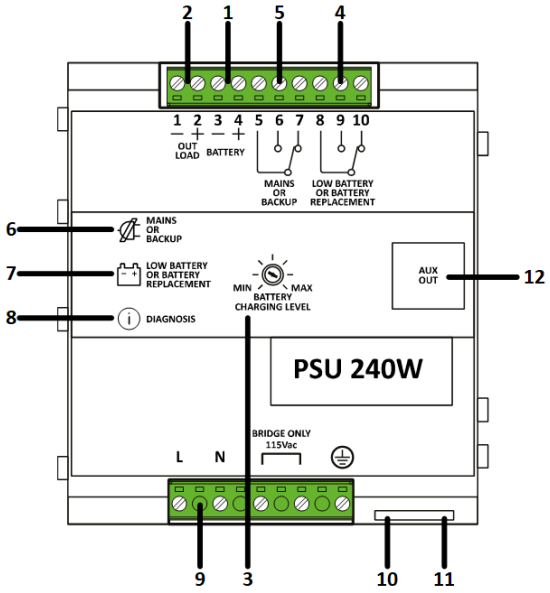
Buffering time depending on:

- Output load,
- Battery capacity,
- Ambient temperature.

In the table below, you can find a typical backup times for different loads at 20°C.

Buffering Time	BATT – 4x 7.2 Ah	BATT – 4x 18 Ah	BATT – 4x 33 Ah
8 W (2G-2S.8.0.F-BoX-PoE-PP)	43 h	108 h	198 h
12.95W (PoE zařízení)	26 h	66 h	122 h
25.5W (PoE+ zařízení)	11 h	33 h	62 h
60W (PoE++ zařízení)	*	14 h	26 h
The indicated times are the maximum possible. The maximum recommended discharge current of the battery is usually one tenth of the battery capacity.			

5 LAY-OUT AND CONNECTIONS

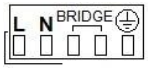


(1) Battery Terminals
(2) Load Terminals
(3) Charging Current Limiter
(4) Fault Relay Terminals
(5) Mains-Backup Relay Terminals
(6) Mains-Backup LED
(7) Fault LED
(8) Diagnostic LED
(9) AC Input
(10) Battery mode
(11) Start without mains
(12) Temperature sensor connection

6 INPUT AND OUTPUT LOAD AND BATTERY CONNECTION

6.1.1 AC Input (9)

Single phase Switching Power Supplies L, N, PE ⊕.



BRIDGE ONLY for input 115 Vac, and connect L, N, PE ⊕.

6.1.2 Battery terminals (1)

Connect four 12 VDC batteries connected in series between terminal 3 (–) and 4 (+).

6.1.3 Load Terminals (2)

Connect this Output to the load, terminal 1 (–) and 2 (+).

7 DRIVE AND MONITORING

7.1 FAULT - STATUS CONDITIONS

7.2 ISOLATED RELAY

7.2.1 STATUS: Mains or Backup: Input Mains On/Off.

(5) Mains-BackUp Relay Terminals -> 5,6,7
(6) LED Mains-BackUp LED

7.2.2 FAULT: Low Battery, Battery Replacement, Faulty Battery or Faulty System

(4) Fault Relay Terminals -> 8,9,10
(8) Diagnostic LED - diagnosis of the system through "blinking code" light signal

7.2.3 Back Up and Fault: Relays and LEDs Conditions

		Relay (5) - LED (6) LED Mains-BackUp LED		Relay (4) - LED (7) Fault Battery	
Relay:		**5-6 Closed OK**	**5-7 Closed**	**8-9 Closed OK**	**8-10 Closed**
Mains Input Vac	ON	■ - led off		■ - led off	
	OFF		■ - led On (1)	■ - led off	
Battery SOC less than 30%	YES		■ - led On		■ - led On (2)
	NO		■ - led On	■ - led off	
Battery or system Fault?	YES	■ - led off			■ - led On
	NO	■ - led off		■ - led off	

Note:
(1) Contact relay Mains/Back switch at least 5 seconds after disconnection of Power.
(2) See Diagnosis Led

7.2.4 Relay Contact Rating:

Max.DC1: 30 Vdc 1 A; AC1: 60 Vac 1A: Resistive load (EN 60947-4-1).Min.1mA at 5 Vdc: Min. permissive load

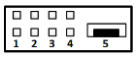
7.3 CHARGING MODE STATUS

	Status	Diagnosis (No.8)	Fault Battery (No.7)
Charging Type	Float	1 Blink/2 sec	OFF
	Absorption	1 Blink/sec	OFF
	Bulk	2 Blink/sec	OFF
	Recovery	5 Blink/sec	OFF

7.4 FAULTY BATTERY / FAULTY SYSTEM

System Auto Diagnosis	Reverse polarity or high battery Voltage	1 Blink/pause	ON
	Battery not connected	2 Blink/pause	ON
	Battery element in Short Circuit	3 Blink/pause	ON
	Overload 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
	Rectifier Alarm	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 Mains input,	10 Blink/pause	ON
	Mains detector failure	12 Blink/pause	ON
	Device over-temperature Alarm	14 Blink/pause	ON
	Calibration error	16 Blink/pause	ON

7.5 START FROM BATTERY ONLY, NO INPUT MAINS VAC (11)



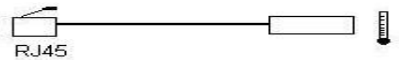
No.11 /Jumper n.5) connect the jumper for starting system without mains. Do not leave jumper in this position, otherwise the system will discharge completely the battery.

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. Elements in short circuit, accidental reverse polarity connection, disconnection of the battery, can easily be detected and removed by help of Blink Code of Diagnosis Led, during the installation and after sale. Each device is suited for all battery types, it is possible setting predefined curves for Open Lead Acid, Sealed Lead Acid, Gel, Ni-Cd, Li-Ion. They guarantee battery reliability in time by continuously testing the internal impedance status, avoiding any possible risk of damage and granting a permanent, reliable and safe connection of the battery to the power supply. The system is able, through a battery stimulation circuit with algorithms of evaluation of the detected parameter, to recognize sulphated batteries or batteries with a short-circuited element. Battery Test: Automatic. Every 60 sec. battery connection check. Every 220 minutes in Float charge, battery efficiency test. Battery Faults can be monitored by relay and led blinking.

8.1 BATTERY CHARGE IN TEMPERATURE COMPENSATED ENVIRONMENT (12)

No. 12 Remove the window label to find the connector: Auxiliary Output “AUX 1”
It is possible to connect the Temperature sensor probe and apply it on the battery.The function of the probe is for temperature battery compensation. With this it is possible to meet the requirements of the EN54- fire certification.



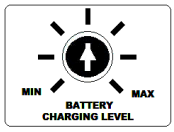
8.1.1 Battery Temperature Compensation Charge

Connecting the cable RJ-TMP (supplied separately) to Auxiliary Output AUX1, the supply will adjust the battery charging voltage in relation to the Battery temperature :

Float charge: Open Lead, AGM, Gel
+/- 3mV/°C x n. of Cells from -20°C to +60°C +120 ÷ -120 mV/Cell compared to the value at 20°C

The device stops charging the battery if the temperature is below -20°C or above +60°C. The sensor placed on cable RJ-TMP must be applied on the battery.

8.2 CHARGING CURRENT LIMITER:



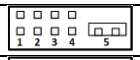
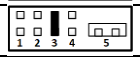
No.3 In order to protect the battery from excessive charging currents, the device allows to limit the maximum charge current by adjusting the trimmer from 20% to 100% of the rated current. To determine the maximum battery charge current, see the battery manufacturer's Data Sheet or, if not available, consider that typically the maximum charge current is 10% of Ah's rated battery current, for both Lead Acid Li-ion and NiCd batteries.

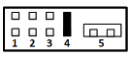
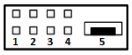
8.3 BATTERY MANAGEMENT CONFIGURATIONS

Completely automatic, all devices are suitable to charge most batteries types thank to User Selectable charging curves. They can charge open lead acid, sealed lead acid, Gel, Ni-Cd and Li-Ion.

8.3.1 Battery Management Configurations (10)

No.10 Preliminary Operations: One device for all battery types.
Caution: Switch off the system before Setting the jumper.

Battery Type Selection	Jumper Position	Float charge (Volt/Cell)	Fast charge (Volt/Cell)
Open Lead		2.23	2.40
AGM Low		2.25	2.40
AGM High		2.27	2.40
Gel Battery		2.30	2.40

Functional Setting		Function
Battery Life test ON		Jumper present or dip switch ON: Life test enabled (not for NiCd)
"Start from Battery" (No Input Mains)(9)		System switch ON from battery without mains.

Note:
1 Do not leave the jumper in position 5; otherwise, in Backup mode the battery is discharged completely close to zero.

8.4 DIAGNOSTIC AND CONTROLS

PB7 devices support the user during installation and operation. A Blink code of Diagnosis Led allows to discriminate among various possible faults.
Error conditions, "LED Battery Fault" ON and "LED Diagnosis" blinking with sequence; see Display Signal section.

- Check for accidental disconnection of the battery cables and immediately switch off the output power.
- Battery not connected: If the battery is not connected the device provides alarm within 10 sec.
- Test of quality wire connections: During Float charge the quality (resistance) on the battery connection is checked every 60 sec. This to detect if the cable connection has been properly made.
- Battery in Open Circuit or Sulphated: In Float charging mode, the All In One performs internal impedance test every 220 minutes.

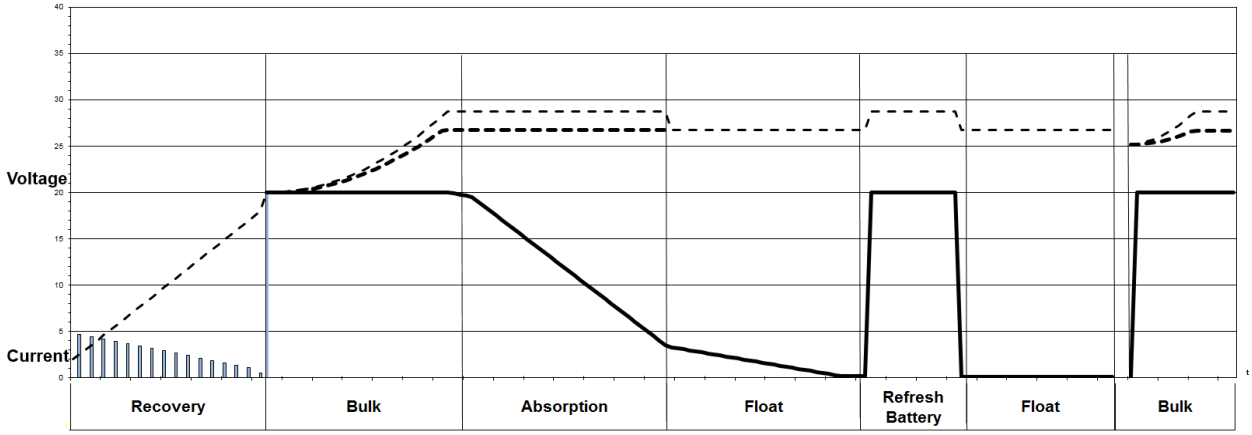
- Reverse Polarity check: If the battery is connected with inverted polarity, the All In One is automatically protected.
- Test of battery voltage connections: Appropriate voltage check, to prevent connection of wrong battery types, above or below nominal voltage.
- End of Charge check : When the battery is fully charged, the device automatically switches in Float charging mode.
- Check for Battery Cells in short circuit: thanks to specific algorithms of evaluation, the Alle In One recognizes batteries with shorted cells. In Float charge every 220 minutes a short-circuit test is carried out.

8.5 PROTECTION FEATURES

- **On the primary side:** the device is equipped whit an internally fuse. If the internal fuse is blown, most likely there is a fault in the device. In that case, the device must be returned to factory for repair.
- **On the secondary side Battery and load:** The device is electrically protected against short circuits and overload.
- **Polarity Inversion:** the module is automatically protected against inversion of battery polarity.
- **Over current and output short circuit:** the unit limits the output current (see the technical data).
- **Deep discharge:** not possible. The unit disconnects the battery when a minimum voltage level is reached.

8.6 CHARGING CURVE

Automatic multi-stage operation and real time diagnostic allows fast recharge and recovery of deep discharged batteries. The type of charging is Voltages stabilized and Current stabilized IUoU. Five charging phases are identified by a flashing code on a Diagnosis LED. To maintain the Output Load close to the nominal voltage (48), don't insert jumper in position 6 to disable fast charge. Fast Charge means also that every 288h, the device goes in "Cycling Refresh Charging" for 85 minutes at 2.4V/Cell.

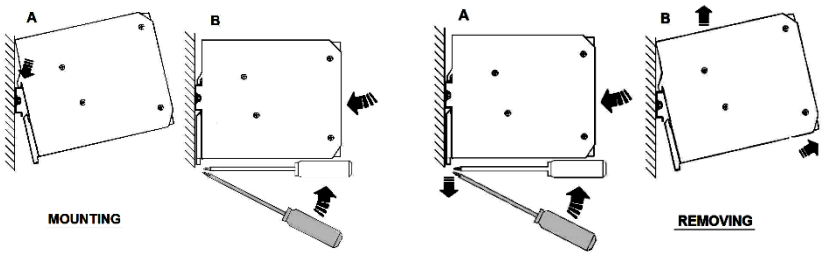


8.7 THERMAL BEHAVIOUR

Surrounding air temperature 50°C. For ambient temperature above 50°C, the output current must be reduced by 2.5% per °C. Max 70°C At the temperature of 70°C the output current will be 50% of In. The equipment does not switch off in case of ambient temperature above 70°C or thermal overload. The devices are protected for Over temperature conditions "worst case"; in this situation the device shuts down the output and automatically restarts when the inner temperature falls within limit.

9 DIN RAIL MOUNTING:

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.



10 ACCESSORIES

10.1 TEMPERATURE SENSORS

- RJ-TMP