Industrial EMP Solutions
CIVILIAN CRITICAL INFRASTRUCTURE PROTECTION
E-mail: industrial_EMP_solutions@outlook.com WEB: www.best-empsolutions.com

HEMP Protected

Automatic Emergency Backup Industrial Battery Charger for Auxiliary DC Critical Power Network

* **For civilian critical infrastructure protection**
* **For nominal DC network voltages 125V and 250V**
* **Automatic activation in case of failure of the main charger**
* **Automatic return to standby mode upon restoration of voltage in the DC network**
* **The compact size and relatively light weight make the charger easy to transportation**
* **Floor-mounted installation and wall-mounted**

1. **D**irect current auxiliary power system (DCAPS) is the most important component of any substation. All other substation systems and equipment (such as power equipment, relay protection, automation, control, communication, emergency, etc.) rely upon its operability. DCAPS failure makes the whole substation completely inoperable and "invisible" for the central control room. Therefore, DCAPS above all others needs the special facilities to ensure its operation upon HEMP. Primarily, the special protection measures are required for electronic battery chargers supplying power to DC current carrying buses, feeding numerous consumers and ensuring battery floating charge. A regular charger is the metal cabinet containing many electronic elements connected with long cables (input AC supply cable, output DC cable and signal cable). Such equipment is particularly sensitive to the effects of HEMP.

2. **T**he backup automatic charger allows the entire DC network (including batteries) to maintain normal operation in case the main charger fails. This charger continuously monitors the voltage level in the DC network. In this mode, the charger is completely HEMP protected. When this voltage falls below the set level due to the failure of the main standard charger (after HEMP

impact), the backup charger activates and returns the voltage in the DC system to normal levels.

Main Parameter	Value	
Type	**230/125-40-x***	**230/250-20-x***
Nominal Output DC Voltage, V	125	250
Power, W	5000	
Max. Output current, A	40	20
Input AC Voltage Range, V	187 – 253	187 – 253
Output Ajustable DC Voltage*, V	95 – 150**	190 – 300**
Threshold reduced voltage at which the charger should be activated*, V	75 - 120**	170 - 270**
Output Voltage Deviation, %	± 0.5	
Ripple, V	≤0.1	
Unbalance current at parallel connection, %	± 3%	
Working Temperature, ˚C	+5˚C to +30˚C	
Natural cooling (see p. 3)	Yes	
Automatic Current Limiting	Yes	
Overvoltage protection	Yes	
Short circuit protection	Yes	
Dimensions, mm	300x800x800	
Weight, kg	60	

* *x = **F** for floor mounting; x = **W** for wall mounting*

** *The voltage within the specified range is set by the manufacturer as factory default setting **at the request of the consumer**, but cannot be changed by the consumer. Factory default setting for charger 230/250-20 type is 237V in float mode and 225V for activation.*

After two hours of operation, the backup charger deactivates automatically but continues to monitor the DC voltage. If the problem persists, the charger automatically reactivates. If the issue has been resolved and the voltage has returned to normal levels, the charger automatically goes back to standby mode. This is a very important function because the charger can be activated for various reasons related to emergency situations that periodically occur in the power network. However, after activation, the charger will no longer be protected from HEMP of any kind. Therefore, it is very important that the charger automatically returns to HEMP-protected mode (that is standby mode) after the fault in the network has been eliminated. But this function can be turned off using a toggle switch **S2** located on the control unit. In this case, the charger remains in an on state constantly after first activation and operates parallel to the standard charger operating at the substation. It is undesirable to disable this function, so switch **S2** is installed in a location not accessible for accidental disconnection by the substation personnel.

3. Under normal condition the charger operates with natural ventilation, which is provided through two ventilation openings covered by honeycomb vent panels that prevent the penetration of electromagnetic waves into the internal space of the charger. Usually, chargers at substations operate most of the time with a small load (about 20-30% of the maximum capacity) and therefore do not require forced cooling. However, with prolonged operation after activation at maximum current (for example, after a deep discharge of the battery), the temperature inside the charger (which has very limited free internal space) may rise. To increase the thermal time constant of power supplies, their casings have good thermal contact with the main mounting board and an additional metal board. In addition, the device is equipped with a current monitoring relay that automatically turns on the intake and exhaust fans when the load exceeds 70% in order to prevent overheating of the power modules. When the temperature inside the charger increases, unrelated to operation at maximum current, another system based on a temperature monitoring relay comes into play. The temperature monitoring relay turns on the intake and exhaust fans automatically when the temperature in the upper part of the cabinet rises to 35-37°C (at the same time, the temperature inside the closed power units can be much higher) and turn off when the temperature drops to 30°C. As a backup redundant element needed in case of failure of the electronic systems for monitoring current and temperature, a simple mechanical thermostat switch is used, which turns on the fans at around 45°C and turns them off at around 30°C.

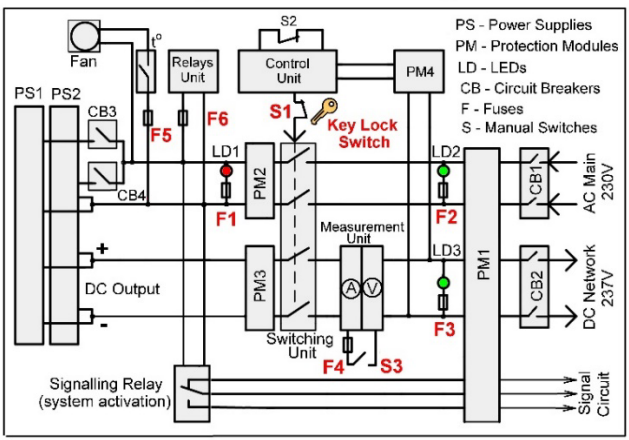
4. The automatic operation mode (automatic activation and deactivation) of the charger can be completely turned off at the request of the consumer using a switch **S1** located inside the charger. When the switch **S1** is moved from the "Protected" position to the "Unprotected" position, the automatic control function is completely disabled, and the device starts to operate as a regular charger. In this mode, the charger remains well protected against ordinary electromagnetic interference, but not against HEMP. Therefore, it is very important that this feature is not disabled without authorization. To prevent unauthorized disabling of this feature, switch **S1** is equipped with a mechanical lock, the key of which cannot be removed after the feature is disabled. In a normal situation the key is stored in a container on the charger door.

5. The charger is equipped with signal lights (green inside and red on the outer side of the door) that reflect its operating mode, as well as an DC ammeter and voltmeter, which are activated by pressing a push button switch **S3**. These devices, like all the others sensitive components of the charger are located inside a closed steel housing that protects them from electromagnetic radiation. And the Control Unit with sensitive electronic components inside (as critical part of the system) is placed in an additional metal enclosure and connects to the DC network through addition special protective module (PM4), using triple-

shielded cables.

6. External cables enter the charger from below through metal glands in the floor of the charger.

Simplified Functional Diagram



7. The charger is built in such a way that damage and failure of auxiliary electronic systems and even one of the internal power supplies do not stop its operation, but only reduce its output power. For this purpose, all secondary electronic devices and electrical circuits are equipped with 6 fuses and 2 addition thermal magnetic circuit breakers that prevent short circuits in the internal circuits when a specific internal electronic module is damaged and a short circuit occurs. These fuses allow for the isolation of the damaged module and its impact on other circuits before the main (input) circuit breaker trips and shuts down the entire charger.

8. To increase the output power two or three times, two or three chargers can be used with their outputs connected in parallel, while the inputs are connected to different phases of the main AC power network. In this case, the separate chargers are installed one on top of the other and fastened to the wall. The independence of each individual part of such a combined charger ensures the redundancy in reliability and survivability necessary for backup emergency equipment.

9. The charger is intended for operation in a control room with a controlled temperature between +5°C to +30°C and humidity up to 85%.

10. The charger can be transported by any means of transport, but only in a horizontal position, with the door facing up.