User guide
LAST-12V, LAST-24V and LAST-48V

Please read the entire instructions carefully before installing or using this product.

MAIN FEATURES:

- Stand alone unit with integrated control/protection electronics.
- Heating power is continuously adjustable with a potentiometer up to the nominal value.
- Heater is activated automatically when the battery voltage is over max. value during braking. This function preserves electrical vehicle braking with the motor even if the battery is fully charged.
- Can be used for ventilation also (fans can be started without the heater).

INSTALLATION INSTRUCTIONS

Connect the unit to the battery with the correct polarity and adequate wire cross section. Insert a fuse - see the table (technical data) for the minimal fuse value. If the heater will be used just for heating purposes and not during electrical braking also then the fuse value can be smaller ⇨ min. fuse rating = nominal power divided by nominal voltage.

The unit must have a switch with which it is switched on. Operation just with the potentiometer is not desirable since otherwise the control electronics and internal power relay would pull some current out of the battery all the time. Potentiometer has to be connected so that the resistance is zero when the potentiometer is in the leftmost position. Use a potentiometer with a 5k or 4k7 resistance (preferably with a switch). A sticker for the potentiometer with a scale is available and 5k potentiometer with a switch (have to be ordered separately). See the schematics for the pin assignment of the connector.

FUNCTIONAL DESCRIPTION

Switch	The unit has to be switched on first. A click sound from internal relay can be heard.
LED	The LED will light when the fan is operating. The LED will flash: • if a too high or too low voltage has been connected to the device, • if the potentiometer is not connected properly or has failed, • in case of overtemperature (for example not enough fresh air available or prolonged operation at peak power) or • if an internal error is detected during self test or during operation. The heater is not switched on if an error is detected. The fan will run if the internal temperature is too high.
Potentiometer	The fan and heater are not operating when the potentiometer is in the leftmost position. When the potentiometer is turned right first the fan is activated (cooling function). When the

	potentiometer is turned to the right the heater is switched on. Power of the heater can be set from 20% to 100% of nominal power. When the battery voltage is going low the power is reduced and the heating is stopped completely when the voltage is under the minimal value (see the technical data for the values).
FAN	The fan is switched on together with the heater and without it when just cooling is requested. The fan operates up to 30 seconds after the heater has been switched off. This time depends on power and time (how long the heater has been operating).
Operation during electrical vehicle braking	The heater is switched on automatically if the battery voltage rises over the predefined value (see the technical data). This function enables the braking function in electrical vehicles even when the battery is fully charged and can not accept the current coming from the electrical motor. To have this function the device must be switched on in warm periods also and the cooling/heating openings of the device must not be covered .

CAUTION

COOLING OPENINGS	Do not cover the cooling fan openings in order to ensure enough air flow. The heating unit will be switched off if the internal temperature will rise.
OPERATION IN ELECTRICAL VEHICLES OR BOATS	The unit must be switched on/off with the main vehicle switch and also during battery charging since otherwise the heater could be switched on automatically during the final charging phase(s).

Technical data

Product version	**LAST-12V**	**LAST-24V**	**LAST-48V**
Nominal power	600W	1000W	1000W
Maximal power	800W	1500W	1500W
Maximal current value (minimal external fuse rating)	80A	56A	28A
Voltage over which the heater is switched on automatically	14,0V	28,0V	56,0V
Maximal operating voltage	16V	32V	65V
Voltage under which the heater will cease to operate	10,8V	21,6V	43,2V
Weight	1,1 kg		
Environmental protection	IP21		
Protection functions	undervoltage, overvoltage, overtemperature, false polarity		

All the parameters (from nominal power to voltages and protection temperatures) are factory adjustable only.

Producer:

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