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USER MANUAL

**universal, modular power supplies CAMELEON
of output voltage of 110V and 220V**

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1. SAFETY PRECAUTIONS

Please read this Manual thoroughly before installation. Failure to comply with the safety precautions listed in this Manual could result in accident or serious personal injuries. The manufacturer is not responsible for damages or personal injuries resulting from improper use of this equipment, not complying with the User Manual.

- The installation of the device should be done in accordance with the information contained in the point Connection.
- This device must be installed and serviced by qualified personnel only.
- **The device must be obligatorily connected to the earth terminal of the mains.**
- Do not remove the device housing during operation. All the DC and AC cables must be disconnected from the device before opening the enclosure.
- Do not cover the ventilation holes allowing for adequate cooling, as this may lead to overheating and damage of the device.
- Do not insert any items into the openings of the housing.
- Do not place the device on wet or damp surfaces.
- Do not expose the device to high temperatures or direct sunlight.
- Do not touch hot parts of the housing (heat sinks) as this may cause burns.
- Before connecting the device to the mains, it is necessary to check the quality of all connections made (mains power supply, load, battery and indication system).
- The space around the device should be kept clean.
- When replacing fuses accessible to the user, make sure to use only fuses of the same type and rating.
- All warranty and post-warranty repairs (including replacement of fuses inside the power supplies) shall be performed by the service personnel or specialized partner authorized by the manufacturer.

1.1. ENVIRONMENTAL PROTECTION



The product packaging is made of materials that can be recycled. Used packaging, after segregation, must be delivered to an appropriate waste treatment facility.



Used product is considered waste which cannot be disposed of in municipal waste containers, but must be submitted to the local recipient of electronic and electrical waste. Appropriate disposal of waste electrical and electronic equipment (WEEE) will contribute to avoiding harmful impacts on public health and natural environment, resulting from inappropriate storage and processing of this kind of equipment.

1.2. MANUFACTURER'S REMARKS

The manufacturer reserves the right to make design and technological changes that do not deteriorate the product quality. Before choosing a particular type of power supply, it is recommended to contact the supplier in order to obtain confirmation of proper selection of the device for the desired application.

2. General description

CAMELEON universal modular power supplies with output voltages of 110V and 220V are a family of products with a unified structure of the power of up to 600W. On the basis of standard power units that are used independently as single-output power supplies, power supplies equipped with additional functions are produced. The power supply has an additional packet that performs a specific function and the special front panel.

In standard, the power units are standard equipped with output characteristic shaping systems with power limitation function and current reduction when short circuited, temperature measurement with

automatic power reduction to protect against overheating and stabilized output current limiting characteristic.

The power supplies are equipped with an internal fan supporting the main convection cooling. Its operation depends on both the ambient temperature and the load level, which significantly increases the reliability of the forced cooling.

In standard, all power supplies are equipped with power factor correction (PFC) and without any additional changes or switching they work with both the mains voltage of 230V AC and with 220V DC voltage used in industrial battery systems. All power units are also equipped with the LED signalization of the operation status and overload as well as the signaling relay of the operation state.

3. Electrical parameters

	Output voltage	
	110V	220V
AC-powered		
Input voltage range	184... 230 ...253V 47...53Hz	
Power factor at nominal conditions	min 0.97	
Protective earth leakage current	~ 1mA	
Input voltage tolerance	176...265V	
Inrush current	30A	
Efficiency under nominal conditions	> 86%	> 86%
DC-powered		
Input voltage range	165... 220 ...297V	
Inrush current	25A	
Efficiency under nominal conditions	> 85%	> 85%
Parametry wyjściowe		
Maximum output current	5A	2.5A
Maximum output power	550W	550W
Overvoltage protection	140...151V	280...295V
Line regulation	< 100mV	< 100mV
Load regulation	< 1.0V	< 2V
Ripple voltage (RMS)	< 20mV	< 50mV
Ripple voltage (peak-to-peak)	< 200mV	< 300mV
Outputs of relay indication		
Relay output loadability	15V/1A, 30V/1A, 60V/0.5A at resistive load	

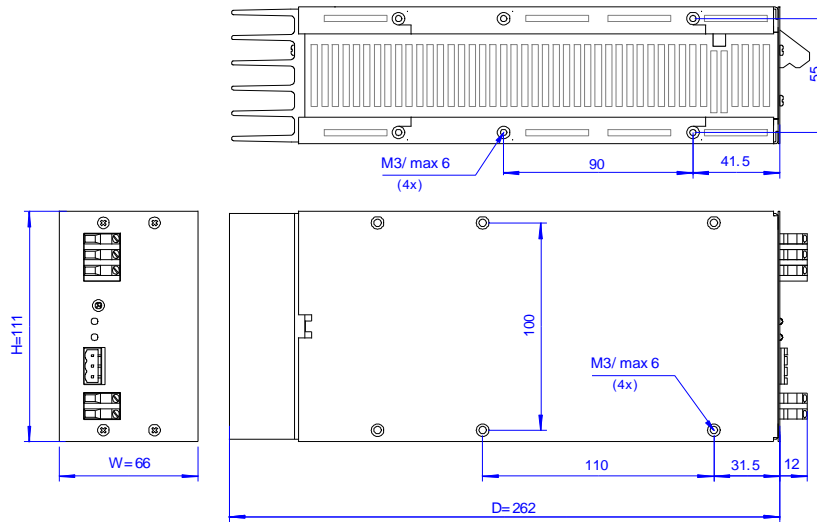
Note: In case of the DC supply, the polarity of its connection is irrelevant.

4. OPERATING CONDITIONS

Recommended storage temperature	+5°C ÷ +40°C
Operating temperature range *)	-25°C ÷ +70°C
Relative humidity (non condensing)	30% ÷ 80%
Direct exposure to sunlight	Unacceptable
Surges during operation	Unacceptable
Electrical safety according to EN 60950-1	I

*) with power reduction for temperatures lower than -15°C and higher than 55°C.

5. OVERALL DIMENSIONS AND MOUNTING

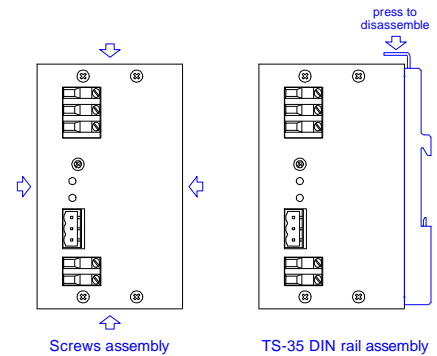


MECHANICAL PROPERTIES

VARIANT	DIMENSIONS: W×H×D	PROTECTION DEGREE
600	66 × 111 × 262 mm	IP 20

The power supply unit can be fixed with four M3 screws to each of the side panels or by means of a TS-35 rail holder.

The power supply unit should be kept in a vertical position due to its interior and external heat sink cooling conditions.



6. Connection

The mains connection must be carried out using the protective cable (3-wire connection: L, N, PE).

Since the power supply units have screw terminals connected to the mains accessible, all manipulations with connections can be performed by the trained service personnel only.

All power supply units are available in two different power connection variants (mains and output): with screw terminals and plug connectors. The control and indication connectors are always of the same type.

TERMINALS APPLIED (PHOENIX CONTACT)

OUTPUT TYPE	BASIC VERSION	OPTIONAL VERSION
Mains power	Screw terminals DMKDS 2.5 max. 2.5mm ²	Plug PC 4/3-ST-7.62 max. 4.0mm ² , 20A
Power supply output	Screw terminals DMKDS 2.5 max. 2.5mm ² max. 26A	Plug PC 4/2-ST-7.62 max. 4.0mm ² , 20A
Control and indication outputs	Plugs MSTB 2.5/x-ST-5.08 max. 2.5mm ²	

x – digit specifying the number of connectors.

6.1. Servicing information

The power supplies include the fuses which are not accessible to a User. Their blowing up usually indicates a serious internal fault. The fuses can be replaced only by the qualified service personnel.

Note.

The fuses are present in both power lines, also in neutral cable.

FUSES INSIDE POWER SUPPLIES

FUSE DESIGNATION	RATING	TYPE
B100, B101	F 5A	fast-acting glasstube 5x20mm

7. TYPES

The power supplies are manufactured in two variants: as a single-output power supply, without additional functions and as a power supply designed for parallel cooperation with the possibility of external control .

Product marking description

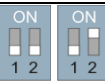
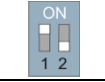
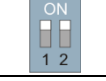
E.g.: **ZM220V2.5A-600R-100**

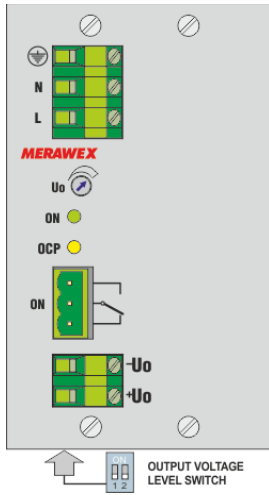
ZM product group designation
220V nominal output voltage
2.5A nominal output current: value associated with the design and output voltage
-600 variant designation
R designation of additional features:
 - no letter means the basic version of power supply;
 - **R** means a power supply intended for parallel cooperation
-100 designation of specific code of the installation and assembly version:
 - first item: **0** – screw terminals; **1** - sockets
 - second item: **0** – standard version, **E** – for mounting in the EURO cassette
 - third item: **0** – standard version, **1, 2, 3** etc. – subsequent custom-made versions
The subsequent zeroes on the right side can be omitted.

7.1. Single-output power supplies

The power supplies allow users to set the output voltage by using the DIP switch accessible from the bottom of the housing and the U_0 potentiometer available on the front panel. The potentiometer's adjustment range is $\pm 5\%$ of the value set by using the DIP switch.

OUTPUT VOLTAGE SETTINGS

SWITCH POSITION	OUTPUT VOLTAGE		DESCRIPTION
	110V	220V	<i>nominal voltage</i>
	126.5V	253V	<i>floating voltage of VLRA battery bank</i>
	132V	264V	<i>charging voltage of lead battery bank</i>



All power supplies feature the output characteristics of UPI type (voltage stabilisation, power limiting and current stabilisation) with additional limitation of the short-circuit current to about 2/3 of the nominal current value. The actual levels of power and current limits are slightly higher than their nominal values. The characteristics of power limitation are automatically adjusted downwards when the temperature inside the power supply unit rises above 75°C.

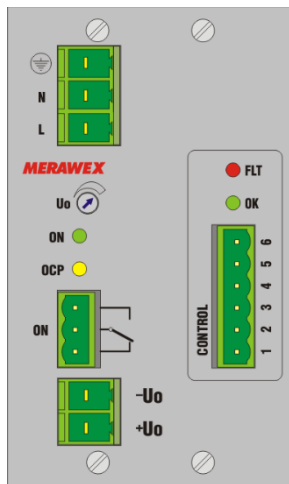
The power supplies are also equipped with overvoltage protection, which in the event of exceeding the permissible voltage level at the output of the power supply, turns it off. It is possible to restart the power supply after disconnecting the mains for ~ 1min.

Signalization:

- green LED **ON** is on when the mains voltage is on and when the converter is operating;
- yellow LED **OCP** is on when the power supply unit has been overloaded (the power or current limitation circuit is active);
- relay **ON** is energised when the mains voltage is supplied and the converter is functional. The drawing of the contacts next to the relay socket shows their layout in the de-energised state, i.e. when the power supply is off.

7.2. Power supply for parallel operation

All basic functions of the power supply resulting from the power unit used are identical to those of the single-output power supply.



The power supply in this version is equipped with an additional **CONTROL** connector and a special system enabling connection of several power supplies for parallel operation with even current sharing. The system also allows you to control the level of the output voltage from the outside, e.g. by a microprocessor controller or a potentiometer. Voltage control may apply to both several power supplies connected for parallel operation and for a single power supply of this type.

The connector additionally provides a stabilized output of **+5V** with a capacity of 10mA that can be used, e.g. to power the voltage regulation potentiometer or other control system. When connecting several power supplies for parallel cooperation and the simultaneous voltage regulation, it is advisable to connect the **+5V** output in parallel, outside of the **Ureg** line, which guarantees the presence of this voltage in the event of a possible failure of one of the power supplies.

DESCRIPTION OF CONTROL CONNECTOR

NUMBER	SYMBOL	FUNCTION
1	RFLT	state of the POWER BOARD *)
2		not connected
3	SB	parallel operation bus
4	EP	+5V/10mA output
5	Ureg	Uo voltage control
6	M	Ground

All pins of the connector are resistant to short circuit.

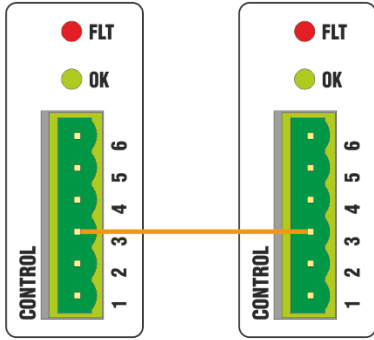
The SB bus can be used only to interconnect the power supplies. Do not connect it with any other external circuits and elements.

The current drawn by the potentiometer from the EP line cannot exceed the value indicated in the table.

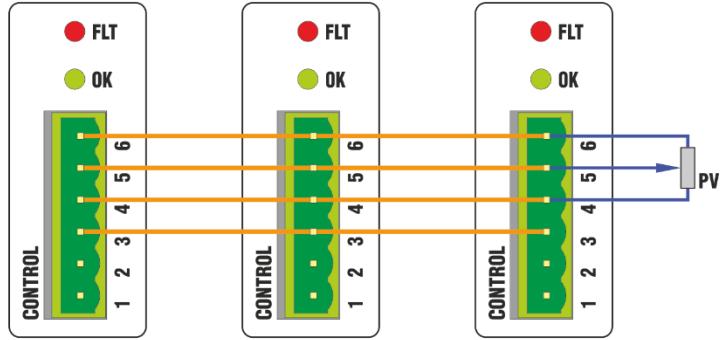
*) Open collector type output with 150Ω resistor.

Examples of using the **CONTROL** connector.

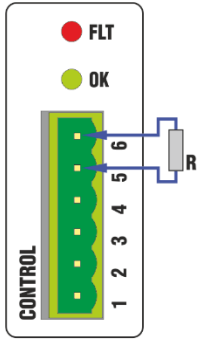
Connection for a parallel work with current sharing



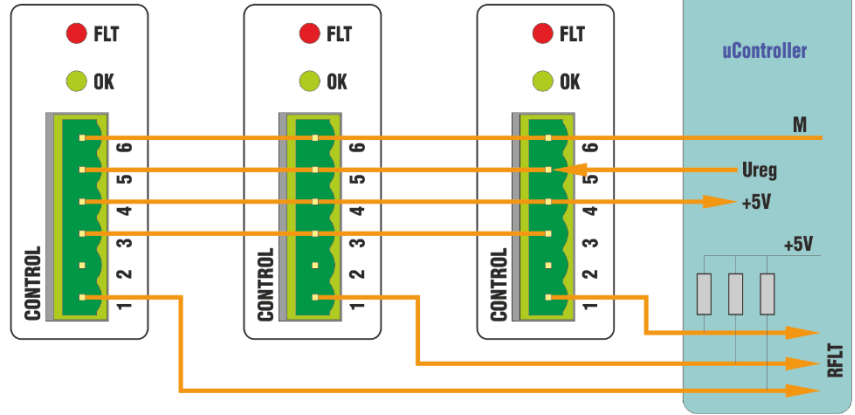
Connection for a parallel work with current sharing and output voltage regulation



Increasing output voltage



Connection for a parallel work with the cooperation with uC



The proper operation of the parallel power supply system, apart from connecting the **SB** line, requires the interconnection of all **U_o** power supplies' outputs in the way appropriate for the load current. It is preferable to use the star topology, so that all lengths of the output wires of individual power supplies are equal which will ensure similar voltage drops and does not deteriorate the accuracy of the current share. In a correctly assembled system, this share is maintained with accuracy of 5% compared to the nominal current of a single power supply unit. In a parallel power supply system one of the power supply unit automatically assumes the master role (controller).

An essential prerequisite for even current sharing is to set identical output voltages of all power supply units by both the output voltage level switch and the potentiometer on the front panel (see **Single-output models**).

The indication of the normal operation **OK** is activated on all slave (controlled) units and deactivated on the master unit. During the continuous operation or at load change the state of the indication may change. The role of the master unit can be taken over by another unit. This is done automatically, also in the case of switching off or failure of any other unit. It is possible to interconnect up to 15 units for parallel operation.

Operating status of the control system is indicated by two LEDs **OK** and **FLT**.

TABLE OF OPERATING STATUS INDICATION OF THE CONTROL SYSTEM

DESCRIPTION OF LED INDICATOR	COLOUR	INDICATION METHOD	EVENT
OK	green	off	no external control and no connection of the SB bus
		on	external control has been activated or the SB bus has been connected
		1/1s	correct current sharing during parallel operation
			current sharing fault during parallel operation
FLT	red	off	normal operation
		on	+5V auxiliary voltage EP output overloaded
			failure of the power supply unit (at presence of voltage from another source on the output)
		1/1s	power supply unit overheated
		blinking every 0.4s	externally forced indication

The numerical values shown above refer to the time of the on and off phase of blinking light indication, expressed in seconds.

In order to use the **RFLT** line indicating the operating mode of the **POWER BOARD**, it must be connected through an external resistor to the voltage of 5V and detection of its logical state.

This line can be also used to trigger the **FLT** LED indication or to disable the control circuit of the selected power supply unit. The latter function may be useful in battery systems which require minimization of the current consumption during the absence of the mains. The indication triggering is carried out by short-circuiting of the **RFLT** line with the ground potential **M** for 50...200ms. After detecting this signal, the **FLT** LED lights on for 0.4 s. If such triggering is repeated 3 times within 2s, the control circuit will be disconnected completely. In order to maintain this disconnection, the voltage must be present on the PSU's output, e.g. supplied from the connected battery bank.

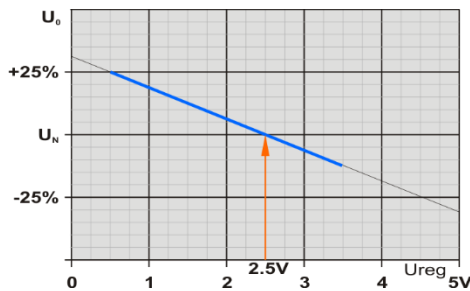
TABLE SUMMARIZING RFLT STATES

STATE	DESCRIPTION
H	mains fault
L	power supply unit fault, mains present
$n(H)_{min.}=0.1$	power supply unit temperature below 30°C
$n(H)_{min.} < n(H) < n(H)_{max.}$	power supply unit temperature between 30°C and 95°C
$n(H)_{max.}=0.9$	power supply unit temperature exceeds 95°C

H: high state (high impedance); L: low state; n(H): duty cycle of square wave.

Remote control of **U_o** output voltage is carried out with the **U_{reg}** line. It is possible to apply external control voltage in the range of 0..5V (bidirectional regulation) or to load this line with a resistor which allows only to increase the output voltage. Although the system in a given control voltage range allows for adjustment within a relatively wide range, the minimum and maximum values listed below should not be exceeded.

PERMISSIBLE RANGES OF OUTPUT VOLTAGES



NOMINAL VOLTAGE	PERMISSIBLE OUTPUT VOLTAGE	
	MINIMUM	MAXIMUM
110 V	97V	138 V
220 V	195 V	275 V

Please note that the use of voltage adjustment input within the full range requires setting the output voltage selector switch (see: **single-output power supply**) to the nominal value. Any other setting may lead to the incorrect operation of the **POWER BOARD** or activation of its overvoltage protection.

8. Cooperation with batteries

Simple single-output power supplies can be used to charge battery packs after setting the appropriate output voltage. The method of setting the voltage is given in Point 7.1. Below, in the table, there are voltage values corresponding to the most commonly used battery sets.

	Battery nominal voltage	Maintenance-free batteries *1)	Standard acid batteries *2)
No. of cells 2V			
55	110 V	126.5 V	132 V
110	220 V	253 V	264 V
N. of batteries 12V			
9	108 V	124.2 V	129.6 V
18	216 V	248.4 V	259.2 V

*1) Floating mode voltage of VRLA batteries at temperature of 25°C 2.3V/cell

*2) Charging voltage 2.4V/cell

The charging current is equal to the current limit of the power supply, which has been described in the Point 7.1. It is possible to use several power supplies connected in parallel to increase the charging current (see the Point 7.2).

Both in the case of a single power supply and several ones connected to each other for parallel operation, it is possible to use a special temperature probe ZM-TEM2, which, connected to the CONTROL socket, makes the output voltage dependent on the temperature in the ratio of -3.85mV/°C /cell. This value is valid in the range of approximately +5 up to + 35°C. Outside this range, the voltage remains constant.



For a set of power supplies cooperating in parallel, a single temperature probe is sufficient, but you should remember to make additional connection between the power supplies (**SB** bus).

The correct installation of the temperature probe consists in placing its plastic housing between the adjacent walls of the battery, in the center of the battery set; where you can expect the highest temperature.