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USER MANUAL

CAMELEON - Universal modular power supplies with output voltage up to 60V

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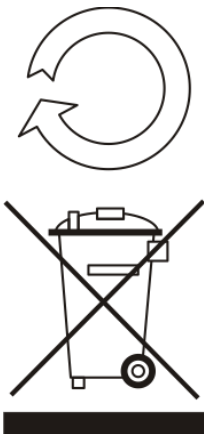
1. SAFETY PRECAUTIONS

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.

- Installation of the device must be done in accordance with the detailed information provided in the sections 5 and 6.
- 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 open the device during operation. All DC and AC cables must be disconnected from the device before opening the housing.
- 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.
- The device may not be used for purposes other than those described in the section 2.

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.



Worn out 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 AND INTENDED USE

CAMELEON universal modular power supplies are a family of products of uniform construction, covering the power range from 125 to 600W. They are intended for use in telecommunications and industrial applications including use with battery banks in uninterrupted power supply systems. Depending on the type, they can be used in fire detection and protection systems that meet the requirements of EN 54-4+A2 and EN 12101-10 (Environmental class 1).

The basic parameters of single-output power supplies are given below. On this basis, other types of power supplies are produced, using the standard power boards, including some additional functions (parallel operation, battery charging, etc.)

3. ELECTRICAL PARAMETERS

	Variant				
	151	200	300	400	600
AC-powered					
Input voltage range	184... 230 ...253V 47...53Hz				
Power factor at nominal conditions	Min 0.66	Min 0.99		Min 0.97	
Protective earth leakage current	~1mA				
Efficiency under nominal conditions					
Version 12V	>78%	> 79%		> 80%	
Version 24V	>83%	>82%		>86%	
Version 48V	>85%	>85%		>87%	
DC-powered					
Input voltage range	187.. 220 ..297V	165... 220 ...297V			
Efficiency under nominal conditions					
Version 12V	>78%	>80%		>78%	
Version 24V	>83%	>82%		>83%	
Version 48V	>85%	>85%		>86%	
Output parameters					
Maximum output current					
Version 12V	10A	12A	16A	24A*)	32A*)
Version 24V	6A	8A	12A	16A	24A*)
Version 48V	3A	4A	6A	8A	12A
Maximum output power					
Version 12V	125W	150W	200W	300W	400W
Version 24V	150W	200W	300W	400W	600W
Nominal voltage 48V	150W	200W	300W	400W	600W
Overvoltage protection					
Version 12V	16.5...18.5V				
Version 24V	33...39V				
Version 48V	67...72V				
Line regulation	<100mV	< 20mV			
Load regulation	<0.4V	<0.3V		<0.4V	
Ripple voltage (RMS)	<20mV	<15mV		<10mV	
Ripple voltage (peak-to-peak)	<150mV				
Outputs of relay (remote) indication					
Relay outputs current-carrying capacity	15V/1A, 30V/1A, 60V/0.5A at resistive load				

*) Instantaneous load. The maximum continuous load can be limited due to the connector type applied (see: section 6. Connection).

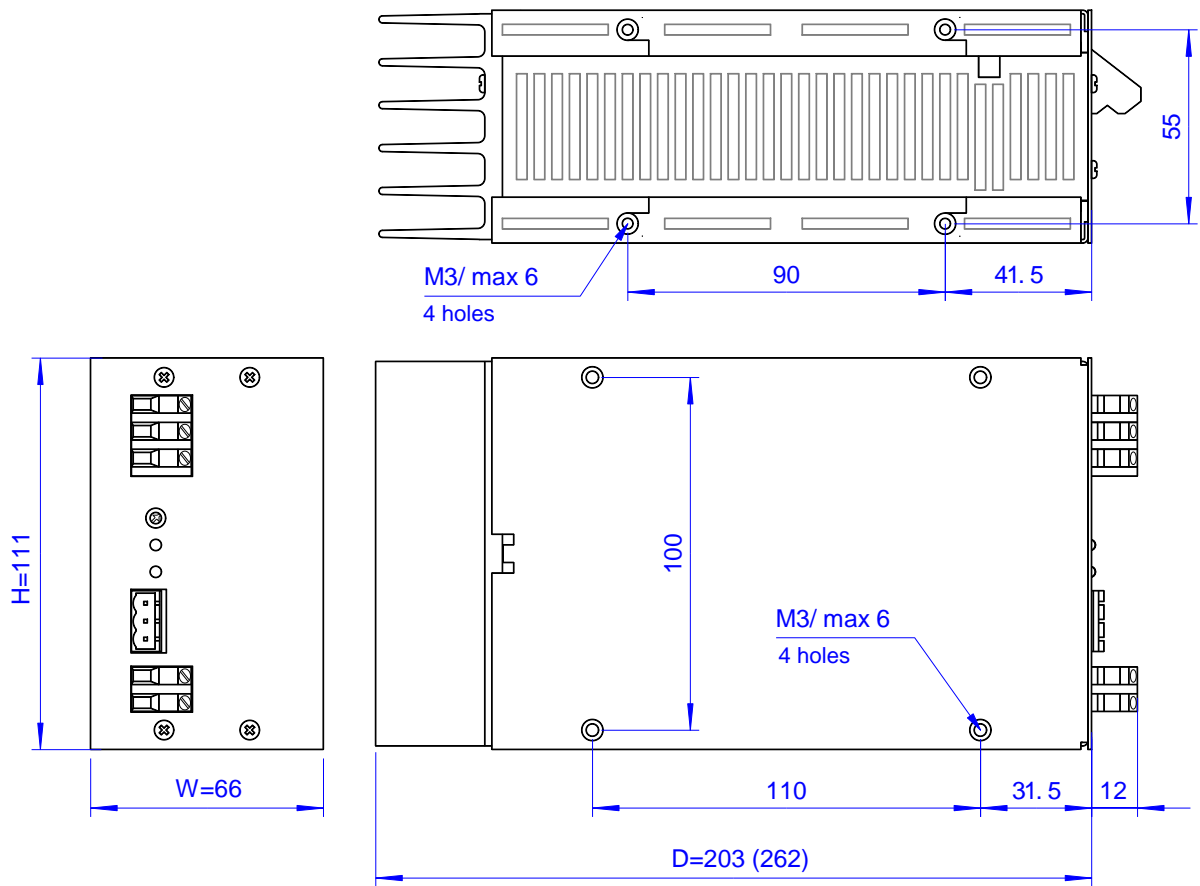
Note: In case of the DC supply, the polarity of its connection is irrelevant

4. OPERATING CONDITIONS

Recommended storage temperature	+5°C ÷ +40°C
Ambient temperature during operation *)	-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

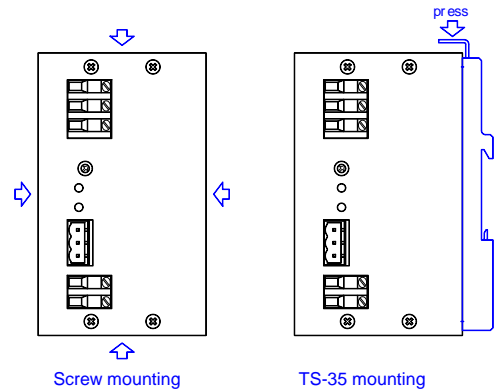


MECHANICAL PROPERTIES DEPENDING ON A VERSION

VARIANT	DIMENSIONS: W×H×D	PROTECTION DEGREE
200, 300 151	66 × 111 × 203 mm	IP 20
400, 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 with two different power connection variants (mains, output, external battery bank): with screw terminals and plug connectors. Control and indication connectors are always of the same type.

TERMINALS APPLIED (PHOENIX CONTACT)

OUTPUT TYPE	BASIC VERSION	OPTIONAL VERSION
Mains supply	Screw terminals: DMKDS 2.5 Max 2.5mm ² 	Plug PC 4/3-ST-7.62 Max 4.0mm ² , 20A 
Power supply unit output and battery connection	Screw terminals: DMKDS 2.5 Max 2.5mm ² Max 26A 	Plug PC 5/2-STCL-7.62 Max 6.0mm ² , 41A 
Control and indication outputs	Connectors MSTB 2.5/x-ST-5.08 Max 2.5mm ² 	
Digital communication output	Connector MC 1.5/3-ST-3.81 Max 1.5mm ² 	

7. TYPES OF POWER SUPPLIES

Based on the single-output power supplies, by adding a specialised modules, other types of power supplies with various additional features are produced. This is summarised in the table below.

ADDITIONAL FEATURES

DESIGNATION	DESCRIPTION	NOTES
No Designation	Single-output	<i>No additional features.</i>
A	with battery cooperation capability - supports the external LED indication, power failure and battery failure relay outputs	
AZ	with battery cooperation capability for use in fire detection and protection systems - measurement of battery resistance, supports the external LED indication, power and battery failure relay outputs	<i>Approved for use in fire detection and protection systems (compliant with EN 54-4/A2) that requires the implementation of optical indication.</i>
PZ	with battery cooperation capability for use in fire detection and protection systems - resistance measurement, input of external signal of failure, power failure and collective failure relay outputs	<i>Approved for use in fire detection and protection systems (compliant with EN 54-4/A2) that require general fault relay output.</i>
B	with battery cooperation capability - with power failure relay output, but without battery supervision module	
C	equipped with digital communication output	<i>RS-485 (as standard), RS-232 or binary OC output (open collector).</i>
R	for parallel operation with remote control capability	<i>When connected up to 15 units</i>
S	specialised version (available on request)	<i>Subsequent versions: S1, S2, etc.</i>

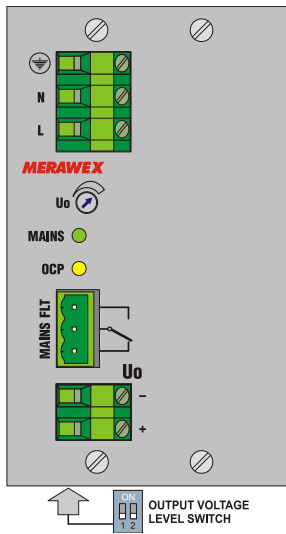
Product marking description

e.g.: **ZM48V6A-300B-100**

- ZM** product group designation
48V nominal output voltage
6A nominal output current: value associated with the design and output voltage
-300 variant designation
B designation of additional features
-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, apart from the units with the battery cooperation capability, 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 CONFIGURATION	OUTPUT VOLTAGE			DESCRIPTION
	12V	24V	48V	<i>Nominal voltage</i>
	13.5V	27.0V	54.0V	<i>Floating voltage of VLRA battery bank</i>
	14.4V	28.8V	57.6V	<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.

Indication:

- green LED **ON** is on when the mains voltage is supplied and the converter is functional;
- yellow LED **OCP** is on when the power supply unit is 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. for the power supply unit which is off.

7.2. POWER SUPPLIES WITH BATTERY COOPERATION CAPABILITY

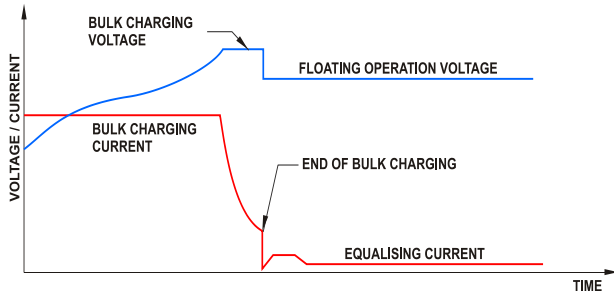
The power supplies with battery cooperation capability are equipped with an additional output for connecting an external battery, the temperature probe input and the internal relay disconnecting the battery after its discharge. The supervision of the battery is carried out by a microprocessor.

In this version, the user cannot adjust the output voltage on his/her own as in case of the single-output power supply – the switch accessible from the bottom of the housing is not active. However, it is possible to select a precise value of voltage suitable for the connected battery bank by using the U_0 potentiometer located on the front panel. The potentiometer is calibrated for the voltage of a single battery cell (V/cell) in the floating mode at the temperature of 25°C. The scale includes 5 positions in the range from 2.2 to 2.4 V/cell with the resolution of 50mV/cell. Despite smooth rotation of the potentiometer, the selection is limited to these 5 positions only (the potentiometer acts as a switch). The recommended setting for the VRLA batteries is 2.25V/cell.

If the power supply unit comes with a temperature probe (the **TEMP PROBE** socket), the voltage specific for the temperature of 25°C is automatically adjusted with a factor of $-4\text{mV}/^\circ\text{C}/\text{cell}$. The adjustment takes place only in the temperature range for which fixed threshold values will not be exceeded: minimum 2.2V/cell and maximum 2.4V/cell. The bulk charging is interrupted when the temperature exceeds 40°C.

The power supply switches into the bulk charging mode that runs automatically when, after restoring the mains supply, the charging current exceeds 50% of the maximum charging current. The bulk charging voltage is 2.36V/cell at temperature of 25°C and similarly to the floating mode voltage depends on the temperature.

The picture below shows the bulk charging process.



In the initial period the power supply maintains current of a fixed value and the voltage of the battery being charged is rising until it reaches the desired bulk charging voltage. From this moment the current starts to fall until it reaches a fixed minimum level of the end of the charging process. Then the output voltage of the power supply unit is switched to a value corresponding to the floating mode. After an instantaneous current decay, for some types of batteries, it may return for a certain time.

In the battery mode (power failure) the voltage of the battery being discharged decreases. When it reaches the level of 1.85V/cell it activates the battery discharge warning and at the voltage of 1.75V/cell, the relay disconnects the battery to protect it from damage due to deep discharge.

The battery can be connected to the power supply unit either when it is disconnected from the mains and also when it is already in use. The battery will be connected by the relay of the power supply unit only when the voltage of the connected battery will be higher than the specific minimum voltage level set (see table below).

The power supply unit can also operate without a battery connected. In this case it will maintain the set voltage at its output terminals, but the battery terminals will remain disconnected.

Thus, the actual level of the output voltage depends on the present battery state. This is depicted in the table below. The table also includes the maximum values of the quiescent current consumed by the power supply during the battery mode. This current decreases below 1mA after automatic battery disconnection.

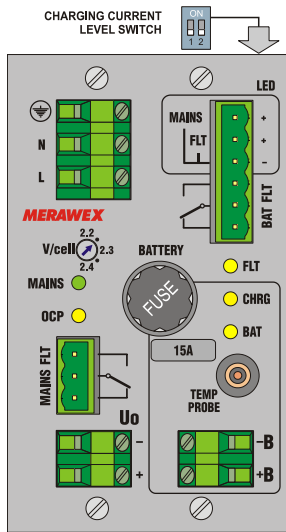
BATTERY AND OUTPUT VOLTAGES OF POWER SUPPLY IN VARIOUS OPERATION STATES.

NOMINAL OUTPUT VOLTAGE	MIN. BATTERY VOLTAGE	FLOATING MODE OPERATION	QUIESCENT CURRENT MAX.	DISCHARGE INDICATION	LVD
		BULK CHARGING MIN. ... MAX.			
12 V	10.8V	13.2...14.4V	100mA	< 11.1V	< 10.5V
24 V	21.6V	26.4...28.8V	35mA	< 22.2V	< 21.0V
48 V	43.2V	52.8...57.6V	25mA	< 44.4V	< 42.0V

The battery circuits are protected with fuses which are accessible for users on the front panel. The fast fuses (F) of the dimensions of 6.3x32mm are used for the purpose. The table includes a list of fuse values in all types of the power supplies.

FUSES IN BATTERY CIRCUITS

NOMINAL VOLTAGE OF THE POWER SUPPLY	VERSION				
	151	200	300	400	600
12V	12.5A	16A	20A	32A	32A
24V	8A	10A	16A	20A	32A
48V	4A	5A	8A	10A	16A



The user has the possibility to choose on his/her own the maximum charging current of the connected battery bank among 4 values by using the switch accessible on the top of the housing. The current value set is valid regardless of the charging mode in which the power supply unit is operating.

CHARGING CURRENT SELECTION

SWITCH POSITION				
CHARGING CURRENT *)	25 %	50 %	75 %	100 %

*) The charging current as a part of the nominal current of the power supply.

Power supplies with battery cooperation capability are produced in 4 versions distinguished by accessories, the indication method and some of the functions associated with an intended use of the product.

LIST OF POWER SUPPLY MODELS INTENDED FOR USE WITH BATTERY BANKS.

<p>Power supply basic version</p>	<p>Power supply with battery cooperation capability with battery supervision function and additional LED indication</p>	<p>Power supply for fire detection and protection systems compliant with EN 54-4/A2</p>	<p>Power supply for fire detection and protection systems compliant with EN 54-4/A2</p>
<p>- with battery cooperation capability but without battery supervision function</p> <p>Symbol: B</p> <p>Example: ZM24V24A-600B</p>	<p>- no battery circuit resistance measurement; - LED indication of general fault (mains and battery) FLT; - external LED indication system repeating a fault indication on the front panel; - separate relay indication of mains fault MAINS FLT and battery fault BAT FLT.</p> <p>Symbol: A</p> <p>Example: ZM24V24A-600A</p>	<p>- battery circuit resistance measurement; - LED indication of general fault (mains and battery) FLT; - external LED indication system repeating a fault indication on the front panel; - separate relay indication of mains fault MAINS FLT and battery fault BAT FLT.</p> <p>Symbol: AZ</p> <p>Example: ZM24V24A-600AZ</p>	<p>- battery circuit resistance measurement; - LED indication of general fault (mains and battery) FLT; - collective relay indication of the mains and battery GEN FLT; - external fault input (on the potential of negative output bus) EXT FLT</p> <p>Symbol: PZ</p> <p>Example: ZM24V24A-600PZ</p>

Battery backup power supply operating mode indication

The below table summarizes the complete list of all the battery cooperation power supplies' indications, including their power boards. Some of the events refer only to the power supplies indicated in the table.

LED INDICATION OF POWER SUPPLY OPERATING MODE

LED DESCRIPTION	LIGHT COLOUR	INDICATION METHOD	EVENT	INDICATION PRIORITY
MAINS	green	on	mains power present, converter in operating state	-
		off	no mains power or converter fault	
OCP	yellow	on	power supply in the power or current limitation mode	-
FLT	yellow	off	no faults	1 (highest priority)
		on	battery mode (no mains or converter fault)	
			low battery voltage	
			no battery	
			no battery circuit continuity	
			battery fuse blown	
			too high battery circuit resistance (in the AZ and PZ versions only)	
no temperature probe or temperature probe faulty				
1/1s	external fault indication (in the PZ versions only)	2		
CHRG	yellow	off	no charging	-
		on	bulk charging in progress	2
		1/1s	floating mode charging	
		0.5/0.5s	rectifier overheated	1
BAT	both colours	off	no faults	-
	yellow	1/1s	battery mode (mains failure or converter fault)	3
		0.5/0.5s	low battery voltage (in the battery mode only) {Ubat<1.85V/cell}	2
		on	no battery (prior to LVD activation only) {Ubat<1.8V/cell}	1
			battery circuit discontinuity (not applies to the B version)	
blue	1/1s	battery fuse blown (in the B version only)		
		1/1s	too high battery circuit resistance (in the AZ and PZ versions only)	4

NOTICE

1. The numerical values shown above refer to the time of the on and off phase of blinking light indication, expressed in seconds.
2. The lack of the temperature probe activates the LED **FLT** indication and the power supply switches into the operation characteristic for the temperature of 25°C.
3. The indication will not be activated if the temperature probe is not connected. The power supply unit operates as at the temperature of 25°C.
4. During the normal operation, the **OCP** LED is off all the time.
5. The external LED indication in the A and AZ power supply versions represents LED indication of the same name, located on the front panel of the power supply.
6. Indication of charging system operating mode is active only if the power supply has recognised the battery bank connected. The rectifier overheat indication is enabled all the time.
7. Battery circuit resistance measurement is required by EN 54-4+A2. The maximum resistance of several tens to hundreds of milliohms varies for different power supplies and depends on their nominal output voltage and power.

RELAY INDICATION OF OPERATING MODE

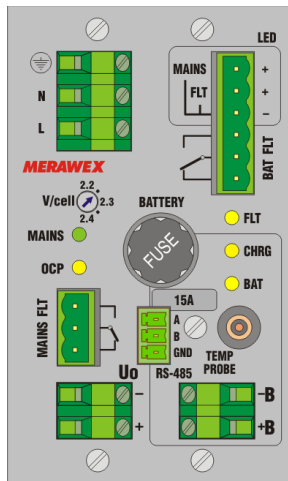
RELAY DESCRIPTION	EVENT	POWER SUPPLY VERSION
MAINS FLT	- mains power failure - converter fault	A, AZ, B, PZ
BAT FLT	- battery control system fault (the indications of the battery operation mode and the lack of the temperature probe are not included)	A, AZ
GEN FLT	- battery control system fault - mains power failure - converter fault - external fault input open	PZ

The events are indicated via relay disabling (voltage-free state). The present states of contacts in this case are shown on the diagram located next to the given relay connection. The relays are fitted with 3 contact pins which provide both normally open (NO) and normally closed (NC) configuration by changing a location of the 2-contact plug. This is depicted in the table below.

INDICATION RELAY CONTACTS' STATES

CONNECTION VIEW	RELAY STATE		CONTACT CONFIGURATIONS	
	ON	OFF	NO	NC

7.3. POWER SUPPLIES WITH BATTERY COOPERATION CAPABILITY WITH DIGITAL COMMUNICATION



All the power supplies designed to be used with batteries can be equipped with a data transmission connection. The standard version features an RS-485 interface supporting the ASCII protocol and 9600 bit/s transmission. It is possible to use an RS-232 interface or a binary OC output.

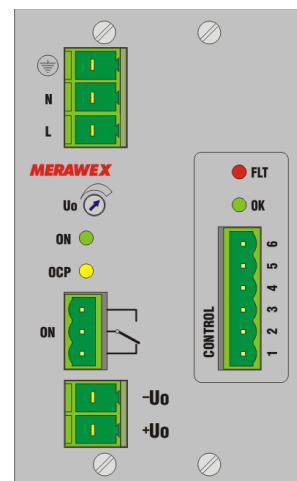
The data transmission output features full galvanic isolation from the other power supply circuits.

The exemplary front panel - marked as AZC with the RS-485 interface – has been shown on the left.

7.4. POWER SUPPLIES FOR PARALLEL OPERATION

All the power supply basic functions resulting from the power board used are the same as the functions of the single output power supply.

This version of the power supply features an additional **CONTROL** connection and a special circuit enabling parallel connection of several PSUs with even current sharing. The circuit also enables for the external control of the output voltage level, e.g. by a microprocessor controller or potentiometer. The voltage control may apply to several PSUs connected in parallel as well as to the single PSU of this type.



The connection also provides the stabilised **+5V** output of current capacity of 10 mA, which may be used e.g. to power the voltage control potentiometer or another control circuit. When several PSUs are connected in parallel with simultaneous voltage control, it is recommended to

also connect the **+5V** output in parallel, apart from the **Ureg** line, which ensures that this voltage will be present in case of a possible fault of any of the PSUs.

DESCRIPTION OF CONTROL CONNECTOR OUTPUTS

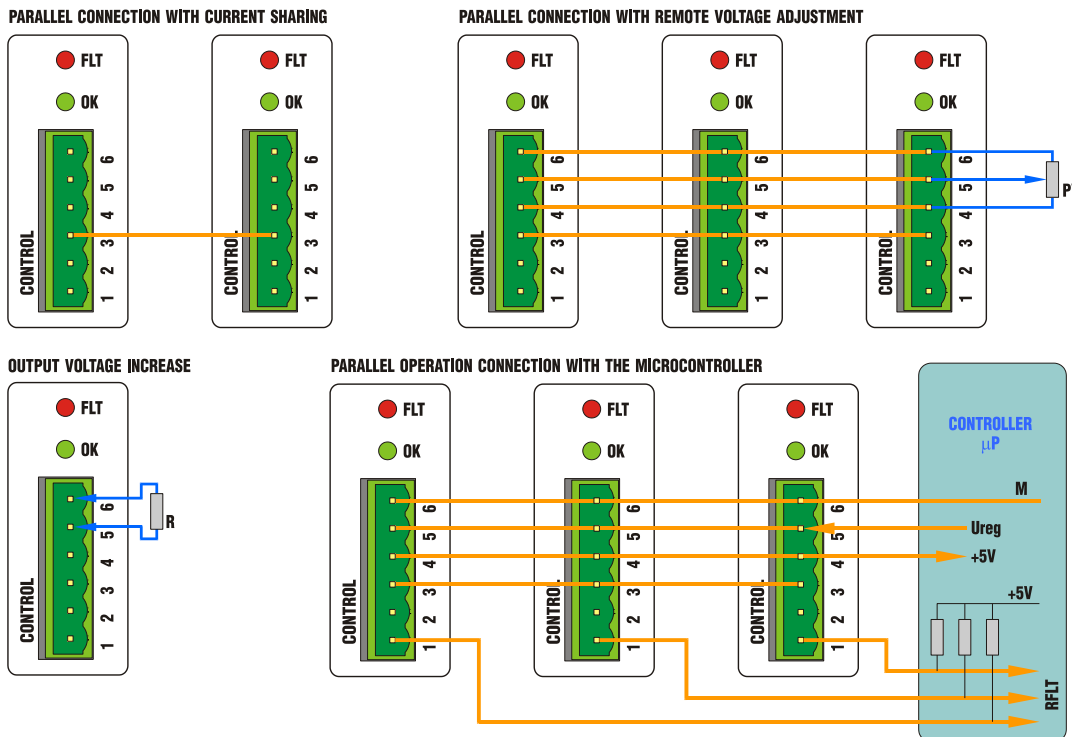
NUMBER	SYMBOL	FUNCTION
1	RFLT	state of the POWER BOARD*)
2		not connected
3	SB	parallel operation bus
4	EP	+5V/10mA output
5	Uctr	U_o voltage control
6	M	Ground

All pins in the connector are resistant to short circuit or voltage applied from the output of the power supply.

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

*) Open collector type output with 150Ω resistor.

Examples of using the **CONTROL** connector.



The proper operation of the parallel power supply system, in addition to 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 on both the output voltage level switch and the potentiometer on the front panel (see **Description of the single-output model**).

The indication of normal operation **OK** is activated on all slave (controlled) units and deactivated on the master unit. During 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 power supply unit. In the case of parallel operation, it is possible to interconnect up to 15 units.

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
			correct current sharing during parallel operation
		1/1s	current sharing fault during parallel operation +5V auxiliary voltage EP output overloaded
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 pull up resistor to a 5V source and its logical state must be detected.

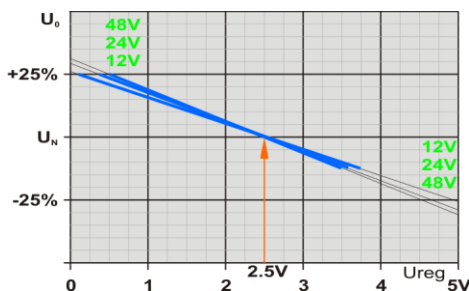
This line may be also used to trigger the **FLT** LED indication or to disable the control circuit of the selected power supply unit. The latter function may be useful in battery systems which require minimization of the current consumption during the absence of the mains. The indication triggering is carried out by short-circuiting of the **RFLT** line with the ground potential **M** for 50...200 ms. After detecting this signal, **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 battery bank connected.

TABLE SUMMARIZING RLFT 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 POWER SUPPLY VOLTAGE	PERMISSIBLE OUTPUT VOLTAGE	
	MINIMUM	MAXIMUM
12 V	10.5 V	15 V
24 V	21 V	30 V
48 V	42 V	60 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.