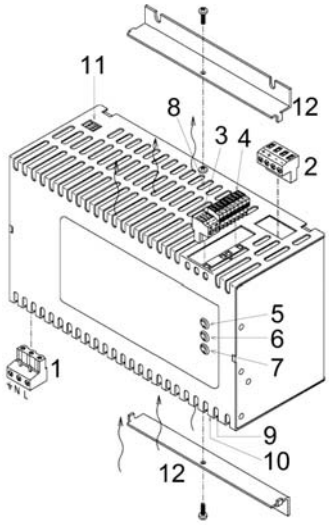
INDUSTRIAL POWER SUPPLIES SFL-SERIES WITH Battery Charger (option UDS)

♦ SFL 12-24-100 UDS ♦ SFL 24-24-100 UDS

Operating Instructions

Dimensions drawings

SFL 12-24-100 UDS



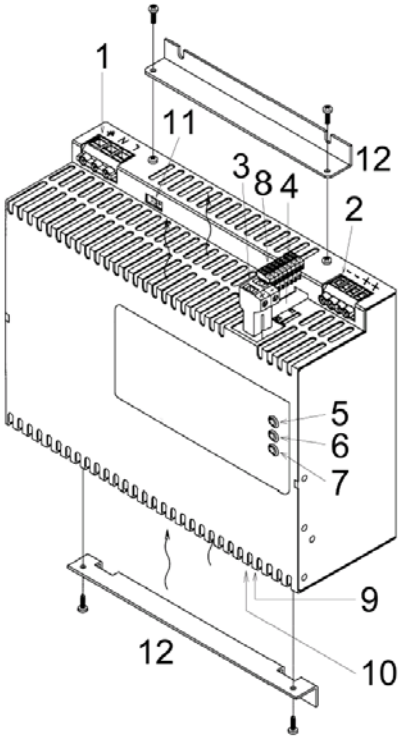
SFL 12-24-100 UDS

Weight: 3.31lb.
Gewicht: 1.50kg
Poids: 1.45kg

Connector 1	1767012	(Mfg. Phoenix)
Connector 2	1757035	(Mfg. Phoenix)
Connector 3	1757019	(Mfg. Phoenix)
Connector 4	1840382	(Mfg. Phoenix)

Drawing	
No.	
1	Input Connector (Con 1)
2	Output Connector (Con 2)
3	Connector for Battery (Con 3)
4	Signal Connector (Con 4)
5	Output OK LED
6	Mains Fail LED
7	Battery Fail LED
8	Output Voltage Adjustment
9	Charging Current Adjustment
10	Charging Voltage Adjustment
11	Input Voltage Selection Switch
12	Chassis Mounting Kit

SFL 24-24-100 UDS



SFL 24-24-100 UDS

Weight: 6.06lb.
Gewicht: 2.75kg
Poids: 2.60kg

Connector 3	1804920	(Mfg. Phoenix)
Connector 4	1840382	(Mfg. Phoenix)

AC Input Connector 1	
Pin	
1	PE Protective Earth
2	Neutral
3	Live

DC Output Connector 2	
Pin	
1	– Output
2	– Output
3	+ Output
4	+ Output

Battery Connector 3	
Pin	
1	– Battery
2	+ Battery

Mechanical Dimensions			
Model Number Artikel Nummer Numéro de commande	**Length Länge Longueur mm [Inch]**	**Height Höhe Hauteur mm [Inch]**	**Depth Tiefe Profondeur mm [Inch]**
SFL12-24-100UDS	207.0 [8.150]	114.6 [4.512]	83.0 [3.268]
SFL24-24-100UDS	243.0 [9.567]	177.2 [6.976]	83.0 [3.268]

Signal Connector 4	
Pin	
1	AC Power OK
2	AC Power Common
3	AC Power Fail
4	Battery OK
5	Battery OK Common
6	Low Battery
7	Battery ON/OFF (System On/OFF)
8	Battery ON/OFF (System On/OFF)

Output Voltage Adjustment: ***Read warnings first!***

Note

These instruction cannot claim all details of possible equipment variations, nor in particular can they provide for every possible example of installation, operation or maintenance. Further information's is obtainable from your local distributor office. Subject to change without prior notice.

Warning

The power supplies are constructed in accordance with the safety requirements of IEC/EN60950, UL1950 and UL508. They fulfil the requirements for CE-compatibility and carries the CE-mark. They are UL and cUL approved.

Hazardous voltages are present in this power supply during normal operating conditions. However, these are inaccessible. Failure to properly maintain the power supply can result in death, severe personal injury or substantial property damage. Only qualified personnel are allowed to work on or around this power supply. The successful and safe operation is dependent on proper storage, handling, installation and operation.

The potentiometer to adjust the output voltage is only allowed to be actuated using an insulated screwdriver; because accidental contact may be made with parts inside the power supply carrying dangerous voltages.

Instructions:

- Check operating instructions.
- Heat sink temperatures of 100°C can be reached.
- Risk of electrical shock and electrical energy discharge. The power supply must not be opened until at least 5 minutes after complete disconnection of the mains.

Caution:

Electrostatically sensitive device. ***Qualified personnel may only open the power supply.***

Description and construction

The SFL power supplies with battery management function module (option UDS) are built-in units. The mounting position has to fulfil the requirements for fireproof case according to UL1950, IEC/EN 60950 or other appropriate national standard. The relevant UL regulations or equivalent local regulations must be observed during installation.

These power supplies are designed for mounting on a DIN rail TS35 (EN 50022-35x15/7.5) and for operation from 115 or 230VAC, 50/60Hz (selectable with input voltage selector switch 115/230VAC) single-phase systems.

The output voltage of the SFL power supplies is potential-free (floating), protected against short circuit and open circuit conditions.

Attention: In case of non-observance or exceeding the mentioned limiting value of the data sheet, the function and electrical safety can be impaired and can destroy the power supply.

Installation:

General assembly and safety instructions of the standard SFL power supply apply. A sufficiently strong DIN-rail has to be provided. As alternative a kit for chassis mounting is available. The correct mounting position for optimal cooling performance must be observed. Above and below the power supply a minimum free space of 80mm [3.15in] is required and on each side of the power supply a minimum space of 50mm [1.97in] is required to allow sufficient air convection. The air temperature measured 10mm [0.39in] below the power supply must not exceed the specified values in the data sheet. Observe power derating above 50°C. (see data sheet)

To fix unit on the DIN-rail, clip top part on DIN-rail; push inwards until you hear a clipping sound. To fix SFL 600 on the DIN-rail, clip top part on DIN-rail, push first downwards and than inwards until the power supply is properly seated.

To remove the unit, grip both sides of the power supply near the bottom and pull outwards. When clip has cleared bottom DIN-rail lift unit off DIN-rail. To remove SFL 600 grip both sides of the power supply near the bottom, pull first downwards and than outwards. When clip has cleared bottom DIN-rail lift unit off DIN-rail.

Only qualified personnel may carry out the installation. The connection of the supply voltage has to be carried out in accordance with the local regulations. A protective device (fuse, MCB) and an easy accessible isolating device for disconnecting the power supply must be provided. All output terminals should be connected to the load.

The battery pack should be ideally being situated underneath or next to the power pack to reduce unnecessary heating up of the batteries. The maximum ambient temperature of the batteries is, depending on the manufacturer, between 40°C and 50°C. In order to minimise additional voltage drops in the power supply lines, the batteries should be situated as close as possible to the power supply and should be wired with maximum cross section (300W unit: 0.2 - 2.5mm^2 rigid or flexible; AWG 24 - AWG 13; 600W units: 0.2 - 4. 0mm^2 rigid or flexible; AWG 24 - AWG 12).

In case of short circuit of charged batteries, massive current flow, which causes welding and damage of the unit and the batteries. Although the UDS unit is also short circuit proof during discharging, a fuse should always secure the batteries externally (short circuit during assembly, etc.). With the UDS battery pack a circuit breaker is already included.

Assembly:

- Wiring of the power supply (load and mains input) ***(check mains-selector-switch!!)***
- Removal of battery fuse or switching off the circuit breaker.
- Wiring of battery with UDS unit ***(check polarity!!)***
- Switching on circuit breaker or inserting fuse.
- To enable the battery-backup, a bridge between pin 7 and pin 8 has to be inserted.

Start Up:

Switching on of the mains supply voltage: Green LED „Output OK“ lights up. If the power pack voltage is in the specified range of tolerance (>93VAC/ >187VAC) the power fail signal is inactive and the LED „Mains fail“ is off. The LED „Battery fail“ turns off after approximately 2 to 3 seconds if the battery is charged and wired up correctly.

It is possible that the battery has been discharged due to storage. Therefore a certain charging time has to be allowed for obtaining the full capacity of the battery. If the UDS unit is fully wired up (mains input voltage = 0VAC) the battery module has a leakage current of typically 40µA (300W) units and 70µA (600W units), which is smaller than the self-discharge of the battery.

If flexible wires are used the wires have to be terminated. (e.g. by using ferrules)

Before installation ensure that the main switch is switched off and prevented from being switched on again and proper position of input voltage selector switch must be observed. In case of non-observance touching at any alive components or improper dealing with this power supply can result in death or severe injury.

Danger: **Never work on the power supply if power is applied!**

Function Description

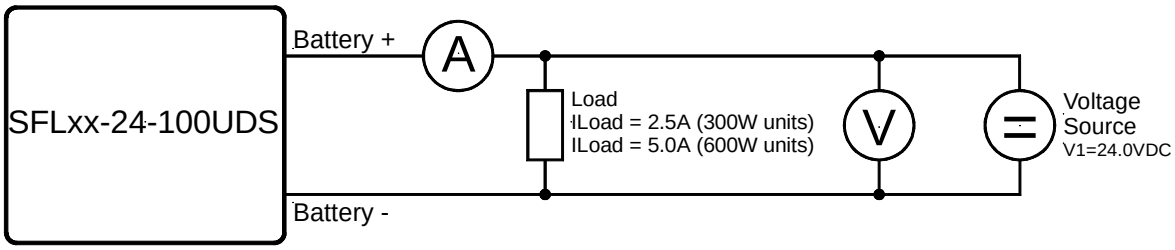
Battery Charging

With the UDS option module, which is built-in the SFL power supply basis unit, a complete battery management system is provided to charge and monitor an external battery. In case of the mains power fails the battery will be switched over automatically and without any interruption to the DC-output. If the mains power is available again the battery will be switched off and charged with an IV-characteristic, which is recommended for close sealed lead batteries. The battery is charged with an adjustable constant current until the battery has reached an adjustable charging voltage. The battery charging voltage will be held at a constant level while the battery charging current decreases to almost 0.0A. Only a minimum charging current flows to maintain the charge. The charging circuit is short circuit proofed. The battery is only charged if the mains power fail signal is inactive, indicating that the input voltage of the power supply is > 93.0VAC (115VAC Input) or > 187.0VAC (230VAC Input). The hold-up time is limited only by battery capacity and load.

Charging Current

The battery charging current is adjusted ex factory at 1.2A (300W units) and 2.4A (600W units). The battery charging current can be adjusted with the potentiometer R15 in the range of 0.15A-1.5A (300W units) and 0.25A-2.5A (600W units). In order to make the adjustment less sensitive to disturbances for smaller charging currents (300W units ➔ < 0.5A; 600W units ➔ < 1.0A) it is recommended to increase the current sense resistance (eliminate from 300W unit ➔ R20 and from 600W unit ➔ R20 & R77).

The following configuration for the adjustment of the charging current is recommended (battery simulation)



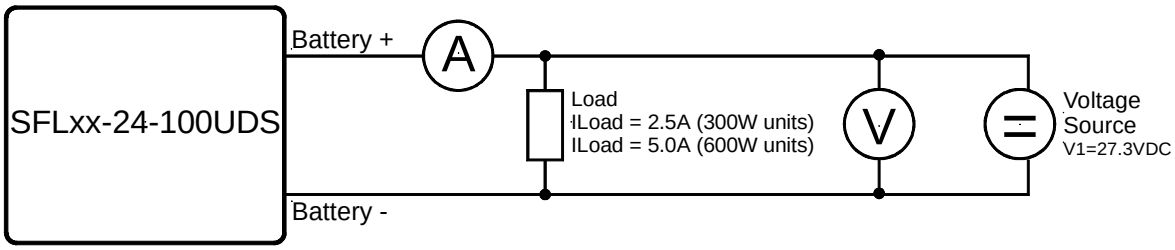
A = Ampmeter
V = Voltmeter

First the charge voltage is measured OFF load. It has to be at least 1V higher than the voltage that is adjusted at the external voltage source (V1 = 24.0VDC). If this is not the case the adjustment has to be made at a lower voltage (i.e. V1 = 22.0VDC). Then the charging current potentiometer R15 is adjusted to the lowest value (turn potentiometer anti-clockwise). Then the voltage source V1 and the load have to be switched ON. Now the battery module delivers the minimum charge current and the source V1 supplies the difference between the load current I_{Load} and the charge current. The charging current can be increased by turning the potentiometer clockwise until the required charging current can be read at the ammeter.

The charging current is adjusted ex-factory at a battery voltage of 24V. Since the charging current changes only a little (±5%) over the range of the battery voltage (18-30VDC), the battery voltage has little influence on the adjustment of the charging current. To ensure operation in the constant current area of the IV-characteristic, the charging current should always be adjusted at a battery voltage of $V_{Batt} < V_{Charge}$ - 1V. The charge current is taken off the main output of the unit. Therefore the main output current has to be reduced by 1.4 times the charging current.

Charging Voltage

In most lead batteries the charge voltage is indicated at 2.25-2.3V per cell. This applies for an ambient temperature of +25°C in stand-by operation. With two in series connected 12V batteries, this results in an average charging voltage of 27.3V (12 cells x 2.275V). The charging voltage can be adjusted with the potentiometer R06 and is set at 27.3V ex factory.



A = Ampmeter
V = Voltmeter

The following configuration for the adjustment of the charging voltage is recommended

The charging voltage potentiometer R06 has to be adjusted to the maximum charging voltage (turn the potentiometer clockwise). Then the power source V1 is adjusted to the required charging voltage (normally 27.3VDC). Turning the potentiometer R06 anti clockwise, the charging voltage decreases linearly. The required charging voltage is attained when the charging current falls below 20mA, i.e. this is the point on the IV-characteristic where the regulation of constant current switches to constant charging voltage.

A quicker and simpler procedure, which is not quite accurate: Measuring and adjusting of the battery voltage at OFF load, i.e. only a voltmeter is connected to the battery terminals Battery+ and Battery-.

If the battery is used for cycle operation, the charging voltage is higher (see data sheet of the relevant battery manufacturers).

The charging voltage is temperature dependent. The battery manufacturers state a temperature range (varies depending on manufacturer), in which the specified capacity of the battery is maintained. If this temperature range is exceeded, the charging voltage has to be temperature compensated. (Option available for greater quantities)

Above a certain temperature (usually +50°C) battery charging is not allowed. If the battery is charged at temperatures below 0°C, extreme delays in charging time have to be anticipated because the chemical process run very slowly.

Battery Test and Battery Warning

The battery is periodically loaded with a current pulse (approximately 5A for 300W units and 7A for 600W units). At the end of each current pulse the battery voltage is measured. If the battery voltage is lower than 22.5V ±5%, the battery-warning signal is activated. During charging the signal stays activated until measured battery is being charged again and passes the 22.5V threshold.

During discharging the battery test is disabled in order to avoid additional discharging. Should the battery voltage fall below the 22.5VDC threshold, the battery-warning signal is activated and stays until the battery is being charged again and passes the 22.5V threshold.

With the battery test the following conditions can be detected.

- The battery is disconnected or wired up through an excessively high resistance.
- The battery fuse is faulty or the circuit breaker is not switched on (on UDS battery pack)
- The battery is just at the beginning of the charging process. Put on a charging current, battery voltage can rise to 24V within milliseconds, even if they have been discharged to 18V. However, the battery collapses when loaded with the current pulse. The battery-warning signal stays on.
- The battery voltage falls below 22.5V threshold during discharging. Buffer time is reduced (see typical discharge curve). Automatic switching off of battery to protect against deep discharge after a short period of time.
- Battery aged, cells with high resistance ➔ buffer time not guaranteed.

The battery-warning signal is indicated by a red LED and is available at a relay contact (60VDC/1A; maximum switching capacity = 30W).

Discharging

Power Fail and Switch-over Mains ⇔ Battery

To generate the power fail signal the battery module measures the input voltage of the power supply. If the input voltage is greater than 93VAC (115VAC Input) or greater than 187.0VAC (230VAC Input) the power fail signal is inactive. It activates if the input voltage falls below a certain minimum value. The minimum value is defined where the power supply has a minimum hold-up time of 5msec. In case of a short mains drop-out, the power fail signal does not activate because the load is supplied by the charged input capacitor (build in the SFL units). This avoids unnecessary discharging of the battery.

The power fail signal is indicated by a red LED and is available at a relay contact (60VDC/1A; maximum switching capacity = 30W).

Switch-over Mains ⇒ Battery

If the power fail signal is activated, the battery is immediately switched to the output without any output voltage interruption. Since the power supply has a certain hold-up time, the output is still supplied by the mains input for the next few milliseconds until the input capacitor have been discharged to a certain voltage (approximately 150VDC). Only now the battery takes over the load.

Switch-over Battery ⇒ Mains

As soon as the power fail signal is deactivated V_{in} > 93VAC (115VAC Input) or V_{in} > 187.0VAC (230VAC Input), the battery is switched off from the output and the power supply takes over the supply of the load without any interruption. If the battery voltage is higher than the adjusted output voltage of the power supply (normally 24VDC) the battery output is discharged to the adjusted output voltage and only then the power supply takes over the load. If the battery output voltage is lower than the adjusted output voltage the power supply takes over the load immediately and regulates it up to the adjusted output voltage.

While discharging the output voltage depends directly on the battery voltage and the load. At full load (300W units: 12A and 600W units: 24A) the battery module will have a typical voltage drop of 1.0V. The voltage drops of the wiring and the internal resistance of the battery have to be added.

The battery module is also short circuit proof in the discharge mode. In case of short circuit, the module switches off. It only can be switched on again when the mains voltage has deactivated the power fail signal in the mean time.

The following situations in discharge mode can cause the battery to switch off permanently, which means that the output is not supplied any longer.

- Under-voltage lockout; V_{Batt} < 18.5VDC to protect from deep discharge.
- Short circuit at the output. This prevents high currents >max load current (300W units: 12A and 600W units: 24A) from overheating the wiring, the battery module and the connected loads (danger of fire).
- Excessive temperature on the semiconductor switch. This can occur in case of excessive load currents (300W units: > 12A and 600W units: > 24A) or excessive ambient temperature (TA > +70°C). Protection against overheating and fire.
- Deactivation of the battery ON/OFF input.

Under-Voltage lockout

The battery reaches the range off deep discharge, if it is going to be discharged below the final discharge voltage. The final discharge voltage (= lowest permitted discharge voltage) is lower at higher load currents.

Today's batteries do not react as sensitively to deep discharge and some manufacturers even allows it under certain conditions. However, deep discharge should be avoided in order to obtain a longer lifetime for the battery. The battery module has an under-voltage lockout, i.e. it switches off immediately if the battery voltage of 18.5V ±0.5V is reached. The voltage of the battery falls off rapidly in this range; further discharging would not gain any buffer time.

Battery ON/OFF

Battery ON

Connecting Pin 7 (minus) and Pin 8 (plus) through a low resistance enables the battery, i.e. the power fail signal is active, and the battery is switched over to the output. The connection can be implemented using a jumper, a relay contact, an optocoupleur or an open collector. The voltage between Pin 7 and Pin 8 has to be <0.7V. The maximum sink current is 5mA.

Battery OFF

If the battery ON/OFF input is open or high resistance (>20kΩ) the battery is disabled, i.e. if power fail is activated the battery will not be switched over to the output and there is no output voltage. If the battery module is in discharging mode, the battery will be switched off immediately. The maximum open collector voltage at the battery ON/OFF input is equal to the output voltage.

There is the option to have the battery ON/OFF input isolated as an optocoupleur input (only for greater quantities).

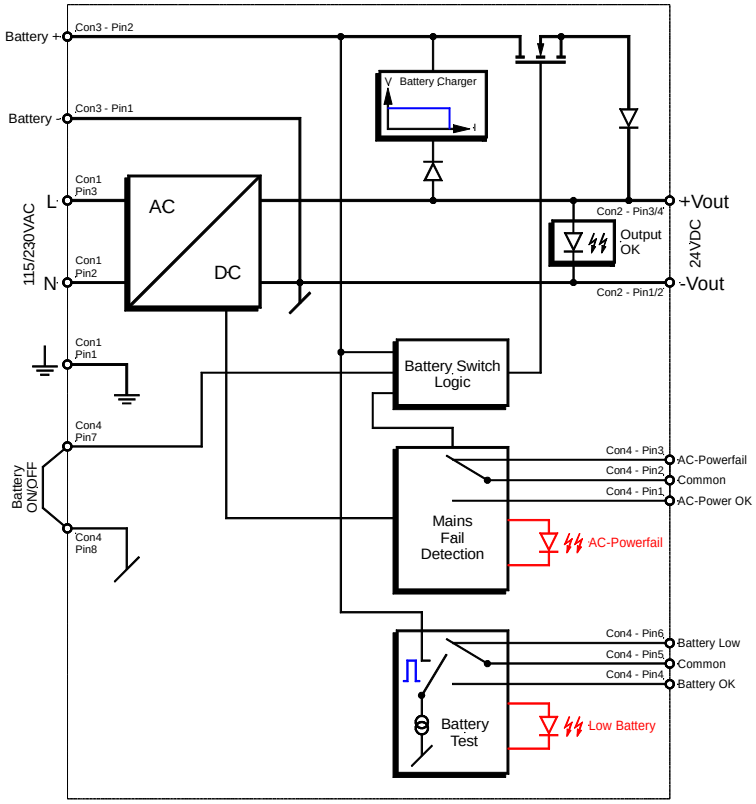
External Battery Pack - SFL7-24BAT (ordered separately)

Sola/Hevi-Duty provides a complete battery pack (capacity 7Ah). This includes two maintenance-free 12V-lead batteries and an in-line overload circuit breaker. The batteries are placed on a supporting frame for wall mounting. Screw terminals are provided for connection. The batteries can be exchanged easily in the field.

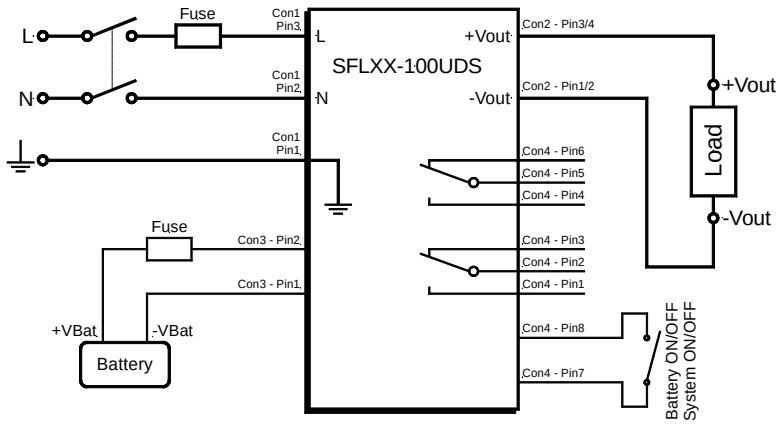
The 25A circuit breaker makes the battery pack short circuit proof. The circuit breaker allows switching off the battery for mounting and maintenance purpose (alternative to the battery ON/OFF signal).

The voltage drops of the battery pack (internal wiring and circuit breaker is 110mV at 12A load and 220mV at 24A load. This voltage drop does not include the internal voltage drop of the battery.

Function Diagram



Wire Connection Diagram



Technical Specifications

Input Specifications

Ordercode Model	Input Voltage Range	Max. Output Power	Output Voltage Factory Set ±50mV	Output current max.	Input current at full load typ.		Inrush current max. at +25°C (<2ms)		Recom-mended Circuit breaker Characteristic C	Efficiency typ. at 230VAC
					115 VAC	230 VAC	115 VAC	230 VAC		
SFL12-24-100UDS	**115/230VAC selectable** by switch	300 Watt	24 VDC	12.0 A	5.4 A	3.3 A	35.0 A	70.0 A	15.0 A	84.0 %
SFL24-24-100UDS	93-132 VAC 187-264 VAC (47-63 Hz)	600 Watt	24 VDC	24.0 A	10.5 A	6.4 A	70.0 A	80.0 A	20.0 A	85.0 %

Output Specifications

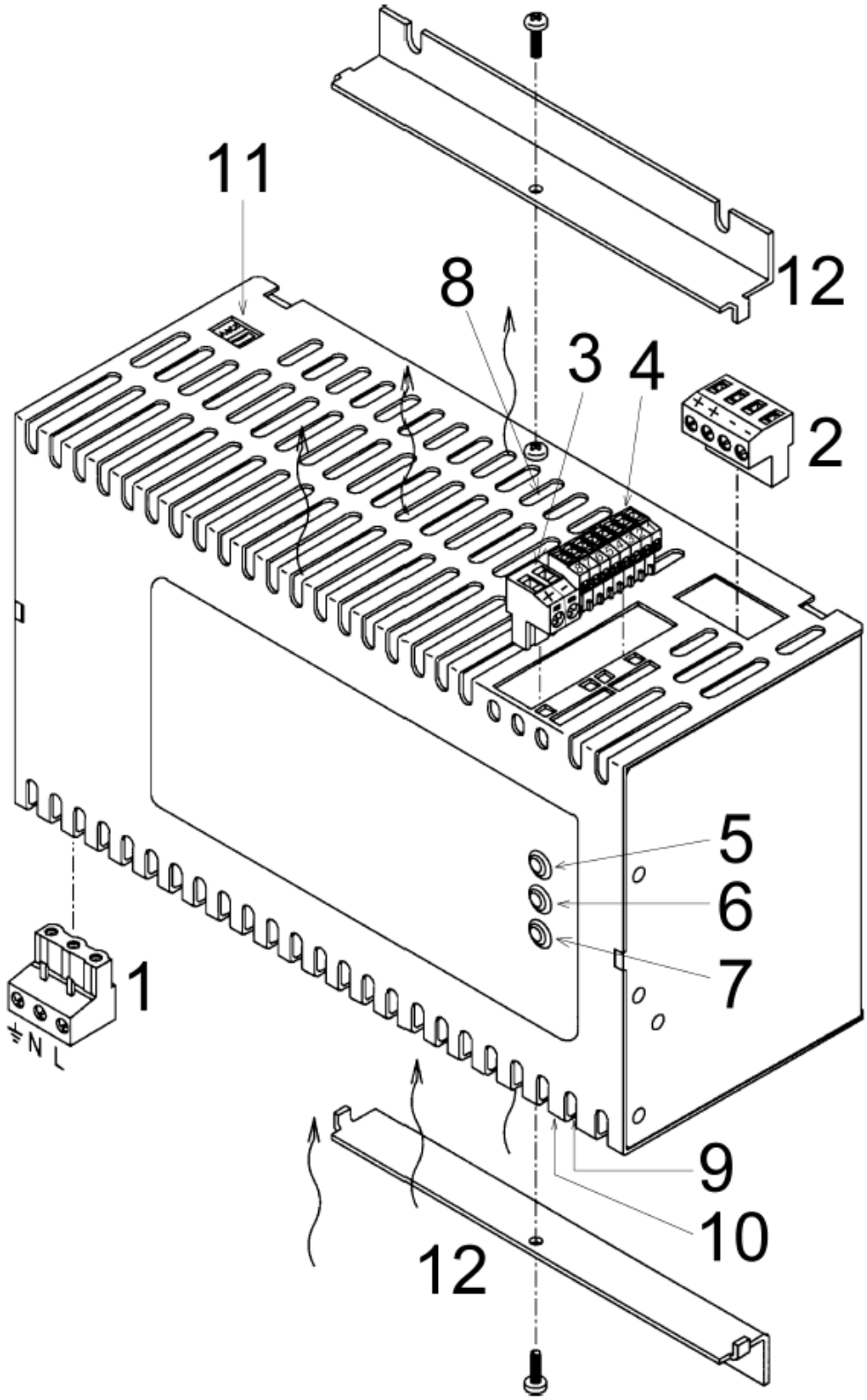
Regulation - Input Variation (Line Regulation) - Load Variation (Load Regulation)	$V_{in\ min}$ - $V_{in\ max}$ 10% - 90% of $I_{out\ max}$ 300W and 600W Models	 ±0.2% max ±1.5% max
Output Voltage ajustable Range with Potentiometer	24 V Model	24 - 28 VDC
Ripple and Noise (20MHz Bandwidth)	at $V_{in\ nom}$ und $I_{out\ max}$	<50mVpp
Electronic Current Limitation, Short Circuit Protection (OCP)	Constant Current Limitation Characteristic	110 % typ. Automatic restart
Parallel Operation		not possible
Overvoltage Protection (OVP)	Triggerpoint at	140% typ. $V_{out\ nom.}$
Hold-up Time		30 ms min.

General Specifications

Operating Temperature Range		-25°C - +70°C
Storage Temperature Range		-25°C - +85°C
Load Derating above 50°C		$2\ ^{\%}/_{°C}$
Humidity (non condensing)		95% rel H max.
Switching Frequency	all Models	80 kHz typ. (PWM)
Safety class (according to IEC 536)		Class 1
Case protection (according to IEC 529)		IP20
Safety Standards according to		IEC / EN 60950, UL / cUL 1950 recognised File No.: E137632 UL 508 recognised File No.: E61379
Conducted EMI on the Input		EN 55022 Class B; EN 55011 Class B; FCC-B
Radiated EMI		EN 55022 Class A
Electromagnetic susceptibility EMC Immunity	Electrostatic discharge (ESD) RF field susceptibility Electrical fast transients / Bursts Surge Immunity to conducted radio frequency disturbances Mains frequency field	IEC / EN 61000-4-2 4kV / 8kV IEC / EN 61000-4-3 10V / m IEC / EN 61000-4-4 2kV IEC / EN 61000-4-5 2kV / 4kV IEC / EN 61000-4-6 10V IEC / EN 61000-4-8 30A / m
Environment	Vibration Shock	IEC 60068-2-6 1gn, 20 sweeps, each axes IEC 60068-2-27 15gn, 11ms, each axes

Connections and terminal assignment

Terminals	Function	Connected load	Remarks
L1 & N	Input Voltage (115/230VAC)	0.5 ... 6.0mm^2	Screw-type terminals
⏚	Protective Earth Conductor	22 ... 10 AWG	Use a screwdriver with blade width of 3.5mm (0.1378in)
+ & -	Output Voltage (24VDC)	use all terminals	Recommended tightening torque 0.5 to 0.7Nm (4.5 to 6.2lb.in.)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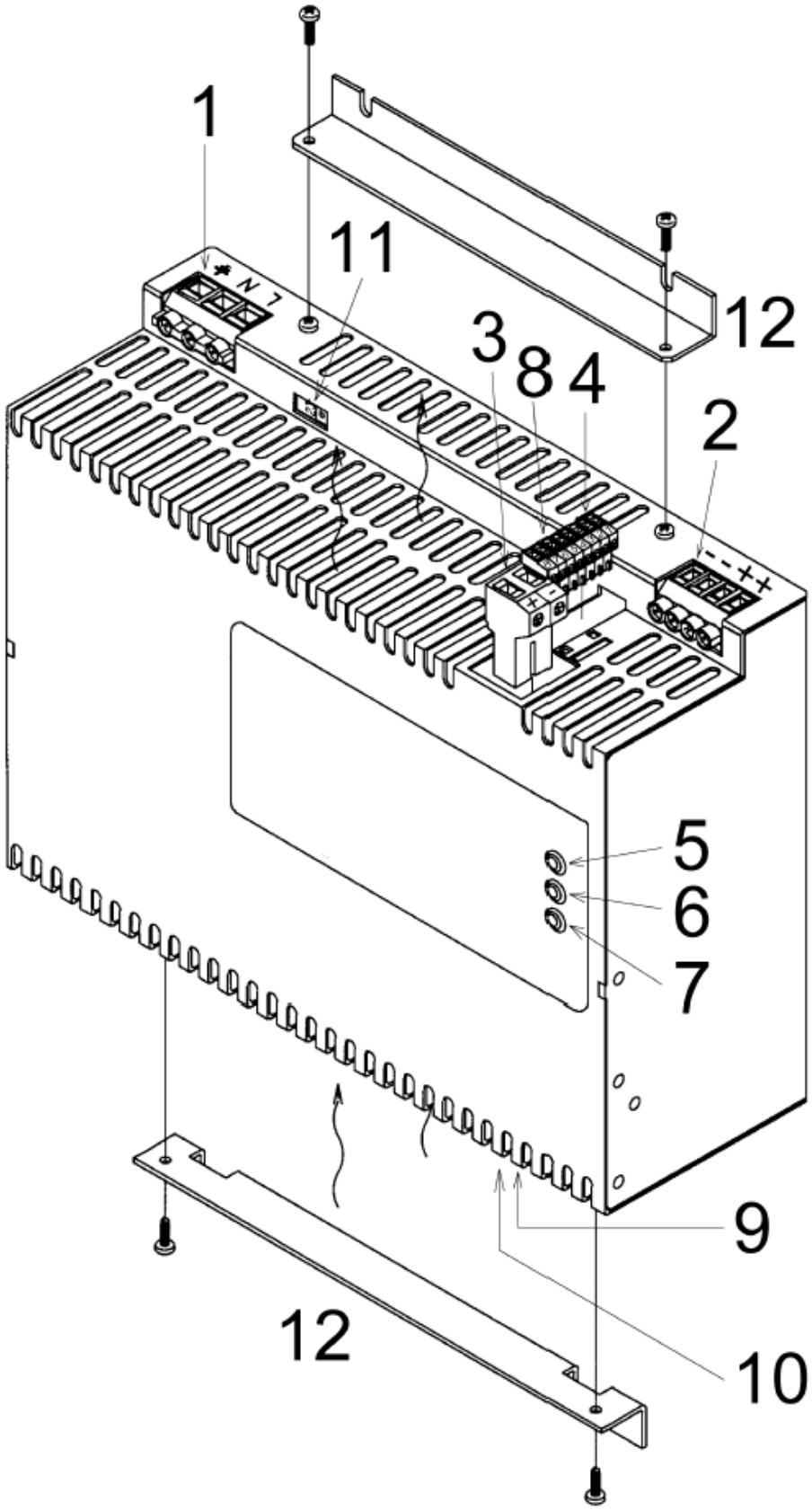
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