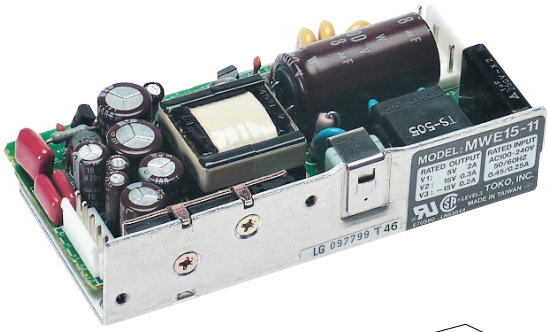
TOKO 15/30 Watt AC-DC Converters MWE Series

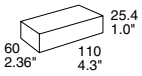
Input voltage range 85...264 V AC
3 outputs 5/±12 V DC and 5/±15 V DC
4300 V DC I/O electric strength test voltage

- Universal AC input
- Flex power topology
- MTBF >144'000 hours
- Convection cooled
- High switching frequency (>100 KHz)
- State-of-the-art wireless transformer design
- Component derating for high reliability
- Noise standard: meets EN55011/55022

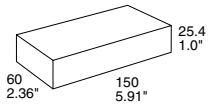
Safety according to IEC/EN 60950, UL 1950, CSA 950

NRTL/C





MWE 15



MWE 30

Summary

The MWEseries strikes the right balance between size and performance right off the drawing board. These ultra compact switchers satisfy the design engineer's demand for less space without sacrificing power and efficiency. Very low profile of one inch is maintained on most models. Choice of 15 and 30 Watt ratings. Universal AC input on all models. The modules are UL 1950 (D3), CSA 950 and LGA (IEC/EN 60950) approved.

Key applications

Equipment for office automation, factory automation, peripheral, communication, security, display, test and measurement, inspection and medical.

Type Survey and Key Data

Table 1: Type survey

Output 1 [1] $U_{o\,nom}$ [V DC]	Output 1 [1] $I_{o\,max}$ [A]	Output 2 [1] $U_{o\,nom}$ [V DC]	Output 2 [1] $I_{o\,max}$ [A]	Output 3 [1] $U_{o\,mom}$ [V DC]	Output 3 [1] $I_{o\,max}$ [A]	Input voltage $U_{i\,min}$…$U_{i\,max}$	Output power T_A = 40 °C $P_{o\,tot}$ [W]	Efficiency [2] η [%]	Type designation
5	3.0	12	0.5	–12	0.5	85…264 V AC 47…63 Hz 110...350 V DC	17.5	65	MWE 15-01
5	5.0	12	1.2	–12	0.5		31	65	MWE 30-01
5	3.0	15	0.5	–15	0.5		17.5	65	MWE 15-11
5	5.0	15	1.2	–15	0.5		31	65	MWE 30-11

[1] The cumulated power of all three outputs may not exceed the total rated power.
[2] Efficiency at $U_{i\,rated}$ and $I_{o\,nom}$.

Table of Contents

Type Key and Product Marking

Type Key MWE 15 - 01

Series ..... MWE
Nominal output power [W] 15/30
Output configuration 01/11

Example: MWE 15-01 = AC-DC converter providing 15 W on 3 outputs of 5 V/3A; 12 V/0.5 A and –12 V/0.5 A.

Functional Description

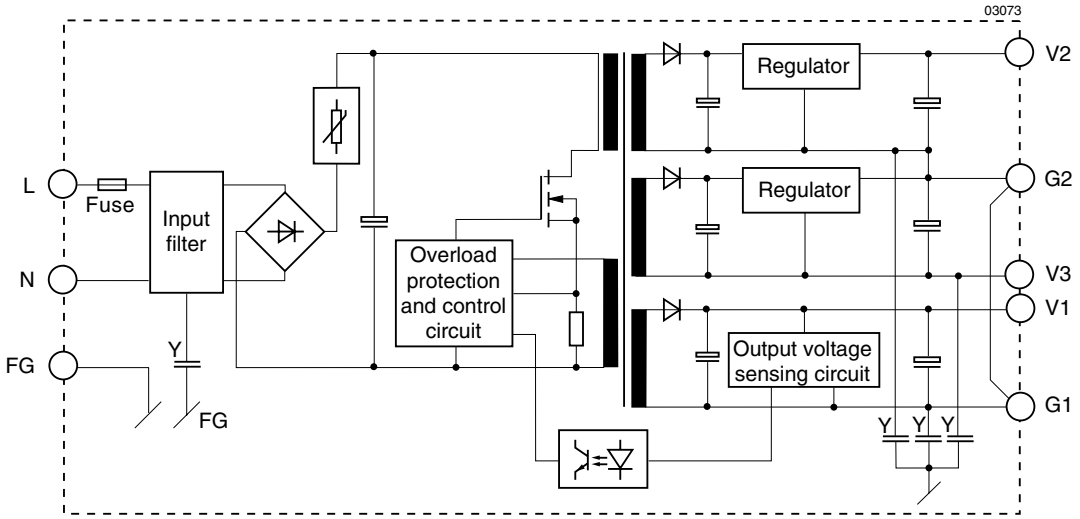


Fig. 1
Block diagram MWE 15

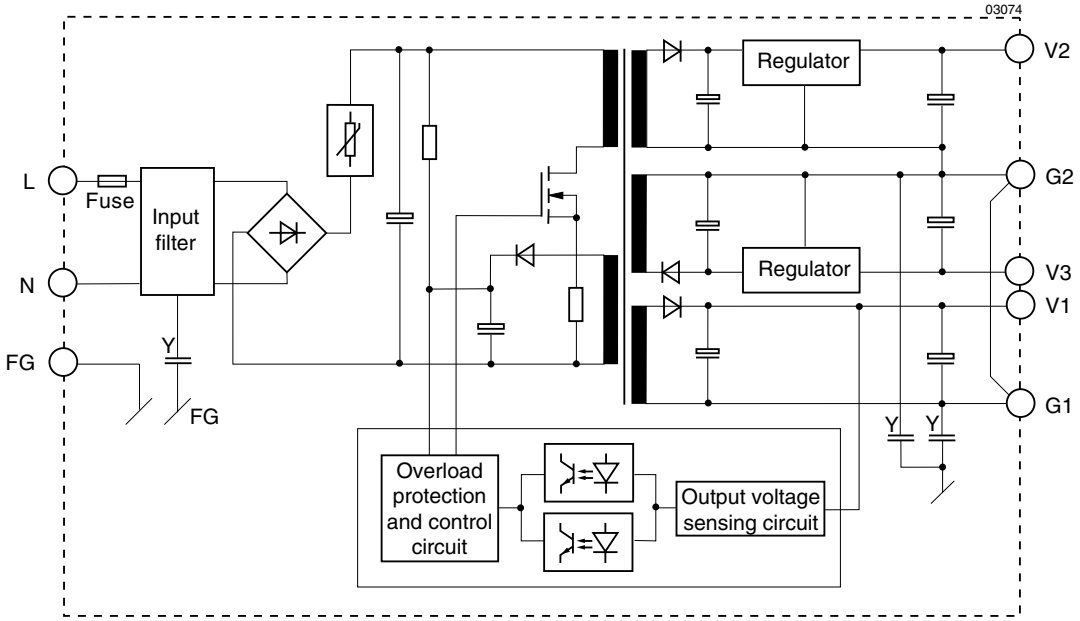


Fig. 2
Block diagram MWE 30

Electrical Input Data

General Condition: T_A = 25°C unless otherwise specified

Table 2: Input data

Characteristics			MWE 15-...	MWE 30-...	Unit
$U_{i\ rated}$	Rated input voltage		100, 120, 200, 220, 240		V AC
U_i	Input voltage range		85…264		
f_i	Line frequency		47…63		Hz
I_i	Input current [1] (typ.)	100/200 V AC	0.45/0.25	0.85/0.45	A
$I_{i\ m}$	Inrush current [1] (max.)	100 V AC	30		
$I_{i\ leak}$	Leakage current (max.)	100 V AC	0.5		mA

[1] At $U_{i\ rated}$ and $I_{o\ nom}$.

Electrical Output Data

General Condition: T_A = 25°C unless otherwise specified

Table 3a: Output data 15 W types

Type			MWE 15-01			MWE 15-11			
Characteristics			V1	V2	V3	V1	V2	V3	Unit
U_o	Output voltage	nom.	5	12	–12	5	15	–15	V
ΔU_o	Voltage setting tolerance		±1	±4	±4	±1	±4	±4	%
$I_{o\ set}$	Voltage setting load		1.25	0.15	0.1	1.25	0.15	0.1	A
$U_{o\ P}$	Overvoltage protection		Not provided			Not provided			
I_o	Output current	min. typ. max.	0.5 2 3	0 0.3 0.5	0 0.2 0.5	0.5 2 3	0 0.3 0.5	0 0.2 0.5	A
$I_{o\ L}$	Output current limitation [2]		105			105			%
$P_{o\ tot}$	Total rated output	max.	17.5			17.5			W
$P_{o\ max}$	Output power		15	6	6	15	7.5	7.5	
u_o	Ripple-noise [1]	max.	100	150	150	100	150	150	mVpp
$\Delta U_{o\ U}$	Line regulation	85...264 V	±2.0	±0.5	±0.5	±2.0	±0.5	±0.5	%
$\Delta U_{o\ I}$	Load regulation	0...100%	±2.0	±1.0	±0.5	±2.0	±1.0	±0.5	
$\Delta U_{o\ t}$	Drift (t = 0.5...8 h)	typ.	0.3			0.3			
α_{Uo}	Change in temp.,	0…50°C	±1			±1			
$t_{o\ r}$	Rise time [1]	max.	100			100			ms
$t_{o\ h\ min}$	Hold up time [1]	100/200 V AC	10/20			10/20			
η	Efficiency [1]	typ.	65			65			%

[1] At $U_{i\ rated}$ and $I_{o\ nom}$ and normal temperature.
[2] Operating at approx. 105% of rated power, constant current method, automatic recovery.

Table 3b: Output data 30 W types

Type			MWE 30-01			MWE 30-11			
Characteristics			V1	V2	V3	V1	V2	V3	Unit
U_o	Output voltage	nom.	5	12	–12	5	15	–15	V
ΔU_o	Voltage setting tolerance		±1	±4	±4	±1	±4	±4	%
$I_{o\ set}$	Voltage setting load		1.85	0.5	0.5	1.85	0.5	0.5	A
$U_{o\ P}$	Overvoltage protection		Not provided			Not provided			
I_o	Output current	min. typ. max.	1 3 5	0 1 1.2	0 0.33 0.5	1 3 5	0 0.8 1.2	0 0.21 0.5	A
$I_{o\ L}$	Output current limitation [2]		105			105			%
$P_{o\ tot}$	Total rated output	max.	31			31			W
$P_{o\ max}$	Output power		25	14	6	25	18	7.5	
u_o	Ripple-noise [1]	max.	100	150	150	100	150	150	mVpp
$\Delta U_{o\ U}$	Line regulation	85...264 V	±2.0	±0.5	±0.5	±2.0	±0.5	±0.5	%
$\Delta U_{o\ I}$	Load regulation	0...100%	±2.0	±1.0	±0.5	±2.0	±1.0	±0.5	
$\Delta U_{o\ t}$	Drift (t = 0.5...8 h)	typ.	0.3			0.3			
α_{Uo}	Change in temp.,	0…50°C	±1			±1			
$t_{o\ r}$	Rise time [1]	max.	100			100			ms
$t_{o\ h\ min}$	Hold up time [1]	100/200 V AC	10/20			10/20			
η	Efficiency [1]	typ.	65			65			%

[1] At $U_{i\ rated}$ and $I_{o\ nom}$ and normal temperature.
[2] Operating at approx. 105% of rated power, constant current method, automatic recovery.

Input and Output Terminals

Table 4: Input and output terminals

Terminal	Function	Explanation
L N	Line input Neutral input	1. Connect to a sine wave of 47...63 Hz, 85...264 V AC, single phase. 2. Use a double or triple core cable fo the input line. 3. Space the AC input line as far as possible from the DC output line.
FG	Frame ground terminal	Connect with low impedance to ground line of equipment on which the power supply is mounted.
V1	Output Terminal 1	Stabilized output of 5 V DC.
V2	Output Terminal 2	Stabilized output of 12 or 15 V DC.
V3	Output Terminal 3	Stabilized output of –12, or –15 V DC.
G1, G2	Ground Terminals	G1: ground terminal for V1, G2: ground terminal for V2 and V3. G1 and G2 are internally interconnected.

Proper Method of Operation

To achieve the proper output voltage from each of the three output channels, the load currents must be within the minimum-maximum ratings. If the load current is below the minimum, use a pre-load.

Output Current Limitation

Each channel has its own built-in current limitation at approx. 105% of the rated currents. In the case of overloading, the circuit operates to avoid excessive current. After removal of the overload, the circuit automatically resets.

Inrush Current

All models feature inrush current limitation circuit by means of power thermistors. Switching the AC input on/off repeatedly in rapid succession (less than 2 minutes waiting) should be avoided. An appropriate AC switch for each model based on its specifications should be provided.

Series or Parallel Connection

The outputs cannot be operated in series or parallel connection with other type of sources.

Thermal Considerations

The relation between the maximum allowed output power $P_{o\ allwed}$, the temperature T_A of the surrounding air and the mounting method is given in the: *Installation Instruction*. The percentage rates apply if the AC-DC converter is located in free, quasi-stationary air (convection cooling).

The following figure shows the allowed output power of an AC-DC converter.

For $P_{o\ max}$ values see: *Type Survey and Key Data*. The thermal conditions are influenced by input voltage, output current, airflow and temperature of surrounding components and surface.

Caution: The installer must ensure that under all operating conditions T_A remains within the limits stated in the table.

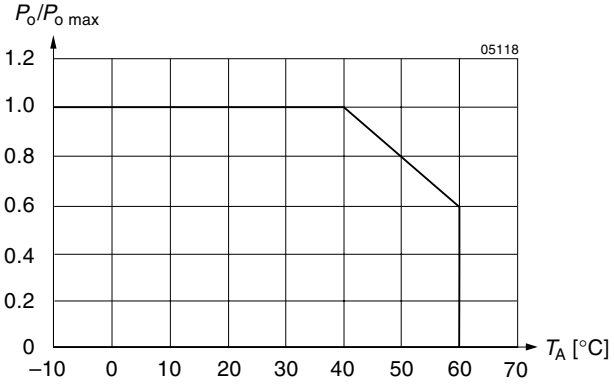


Fig. 3
Maximum allowed output power versus ambient temperature

Electromagnetic Compatibility (EMC)

Electromagnetic Immunity

A metal oxide VDR together with an input fuse and an input filter form an effective protection against high input transient voltages which typically occur in most installations, but especially in battery driven mobile applications. The MWE series has been successfully tested to the following specifications:

Table 5: Immunity type tests

Phenomenon	Standard	Level	Coupling mode [3]	Value applied	Waveform	Source Imped.	Test procedure	In oper.	Perform.
Electrostatic discharge	IEC/EN 61000-4-2	x	air discharge to frame	6000 V_p	1/50 ns	330 Ω	10 positive and 10 negative discharges	yes	[1]
Electromagnetic field	IEC/EN 61000-4-3	x	antenna in 1 m distance	10 V/m	sine wave modulated w. 1 kHz		26…1000 MHz	yes	[1]
Electrical fast transient/burst	IEC/EN 61000-4-4	x	i/c, +i/–i	2000 V_p	5/50 ns	50 Ω	1 min positive 1 min negative bursts per coupling mode	yes	[1]
Surge	IEC/EN 61000-4-5	x	i/c	2000 V_p	1.2/50 µs	12 Ω	5 pos. and 5 neg. surges per coupling mode	yes [2]	[1]

[1] Normal operation, no deviation from specifications.
[2] No load.
[3] i = input, o = output, c = case.

Electromagnetic Emissions

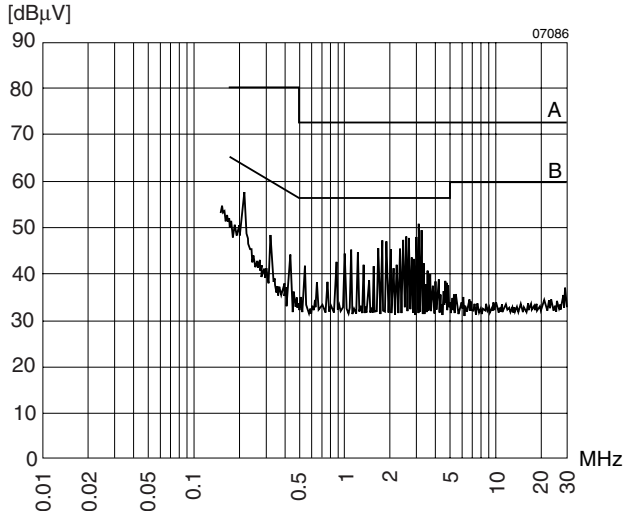


Fig. 4
The disturbance voltage (quasi peak) at the input according to CISPR11/22 and EN 55011/22, measured at $U_{i\ rated}$ and $I_{o\ nom}$ for MWE 15-01

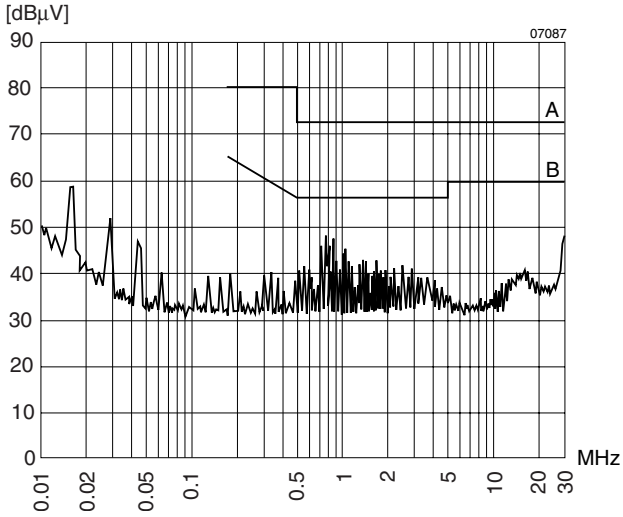


Fig. 5
The disturbance voltage (quasi peak) at the input according to CISPR11/22 and EN 55011/22, measured at $U_{i\ rated}$ and $I_{o\ nom}$ for MWE 30-11

Immunitiy to Environmental Conditions

Table 6: Mechanical stress

Test		Parameters	
Ca	Humidity (no condensation)	Relative humidity:	30...85 % Unit operating/storage
Ea	Shock	Acceleration: Bump duration: Number of bumps:	20 g_n (196.2 m/s^2) 11 ±5 ms 18 (3 each direction) Unit not operating
Fc	Vibration	Frequency: Maximum vibration amplitude: Acceleration: Duration:	5...55 Hz 10 mm (5...10 Hz) 2 g_n (19.6 m/s^2, 10...55 Hz) 3 h (1 h each axis) Unit not operating

Table 7: Temperature specifications

Characteristic		Conditions	min	max	Unit
T_A	Ambient temperature range without derating	$U_{i\ min}$...$U_{i\ max}$	–10	40	°C
T_A	Ambient temperature range with derating (see: *Thermal Considerations*)		–10	60	
T_S	Storage temperature range	Not operational	–20	75	

Table 8: MTBF values

MTBF	Type	Ground Benign T_C =25 °C
According to MIL-HDBK-217D	MWE 15	144'000 h
	MWE 30	126'000 h

Mechanical Data

Dimensions in mm. Tolerances ±1 mm unless otherwise indicated.

European Projection

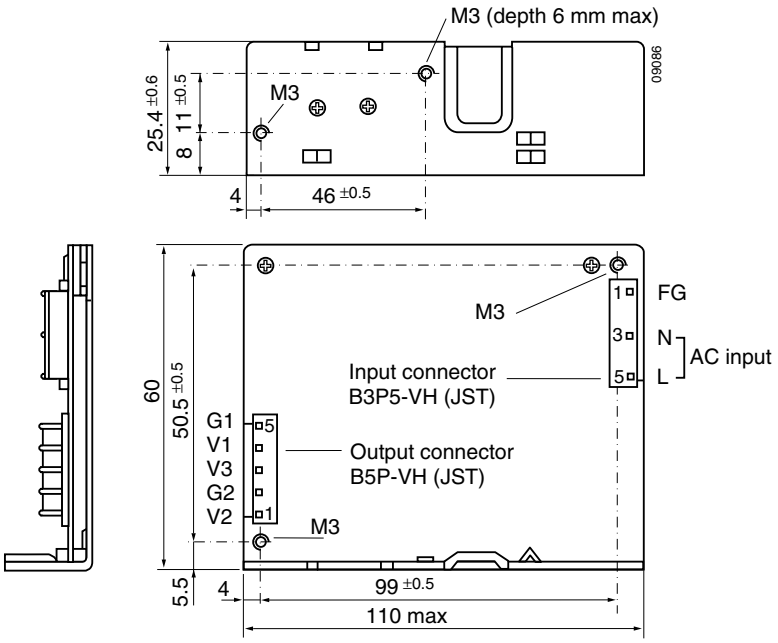


Fig. 6
MWE 15, weight: 150 g

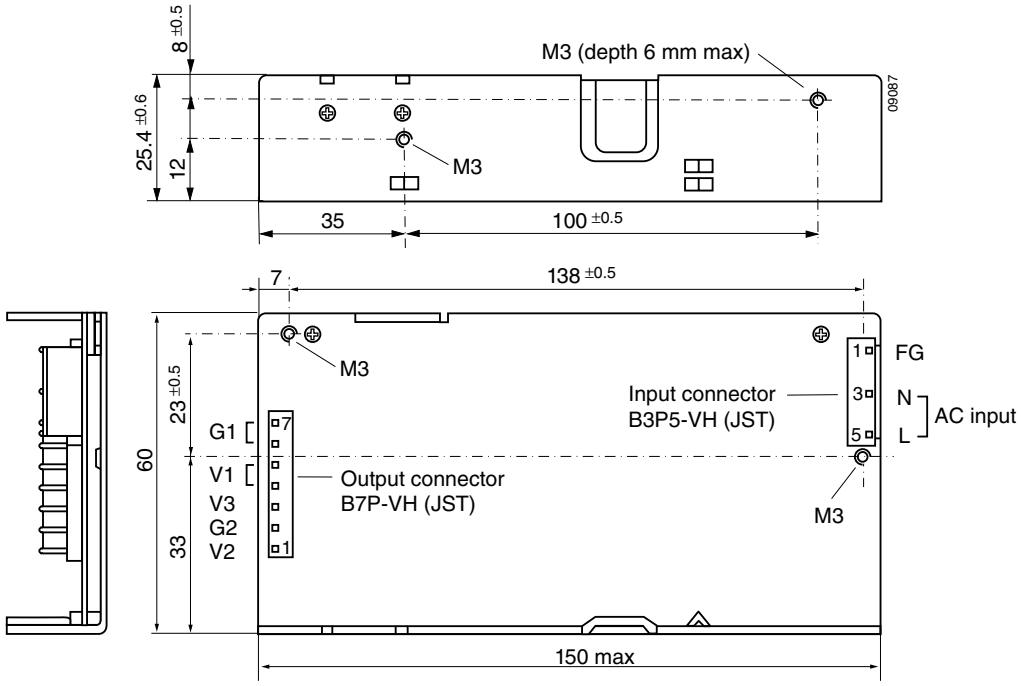


Fig. 7
MWE 30, weight: 230 g

Safety and Installation Instructions

Installation Instructions

Our AC-DC converters are components, intended exclusively for inclusion within other equipment by an industrial assembly operation or by professional installers. Installation must strictly follow the national safety regulations in compliance with the enclosure, mounting, creepage, clearance, casualty, markings and segregation requirements of the end-use application. See also: *Technical Information: Installation and Application.*

Connection to the system shall be made via the terminal block at the rear side of the unit according to: *Terminal Assignment.*

For safety reasons it is essential to connect the FG and ACG terminals with protective earth. See also: *Safety of operator accessible output circuit.*

A fuse is built-in in the connection from the L terminal of the unit. Since this fuse is designed to protect the unit in case of an overcurrent and does not necessarily cover all customer needs, an external fuse suitable for the application and in compliance with the local requirements should be installed in the wiring to the phase terminal L. A second fuse in the wiring to the neutral terminal N is needed if:

- Local requirements demand an individual fuse in each source line
- Neutral and earth impedance is high or undefined
- Phase and neutral of the mains are not defined or cannot be assigned to the corresponding terminals (L to phase and N to neutral)

Important: Do not open the modules, or guarantee will be invalidated.

Make sure that there is sufficient air flow possible for convection cooling. This should be verified by measuring the ambient temperature when the unit is installed and operated in the end-use application. The maximum specified ambient temperature $T_{A\,max}$ must not not be overriden, depending on output power and mounting method. See: *Thermal Considerations* and table *Allowed output power by mounting method*.

Mounting Methods

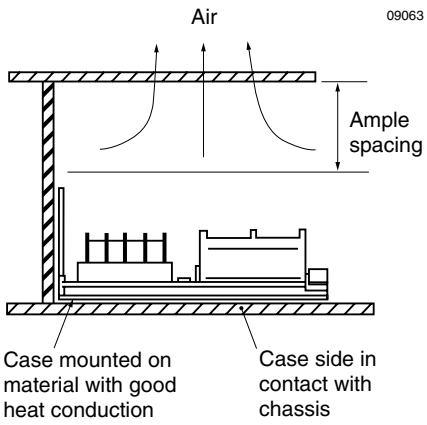


Fig. 8
Hoirizontal mounting

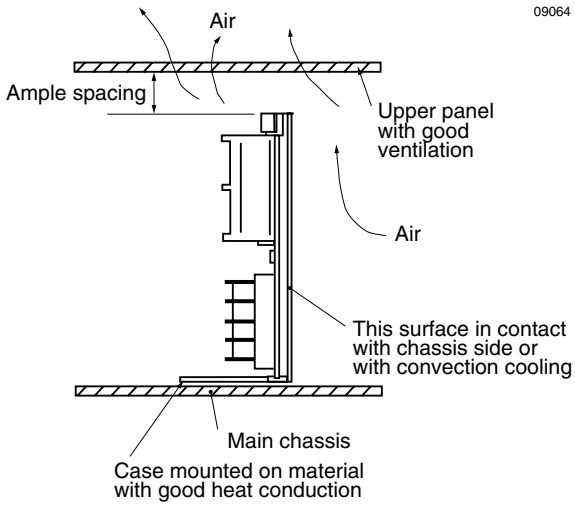


Fig. 9
Vertical mounting

Standards and approvals

The AC-DC converters correspond to class I equipment and are UL recognized according to UL 1950, UL recognized for Canada to CAN/CSA 950 and LGA approved to IEC/EN 60950 standards.

The units have been evaluated for:

- Building in,
- Basic insulation between input and frame and double or reinforced insulation between input and output, based on their maximum input voltage.
- Operational insulation between output and frame,
- The use in a pollution degree 2 environment,
- Connecting the input to an overvoltage category II circuit if >150 V or an overvoltage category III circuit if ≤150 V.

The AC-DC converters are subject to manufacturing surveillance in accordance with the above mentioned UL, CSA, EN and with ISO 9001 standards.

Isolation

The electric strength test is performed as factory test in accordance with IEC/EN 60950 and UL 1950 and should not be repeated in the field. Power-One will not honour any guarantee claims resulting from electric strength field tests.

Table 9: Isolation

Characteristic	Input to frame	Input to output	Output to frame	Unit
Electric strength test voltage 1 s	-	3.0 [1]	-	kV_{rms}
	-	4.3 [1]	-	kV DC
Insulation resist. at 500 V DC	-	>100	>100	MΩ
Leakage current	-	–	<15	mA

[1] In accordance with IEC/EN 60950 only subassemblies are tested in factory with this voltage.

Safety of operator accessible output circuit

If the output circuit of an AC-DC converter is operator accessible, it shall be an SELV circuit according to the IEC/EN 60950 related safety standards

The following table shows a possible installation configuration, compliance with which causes the output circuit of the AC-DC converter to be an SELV circuit according to IEC/EN 60950 up to a configured output voltage (sum of nominal voltages if in series or +– configuration) of 44 V.

However, it is the sole responsibility of the installer to assure the compliance with the relevant and applicable safety regulations. More information is given in: *Technical Information: Safety*.

Table 10: Safety concept leading to an SELV output circuit

Conditions	AC-DC converter	Installation	Result
Supply voltage	Grade of isolation, provided by the AC-DC converter	Measures to achieve the resulting safety status of the output circuit	Safety status of the AC-DC converter output circuit
Mains ≤250 V AC	Double or reinforced	Earthed frame	SELV circuit

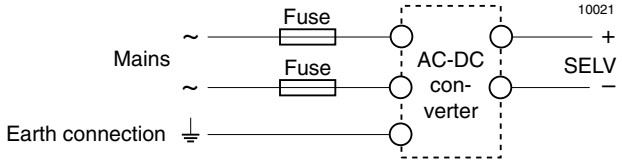


Fig. 10
Schematic safety concept
Use fuses and earth connection as per: Installation Instructions *and table:* Safety concept leading to an SELV output circuit.

Table 11: Safety approvals

Safety Approvals	NRTL/C	CSA	LGA
MWE 15, MWE 30	UL 1950	CSA 950	IEC/EN 60950

Protection Degree

The protection degree of the AC-DC converters is IP 20, exept in the vicinity ot the terminal block, where it depends on the installation.

Accessories

Connector Kits

Table 12: Connector kit specification

Type	Connector kit designation	Input housing	Qty.	Contacts	Qty.	Output housing	Qty.	Contacts	Qty.
MWE 15	MLCK01	VHR-5N	1	SVH-21T-P1.1	3	VHR-5N	1	SVH-21T-P1.1	5
MWE 30	MLCK02	VHR-5N	1	SVH-21T-P1.1	3	VHR-7N	1	SVH-21T-P1.1	7

Cable Kit

Table 13: Cable kit (to be ordered separately from power supply)

Position at	Type of cable kit	Power supply	Material / Length / Cross section	Wire color						
				V1	V2	V3	G	AC (L)	AC (N)	FG
AC input side	CB11	MWE 15 MWE 30	UL 1015 / 60 cm AWG 20 ≈ 0.50 mm²	–	–	–	–	Black (5)	White (3)	Green-Yellow (1)
DC output side	CB12	MWE 15	UL 1007 / 60 cm AWG 18 ≈ 1 mm²	Red (4)	Brown (1)	Blue (3)	Black (2, 5)	–	–	–
	CB13	MWE 30	UL 1007 / 60 cm AWG 18 ≈ 1 mm²	Red (4, 5)	Brown (1)	Blue (3)	Black (2, 6, 7)	–	–	–