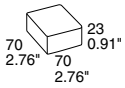
25 Watt DC-DC Converters

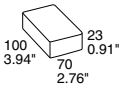
IMR 25-Series

Input voltage range up to 72 V DC
1, 2 or 3 outputs up to 30 V DC
1500 V DC I/O electric strength test voltage

- Input voltage range 2:1
- Input filter built-in
- High efficiency up to 82%
- Short-circuit proof
- No derating
- Low cost



single and dual output



triple output

Summary

The IMR 25 series of DC-DC converters have been developed for powering commercial type of electronic circuits, e.g. telephone systems components, industrial controllers and small appliances. They are suitable for applications with standard battery voltages. The IMR 25 converters feature good efficiency and good dynamic response to load changes and at start-up. The IMR 25 modules are short-circuit proof.

Table of Contents

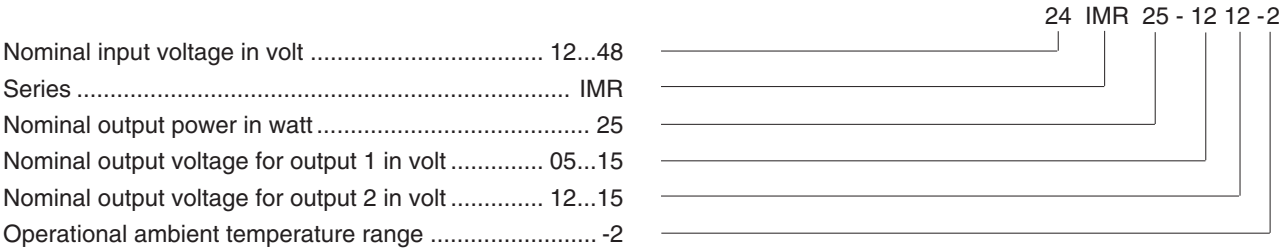
Type Survey and Key Data

Table 1: Type survey

Output 1		Output 2		Output 3		Output power	Input voltage range	Eff.	Types designation
$U_{o\,nom}$ [V]	$I_{o\,nom}$ [mA]	$U_{o\,nom}$ [V]	$I_{o\,nom}$ [mA]	$U_{o\,nom}$ [V]	$I_{o\,nom}$ [mA]	T_A = 50 °C $P_{o\,nom}$ [W]	U_i [V DC]	η_{min} [%]	
3.3	6500	-	-	-	-	22	9...18	77	12 IMR 25-03-2
3.3	6500	-	-	-	-	22	18...36	79	24 IMR 25-03-2
3.3	6500	-	-	-	-	22	36...72	80	48 IMR 25-03-2
5	5000	-	-	-	-	25	9...18	77	12 IMR 25-05-2
5	5000	-	-	-	-	25	18...36	79	24 IMR 25-05-2
5	5000	-	-	-	-	25	36...72	80	48 IMR 25-05-2
12	2100	-	-	-	-	25	9...18	80	12 IMR 25-12-2
12	2100	-	-	-	-	25	18...36	81	24 IMR 25-12-2
12	2100	-	-	-	-	25	36...72	83	48 IMR 25-12-2
15	1700	-	-	-	-	25	9...18	80	12 IMR 25-15-2
15	1700	-	-	-	-	25	18...36	81	24 IMR 25-15-2
15	1700	-	-	-	-	25	36...72	83	48 IMR 25-15-2
+5	+4700	–5	–300	-	-	25	9...18	77	12 IMR 25-0505-2
+5	+4700	–5	–300	-	-	25	18...36	79	24 IMR 25-0505-2
+5	+4700	–5	–300	-	-	25	36...72	80	48 IMR 25-0505-2
+12	+1800	–12	–300	-	-	25	9...18	80	12 IMR 25-1212-2
+12	+1800	–12	–300	-	-	25	18...36	81	24 IMR 25-1212-2
+12	+1800	–12	–300	-	-	25	36...72	83	48 IMR 25-1212-2
+15	+1400	–15	–300	-	-	25	9...18	80	12 IMR 25-1515-2
+15	+1400	–15	–300	-	-	25	18...36	81	24 IMR 25-1515-2
+15	+1400	–15	–300	-	-	25	36...72	83	48 IMR 25-1515-2
+5	+4000	+12	+300	–12	–300	27.2	9...18	76	12 IMR 25-051212-2
+5	+4000	+12	+300	–12	–300	27.2	18...36	77	24 IMR 25-051212-2
+5	+4000	+12	+300	–12	–300	27.2	36...72	78	48 IMR 25-051212-2
+5	+3500	+15	+300	–15	–300	26.5	9...18	77	12 IMR 25-051515-2
+5	+3500	+15	+300	–15	–300	26.5	18...36	78	24 IMR 25-051515-2
+5	+3500	+15	+300	–15	–300	26.5	36...72	79	48 IMR 25-051515-2

Type Key and Product Marking

Type Key



Functional Description

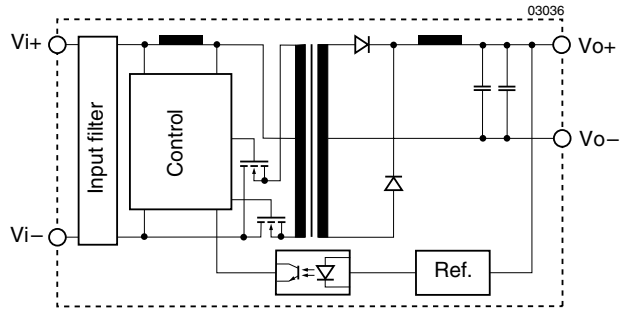


Fig. 1
Single output converter block diagram

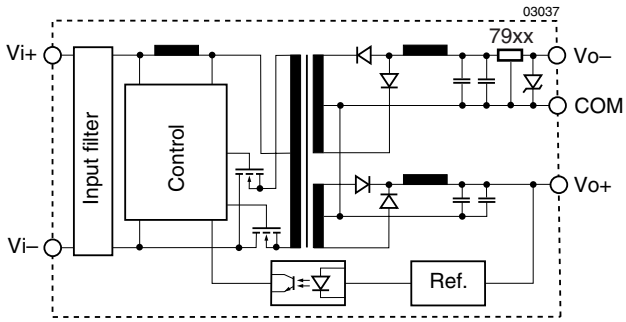


Fig. 2
Dual output converter block diagram

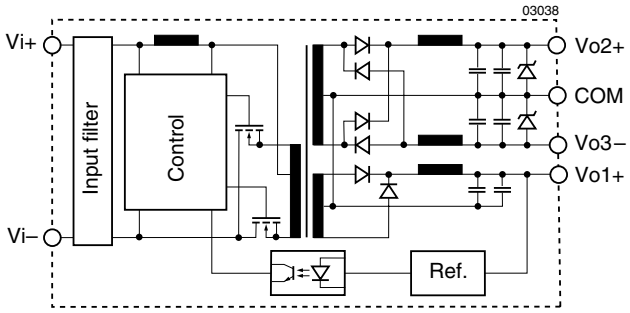


Fig. 3
Triple output converter block diagram

Electrical Input Data

General condition: T_A = 25 °C unless otherwise specified.

Table 2: Input data

Input			12 IMR 25			24 IMR 25			48 IMR 25			
Characteristics		Conditions	min	typ	max	min	typ	max	min	typ	max	Unit
U_i	Input voltage range	$T_{A\,min}$...$T_{A\,max}$ I_o = 0...$I_{o\,nom}$	9		18	18		36	36		72	V DC
$U_{i\,nom}$	Nominal input voltage			12			24			48		
$U_{i\,abs}$	Maximum input voltage without damage		0		21	0		40	0		75	
$I_{i\,0}$	No load input current	$U_{i\,nom}$, I_o = 0		35			30			25		mA
$I_{i\,L}$	Input current limitation	$U_{i\,nom}$, full load		1.25 $P_{i\,nom}$			1.25 $P_{i\,nom}$			1.25 $P_{i\,nom}$		W
$U_{i\,rev}$	Reverse input voltage	U_i = negative or protection		shunt diode reverse polarity			shunt diode use external fuse			shunt diode use external fuse		

Electrical Output Data

General condition: T_A = 25 °C unless otherwise specified.

Table 3a: Output data for single output types

Output			.. IMR 25-03			.. IMR 25-05			.. IMR 25-12			.. IMR 25-15			
Characteristics		Conditions	min	typ	max	min	typ	max	min	typ	max	min	typ	max	Unit
U_o	Output voltage	$U_{i\,nom}$, $I_{o\,nom}$	3.24	3.36		4.95	5	5.05	11.88	12	12.12	14.85	15	15.15	V
I_o	Output current	$U_{i\,min}$...$U_{i\,max}$		6500			5000			2100			1700		mA
u_o	Output voltage noise (BW = 20 MHz)	$U_{i\,nom}$ $I_{o\,nom}$		50			50			120			150		mV_{pp}
$\Delta U_{o\,U}$	Static line regulation	$U_{i\,min}$...$U_{i\,max}$ $I_{o\,nom}$		±1			±1			±1			±1		%
$\Delta U_{o\,I}$	Static load regulation	$U_{i\,nom}$ $I_{o\,nom}$...0	3.23	3.37		4.9	5.1		11.76	12.24		14.7	15.3		V DC
t_r	Transient recovery time	$I_{o\,nom} \leftrightarrow 1/2$		500			500			500			500		µs
α_{Uo}	Temperature coefficient	$U_{i\,nom}$, $I_{o\,nom}$		±0.02			±0.02			±0.02			±0.02		%/K
f_s	Switching frequency		80			80			80			80			kHz

Table 3b: Output data for dual output types

Input			.. IMR 25-0505						.. IMR 25-1212						
Characteristics		Conditions	Output 1			Output 2			Output 1			Output 2			Unit
			min	typ	max	min	typ	max	min	typ	max	min	typ	max	
U_o	Output voltage	$U_{i\,nom}$, $I_{o\,nom}$	4.95	5	5.1	-4.85	-5	-5.15	11.76	12	12.24	-11.76	-12	-12.24	V
$U_{o\,max}$	Maximum output voltage	$U_{i\,min}$...$U_{i\,max}$			5.1			-6.2			12.24			-15	
I_o	Output current		940	4700		60	300	500 [1]	360	1800		60	300	500 [1]	mA
u_o	Output voltage noise (BW = 20 MHz)	$U_{i\,nom}$ $I_{o\,nom}$		50	100		70	100		150	240		200	240	mV_{pp}
$\Delta U_{o\,U}$	Static line regulation	$U_{i\,min}$...$U_{i\,max}$ $I_{o\,nom}$			±1			±1			±1			±1	%
$\Delta U_{o\,I}$	Static load regulation	$U_{i\,nom}$ (0.2...1) $I_{o\,nom}$	4.9	5	5.1	-4.85	-5	-5.15	11.76	12	12.24	-11.76	-12	-12.24	V DC
t_r	Transient recovery time	$I_{o\,nom} \leftrightarrow 1/2$		500			500			500			500		µs
α_{Uo}	Temperature coefficient	$U_{i\,nom}$, $I_{o\,nom}$		±0.02			±0.02			±0.02			±0.02		%/K
f_s	Switching frequency		80			80			80			80			kHz

Table 3c: Output data for dual output units

Input			.. IMR 25-1515						
Characteristics		Conditions	Output 1			Output 2			Unit
			min	typ	max	min	typ	max	
U_o	Output voltage	$U_{i\,nom}$, $I_{o\,nom}$	14.7	15	15.3	-14.7	-15	-15.3	V
$U_{o\,max}$	Maximum output voltage	$U_{i\,min}$...$U_{i\,max}$			15.3			-18	
I_o	Output current		280	1400		60	300	500 [1]	mA
u_o	Output voltage noise (BW = 20 MHz)	$U_{i\,nom}$ $I_{o\,nom}$		150	300		200	300	mV_{pp}
$\Delta U_{o\,U}$	Static line regulation	$U_{i\,min}$...$U_{i\,max}$ $I_{o\,nom}$			±1			±1	%
$\Delta U_{o\,I}$	Static load regulation	$U_{i\,nom}$ (0.2...1) $I_{o\,nom}$	14.7	15	15.3	-14.7	-15	-15.3	V DC
t_r	Transient recovery time	$I_{o\,nom} \leftrightarrow 1/2$		500			500		µs
α_{Uo}	Temperature coefficient	$U_{i\,nom}$, $I_{o\,nom}$		±0.02			±0.02		%/K
f_s	Switching frequency		80			80			kHz

[1] Total power may not exceed maximum power as stated in table: *Type Survey and Key Data*.

Table 3d: Output data for triple output units

Output			.. IMR 25-051212									
Characteristics		Conditions	Output 1 min	Output 1 typ	Output 1 max	Output 2 min	Output 2 typ	Output 2 max	Output 3 min	Output 3 typ	Output 3 max	Unit
U_o	Output voltage	$U_{i\,nom}$, $I_{o\,nom}$	4.9	5	5.1	11.76	12	12.24	–11.76	–12	–12.24	V
$U_{o\,max}$	Maximum output voltage	$U_{i\,min}$...$U_{i\,max}$			5.1			15			–15	
I_o	Output current		800	4000		60	300	500 [1]	60	300	500 [1]	mA
u_o	Output voltage noise (BW = 20 MHz)	$U_{i\,nom}$ $I_{o\,nom}$		50	100		150	240		150	240	mV_{pp}
$\Delta U_{o\,U}$	Static line regulation	$U_{i\,min}$...$U_{i\,max}$ $I_{o\,nom}$			±1			±1			±1	%
$\Delta U_{o\,I}$	Static load regulation	$U_{i\,nom}$ (0.2...1) $I_{o\,nom}$	4.9	5	5.1	11.4	12	12.6	–11.4	–12	–12.6	V
t_r	Transient recovery time	$I_{o\,nom} \leftrightarrow 1/2$		500			500			500		µs
α_{Uo}	Temperature coefficient	$U_{i\,nom}$, $I_{o\,nom}$		±0.02			±0.02			±0.02		%/K
f_s	Switching frequency		80			80			80			kHz

Table 3e: Output data for triple output units

Output			.. IMR 25-051515-2									
Characteristics		Conditions	Output 1 min	Output 1 typ	Output 1 max	Output 2 min	Output 2 typ	Output 2 max	Output 3 min	Output 3 typ	Output 3 max	Unit
U_o	Output voltage	$U_{i\,nom}$, $I_{o\,nom}$	4.9	5	5.1	14.7	15	15.3	–14.7	–15	–15.3	V
$U_{o\,max}$	Maximum output voltage	$U_{i\,min}$...$U_{i\,max}$			5.1			18			–18	
I_o	Output current		700	3500		60	300	500 [1]	60	300	500 [1]	mA
u_o	Output voltage noise (BW = 20 MHz)	$U_{i\,nom}$ $I_{o\,nom}$		50	100		200	300		200	300	mV_{pp}
$\Delta U_{o\,U}$	Static line regulation	$U_{i\,min}$...$U_{i\,max}$ $I_{o\,nom}$			±1			±1			±1	%
$\Delta U_{o\,I}$	Static load regulation	$U_{i\,nom}$ (0.2...1) $I_{o\,nom}$	4.9	5	5.1	14.25	15	15.75	–14.25	–15	–15.75	V
t_r	Transient recovery time	$I_{o\,nom} \leftrightarrow 1/2$		500			500			500		µs
α_{uo}	Temperature coefficient	$U_{i\,nom}$, $I_{o\,nom}$		±0.02			±0.02			±0.02		%/K
f_s	Switching frequency		80			80			80			kHz

[1] Total power may not exceed maximum power as stated in table *Type Survey and Key Data*.

Thermal Considerations

If a converter is operated, the relationship between the ambient temperature T_A and the case temperature T_C depends heavily on the conditions of operation and integration into a system. The thermal conditions are influenced by input voltage, output current, airflow, temperature of surrounding components and surfaces and the properties of the printed circuit board. The specified maximum ambient temperature $T_{A\,max}$ is therefore only an indicative value and under practical operating conditions, the ambient temperature T_A may be higher or lower than this value.

Caution: The case temperature T_C measured at the *Measuring point of case temperature* T_C (see: *Mechanical Data*) may under no circumstances exceed the specified maximum value. The installer must ensure that under all operating conditions T_C remains within the limits stated in the table: *Temperature specifications.*

Connection in Parallel

The current limitation characteristics is fold-back. Therefore, parallel connection is not possible.

Connection in Series

The outputs of one or more units can be connected in series. No suppressor diodes are required. Power-One, however recommends to protect each individual output with a Zener diode or preferably a suppressor diode, to avoid reverse polarity that may occur if the output voltages do not rise simultaneously.

Protection Scheme

The IMR series is continuously short circuit protected by means of input power limitation. The unit will not be damaged if started up into a short circuit. After removal of the short circuit, it will resume normal operation.

The IMR series is also no-load proof, meaning that the regulation is still effective with no load and the output voltage does not rise. However, due to component tolerances, oscillation could occur and ripple and noise can be outside of specified values. If the converter is used in senitive electronic circuits with no-load conditions, it is recommended to pre-load the outputs with at least 20% of the specified nominal load.

Electromagnetic Compatibility (EMC)

Filter recommendations for compliance with CISPR 22/EN 55022, class B

Electromagnetic emission requirements according to EN 55022, class B can be easily achieved by adding an external input filter consisting of three additional capacitors and one common mode ring core choke.

The filter components should be placed as close as possible to the input of the converter.

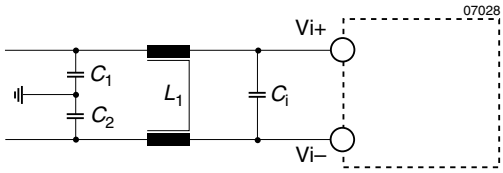


Fig. 4
Input filter arrangement for 48 V DC types

Table 4: Input filter components

Input voltage	C_1	C_2	Type	L_1	Type	C_i	Type
12 V DC	3.3 µF 50 V	3.3 µF 50 V	Al-Chip (low ERS)	3.9 mH	Siemens B 82724-A2402-N1	6.8 µF 50 V	Al-Chip (low ERS)
24 V DC	2.,2 µF 100 V	2.2 µF 100 V	Al-Chip (low ERS)	2.2 mH	Siemens B 82722-A2202-N1	4.7 µF 100 V	Al-Chip (low ERS)
48 V DC	1 µF [1] 100 V	1 µF [1] 100 V	Al-Chip (low ERS)	2.2 mH	Siemens 82721-K2202-N1	4.7 µF 100 V	Al-Chip (low ERS)

[1] Only valid for input voltages up to 60 V DC.

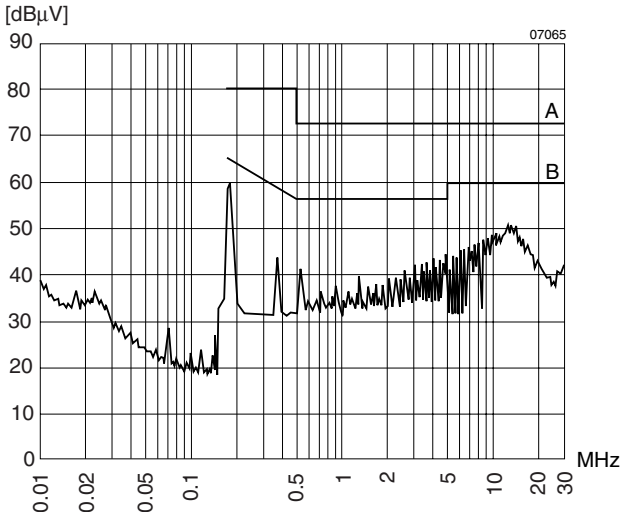


Fig. 5
Typical disturbance voltage (quasi-peak) at the input according to CISPR 11/22 and EN 55011/22, measured at $U_{i\ rated}$ and $I_{o\ nom}$, e.g. for 12 IMR 25-05-2.

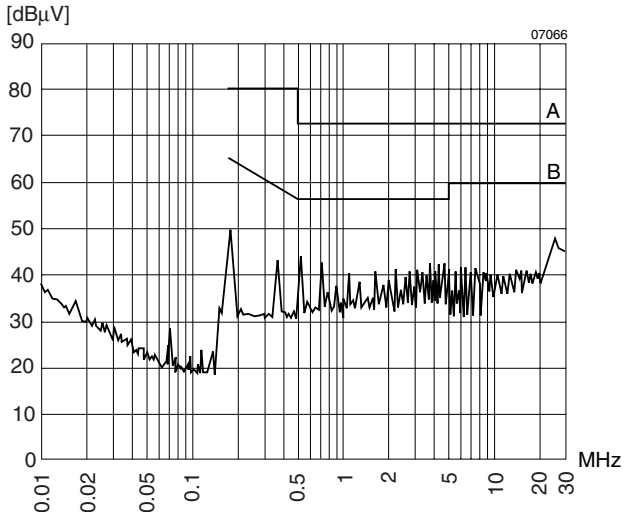


Fig. 6
Typical disturbance voltage (quasi-peak) at the input according to CISPR 11/22 and EN 55011/22, measured at $U_{i\ rated}$ and $I_{o\ nom}$, e.g. for 24 IMR 25-05-2.

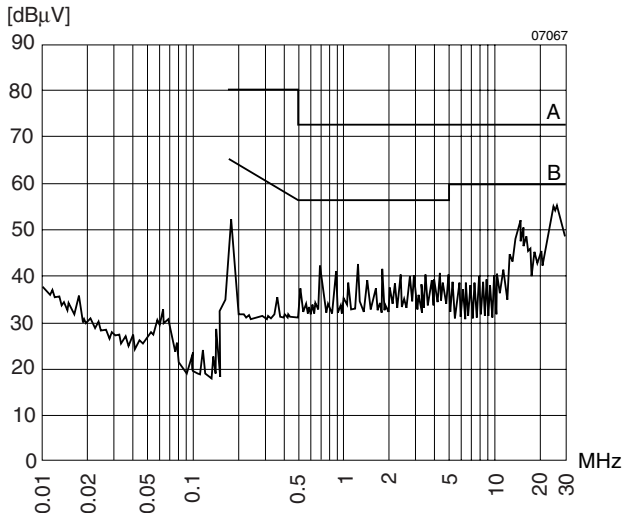


Fig. 7
Typical disturbance voltage (quasi-peak) at the input according to CISPR 11/22 and EN 55011/22, measured at $U_{i\ rated}$ and $I_{o\ nom}$, e.g. for 48 IMR 25-05-2.

Immunity to Environmental Conditions

Table 5: Temperature specifications, valid for air pressure of 800...1200 hPa (800...1200 mbar)

Temperature			Standard -2		
Characteristics		Conditions	min	max	Unit
T_A	Ambient temperature	$U_{i\,nom}$ $I_o = 0...I_{o\,nom}$	–10	50	°C
T_C	Case temperature		–10	80	
T_S	Storage temperature	Non operational	–40	85	

Table 6: MTBF

MTBF	Ground Benign	Ground Fixed		Ground Mobile
MTBF according to MIL-HDBK-217F, N2	40 °C	40 °C	70 °C [1]	50 °C
	1'996'000 h	389'000 h	198'000	176'000 h

[1] Available as customer specific model.

Mechanical Data

Dimensions in mm. Tolerances ±0.3 mm unless otherwise specified.

European Projection

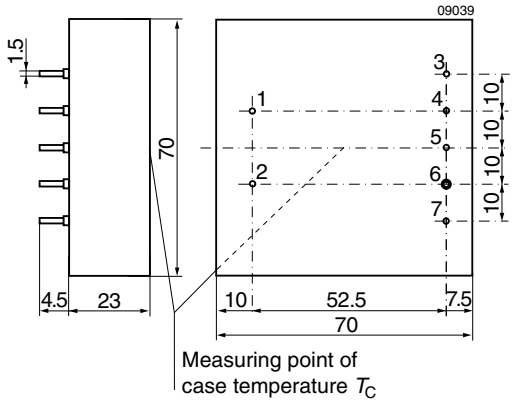


Fig. 8
Case IMR 25 "A" for single and dual output units
Weight: 180 g

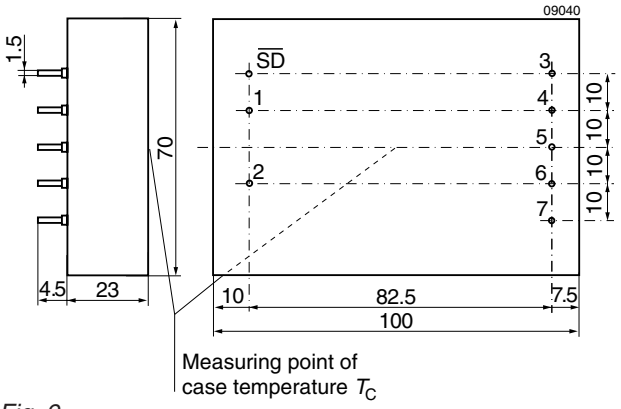


Fig. 9
Case IMR 25 "B" for triple output units
Weight: 300 g

Safety and Installation Instructions

Installation Instruction

Installation of the DC-DC converters 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.

Connection to the system shall be made via a printed circuit board according to: *Mechanical Data*.

The units should be connected to a secondary circuit.

Check for hazardous voltages before altering any connections.

Ensure that a unit failure (e.g. by an internal short-circuit) does not result in a hazardous condition. See also: *Safety of operator accessible output circuit.*

Cleaning Agents

In order to avoid possible damage, any penetration of cleaning fluids is to be prevented, since the power supplies are not hermetically sealed.

Fig. 7: Pin allocation

Pin	Single output	Dual output	Triple output
1	Vi+	Vi+	Vi+
2	Vi–	Vi–	Vi–
3	Vo+	Vo+	Vo1+
4	Vo+	Vo+	COM
5	Vo–	COM	Vo2+
6	Vo–	COM	COM
7	n.c.	Vo–	Vo3–

Standards and approvals

The units have been evaluated for:

- Building in
- Operational insulation input to output
- The use in a pollution degree 2 environment
- Connecting the input to a secondary circuit which is subject to a maximum transient rating of 1500 V.

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.

Protection Degree

The protection degree of the DC-DC converters is IP 40.

Input Fuse

To prevent excessive current flowing through the input supply line in case of a short-circuit across the converter input an external fuse should be installed in a non earthed input supply line. We recommend a fast acting fuse F8A for 12 IMR 25 types, F4A for 24 IMR 25 and F2A for 48 IMR 25 types.

Table 8: Electric strength test voltages, clearance and creepage distances

Characteristic	Input to output	Unit
Electric strength test voltage 1 s	1.1	kV_{rms}
	1.5	kV DC
Coupling capacitance	≈350	pF
Insulation resistance at 500 V DC	>1000	MΩ

Safety of operator accessible output circuit

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

The following table shows some possible installation configurations, compliance with which causes the output circuit of the DC-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 30 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 9: Insulation concept leading to an SELV output circuit

Conditions	Front end			DC-DC converter	Result
Supply voltage	Minimum required grade of isolation, to be provided by the AC-DC front end, including mains supplied battery charger	Maximum DC output voltage from the front end [1]	Minimum required safety status of the front end output circuit	Measures to achieve the specified safety status of the output circuit	Safety status of the DC-DC converter output circuit
Mains ≤250 V AC	Basic	≤60 V	Earthed SELV circuit [2]	Operational insulation, provided by the DC-DC converter	SELV circuit
			ELV circuit	Input fuse [3] output suppressor diodes [4], and earthed output circuit [2]	Earthed SELV circuit
		>60 V	Hazardous voltage secondary circuit		
	Double or reinforced	≤60 V	SELV circuit	Operational insulation, provided by the DC-DC converter	SELV circuit
		>60 V	TNV-2 circuit	Earthed output circuit [2]	Earthed SELV
			Double or reinforced insulated unearthed hazardous voltage secondary circuit [5]	Input fuse [3] and output suppressor diodes [4]	SELV circuit

[1] The front end output voltage should match the specified input voltage range of the DC-DC converter.
[2] The earth connection has to be provided by the installer according to the relevant safety standard, e.g. IEC/EN 60950.
[3] The installer shall provide an approved fuse (type with the lowest rating suitable for the application) in a non-earthed input conductor directly at the input of the DC-DC converter (see fig.: *Schematic safety concept*). For UL's purpose, the fuse needs to be UL-listed. See also: *Input Fuse*.
[4] Each suppressor diode should be dimensioned in such a way, that in the case of an insulation fault the diode is able to limit the output voltage to SELV (<60 V) until the input fuse blows (see fig.: *Schematic safety concept*).
[5] Has to be insulated from earth by double or reinforced insulation according to the relevant safety standard, based on the maximum output voltage from the front end.

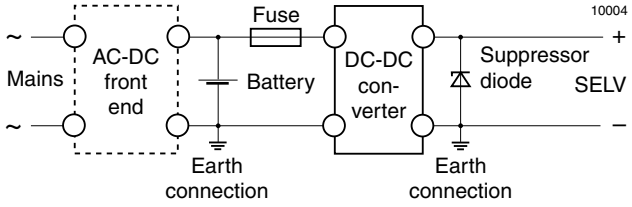


Fig. 10
Schematic safety concept. Use fuse, suppressor diode and earth connection as per table Safety concept leading to an SELV output circuit.