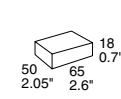
TOKO 5/10/15/30 Watt AC-DC Converters SWE Series

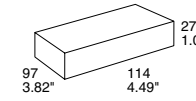
Input to output isolation
Single output

- Ultra thin and compact
- High isolation
- Universal input (85...264 V AC)
- Noise standard: meets EN 55011/55022

Safety according to IEC/EN 60950



SWE 05



SWE 30

Summary

The new SWE series of ultra compact switchers satisfies 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 5, 10, 15, and 30 Watt ratings with single output, open frame or covered models are available. Universal AC input on all models and UL1950, CSA 1402 and TÜF (IEC/EN 60950) approvals, meeting FCC class B, EN 55022 noise standards.

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 $U_{o\,nom}$ [V DC]	Output $I_{o\,nom}$ [A]	Input voltage range $U_{i\,min}...U_{i\,max}$	Rated power $T_A = 40°C$ $P_{o\,tot}$ [W]	Efficiency [1] η [%]	Type designation Case Terminal strip	Type designation Open frame Terminal strip	Type designation Open frame Connector
5	1.0	85...264 V AC 47...63 Hz	5	70	–	–	SWE 05-05FC
5	2.0		10	70	–	SWE 10-05F	SWE 10-05FC
5	3.0		15	70	SWE 15-05C	SWE 15-05F	SWE 15-05FC
5	6.0		30	70	SWE 30-05C	SWE 30-05F	SWE 30-05FC
12	0.42		5	75	–	–	SWE 05-12FC
12	0.83		10	75	–	SWE 10-12F	SWE 10-12FC
12	1.30		15	75	SWE 15-12C	SWE 15-12F	SWE 15-12FC
12	2.50		30	75	SWE 30-12C	SWE 30-12F	SWE 30-12FC
15	0.67		10	75	–	SWE 10-15F	SWE 10-15FC
15	1.00		15	75	SWE 15-15C	SWE 15-15F	SWE 15-15FC
15	2.00		30	75	SWE 30-15C	SWE 30-15F	SWE 30-15FC
24	0.42		10	75	–	SWE 10-24F	SWE 10-24FC
24	0.63		15	75	SWE 15-24C	SWE 15-24F	SWE 15-24FC
24	1.33		30	75	SWE 30-24C	SWE 30-24F	SWE 30-24FC

[1] Efficiency at $U_{i\,rated}$ and $I_{o\,nom}$

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Type Key

Type Key

SWE 15 – 12 FC

Series ..... SWE
Nominal output power [W] ..... 05…30
Nominal output voltage [V] ..... 05…24
Structure and connections
Case with terminal strip C
Open frame with terminal strip ..... F
Open frame with connector ..... FC
Printed circuit board with connector ..... PC [1]

[1] For SWE 05, SWE 10, SWE 15

Example: SWE 15-12 F = AC-DC converter providing 12 V/1.3 A and configured as open frame with terminal strip.

Functional Description

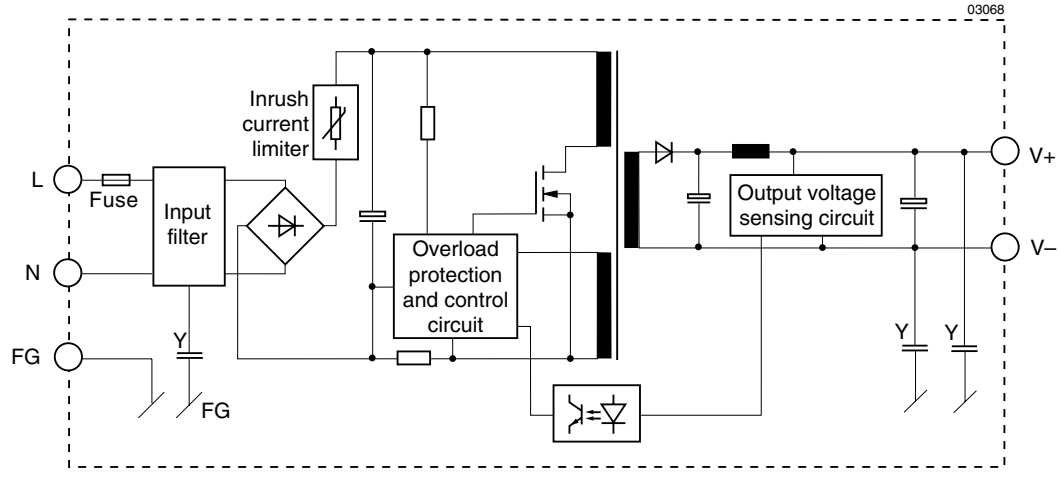

Fig. 1
Block diagram SWE 05/10/15

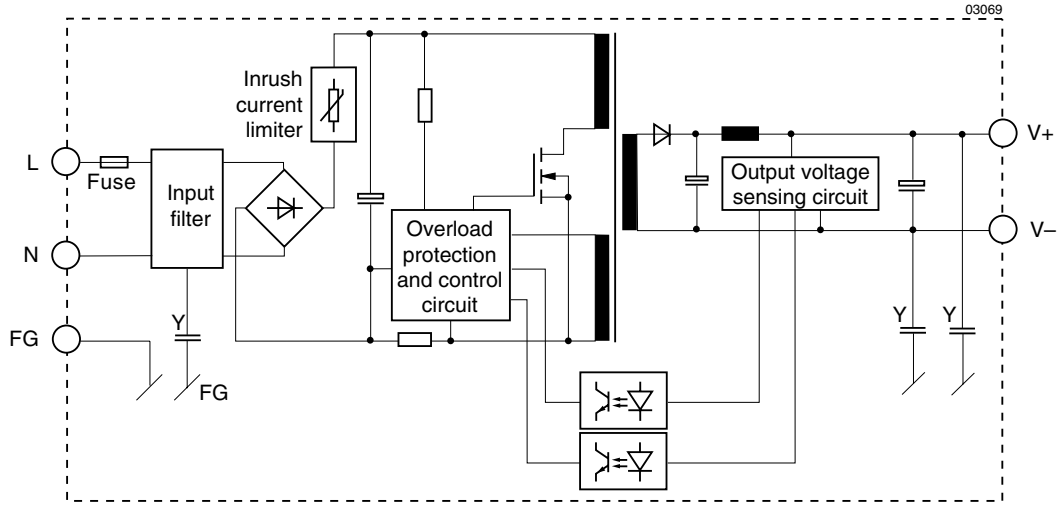

Fig. 2
Block diagram SWE 30

Electrical Input Data

General Condition: T_A = 25 °C unless otherwise specified

Table 2: Input data

Characteristics			SWE 05-..	SWE 10-..	SWE 15-..	SWE 30-..	Unit
$U_{i\ rated}$	Rated input voltage		100-120/200-240				V AC
U_i	Input range voltage		85...264				
f_i	Line frequency		47...63				Hz
I_i	Input current [1]	100/200 V AC	0.12/0.06	0.24/0.12	0.36/0.17	0.7/0.5	A
I_{inr}	Inrush current (max.) [1]	100/200 V AC	30/60	30/60	30/60	45/90	
$I_{i\ leak}$	Leakage current (max.)	120/240 V AC	0.5/0.75				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 5 W types

Characteristics			SWE 05-05..	SWE 05-12..	Unit
$U_{o\ nom}$	Output voltage	nom.	5	12	V
	Adjustable voltage range		±10		%
$I_{o\ nom}$	Rated output current		1	0.42	A
I_o	Output current	min./max.	0...100		%
U_o	Ripple-noise [1]	max.	120		mVpp
$\Delta U_{o\ U}$	Line regulation	85...264 V	±3		%
$\Delta U_{o\ I}$	Load regulation	0...100%	±3		
$\Delta U_{o\ t}$	Drift (t = 0.5...8 h)	typ.	±3		
α_{Uo}	Change in temp.	0...50 °C	±3		
$I_{o\ L}$	Output current limitation [2]		105		
$U_{o\ P}$	Overvoltage protection	max.	not available		
	Remote sensing		not available		
	Output indicator		LED on PCB		
$t_{o\ r}$	Rise time [1]	max.	30	100	ms
$t_{o\ h\ min}$	Hold up time [1]	100 V AC	15		
η	Efficiency [1]	typ.	70	75	%

[1] At $U_{i\ rated}$ and $I_{o\ nom}$
[2] Constant current method, automatic recovery

General Condition: T_A = 25°C unless otherwise specified

Table 3b: Output data 10 W types

Characteristics		SWE 10-05..	SWE 10-12..	SWE 10-15..	SWE 10-24..	Unit
$U_{o\,nom}$	Output voltage nom.	5	12	15	24	V
	Adjustable voltage range	±10				%
$I_{o\,nom}$	Rated output current	2.0	0.83	0.67	0.42	A
I_o	Output current min./max.	0...100				%
U_o	Ripple-noise [1] max.	120	120	150	200	mVpp
$\Delta U_{o\,U}$	Line regulation 85...264 V	±3				%
$\Delta U_{o\,I}$	Load regulation 0...100%	±3				
$\Delta U_{o\,t}$	Drift (t = 0.5...8 h) typ.	±3				
α_{Uo}	Change in temp. 0...50°C	±3				
$I_{o\,L}$	Output current limitation [2]	105				
$U_{o\,P}$	Overvoltage protection max.	not available				
	Remote sensing	not available				
	Output indicator	LED on PCB				
$t_{o\,r}$	Rise time [1] max.	30	100	150	200	ms
$t_{o\,h\,min}$	Hold up time [1] 100 V AC	15				
η	Efficiency [1] typ.	70	75	75	75	%

Table 3c: Output data 15 W types

Characteristics		SWE 15-05..	SWE 15-12..	SWE 15-15..	SWE 15-24..	Unit
$U_{o\,nom}$	Output voltage nom.	5	12	15	24	V
	Adjustable voltage range	±10				%
$I_{o\,nom}$	Rated output current	3	1.3	1	0.63	A
I_o	Output current min./max.	0...100				%
U_o	Ripple-noise [1] max.	120	120	150	200	mVpp
$\Delta U_{o\,U}$	Line regulation 85...264 V	±3				%
$\Delta U_{o\,I}$	Load regulation 0...100%	±3				
$\Delta U_{o\,t}$	Drift (t = 0.5...8 h) typ.	±3				
α_{Uo}	Change in temp. 0...50°C	±3				
$I_{o\,L}$	Output current limitation [2]	105				
$U_{o\,P}$	Overvoltage protection max.	not available				
	Remote sensing	not available				
	Output indicator	LED on PCB				
$t_{o\,r}$	Rise time [1] max.	30	100	150	200	ms
$t_{h\,min}$	Hold up time [1] 100 V AC	15				
η	Efficiency [1] typ.	70	75	75	75	%

[1] At $U_{i\,rated}$ and $I_{o\,nom}$
[2] Constant current method, automatic recovery

General Condition: T_A = 25°C unless otherwise specified

Table 3d: Output data 30 W types

Characteristics		SWE 30-05..	SWE 30-12..	SWE 30-15..	SWE 30-24..	Unit
$U_{o\,nom}$	Output voltage nom.	5	12	15	24	V
	Adjustable voltage range	±10				%
$I_{o\,nom}$	Rated output current	6	2.5	2	1.3	A
I_o	Output current min./max.	0...100				%
U_o	Ripple-noise [1] max.	120	120	150	200	mVpp
$\Delta U_{o\,U}$	Line regulation 85...264 V	±3				%
$\Delta U_{o\,I}$	Load regulation 0...100%	±3				
$\Delta U_{o\,t}$	Drift (t = 0.5…8 h) typ.	±3				
α_{Uo}	Change in temp. 0....50°C	±3				
$I_{o\,L}$	Output current limitation [2]	105				
$U_{o\,P}$	Overvoltage protection max.	6.9	15.5	20	31	V
	Remote sensing	not available				
	Output indicator	LED on PCB				
$t_{o\,r}$	Rise time [1] max.	30	100	150	200	ms
$t_{o\,h\,min}$	Hold up time [1] 100 V AC	15				
η	Efficiency [1] typ.	70	75	75	75	%

[1] At $U_{i\,rated}$ and $I_{o\,nom}$
[2] Constant current method, automatic recovery

Input and Output Terminals

Table 4: Input and output terminals

Terminal	Function	Explanation
L (line) N (neutral)	Input terminal	• Connect to AC of 85 to 264 V, sine wave, single phase • Space the AC input line as far as possible from the DC output line.
FG	Frame ground terminal	• For frame grounding, connect to ground of main chassis.
+V –V	Output terminal Output terminal	• Output voltage.

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 if mounting method A is used.

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.

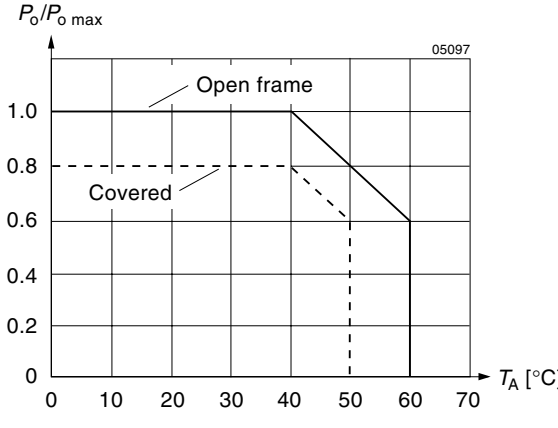

Fig. 3
Maximum allowed output power versus ambient temperature with mounting method A

Series and Parallel Connection

The outputs of the SWE modules cannot be operated in series or parallel connection.

Electromagnetic Compatibility (EMC)

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 SWE series has been successfully tested to the following specifications:

Electromagnetic Immunity

Table 5: Immunity type tests

Phenomenon	Standard [1]	Level	Coupling mode [2]	Value applied	Waveform	Source imped.	Test procedure	In oper.	Perform. [3]
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	[4]
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	[4]
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 transients per coupling mode	yes	[4]
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	[4]

[1] Related and previous standards are referenced in: *Technical Information: Standards*.
[2] i = input, o = output, c = case.
[3] A = Normal operation, no deviation from specifications, B = Temporary deviation from specs possible.
[4] Normal operation, no deviation from specifications.

Electromagnetic Emissions

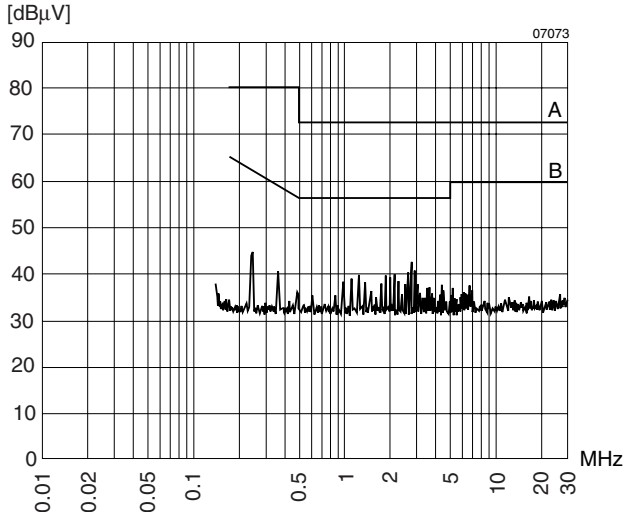

Fig. 4
Typical disturbance voltage (quasi-peak) at the input according to CISPR 11/22 and EN 55011/22, measured at $U_{i\,nom}$ and $I_{o\,nom}$. e.g. SWE 05-05FC

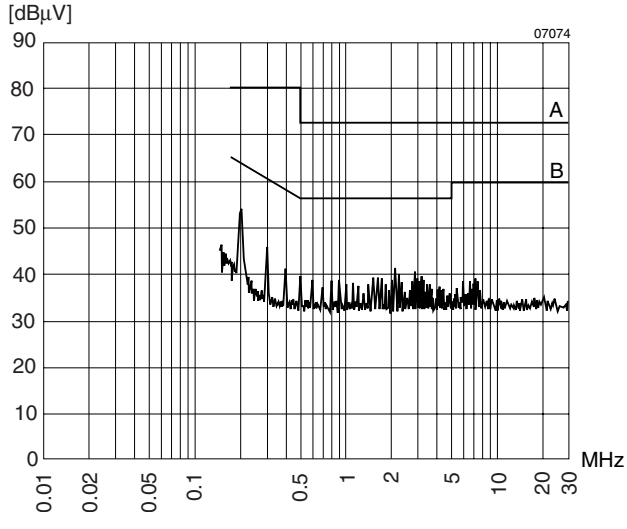

Fig. 5
Typical disturbance voltage (quasi-peak) at the input according to CISPR 11/22 and EN 55011/22, measured at $U_{i\,nom}$ and $I_{o\,nom}$. e.g. SWE 10-05FC

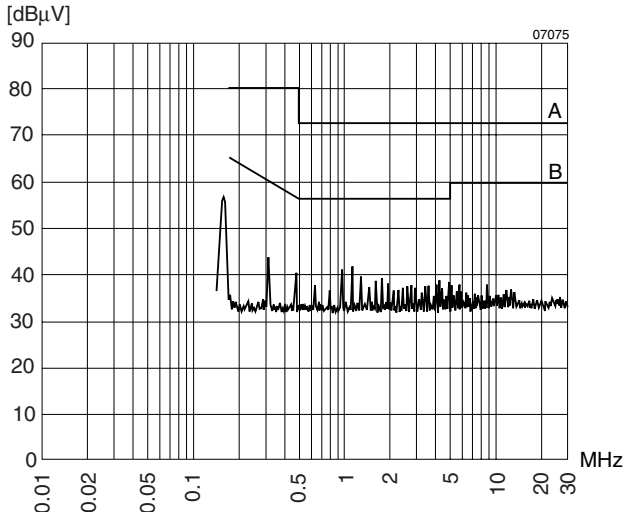

Fig. 6
Typical disturbance voltage (quasi-peak) at the input according to CISPR 11/22 and EN 55011/22, measured at $U_{i\,nom}$ and $I_{o\,nom}$. e.g. SWE 15-05FC

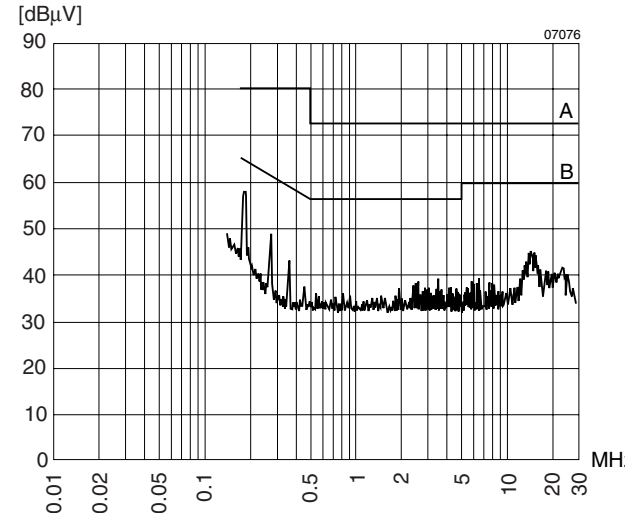

Fig. 7
Typical disturbance voltage (quasi-peak) at the input according to CISPR 11/22 and EN 55011/22, measured at $U_{i\,nom}$ and $I_{o\,nom}$. e.g. SWE 30-05FC

Immunity to Environmental Conditions

Table 6: Mechanical stress

Test		Parameters	
Ca	Humidity (no dew condensation)	Relative humidity:	30...85 % Unit operating/storage
Ea	Shock	Acceleration: Bump duration: Number of bumps:	20 g (196.2 m/s^2) 11 ms, ±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 (19.6 m/s^2) 3 h (1 h each axis) Unit not operating

Table 7: Temperature specifications

Characteristic		min	max	Unit
T_A	Operating ambient temperature range without derating (see: *Thermal Considerations*)	0	40	°C
	Operating ambient temperature range with derating (see: *Thermal Considerations*)	0	60	
T_S	Storage temperature range	–20	75	

Table 8: MTBF Values

MTBF	Type	Ground Benign T_C =25 °C
According to MIL-HDBK-217D	SWE 05	193'000 h
	SWE 10	163'000 h
	SWE 15	156'000 h
	SWE 30	114'000 h

Mechanical Data

Dimensions in mm. Tolerance: ±1mm unless otherwise indicated.

European Projection

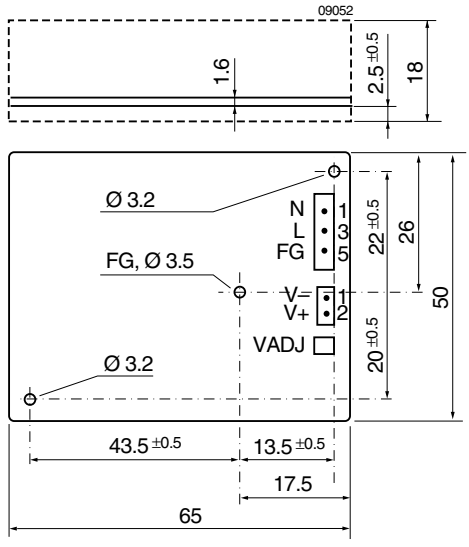

Fig. 9
SWE 05 (PCB), weight: 50 g

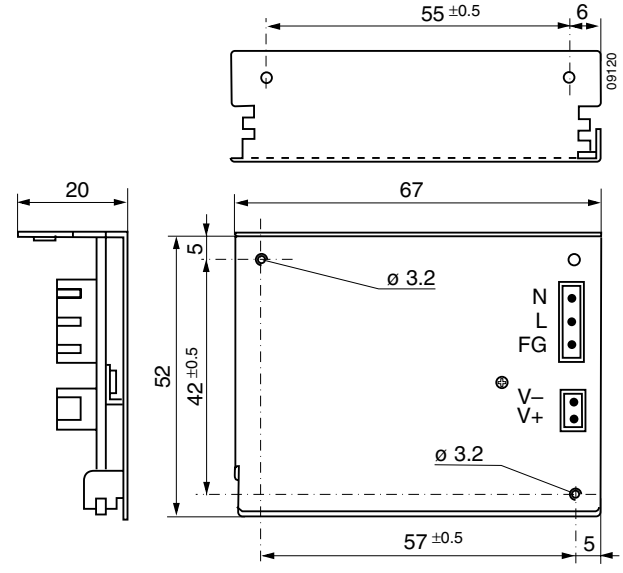

Fig. 10
SWE 05 (open frame with connector), weight: 100 g

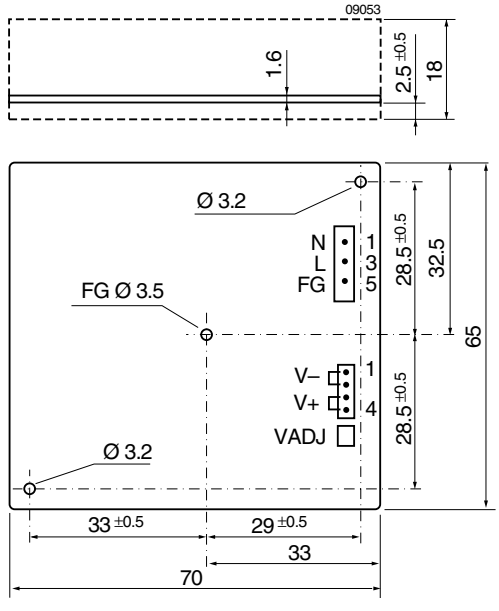

Fig. 9
SWE 10 (PCB), weight: 60 g

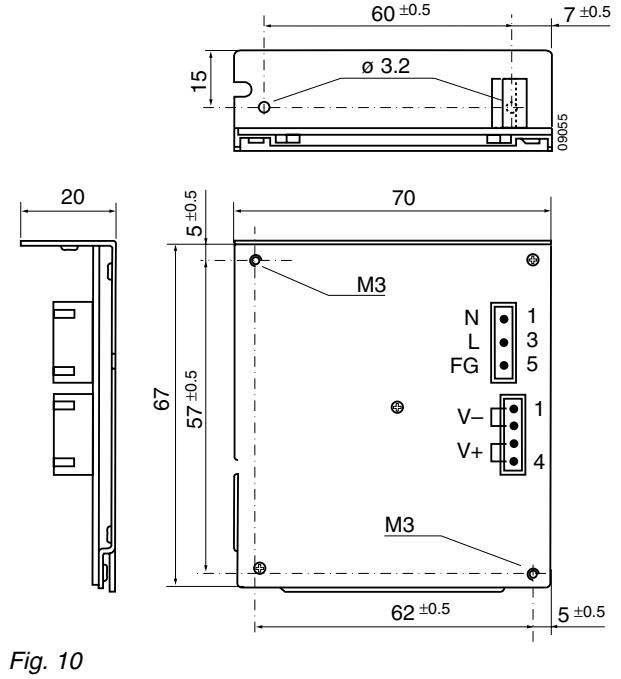

Fig. 10
SWE 10 (open frame with connector), weight: 150 g

Note: When a SWE power supply is mounted from bottom side, the screw shall not be longer than 6 mm.

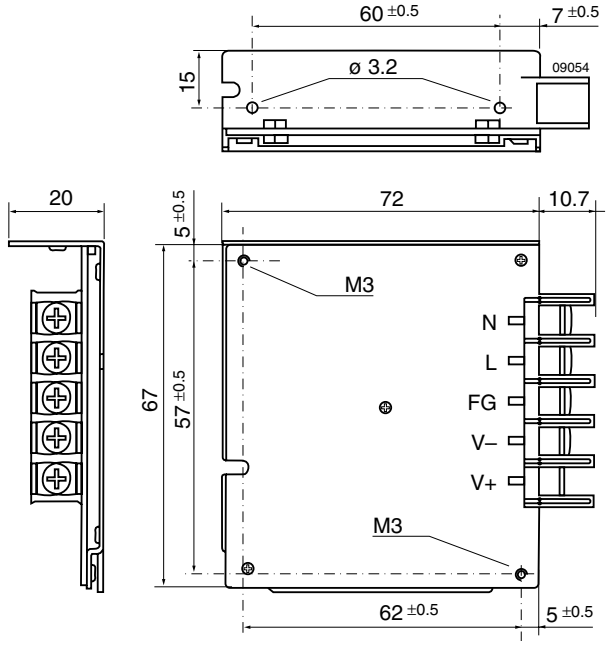

Fig. 11
SWE 10 (with terminal strip open or covered), weight: 150 g

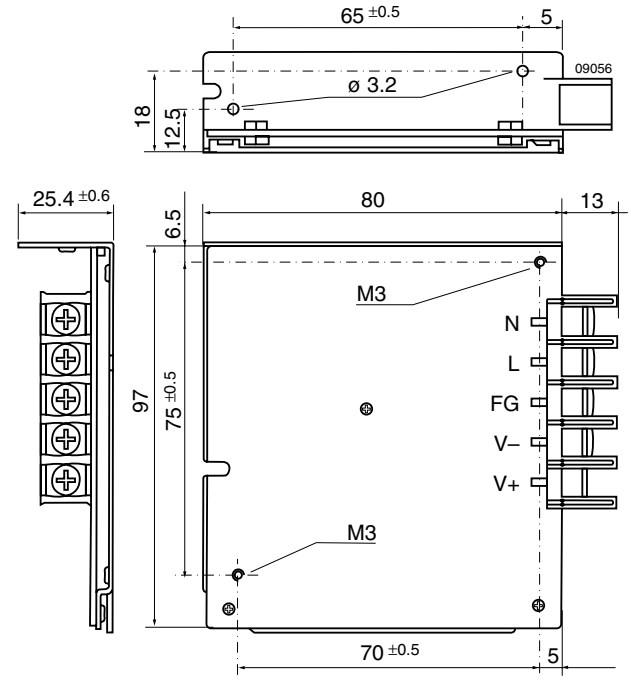

Fig. 12
SWE 15 (open frame), weight: 220 g

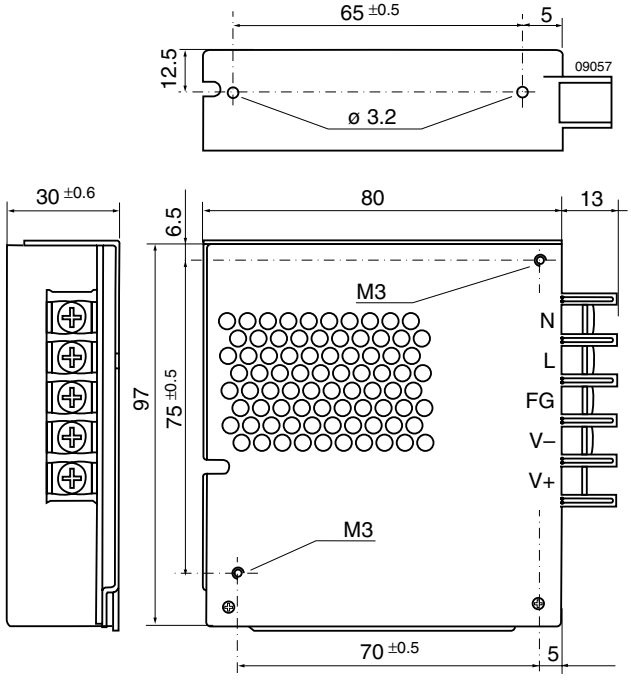

Fig. 13
SWE 15 (covered with terminal strip), weight: 220 g

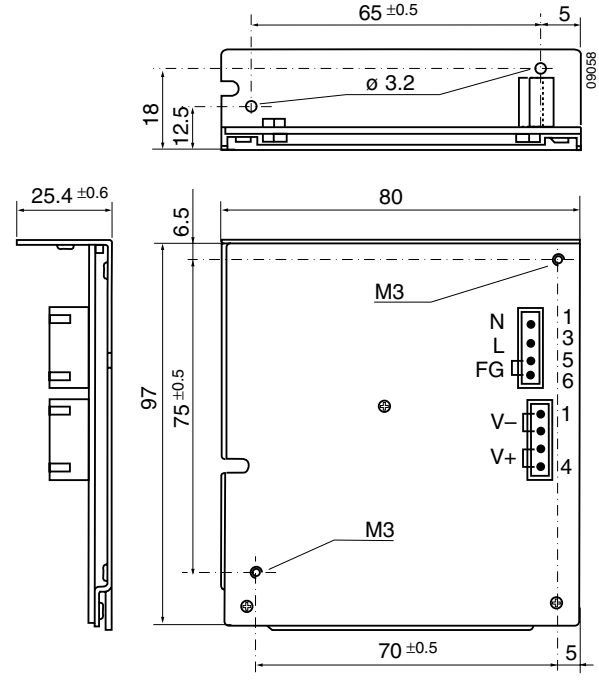

Fig. 14
SWE 15 (open frame) with connector), weight: 220 g

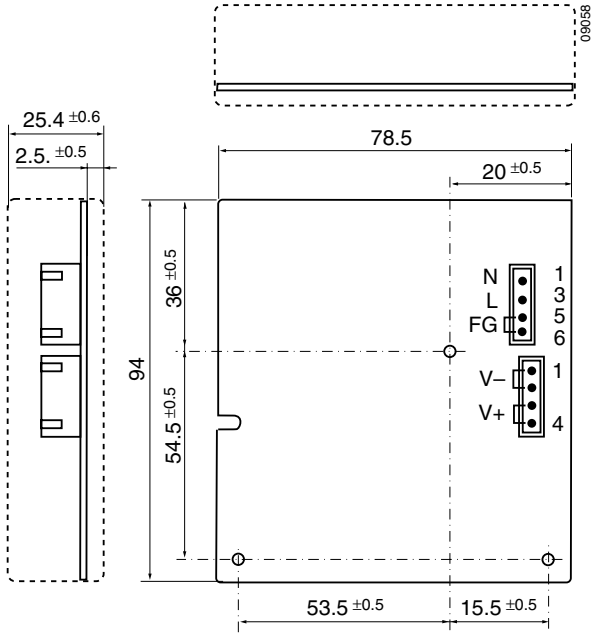

Fig. 15
SWE 15 (PCB), weight: 100 g

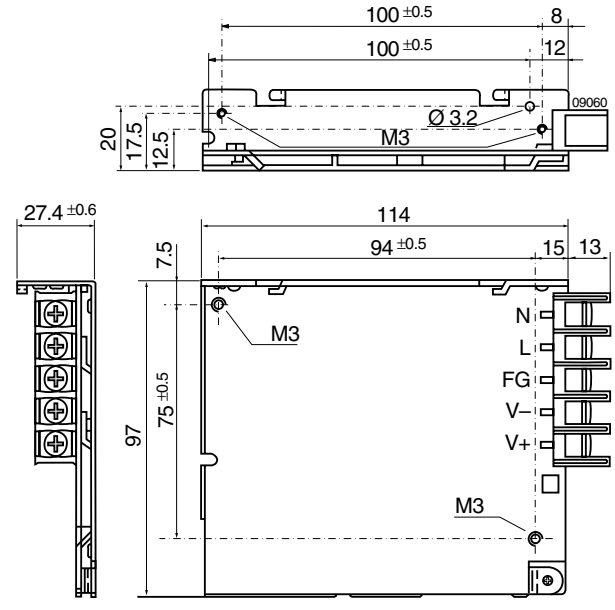

Fig. 16
SWE 30 (open frame), weight: 250 g

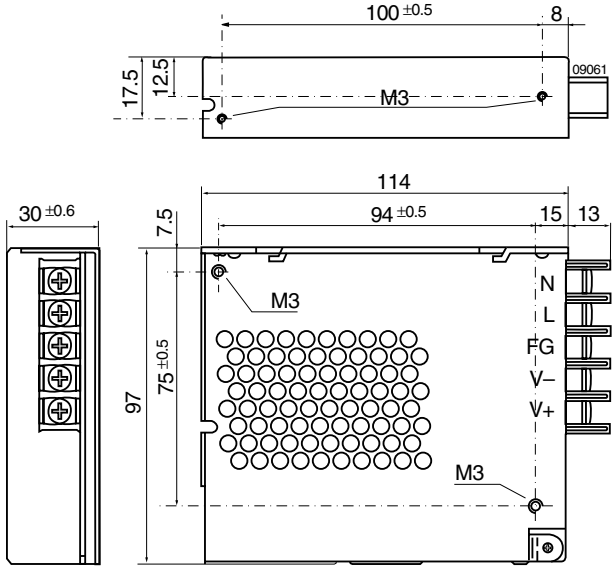

Fig. 17
SWE 30 (covered with terminal strip), weight: 250 g

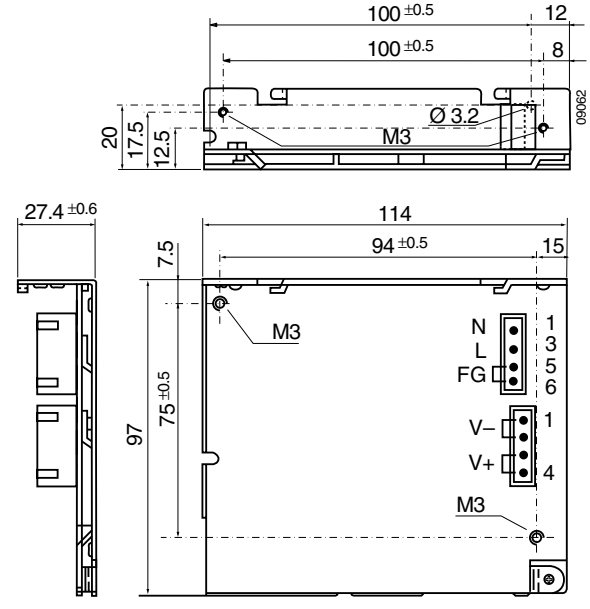

Fig. 18
SWE 30 (open frame with connectors), weight: 250 g

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

Care should be taken that there is sufficient air convection around the power supply unit.

Whenever possible, forced air cooling is recommended to obtain a higher reliability.

For open frame or covered structures:

a) Horizontal mounting: Use tapped holes at bottom side of the frame for fastening to the chassis. Use M3 screws with torque at less than 5 kpcm. Screw length should not damage the insulation.

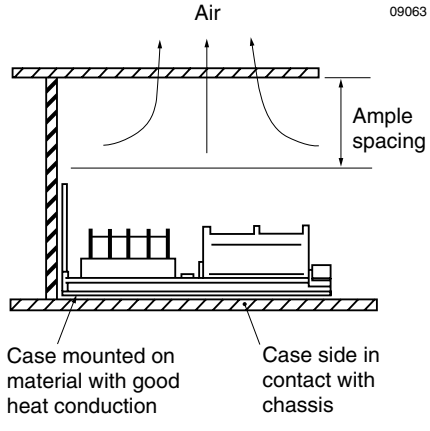

Fig. 19
Hoirizontal mounting

b) Vertical mounting: Holes are provided on the flange; M3 screws should be used.

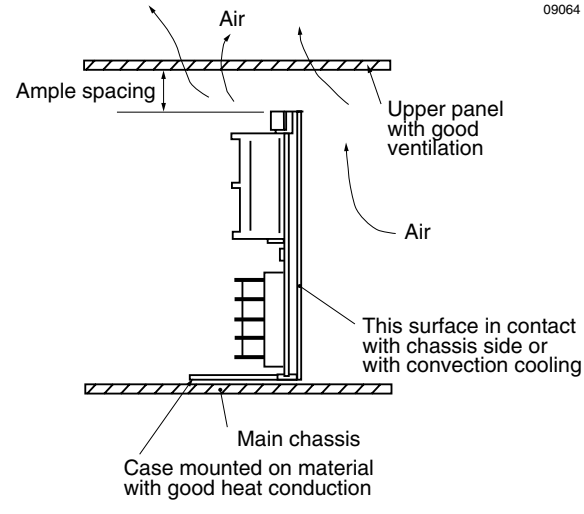

Fig. 20
Vertical mounting

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.

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 C22.2 No. 950-95 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. Melcher 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	2.0	3.0 [1]	-	kV_{rms}
	2.8	4.2 [1]	-	kV DC
Insulation resist. at 500 V DC	-	>100	>100	MΩ
Leckage 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

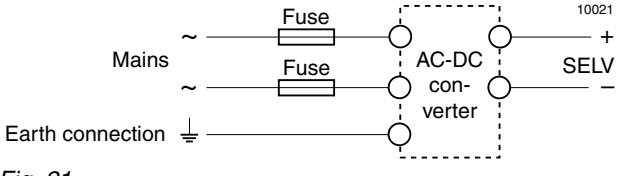

Fig. 21
Schematic safety concept
Use fuses and earth connection as per: Installation Instructions *and table:* Safety concept leading to an SELV output circuit.

Table 11: Safety approvals

Safety Approvals	UL 1950	CSA 1402	TÜV [1]
SWE 05/10/15/30	x	x	x

[1] EN 60950

Accessories

Table 12: Connector kit specification

Type	Connector kit designation	Input housing	Qty.	Contacts	Qty.	Output housing	Qty.	Contacts	Qty.
SWE 05	MLCK03	XHP-5	1	SXH-001T-P0.1	3	XHP-2	1	SXH-001T-P0.1	2
SWE 10	MLCK04	XHP-5	1	SXH-001T-P0.1	3	XHP-4	1	SXH-001T-P0.1	4
SWE 15	MLCK05	VHR-6N	1	SVH-21T-P1.1	3	VHR-4N	1	SVH-21T-P1.1	4
SWE 30	MLCK05	VHR-6N	1	SVH-21T-P1.1	3	VHR-4N	1	SVH-21T-P1.1	4

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

Position at	Name of cable kit	Power supply	Material | Length Cross section	Wire color				
				+V	–V	FG	L	N
AC input side	CB-19	SWE 05 SWE 10	UL 1430 | 60 cm AWG 22 ≈ 0.34 mm^2	–	–	Green (5)	Black (3)	White (1)
	CB-24	SWE 15 SWE 30	UL 1015 | 60 cm AWG 20 ≈ 0.5 mm^2	–	–	Green (5, 6)	Black (3)	White (1)
DC output side	CB-20	SWE 05	UL 1430 | 60 cm AWG 22 ≈ 0.34 mm^2	Red (2)	Black (1)	–	–	–
	CB-21	SWE 15 SWE 30	UL 1430 | 60 cm AWG 18 ≈ 1 mm^2	Red (3, 4)	Black (1, 2)	–	–	–
	CB-25	SWE 10	UL 1430 | 60 cm AWG 22 ≈ 0.34 mm^2	Red (3, 4)	Black (1, 2)	–	–	–