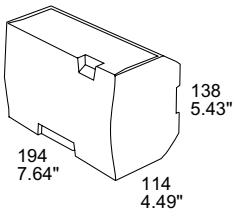

RoHS Compliant

Features

- RoHS lead-free-solder and lead-solder-exempted products are available
- Rugged 35 mm DIN-rail snap-fit design
- Class I equipment
- Universal AC-input with single stage conversion AC to DC or DC input of 90 to 350 V
- Power factor correction, harmonics IEC/EN 61000-3-2
- Virtually no inrush current
- Immunity to IEC/EN 61000-4-2, -3, -4, -5, -6, -11
- Emissions according to EN 55011/022
- Very high efficiency; up to 89%
- Short-term output peak power capability, rectangular current limiting characteristic
- Single or two independently regulated outputs with 24, 36, or 48 V
- Outputs no-load, overload, and short-circuit proof
- PCBs protected by lacquer
- Very high reliability

Safety according to IEC/EN 60950-1, UL/CSA 60950-1, IEC/EN 50178, IEC 61010-1, UL 508

Description

The Convert Select front end series represents a family of DIN-rail mountable AC-DC and DC-DC converters with power factor correction. The converters have been designed according to the latest industry requirements and standards. They are ideal for use in outdoor and other demanding applications to power building control systems, factory automation, industrial controls, instrumentation, electro-magnetic drives, fans, and other DC loads. Different models are available with a single output or two independently regulated, electrically isolated outputs with 24, 36, or 48 V. Special models for battery charging are available.

Key features of the Convert Select line include power factor correction with low harmonic distortion, negligibly low inrush current, high immunity to transients and surges, and low electromagnetic emissions. Internal protection circuits such as input over- and undervoltage lockout, thermal protection, as well as output overvoltage protection by a second control loop ensure safe operation of the final system.

The outputs deliver an electrically-isolated Safety Extra Low Voltage, SELV, (except models LXR/LXN1740) and low output noise. They are no-load, overload, and short-circuit proof. The electronically controlled short-term peak power capability of up to 150% of the rated output power enables the front end converters to deliver additional power to start-up motors or to safely operate subsequent circuit breakers. Built-in large sized output capacitors absorb possible reverse energy, which may be caused by quick deceleration of electromagnetic drives connected directly to the output. A green LED at the front cover displays the status of the output(s).

The Convert Select Series was designed according to all relevant international safety standards. The converters are approved by TÜV and UL, and are UL 508 listed. Adequate clearances and creepage distances allow operation in pollution degree 3 environment (with AC input). All board assemblies are coated with a protective lacquer.

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The thermal concept allows operation at full load up to an ambient temperature of 60 °C in free air without forced cooling. A rugged DIN snap-fit device allows easy and reliable fixing onto the various 35 mm DIN-rail models. The converters are fitted with cage clamp terminals easily accessible from the front. System connectors with screw terminals for use with pre-assembled harnesses, external adjustment of the output voltage, as well as various auxiliary functions are available as options.

Model Selection

Table 1: Standard models

Output 1 $V_{o1\ nom}$[1] [VDC]	Output 1 $I_{o1\ nom}$ [A]	Output 2 $V_{o2\ nom}$[1] [VDC]	Output 2 $I_{o2\ nom}$ [A]	Output Power $P_{o\ nom}$ [W]	Operating Input Voltage $V_{i\ min}$ - $V_{i\ max}$	Type Designation	Effic. η_{min}[7] [%]	Options [3, 5]
24.7	15	-	-	371	85[2] – 264 VAC, 47 – 63 Hz[4], 90[2] – 350 VDC[6]	LXR1601-6	87	R, D1, D2, D5, M1, M2, F, K2, G
24.7	20	-	-	494		LXN1601-6	87	
37	10	-	-	370		LXR1701-6[3]	88	
37	13.4	-	-	496		LXN1701-6[3]	88	
49.4	7.5	-	-	371		LXR1801-6	88	
49.4	10	-	-	494		LXN1801-6	88	
24.7	10	24.7	10	494		LXN2660-6	87	
37	6.7	37	6.7	496		LXN2770-6[3]	88	
49.4	5	49.4	5	494		LXN2880-6	88	

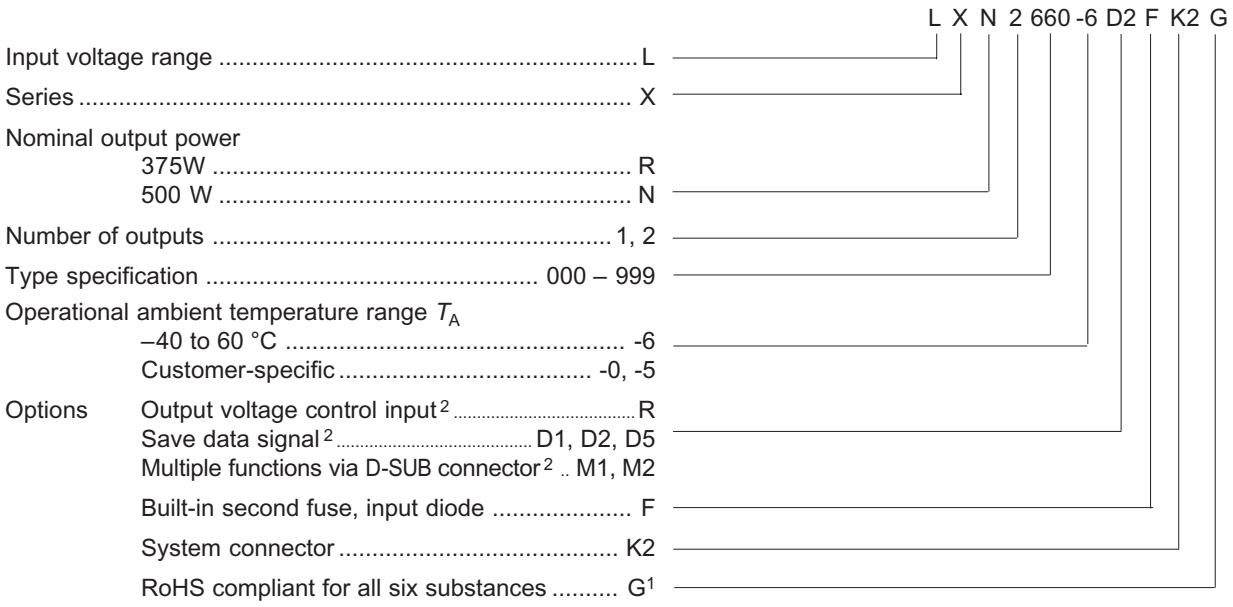
1 R-input not connected.
2 For derating at low input voltage see section *Output Power Derating.*
3 For minimum quantity and lead times contact Power-One.
4 The converters have been tested up to 440 Hz; for operating frequencies <47 Hz or >63 Hz contact Power-One.
5 On double-output models the options R, M2, D1, D2, D5 are related to the second output only.
6 $V_i \leq 250$ VDC for models with option F
7 Min. efficiency at $V_{i\ nom}$, $I_{o\ nom}$, and T_A = 25 °C. Typical values are approx. 2% better.

Table 2: Battery charger models (M1 included)

Output Voltage V_{Bat} [VDC]	Output Voltage $V_{o\ safe}$[1] [VDC]	Output Voltage $V_{o\ max}$ [VDC]	Nominal Output Values $V_{o\ nom}$[5] [VDC]	Nominal Output Values $I_{o\ nom}$[5] [A]	Nominal Output Values $P_{o\ nom}$[5] [W]	Operating Input Voltage $V_{i\ min}$ - $V_{i\ max}$	Type Designation	Effic. η_{min}[7] [%]	Options [3]
24	25.68[1]	29.3	27.3	12.6	344	85[2] – 264 VAC, 47 – 63 Hz[4], 90[2] – 350 VDC[6]	LXR1240-6M1	87	F, K2, G
				16.8	458		LXN1240-6M1	87	
36	38.52[1]	43.95	40.88	8.4	343		LXR1840-6M1[3]	87	
				11.2	458		LXN1840-6M1[3]	87	
48	51.36[1]	58.6	54.5	6.3	343		LXR1740-6M1	87	
				8.4	458		LXN1740-6M1	87	

1 Setting voltage (typ.) with open R-input
2 For derating at low input voltage see section *Output Power Derating*.
3 For minimum quantity and lead times consult Power-One.
4 The converters have been tested up to 440 Hz; for operating frequency <47 Hz or >63 Hz contact Power-One.
5 Nominal output figures, calculated with a cell voltage of 2.27 V at 20 °C.
6 $V_i \leq 250$ VDC for models with option F.
7 Min. efficiency at $V_{i\ nom}$, $V_{o\ nom}$, $I_{o\ nom}$, and T_A = 25 °C. Typical values are approx. 2% better.

Part Number Description



[1] G is always placed at the end of the part number. Consult Power-One for availability!
[2] Only one of these options is possible.

Example: LXN2660-6D2FK2G: Power factor corrected AC-DC converter, operating input voltage range 85 – 264 VAC, 2 electrically isolated and individually regulated outputs, each providing 24.7 V, 10 A, options D2, F, K2, and RoHS-compatible for all 6 substances.

Product Marking

Basic type designation, applicable safety approval and recognition marks, CE mark, warnings, pin designation, Power-One company logo.

Specific type designation, input voltage range, nominal output voltages and currents, degree of protection, batch and serial number, data code including production site, version, date of production.

Models with four powertrains have one or two outputs. Double-output models exhibit individual control of each output.

The input voltage is fed via fuse, filter, and rectifier to the powertrains with main transformers designed in planar technique. The input filter with very small input capacitance generates virtually no inrush current. An input transient suppressor protects the converter against high voltage peaks and surges. Input over- and undervoltage lockout as well as input current limitation protect the converter from operation outside of its specification. The input voltage waveform is sensed by the primary control logic to allow active power factor correction, forcing the input current to follow the input voltage waveform.

The secondary side of each main transformer supplies via the rectifier diode a large electrolytic output storage capacitor providing for the hold-up time. Double-output models exhibit an individual control logic for each output. The output voltage and the output current are measured and fed back to the primary control logic via an optocoupler. A second control loop monitors the output voltage. It disables the output in the case of a failure in the control logic and limits the output voltage.

Built-in temperature sensors monitor the internal temperature of each powertrain. If the temperature exceeds the limit, the converter reduces the output power continuously to keep the temperature below its limit. A green LED on the front cover confirms the presence of the output voltage(s).

The R input (option R, M1, or M2) allows for external adjustment of the output voltage by means of a resistor or an external voltage source. An external sensor can be connected to the R input and allows for temperature-controlled battery charging; see *Accessories*.

Electrical Input Data

General conditions:
T_A = 25 °C, unless T_C is specified.

Table 3: Input data LW models

Input			LXR						LXN						Unit
			AC-Input			DC-Input			AC-Input			DC-Input			
Characteristic		Conditions	min	typ	max	min	typ	max	min	typ	max	min	typ	max	
V_i	Operating input voltage range	I_o = 0 – $I_{o\,nom}$ T_c – $T_{c\,max}$	85 [2]		264	90 [2]		350 [3]	85 [2]		264	90 [2]		350 [3]	V
$V_{i\,nom}$	Rated input volt. range		100	(230)	240		220		100	(230)	240		220		
f_i	Rated input frequency [1]			50 – 60			--			50 – 60			--		Hz
I_i	Input current	$I_{o\,nom}$, V_i = $V_{i\,nom}$ $I_{o\,nom}$, V_i = $V_{i\,min}$		1.9 5.2			1.95 5.0			2.6 7.0			2.6 6.6		A
P_{i0}	No-load input power	$V_{i\,min}$ – $V_{i\,max}$		3			3			3			3		W
I_{inrush}	Inrush current	$V_{i\,max}$, t > 0.1 ms		5			5			5			5		A
C_i	Input capacitance			5			5			6			6		µF
PF	Power factor	$V_{i\,nom}$ = 230 V, $I_{o\,nom}$	0.90				--		0.90				--		
$V_{i\,RFI}$	Conducted input RFI	EN 55011/55022 $V_{i\,nom}$, $I_{o\,nom}$		A			A			A			A		
	Radiated input RFI														
f_{switch}	Switching frequency			130			130			130			130		kHz

[1] For operating frequencies <47 Hz and >63 Hz contact Power-One. The converters have been tested up to 440 Hz.
[2] Output power derating at low input voltage and/or high case temperature T_C; see *Output power derating*.
[3] $V_i \leq$ 250 VDC for models with option F.

Table 4: P_o derating according to UL 60950 at T_A = 60 °C, or according to UL 508 at T_{out} = 50 °C

Model	$P_{o\ nom}$	$T_{C\ max}$	Derate below		derate by
	[W]	[°C]	V_i [VAC]	V_i [VDC]	[W/V]
LXR1601-6	371	84	125	115	–1.8
LXR1701-6	370	84	125	115	–1.8
LXR1801-6	371	84	125	115	–1.8
LXN1601/2660-6	494	84	125	115	–2.5
LXN1701-6	496	84	125	115	–2.5
LXN1801/2880-6	494	84	125	115	–2.5

Table 5: P_o derating according to UL 60950 at T_A = 50 °C, or according to UL 508 at T_{out} = 40 °C

Model	$P_{o\ nom}$	$T_{C\ max}$	Derate below		derate by
	[W]	[°C]	V_i [VAC]	V_i [VDC]	[W/V]
LXR1601-6	371	78	100	no derating	–1.5
LXR1701-6	370	78	100	no derating	–1.5
LXR1801-6	371	78	100	no derating	–1.5
LXN1601/2660-6	494	78	100	no derating	–2
LXN1701-6	496	78	100	no derating	–2
LXN1801/2880-6	494	78	100	no derating	–2

Output Power Derating

The output power of LX models must be decreased at low input voltage and/or powertrain temperature above 125 °C.

The powertrain temperature depends on the output power, the input voltage, and the cooling method. At low input voltage the losses increase. At the maximum specified environment temperature T_A free air convection cooling might be insufficient. As a result, the output power has to be reduced according to the tables 4 and 5.

Note: The measurements have been made at the approval tests with free air convection cooling according to UL 60950, specified ambient temperature T_A, and with the converter built in a cardboard box according to UL 508 and a specified temperature outside the box T_{out}. The tables give a correlation between T_A or T_{out} and the case temperature T_C (measuring point T_C see *Mechanical Data*). For models not specified, please contact Power-One.

Input Fuse and Protection

A slow blow fuse (Schurter T 10A, 5 × 20 mm), protected by a sleeve, is connected in the line input. For DC input voltages above 250 V an external DC fuse or a circuit breaker must be installed; observe the *Installation Instructions*.

Converters with option F have 2 fuses, one in each input line. The DC input voltage for all converters with option F is limited to 250 V.

A VDR and a symmetrical input filter form an effective protection against input transients.

An under- and overvoltage lockout protects the converter, which is disabled below $V_{i\ min}$ and above $V_{i\ max}$ by an internally generated inhibit signal.

The built-in bridge rectifier provides reverse polarity protection at the input if operated from DC.

Efficiency

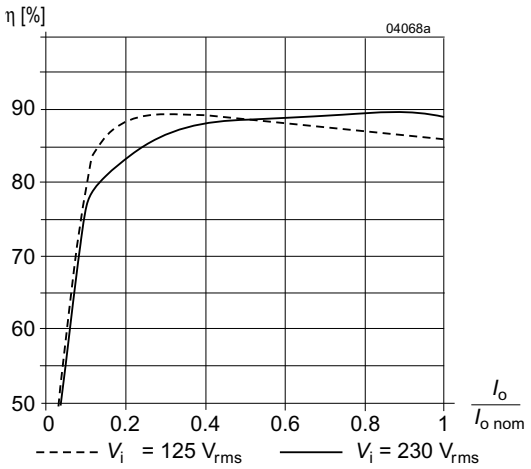


Fig. 3
Efficiency versus load

Power Factor, Harmonics

All converters feature active power factor correction.

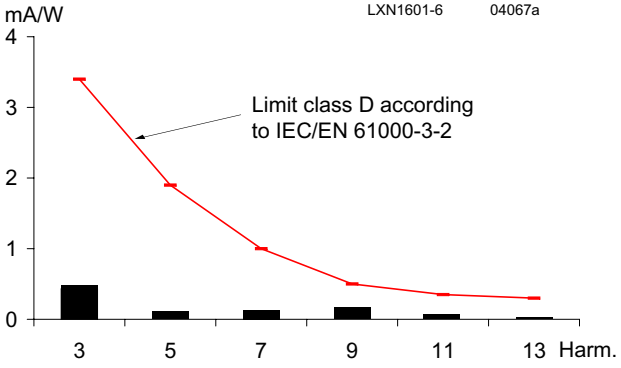


Fig. 4
Harmonic currents at input current, measured at V_i = 230 VAC, $I_o = I_{o\,nom}$ (LXN1601-6)

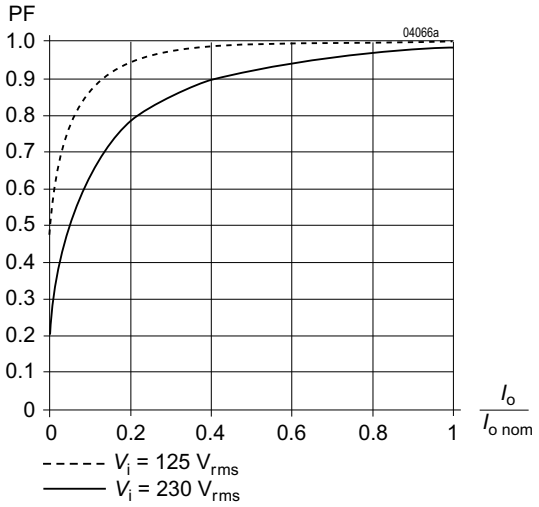


Fig. 5
Power factor versus load

Electrical Output Data

Table 6a: Output data of 375 Watt standard models. General conditions: T_A = 25 °C, unless T_A is specified; R input open-circuit

Model			LXR1601			LXR1701			LXR1801			Unit
Characteristic		Conditions	min	typ	max	min	typ	max	min	typ	max	
$V_{o\,nom}$	Output voltage nominal [1]	$V_{i\,nom}$, $I_{o\,nom}$	24.25	24.7	25.2	36.4	37	37.8	48.5	49.36	50.4	V
		*	24.4	24.7	25.0	36.6	37	37.5	48.8	49.36	50.0	
$V_{o\,worst}$	Output voltage range of tolerance	$V_{i\,min}$ – $V_{i\,max}$, I_o = (0.1 – 1) $I_{o\,nom}$	24.0		25.8	36.0		38.7	48.0		51.6	
$V_{o\,L}$	Overvoltage protection		28.5		30	42.7		45	57		60	
$P_{o\,nom}$	Nominal output power			371			370			371		W
$I_{o\,nom}$	Output current nominal			15			10			7.5		A
$I_{o\,L}$	Output current limit [3]	$V_{i\,min}$ – $V_{i\,max}$	15.1		17.2	10.2		11.4	7.65		8.7	
I_{op}	Output current boost [4]	typ. 1 s		22.5			15			11.3		
v_o	Ripple and noise	V_i = 230 VAC, f_i = 50 Hz, $I_{o\,nom}$		100			100			100		mV_{pp}
				1100 [2]			1200 [2]			1200 [2]		
$\Delta V_{o\,u}$	Static line regulation	$V_{i\,min}$ – $V_{i\,max}$, $I_{o\,nom}$		±0.1			±0.15			±0.15		V
$\Delta V_{o\,l}$	Static load regulation	$V_{i\,nom}$, I_o = (0.1 – 1) $I_{o\,nom}$		–0.4			–0.6			–0.8		
v_{od}	Dynamic load regulation Voltage deviation and recovery time	$V_{i\,nom}$, I_o = (0.5 ↔ 1) $I_{o\,nom}$		±1.2			±1.5			±1.8		
				40			80			80		ms
αv_o	Temperature coefficient	$T_{C\,min}$ – $T_{C\,max}$		±0.02			±0.02			±0.02		%/K
t_{or}	Start-up time	V_i = 0 → $V_{i\,nom}$, $I_{o\,nom}$		700			700			700		ms
$t_{oh\,min}$	Hold-up time	$I_{o\,nom}$, $V_{o\,nom}$ → 0.8 $V_{o\,nom}$		15			20			25		

* Converters with version V105 or higher
1 Setting voltage with open R-input
2 Superimposed low frequency ripple at 2 • f_i
3 Rectangular current limit characteristic (continuous operation)
4 Short-term peak power capability 150% of $P_{o\,nom}$ for approx. 1 s

Table 6b: Output data of 500 Watt single-output standard models. General conditions as per table 6a.

Model				LXN1601			LXN1701			LXN1801			Unit
Characteristic		Conditions		min	typ	max	min	typ	max	min	typ	max	
$V_{o\,nom}$	Output voltage nominal [1]	$V_{i\,nom}$, $I_{o\,nom}$		24.25	24.7	25.2	36.4	37	37.8	48.5	49.36	50.4	V
			*	24.4	24.7	25.0	36.6	37	37.5	48.8	49.36	50.0	
$V_{o\,worst}$	Output voltage range of tolerance	$V_{i\,min} - V_{i\,max}$, $I_o = (0.1 - 1)\ I_{o\,nom}$		24.0		25.8	36.0		38.7	48.0		51.6	
$V_{o\,L}$	Overvoltage protection			28.5		30	42.7		45	57		60	
$P_{o\,nom}$	Nominal output power				494			496			494		W
$I_{o\,nom}$	Output current nominal				20			13.4			10		A
$I_{o\,L}$	Output current limit [3]	$V_{i\,min} - V_{i\,max}$		20.2		22.8	13.5		15.2	10.1		11.4	
I_{op}	Output current boost [4]	typ. 1 s			30			20			15		
v_o	Ripple and noise	V_i = 230 VAC, f_i = 50 Hz, $I_{o\,nom}$			100			100			100		mV_{pp}
			2		1100 [2]			1200 [2]			1200 [2]		
$\Delta V_{o\,u}$	Static line regulation	$V_{i\,min} - V_{i\,max}$, $I_{o\,nom}$			±0.1			±0.15			±0.15		V
$\Delta V_{o\,l}$	Static load regulation	$V_{i\,nom}$, $I_o = (0.1 - 1)\ I_{o\,nom}$			−0.4			−0.6			−0.8		
v_{od}	Dynamic load regulation	$V_{i\,nom}$, $I_o = (0.5 \leftrightarrow 1)\ I_{o\,nom}$			±1.2			±1.5			±1.8		
	Voltage deviation and recovery time				40			80			80		ms
αv_o	Temperature coefficient	$T_{C\,min} - T_{C\,max}$			±0.02			±0.02			±0.02		%/K
t_{or}	Start-up time	$V_i = 0 \rightarrow V_{i\,nom}, I_{o\,nom}$			700			700			700		ms
$t_{oh\,min}$	Hold-up time	$I_{o\,nom}, V_{o\,nom} \rightarrow 0.8\ V_{o\,nom}$			15			20			25		

Table 6c: Output data of 500 Watt double-output models. General conditions as per table 6a.

Model				LXN2660			LXN2770			LXN2880			Unit
Characteristic		Conditions		min	typ	max	min	typ	max	min	typ	max	
$V_{o\,nom}$	Output voltage nominal [1]	$V_{i\,nom}$, $I_{o\,nom}$		24.25	24.7	25.2	36.4	37	37.8	48.5	49.36	50.4	V
			*	24.4	24.7	25.0	36.6	37	37.5	48.8	49.36	50.0	
$V_{o\,worst}$	Output voltage range of tolerance	$V_{i\,min} - V_{i\,max}$, $I_o = (0.1 - 1)\ I_{o\,nom}$		24.0		25.8	36.0		38.7	48.0		51.6	
$V_{o\,L}$	Overvoltage protection			28.5		30	42.7		45	57		60	
$P_{o\,nom}$	Nominal output power				494			496			494		W
$I_{o\,nom}$	Output current nominal				2 × 10			2 × 6.7			2 × 5		A
$I_{o\,L}$	Output current limit [3]	$V_{i\,min} - V_{i\,max}$		10.2		11.4	6.8		7.7	5.05		5.7	
I_{op}	Output current boost [4]	typ. 1 s			2 × 15			2 × 10			2 × 7.5		
v_o	Ripple and noise	V_i = 230 VAC, f_i = 50 Hz, $I_{o\,nom}$			100			100			100		mV_{pp}
			2		1100 [2]			1200 [2]			1200 [2]		
$\Delta V_{o\,u}$	Static line regulation	$V_{i\,min} - V_{i\,max}$, $I_{o\,nom}$			±0.1			±0.15			±0.15		V
$\Delta V_{o\,l}$	Static load regulation	$V_{i\,nom}$, $I_o = (0.1 - 1)\ I_{o\,nom}$			−0.4			−0.6			−0.8		
v_{od}	Dynamic load regulation	$V_{i\,nom}$, $I_o = (0.5 \leftrightarrow 1)\ I_{o\,nom}$			±1.2			±1.5			±1.8		
	Voltage deviation and recovery time				40			80			80		ms
αv_o	Temperature coefficient	$T_{C\,min} - T_{C\,max}$			±0.02			±0.02			±0.02		%/K
t_{or}	Start-up time	$V_i = 0 \rightarrow V_{i\,nom}, I_{o\,nom}$			700			700			700		ms
$t_{oh\,min}$	Hold-up time	$I_{o\,nom}, V_{o\,nom} \rightarrow 0.8\ V_{o\,nom}$			15			20			25		

* Converters with version V105 or higher
1 Setting voltage with open R-input
2 Superimposed low frequency ripple at 2 • f_i
3 Rectangular current limit characteristic (continuous operation)
4 Short-term peak power capability 150% of $P_{o\,nom}$ for approx. 1 s

Immunity to Environmental Conditions

Table 9: Mechanical stress and climatic

Test method		Standard	Test conditions		Status
Cab	Damp heat steady state	IEC/EN 60068-2-78 MIL-STD-810D sect. 507.2	Temperature: Relative humidity: Duration:	40 ±2 °C 93 +2/-3 % 56 days	Converter not operating
Kb	Salt mist, cyclic (sodium chloride NaCl solution)	IEC/EN 60068-2-52	Concentration: Duration: Conditions: Storage duration:	5% (30 °C) 2 h per cycle 40 °C, 93% rel. humidity 3 cycles of 22 h	Converter not operating
Eb	Bump (half-sinusoidal)	IEC/EN 60068-2-29 MIL-STD-810D sect. 516.3	Acceleration amplitude: Bump duration: 6000 bumps:	25 g_n = 245 m/s^2 11 ms 1000 in each direction	Converter not operating, wall-mounted[1]
			Acceleration amplitude: Bump duration: 6000 bumps:	10 g_n = 98.1 m/s^2 11 ms 1000 in each direction	Converter not operating, on DIN-rail [2]
Fc	Vibration (sinusoidal)	IEC/EN 60068-2-6 MIL-STD-810D sect. 514.3	Acceleration amplitude and frequency (1 Octave/min): Test duration:	0.35 mm (10 – 60 Hz) 5 g_n = 49 m/s^2 (60 – 2000 Hz) 7.5 h (2.5 h each axis)	Converter operating, wall-mounted[1]
			Acceleration amplitude and frequency (1 Octave/min): Test duration:	0.25 mm (10 – 60 Hz) 2 g_n = 19 m/s^2 (60 – 2000 Hz) 7.5 h (2.5 h each axis)	Converter operating, on DIN-rail [2]
Ea	Shock (half-sinusoidal)	IEC/EN 60068-2-27 MIL-STD-810D sect. 516.3	Acceleration amplitude: Bump duration: Number of bumps:	50 g_n = 490 m/s^2 11 ms 18 (3 in each direction)	Converter not operating, wall-mounted[1]
Fda	Random vibration wide band Reproducibility high	IEC/EN 60068-2-35	Acceleration spectral density: Frequency band: Acceleration magnitude: Test duration:	0.05 g_n^2/Hz 20 – 500 Hz 4.9 $g_{n\ rms}$ 3 h (1 h each axis)	Converter operating, wall-mounted[1]
			Acceleration spectral density: Frequency band: Acceleration magnitude: Test duration:	0.01 g_n^2/Hz 20 – 500 Hz 2.2 $g_{n\ rms}$ 1.5 h (0.5 h each axis)	Converter operating, mounted on a DIN-rail [2]

[1] Wall-mounted with brackets UMB-W [HZZ00618]; see *Accessories*
[2] Fastened on a DIN-rail with 2 additional DIN-rail fixing brackets DMB-EWG; see *Accessories*. This also covers wall-mounting with brackets, because wall mounting performs better in vibration test.

Temperatures

Table 10: Temperature specifications, valid for an air pressure of 800 - 1200 hPa (800 - 1200 mbar)

Model			Standard models -6		Unit
Characteristics		Conditions	min	max	
T_A	Ambient temperature	Converter operating[1]	–40	60	°C
T_C	Case temperature		–40	90[2]	
T_S	Storage temperature	Not operating	–40	100	

[1] See *Thermal Considerations*
[2] See table 4 and 5 P_o *derating*

Failure Rates

Table 12: MTBF

Values at specified case temperature	Model	Ground benign 40 °C	Ground fixed 40 °C	Ground fixed 70 °C	Ground mobile 50 °C	Unit
MTBF [1]	LXN1801-6	400 000	110 000	50 000	40 000	h

[1] Calculated according to MIL-HDBK-217E, notice 2.

Mechanical Data

Dimensions in mm.

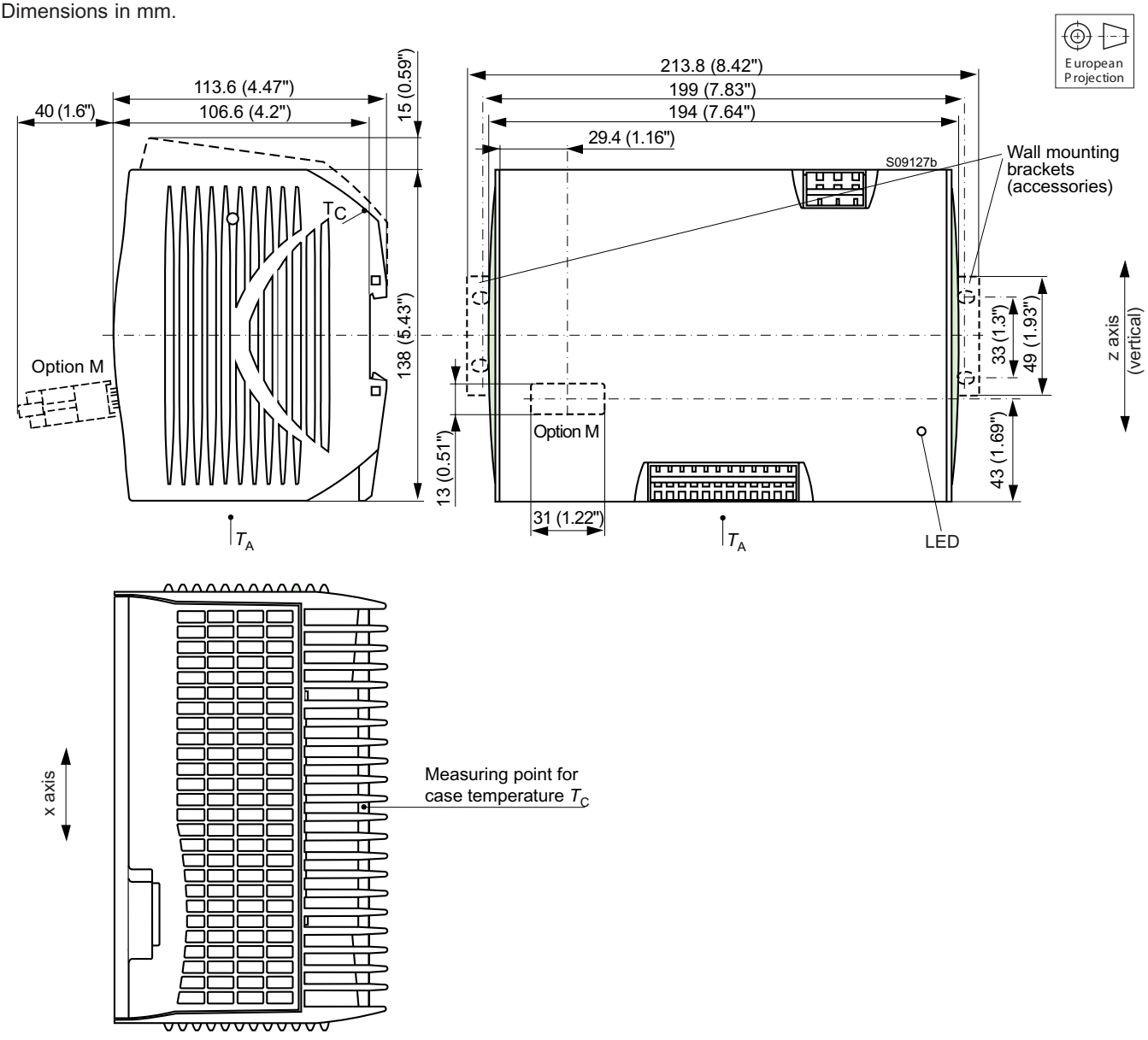


Fig. 13
Case X01
LXR: weight approx. 2600 g
LXN: weight approx. 2800 g
Case designed by ATP, Munich.