

Power Supply - 24V, 10 A, 240 W, Single-phase Input

Catalog Numbers 1606-XLE240E, 1606-XLE240EC, 1606-XLE240EL, 1606-XLE240EH, 1606-XLE240ED

Allen-Bradley
by ROCKWELL AUTOMATION

Reference Manual

Original Instructions

Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.

IMPORTANT Identifies information that is critical for successful application and understanding of the product.

Labels may also be on or inside the equipment to provide specific precautions.

SHOCK HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.

BURN HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.

ARC FLASH HAZARD: Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

Table of Contents

Notes:

Terminology and Abbreviations

Term, Abbreviation, or Symbol	Definition
PE and symbol	PE is the abbreviation for Protective Earth and has the same meaning as the symbol.
	The symbol for Protective Earth. This symbol has the same meaning as PE.
Earth, Ground	This document uses the term 'earth' which is the same as the U.S. term 'ground.'
4000V AC	A value with the unit (V AC) at the end is a momentary value without any additional tolerances included.
50 Hz vs. 60 Hz	As long as not otherwise stated, AC 100V and AC 230V parameters are valid at 50 Hz mains frequency. AC 120V parameters are valid for 60 Hz mains frequency.
typ	A typical value.
nom	A nominal value.
– (alone in a table cell)	A dash alone in a table cell indicates that there is no information to be included in that cell.

Unless otherwise noted, all values in this document are typical values under the following conditions: 24V, 10 A, 230V AC, 50 Hz, 25 °C (77 °F) ambient temperature, and after a 5 minute run-in time.

Product Overview

The 1606-XLE units are high-end power supplies in a medium price range that do not compromise quality, reliability, and performance. The XLE Series is part of the Bulletin 1606 power supply family. The most outstanding features of XLE240 series are the high efficiency, advanced inrush current limitation, active PFC, and wide operational temperature range.

The XLE Series includes all essential basic functions. The devices have a power reserve of 20% included, which may even be used continuously at temperatures up to 45 °C (113 °F). Additionally, the 1606-XLE240 can deliver three times the nominal output current for at least 12 ms, which helps to trip fuses on faulty output branches.

This unit is suitable for nearly every situation because of its high immunity to transients and power surges, low electromagnetic emission, DC OK relay contact, and a large international approval package for various applications.

Power supply features:

- AC 100…240V Wide-range Input
- Width only 39 mm (1.54 in.)
- Efficiency up to 95.2%
- Excellent Partial Load Efficiency
- 20% Output Power Reserves
- Safe HiccupPLUS Overload Mode
- Easy Fuse Breaking due to High Overload Peak Current
- Active Power Factor Correction (PFC)
- Minimal Inrush Current Surge
- Full Power From -25…+60 °C (-13…+140 °F)
- DC OK Relay Contact

Specifications

Attributes	Values	Notes
Output voltage	DC 24V	Nominal
Adjustment range	24...28V	Factory setting 24.1V
Output current	12.0...10.3 A	Below +45 °C (113 °F) ambient
	10.0...8.6 A	At +60 °C (140 °F) ambient
	7.5...6.5 A	At +70 °C (158 °F) ambient
	Derate linearly from 45...70 °C (113...158 °F)	
Input voltage AC	AC 100...40V	-15% / +10%
Mains frequency	50...60 Hz	±6%
Input current AC	2.15 / 1.13 A	At 120 / 230V AC
Power factor	0.99 / 0.97	At 120 / 230V AC
Input voltage DC	DC 110...150V ±20%	For power supplies: 1606-XLE240E, 1606-XLE240EC 1606-XLE240EL 1606-XLE240EH
	DC 110...300V ±20%	For power supply 1606-XLE240EP
Input current DC	2.35 A	At 110V DC
	2.35 / 0.84 A	At 110 / 300V DC
Input inrush current	6 / 9 A pk	At 40 °C (104 °F) 120 / 230V AC
Efficiency	93.6 / 95.2%	At 120 / 230V AC
Losses	16.4 / 12.1 W	At 120 / 230V AC
Hold-up time	37 / 37 ms	At 120 / 230V AC
Temperature range	-25...+70 °C (-13...+158 °F)	—
Size (w x h x d)	39 x 124 x 117 mm (1.54 x 4.88 x 4.61 in.)	Without DIN rail
Weight	600 g (1.3 lb)	—

Catalog Numbers

Catalog Number	Description
1606-XLE240E	Power supply, screw terminals
1606-XLE240EC	Power supply, screw terminals, conformal coated printed circuit boards
1606-XLE240EL	Power supply, spring-clamp terminals
1606-XLE240EH	Power supply, push-in terminals
1606-XLE240EP	Power supply, screw terminals, extended DC input range
1606-XLA-XLE	Wall/panel mount bracket
1606-XLA-S44	Side mount bracket

AC Input

Attributes		Values	Notes
AC input	Nom	AC 100...240V	Suitable for TN-, TT-, and IT mains networks
AC input range	Min	85...264V AC	Continuous operation
	Min	264...300V AC	For 500 ms max
Allowed voltage L or N to earth	Max	300V AC	Continuous according to IEC 62477-1
Input frequency	Nom	50...60 Hz	±6%
Turn-on voltage	Typ	80V AC	Steady-state value, see Figure 1
Shut-down voltage	Typ	70V AC	Steady-state value, see Figure 1
	Typ	55V AC	Dynamic value for 250 ms max
External input protection	–	See recommendations in External Input Protection on page 27.	

Attributes		Values			Notes
		100V AC	120V AC	230V AC	
Input current	Typ	2.60 A	2.15 A	1.13 A	At 24V, 10 A, see Figure 3
Power factor(1)	Typ	0.99	0.99	0.97	At 24V, 10 A, see Figure 4
Crest factor(2)	Typ	1.5	1.5	1.65	At 24V, 10 A
Start-up delay	Typ	300 ms	290 ms	240 ms	See Figure 2
Rise time	Typ	30 ms	30 ms	30 ms	At 24V, 10 A constant current load, 0 mF load capacitance, see Figure 2
	Typ	75 ms	75 ms	75 ms	At 24V, 10 A constant current load, 10 mF load capacitance, see Figure 2
Turn-on overshoot	Max	200 mV	200 mV	200 mV	See Figure 2
External input protection	–	See recommendations in External Input Protection on page 27.			

(1) The power factor is the ratio of the true (or real) power to the apparent power in an AC circuit.
(2) The crest factor is the mathematical ratio of the peak value to RMS value of the input current waveform.

Figure 1 - Input Voltage Range

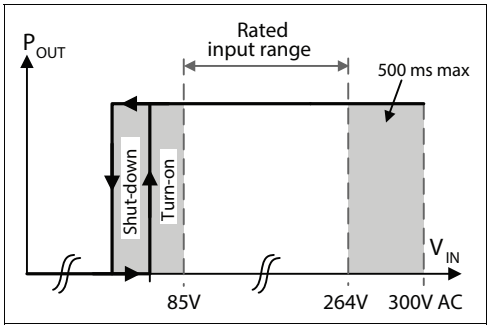


Figure 2 - Turn-on Behavior, Definitions

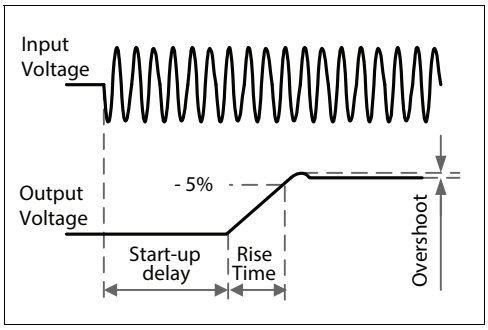


Figure 3 - Input Current vs. Output Current at 24V Output Voltage

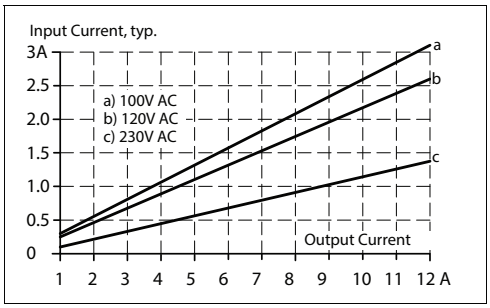
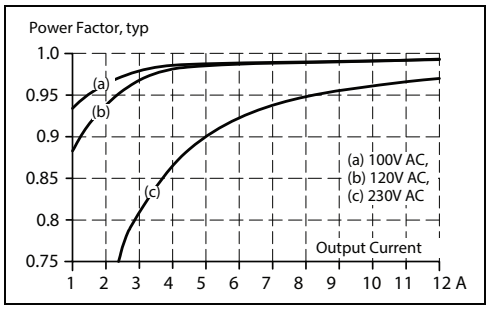


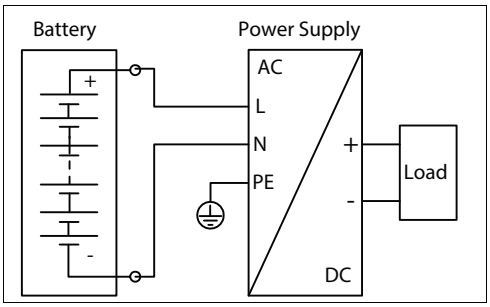
Figure 4 - Power Factor vs. Output Current at 24V Output Voltage



DC Input

Attributes		Values	Notes
DC input	Nom	DC 110...150V	±20% For 1606-XLE240E, 1606-XLE240EC, 1606-XLE240EL, and 1606-XLE240EH
	Nom	DC 110...300V	±20% For 1606-XLE240EP
DC input range	Min	88...180V DC	For 1606-XLE240E, 1606-XLE240EC, 1606-XLE240EL, and 1606-XLE240EH, continuous operation
	Min	88...360V DC	For 1606-XLE240EP
DC input current	Typ	2.35 A	At 110V DC, at 24V, 10 A
	Typ	0.84 A	At 300V DC, at 24V, 10 A
Allowed Voltage L/N to Earth	Max	375V DC	Continuous, according to IEC 62477-1
Turn-on voltage	Typ	80V DC	Steady state value
Shut-down voltage	Typ	70V DC	Steady state value
	Typ	55V DC	Dynamic value for 250 ms max

Figure 5 - Wiring for DC Input



Instructions for DC Use

1. Use a battery or a similar DC source. A supply from the intermediate DC-bus of a frequency converter is not recommended and can cause a malfunction or damage the unit.
2. Connect +pole to L and –pole to N.
3. Connect the PE terminal to an earth wire or to the machine ground.

Input Inrush Current

An active inrush limitation circuit (NTCs, which are bypassed by a relay contact) limits the input inrush current after turn-on of the input voltage.

The charging current into EMI suppression capacitors is disregarded in the first microseconds after switch-on.

Attributes		Values			
		100V	120V	230V	Notes
Inrush current	Max	11 A pk	7 A pk	11 A pk	At 40 °C (104 °F), cold start
	Typ	9 A pk	6 A pk	6 A pk	At 25 °C (77 °F), cold start
	Typ	9 A pk	6 A pk	9 A pk	At 40 °C (104 °F), cold start
Inrush energy	Max	0.1 A^2s	0.1 A^2s	0.4 A^2s	At 40 °C (104 °F), cold start

Figure 6 - Typical Turn-on Behavior at Nominal Load, 120V AC Input, and 25 °C (77 °F) Ambient

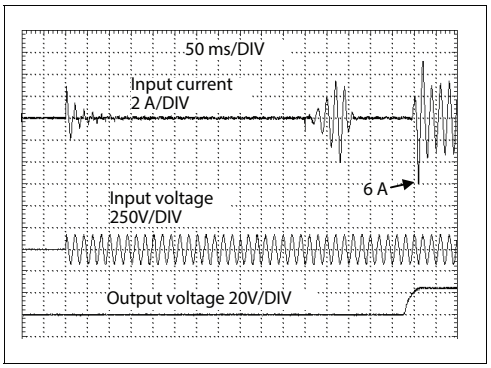
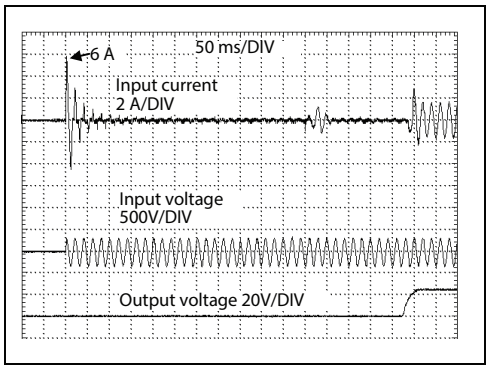


Figure 7 - Typical Turn-on Behavior at Nominal Load, 230V AC Input, and 25 °C (77 °F) Ambient



Output

Attributes		Values	Notes
Output voltage	Nom	24V	–
Adjustment range	Min	24...28V	Guaranteed value
	Max	30.0V	This is the max output voltage that can occur at the clockwise end position of the potentiometer due to tolerances. It is not guaranteed that this value can be achieved.
Factory settings	Typ	24.1V	±0.2%, at full load and cold unit
Line regulation	Max	10 mV	85...300V AC
Load regulation	Max	50 mV	0...12 A, static value, see Figure 8
Ripple and noise voltage	Max	50 mVpp	Bandwidth 20 Hz...20 MHz, 50 Ω
Output current	Nom	12 A(1)	At 24V and an ambient temperature below 45 °C (113 °F), see Figure 22 on page 18.
	Nom	10 A	At 24V and 60 °C (140 °F) ambient temperature, see Figure 8
	Nom	7.5 A	At 24V and 70 °C (158 °F) ambient temperature, see Figure 8
	Nom	10.3 A(1)	At 28V and an ambient temperature below 45 °C (113 °F), see Figure 22 on page 18
	Nom	8.6 A	At 28V and 60 °C (140 °F) ambient temperature, see Figure 8
	Nom	6.45 A	At 28V and 70 °C (158 °F) ambient temperature, see Figure 22 on page 18
	Typ	30 A	For minimal 12 ms once every 5 seconds, see Figure 9.The output voltage stays above 20V. See Peak Current Capability on page 26 for more peak current measurements. For AC 100V mains, the pulse length is shorter than 12 ms.
Overload behavior	–	Continuous current	Output voltage above 13V DC, see Figure 8
	–	Hiccup*PLUS* mode(2)	Output voltage below 13V DC, see Figure 8
Short-circuit current	Min	12.5 A(3)	Load impedance <45 mΩ, see Figure 10
	Max	15.5 A(3)	Load impedance <45 mΩ, see Figure 10
	Max	5 A	Average (R.M.S.) current, load impedance 50 mΩ, see Figure 10
	Min	28 A	Up to 12 ms, load impedance <45 mΩ, see Figure 9
	Typ	30.5 A	Up to 12 ms, load impedance <45 mΩ, see Figure 9
Output capacitance	Typ	4400 µF	Included inside the power supply

(1) Power Boost: This power/ current is continuously allowed up to an ambient temperature of 45 °C (113 °F). Above this temperature, do not use this power or current longer than a duty cycle of 10% and/or not longer than 1 minute every 10 minutes.
(2) HiccupPLUS Mode: At heavy overloads (when output voltage falls below 13V), the power supply delivers continuous output current for 2 s. After this, the output is switched off for approximately 18 s before a new start attempt is automatically performed. This cycle is repeated as long as the overload exists. If the overload has been cleared, the device operates normally. See Figure 10.
(3) Discharge current of output capacitors is not included.

Figure 8 - Output Voltage vs. Output Current, Typ

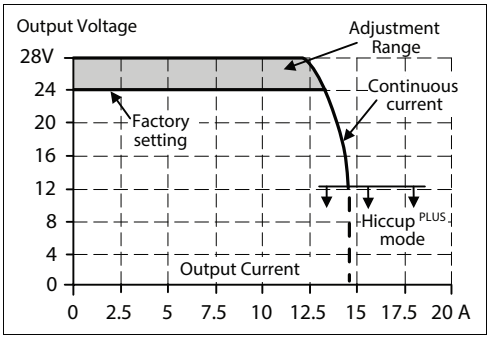


Figure 9 - Dynamic Output Current Capability, Typ

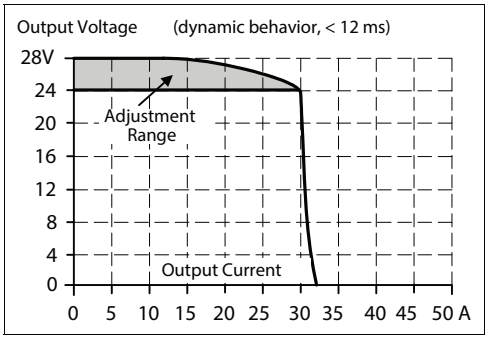
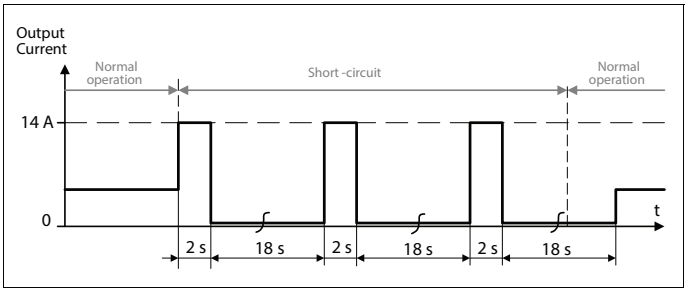


Figure 10 - Short-circuit on Output, Hiccup^{PLUS} Mode, Typ



Hold-up Time

Attributes		Values			Notes
		100V AC	120V AC	230V AC	
Hold-up Time	Typ	73 ms	73 ms	73 ms	At 24V, 5 A, see Figure 11
	Min	55 ms	55 ms	55 ms	At 24V, 5 A, see Figure 11
	Typ	37 ms	37 ms	37 ms	At 24V, 10 A, see Figure 11
	Min	28 ms	28 ms	28 ms	At 24V, 10 A, see Figure 11

Figure 11 - Hold-up Time vs. Input Voltage

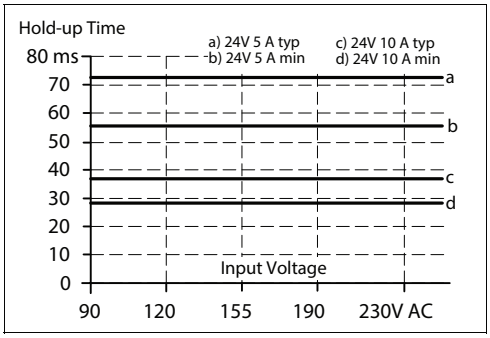
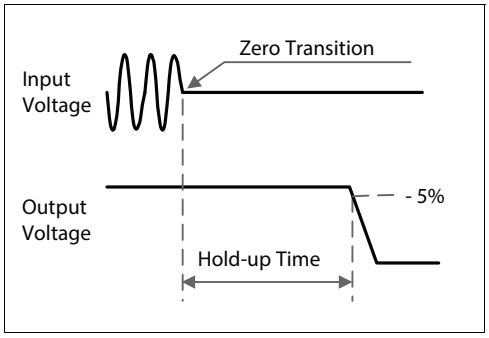


Figure 12 - Shutdown Behavior, Definitions

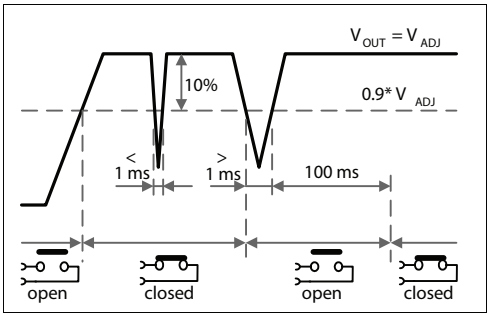


DC OK Relay Contact

This feature monitors the output voltage on the output terminals of a running power supply.

Attributes	Descriptions
Contact closes	As soon as the output voltage reaches 90% typ of the adjusted output voltage level.
Contact opens	As soon as the output voltage dips more than 10% below the adjusted output voltage. Short dips are extended to a signal length of 100 ms. Dips shorter than 1 ms are ignored.
Switching hysteresis	1V
Contact ratings	Maximal 60V DC 0.3 A, 30V DC 1 A, 30V AC 0.5 A, resistive load Minimal permissible load: 1 mA at 5V DC
Isolation voltage	See Dielectric Strength on page 20.

Figure 13 - DC OK Relay Contact Behavior



Efficiency and Power Loss

Attributes		Values			Notes
		100V AC	120V AC	230V AC	
Efficiency	Typ	92.9%	93.6%	95.2%	At 24V, 10 A
	Typ	92.5%	93.4%	95.1%	At 24V, 12 A (Power Boost)
Average Efficiency(1)	Typ	92.5%	93.0%	94.3%	25% at 2.5 A, 25% at 5 A, 25% at 7.5 A. 25% at 10 A
Power losses	Typ	2.5 W	2.1 W	1.8 W	At 24V, 0 A
	Typ	9.8 W	8.9 W	7.1 W	At 24V, 5 A
	Typ	18.3 W	16.4 W	12.1 W	At 24V, 10 A
	Typ	23.4 W	21.7 W	14.8 W	At 24V, 12 A (Power Boost)

(1) The average efficiency is an assumption for a typical application where the power supply is loaded with the following:
25% of the nominal load for 25% of the time
50% of the nominal load for 25% of the time
75% of the nominal load for 25% of the time
100% of the nominal load for 25% of the time

Figure 14 - Efficiency vs. Output Current at 24V, Typ

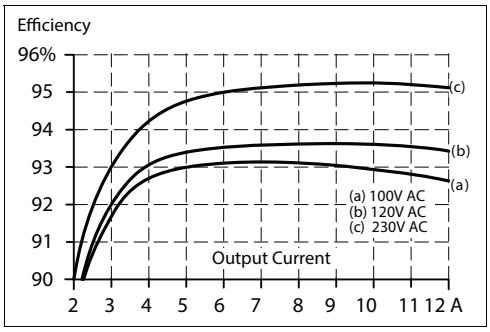


Figure 15 - Power Losses vs. Output Current at 24V, Typ

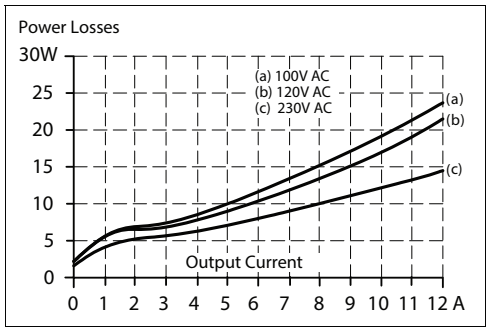


Figure 16 - Efficiency vs. Input Voltage at 24V, 10 A, Typ

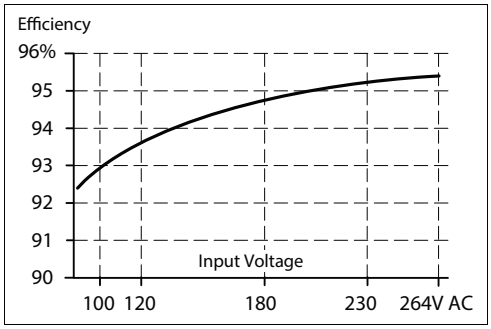
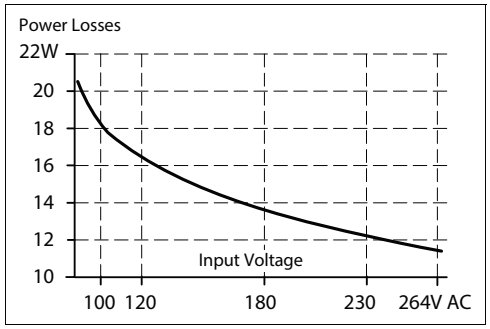


Figure 17 - Power Losses vs. Input Voltage at 24V, 10 A, Typ



Lifetime Expectancy

The lifetime expectancies that are shown in the table indicate the minimum operating hours (service life) and are determined by the lifetime expectancies of the built-in electrolytic capacitors. Lifetime expectancy is specified in operational hours and is calculated according to the manufacturer specification of the capacitor. The manufacturer of the electrolytic capacitors only states a maximum life of up to 15 years (131,400 h). Any number that exceeds this value is a calculated theoretical lifetime, which can be used to compare devices.

Attributes	Values			Notes
	100V AC	120V AC	230V AC	
Lifetime Expectancy	128,000 h	141,000 h	176,000 h	At 24V, 5 A and 40 °C (104 °F)
	61,000 h	75,000 h	120,000 h	At 24V, 10 A and 40 °C (104 °F)
	47,000 h	59,000 h	101,000 h	At 24V, 12 A and 40 °C (104 °F)
	363,000 h	399,000 h	499,000 h	At 24V, 5 A and 25 °C (77 °F)
	173,000 h	211,000 h	338,000 h	At 24V, 10 A and 25 °C (77 °F)
	132,000 h	166,000 h	286,000 h	At 24V, 12 A and 25 °C (77 °F)

Mean Time Between Failure

Mean Time Between Failure (MTBF) is calculated according to statistical device failures, and indicates reliability of a device. It is the statistical representation of the likelihood of a unit to fail and does not necessarily represent the life of a product.

The MTBF value is a statistical representation of the likelihood of a device to fail. An MTBF value of, for example, 1,000,000 h means that statistically one unit fails every 100 hours if 10,000 units are installed in the field. However, it cannot be determined if the failed unit has been running for 50,000 h or only for 100 h.

For these types of units, the MTTF (Mean Time To Failure) value is the same value as the MTBF value.

Attributes	Values			Notes
	100V AC	120V AC	230V AC	
MTBF SN 29500, IEC 61709	550,000 h	560,000 h	661,000 h	At 24V, 10 A and 40 °C (104 °F)
	1,003,000 h	1,017,000 h	1,176,000 h	At 24V, 10 A and 25 °C (77 °F)
MTBF MIL HDBK 217F	188,000 h	188,000 h	213,000 h	At 24V, 10 A and 40 °C (104 °F); Ground Benign GB40
	252,000 h	252,000 h	290,000 h	At 24V, 10 A and 25 °C (77 °F); Ground Benign GB25
	40,000 h	40,000 h	47,000 h	At 24V, 10 A and 40 °C (104 °F); Ground Fixed GF40
	51,000 h	51,000 h	61,000 h	At 24V, 10 A and 25 °C (77 °F); Ground Fixed GF25

Terminals and Wiring

The terminals are IP20 fingersafe constructed and suitable for field wiring and factory wiring.

Table 1 - 1606-XLE240E, -XLE240EC, -XLE240EP

Attributes	Values		
	Input	Output	DC Signal
Type	Screw termination	Screw termination	Push-in termination
Solid wire	6 mm^2 max	6 mm^2 max	1.5 mm^2 max
Stranded wire	4 mm^2 max	4 mm^2 max	1.5 mm^2 max
American Wire Gauge	AWG 20...10	AWG 20...10	AWG 24...16
Wire diameter max (including ferrules)	2.8 mm (0.11 in.)	2.8 mm (0.11 in.)	1.6 mm (0.06 in.)
Recommended tightening torque	1 N•m max (9 lb•in max)	1 N•m max (9 lb•in max)	–
Wire stripping length	7 mm (0.28 in.)	7 mm (0.28 in.)	7 mm (0.28 in.)
Screwdriver	3.5 mm (0.14 in.) slotted or cross-head No 2	3.5 mm (0.14 in.) slotted or cross-head No 2	3 mm (0.12 in.) slotted to open the spring

Table 2 - 1606-XLE240EL

Attributes	Values		
	Input	Output	DC Signal
Type	Quick-connect spring-clamp termination	Quick-connect spring-clamp termination	Push-in termination
Solid wire	6 mm^2 max	6 mm^2 max	1.5 mm^2 max
Stranded wire	4 mm^2 max	4 mm^2 max	1.5 mm^2 max
American Wire Gauge	AWG 20...10	AWG 20...10	AWG 24...16
Wire diameter max (including ferrules)	2.8 mm (0.11 in.)	2.8 mm (0.11 in.)	1.6 mm (0.06 in.)
Wire stripping length	10 mm (0.4 in.)	10 mm (0.4 in.)	7 mm (0.28 in.)
Screwdriver	–	–	3 mm (0.12 in.) slotted to open the spring

Table 3 - 1606-XLE240EH

Attributes	Values		
	Input	Output	DC Signal
Type	Push-in termination	Push-in termination	Push-in termination
Solid wire	2.5 mm^2 max	2.5 mm^2 max	1.5 mm^2 max
Stranded wire	2.5 mm^2 max	2.5 mm^2 max	1.5 mm^2 max
Stranded wire with ferrules	1.5 mm^2 max	1.5 mm^2 max	1.5 mm^2 max
American Wire Gauge	AWG 24...12	AWG 24...12	AWG 24...16
Wire diameter max (including ferrules)	2.3 mm (0.09 in.)	2.3 mm (0.09 in.)	1.6 mm (0.06 in.)
Wire stripping length	10 mm (0.4 in.)	10 mm (0.4 in.)	7 mm (0.28 in.)
Screwdriver	3.0 mm (0.12 in.) slotted to open the spring	3.0 mm (0.12 in.) slotted to open the spring	3 mm (0.12 in.) slotted to open the spring

Wiring Instructions

1. Use appropriate copper cables that are designed for minimum operating temperatures of:
   - 60 °C (140 °F) for ambient up to 45 °C (113 °F)
   - 75 °C (167 °F) for ambient up to 60 °C (140 °F)
   - 90 °C (194 °F) for ambient up to 70 °C (158 °F)
2. Follow national installation codes and installation regulations.
3. Ensure that all strands of a stranded wire enter the terminal connection.
4. Securely tighten unused terminal compartments.
5. Ferrules are allowed.

Daisy Chaining

Daisy chaining (jumping from one power supply output to the next) is allowed for catalog numbers: 1606-XLE240E, -XLE240EC, -XLE240EP, and -XLE240EL. Daisy chaining is not allowed for 1606-XLE240EH.

Daisy chaining is allowed as long as the average output current through one terminal pin does not exceed 25 A. If the current is higher, use a separate distribution terminal block as shown in Figure 19.

Figure 18 - Daisy Chaining of Outputs

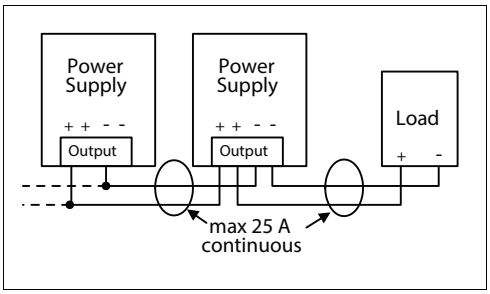
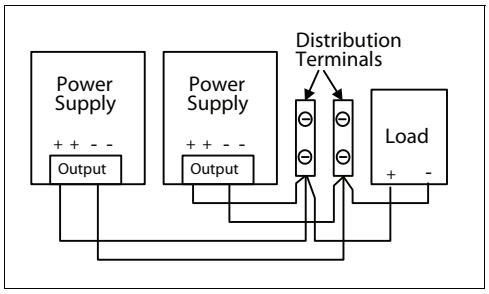
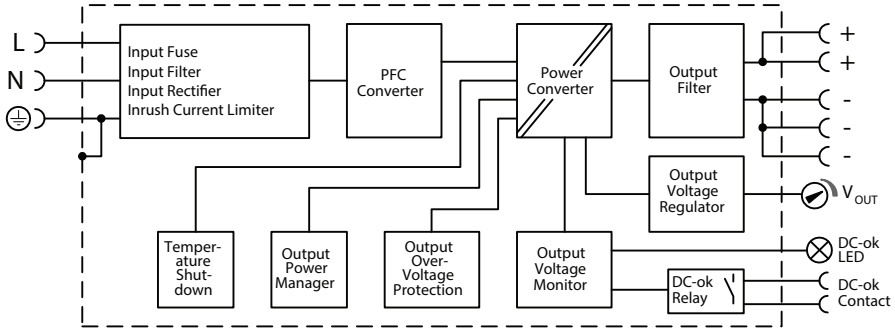


Figure 19 - Using Distribution Terminals



Functional Diagram

Figure 20 - Functional Diagram



Front Side User Elements

Figure 21 - Front Side User Elements

1606-XLE240E

1606-XLE240EC

1606-XLE240EL

1606-XLE240EH

1606-XLE240EP

User Element	Description
1	**Input Terminals** 1606-XLE240E, 1606-XLE240EC, 1606-XLE240EP: Screw terminals 1606-XLE240EL: Spring-clamp terminals 1606-XLE240EH: Push-in terminals N, L Line input, PE (Protective Earth) input
2	**Output Terminals** (two identical + poles and three identical - poles) 1606-XLE240E, 1606-XLE240EC, 1606-XLE240EP: Screw terminals 1606-XLE240EL: Spring-clamp terminals 1606-XLE240EH: Push-in terminals **+** Positive output **–** Negative (return) output
3	**Output Voltage Potentiometer** Open the flap to adjust the output voltage. The factory setting is 24.1V.
4	**DC OK Status Indicator** (green) On when the output voltage is in range and the DC OK contact is closed.
5	**DC OK Relay Contact** (push-in terminals) Monitors the output voltage of the running power supply. See DC OK Relay Contact on page 11 for details.

Electromagnetic Compatibility

The power supply is suitable for applications in industrial, residential, commercial, and light industrial environments.

The following table provides electromagnetic compatibility (EMC) immunity information according to generic standards EN 61000-6-1 and EN 61000-6-2.

Attributes	Standards	Values		Criteria[1]
Electrostatic discharge	EN 61000-4-2	Contact discharge Air discharge	8 kV	Criterion A
			15 kV	Criterion A
Electromagnetic RF field	EN 61000-4-3	80 MHz...2.7 GHz	20V/m	Criterion A
Fast transients (Burst)	EN 61000-4-4	Input lines	4 kV	Criterion A
		Output lines	2 kV	Criterion A
		DC OK signal (coupling clamp)	2 kV	Criterion A
Surge voltage on input	EN 61000-4-5	L to N	2 kV	Criterion A
		L to PE, N to PE	4 kV	Criterion A
Surge voltage on output	EN 61000-4-5	+ to -	1 kV	Criterion A
		+/- to PE	2 kV	Criterion A
Surge voltage on Signals	EN 61000-4-5	DC OK Signal to PE	1 kV	Criterion A
Conducted disturbance	EN 61000-4-6	0.15...80 mHz	20V	Criterion A
Mains voltage dips	EN 61000-4-11	0% of 100V AC	0V AC, 20 ms	Criterion A
		40% of 100V AC	40V AC, 200 ms	Criterion C
		70% of 100V AC	70V AC, 500 ms	Criterion C
		0% of 200V AC	0V AC, 20 ms	Criterion A
		40% of 200V AC	80V AC, 200 ms	Criterion A
		70% of 200V AC	140V AC, 500 ms	Criterion A
Voltage interruptions	EN 61000-4-11	0% of 200V AC (=0V)	5000 ms	Criterion C
Voltage sags	SEMI F47 0706	Dips on the input voltage according to SEMI F47 standard		
		80% of 120V AC (96V AC)	1000 ms	Criterion A
		70% of 120V AC (84V AC)	500 ms	Criterion A
		50% of 120V AC (60V AC)	200 ms	Criterion A
Powerful transients	VDE 0160	Over entire load range	750V, 0.3 ms	Criterion A

(1) Criterion A: Power supply shows normal operation behavior within the defined limits.
Criterion C: Temporary loss of function is possible. Power supply may shut down and restart by itself. No damage or hazards for the power supply occur.

The following table provides EMC Emissions information according to generic standards EN 61000-6-3 and EN 61000-6-4.

Attributes	Standards	Notes
Conducted emission input lines	EN 55011, EN 55015, EN 55022, FCC Part 15, CISPR 11, CISPR 22	Class B
Conducted emission output lines[1]	IEC/CISPR 16-1-2, IEC/CISPR 16-2-1	Limits for DC power port according to EN 61000-6-3 fulfilled
Radiated emission	EN 55011, EN 55022	Class B
Harmonic input current	EN 61000-3-2	Class A fulfilled between 0...12 A load Class C fulfilled between 6...12 A load
Voltage fluctuations, flicker	EN 61000-3-3	Fulfilled[2]
This device complies with FCC Part 15 rules. Operation is subjected to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation		

(1) For information only, not mandatory for EN 61000-6-3.
(2) Tested with constant current loads, non-pulsing.

The following table provides switching frequencies.

Converters	Frequencies	Notes
PFC converter	110 kHz	Fixed frequency
Main converter	84...140 kHz	Output load dependent
Auxiliary converter	60 kHz	Fixed frequency

Environment

Attributes	Values	Notes
Operational temperature(1)	-25...+70 °C (-13...+158 °F)	Reduce output power according to Figure 22.
Storage temperature	-40...+85 °C (-40...+185 °F)	For storage and transportation
Output derating	3.2 W/1 °C (3.2 W/1.8 °F)	From 45...60 °C (113...140 °F)
	6 W/1 °C (6 W/1.8 °F)	From 60...70 °C (140...158 °F)
Humidity	5...95% r.h.	According to IEC 60068-2-30. Do not energize while condensation is present.
Vibration sinusoidal(2)	2...17.8 Hz: ±1.6 mm (0.06 in.); 17.8...500 Hz: 2 g 2 hours / axis	According to IEC 60068-2-6
Shock(2)	30 g 6 ms, 20 g 11 ms, 3 bumps / direction, 18 bumps in total	According to IEC 60068-2-27
Altitude	0...2000 m (0...6560 ft)	Without any restrictions
	2000...6000 m (6560...19,685 ft)	Reduce output power or ambient temperature, see Figure 23.
Altitude derating	15 W/1000 m (15 W/ 3281 ft) or 5 °C/1000 m (9 °F/ 3281 ft)	Above 2000 m (6500 ft), see Figure 23
Overvoltage category	III	According to IEC 62477-1 for altitudes up to 2000 m (6560 ft)
	II	According to IEC 62477-1 for altitudes from 2000...6000 m (6560...19685 ft)
Degree of pollution	2	According to IEC 62477-1, not conductive
LABS compatibility	The unit does not release any silicone or other LABS-critical substances and is suitable for use in paint shops.	
Corrosive gases	ISA-71.04-1985, Severity Level G3, IEC 60068-2-60 Test Ke Method 4	
Audible noise	Some audible noise may be emitted from the power supply during no load, overload, or short circuit.	

(1) Operational temperature is the same as the ambient or surrounding temperature and is defined as the air temperature 2 cm (0.79 in.) below the unit.
(2) Tested in combination with DIN rails according to EN 60715 with a height of 15 mm (0.59 in.) and a thickness of 1.3 mm (0.05 in.) and standard orientation.

Figure 22 - Output Current vs. Ambient Temperature

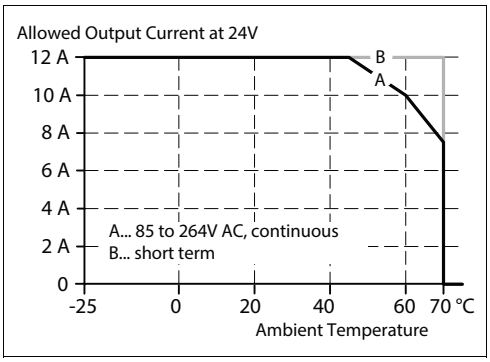
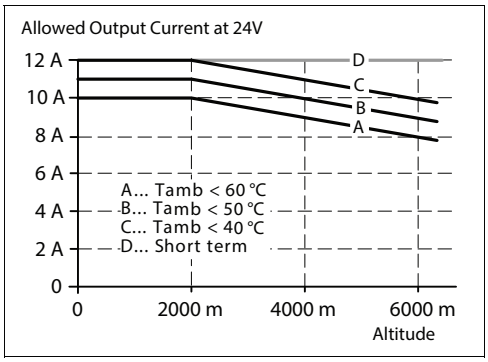


Figure 23 - Output Current vs. Altitude



Protection Features

Attributes	Values	Notes
Output protection	Electronically protected against overload, no-load, and short-circuits. If there is a protection event, audible noise may occur.	
Output overvoltage protection	30.5V DC typ, 32V DC max	If there is an internal power supply anomaly, a redundant circuit limits the max output voltage. The output shuts down and automatically attempts to restart.
Degree of protection	IP 20	EN/IEC 60529
Penetration protection	> 4 mm (0.16 in.)	For example, screws, and small parts
Over-temperature protection	Yes	Output shuts down and the power supply automatically restarts. The temperature sensor is installed on critical components inside the unit and turns off the unit in safety critical situations. Safety critical situations can include when derating requirements are not observed, ambient temperature is too high, ventilation is obstructed, or the derating requirements for a mounting orientation are not followed. There is no correlation between the operating temperature and turn-off temperature since this is dependent on input voltage, load, and installation methods.
Input transient protection	MOV (Metal Oxide Varistor)	For protection values, see Electromagnetic Compatibility on page 17.
Internal input fuse	Included	Slow-blow high-braking capacity fuse that is not user replaceable.

Safety Features

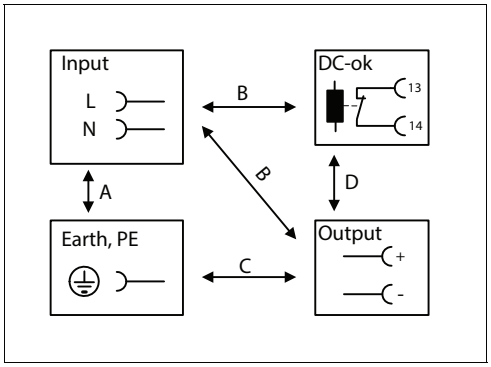
Attributes	Values	Notes
Input / output separation	Double or reinforced galvanic isolation	
	SELV	IEC/EN 60950-1
	PELV	IEC/EN 60204-1, EN 62477-1, IEC 60364-4-41
Class of protection	I	PE (Protective Earth) connection required
Isolation resistance	> 500 MΩ	At delivered condition between input and output, measured with 500V DC
	> 500 MΩ	At delivered condition between input and PE, measured with 500V DC
	> 500 MΩ	At delivered condition between output and PE, measured with 500V DC
	> 500 MΩ	At delivered condition between output and DC OK contacts, measured with 500V DC
PE resistance	< 0.1 Ω	Resistance between PE terminal and the housing in the area of the DIN rail mounting bracket.
Touch current (leakage current)	0.14 mA typ / 0.36 mA typ	At 100V AC, 50 Hz, TN-,TT-mains / IT-mains
	0.20 mA typ / 0.50 mA typ	At 120V AC, 60 Hz, TN-,TT-mains / IT-mains
	0.33 mA typ / 0.86 mA typ	At 230V AC, 50 Hz, TN-,TT-mains / IT-mains
	0.18 mA max / 0.43 mA max	At 110V AC, 50 Hz, TN-,TT-mains / IT-mains
	0.26 mA max / 0.61 mA max	At 132V AC, 60 Hz, TN-,TT-mains / IT-mains
	0.44 mA max / 1.05 mA max	At 264V AC, 50 Hz, TN-,TT-mains / IT-mains

Dielectric Strength

The output voltage is floating and has no ohmic connection to the ground. The manufacturer conducts type and factory tests. Field tests may be conducted in the field using the appropriate test equipment, which applies the voltage with a slow ramp (2 s up and 2 s down). Connect all input-terminals together as well as all output poles before conducting the test. When testing, set the cut-off current settings to the value in the following table.

Test Type	Time	A	B	C	D
Type Test	60 s	2500V AC	4000V AC	1000V AC	500V AC
Factory Test	5 s	2500V AC	2500V AC	500V AC	500V AC
Field Test	5 s	2000V AC	2000V AC	500V AC	500V AC
Cutoff Current Setting	–	>10 mA	>10 mA	>20 mA	>1 mA

Figure 24 - Dielectric Strength



To fulfill the PELV requirements according to EN60204-1 § 6.4.1, we recommend that either the + pole, the – pole, or another part of the output circuit shall be connected to the protective earth system. This helps to avoid situations in which a load starts unexpectedly or cannot be switched off when unnoticed earth faults occur.

IMPORTANT When testing input to DC OK, ensure that the max voltage between DC OK and the output is not exceeded (column D). We recommend connecting DC OK pins and the output pins together when performing the test.

Approvals

Approval Name	Approval Symbol	Notes
EC Declaration of Conformity	CE	The CE marking indicates conformance with the - EMC Directive, - Low Voltage Directive (LVD) and the - ATEX directive
IEC 60950-1 2nd Edition	IECEE CB SCHEME	CB Scheme, Information Technology Equipment
UL 508	c UL US LISTED IND. CONT. EQ.	Listed for use as Industrial Control Equipment; U.S.A. (UL 508) and Canada (C22.2 No. 107-1-01); E-File: NMTR(7).E56639
UL 60950-1 2nd Edition	c UL US	Recognized for use as Information Technology Equipment, Level 5; U.S.A. (UL 60950-1) and Canada (C22.2 No. 60950-1); E-File: QQGQ(2,8). E168663 Applicable for altitudes up to 2000 m (6562 ft).
ANSI / ISA 12.12.01-2015 Class I Div 2 (except 1606-XLE240EH)	C SP US	Recognized for use in Hazardous Location Class I Div 2 T4 Groups A,B,C,D systems; U.S.A. (ANSI / ISA 12.12.01-2015) and Canada (C22.2 No. 213-M1987)
EN 60079-0, EN 60079-15 ATEX (except 1606-XLE240EH)	Ex I 3G Ex nA nC IIC T4 Gc	Approval for use in hazardous locations Zone 2 Category 3G. Number of ATEX certificate: EPS 15 ATEX 1 101 X The power supply must be built in, inside of an IP54 enclosure.
IEC 60079-0, IEC 60079-15 (except 1606-XLE240EH)	IECEx	Suitable for use in Class 1 Zone 2 Groups IIa, IIb and IIc locations. Number of IECEx certificate: IECEx EPS 15.0079X
Marine (except 1606-XLE240EH, 1606-XLE240EP)	GL	GL (Germanischer Lloyd) classified Environmental category: C, EMC2 Marine and offshore applications
EAC TR Registration	EAC	Registration for the Eurasian Customs Union market (Russia, Kazakhstan, Belarus)

Other Standards

Standard Name	Standard Symbol	Notes
RoHS Directive	RoHS ✓	Directive 2011/65/EU of the European Parliament and the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.
REACH Directive	REACH ✓	Directive 1907/2006/EU of the European Parliament and the Council of June 1, 2007 regarding the Registration, Evaluation, Authorization, and Restriction of Chemicals (REACH)
IEC/EN 61558-2-16 (Annex BB)	Safety Isolating Transformer	Safety Isolating Transformers corresponding to Part 2-6 of the IEC/EN 61558

Physical Dimensions and Weight

Attributes	Values
Width	39 mm (1.54 in.)
Height	124 mm (4.88 in.)
Depth	117 mm (4.61 in.) The DIN rail height must be added to the unit depth to calculate the total required installation depth.
Weight	600 g (1.3 lb)
DIN rail	Use 35 mm (1.38 in.) DIN rails according to EN 60715 or EN 50022 with a height of 7.5 mm or 15 mm (0.30 in. or 0.59 in.).
Housing material	Body: Aluminum alloy Cover: Zinc-plated steel
Installation clearances	See Specifications on page 6.

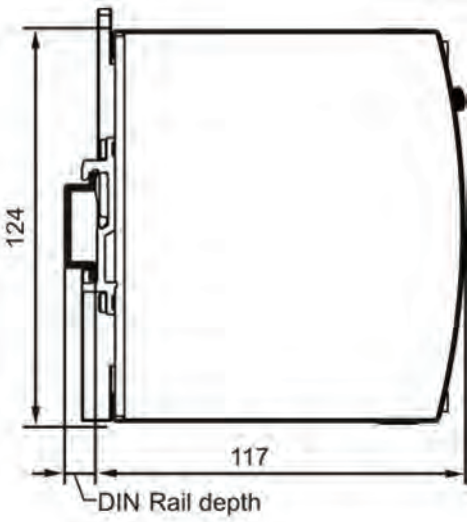
Figure 25 - Approximate Dimensions (in millimeters)

1606-XLE240E,
1606-XLE240EC,
1606-XLE240EP

1606-XLE240EL

1606-XLE240EH

Side View



Accessories

This section describes accessories that can be used with the power supplies.

Wall/Panel Mount Bracket

All dimensions are in millimeters.

Figure 26 - Left Isometric View

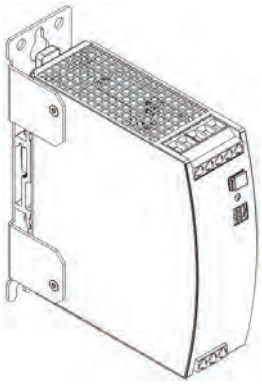


Figure 27 - Right Isometric View

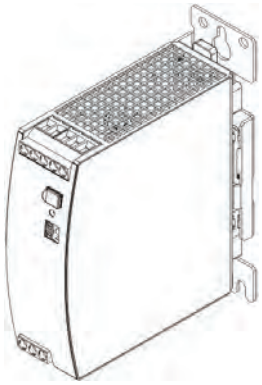


Figure 28 - Back Isometric View

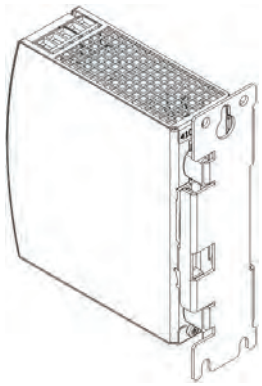


Figure 29 - Front View

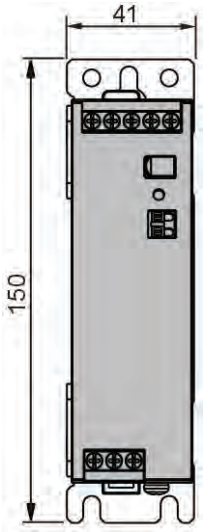


Figure 30 - Bracket

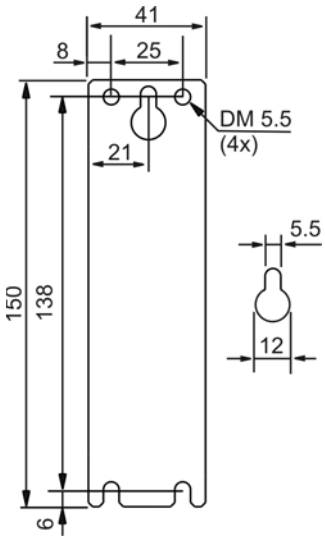
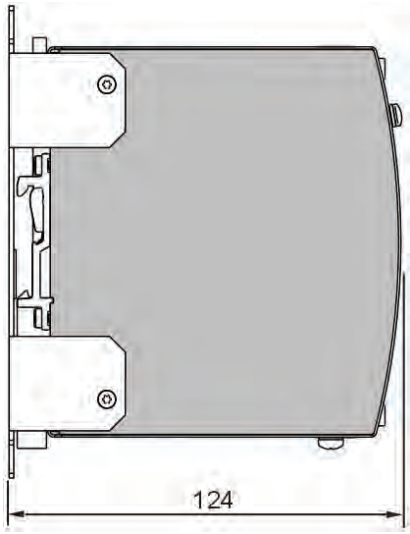


Figure 31 - Side View



Side Mount Bracket

This bracket is used to mount the power supply sideways with or without using a DIN rail.

The two aluminum brackets and the black plastic slider of the unit have to be detached, so that the steel brackets can be mounted.

For sideway DIN rail mounting, the removed aluminum brackets and the black plastic slider must be mounted on the steel bracket.

Figure 32 - Side Mount Bracket

Figure 33 - Side Mounting Without DIN Rail Brackets

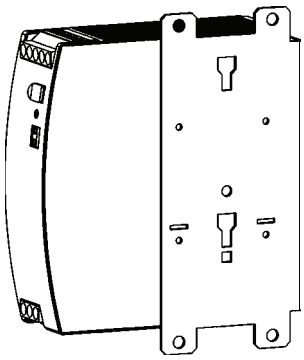


Figure 34 - Side Mounting With DIN Rail Brackets

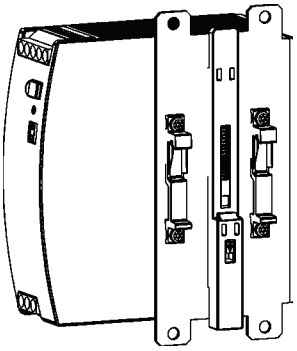
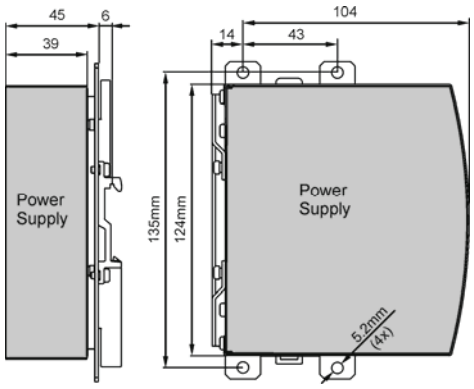


Figure 35 - Mounting Dimensions Side Mounting Bracket



Redundancy Module

The redundancy module 1606-XLERED20 is equipped with two input channels, which are individually decoupled using MOSFET technology. Using MOSFETs instead of diodes reduces the heat generation and the voltage drop between input and output. The 1606-XLERED20 does not require an additional auxiliary voltage and is self-powered even if there is a short circuit across the output.

Due to the low power losses, the unit is slender and only requires 32 mm (1.26 in.) width on the DIN rail.

The 1606-XLERED20 can be used for N+1 and 1+1 redundancy systems.

Further information and wiring configurations can be found in Parallel Use for Redundancy on page 31.

Redundancy Module with Automated Load Sharing

The redundancy module 1606-XLERED20Y is equipped with two input channels, which are individually decoupled using MOSFET technology. Using MOSFETs instead of diodes reduces the heat generation and the voltage drop between input and output. The 1606-XLERED20Y does not require an additional auxiliary voltage and is self-powered even if there is a short circuit across the output.

Due to the low power losses, the unit is slender and only requires 32 mm (1.26 in.) width on the DIN rail.

The 1606-XLERED20Y is optimized for 1+1 redundancy systems.

Compared to the 1606-XLERED20, the 1606-XLERED20Y is featured with an automated load sharing between the connected power supplies. The 1606-XLERED20Y monitors the function of the redundancy circuitry and provides a signal if the output current is too high. This could help prevent redundancy if one power supply fails.

Further information and wiring configurations can be found in Parallel Use for Redundancy on page 31.

Peak Current Capability

The unit can deliver peak currents (up to several milliseconds) which are higher than the specified short-term currents. This helps to start loads that demand high current. Solenoids, contactors and pneumatic modules often have a steady state coil and a pick-up coil. The inrush current demand of the pick-up coil is several times higher than the steady-state current and usually exceeds the nominal output current (including the Power Boost). The same situation applies when starting a capacitive load.

The peak current capability also ensures the safe operation of subsequent circuit breakers of load circuits. The load branches are often individually protected with circuit breakers or fuses. If there is a short or an overload in one branch circuit, the fuse or circuit breaker need a certain amount of overcurrent to open in a timely manner. This avoids voltage loss in adjacent circuits.

The extra current (peak current) is supplied by the power converter and the built-in large sized output capacitors of the power supply. The capacitors get discharged during such an event, which causes a voltage dip on the output. Figure 36, Figure 37, and Figure 38 show typical voltage dips for resistive loads.

The DC OK relay triggers when the voltage dips more than 10% for longer than 1 ms.

Figure 36 - 20 A Peak Current for 50 ms, Typ (2x the nominal current)

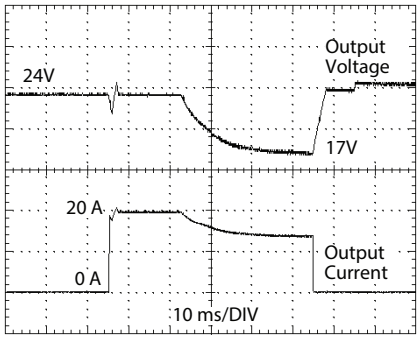


Figure 37 - 30 A Peak Current for 12 ms, Typ (3x the nominal current)

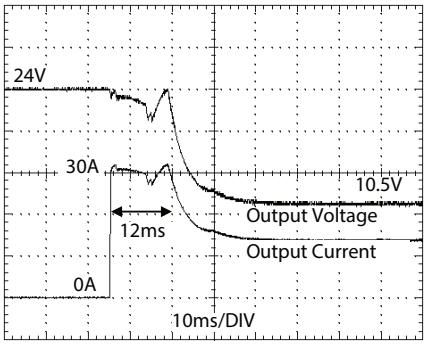
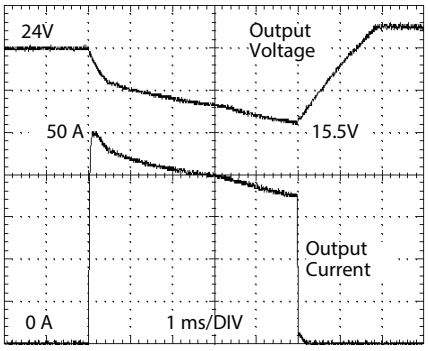


Figure 38 - 50 A Peak Current for 5 ms, Typ (5x the nominal current)



Peak Current Voltage Dips Typ	Notes
From 24V to 17V	At 20 A for 50 ms, resistive load
From 24V to 19V	At 50 A for 2 ms, resistive load
From 24V to 15.5V	At 50 A for 5 ms, resistive load

Back-feeding Loads

Loads such as decelerating motors and inductors can feed voltage back to the power supply. This feature is also called return voltage immunity or resistance against Back-Electromagnetic Force (Back-EMF).

This power supply is resistant and does not show malfunctioning when a load feeds back voltage to the power supply. It does not matter whether the power supply is on or off.

The maximum allowed feed-back-voltage is 35V DC. The maximum allowed feed-back peak current is 40 A. Higher currents can temporarily shut down the output voltage. The absorbing energy can be calculated according to the built-in large sized output capacitor which is specified in Output on page 10.

External Input Protection

The unit is tested and approved for branch circuits up to 30 A (UL) and 32 A (IEC). An external protection is only required if the supplying branch has an ampacity greater than the ampacity for the relevant standard. Check also local codes and local requirements. In some countries, local regulations might apply.

If an external fuse is necessary or used, minimum requirements must be considered to avoid nuisance tripping of the circuit breaker. A minimum value of 6 A, B-Characteristic or C-Characteristic breaker should be used.

Output Circuit Breakers

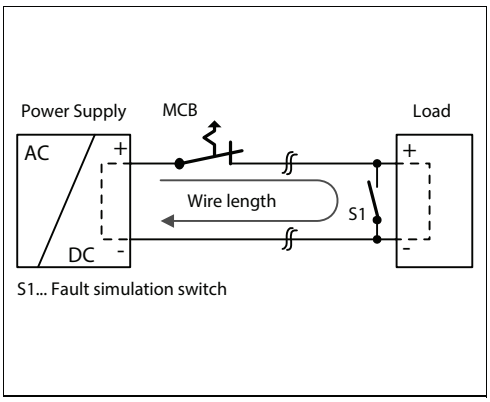
Standard miniature circuit breakers (MCBs or UL 1077 circuit breakers) are commonly used for AC-supply systems and may also be used on 24V branches.

MCBs are designed to help protect wires and circuits. If the ampere value and the characteristics of the MCB are adapted to the wire size that is used, the wiring is considered as thermally safe regardless of whether the MCB opens or not.

To avoid voltage dips and undervoltage situations in adjacent 24V branches that are supplied by the same source, a fast (magnetic) tripping of the MCB is desired. A quick shutdown within 10 ms is necessary corresponding roughly to the ride-through time of PLCs. This requires power supplies with high current reserves and large output capacitors. Furthermore, the impedance of the faulty branch must be sufficiently small in order for the current to flow. The best current reserve in the power supply does not help if Ohm's law does not permit current flow. The following table has typical test results showing which B- and C-Characteristic MCBs magnetically trip depending on the wire cross section and wire length. The following table shows maximal wire length for a fast (magnetic) tripping. Consider twice the distance to the load (or cable length) when calculating the total wire length (+ and – wire).

	0.75 mm²	**1.0 mm²**	**1.5 mm²**	**2.5 mm²**
C-2 A	30 m (98 ft)	37 m (121 ft)	54 m (177 ft)	84 m (275 ft)
C-3 A	25 m (82 ft)	30 m (98 ft)	46 m (151 ft)	69 m (226 ft)
C-4 A	9 m (29 ft)	15 m (49 ft)	25 m (82 ft)	34 m (111 ft)
C-6 A	3 m (10 ft)	3 m (10 ft)	4 m (13 ft)	7 m (23 ft)
C-8 A	–	–	–	–
B-6 A	12 m (39 ft)	15 m (49 ft)	21 m (69 ft)	34 m (111 ft)
B-10 A	3 m (10 ft)	3 m (10 ft)	4 m (13 ft)	9 m (29 ft)
B-13 A	2 m (6 ft)	2 m (6 ft)	3 m (10 ft)	6 m (20 ft)

Figure 39 - Test Circuit



Series Operation

Power supplies of the same type can be connected in series for higher output voltages. It is possible to connect as many units in series as needed, providing the sum of the output voltage does not exceed 150V DC. Voltages with a potential above 60V DC are not SELV anymore and can be dangerous. Such voltages must be installed with a protection against touching.

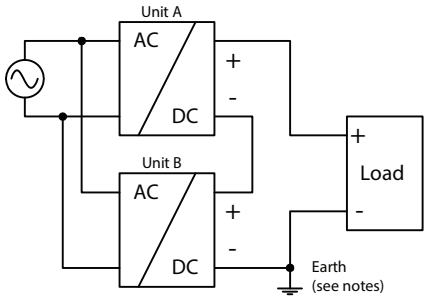
Earthing of the output is required when the sum of the output voltage is above 60V DC.

Avoid return voltage (for example from a decelerating motor or battery) which is applied to the output terminals.

Restrictions: Keep an installation clearance of 15 mm (0.59 in.) (left / right) between two power supplies and avoid installing the power supplies on top of each other. Do not use power supplies in series in mounting orientations other than the standard mounting orientation (terminals on bottom of the unit).

Leakage current, EMI, inrush current, harmonics increase when using multiple power supplies.

Figure 40 - Series Operation



Parallel Use to Increase Output Power

1606-XLE240E power supplies can be paralleled to increase the output power. The output voltage of all power supplies shall either be adjusted to the same value (±100 mV) with the same load conditions on all units, or the units can be left with the factory settings. There is no feature included that balances the load current between the power supplies. Usually the power supply with the higher adjusted output voltage draws current until it goes into current limitation. This means no harm to this power supply as long as the ambient temperature stays below 40 °C (104 °F).

If more than three units are connected in parallel, a fuse or circuit breaker with a rating of 15 A or 16 A is required on each output. Alternatively, a diode or redundancy module can also be used.

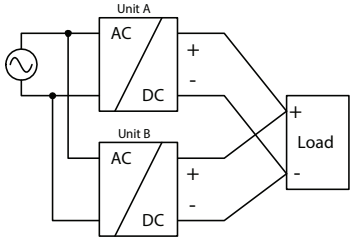
Energize all units simultaneously to avoid the overload HiccupPLUS mode. It also might be necessary to cycle the input power (turn off for at least five seconds), if the output was in HiccupPLUS mode due to overload or short circuits and the required output current is higher than the current of one unit.

Restrictions: Keep an installation clearance of 15 mm (0.59 in.) (left / right) between two power supplies and avoid installing the power supplies on top of each other. To use power supplies in parallel, ensure the following:

- The power supplies are in the standard mounting orientation (terminals on bottom of the unit).
- The power supplies are not in any condition where a derating of the output current is required, such as altitude.

Leakage current, EMI, inrush current, harmonics increase when using multiple power supplies.

Figure 41 - Parallel Use to Increase Output Power



Parallel Use for Redundancy

The power supply can be used for either 1+1 redundancy or N+1 redundancy.

1+1 Redundancy

Power supplies can be paralleled for redundancy to gain higher system availability. Redundant systems require a certain amount of extra power to support the load in case one power supply unit fails. The simplest way is to put two power supplies in parallel. This is called a 1+1 redundancy. In case one power supply unit fails, the other one is automatically able to support the load current without any interruption. It is essential to use a redundancy module to decouple power supplies from each other. This helps prevent the defective unit from becoming a load for the other power supplies, helping to maintain output voltage.

Instead of external redundancy modules, you can use power supplies with built-in redundancy, such as 1606-XLE240ERL (spring-clamp terminals), or 1606-XLE240ERZ (plug connectors for hot swap).

Recommendations for building redundant power systems:

- Use separate input fuses for each power supply.
- Monitor the individual power supply units. Therefore, use the DC OK relay contact of the power supply.
- It is desirable to set the output voltages of all units to the same value (± 100 mV) or leave it at the factory setting.

Leakage current, EMI, inrush current, and harmonics increase when using multiple power supplies.

Wiring examples for 1+1 redundancy:

Figure 42 - Wiring for 1+1 Redundancy with the 1606-XLERED20 Redundancy Module

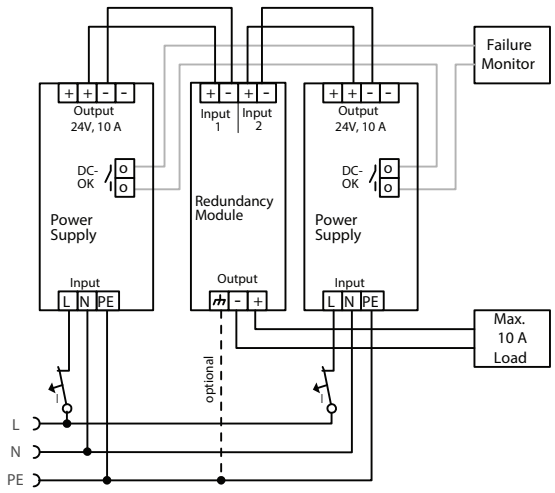
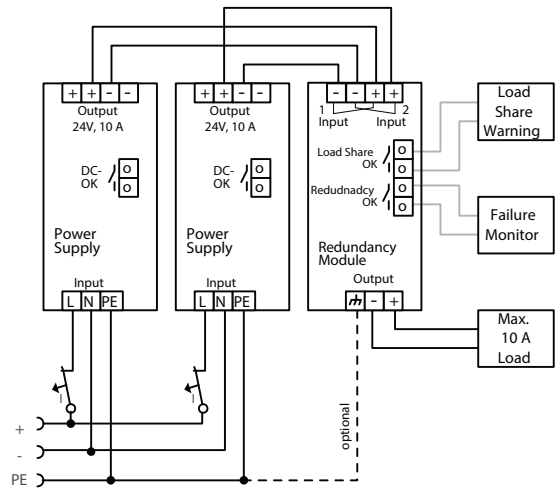


Figure 43 - Wiring for 1+1 Redundancy with the 1606-XLERED20Y Redundancy Module



N+1 Redundancy

Redundant systems for a higher power demand are usually built in an N+1 method. For example, four power supplies, each rated for 10 A, are paralleled to build a 30 A redundant system.

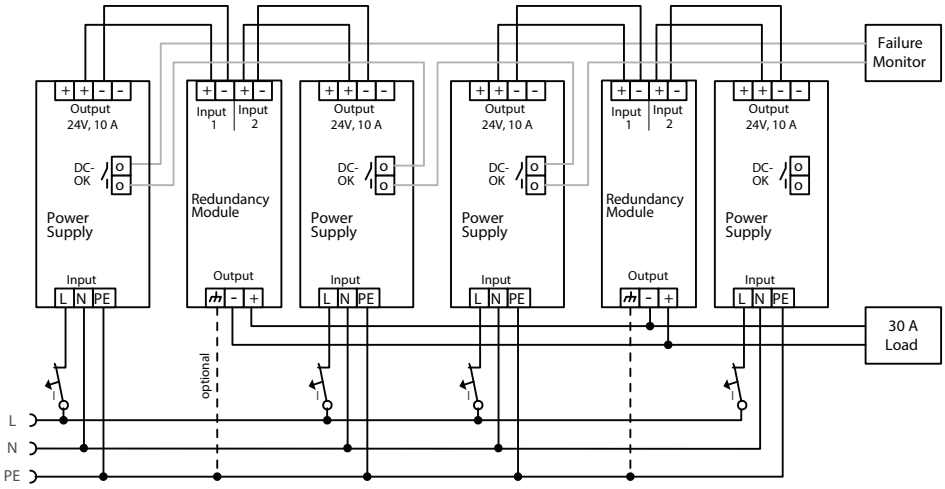
Leakage current, EMI, inrush current, and harmonics increase when using multiple power supplies.

Keep an installation clearance of 15 mm (0.59 in.) (left / right) between two power supplies and avoid installing the power supplies on top of each other. To use power supplies in parallel, ensure the following:

- The power supplies are in the standard mounting orientation (terminals on bottom of the unit).
- The power supplies are not in any condition where a derating of the output current is required, such as altitude.

Wiring examples for 1+1 redundancy:

Figure 44 - Wiring for N+1 Redundancy with Four Power Supplies and Two 1606-XLERED20 Redundancy Modules



Inductive and Capacitive Loads

The unit is designed to supply any kind of loads, including capacitive and inductive loads. If large capacitors, such as EDLCs (electric double layer capacitors or “UltraCaps”) with a capacitance larger than 1.5 F are connected to the output, the unit might charge the capacitor in the HiccupPLUS mode (see Output on page 10).

Charging Of Batteries

The power supply can be used to charge lead-acid or maintenance free batteries (SLA or VRLA batteries). Charging requires two 12V batteries in series.

Instructions for charging batteries:

1. Set the output voltage (measured at no load and at the battery end of the cable) precisely to the end-of-charge voltage.

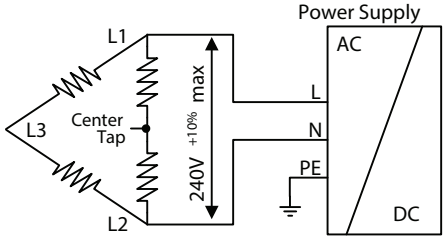
End-of-charge voltage	27.8V	27.5V	27.15V	26.8V
Battery temperature	10 °C (50 °F)	20 °C (68 °F)	30 °C (86 °F)	40 °C (104 °F)

2. Use a 15 A or 16 A circuit breaker (or blocking diode) between the power supply and the battery.
3. Ensure that the output current of the power supply is below the allowed charging current of the battery.
4. Use only matched batteries when putting 12V types in series.
5. Ensure that the ambient temperature of the power supply stays below 40 °C (104 °F).
6. The return current to the power supply (battery discharge current) is 3.5 mA typ when the power supply is switched off (except in case a blocking diode is used).

Operation On Two Phases

The power supply can also be used on two-phases of a three-phase-system. Such a phase-to-phase connection is allowed as long as the supplying voltage is below 240V+10%.

Figure 45 - Operation on Two Phases



Use in a Tightly Sealed Enclosure

When the power supply is installed in a tightly sealed enclosure, the temperature inside the enclosure is higher than outside. In such situations, the inside temperature defines the ambient temperature for the power supply.

The following measurement results can be used as a reference to estimate the temperature rise inside the enclosure.

The power supply is placed in the middle of the box. No other heat producing items are inside the box.

The temperature sensor inside the box is placed in the middle of the right side of the power supply with a distance of 1 cm (0.39 in.).

Attributes	Case A	Case B	Case C	Case D
Enclosure size	110 x 180 x 165 mm (4.33 x 7.09 x 6.50 in.) Rittal Typ IP66 Box PK 9516 100, plastic	110 x 180 x 165 mm (4.33 x 7.09 x 6.50 in.) Rittal Typ IP66 Box PK 9516 100, plastic	180 x 180 x 165 mm (7.09 x 7.09 x 6.50 in.) Rittal Typ IP66 Box PK 9519 100, plastic	180 x 180 x 165 mm (7.09 x 7.09 x 6.50 in.) Rittal Typ IP66 Box PK 9519 100, plastic
Input voltage	230V AC	230V AC	230V AC	230V AC
Load	24V, 8 A; (=80%)	24V, 10 A; (=100%)	24V, 8 A; (=80%)	24V, 10 A; (=100%)
Temperature inside the box	48.6 °C (119.48 °F)	53.8 °C (128.84 °F)	42.0 °C (107.6 °F)	48.1 °C (118.58 °F)
Temperature outside the box	26.3 °C (79.34 °F)	26.6 °C (79.88 °F)	25.8 °C (78.44 °F)	26.2 °C (79.16 °F)
Temperature rise	22.3 K (40.14 °F)	27.2 K (48.96 °F)	16.2 K (29.16 °F)	21.9 K (39.42 °F)

Mounting Orientations

Mounting orientations other than Orientation A, all terminals on the bottom, require a reduction in continuous output power or a limitation in the maximum allowed ambient temperature. The amount of reduction influences the lifetime expectancy of the power supply. Therefore, two different derating curves for continuous operation are shown below:

- Curve A1 - Recommended output current.
- Curve A2 - Max allowed output current (results in approximately half the lifetime expectancy of A1).

Figure 46 - Mounting Orientation A (standard orientation)

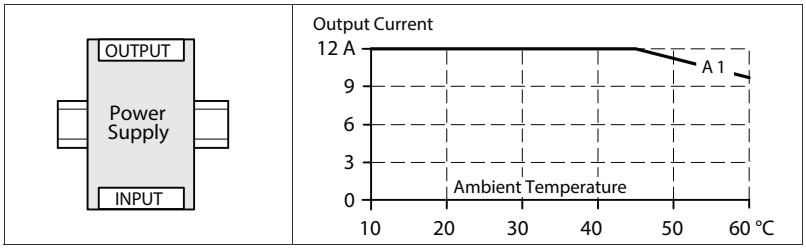


Figure 47 - Mounting Orientation B (upside down)

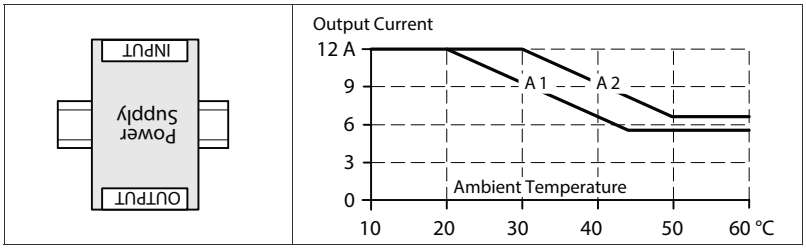


Figure 48 - Mounting Orientation C (table-top mounting)

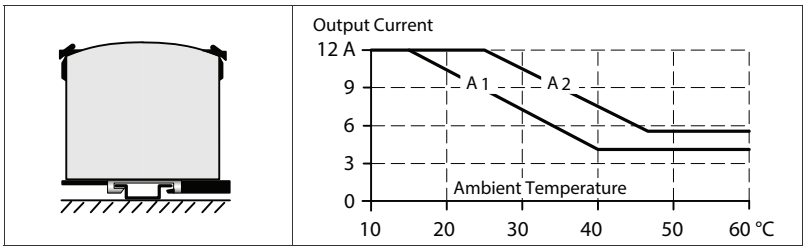


Figure 49 - Mounting Orientation D (horizontal clockwise)

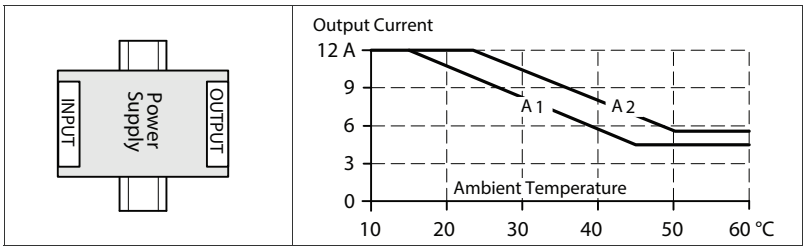
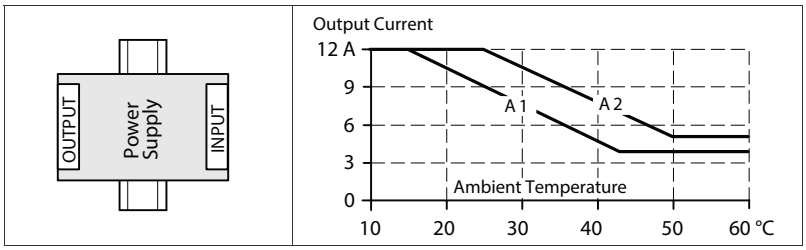


Figure 50 - Mounting Orientation E (horizontal counterclockwise)



Notes:

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
1606-XL Power Supply Technical Data, publication 1606-TD001	Provides specifications and certifications for the 1606-XL240E-3 power supply.
Switched Mode Power Supply Specifications Technical Data, publication 1606-TD002	Provides specifications for Bulletin 1606 6-XL, -XLE, -XLP, and -XLS products and applications.
Industrial Components Preventive Maintenance, Enclosures, and Contact Ratings Specifications, publication IC-TD002	Provides a quick reference tool for Allen-Bradley industrial automation controls and assemblies.
Safety Guidelines for the Application, Installation, and Maintenance of Solid-State Control, publication SGI-1.1	Designed to harmonize with NEMA Standards Publication No. ICS 1.1-1987 and provides general guidelines for the application, installation, and maintenance of solid-state control in the form of individual devices or packaged assemblies incorporating solid-state components.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, rok.auto/certifications.	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at rok.auto/literature.

Rockwell Automation Support

Use these resources to access support information.

Technical Support Center	Find help with how-to videos, FAQs, chat, user forums, and product notification updates.	rok.auto/support
Knowledgebase	Access Knowledgebase articles.	rok.auto/knowledgebase
Local Technical Support Phone Numbers	Locate the telephone number for your country.	rok.auto/phonesupport
Literature Library	Find installation instructions, manuals, brochures, and technical data publications.	rok.auto/literature
Product Compatibility and Download Center (PCDC)	Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes.	rok.auto/pcdc

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Waste Electrical and Electronic Equipment (WEEE)

At the end of life, this equipment should be collected separately from any unsorted municipal waste.

Rockwell Automation maintains current product environmental compliance information on its website at rok.auto/pec.

Rockwell Otomasyon Ticaret A.Ş. Kar Plaza İş Merkezi E Blok Kat:6 34752, İçerenköy, İstanbul, Tel: +90 (216) 5698400 EEE Yönetmeliğine Uygundur

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AMERICAS: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
EUROPE/MIDDLE EAST/AFRICA: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
ASIA PACIFIC: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

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