Reference Manual

Original Instructions

Allen-Bradley

Basic Power Supply 5 A

Catalog Number 1606-XLB120E

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 circu mstances 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 circu mstances 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

Summary of Changes

This manual contains new and updated information as indicated in the following table.

Topic	Page
Corrected dimension information	23

Additional Resources

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

Resource	Description
Switched Mode Power Supply Technical Data, publication 1606-TD002	Provides specifications and approximate dimensions for full line of switched mode power supplies.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation® industrial system.
Product Certifications website, http://www.rockwellautomation.com/global/certification/overview.page	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http://www.rockwellautomation.com/global/literature-library/overview.page. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

Terminology and Abbreviations

Term	Definition
230V AC	A figure with the unit (V AC) at the end is a momentary figure 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.
AC 230V	A figure that is displayed with the AC or DC before the value represents a nominal voltage with standard tolerances included. For example: DC 12V describes a 12V battery, whether it is full (13.7V) or flat (10V)
Earth, Ground	This document uses the term “earth” which is the same as the U.S. term “ground”.
PE and symbol	PE is the abbreviation for **P**rotective **E**arth and has the same meaning as the symbol.
PELV	Protection by extra-low voltage
SELV	Safety by extra-low voltage

Product Overview

1606-XLB Basic Power Supplies are compact, industrial grade power supplies that focus on the essential features needed in industrial applications.

The housing is made of a high-grade, reinforced molded material, which permits the units to be used in ambient temperatures up to 70 °C (158 °F).

This power supply features a wide input voltage range, which makes it suitable for global use.

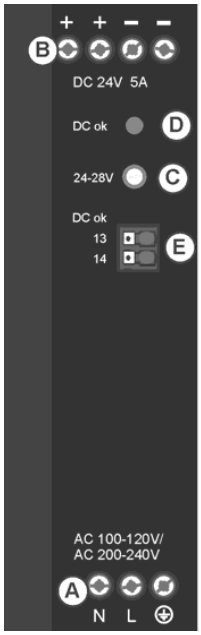
The addition of a DC-OK signal makes the power supply ideal for many industry applications such as: process, automation, and many other critical applications where preventive function monitoring can help to avoid long downtimes.

The 1606-XLB120E power supply offers these features:

- 100...120V/200...240V AC auto-select input
- Cost that is optimized without compromising the quality or reliability
- Small width of 39 mm (1.54 in.) takes up less space on the DIN rail
- Efficiency up to 92.3%
- Full power between -10...+55 °C (14...131 °F)
- DC-OK relay contact included
- 1-year warranty

Front Side and User Elements

Figure 1 - Front Side of DC-UPS



Letter	Description
A	**Input terminals - (**screw terminals) N, L - Line input PE - Protective earth input
B	**Output terminals** - (screw terminals, two pins per pole) + Positive output – Negative (return) output
C	**Output voltage potentiometer -** Guaranteed adjustment range: 24…28V Factory set: 24.1V
D	**DC-OK status indicator-** (green) On, when the output voltage is >18V
E	**DC-OK Relay Contact** (push-in terminals)

Protection Features

Attribute	1606-XLB120E	
Output protection	Electronically protected against overload, no-load, and short circuits	
Output overvoltage protection	typ 31V DC max 34V DC	In case of an internal power supply anomaly, a redundant circuit limits the maximum output voltage. In such a case, the output shuts down and stays down until the input voltage is turned off and on again for at least 1 minute or until the green status indicator went off.
Degree of protection	IP 20	EN/IEC 60529 Caution: For use in a controlled environment according to CSA 22.2 No 107.1-01.
Over-temperature protection	no	
Input transient protection	MOV (Metal Oxide Varistor)	
Internal input fuse	Included	Not user replaceable

Safety Features

Attribute	1606-XLB120E	
Input/output separation double or reinforced insulation	SELV	IEC/EN 60950-1
	PELV	IEC/EN 60204-1, EN 50178, IEC 62103, IEC 60364-4-41
Class of protection	I	PE (Protective Earth) connection required
Isolation resistance	> 100 MOhm	Input to output, 500V DC
Touch current (leakage current)	typ 0.21 mA/0.46 mA	100V AC, 50 Hz, TN-,TT-mains/IT-mains
	typ 0.30 mA/0.65 mA	120V AC, 60 Hz, TN-,TT-mains/IT-mains
	typ 0.33 mA/0.72 mA	230V AC, 50 Hz, TN-,TT-mains/IT-mains
	< 0.27 mA/0.56 mA	110V AC, 50 Hz, TN-,TT-mains/IT-mains
	< 0.38 mA/0.78 mA	132V AC, 60 Hz, TN-,TT-mains/IT-mains
	< 0.43 mA/0.90 mA	264V AC, 50 Hz, TN-,TT-mains/IT-mains

Installation Notes

- Use appropriate copper cables that are designed for minimum operating temperatures of:
  - 75 °C (167 °F) for ambient up to 55 °C (131 °F) minimum.
  - 90 °C (194 °F) for ambient up to 70 °C (158 °F) minimum.
- Follow national installation codes and installation regulations
- Verify that all strands of a stranded wire enter the terminal connection.
- Do not use the power supply without a PE connection.
- Secure unused terminal compartments tightly.
- Ferrules are allowed.

Terminals and Wiring

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

Attribute	Input and Output Terminals	DC-OK Signal Terminal
Terminal type	Screw terminals	Push-in terminals
Solid wire, max	6 mm^2	1.5 mm^2
Stranded wire, max	4 mm^2	1.5 mm^2
American Wire Gauge	AWG 20-10	AWG 28-16
Wire diameter, max including ferrules)	2.8 mm (0.11 in.)	1.6 mm (0.06 in.)
Wire stripping length	7 mm (0.28 in.)	7 mm (0.28 in.)
Screwdriver	3.5 mm (0.14 in.) slotted or cross-head No 2	Not required
Recommended tightening torque	1 N•m (9 lb•in)	Not applicable

Input

Attribute		1606-XLB120E	
AC input	nom	100…120V/200…240V AC	Auto-select, suitable for TN-, TT- and IT mains networks
AC input range	min	90…132V AC/180…264V AC	continuous operation
	min	264…300V AC	< 500 ms
Allowed voltage L or N to earth	max	300V AC	continuous, IEC 62103
Input frequency	nom	50…60 Hz	±6%
External input protection		See recommendations in External Input Protection on page 16	

Attribute		AC 100V	AC 120V	AC 230V	
Input current	typ	2.0 A	1.72 A	1.05 A	at 24V, 5 A, see Figure 3
Power factor(1)	typ	0.66	0.64	0.54	at 24V, 5 A, see Figure 5
Crest factor(2)	typ	2.7	2.8	3.4	at 24V, 5 A
Turn-on voltage	typ	78V AC	78V AC	157V AC	at 24V 0 A, steady-state value, see Figure 2
Shut-down voltage	typ	68V AC	68V AC	68V AC	at 24V 5 A, steady-state value, see Figure 2
Start-up delay	typ	400 ms	400 ms	100 ms	see Figure 4
Rise time	typ	30 ms	30 ms	30 ms	at 24V, 5 A const. current load, 0mF load capacitance, see Figure 4
	typ	90 ms	90 ms	90 ms	at 24V, 5 A const. current load, 5mF load capacitance, see Figure 4
Turn-on overshoot	max	200 mV	200 mV	200 mV	see Figure 4

(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 the T ms value of the input current waveform.

Figure 2 - Input Voltage Range, typ

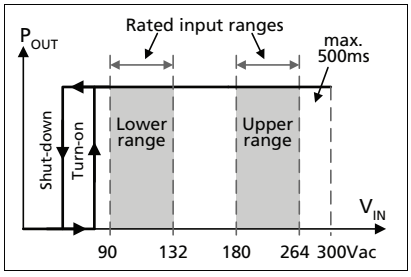


Figure 3 - Input Current vs. Output Load at 24V

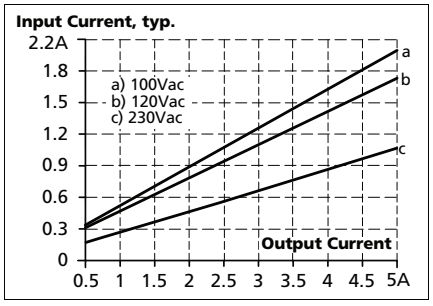


Figure 4 - Turn-on Behavior, Definitions

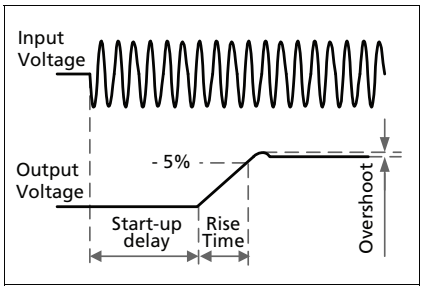
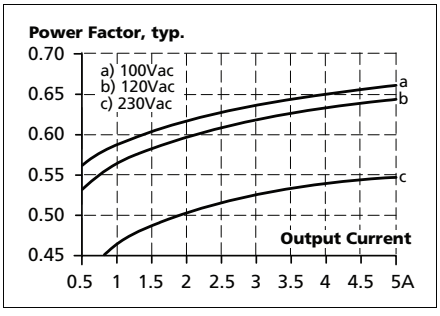


Figure 5 - Power Factor vs. Output Load



DC-Input

Do not operate the power supply with DC-input voltage.

Input Inrush Current

A NTC inrush limiter limits the input inrush current after turn-on of the input voltage.

Attribute		AC 100V	AC 120V	AC 230V	Notes
Inrush current	max	23 A peak	27 A peak	40 A peak	40 °C (104 °F) ambient, cold start
	typ	18 A peak	22 A peak	33 A peak	
Inrush energy	typ	13 A peak	16 A peak	30 A peak	25 °C (77 °F) ambient, cold start
	max	0.4 A^2s	0.5 A^2s	1.5 A^2s	40 °C (104 °F) ambient, cold start

Figure 6 - Input Inrush Current, Typical Behavior, 230V AC Input, 24V 5 A Output, 40 °C (104 °F) Ambient

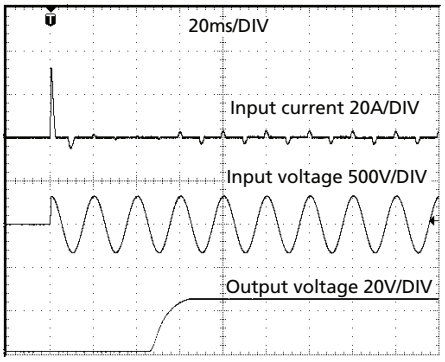
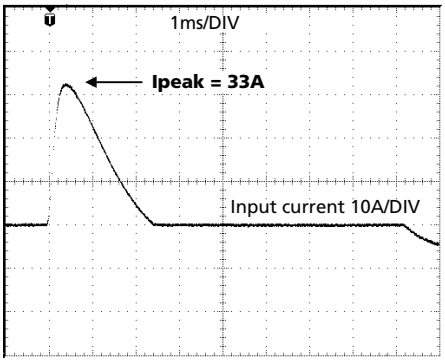


Figure 7 - Input Inrush Current, Zoom Into First Peak 230V AC Input, 24V 5 A Output, 40 °C (104 °F) Ambient



Output

Attribute		1606-XLB120E	Notes
Output voltage	nom	DC 24V	
Adjustment range	min	24…28V	guaranteed
	max	30V(1)	at clockwise end position of potentiometer
Factory settings	typ	24.1V	±0.2 %, at full load, cold unit
Line regulation	max	10 mV	90…132/180…264V AC
Load regulation	max	150 mV	static value, 0 A .. 5 A .. 0 A
Ripple and noise voltage	max	100 mVpp	20 Hz to 20 MHz, 50 Ohms
Output current	for AC 110…120/220…240V mains voltages (includes AC 208V mains):		
	nom	5 A	at 24V, below 55 °C (122 °F) ambient temperature
		4.3 A	at 28V, below 55 °C (122 °F) ambient temperature
		3.1 A	at 24V, at 70 °C (158 °F) ambient temperature
		2.7 A	at 28V, at 70 °C (158 °F) ambient temperature
		Derate linearly between +55 °C (122 °F) and +70 °C (158 °F)	
	for AC 100/200V mains voltages:		
	nom	5 A	at 24V, below 55 °C (122 °F) ambient temperature
		4.3 A	at 28V, below 55 °C (122 °F) ambient temperature
		2.5 A	at 24V, at 70 °C (158 °F) ambient temperature
		2.1 A	at 28V, at 70 °C (158 °F) ambient temperature
		Derate linearly 50 …70 °C (122…158 °F)	
Overload behavior		continuous current	output voltage > 10V DC, see Figure 8
		Intermittent	output voltage < 10V DC, see Figure 8
Short Circuit current	typ	3.5 A(2)	average (R.M.S.) current, load impedance 50mOhm
Output capacitance	typ	2 050 µF	included inside the power supply

(1) This is the maximum output voltage that can occur at the clockwise end position of the potentiometer due to tolerances. It is not guaranteed value that can be achieved. The typical value is about 28.5V.

(2) Discharge current of output capacitors is not included.

Figure 8 - Output Voltage vs. Output Current, R ms current, typ

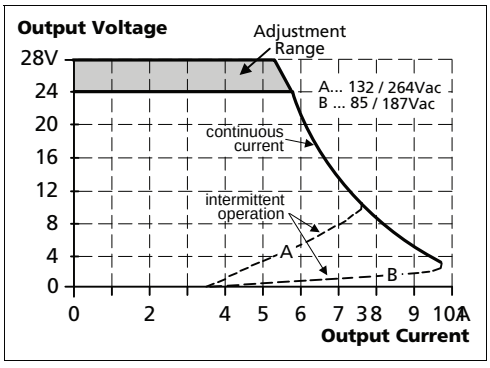
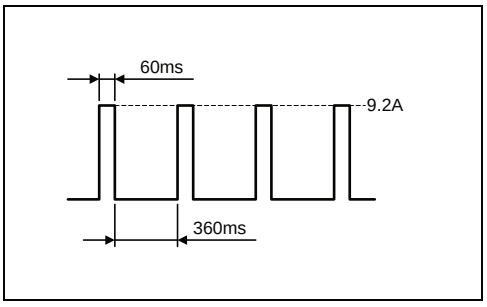


Figure 9 - Intermittent Operation at Shorted Output, typ



Hold-up Time

Type		AC 100V	AC 120V	AC 230V
24V, 2.5 A	typ	64 ms	108 ms	105 ms
	min	54 ms	91 ms	88 ms
24V, 5 A	typ	26 ms	51 ms	50 ms
	min	22 ms	43 ms	42 ms

Figure 10 - Hold-up Time vs. Input Voltage

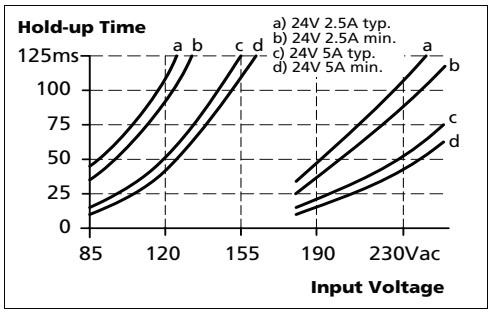
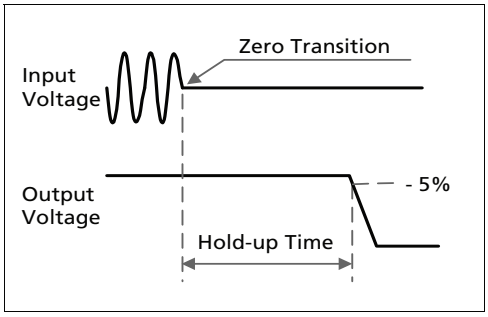


Figure 11 - Shut-down behavior, definitions

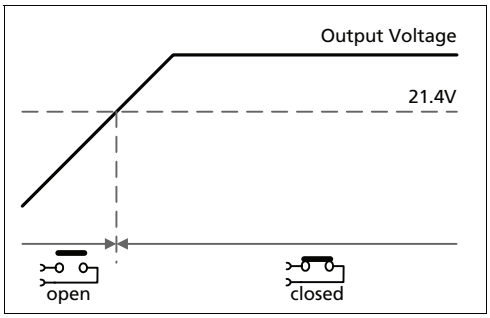


DC OK Relay Contact

This feature monitors the output voltage that is produced by the power supply itself. It is independent of a back-fed voltage from a unit that is connected in parallel to the power supply output (for example, redundant application).

Attribute	1606-XLB120E		
Contact closes	As soon as the output voltage reaches 21.4V		
Contact opens	As soon as the output voltage dips below 21.4V		
Contact ratings	max	60V DC 0.3 A, 30V DC 1 A, 30V AC 0.5 A	resistive load
	min	1 mA at 5V DC	minimum required load
Isolation voltage	See Dielectric Strength on page 21		

Figure 12 - DC-OK Relay Contact Behavior



Efficiency and Power Loss

Attribute		AC 100V	AC 120V	AC 230V	Notes
Efficiency	typ	90.7%	91.2%	92.3%	at 24V, 5 A
Average efficiency(1)	typ	89.2%	89.4%	90.6%	25% at 1.25 A, 25% at 2.5 A, 25% at 3.75 A. 25% at 5 A
Power losses	typ	1.4 W	1.5 W	0.7 W	at 24V, 0 A
	typ	7.0 W	7.4 W	6.0 W	at 24V, 2.5 A
	typ	12.3 W	11.6 W	10.0 W	at 24V, 5 A

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

Figure 13 - Efficiency vs. Output Current, typ

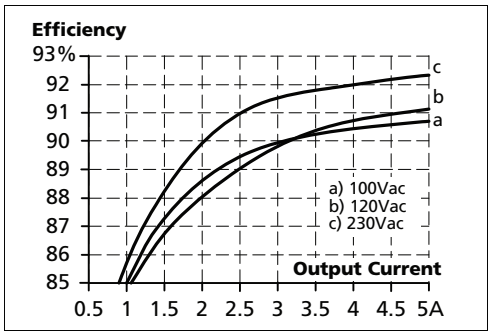


Figure 14 - Efficiency vs. Input Voltage at 24V, 5 A, typ

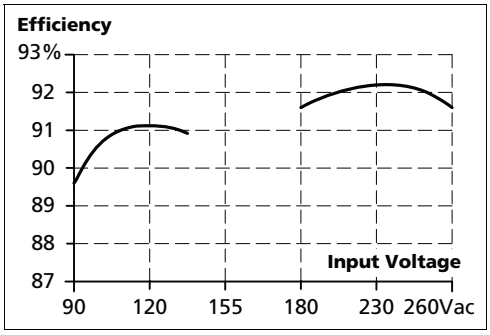


Figure 15 - Power Losses vs. Output Current at 24V, typ

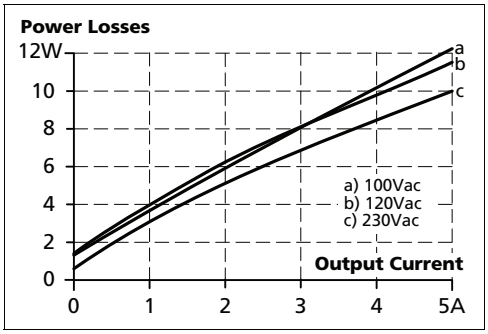
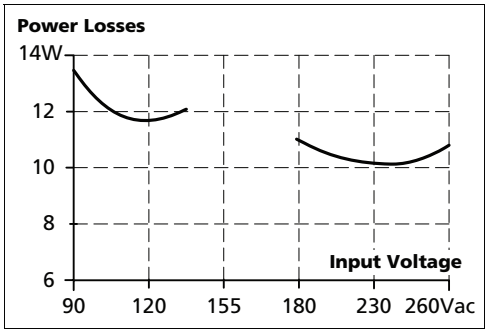


Figure 16 - Power Losses vs. Input Voltage at 24V, 5 A



Lifetime Expectancy and Mean Time between Failure (MTBF)

Attribute		AC 100V	AC 120V	AC 230V	Notes
Lifetime expectancy[1]		181 000 h	194 000 h	219 000 h	at 24V, 2.5 A and 40 °C (104 °F)
		511 000 h	548 000 h	621 000 h	at 24V, 2.5 A and 25 °C (77 °F)
		66 000 h	68 000 h	83 000 h	at 24V, 5 A and 40 °C (104 °F)
		188 000 h	193 000 h	234 000 h	at 24V, 5 A and 25 °C (77 °F)
MTBF[2]	SN 29500, IEC 61709	1 065 000 h	1 147 000 h	1 379 000 h	at 24V, 5 A and 40 °C (104 °F)
		2 038 000 h	2 166 000 h	2 519 000 h	at 24V, 5 A and 25 °C (77 °F)
	MIL HDBK 217 F	681 000 h	651 000 h	645 000 h	at 24V, 5 A and 40 °C (104 °F); Ground Benign GB40
		872 000 h	842 000 h	839 000 h	at 24V, 5 A and 25 °C (77 °F); Ground Benign GB25
		165 000 h	164 000 h	168 000 h	at 24V, 5 A and 40 °C(104 °F); Ground Fixed GF40
		206 000 h	205 000 h	211 000 h	at 24V, 5 A and 25 °C (77 °F); Ground Fixed GF25

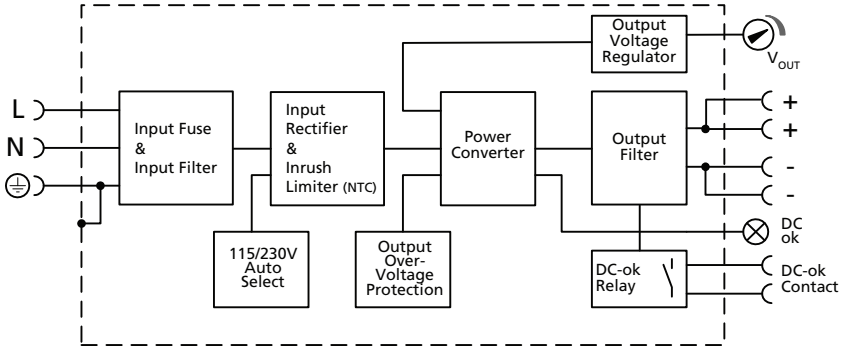
(1) The Lifetime expectancy that is shown in the table indicates the minimum operating hours (service life) and is determined by the lifetime expectancy of the built-in electrolytic capacitors. Lifetime expectancy is specified in operational hours and is calculated according to the capacitor's manufacturer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

(2) MTBF stands for Mean Time Between Failure, which 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 figure is a statistical representation of the likelihood of a device to fail. A MTBF figure 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.

Functional Diagram

Figure 17 - Functional Diagram



EMC

EMC Immunity	According to Generic Standards EN 61000-6-1 and EN 61000-6-2			Criterion[1]
Electrostatic discharge	EN 61000-4-2	contact discharge air discharge	8 kV 8 kV	Criterion A 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 output lines DC-OK signal (coupling clamp)	4 kV 2 kV 2 kV	Criterion A Criterion A Criterion A
Surge voltage on input	EN 61000-4-5	L ->N L ->PE, N ->PE	2 kV 4 kV	Criterion A Criterion A
Surge voltage on output	EN 61000-4-5	+ ->- +/- ->PE	500V 1 kV	Criterion A Criterion A
Surge voltage on DC-OK	EN 61000-4-5	DC-OK signal… PE	1 kV	Criterion A
Conducted disturbance	EN 61000-4-6	0.15…80 M Hz	20V	Criterion A
Mains voltage dips	EN 61000-4-11	0% of 100V AC 40% of 100V AC 70% of 100V AC 0% of 200V AC 40% of 200V AC 70% of 200V AC	0V AC, 20 ms 40V AC, 200 ms 70V AC, 500 ms 0V AC, 20 ms 80V AC, 200 ms 140V AC, 500 ms	Criterion A Criterion C Criterion A[2] Criterion A Criterion C Criterion A
Voltage interruptions	EN 61000-4-11	0% of 220V AC (=0V)	5000 ms	Criterion C
Voltage sags	SEMI F47 0706	dips on the input voltage according to SEMI F47 standard		
		80% of 208V AC (166V AC) 70% of 208V AC (146V AC) 50% of 208V AC (104V AC) 80% of 120V AC (96V AC) 70% of 120V AC (84V AC) 50% of 120V AC (60V AC)	1000 ms 500 ms 200 ms 1000 ms 500 ms 200 ms	Criterion A Criterion A Criterion C Criterion A Criterion A Criterion C
Powerful transients	VDE 0160	over entire load range	750V, 1.3 ms	Criterion A

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

(2) Below 4.5 A, Criterion C for currents above 5 A.

EMC Emission	According to Generic Standards: EN 61000-6-3, EN 610000-6-4	
Conducted emission input lines	EN 55011, 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 not fulfilled
Radiated emission	EN 55011, EN 55022	Class B
Harmonic input current	EN 61000-3-2	Fulfilled for class A equipment
Voltage fluctuations, flicker	EN 61000-3-3	Fulfilled[2]
This device complies with FCC Part 15 rules. Operation is subjected to following two conditions: (1) this device cannot cause harmful interference, and (2) this device must accept any interference received, including interference that can cause undesired operation.		

(1) For information only, not mandatory for EN 61000-6-3.

(2) Tested with constant current loads, non-pulsing.

Application Notes

Peak Current Capability

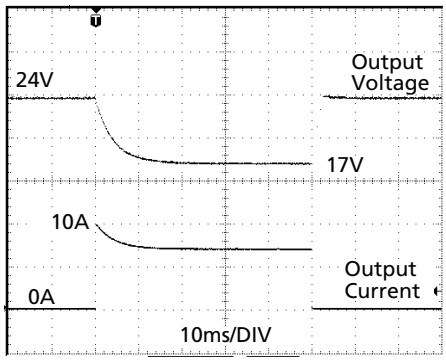
The unit can deliver peak currents (up to several milliseconds) which are higher than the specified short-term currents.

This helps to start current demanding loads. 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. The same situation applies when starting a capacitive load.

The peak current capability also verifies 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.

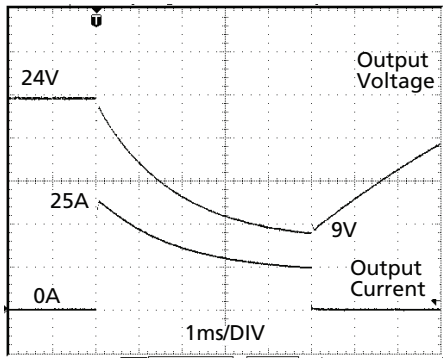
The extra current (peak current) is supplied by the power converter and the built-in large sized output capacitors of the power supply. The capacitors get discharged during such an event, which causes a voltage dip on the output. The following two examples show typical voltage dips:

Figure 18 - Peak Load with 2x the Nominal Current for 50 ms, typ



10 A Peak load (resistive) for 50 ms
Output voltage dips from 24V to 17V.

Figure 19 - Peak Load with 5x the Nominal Current for 5 ms, typ



25 A Peak load (resistive) for 5 ms
Output voltage dips from 24V to 9V.

Peak Current Capability		Voltage Dip	Peak Load
Peak current voltage dips	typ	24…17V	at 10 A for 50 ms, resistive load
	typ	24…13V	at 25 A for 2 ms, resistive load
	typ	24…9V	at 25 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- E.M.F. (Electro Magnetic Force).

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 absorbing energy can be calculated according to the built-in large sized output capacitor that 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 this. Check also local codes and local requirements. In some countries local regulations might apply.

If an external fuse is necessary or utilized, minimum requirements need to be considered to avoid nuisance tripping of the circuit breaker. A minimum value of 10 A, B-characteristic or 6 A, C-characteristic breaker should be used.

Parallel Use to Increase Output Power

Do not use the power supply in parallel to increase the output power.

Parallel Use for 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.

This simple way to build a redundant system does not cover failures such as an internal short circuit in the secondary side of the power supply. In such a case, the defect unit becomes a load for the other power supplies and the output voltage cannot be maintained any more. This can only be avoided by utilizing decoupling diodes that are included in the redundancy module.

Recommendations for building redundant power systems:

- Use the DC-OK signal contact to monitor the individual power supply units.
- Use separate input fuses for each power supply.
- Use separate mains systems for each power supply whenever it is possible.
- It is desirable to set the output voltages of all units to the same value (± 100 mV) or leave it at the factory setting.

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 any more and can be dangerous. Such voltages must be installed with a protection against touching.

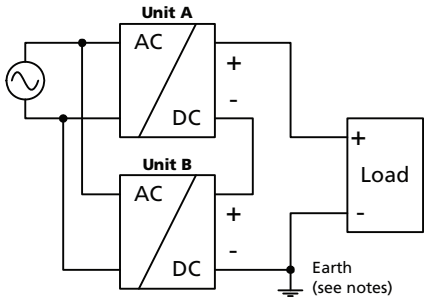
Earthing of the output is required when the sum of the output voltage is above 60V DC.

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

Keep an installation clearance (left/right) of 15 mm (0.59 in.)between two power supplies and avoid installing the power supplies on top of each other.

Pay attention that leakage current, EMI, inrush current, harmonics increase when using multiple power supplies.

Figure 20 - Series Operation



Inductive and Capacitive Loads

- No limitations for inductive loads.
- No limitations for capacitive loads in combination with an additional resistive type of load.
- Limitations apply for capacitive loads in combination with constant current type of loads:
  - 20 mF Max with an additional 2.5 A constant current load and
  - 10 mF max with an additional 5 A constant current load.

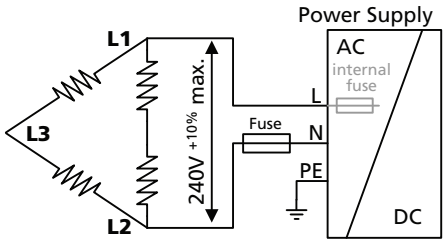
Charging of Batteries

Do not use the power supply to charge batteries.

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 21 - 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.

- Enclosure
  - Rittal Type IP 66 Box PK 9516 100
  - Plastic
  - 110 x 180 x 165 mm (4.33 x 7.09 x 6.50 in)
- Input
  - 230V AC

Attribute	Case A	Case B
Load(1)	24V, 5 A	24V, 4 A (=80 %)
Temperature inside the box(2)	41.5 °C (106.7 °F)	38.9 °C (102 °F)
Temperature outside the box	24.4 °C (75.9 °F)	24.2 °C (75.6 °F)
Temperature rise	17.1K	14.5K

(1) Load is placed outside the box.

(2) In the middle of the right side of the power supply with a distance of 1 cm (0.39 in.).

Specifications

Attribute		1606-XLB120E	Notes
Output voltage		DC 24V	
		24…28V DC	Adjustment range
Output	for AC 110…120/ 220…240V mains:	5.0...4.3 A 3.1...2.7 A	at 24…28V, <55 °C (122 °F) at 24…28V, <70 °C (158 °F)
	for AC 100/200V mains:	5.0...4.3 A 2.5...2.1 A	at 24…28V, <50 °C (122 °F) at 24…28V, <70 °C (158 °F)
Output ripple		< 100 mVpp	20 Hz to 20 MHz
AC Input voltage		AC 100…120V/ 200…240V	±10% Auto-Select
Mains frequency		50…60 Hz	±6 %
AC Input current		1.72 A/1.05 A	at 120/ 230V AC
Power factor		0.64/0.54	at 120/ 230V AC
AC Inrush current		22 A/33 A peak	at 120/ 230V AC, 40 °C (140 °F)
Efficiency		91.2 /92.3%	at 120/ 230V AC
Losses		11.6 W/10.0 W	at 120/ 230V AC
Temp. range		-10… +70 °C (14… 158 °F)	operational
Derating		3 W/°C	55…70 °C (131… 158 °F) (1)
Hold-up time		51 ms/50 ms	at 120/ 230V AC
Dimensions		39 x 124 x124 mm (1.53 x 4.88 x 4.88)	W x H x D
Weight		370 g/0.81 lb	

(1) 50…70 °C (122…158 °F) for AC 100 V/ 200V mains

Environment

Attribute	1606-XLB120E	Notes
Operational temperature(1)	-10… +70 °C (14… 158 °F)	reduce output power according to Figure 22
Storage temperature	-40… +85 °C (-40… 185 °F)	for storage and transportation
Output derating(2)	3W/°C (55…70 °C 131…158 °F) 3W/°C (50…70 °C; 122…158 °F)	for AC 110-120/220-240V mains systems for AC 100/200V mains systems
Humidity(3)	5...95% r.h.	IEC 60068-2-30
Vibration sinusoidal(4)	2-17.8Hz: ±1.6mm; 17.8-500Hz: 2g 2 hours/axis	IEC 60068-2-6
Shock(5)	30g 6ms, 20g 11ms 3 bumps/direction, 18 bumps in total	IEC 60068-2-27
Altitude	0…2000 m (0…6 560 ft.)	without any restrictions
	2000…6000 m (6 560… 20 000 ft.)	reduce output power or ambient temperature, see Figure 22 IEC 62103, EN 50178, overvoltage category II
Altitude derating	7.5W/1000m or 5 °C/1000m	> 2000 m (6500 ft.), see Figure 23
Overvoltage category	III	IEC 62103, EN 50178, altitudes up to 2000m
	II	altitudes from 2000m to 6000m
Degree of pollution	2	IEC 62103, EN 50178, not conductive
LABS compatibility	The unit does not release any silicone or other LABS-critical substances and is suitable for use in paint shops.	

(1) Operational temperature is the same as the ambient or surrounding temperature and is defined as the air temperature 2cm below the unit.

(2) For AC 208V mains use AC 200…220V values.

(3) Do not energize while condensation is present.

(4) Tested on a DIN Rail with a thickness of 1.3 mm.

(5) Tested on a DIN Rail with a thickness of 1.3 mm.

Figure 22 - Output Current vs. Ambient Temperature

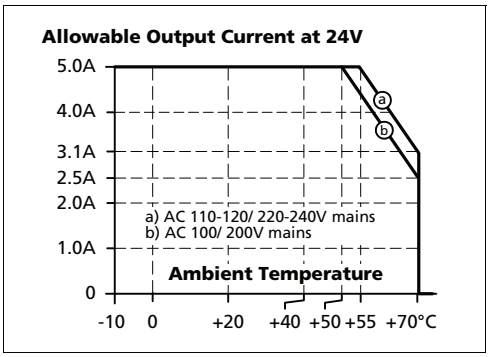
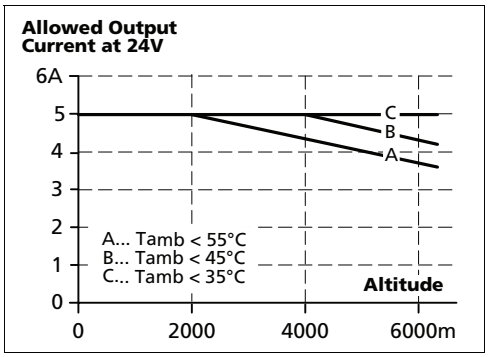


Figure 23 - Output Current vs. Altitude

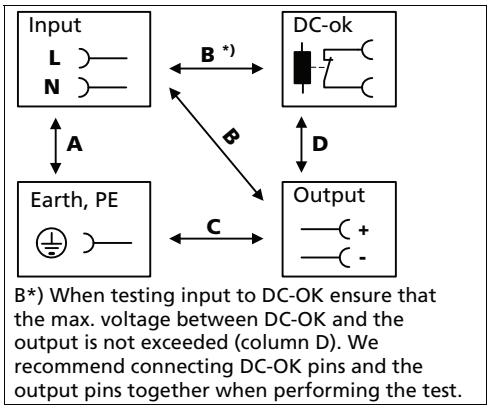


Dielectric Strength

The output voltage is floating and has no ohmic connection to the ground. Type and factory tests are conducted by the manufacturer. Field tests can 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 and all output poles before conducting the test. When testing, set the cutoff current settings to the value in the following table.

		A	B	C	D
Type test	60 s	2500V AC	3000V 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	> 15 mA	> 1 mA

Figure 24 - Dielectric Strength



To meet the PELV requirements according to EN60204-1 § 6.4.1, we recommend that either the + pole, the – pole or any other part of the output circuit 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.

Standards Compliance and Certifications

EC Declaration of Conformity		The CE Marking indicates conformance with the low voltage directive and EMC Directive. EN 60950-1, EN 61000-6
UL 508		Listed for use as Industrial Control Equipment ;U.S.A. (UL 508) and Canada (C22.2 No. 14-15); File: E56639
UL 60950-1		Recognized for use as Information Technology Equipment, U.S.A. (UL 60950-1) and Canada (C22.2 No. 60950); File: E 168663.
RCM Declaration of Conformity		C-tick is for products intended for sale and use within the Australian market.
EAC		EAC is for products intended for sale and use within the Russian market.

Approximate Dimensions and Weight

Attribute	1606-XLB120E
Width	39 mm (1.54 in.)
Height	125 mm (4.92 in.)
Depth[1]	128.95 mm (5.08 in.)
Weight	370 g (0.81 lb)
DIN Rail	Use 35 mm DIN rails according to EN 60715 or EN 50022 with a height of 7.5 or 15 mm.
Plastic Material of Housing	Flame retardant Polycarbonate (PC) - UL94-V0 Vicat softening temperature specified with 149 °C according to ASTM D1525
Installation Clearances	Keep the following installation clearances: 40 mm on top, 20 mm on the bottom, 5 mm on the left and right sides are recommended when the device is loaded permanently with more than 50% of the rated power. Increase this clearance to 15 mm in case the adjacent device is a heat source (for example, another power supply).

(1) The DIN rail height must be added to the unit depth to calculate the total required installation depth.

Dimensions are in mm (in).

Figure 25 - Front View

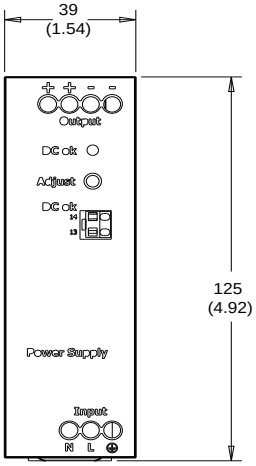
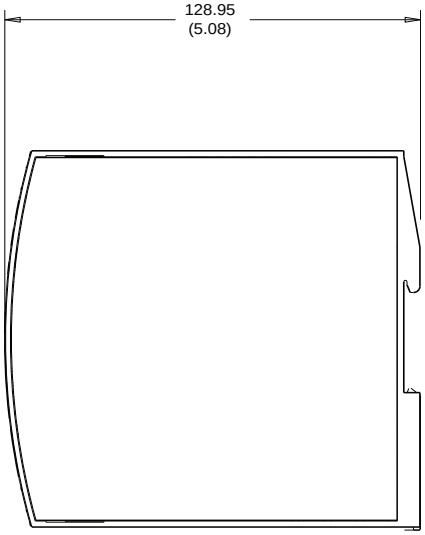


Figure 26 - Side View



Notes:

Rockwell Automation Support

Use the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	https://rockwellautomation.custhelp.com/
Local Technical Support Phone Numbers	Locate the phone number for your country.	http://www.rockwellautomation.com/global/support/get-support-now.page
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	http://www.rockwellautomation.com/global/support/direct-dial.page
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	http://www.rockwellautomation.com/global/literature-library/overview.page
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	http://www.rockwellautomation.com/global/support/pcdc.page

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