EPC Bidirectional DC/DC converters

buck-boost series

The EPC-buck-boost family is a newly designed bidirectional DC/DC power converter that addresses the challenges of the new energy transition. These step-up step-down converters utilize the latest technology and offer a wide voltage range, making them compatible with various input and output voltage levels for multiple industrial applications. They achieve high efficiency in both directions, ensuring effective energy flow without significant power losses.

KEY FEATURES

- Wide voltage range
- Voltage Droop Control
- Voltage and current control
- Soft start from 0 V
- MPPT from PV
- CAN communication
- Embedded protections (Over - current, voltage, temperature)
- High efficiency
- Power scalable. Paralleling.
- Rack and wall mounting enclosure
- Compact design

TYPICAL APPLICATIONS

- Power supply
- Smart grids
- Battery charger
- Energy storage systems
- Energy recovery
- Hydrogen generation
- Battery hybridization
- Solar panels - MPPT

The converters support parallel operation for higher power output and can be installed in compact spaces. They include a standalone configuration with soft-start and wide voltage ranges for an easy initial set-up.

The converters offer scalability and improved system reliability through a modular parallelization approach to power conversion. They integrate CAN communication, enabling precise control over output parameters and measurement

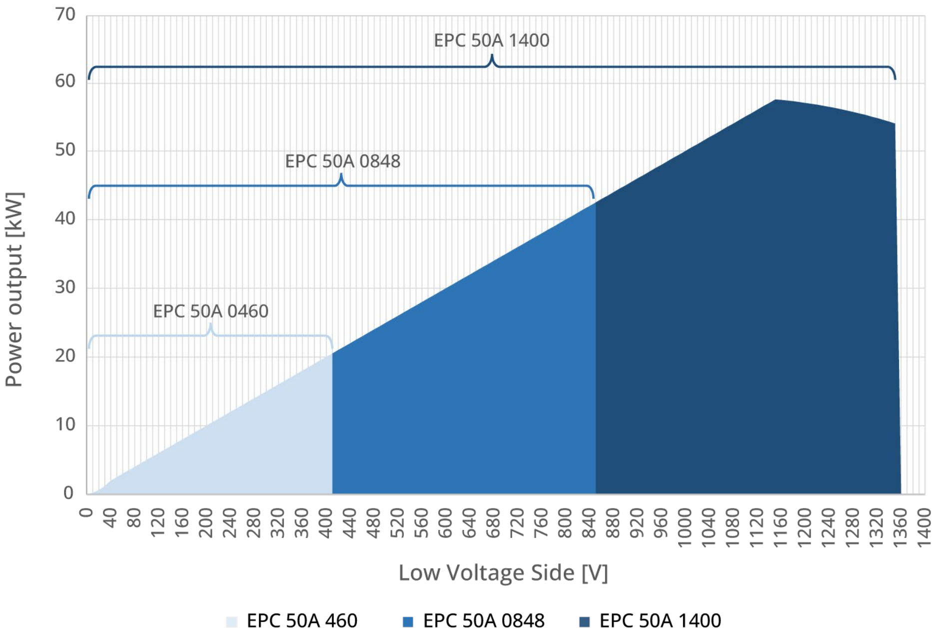
Overall, the EPC family of bidirectional DC/DC power converters provides high efficiency, flexibility, scalability, and control, making them suitable for a broad range of applications in the new energy transition.

ELECTRICAL SPECIFICATIONS

Model	EPC 50A 0460	EPC 50A 0848	EPC 50A 1400
Nominal Current [A]	50	50	50
Max power [kW] (1)	20	40	57
High Side Voltage range (operation) [V]	50 – 460	50 – 848	200 – 1400
Low Side Voltage range (operation) [V] (2)	0 - 410	0 - 798	0 - 1348
Max High/Low Side Voltage (withstand) [V]	650	1200	1400
Max. efficiency	98.1%	99.2%	99.54%
Control	Voltage, Current, Power, MPPT, Voltage Droop Control Modes available for both sides (Low and High Side)		
Availability	Q4- 2025	Q3-2025	Q3 -2024

(1) Transferred power is the result of the voltage in the Low Side multiplied by the Current. Maximum power is achieved at 1154V in Low Side which means 1154*50=57.7kW

(2) To allow discharging, from Low-Side to High-Side, the voltage on the Low-Side must follow the following equation: $V_{LOW\ SIDE}[V] \geq (0.02 \times V_{HIGH\ SIDE}) + 10$
To allow charging, from High-Side to Low-Side, the voltage on the Low-Side must follow the following equation: $V_{LOW\ SIDE}[V] \leq (0.98 \times V_{HIGH\ SIDE}) - 10$

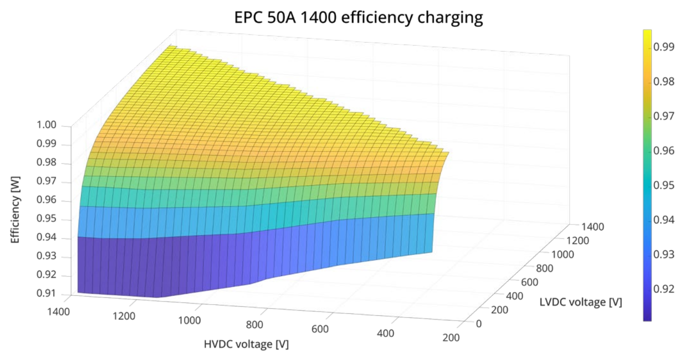


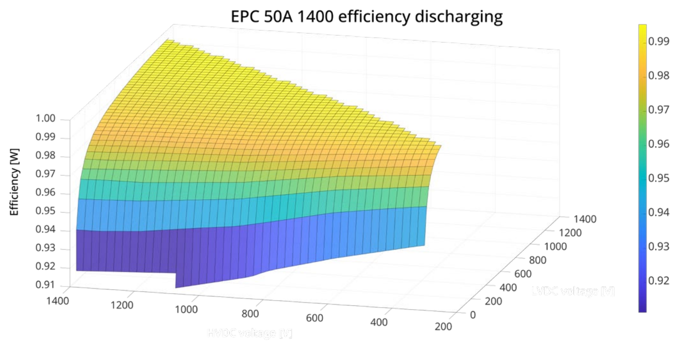
GENERAL SPECIFICATIONS

Item	Description
Operating temperature	-30 to 50 ºC (derating can be applied over 40 ºC)
Storage temperature	-30 to 70 ºC
Cooling	Air cooled (Fans only ON when needed)
MTBF	TELCORDIA SR-332, Issue 3: >320000 hours
Maintenance	No electrolytic capacitors in DC links (Long life FILM capacitors) Fan replacement >70000 h

Efficiency

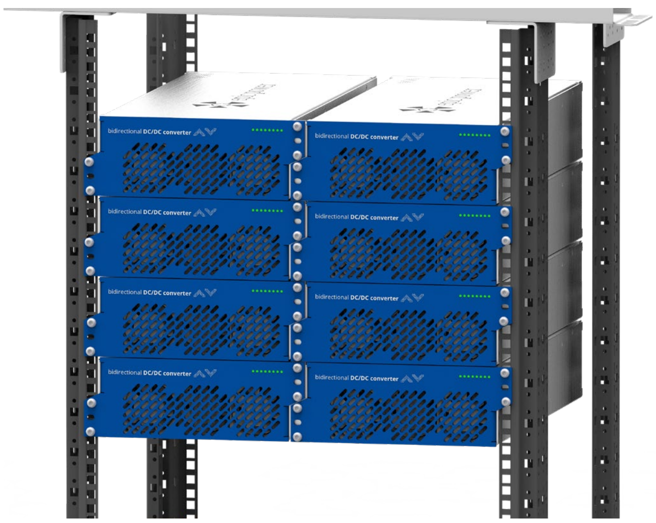
The following efficiency curves include the consumption of the control and cooling of the converter as the units are self-powered. If we consider only the switching stage, the efficiency would be higher.





Regulations

Directive	Standards
Low Voltage Regulations (LVD): European directive 2014/35/UE	EN 62477-1:2012, A11:2014,A1:2017,A12:2021. Safety requirements for power electronic converter systems and equipment EN 62109-1:2010. Safety of power converters for use in photovoltaic power systems
Electromagnetic Compatibility Regulations (EMC): European directive 2014/30/UE,	EN IEC 61000-6-2:2019. Electromagnetic compatibility (EMC) -- Part 6-2: EN IEC 61000-6-4:2019. Electromagnetic compatibility (EMC) -- Part 6-4 EN IEC 61204-3:2018. Low voltage power supplies, d.c. output - Part 3: Electromagnetic compatibility (EMC) EN 12015:2021. Electromagnetic compatibility - Product family standard for lifts, escalators and moving walks – Emission EN 12016:2014. Electromagnetic compatibility - Product family standard for lifts, escalators and moving walks – Immunity
Restriction of hazardous substances: European directive 2011/65/UE	EN IEC 63000:2018. Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances
UL/CSA	UL 1741:2021 Ed. 3 - Inverters, converters, controllers and interconnection system equipment for use with distributed energy resources. UL 61800-5-1:2012 Ed.1+R:20Jun2018 - Adjustable Speed Electrical Power Drive Systems - Part 5-1: Safety requirements - electrical thermal and energy CSA C22.2#107.1:2016 Ed. 4 - Power Conversion Equipment

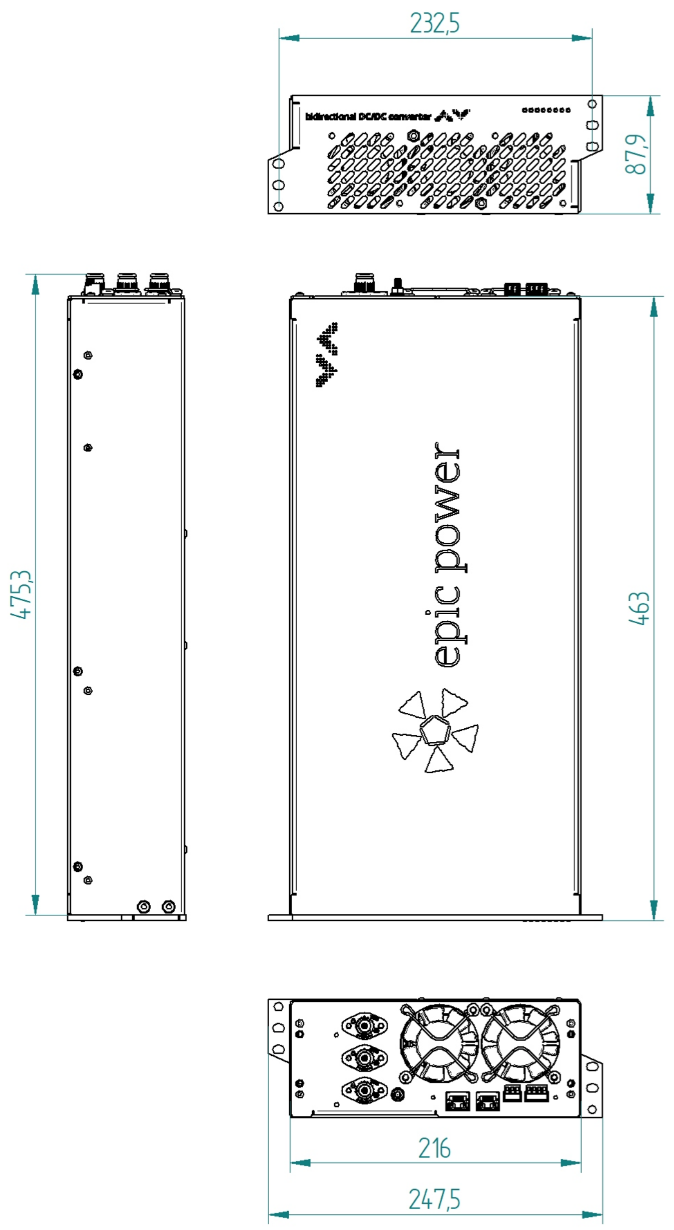


MECHANICAL SPECIFICATIONS

Model	EPC 50A 0460	EPC 50A 0848	EPC 50A 1200
Size *	247.5 x 87.9 x 479.3 mm - Size 4 *	247.5 x 87.9 x 479.3 mm - Size 4 *	247.5 x 87.9 x 479.3 mm - Size 4 *
Weight	9.34 kg	9.89 kg	10.25 kg
Enclosure	2U Half rack	2U Half rack	2U Half rack
IP rating	IP20	IP20	IP20

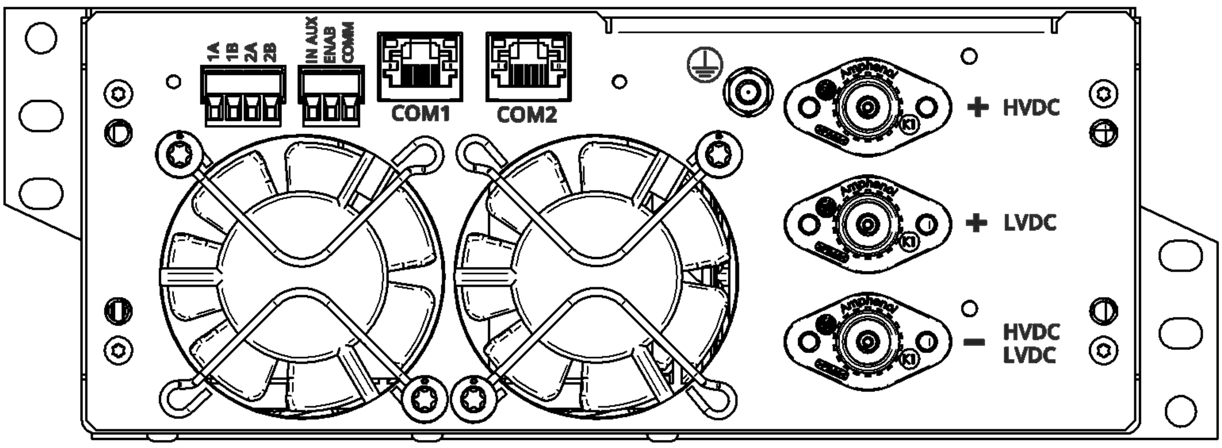
*. See mechanical dimensions

MECHANICAL DIMENSIONS



EPC BIDIRECTIONAL DC-DC CONVERTERS (SIZE 4): OVERALL DIMMENSIONS- 2U HALF RACK

ELECTRICAL CONNECTIONS



EPC BIDIRECTIONAL DC-DC CONVERTERS (SIZE 4): PERIPHERICAL AND POWER CONNECTORS

	OUTPUTS TO CONTROLLER
OUT 1A	Reserved
OUT 1B	Reserved
OUT 2A	Reserved
OUT 2B	Reserved

Pluggable Terminal Block with M2 screw - Würth Elektronik – MPN: 691361300004

Notes: Potential-free relay contacts. Max Voltage 24Vdc / 250Vac (without temporary overvoltage and OVC I) Max Current 3A

	INPUTS FROM CONTROLLER
IN AUX	Reserved Input for custom applications
ENABLE	Enable DC/DC
COMMON	Common from inputs signals

Pluggable Terminal Block with M2 screw - Würth Elektronik – MPN: 691361300003

Notes: Optocoupled input. Do not apply voltage

	COMMUNICATIONS
COM1	CAN Network
COM2	CAN Network

Connector: RJ45

	POWER CONNECTORS
+ HVDC	Positive High Voltage Side
+ LVDC	Positive Low Voltage Side
- HVDC -LVDC	Negative (both sides)

Connector: Amphenol SURLOK PLUS– MPNs:
C10-754727-2202 (red)
C10-754727-0201 (orange)
C10-754727-1201 (black)

COMUNICATIONS AND CONTROL MODES

Item	Description
Protocol	CAN 2.0B compatible hardware
Data rate	typical 125kbps (min 125kbps, max 500kbps, configurable by communications)
Frame Format	extended frame (29 bits)
Endianess	Little Endian
Messages period	default value: 250ms (min 50ms, max 1000ms, configurable by communications)

Depending on the application, several kinds of controls are available.

AUTONOMOUS MODE (AMODE)

The EPC feed the load within a voltage range with a sophisticated control loop that is able to supply or regenerate energy when needed with no added communications. In this mode, voltage is regulated in the HVDC if LVDC is within the usable voltage range. This mode is used to supply standard motor drives or inverters. Via CAN communication configuration is available.

CURRENT CONTROLLED MODE (CCMODE)

An external controller would set the current reference for the HVDC side. Positive current is defined as charging current. Negative current is defined as discharging current. In order to avoid errors during charging and discharging processes, there is another signal that sets the current direction.

HIGH SIDE VOLTAGE CONTROLLED MODE (HSVCMODE)

In this mode, the external controller will set the voltage reference for the High Voltage DC side (HVDC side). Power and current limits can be configured

Low Side Voltage Controlled Mode (LSVCMode)

In this mode, the external controller will set the voltage reference for the Low Voltage DC side (LVDC side). Power and current limits can be configured

Adaptative High Side Autonomous Mode (AHSAMode)

AHSA mode is intended to control the voltage on the high voltage DC side (HVDC) under a bidirectional operating mode. The AHSA mode enables the parallelization of several EPC converter units with no communication between them. Besides, it provides a very high efficiency even at low loads

Adaptative Low Side Autonomous Mode (ALSAMode)

The AHSA mode is intended to control the voltage on the low voltage DC side (HVDC) under a bidirectional operating mode. The AHSA mode enables the parallelization of several EPC converter units with no communication between them. Besides, it provides a very high efficiency even at low loads.

High Side Photovoltaic Mode (HSPVMode)

In this mode, the EPC converter performs MPPT tracking algorithm in the HVDC side. This mode is used when solar panels are connected to the HVDC side. The external controller is able set the voltage reference for the LVDC side. Also current or power limits can be configured.

Low Side Photovoltaic Mode (LSPVMode)

In this mode, the EPC converter performs MPPT tracking algorithm in the LVDC side. This mode is used when solar panels are connected to the LVDC side. The external controller is able set the voltage reference for the HVDC side. Also current or power limits can be configured.

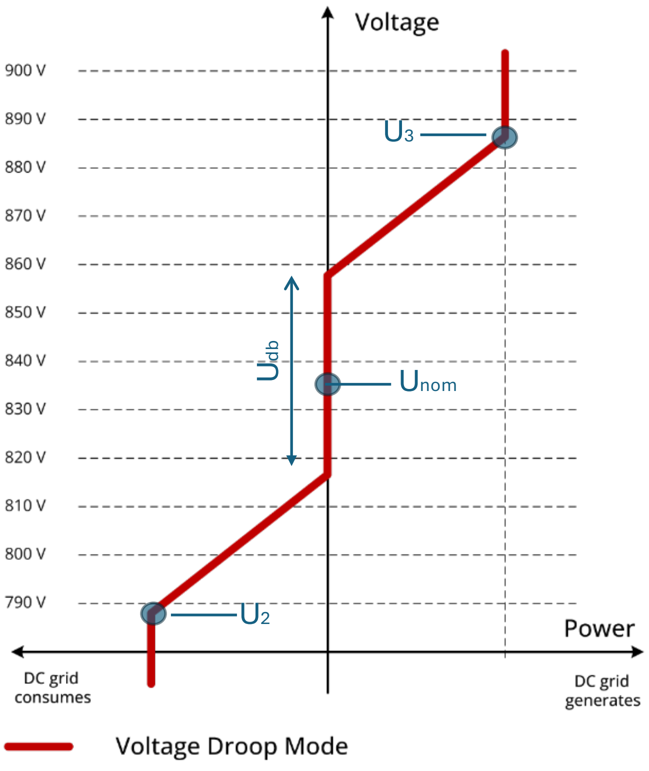
Voltage Droop Control Mode (xSVDCMode))

The "Voltage Droop" control is used in DC systems, particularly in distributed generation and microgrids, to allow multiple power sources to share the load efficiently without the need for communication between them. It is based on the relationship between voltage and current.

A "droop" curve is established, which relates the output voltage of a power source to the current it supplies. As the current increases, the output voltage decreases according to a predefined slope. This way, power is adjusted automatically according to this curve. This method ensures that the load is shared evenly among the sources.

"Voltage Droop" control has three key advantages: simplicity (no communication is required between power sources), stability (allowing automatic load sharing), and flexibility (can adapt to changes in load and the number of power sources connected to the system)..

To configure the "Voltage Droop" control, the integrator must only select the following parameters shown in the graph. This definition follows CurrentOS Foundation standards:



- U_{nom}: Nominal voltage of the application or middle voltage point of the deadband.
- U_{db}: Deadband range in voltage. The converters will not transfer power in any direction as the voltage is not providing information for the converters to operate.
- U_2: Voltage at which the converters will be transferring full power discharging the energy source towards the DC bus they are regulating. If the voltage has reached that point, the DC bus is demanding full power.
- U_3: Voltage at which the converters will be transferring full power, discharging the DC bus they are regulating towards the energy sink.