EPC Bidirectional DC/DC converters

isolated series

KEY FEATURES

- Wide voltage range
- Voltage Droop Control
- Voltage and current control
- Soft start from 0 V
- High efficiency
- Galvanic isolation
- Power scalable. Paralleling.
- Protections (Overcurrent, overvoltage, overtemperature)
- CAN communication
- Custom design under request
- MPPT from PV

TYPICAL APPLICATIONS

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

The EPC is a family of bidirectional DC-to-DC power converters designed for a wide range of applications. They offer ultra-high efficiency in both directions with galvanic isolation. The standalone configuration with Soft-Start and wide voltage ranges allows for quick and easy setup. Multiple converters can be connected in parallel to achieve higher power. CAN communication enables various control modes such as voltage control, current control, MPPT, Voltage Droop Control, among others, while also measuring all the main relevant operational parameters.

ELECTRICAL SPECIFICATIONS

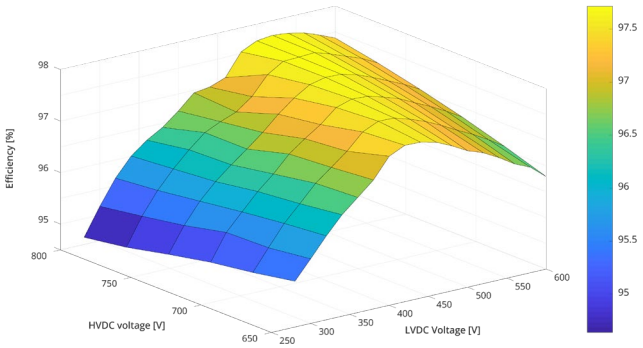
Model	EPC 3k5 648i	EPC 5k5 648i	EPC 2k2 624i	EPC 2k2 348i	EPC 2k2 324i	EPC 4k8 6125i	EPC 7k 670i	EPC 8k 8380i
Peak power	4.2 kW	6.5 kW	2.6 kW	2.6 kW	2.6 kW	4.8 kW	7.5 kW	10 kW
Nominal power	3.5 kW	5.5 kW	2.2 kW	2.2 kW	2.2 kW	4.8 kW	7.0 kW	8.0 kW
High side voltage (Vdc)	510 to 848 V			280 to 450 V		430 to 830 V	510 to 848 V	500 to-848 V
High side current (max)	6 A (7.5 A)	10 A (12 A)	4 A (5 A)	7 A (9.3 A)	7 A (9.3 A)	9 A	11.6 A (12.5 A)	11 A (15 A)
Low side voltage (Vdc)	38 to 59 V (optional from 0 V)		19 to 30 V (optional from 0 V)	38 to 59 V (optional from 0 V)	19 to 30 V (optional from 0 V)	110 to 165 V (optional from 0 V)	40 to 100 V (optional from 0 V)	280 to 600 V (optional from 0 V)
Low side current (max)	75 A (115 A)	115 A (180 A)	92 A (130 A)	50 A (70 A)	92 A (130 A)	45 A	100 A (108 A)	21 A (33 A)
Isolation	High to Low side: 2.5 kV High side to earth: 4 kV; Low side to earth: 1.5 kV (2.5 kV for EPC-4k8-6125) Low side to user signals: 3 kV (5 kV for EPC-4k8-6125)							
Max. efficiency	98 %							
Stand-by	<3 W							
Control	Digital control self-powered from High or Low Side Voltage (Low Side prioritized)							
Digital control self-powered from	Low Side Voltage (optional version from Low and High side: EPC 3k5 648iHL	Low Side Voltage (optional version from Low and High side: EPC 5k5 648iHL	Low Voltage Side (optional version from Low and High side: EPC 2k2 624iHL	Low Side Voltage (optional version from Low and High side: EPC 2k2 348iHL	Low Side Voltage (optional version from Low and High side: EPC 2k2 324iHL	Low Side Voltage (optional version from Low and High side: EPC 4k8 6125iHL	Low Side Voltage (optional version from Low and High side: EPC 7k 670iHL	High Side Voltage (optional version from Low and High side: EPC 8k 8380iHL

GENERAL SPECIFICATIONS

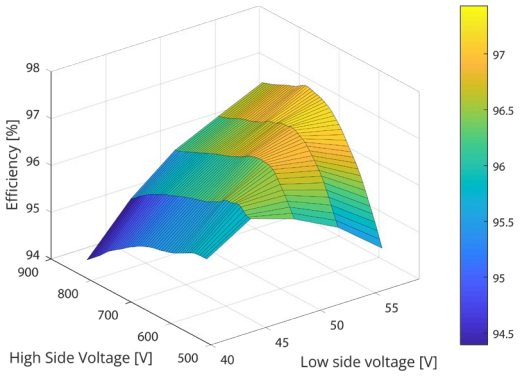
Item	Description
Operating temperature	-10 to 40 °C
Storage temperature	-10 to 70 °C
Cooling	Air cooled (Fans only ON when needed)
Communication protocol	CAN 2.0B: Bus speed typical 125kbps (min 125kbps, max 500kbps) Messages period: Default value: 250ms; Minimum value: 50m; Maximum value: 1000ms
MTBF	TELCORDIA SR-332, Issue 3: >350400 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.



EPC 8k 8380i charging at nominal power



EPC 7k 670i charging at nominal power

REGULATIONS

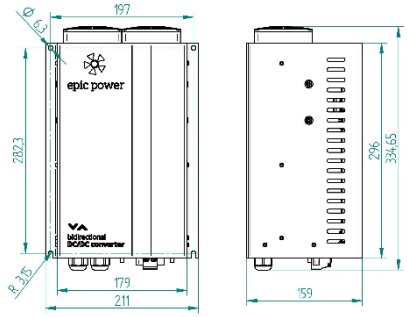
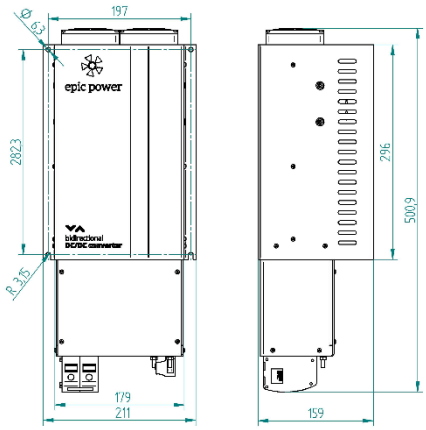
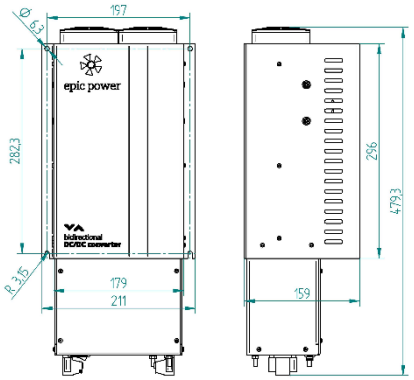
Regulations	
UL 61800-5-1	Standard for safety – Adjustable Speed Electrical Power Drive Systems – Part 5-1: Safety Requirements – Electrical, Thermal and Energy
UL 1741	Standard for safety – Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources
CSA 22.2 No. 107.1	Power conversion equipment
Low Voltage Regulations (LVD): European directive 2014/35/UE	UNE-EN 62109-1:2010. Safety of power converters for use in photovoltaic power systems UNE-EN 62477-1:2012 + A11:2014, A1:2017, A12:2021. Safety requirements for power electronic converter systems and equipment
Electromagnetic Compatibility Regulations (EMC): European directive 2014/30/UE	UNE-EN 12015:2021. Electromagnetic compatibility - Product family standard for lifts, escalators and moving walks – Emission UNE-EN 12016:2014. Electromagnetic compatibility - Product family standard for lifts, escalators and moving walks – Immunity EN 61000-6-2:2019. Electromagnetic compatibility (EMC). Generic standards. Immunity standard for industrial environments EN 61000-6-4:2019. Electromagnetic compatibility (EMC). Generic standards. Emission standard for industrial environments EN 61204-3:2018. Low-voltage switch mode power supplies. Electromagnetic compatibility (EMC)
Restriction of hazardous substances: European directive 2011/65/UE	UNE-EN 50581:2012. Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances[o]

MECHANICAL SPECIFICATIONS

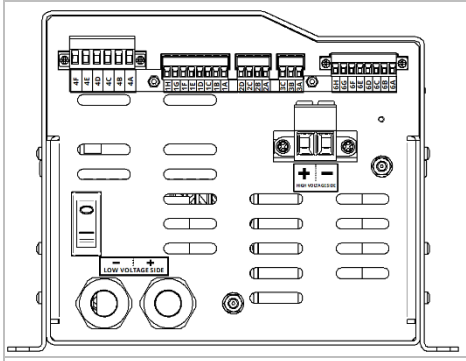
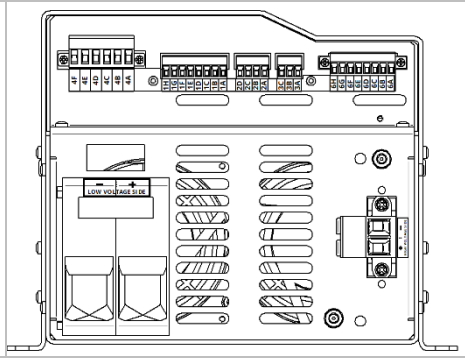
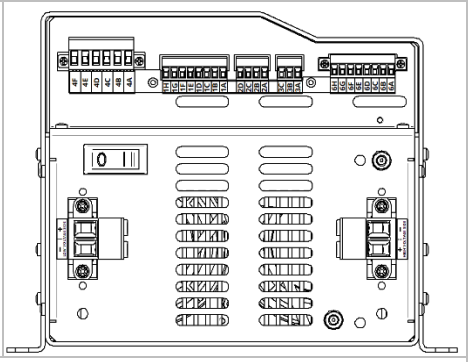
Model	EPC 3k5 648i	EPC 5k5 648i	EPC 2k2 624i	EPC 2k2 348i	EPC 2k2 324i	EPC 4k8 6125i	EPC 7k 670i	EPC 8k 8380i
Size	Size 1*	Size 2*	Size 1*	Size 1*	Size 1*	Size 1*	Size 2*	Size 3*
Weight	6.05 kg	8.95 kg	6.15 kg	6.00 kg	6.05 kg	6.70 kg	7.95 kg	8,90 kg
Enclosure		IP 20						

*. See mechanical dimensions

MECHANICAL DIMENSIONS

SIZE 1	SIZE 2	SIZE 3
		
SIZE 1	SIZE 2	SIZE 3

ELECTRICAL CONNECTIONS

SIZE 1	SIZE 2	SIZE 3
		

SIZE 1 & SIZE 2 & SIZE 3: PERIPHERICAL CONNECTORS

Outputs to controller	
1A	Common
1B	Status OK (NO)
1C	Temperature warning (NC)
1D	Temperature warning (NO)
1E	Reserved (NO)
1F	Reserved (NO)
1G	Earth Leakage detection (NO)
1H	Reserved (NO)

Reserved	
2A	Reserved
2B	Reserved
2C	RC Charger + (Optional)
2D	RC Charger – (Optional)

Inputs from controller	
3A	Common
3B	Enable DC/DC
3C	Safety Disconnection

LVDC link access to accessories	
4A	Load + (optional)
4B	Load - (optional)
4C	AC + Charger (optional)
4D	AC - Charger (optional)
4E	Solar charger + (optional)
4F	Solar charger – (optional)

Connector 1: Potential-free relay contacts. Max Voltage 24Vdc / 250Vac. Max Current 3A
Connector 4: Max current of each terminal is 20A. Place gR 25A external fuses
Connector 6: Connection to optional EPC CAN Interface. See Manual EPC Series

SIZE 1: POWER CONNECTORS	SIZE 2: POWER CONNECTORS	SIZE 3: POWER CONNECTORS
High voltage side: Phoenix Contact - PC 6/ 2-STF-10,16 - Low Voltage DC link: 2 x Cable gland	High voltage side: Phoenix Contact - PC 6/ 2-STF-10,16 - Low Voltage DC link: Phoenix Contact - UW 95-POT/S	High voltage side: Phoenix Contact - PC 6/ 2-STF-10,16 - Low Voltage DC link: Phoenix Contact - PC 6/ 2-STF-10,16 -

CONTROL MODES

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

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. This mode is not available for full range of EPC series.

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. This mode is not available for full range of EPC series.

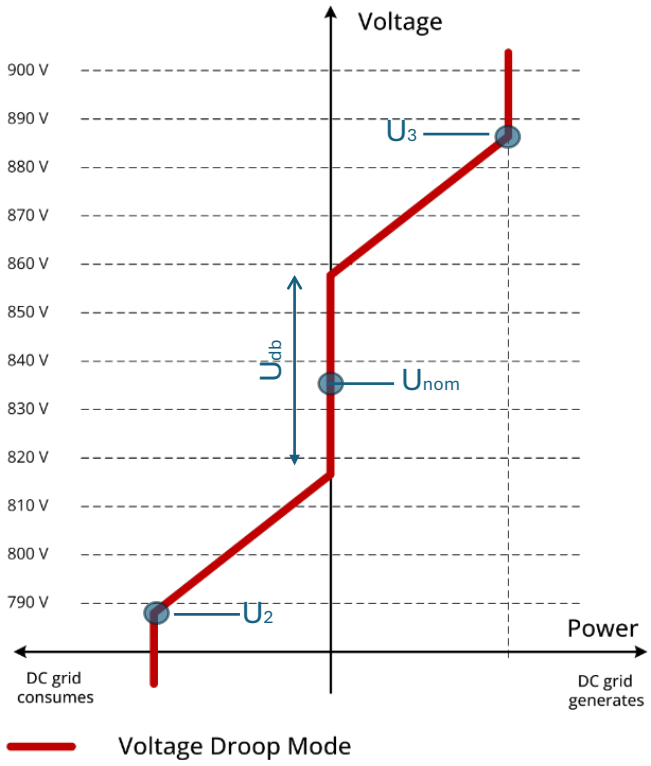
VOLTAGE DROOP CONTROL MODE (XSVDCMODE))

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 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.