Power Electronics for Public Transport Vehicles

EMUs & DMUs

EMUs & DMUs

MEDCOM is a manufacturer of propulsion systems for electric multiple units and auxiliary converters used to supply AC and DC loads in EMU and DMU vehicles.

Medcom's propulsion inverters are based on the HV IGBT technology. A small number of switching components (14 ÷ 28 per vehicle) ensures a high level of reliability and easy maintenance of the vehicles.

Owing to the application of modern control systems, the inverters provide control of speed for each axle of the vehicle, effective electrodynamic braking with a driving torque within the whole range and also a possibility of emergency braking in case of blackout in the traction network.

The currently manufactured 300 kW and 800 kW inverters provide very high driving parameters of the motor units. Their main advantages are a very low noise level and a high driving comfort.

Auxiliary converters of the power range from 20 kW to 350 kW ensure power supply for the components of the power transmission system, as well as all other main loads (control, lighting, compressors, fans) of the traction unit. The heating, ventilation and air conditioning systems of vehicles are also supplied from the auxiliary converters.

All inverters and converters are equipped with a diagnostic-control system based on a MVB, CAN 2.0 B or RS232 interface.

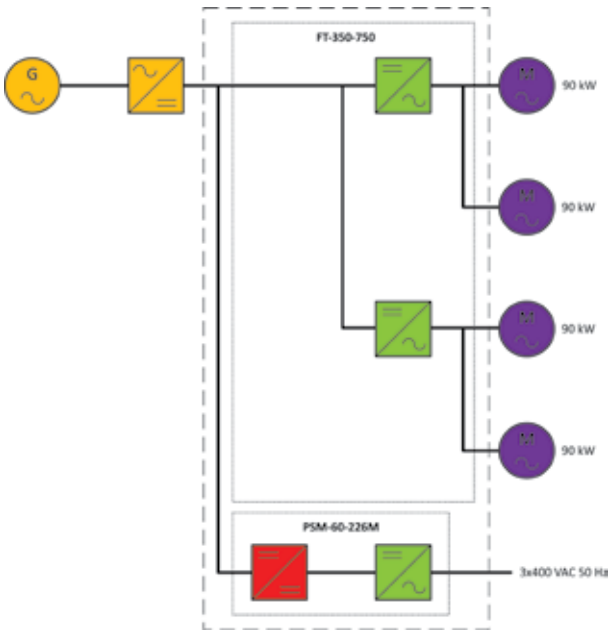
FT-350-750/PSM-60-226M

Propulsion inverter for Asynchronous Drives

The propulsion inverter integrated with auxiliary converter is placed in one cabinet container that can be mounted inside vehicle. The inverter as well as the converter are equipped with a forced ventilation with integrated fans, which ensures the proper operation in the wide range of ambient temperature. The diagnostics and control of the system components is provided via CANBus interface. In the cabinet there are two propulsion inverters 180 kW each. Each inverter supplies two traction motors.

Auxiliary converter PSM–60 is fully automated device designed to convert DC voltage of the 750 VDC traction into 3x400 VAC used to supply loads. The auxiliary converter is based on a multiple energy conversion technique and is equipped with forced ventilation system with integrated fan.

BLOCK DIAGRAM



FT-350-750		
Input voltage		**750 VDC**
Nominal power		**2 x 180 kW**
AC Output		**3x440 VAC**
Auxiliary voltage		**24 VDC +25% ÷ -30%**
PSM-60		
Input voltage		**750 VDC**
Nominal power		**60 kVA**
AC Output		**3x400 VAC / 50 Hz**
Auxiliary voltage		**24 VDC +25% ÷ -30%**
Housing		
Cooling method		**Forced air**
Weight		**625 kg**
Dimensions		**1706 × 950 × 803 mm**
Protection degree	Clean section	**IP54**
	Dirty section	**IP20**

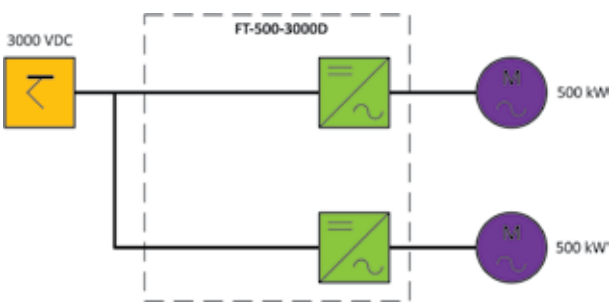
FT-500-3000D

Propulsion inverter for Asynchronous Drives

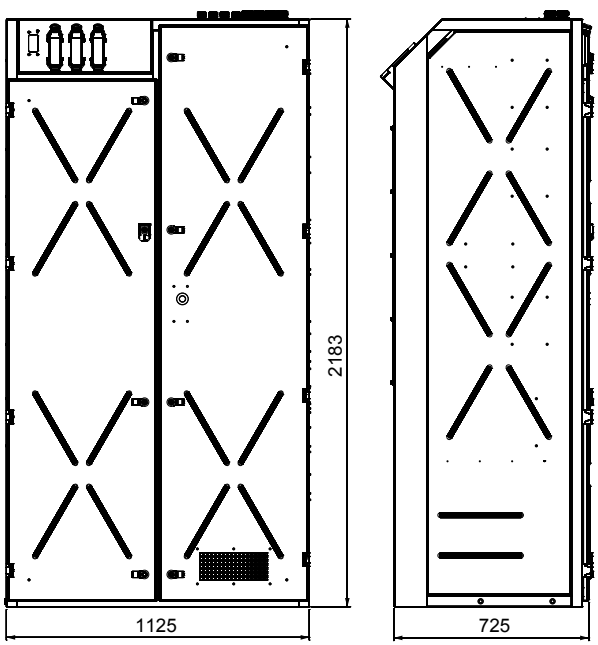
The FT-500-3000D propulsion inverter is a modern chopperless system of the direct three-phase inverter based on the HV IGBT technology. The control of the converter is performed in the DSP (Digital Signal Processor) technology with the application of the FOC SVPWM (Field Oriented Space Vector Pulse Width Modulation).
Within the range of high speeds, the system co-operates with a synchronized Bus Clamping Pulse Width Modulation, which causes reduction of losses and noise. The control system ensures acceleration with a constant torque and low power losses. The drive can operate with rheostatic or regenerative braking. The inverter system guarantees very good traction parameters and perfect stabilization of the driving torque. The applied system of busbars combined with a perfect IGBT driver guarantee a failure-free performance at short circuits. It also eliminates the possibility of secondary damages in case of the transistor's failure. The applied capacitors ensure long service lifetime and resistance of the system to changes of voltage in the traction network. Additionally the inverter system is also protected with a thyristor crowbar. The inverter meets UN and EN standards requirements with regard to safety and electromagnetic compatibility. The system has very low levels of low frequency interferencess generated to the traction network. The inverter allows supplying two traction motors, each with power of 500 kW. The inverter is equipped with a forced air-cooling system, operates within the temperature range of –40°C ÷ +40°C. The diagnostics and control of the inverter is possible through the CANbus interface.

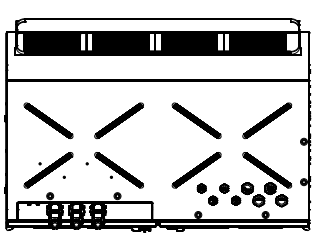
Specification	
Input voltage	**3000 VDC, +30 ÷ –30%**
Auxiliary voltage	**24 VDC +25 ÷ –30%**
Rated current	**2×150 Arms**
Maximum output current	**2×300 Arms**
Rated power	**2×500 kW**
Cooling	**forced-air**
Weight	**767 kg**
Dimensions	**1125 × 725 × 2183 mm**

BLOCK DIAGRAM



HOUSING



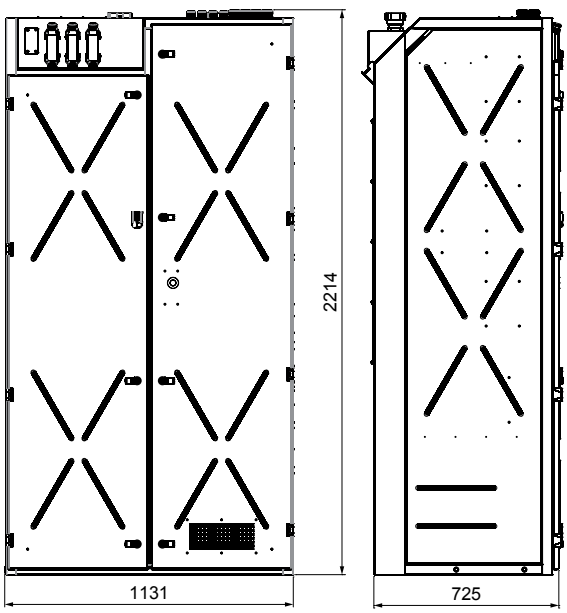


FT-500-3000D-LQC

Propulsion inverter for Asynchronous Drives

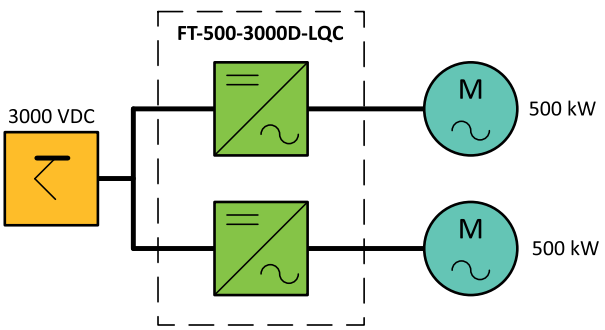
The FT-500-3000D-LQC propulsion inverter is a modern chopperless system of the direct three-phase inverter based on the HV IGBT 6.5 kV technology. The control of the converter is performed in the DSP (Digital Signal Processor) technology with the application of the FOC SVPWM (Field Oriented Space Vector Pulse Width Modulation).
Within the range of high speeds, the system co-operates with a synchronized Bus Clamping Pulse Width Modulation, which causes reduction of losses and noise. The control system ensures acceleration with a constant torque and low power losses. The drive can operate with rheostatic or regenerative braking. The inverter system guarantees very good traction parameters and perfect stabilization of the driving torque. The applied system of busbars combined with a perfect IGBT driver guarantee a failure-free performance at short circuits. It also eliminates the possibility of secondary damages in case of the transistor's failure. The applied capacitors ensure long service lifetime and resistance of the system to changes of voltage in the traction network. Additionally the inverter system is also protected with a thyristor crowbar. The inverter meets UN and EN standards requirements with regard to safety and electromagnetic compatibility. The system has very low levels of low frequency interferencess generated to the traction network. The inverter allows supplying two traction motors, each with power of 500 kW. The inverter is equipped with an external liquid cooling system, operates within the temperature range of –40 °C ÷ +40 °C. The diagnostics and control of the inverter is possible through the CANbus interface.

HOUSING



Specification	
Input voltage	**3000 VDC, +30 ÷ –30%**
Auxiliary voltage	**24 VDC +25 ÷ –30%**
Rated current	**2×150 Arms**
Maximum output current	**2×300 Arms**
Rated power	**2×500 kW**
Cooling	**external, liquid**
Weight	**767 kg**
Dimensions	**1131×725×2214 mm**

BLOCK DIAGRAM



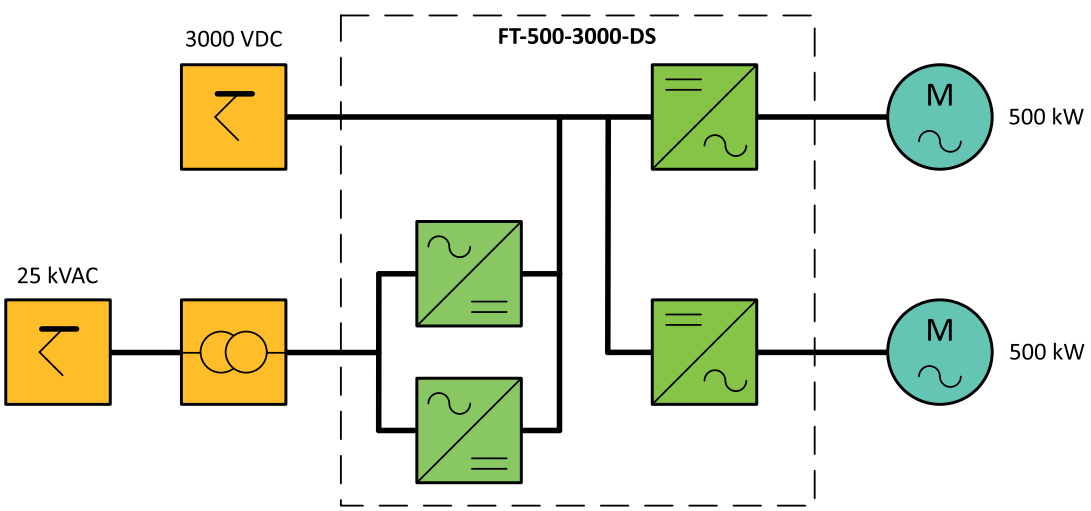
FT-500-3000-DS

Double System Propulsion inverter
for Asynchronous Drives

The FT-500-3000-DS propulsion inverter is a modern chopperless system of the direct three-phase inverter based on the HV IGBT technology. The control of the converter is performed in the DSP (Digital Signal Processor) technology with the application of the FOC SVPWM (Field Oriented Space Vector Pulse Width Modulation). Within the range of high speeds, the system co-operates with a synchronized Bus Clamping Pulse Width Modulation, which causes reduction of losses and noise. The control system ensures acceleration with a constant torque and low power losses. The drive can operate with rheostatic or regenerative braking. The inverter system guarantees very good traction parameters and perfect stabilization of the driving torque. The applied braking resistors made of stainless steel guarantee a long service lifetime and low noise level. The applied system of busbars combined with a perfect IGBT driver guarantee a failure-free performance at short circuits. It also eliminates the possibility of secondary damages in case of the transistor's failure. The applied capacitors ensure long service lifetime and resistance of the system to changes of voltage in the traction network. Additionally the inverter system is also protected with a thyristor crowbar. The inverter meets UN and EN standards requirements with regard to safety and electromagnetic compatibility. The system has very low levels of low frequency interferencess generated to the traction network. The inverter is equipped with a forced air-cooling system and operates within the temperature range of –40 °C ÷ +40 °C. Lack of the cooling liquid increases the reliability and lowers operating costs of the vehicle. The diagnostics and control of the inverter is possible through the CANbus interface.

Specification	
Input voltage	**25000 VAC** **3000 VDC +30 ÷ –30%**
Auxiliary voltage	**24 VDC +30 ÷ –30%**
Rated current	**260 Arms**
Maximum output current	**311 Arms**
Rated power	**2×500 kW**
Cooling	**forced-air**
Weight	**950 kg**
Dimensions of cabinet with two inverters	**2024 × 2242 × 918 mm**

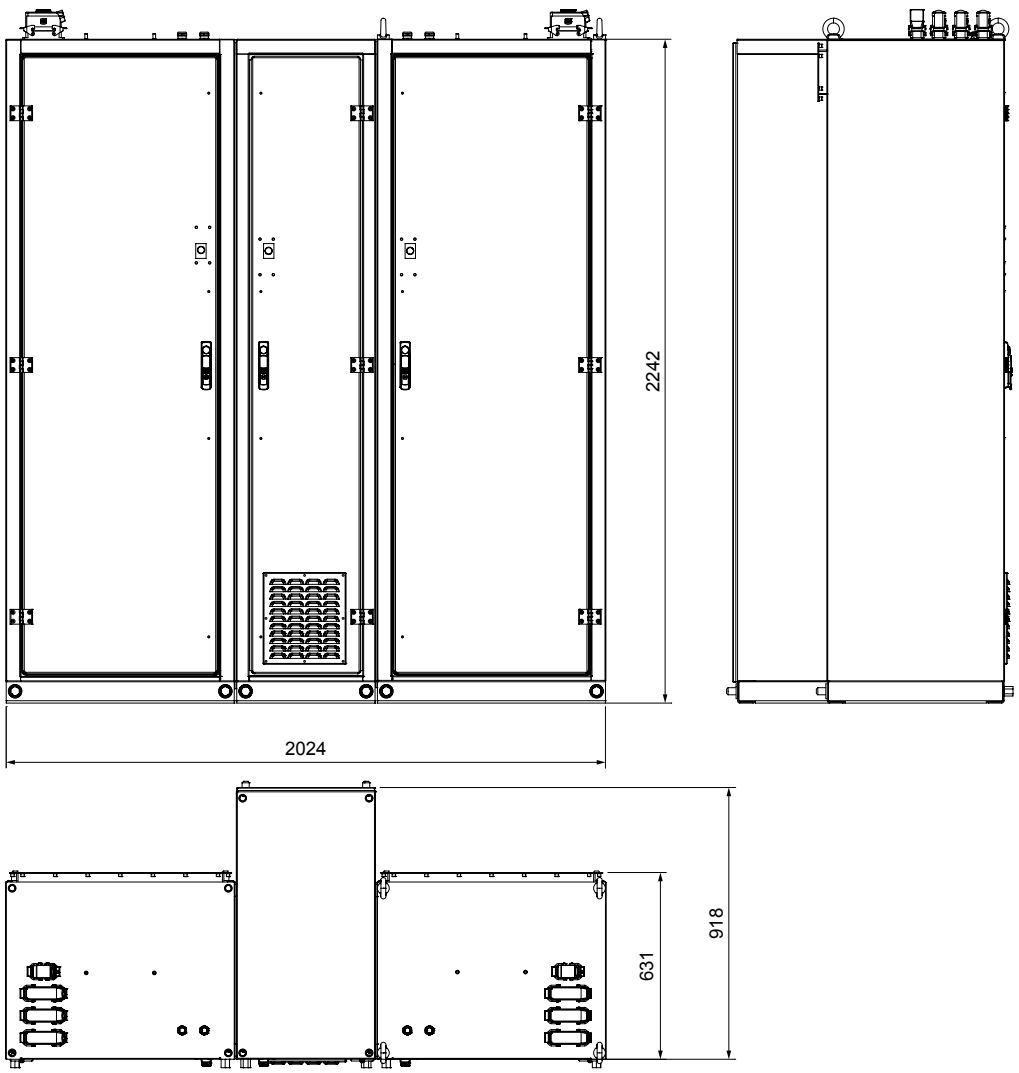
BLOCK DIAGRAM OF THE SET FT-500-3000-DS ELECTRIC MULTIPLE UNIT



FT-500-3000-DS

Double System Propulsion inverter
for Asynchronous Drives

HOUSING OF THE FT-500-3000-DS INVERTER



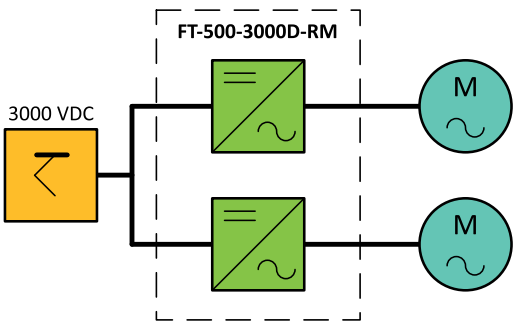
FT-500-3000D-RM

Propulsion inverter
for Asynchronous Drives

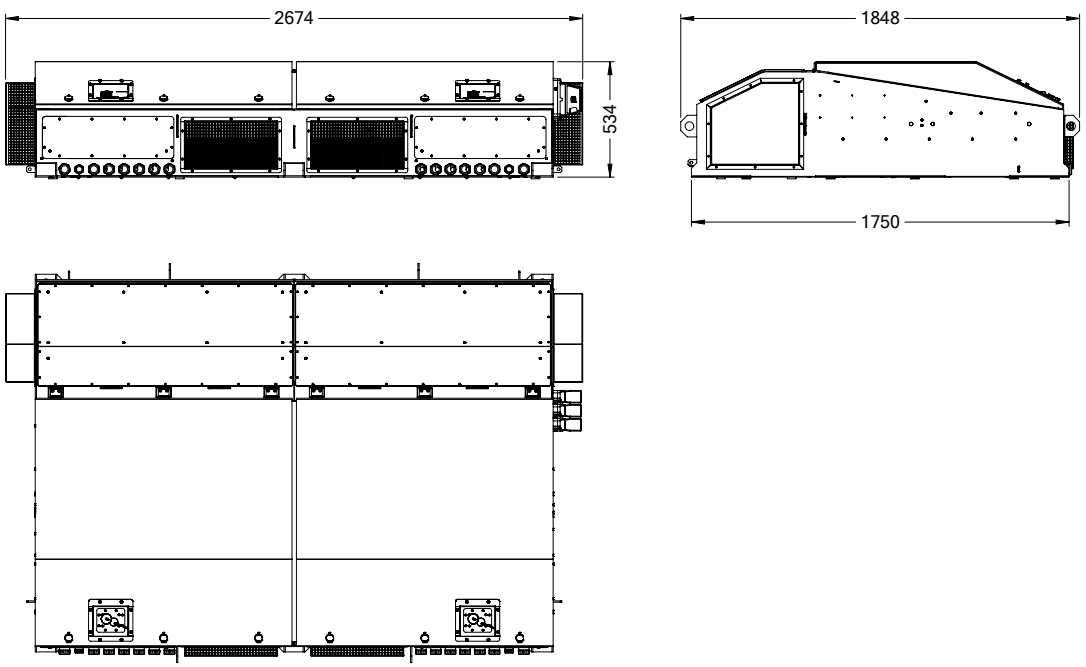
The traction container box is designed to power the traction motors driving the wheel axles in an electrical multiple unit. The use of two propulsion inverters boxes enables driving four wheel axles of the vehicle on the motor car. The units are designed for installation on the roof on the outermost sections of the vehicle. The propulsion inverters are designed to be supplied by 3000 VDC traction voltage.
The drive units in the vehicle enable starting, driving with a given torque, coasting and braking the vehicle. They also enable starting, driving and braking with the reverse travel direction.

Specification	
Input voltage	**3000 VDC +25% ÷ -30%**
Auxiliary voltage	**24 VDC +25% ÷ -30%**
Rated output current	**2 x 170 Arms**
Maximum output current	**2 x 300 Arms / 180 s**
Rated power	**2 x 500 kW**
Housing	
Cooling	**Forced air**
Weight	**1202 kg**
Dimensions	**2674 x 1750 x 534 mm**

BLOCK DIAGRAM



HOUSING



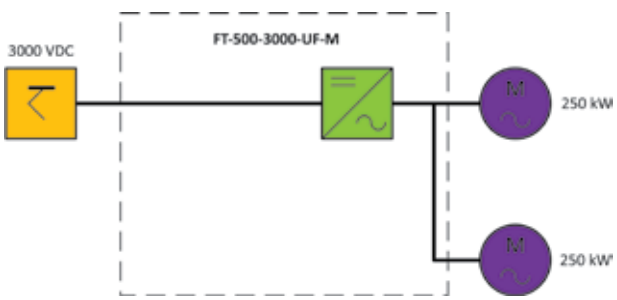
FT-500-3000-UF-M

Propulsion inverter
for Asynchronous Drives

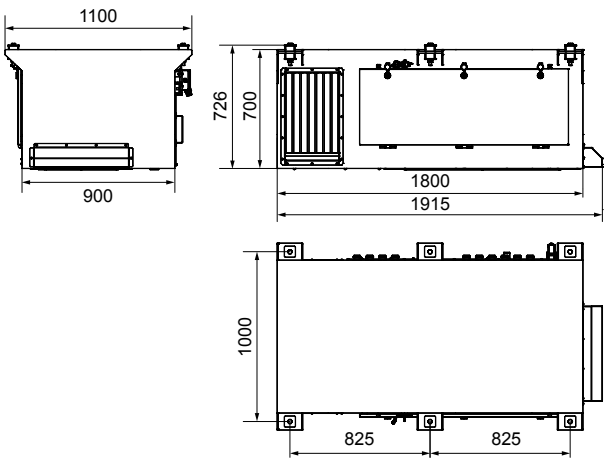
The FT-500-3000-UF-M propulsion inverter is a modern chopperless system of the direct three-phase inverter based on the HV IGBT technology. The control of the converter is performed in the DSP (Digital Signal Processor) technology with the application of the FOC SVPWM (Field Oriented Space Vector Pulse Width Modulation). Within the range of high speeds, the system co-operates with a synchronized Bus Clamping Pulse Width Modulation, which causes reduction of losses and noise. The control system ensures acceleration with a constant torque and low power losses. The drive can operate with rheostatic or regenerative braking. The inverter system guarantees very good traction parameters and perfect stabilization of the driving torque. The applied braking resistors made of stainless steel guarantee a long service lifetime and low noise level. The applied system of busbars combined with a perfect IGBT driver guarantee a failure-free performance at short circuits. It also eliminates the possibility of secondary damages in case of the transistor's failure. The applied capacitors ensure long service lifetime and resistance of the system to changes of voltage in the traction network. The inverter system is also protected with a thyristor crowbar. The inverter meets UN and EN standards requirements with regard to safety and electromagnetic compatibility. The system has very low levels of low frequency interferencess generated to the traction network. The inverter is equipped with a forced air-cooling system and operates within the temperature range of –40 °C ÷ +40 °C. Lack of the cooling liquid increases the reliability and decreases the operating costs of the vehicle. The diagnostics and control of the inverter is possible through the CANbus interface.

Specification	
Input voltage	**3000 VDC +30 ÷ –30%**
Auxiliary voltage	**24 VDC +10 ÷ –40%**
Rated current	**200 Arms**
Maximum output current	**250 Arms**
Rated power	**500 kW**
Cooling	**forced-air**
Weight (without output chokes)	**510 kg**
Dimensions	**1915 × 700 × 1100 mm**

BLOCK DIAGRAM



HOUSING



FT-800-3000

Propulsion inverter for Asynchronous Drives

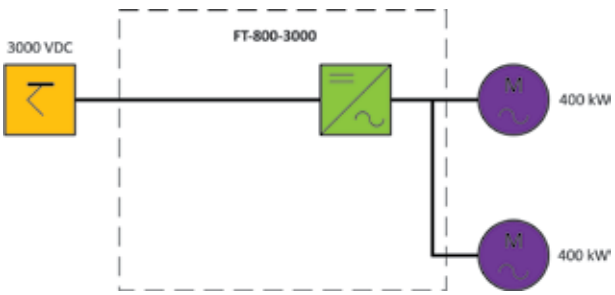
The FT-800-3000 propulsion inverter is a modern chopperless system of the direct three-phase inverter based on the HV IGBT technology. The control of the converter is performed in the DSP (Digital Signal Processor) technology with the application of the FOC SVPWM (Field Oriented Space Vector Pulse Width Modulation).

Within the range of high speeds, the system co-operates with a synchronized Bus Clamping Pulse Width Modulation, which causes reduction of losses and noise. The control system ensures acceleration with a constant torque and low power losses. The drive can operate with rheostatic or regenerative braking. The inverter system guarantees very good traction parameters and perfect stabilization of the driving torque. The applied braking resistors made of stainless steel guarantee a long service lifetime and low noise level. The applied system of busbars combined with a perfect IGBT driver guarantee a failure-free performance at short circuits. It also eliminates the possibility of secondary damages in case of the transistor's failure. The applied capacitors ensure long service lifetime and resistance of the system to changes of voltage in the traction network. Additionally the inverter system is also protected with a thyristor crowbar. The inverter meets EN standards requirements with regard to safety and electromagnetic compatibility. The system has very low levels of low frequency interferencess generated to the traction network.

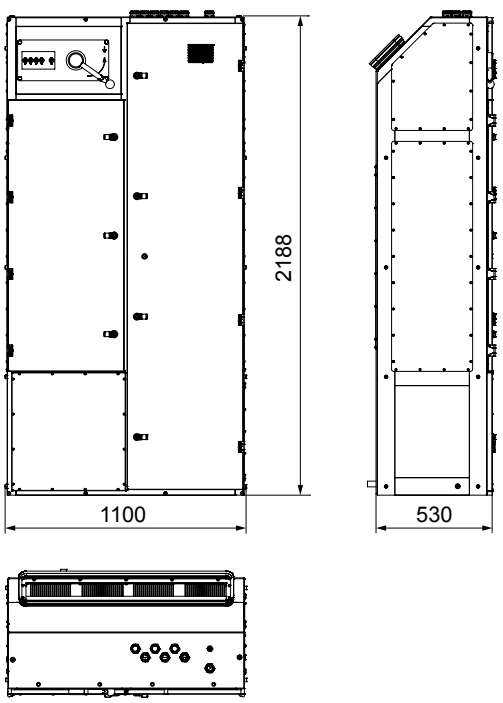
The inverter allows supplying two traction motors, each with power of 400 kW.

The inverter is equipped with a forced air-cooling system, operates within the temperature range of –40°C ÷ +40°C. Lack of the cooling liquid increases the reliability and lowers operating costs of the vehicle. The diagnostics and control of the inverter is possible through the CANbus interface.

BLOCK DIAGRAM



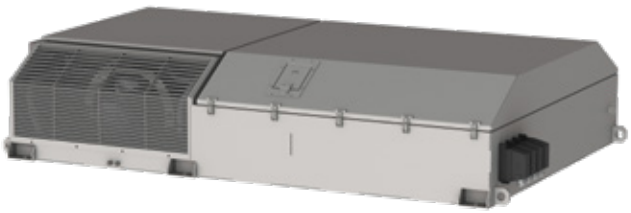
HOUSING



Specification	
Input voltage	**3000 VDC, +30 ÷ –30%**
Auxiliary voltage	**24 VDC, +10 ÷ –40%**
Rated current	**266 Arms**
Maximum output current	**350 Arms**
Rated power	**800 kW**
Cooling	**forced-air**
Weight	**600 kg**
Dimensions	**1100 × 530 × 2188 mm**

FT-800-3000-LQC /PSM-82-LQC

Propulsion inverter for Asynchronous Drives

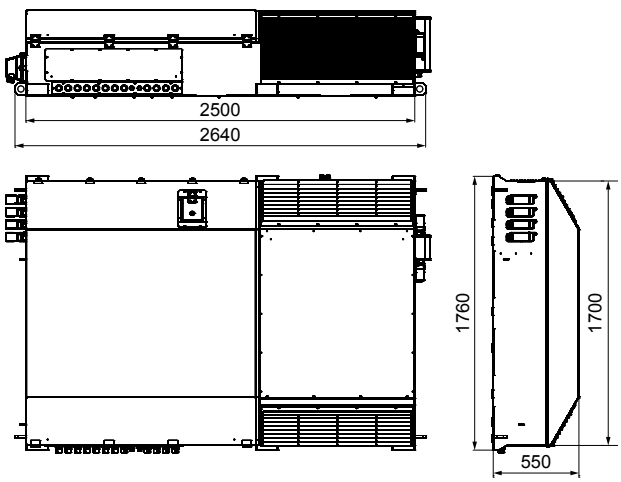


The FT-800-3000-LQC propulsion inverter is a modern chopperless system of the direct three-phase inverter based on the HV IGBT 6.5 kV technology. The control of the converter is performed in the DSP (Digital Signal Processor) technology with the application of the FOC SVPWM (Field Oriented Space Vector Pulse Width Modulation). Within the range of high speeds, the system co-operates with a synchronized Bus Clamping Pulse Width Modulation, which causes reduction of losses and noise. The control system ensures acceleration with a constant torque and low power losses. The drive can operate with rheostatic or regenerative braking. The inverter system guarantees very good traction parameters and perfect stabilization of the driving torque. The applied system of busbars combined with a perfect IGBT driver guarantee a failure-free performance at short circuits. It also eliminates the possibility of secondary damages in case of the transistor's failure. The applied capacitors ensure long service lifetime and resistance of the system to changes of voltage in the traction network. Additionally the inverter system is also protected with a thyristor crowbar. The device meets UIC and EN standards requirements with regard to safety and electromagnetic compatibility. The system has very low levels of low frequency interferencess generated to the traction network. The inverter allows supplying two traction motors, each with power of 400 kW. The diagnostics and control of the inverter is possible through the CANbus interface.

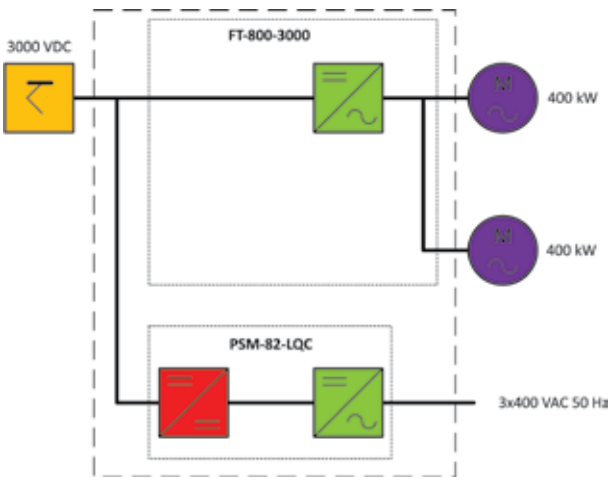
The PSM-82-LQC auxiliary converter has been designed to convert 3000 VDC traction voltage into 3×400 VAC, used in the EMU 36WE and 37WE vehicle traction system.

The inverter and auxiliary converter are equipped with a liquid cooling system, operates within the temperature range of –30°C ÷ +40°C.

HOUSING



BLOCK DIAGRAM



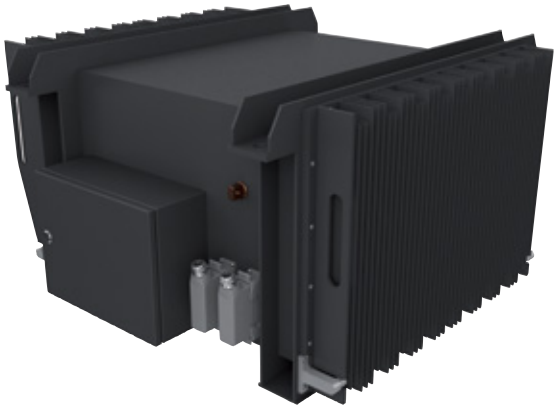
FT-800-3000-LQC /PSM-82-LQC

Propulsion inverter for Asynchronous Drives

Specification	
FT-800-3000-LQC	
Input voltage	**3000 VDC, +30 ÷ –30%**
Auxiliary voltage	**24 VDC, +25 ÷ –30%**
Rated current	**250 Arms**
Maximum output current	**480 Arms**
Rated power	**800 kW**
PSM-82-LQC auxiliary converter	
Input voltage	**3000 VDC +30 ÷ –30%**
Auxiliary voltage	**24 VDC +25 ÷ –30%**
Power	**90 kVA**
Voltage stability	**≤ 5%**
Nominal current In	**130 A**
Frequency	**50 Hz ±1 Hz**
3-wire output	**L1, L2, L3 + PE**
Overload	**160%, 5 s**
Unbalanced load	**max 10%**
Output waveform	**sinusoidal THD ≤ 5%**
Efficiency	**>90%**
Electronic (overload and short-circuit)	
Cooling system	
Power supply	**3×400 V/50 Hz**
Auxiliary voltage	**24 VDC +25 ÷ –30%**
Weight (inverter together with a auxiliary converter and cooling system)	**1285 kg**
Dimensions	**1760 × 2640 × 550 mm**

PSM-26NS

Auxiliary converter

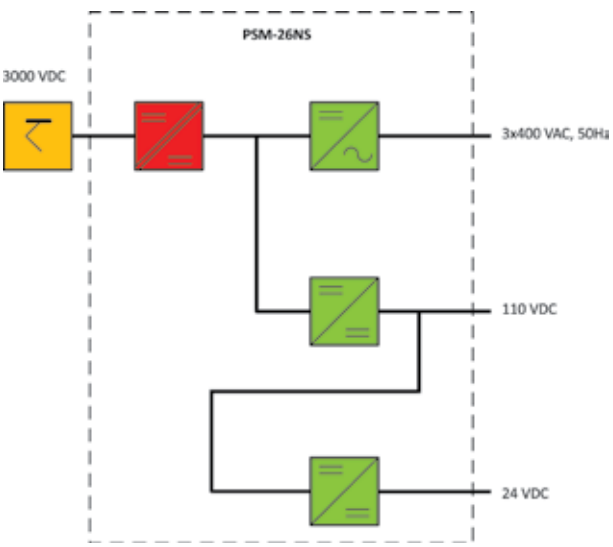


The PSM-26NS (for EMUs EN57 and EN71 type) auxiliary converter has been designed to convert traction DC voltage of 3000 V into low DC voltages 110 VDC and 24 VDC and 3×400 VAC AC voltage used in the low voltage installations of the EMU EN57. The load of 3×400 VAC voltage may be asymmetric, which enables the power supply of 230 VAC max 3 kVA circuits without exceeding the load of 6 kVA per phase. The high voltage stage uses HV IGBT modules.

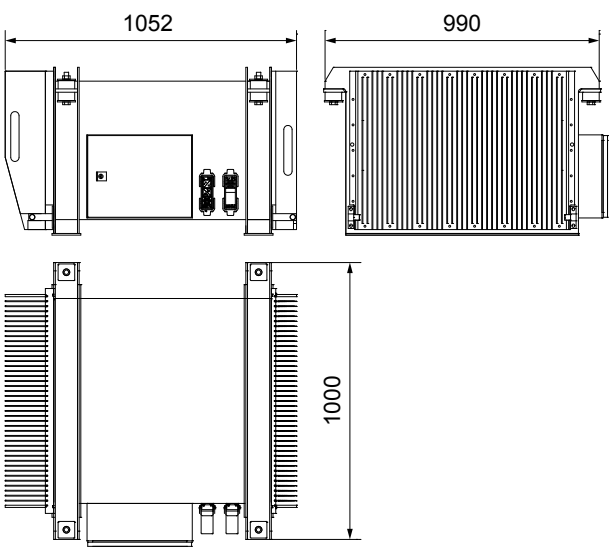
Specification	
Input voltage	**3000 VDC operating range 1800÷4000 V (1800–4200 V short time)**
Output voltage 1	**3×400 VAC**
Output power 18 kVA; Output frequency 50–1 Hz; 5 wire output L1, L2, L3, N, PE; Voltage stability ≤ 5%; overload capability 500%/5 s (inrush current of motors); maximum load unbalancing 50%; Sinusoidal output voltage (THD(u) ≤ 5%); Electronic (overload and short circuit) protection	
Output voltage 2	**110 VDC**
Output power 6 kW; Voltage stability ≤ 1%; Voltage ripples ≤ 0.5%; Limitation of battery charging current to 15–30 A; Electronic (overload and short circuit) protection; Electronic over-voltage protection	
Output voltage 3	**24 VDC**
Output power 2 kW; Voltage stability ≤ 5%; Voltage ripples ≤ 1%; Electronic (overload and short circuit) protection; Electronic overvoltage protection	
Total output power	**26 kW**
Total efficiency	**≥ 90%**
Ambient temperature	**–30 ÷ +40°C**
Protection degree	**IP56**
Weight	**280 kg**
Dimensions	**1052 × 1000 × 990 mm**

NOTE: In case the voltage of 4200 V is exceeded, the operation of the converter is stopped. The converter starts to operate automatically when traction voltage is lowered.

BLOCK DIAGRAM



HOUSING



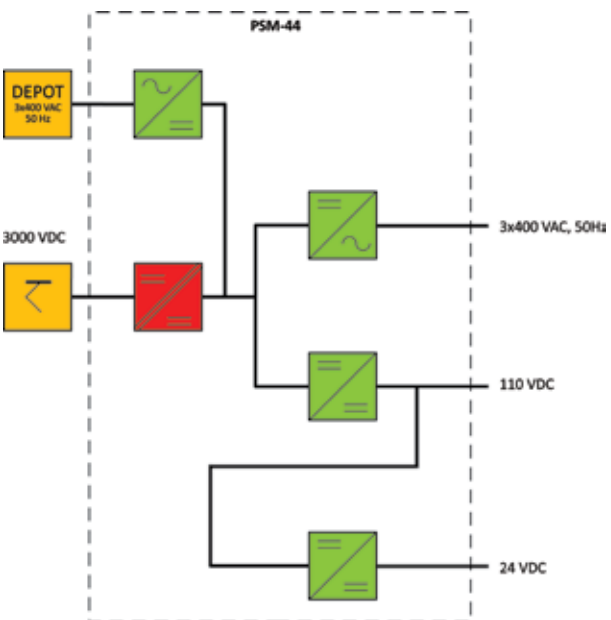
PSM-44

Auxiliary converter

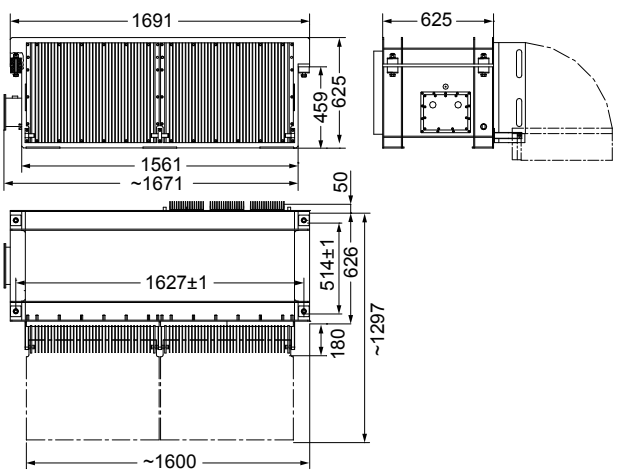
The PSM-44 auxiliary converter has been designed to convert 3000 VDC voltage used in the railway traction networks into 110 VDC and 24 VDC as well as 3×400 VAC and 220 VAC, used in the low voltage systems of EMUs (EN57). Auxiliary converter can be loaded with an unbalanced load of up to 6 kVA per line. In standstill conditions, (when the power supply with 3000 V is off) the converter may be powered from the 3×400 VAC industrial network.

Specification	
Input voltage	**3000 VDC** **operating range 1800÷4000 V (1800÷4200 V short time)**
Output voltage DC	**110 VDC**
P = 10.5 kW; Co-operation with the battery; Current stability ≤ ±2%; Voltage stability ≤ ±1%; Voltage ripples ≤ 0.5%; Battery charging current 15–30 A (adjustable); Electronic (overvoltage, overload, short circuit) protection	
Output voltage AC 1	**3×400 V (50 Hz)**
P = 23 kW; Voltage stability ≤ ±5%; Frequency stability ≤ ±2.0%; THD(u) ≤ 5%; Overload 300%/5 s; Unbalanced load max 30%; Electronic (overload, short circuit) protection	
Output voltage DC 2	**24 VDC**
P = 7.5 kW; Voltage stability ≤ ±5%; Voltage ripples ≤ 1%; Electronic (overvoltage, overload, short circuit) protection	
Total output power	**44 kW**
Total efficiency	**≥ 90%**
Monitoring	**CANopen**
Ambient temperature	**–40 ÷ +40°C**
Protection degree	**IP56**
Weight	**530 kg**
Dimensions	**856 × 1691 × 626 mm**

BLOCK DIAGRAM



HOUSING



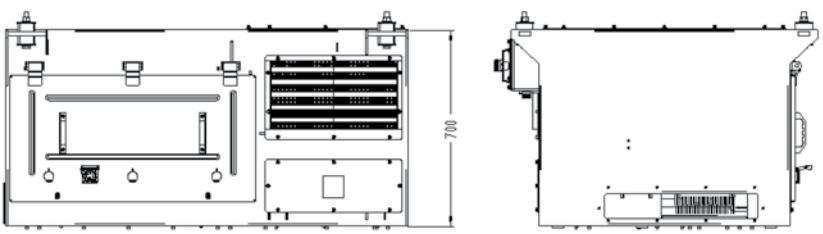
PSM-81

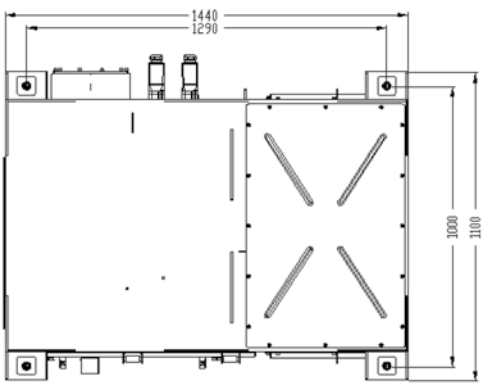
Auxiliary converter

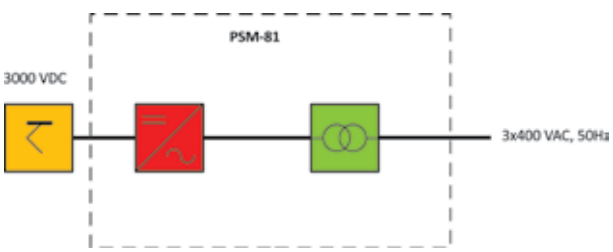
The PSM-81 auxiliary converter has been designed to convert 3000 VDC traction voltage into 3×400 VAC, used in the EMU EN57 vehicle traction system.

Specification	
Input voltage	
HV	**3000 VDC z FT-500-3000-UF-M** (range 2000÷4000 V)
LV	**Auxiliary 24 VDC** (–30 ÷ +25%)
Output voltage	**3×400 V (50 Hz)**
Total power	**86 kVA (78 kW)**
Voltage stability	**≤ 5%**
Nominal current In	**125 A**
Frequency	**50±1 Hz**
3-wire output	**L1, L2, L3 + PE**
Overload	**80%, 5 s**
Unbalanced load	**max 10%**
Output waveform	**sinusoidal THD ≤ 5%**
Electronic (overload and short-circuit) protection	
Efficiency	**> 90%**
Ambient temperature	**–30 ÷ +40°C**
Protection degree	**IP55/IP20**
Weight	**700 kg**
Dimensions	**1100 × 1440 × 700 mm**

HOUSING







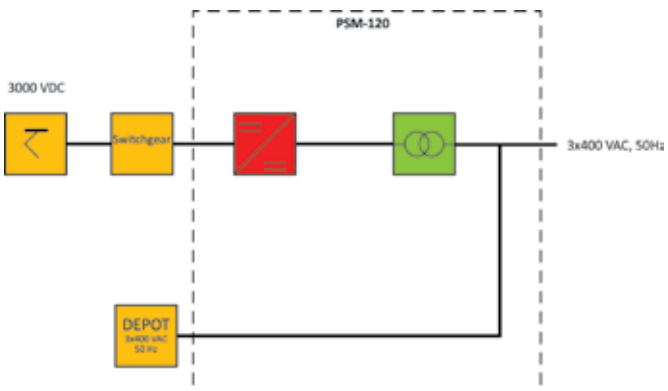
PSM-120

Auxiliary converter with High Voltage Switchgear

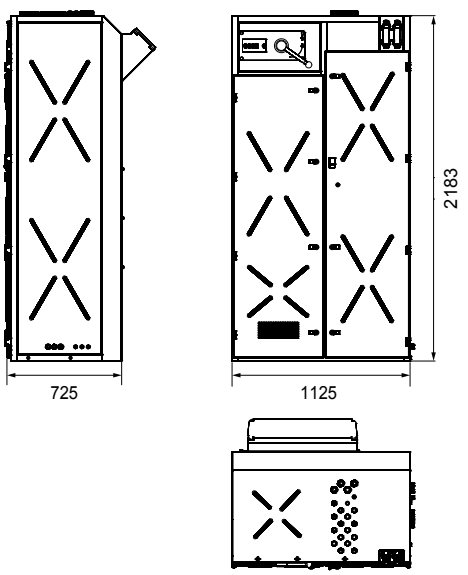
Auxiliary converter type PSM-120 has been designed to supply the circuitry of the railway vehicle with 3×400 V 50 Hz. Input power supply for this converter is 3000 VDC. It is possible to supply the co-nverter from a 3×400 V 50 Hz depot supply. The PSM-120 auxiliary converter is built-in in a tight metal housing made of steel. In one cabinet there are auxiliary converter and high voltage switchgear for EMU (for propulsion drives). The main high voltage transformer of the converter is design in separate container mounted on the roof of the train.

Specification	
Input voltage HVDC	**3000 VDC** (range 2000÷4000 V)
Switchgear outputs	**two 500 kW for propulsions drives** **120 kW for auxiliary converter**
Overvoltage protection	**YES**
Converter Input voltage	**3000 VDC traction** **3×400 VAC Depot**
Power 44 kVA; Frequency 50 Hz; 3-wire input L1, L2, L3, Necessary short circuit protection in front of the depot source	
Converter output voltage AC	**3×400 VAC**
Power 120 kVA; cos f ≥ 0.85; Output frequency 50±1 Hz; 3-wire output L1, L2, L3, Voltage stability 5%; Overload 200%/3 s (motor start-up); Load asymmetry max 10%; Output waveform sinusoidal (THDu < 5%); Electronic overload and short circuit protection	
Total power	**120 kVA/112 kW**
Efficiency	**> 90%**
Weight	**530 kg main cabinet**
Dimension	**1125 × 725 × 2183 mm main cabinet**

BLOCK DIAGRAM



HOUSING



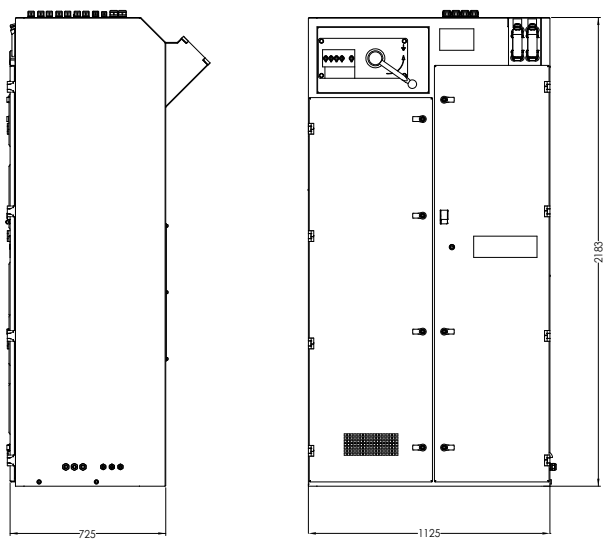
PSM-140

Auxiliary converter

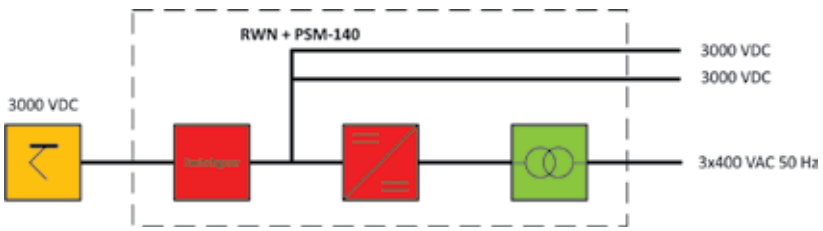
Auxiliary converter type PSM-140 has been designed to supply the circuitry of the railway vehicle with 3×400 V 50 Hz. Input power supply for this converter is 3000 VDC. It is possible to supply the co-nverter from a 3×400 V 50 Hz depot supply. The PSM-120 auxiliary converter is built-in in a tight metal housing made of steel. In one cabinet there are auxiliary converter and high voltage switchgear for EMU (for propulsion drives). The main high voltage transformer of the converter is design in separate container mounted on the roof of the train.

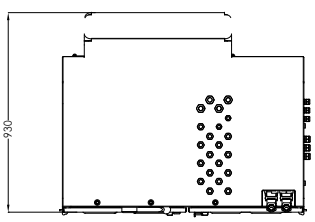
PSM-140		
Input voltages	**3000 VDC**	
AC Output	**3×400 VAC / 50 Hz / 140 kVA**	
DC Output 1 (from switchgear to propulsion system)	**3000 VDC / 500 kW**	
DC Output 2 (from switchgear to propulsion system)	**3000 VDC / 500 kW**	
Housing		
Cooling	**forced-air**	
Weight	**540 kg**	
Dimensions	**1125 × 725 × 2183 mm**	
Protection degree	**Clean section**	**IP22 (housing inside vehicle)**

HOUSING



BLOCK DIAGRAM





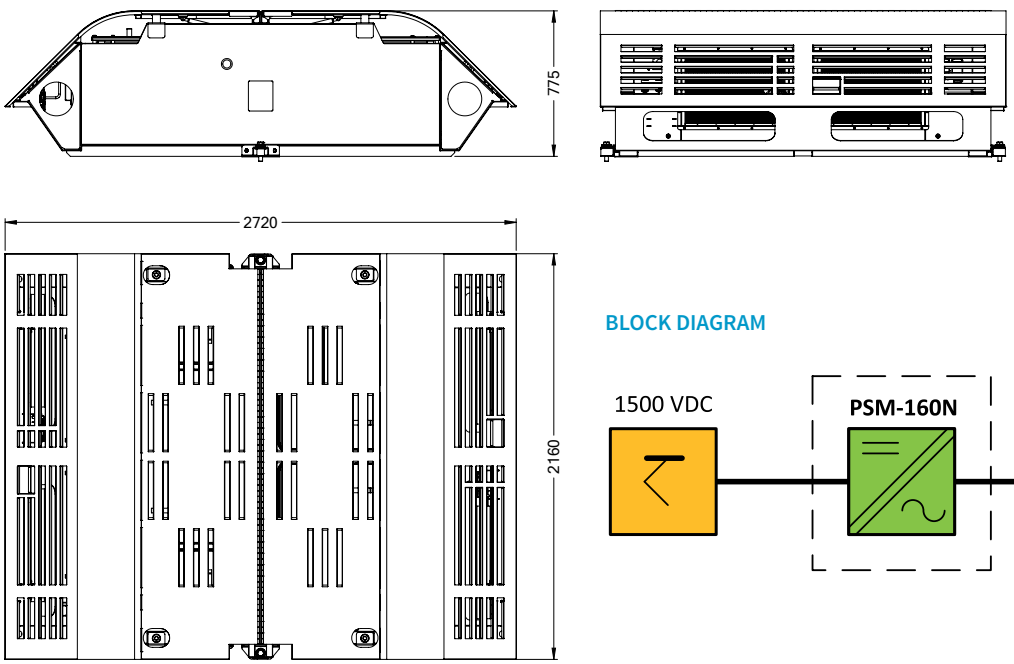
PSM-160N

Auxiliary converter

The PSM-160N Auxiliary power supply is a fully automated device designed to convert 1500 VDC traction voltage into 3x415 V/ 50 Hz AC voltage. The device uses multiple energy conversion technology. The traction voltage is converted to high AC voltage and then converted to the 3-phase AC voltage. As a result of incorporating single-chip microprocessors and IGBT transistors, the converter generates a sinusoidal AC voltage with low harmonic content at the output. The APU ensures proper AC supply for additional charger (ZB110DC100 – in separate box) to charge onboard batteries and onboard loads on the trains, which ensuring its proper protections (e.g. by battery charging current limitation system). The control system adopted in presented converter ensures high frequency stability, very good phase symmetry of the output voltage and a very low level of interferencess generated by the system. The semiconductor elements used in the device are selected with sufficient margin to achieve the assumed system overloads. The converter is equipped with a module enabling communication with the master controller via a Ethernet interface. In this way, information on the operation or failure of the unit is transmitted. The unit is entirely self-maintaining - the control system monitors the states at the output terminals and protects the converter in the event of a long-term overload or short circuit. The unit is mounted on the roof of the vehicle. The unit has its own cooling system (air only), with a separate dirty zone where a mechanical filter is installed to prevent dirt from entering the container.

Specification		
Input voltage		**1500 VDC (±30%)**
AC output voltage		**3x415 VAC, 50 Hz**
AC output power		**160 kVA / 136 kW**
AC output overload		**320 kVA / 192 kW for 10 s**
Control voltage		**110 VDC +25% ÷ -30%**
Housing		
Cooling		**Forced air**
Weight		**1540 kg**
Dimensions		**2720 x 2160 x 775 mm**
Protection degree	Clean section	**IP56**
	Dirty section	**IP21**

HOUSING



BLOCK DIAGRAM

PSM-160-UF

Auxiliary converter

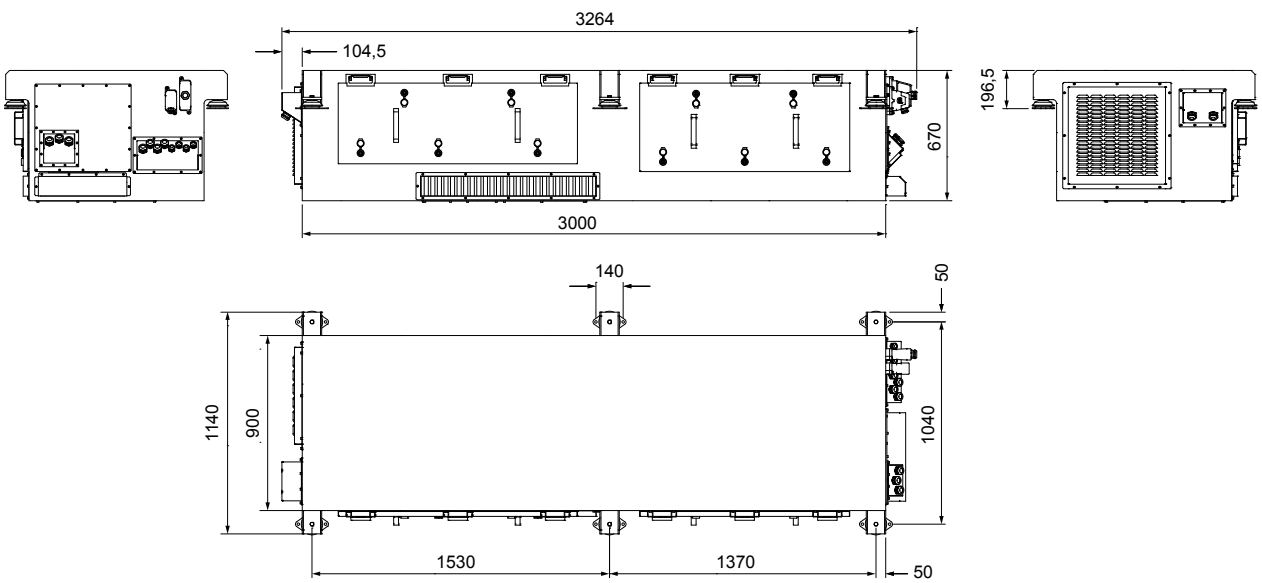
Auxiliary converter type PSM-160 has been designed to supply the circuitry of the railway vehicle with 3×380 V and 3×220 V, both 60 Hz and 72 VDC. Input power supply for this converter is 3000 VDC. It is possible to supply the converter from a 3×380 V 60 Hz depot supply. The PSM-160 auxiliary converter is built-in in a tight metal housing made of aluminum profiles and sheets. Some of these profiles are used for heat dissipation.

Specification	
Input voltage HVDC	**3000 VDC** (range 2000÷4000V)
Overvoltage protection	**YES**
Input voltage AC Depot	**3×380 V**
Power 83 kVA; Frequency 60 Hz; 4-wire input L1, L2, L3, N; Necessary short circuit protection in front of the depot source	
Output voltage AC1	**3×380 VAC**
Power 120 kVA; cos φ ≥ 0.8; Output frequency 60±1 Hz; 4-wire output L1, L2, L3, N; Voltage stability 5%; Overload 200%, 3 s (motor start-up); Load asymmetry max 10%; Output waveform sinusoidal (THD<5%); Electronic overload and short circuit protection	
Output voltage AC2	**3×220 VAC**
Power 25 kVA; cos φ ≥ 0.8; Frequency 60±1 Hz; 4-wire output L1, L2, L3,N; Voltage stability 5%; Load asymmetry max 10%; Output waveform sinusoidal (THD < 5%); Fuse 100 A overload and short circuit protection	
Output voltage LVDC	**72 VDC**
Power 10 kW; Voltage stability 1%; Voltage ripples < 0.5%; Battery current limit adjustable level (range 20÷60 A); Electronic overload and short circuit protection; Electronic overvoltage protection; Thermal compensation of output voltage	
Total power	**160 kVA/150 kW**
Efficiency	**> 90%**
Data bus	**CANopen**
Ambient temperature	**0 ÷ +40°C**
Cooling	**forced-air**
Assembling	**under the floor**
Protection degree	**IP55 (IP22 cooling compartment)**
Weight	**1250 kg**
Dimensions	**3000 × 1140 × 670 mm**

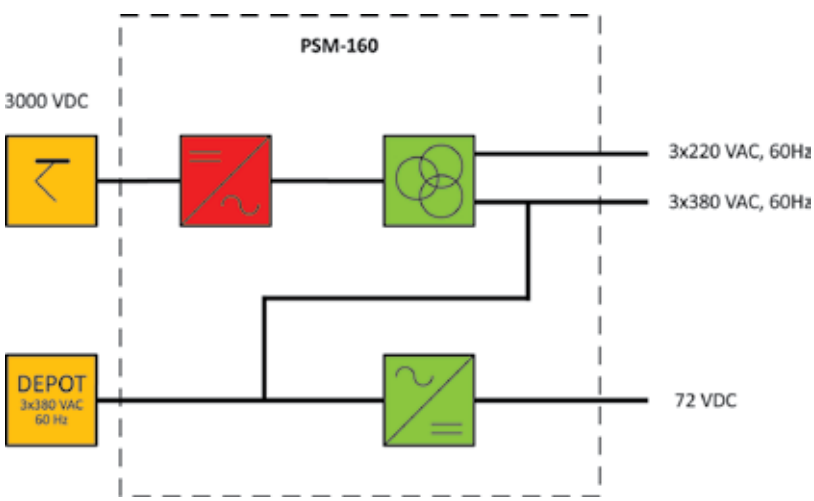
PSM-160-UF

Auxiliary converter

HOUSING



BLOCK DIAGRAM



NEW

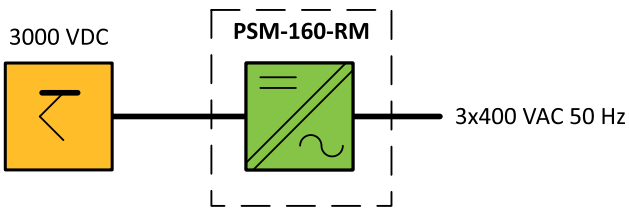
PSM-160-RM

Auxiliary converter

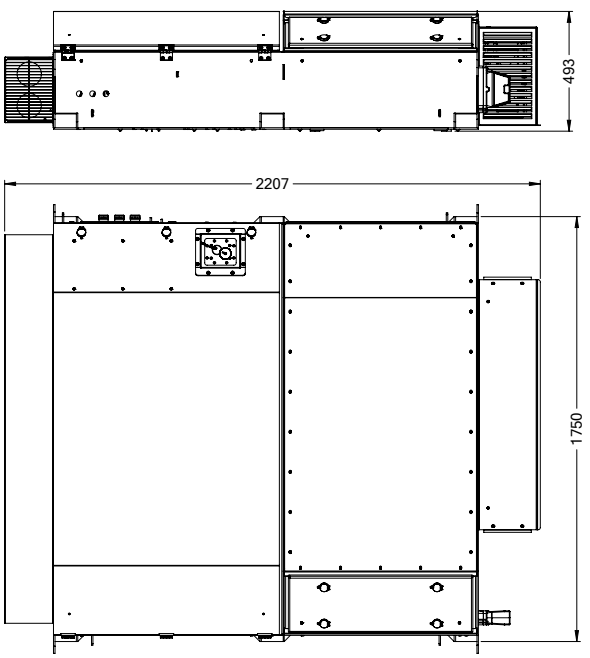
The auxiliary converter PSM-160-RM is designed for converting traction power supply voltage 3000 VDC to 3x400 VAC / 50 Hz of auxiliary circuits voltage of an electric train set. Auxiliary converter is a fully automated device and allows continuous supply of low-voltage circuits, irrespective of the value of the current input voltage of the traction power supply (within the range compliant with the PN-EN-50155 standard). The 3 kVDC input voltage supplied via the precharge circuit is converted by the inverter into a three-phase AC voltage. This voltage is supplied to the 3x400 V (50 Hz) output via a transformer system after passing through a capacitive filter and a fuse disconnector. The operation of the converter, including its precharging system, is controlled by a microprocessor control system supplied with external 24 VDC.
Using the latest generation of single-chip microprocessors and IGBT transistors, the device allows a sinusoidal AC voltage with low harmonic content to be obtained at the output. The semiconductor elements used in the device are selected to achieve appropriate system overload levels. The IGBT modules have a maximum allowable blocking voltage of 6.5 kV. The device is fully automated - the control system controls the voltage levels at the output terminals and the amount of output current, therefore protecting the converter from long-term overloads and short-circuits. The control system used (supplied by an external 24 VDC voltage) provides high frequency stability, very good output voltage phase symmetry and a very low level of interferencess generated by the system.

Specification		
Input voltage		**3000 VDC**
Auxiliary voltage		**24 VDC -30% ÷ +25%**
Output power		**160 kVA / 144 kW**
Output voltage		**3x400 VAC / 50 Hz**
Voltage stability		**≤ 5%**
THD		**≤ 5%**
Rated current		**3 x 232 A**
Maximum current		**3 x 370 A / 5 s**
Housing		
Weight		**1047 kg**
Cooling		**Forced air**
Dimensions		**2207 x 1750 x 493 mm**
Protection degree	Clean section	**IP55**
	Dirty section	**IP20**
Ambient temperature		**-30°C ÷ +40°C**

BLOCK DIAGRAM



HOUSING

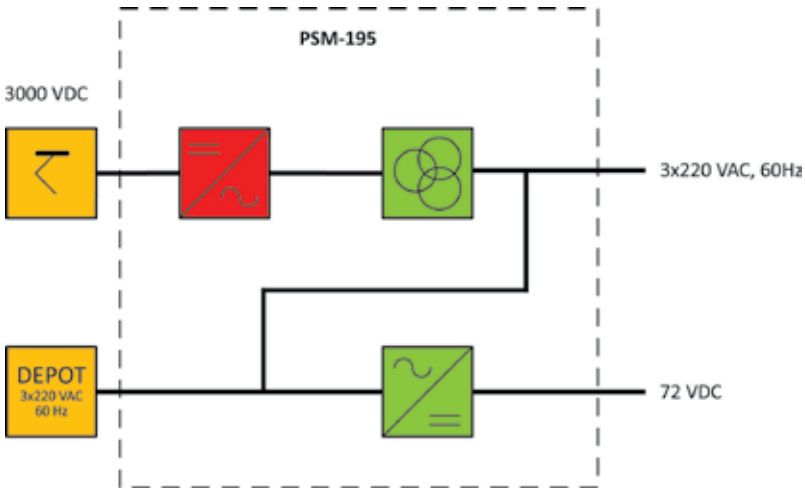


PSM-195

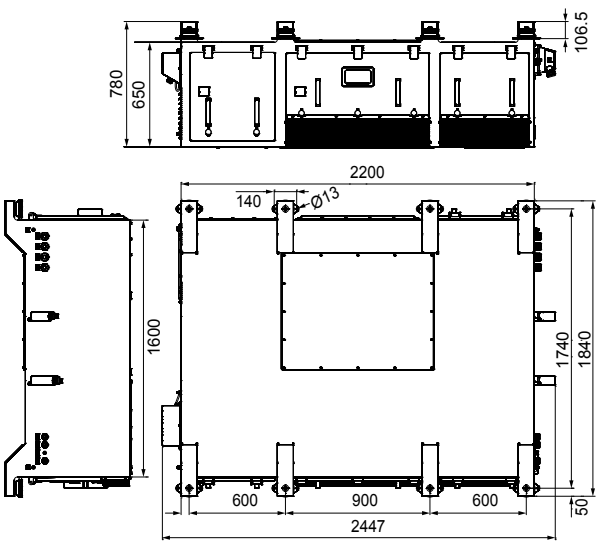
Auxiliary converter

Auxiliary converter type PSM-195 has been designed to supply the circuitry of the railway vehicle with 3×380 V /60 Hz and 72 VDC. Input power supply for this converter is 3000 VDC. It is possible to supply the converter from a 3×380 V 60 Hz depot supply. The PSM-195 auxiliary converter is built-in in a tight metal housing made of aluminum. Some of these profiles are used for heat dissipation.

BLOCK DIAGRAM



HOUSING



PSM-195

Auxiliary converter

Specification	
Mounting	**under the frame**
Protection level	**IP66/IP21 (open areas for transformer and filter inductors)**
Cooling	**forced-air**
Converter dimensions (L×W×H)	**2210 × 1840 × 780 mm**
Converter weight	**1500 kg**
Input parameters	
Catenary	
Input voltage	**3000 VDC (2000–3900 VDC)**
Overvoltage protection	**yes**
Efficiency	**≥ 90%**
Depot supply	
Depot input power limitation (performed in the depot)	**35 kW**
Depot input voltage	**3×380 VAC/60 Hz**
Output parameters	
Input-output galvanic isolation	**yes**
AC output	
AC output voltage	**3×380 V/60 Hz**
AC output voltage stability	**±5%**
AC output load	**195 kVA/160 kW**
AC nominal frequency	**60 Hz ±1%**
Output configuration	**3 phases + N**
Waveform	**Sinus**
AC rated power factor	**≥ 0.85**
AC overload capacity	**327 kVA, PF>0.64, 2 s**
AC THD(u)	**< 6 %, at THDi of loads < 10%**
100 first harmonics are analyzed in the measurement of THDu of AC output; no information of THD is available in the system	
AC output contactor	**yes**
AC overvoltage protection	**yes**
AC overload protection	**yes**
AC overcurrent protection	**yes**
The tolerance for the static adjustment of the voltage	**±5%**
DC output	
DC output voltage range	**72 V (50÷90 V)**
DC load capacity	**16.5 kW**
DC ripples	**< 1%**
DC output voltage stability	**±1%**
Maximum DC current (including charging)	**230 A**

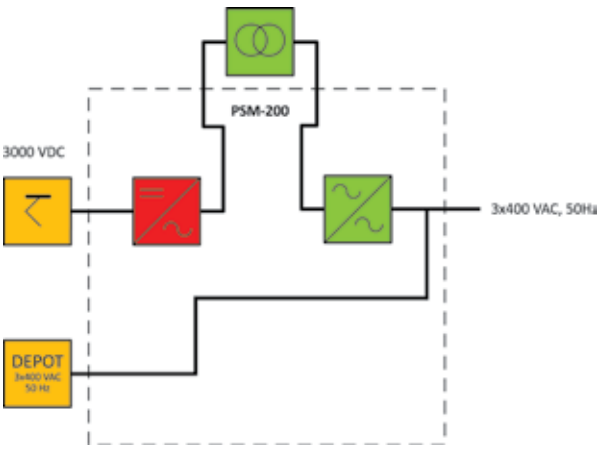
PSM-200

Auxiliary converter

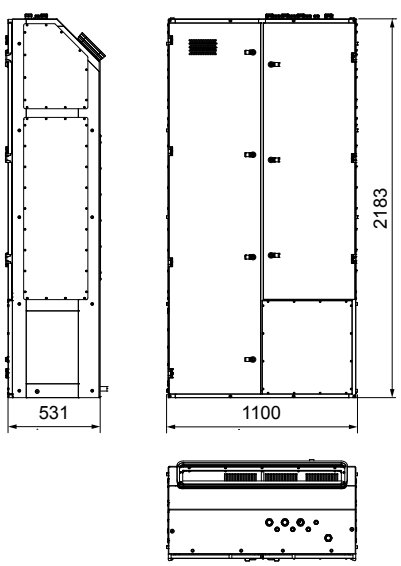
The auxiliary converter PSM-200 has been designed to supply the circuitry of a railway vehicle with 3×400 V/50 Hz. Input power supply for this converter is 3000 VDC. It is possible to supply the converter from 3×400 V 50 Hz depot supply. The control unit of the PSM-200 is supplied from a 24 VDC source.

Specification	
Input voltage HVDC	**3000 VDC** (range 2000÷4000 V)
Overvoltage protection	**MOV, SCR Crowbar**
Input voltage AC Depot	**3×400 VAC**
Power 83 kVA, Frequency 50 Hz, 3-wire input L1, L2, L3;	
Input voltage LVDC	**24 VDC**
Power 200 W; Voltage range –30 ÷ +25%;	
Output voltage AC	**3×400 VAC**
Power 200 kVA; cos ϕ ≥ 0.8; Frequency 50±1 Hz, 3-wire output L1, L2, L3; Voltage stability ±5%; Overload 200%, 3 s (motor start-up); Load asymmetry max 10%; Voltage waveform sinusoidal (THD <5%); Electronic overload and short circuit protection	
Total power	**200 kVA/190 kW**
Efficiency	**> 90%**
Monitoring	**CANopen**
Ambient temperature	**–30 ÷ +40°C**
Cooling	**forced-air**
Assembling	**in the cabinet**
Protection degree	**IP54 (IP54 cooling compartment too)**
Weight	**700 kg**
Dimensions	**1100 × 531 × 2183 mm**

BLOCK DIAGRAM



HOUSING

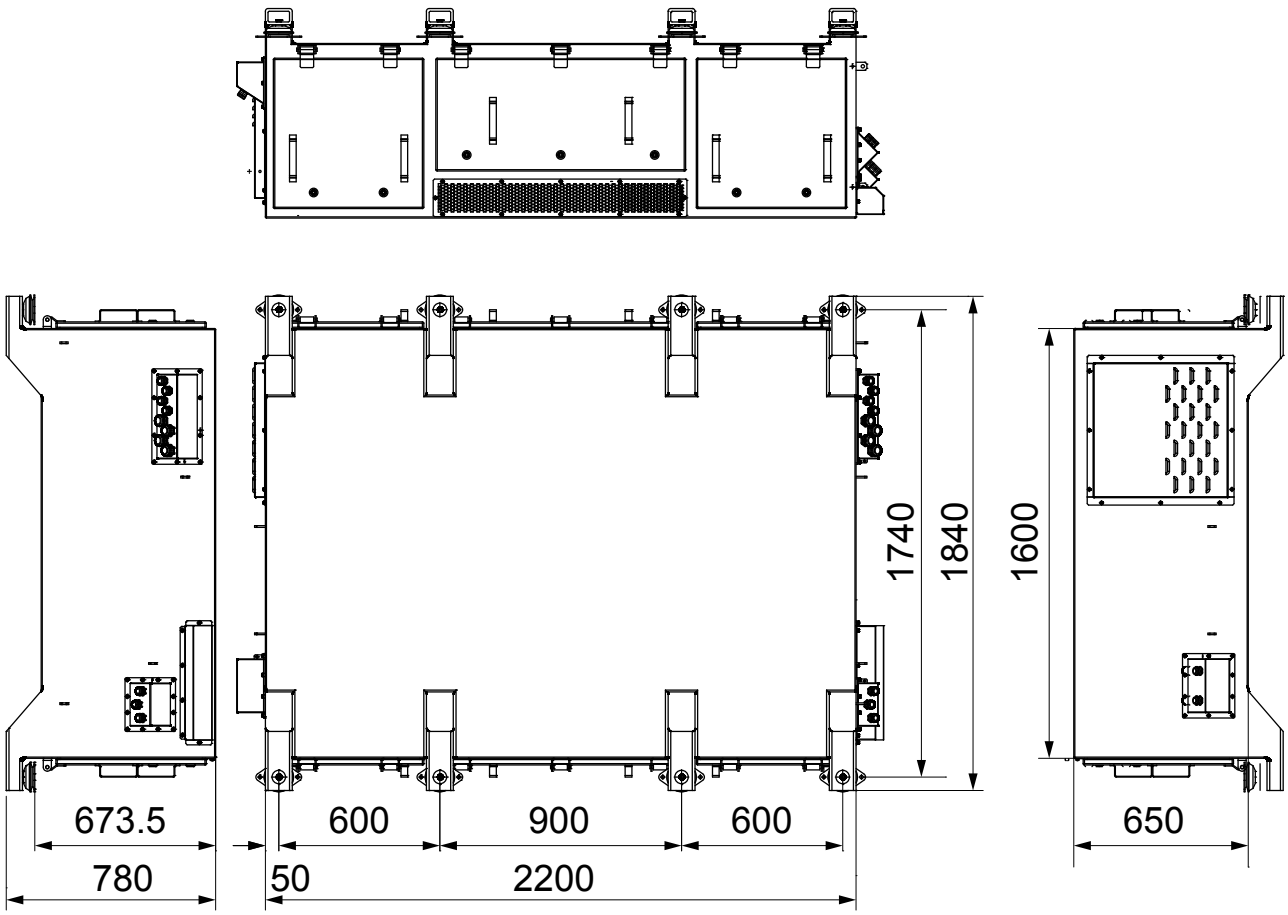


PSM-220

Auxiliary converter

The auxiliary converter type PSM-220 has been designed to supply the circuitry of a railway vehicle with the 3×400 V/50 Hz and 110 VDC. Input power supply for this converter is 1500 VDC. It is possible to use a 3×400 V 50 Hz depot power supply. The PSM-220 auxiliary converter is built-in in a tight metal housing made of aluminum. Some of these profiles are used for heat dissipation. The housing is prepared to be assembled under the floor. The control unit of the PSM-220 is supplied from a 110 VDC source.

HOUSING

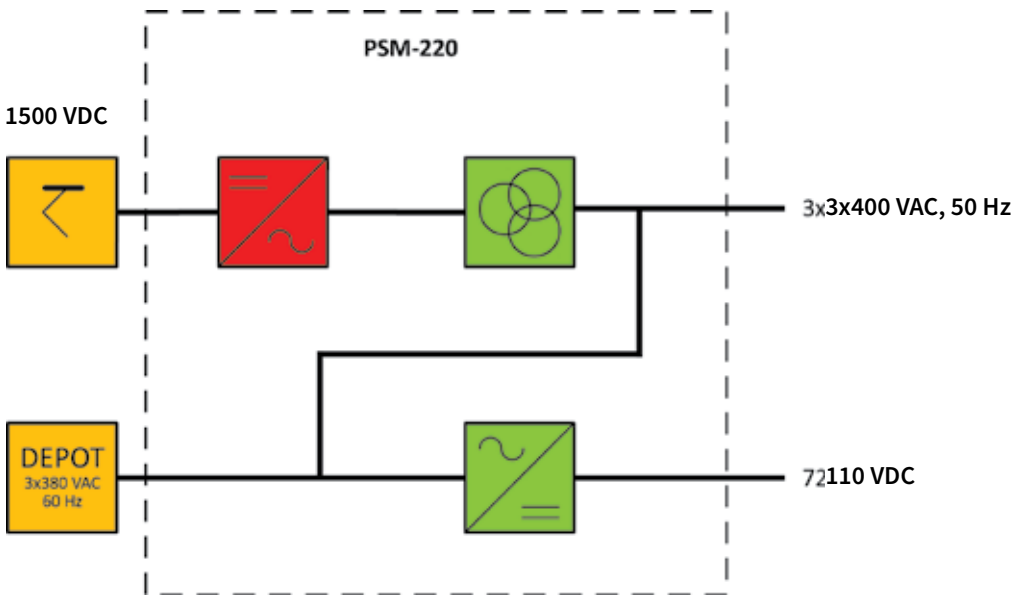


PSM-220

Auxiliary converter

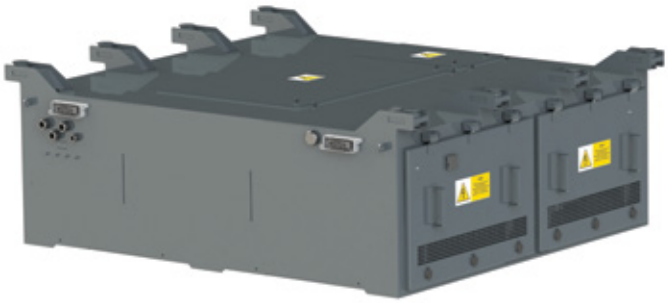
Specification		
Input voltage		**1500 VDC (range 1200 V ÷ 1800 V)**
AC Output 3x400 V (50 Hz)	**Rated power**	**203 kVA (187 kW)**
	Voltage stability	**≤ 5%**
	Nominal current	**294 A**
	Frequency	**50 Hz ± 1 Hz**
	Overload	**200%, 5s**
	Load asymmetry	**max 10%**
	Harmonic level	**THD ≤ 5%**
	4-line output	**L1,L2,L3,N + PE**
	Protections	**short circuit / asymmetry / overload**
110 VDC output	**Rated power**	**20 kW**
	Nominal current	**182 A**
	4-line output	**110 V+LOAD; 110 V+EMER; 110 V+BAT; common 110 V**
24 VDC output	**Rated power**	**1.5 kW**
	Nominal current	**63 A**
	Voltage stability	**±5%**
Maximum constants power		**209 kW**
Efficiency		**> 90%**
Ambient temperature		**-30°C ÷ +40°C**
Housing type/Protection degree		**Aluminum IP55 (IP65 connectors)**
Weight		**1470 kg**
Dimensions		**1740 x 2220 x 650 mm**

BLOCK DIAGRAM



PSM-230

Auxiliary converter



The auxiliary power unit PSM-230 (APU) were designed applying state of the art technologies: IGBT modules, Digital Signal Processors, modern magnetic materials, resin stabilization and others. The modern technological and circuitry solution provides excellent output parameters. The converter shares the input filter with the propulsion inverter that eliminates the fluctuations or transient inputs that may introduce noise into the equipment or from the APU to the catenary.

The APU is supplied from the DC link voltage of the propulsion converter of the train. Using LF power conversion technology and modern PWM algorithms, it generates a pure sinusoidal three-phase output voltage.

Auxiliary converter PSM-230 (APU) was designed to supply the auxiliary circuits and to charge batteries in train cars through a 110 VDC rectifier.

APU will be built in tight metal housing made of welded aluminium. Some of these profiles are used for heat dissipation.

Cooling of the converter PSM-230 is a result of forced air along the inner heatsink of the converter. The air cooling channel is in the dirty zone of the APU. The converter has an automatic control system that monitors the states of the outputs and protects it against overloads or short circuits. Every fault state is detected and followed by an appropriate alarm signal sent through CANBUS.

Maintenance access of the APU is provided by means of the modular construction of the main functional block of the converter.

The PSM converter is a high-power single-system auxiliary converter based on IGBT technology. The control of the converter is performed in DSP (Digital Signal Processor) technology.

The system is characterized by a low level of harmonics distortion in the output voltage, very high efficiency and high overload capability.

The applied bus-bar system in combination with a perfect IGBT driver guarantees a failure free performance upon short-circuits and eliminates the possibility of secondary damages in case of transistor failure.

The converter meets the international and EN standards in safety and electromagnetic compatibility.

The system provides a very low level of interferencess emitted to the traction network and loads.

The converter equipped with a forced air-cooling system operates within a wide range of external temperatures.

The diagnostics and control of the converter is provided via the CANBUS and CAN gateway interface.

Control is provided via the CAN interface. Diagnostics is provided via the ETH interface. The battery charging block operates in a mode which is optimal for the battery.

The modes are set automatically – in order to protect and extend the lifetime and ensure optimal operation of the batteries. The PSM-230 converter is mounted under the frame of the vehicle. Access to its components is provided on the side of the vehicle, after removing the side flaps.

The inverter is designed to withstand the starting of all AC loads following a starting sequence.

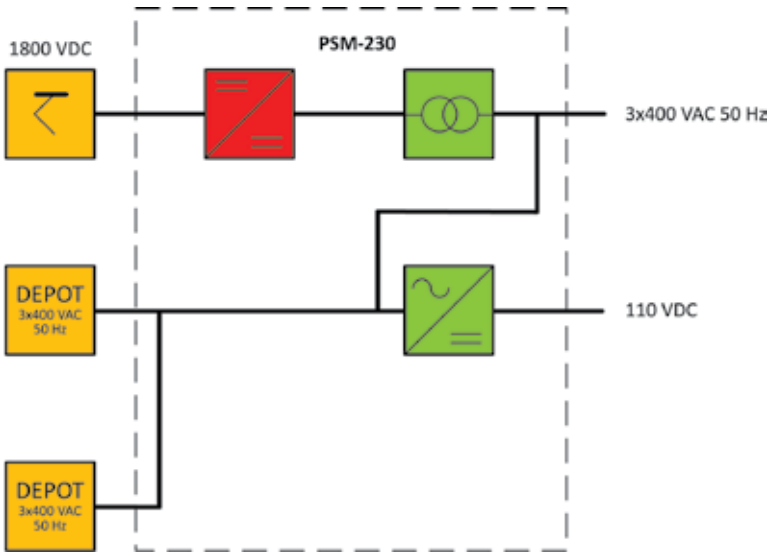
Auxiliary 110 VDC power is supplied by the inverter / rectifier and battery. Therefore, the outputs of one 110 VDC rectifier are operated in parallel, feeding batteries and train equipment, so it automatically adjusts its loads without overload (regulation curves).

PSM-230		
Input voltages	**1500 VDC (catenary)** **3×400 VAC / 50 Hz (Depot)** **3×400 VAC / 50 Hz (Depot)**	
AC Output	**3×400 VAC / 50 Hz / 210 kVA**	
DC Output	**110 VDC / 20 kW**	
Housing		
Cooling	**forced-air**	
Weight	**1350 kg**	
Dimensions	**2042 × 1700 × 787 mm**	
Protection degree	**Clean section**	**IP65**
	Dirty section	**IP21**

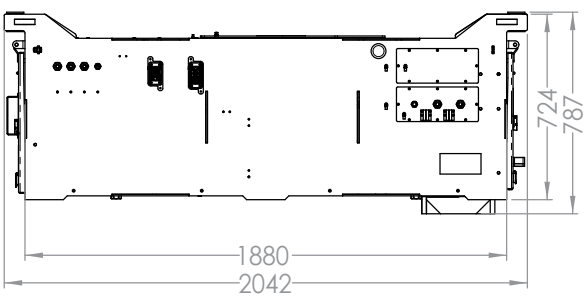
PSM-230

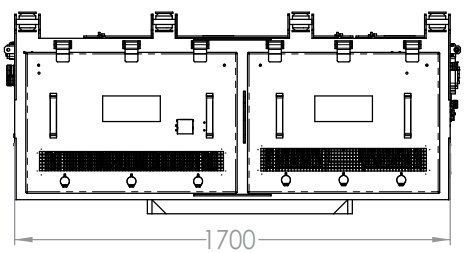
Auxiliary converter

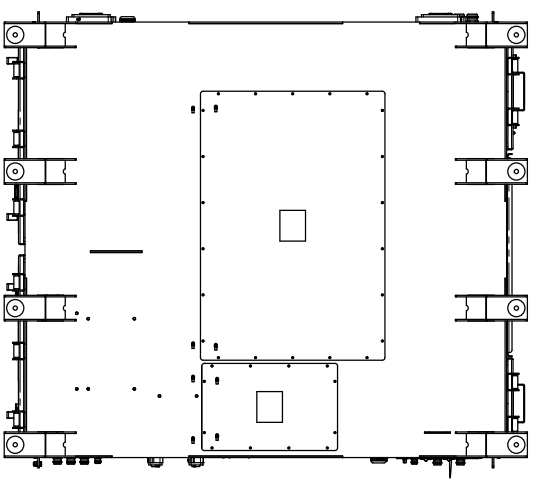
BLOCK DIAGRAM



HOUSING







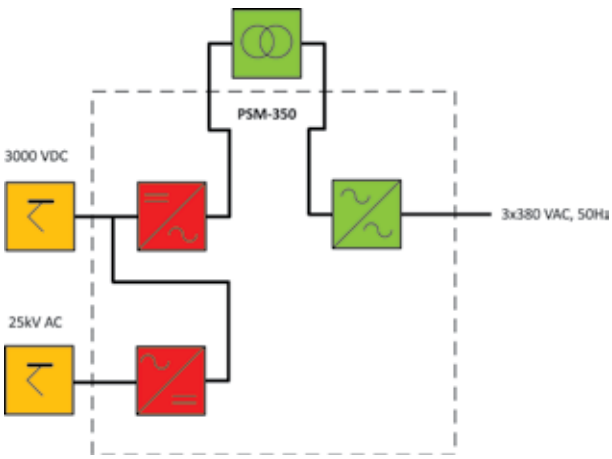
PSM-350

Auxiliary converter

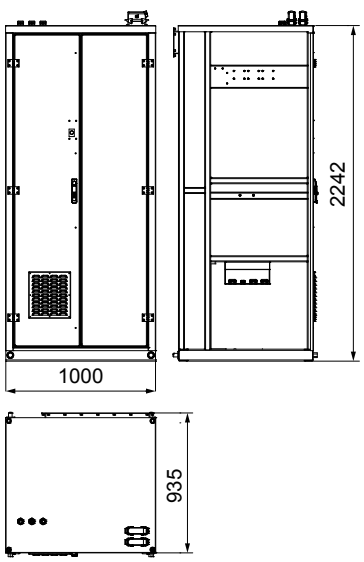
The PSM-350 auxiliary converter has been designed to supply the circuits of train cars with 3×380 V/50 Hz. Inputpower supply for this converter is 3000 VDC or 25 kVAC depending on the train's operation mode. In the 3000 VDC operation mode the converter is supplied from the DC link circuit of FT-500-3000-DS propulsion inverter. In the 25 kVAC operation mode the converter is supplied from the HV transformer of the train. Active Front End structure on the front of the PSM-350 results in pure sinusoidal current collected from the AC traction. The housing is prepared for in-car assembly. The control unit of the PSM-350 is supplied from a 24 VDC source.

Specification	
Input voltage HV	**3000 VDC** direct from FT-500-3000-DS (operating range 2000÷4000 VDC) **25 kVAC** through external HV transformer 2083 VAC (operating range 1583÷2292 VAC)
Overvoltage protection	**yes**
Input-output galvanic isolation	**yes**
Output voltage AC	**3×380 VAC/50 Hz**
Output power	**350 kVA**
3-wire output	**L1, L2, L3 neutral grounded**
Power factor	**≥ 0.8**
Voltage stability	**≤ 5%**
Frequency stability	**≤ 1%**
Overload/short circuit capacity	**2×In/3 s (200%/3 s)**
THD(u)	**≤ 5% typical 3%**
General	
Total output power	**350 kVA/330 kW**
Efficiency	**≥ 90%**
Monitoring	**CANopen**
Ambient temperature	**–40 ÷ +40°C**
Cooling	**forced-air**
Mounting	**inside the car**
Protection degree	**IP55/IP20 cooling compartment**
Weight	**825 kg**
Dimensions	**1000 × 2242 × 935 mm**

BLOCK DIAGRAM



HOUSING



ZB24DC200

Battery Charger

The ZB24DC200 series battery charger has been designed to charge batteries and supply DC loads of the rated voltage of 24 VDC – in co-operation with the battery. The charger may operate without the battery or with any type of battery. The charger incorporates the IGBT technology with primary switching, control is performed by the microcontroller, whose algorithm provides:

- constant monitoring of the supply voltage,
- monitoring of output currents and voltages,
- generation of alarm signals,
- independent stabilisation of output current and battery current,
- thermal compensation of the battery voltage,
- battery diagnostics (circuit continuity).

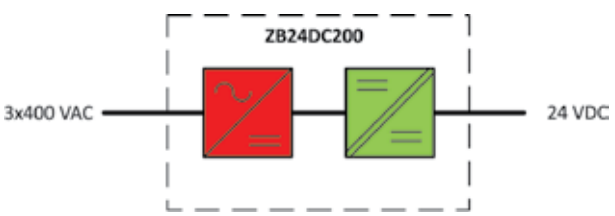
The charger has 3 alarm contacts which signal:

- lack of battery charging,
- overload,
- low output voltage.

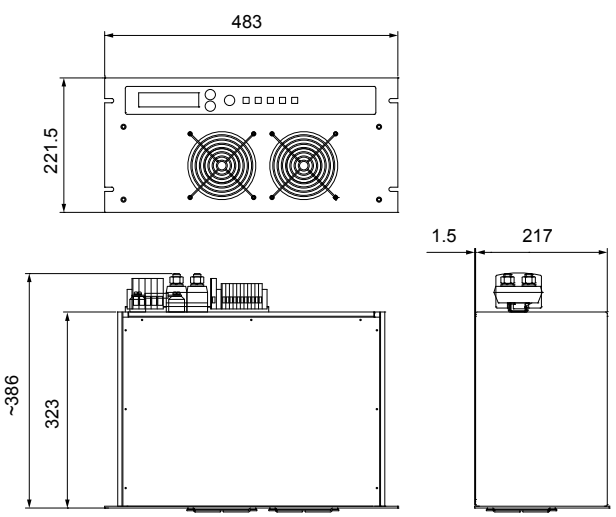
Control and diagnostics are possible via RS232 or MVB, CAN 2.0 B interface. The charger may operate in the following modes: “float charging”, “boost charging”, “equalising charging”. The modes can be set manually or automatically.

Specification	
Input voltage	**3×400 VAC, 50 Hz**
Output voltage (Un)	**24 VDC**
Output voltage stability	**≤ 1%**
Output voltage ripples	**≤ 0.5%**
Range of output voltage thermal compensation Un	**–10 ÷ +40°C**
Output current (In)	**200 A**
Battery current reduction regulation	**(0.1–1) In**
Housing type	**Rack 19"**
Protection degree	**IP21**
Ambient temperature	**–40 ÷ +45°C**
Dimensions	**483 × 222 × 386 mm (5U)**

BLOCK DIAGRAM



HOUSING



ZB24DC300

Battery Charger

The ZB24DC300 series battery charger has been designed to charge batteries and supply DC loads of the rated voltage of 24 VDC – in co--operation with the battery. The charger may operate without the battery or with any type of battery. The charger incorporates the IGBT technology with primary switching, control is performed by the microcontroller, whose algorithm ensures:

- constant monitoring of the supply voltage,
- monitoring of output currents and voltages,
- generation of alarm signals,
- independent stabilisation of output current and battery current,
- thermal compensation of the battery voltage,
- battery diagnostics (circuit continuity).

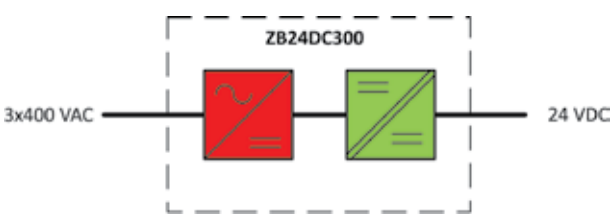
The charger has 3 alarm contacts which signal:

- lack of battery charging,
- overload,
- low output voltage.

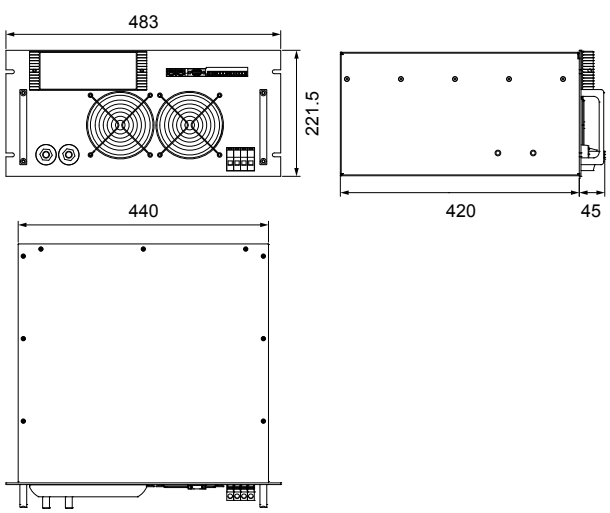
Control and diagnostics are possible via RS232 or MVB, CAN 2.0 B interface. The charger may operate in the following modes: “float charging”, “equalising charging”, “boost charging”. The modes can be set manually or automatically. The design of the charger allows it to be installed inside the battery compartment.

Specification	
Input voltage	**3×400 VAC, 50 Hz**
Output voltage (Un)	**24 VDC**
Output voltage stability	**≤ 1%**
Output voltage ripples	**≤ 0.5%**
Output current (In)	**300 A**
Battery current reduction regulation	**(0.1–1) In**
Protection degree	**IP55**
Ambient temperature	**–40 ÷ +45°C**
Dimensions	**483 × 222 × 465 mm (5U)**

BLOCK DIAGRAM



HOUSING



ZB24DC300E

Battery Charger

The ZB24DC300E series battery charger has been designed to charge batteries and supply DC loads of the rated voltage of 24 VDC – in co-operation with the battery. The charger may operate without the battery or with any type of battery. The charger incorporates the IGBT technology with primary switching, control is performed by the microcontroller, whose algorithm ensures:

- constant monitoring of the supply voltage,
- monitoring of output currents and voltages,
- generation of alarm signals,
- independent stabilisation of output current and battery current,
- thermal compensation of the battery voltage,
- battery diagnostics (circuit continuity).

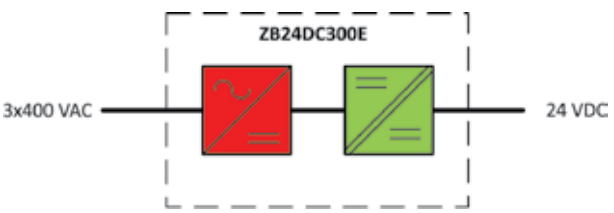
The charger has 3 alarm contacts which signal:

- lack of battery charging,
- overload,
- low output voltage.

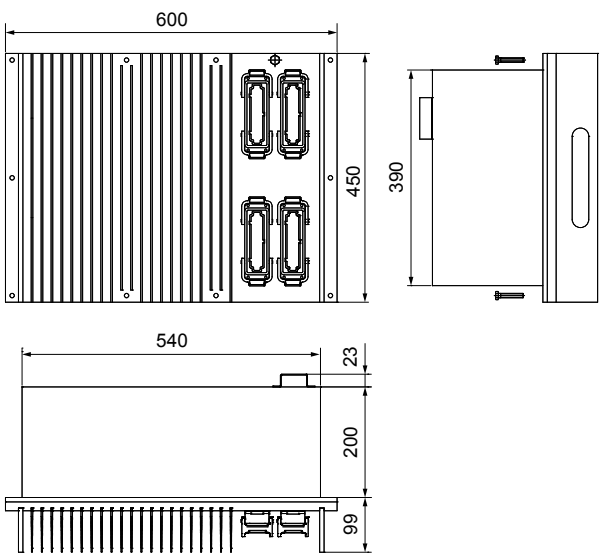
Control and diagnostics are possible via RS232 or MVB, CAN 2.0 B interface. The charger may operate in the following modes: “float charging”, “equalising charging”, “boost charging”. The modes can be set manually or automatically. The design of the charger allows it to be installed inside the battery compartment.

Specification	
Input voltage	**3×400 VAC, 50 Hz**
Output voltage (Un)	**24 VDC**
Output voltage stability	**≤ 1%**
Output voltage ripples	**≤ 0.5%**
Output current (In)	**300 A**
Battery current reduction regulation	**(0.1–1) In**
Protection degree	**IP55**
Ambient temperature	**–40 ÷ +45°C**
Dimensions	**600 × 450 × 322 mm (5U)**

BLOCK DIAGRAM



HOUSING



ZB24DC400E

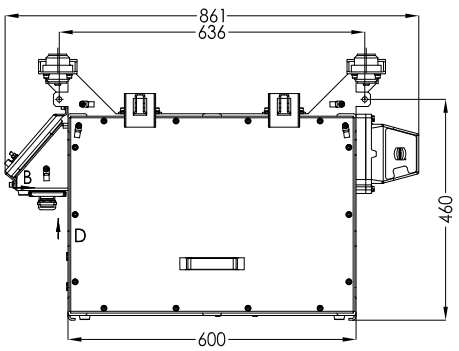
Battery Charger

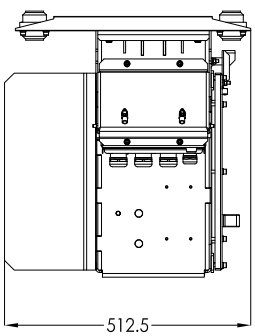
The device draws energy from a 3×400V 50Hz platform grid and converts it into the 24 V used in the LV carriage supply grid and for battery charging. The main features of the charger are: very good stability of the output voltage and temperature correction of the battery charging voltage. The device is fitted with a microprocessor control system which limits the output current in case of overload or short-circuits.

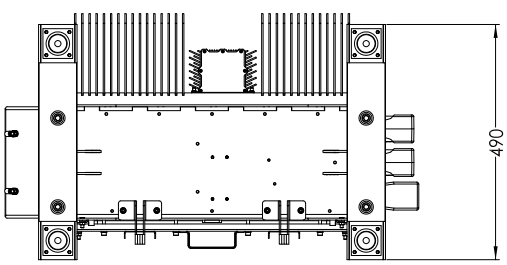
The charger has galvanic insulation between the input and output circuits.

Specification	
Input voltage	**3×400 VAC**
Rated output power	**10 kW**
Rated output voltage	**24 VDC**
Range of output voltage regulation	**±15%**
Rated output current	**417 A**
Output voltage stability	**≤ ± 1%**
Output voltage ripples	**≤ ± 0.5%**
Ambient temperature	**–30°C ÷ +45°C**
Cooling	**natural**
Protection degree	**IP65**
Weight	**96 kg**
Dimensions	**513 × 460 × 861 mm**

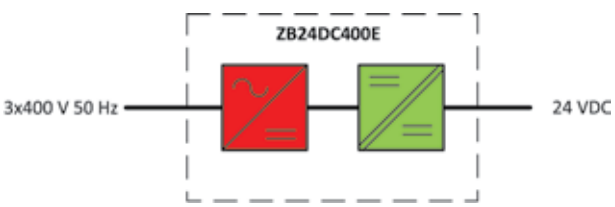
HOUSING







BLOCK DIAGRAM



ZB24DC400 SiC 3U

Battery Charger

Specification	
Input voltage	**3x400 VAC, 50 Hz, -15% ÷ +15%**
Output voltage	**24 VDC (17 ÷ 31 VDC)**
Output voltage stability	**≤ 1%**
Output voltage ripples	**≤ 0.5%**
Output current	**400 A**
Battery current reduction regulation	**(0.1 ÷ 1) In**
Operating temperature range	**-40°C ÷ +45°C**
Efficiency	**≥ 94%**
Communication interface	**CANOpen**
Housing	
Weight	**23 kg**
Cooling	**Forced air**
Dimensions 19” Rack 3U	**483 x 386 x 133 mm**
Protection degree	**IP20**

The ZB24DC400 SiC 3U series battery charger has been designed to charge batteries and supply DC loads of the rated voltage of 24 VDC – in cooperation with the battery. The charger may operate without the battery or with any type of battery. The charger incorporates the SiC technology with primary switching, control is performed by the microcontroller, whose algorithm ensures:

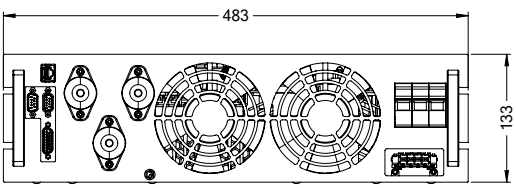
- constant monitoring of the supply voltage,
- monitoring of output currents and voltages,
- generation of alarm signals,
- independent stabilisation of output current and battery current,
- thermal compensation of the battery voltage,
- battery diagnostics.

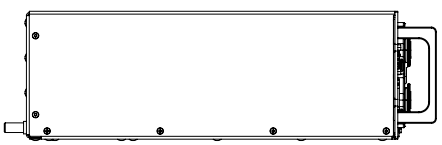
The charger has 3 alarm contacts which signal:

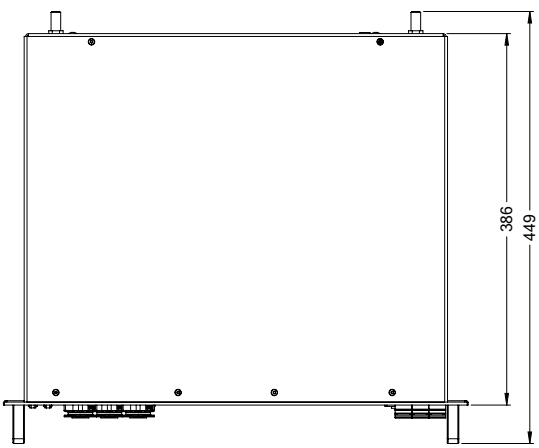
- lack of battery charging,
- overload,
- low output voltage.

Control and diagnostics are possible via CAN 2.0 B interface. The charger may operate in the following modes: “float charging”, “equalising charging”, “boost charging”. The modes can be set manually or automatically.

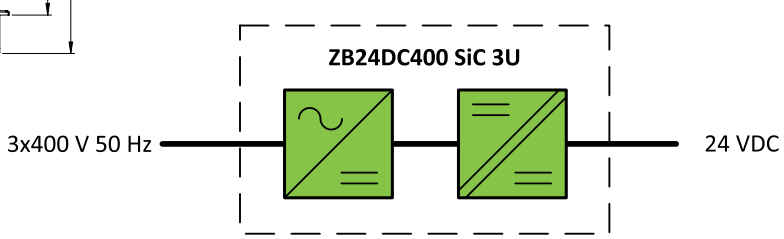
HOUSING







BLOCK DIAGRAM



ZB36DC150

Battery Charger

Specification	
Input voltage	**230 VAC, +40 ÷ –40%**
Rated output power	**6 kW**
Rated output voltage	**36 VDC**
Range of output voltage regulation	**25÷43 V**
Rated output current	**150 A**
Output voltage stability	**≤ 1%**
Output voltage ripples	**≤ 2%**
Efficiency	**≥ 93%**
THD of the input current	**≤ 5%**
Ambient temperature	**–40 ÷ +50°C**
Cooling	**forced-air**
Protection degree	**IP20**
Weight	**35 kg**
Dimensions	**450 × 380 × 255 mm**

The ZB36DC150 series battery charger has been designed to charge batteries or supply DC loads of the rated voltage of 36 VDC – in co-operation with the battery. The charger incorporates the IGBT technology with primary switching, control is performed by the microcontroller, whose algorithm ensures:

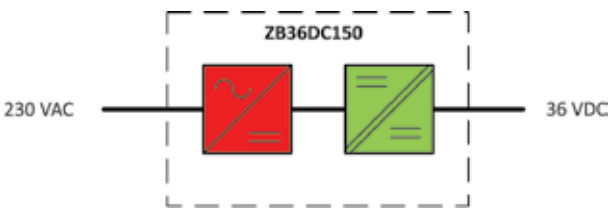
- constant monitoring of the supply voltage,
- monitoring of output currents and voltages,
- independent stabilisation of output current and battery current,
- thermal compensation of the battery voltage,
- battery diagnostics (load, continuity).

The charger has 3 alarm contacts which signal:

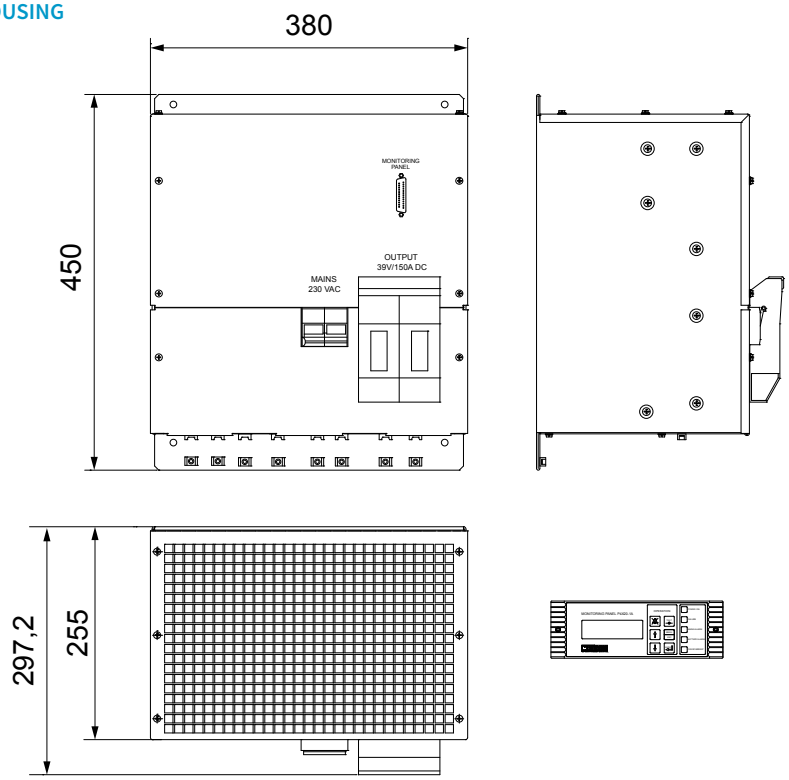
- lack of battery charging,
- overload,
- low output voltage.

Control and diagnostics are possible via RS232 or MVB, CAN 2.0 B interface. The charger may operate in the following modes: “float charging”, “equalising charging”, “boost charging”. The modes can be set manually or automatically.

BLOCK DIAGRAM



HOUSING



ZB110DC80 SiC

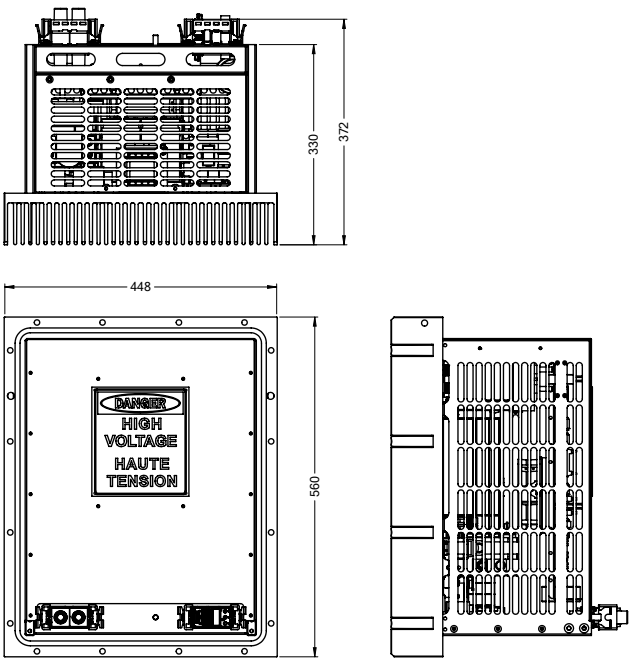
Battery Charger

Battery charger is designed for conversion of 3x480 VAC into 110 VDC used for charging the lead acid, nickel cadmium or lithium batteries. Battery charger enables measurement of battery temperature as well as battery current and voltage. This data enables BC to perform charging of battery with charging parameters compensation. The charger has galvanic insulation between input and output circuits. The main features of the charger are: very good stability of the output voltage and temperature correction of the battery charging voltage. The device is fitted with a microprocessor control system which limits the output current in case of overload or short--circuit. The battery charger is also protected against such events as failure of temperature sensor, low input voltage, input phase loss. In case of improper – reverse battery connection or system overload the device should be not damaged. The BC is also equipped with Ethernet communication interface for diagnostic purposes.

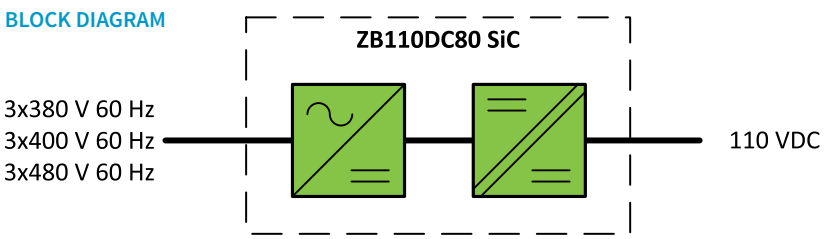
The battery charger, which is mounted on the heatsink is a module intended for passenger coaches applications. The device is using natural cooling. Heatsink mounted on the back of battery charger increases efficiency of module cooling.

Specification	
Nominal input voltage	**3 x 400 VAC 60 Hz** **3 x 480 VAC 60 Hz** **3 x 380 VAC 60 Hz**
Input voltage range	**+10% ÷ -15%**
Total output power	**9 kW**
Nominal output voltage	**110 VDC**
Output nominal current	**80 A**
DC output voltage ripples	**≤ 1% RMS**
Output protection	**Overload / short-circuit**
Efficiency	**> 96%**
Communication Interface	**Ethernet**
Housing	
Dimensions	**560 x 448 x 330 mm**
Weight	**51 kg**
Ambient temperature	**-40°C ÷ +45°C**
Cooling	**Natural**

HOUSING



BLOCK DIAGRAM



ZB110DC150

Battery charger

The ZB110DC150R power supply adapter is designed for converting the 3×400 VAC-50 Hz voltage to a DC voltage of 101-140 V, intended for using in low-voltage systems of rail vehiclees.

This device draws electricity from the 3x400 V (50 Hz) network and generates a 101–140 VDC voltage, intended for supplying the circuits of the rail vehicle system.

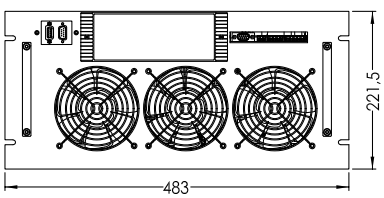
Key advantages of the power supply adapter include: good stability of the output voltage and very low output voltage ripple.

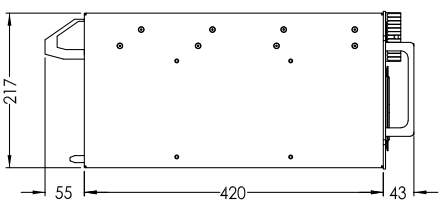
The device is completely maintenance-free – it is equipped with a microprocessor control system, which limits the output current in case of an overload or short circuit.

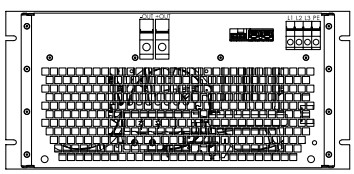
The power supply adapter has a galvanic isolation between the input and output circuit.

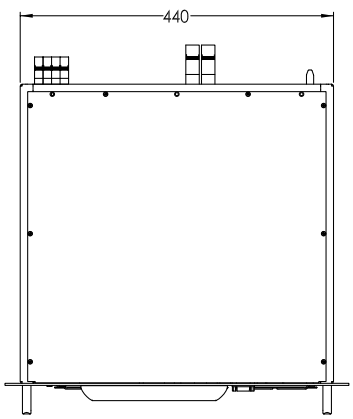
PSM-230	
Input voltage	**3×400 VAC**
Rated output power	**15 kW**
Rated output voltage	**101 – 140 VDC**
Output voltage stability	**2%**
Output voltage ripples	**0.5%**
Efficiency	**≥ 92%**
Ambient temperature	**–25°C ÷ +45°C**
Cooling	**forced-air**
Protection degree	**IP21**
Weight	**38 kg**
Dimensions	**483×221, 5×518 mm** **Rack Mount 5U**

HOUSING

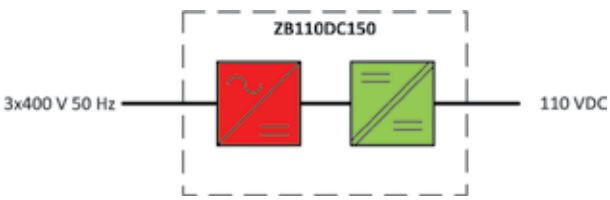








BLOCK DIAGRAM



ZB110DC270 SiC

Battery Charger

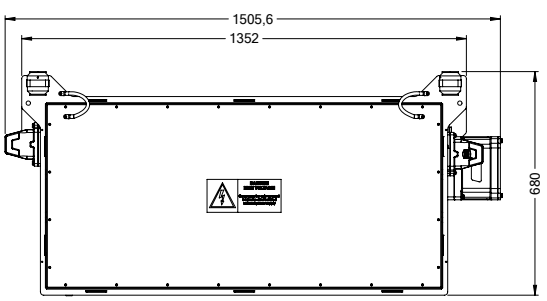
Battery charger ZB110DC270 SiC is designed for conversion of 3x400 VAC (from platform grid) into 110 VDC used for charging battery and supply for LV supply grid of the vehicle. Battery Charger is intended for passenger coaches applications.
The BC enables:

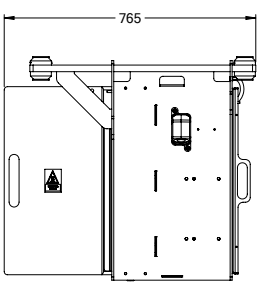
- charging of battery with charging parameters compensation
- Ethernet for diagnostic purposes
- measurement of current and voltage of battery circuits
- measurement of battery temperature

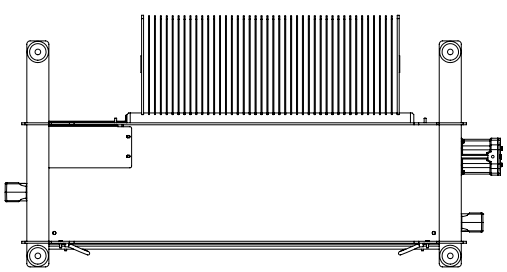
The main features of the charger are: very good stability of the output voltage and temperature correction of the battery charging voltage. The device is fitted with a microprocessor control system which limits the output current in case of overload or short-circuit. The charger has galvanic insulation between input and output circuits. Battery charger is equipped with a multilevel system for protection against over-voltages occurring in the platform grid line such as LC passive filters, non-linear voltage limiters (varistors). In result the reliability of performance of the device is increased. The battery charger is also protected against such events as failure of temperature sensor, low input voltage, input phase loss. Automatic thermal compensation of the battery charging voltage (implemented in accordance with the requirements of battery manufacturers), which allows the batteries to be charged optimally independently on maintenance ambient temperature thus prolonging their lifetime with minimum maintenance. The battery charger is also fitted with Ethernet bus interface, which provides the possibility of continuous monitoring of the operation of devices. Battery charger is placed in aluminum box with a heatsink mounted on the back. The battery charger is dedicated for mounting underneath vehicle frame. Battery charger is using natural cooling, the housing heatsink increases efficiency of device cooling.

Specification	
Input voltage	**3x400 VAC ±10%**
Frequency of the input voltage	**50 Hz ±5%**
Output voltages	**110 VDC +25% ÷-30%**
Output voltage stability	**1%**
Output voltage ripple	**1%**
Output power	**29 kW**
Maximum output current	**264 A**
Efficiency	**≥ 96%**
Housing	
Dimensions	**680 x 1352 x 765 mm**
Weight	**221 kg**
IP level	**IP65**
Operating temperature	**-25°C ÷ +70°C**
Cooling	**Natural**

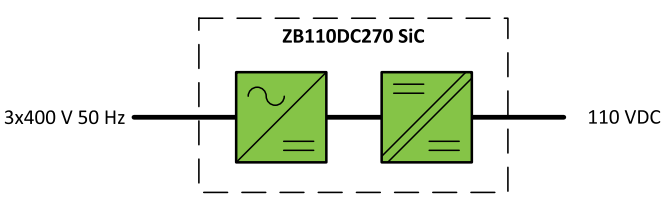
HOUSING







BLOCK DIAGRAM



NEW

FCEC-2x100

Fuel Cell Energy Converter

Fuel cell energy converter is intended for rolling stock applications. The converter, which uses full SiC technology, is designed for energy transfer from fuel cell to traction battery (charging). During operation fuel cell energy converter and traction battery are connected to propulsion system circuit. The converter transforms energy generated by the fuel cell into the energy used for charging the traction battery.

The converter enables:

- charging of traction battery from the fuel cell with charging power regulation
- CAN communication with fuel cell control unit
- measurement of current and voltage of fuel cell and battery circuits
- supplying BOP (Balance of Plant) from the battery during the start of the fuel cell
-

Converter can operate in two modes: buck and boost mode. During start - up the FCU requires the buck mode operation to precharge BOP. The current request from the train main controller is converted by the FCU to set the operation points of both converters, which will be asymmetric due to the power asymmetry. To achieve the synchronization, converters are switched to the boost operating mode. This mode is current controlled. The current is exported due to the train main controller request.

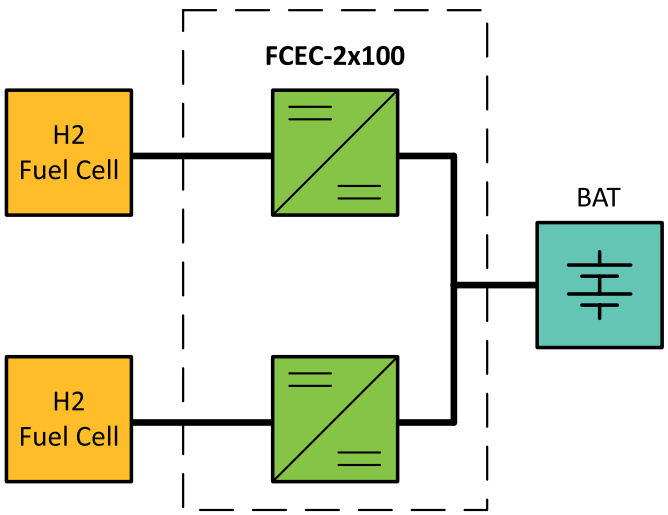
Fuel cell energy converter is placed in aluminum housing. Converter is designed for installation in a dedicated container. The converter is equipped with cooling system, which uses coolant medium to reduce the converter elements temperature. The cover is equipped with a service handle, which can be removed prior to the device mounting on the vehicle.

Specification	
Supply voltage range	**330-726 VDC**
Nominal current	**290 A (at 423 VDC)**
Input power	**123 kW (from one fuel cell)**
Output voltage range	**700-999 VDC**
Output power	**213 kW**
Battery charging current	**304-213 A**
Efficiency	**> 99%**
Communication interface	**CANBUS**
Converter A output parameters	
Output power	**96.5 kW**
Rated current	**138-97 ADC**
Converter B output parameters	
Output power	**116 kW**
Rated current	**167-116 ADC**
Input parameter – control power supply	
Nominal input voltage	**24 VDC -33% ÷ +33% (16 ÷ 32 VDC)**
Housing	
Dimensions	**845 x 500 x 275 mm**
Weight	**125 kg**
Protection degree	**IP56**
Ambient temperature	**-40°C ÷ 45°C**
Cooling	**Liquid**

FCEC-2x100

Fuel Cell Energy Converter

BLOCK DIAGRAM



HOUSING