



PRODUCT CATALOG
TRACTION&TRANSPORT

ABOUT US

APS ENERGIA, established in 1995, is a Stock Listed Company on Warsaw Stock Exchange. Designs and manufactures critical power supply systems for power generation, including nuclear power, traction and transport, oil and gas, renewable energy sources, medicine, telecommunications, defence industry, and other industries. Since its foundation, the company has been associated with technical universities and cooperates with research centers in Poland and the EU and, as a result, employs the best university graduates. APS Energia has an R&D department with an innovative approach and designs custom-made solutions with the best parameters available in the latest technologies. The production takes place in three plants, and the devices are delivered worldwide. The subsidiaries of the APS Energia Group are located in Poland, the Czech Republic, Kazakhstan, Azerbaijan, Turkey, and Ukraine.

A COMPREHENSIVE APPROACH: FROM DESIGN THROUGH ASSEMBLY TO SERVICE

We provide comprehensive support from the designing devices according to the customer's needs up to the configuration phase and installation at their side. Our offer includes a warranty, after-sale services, and professional guidance at every project stage worldwide.

CUSTOM-MADE SOLUTIONS

Devices produced by APS Energia are tailored to individual needs of our clients. Our engineers analyse demand and technical parameters of each system and design solutions that guarantee reliable power supply for crucial receivers.



27 YEARS ON THE MARKET



11,000 SQM. TOTAL
PRODUCTION AND OFFICE AREA



ON STOCK EXCHANGE
SINCE 2013



INTERNATIONAL
EXPERIENCE



INNOVATIVE TECHNOLOGIES

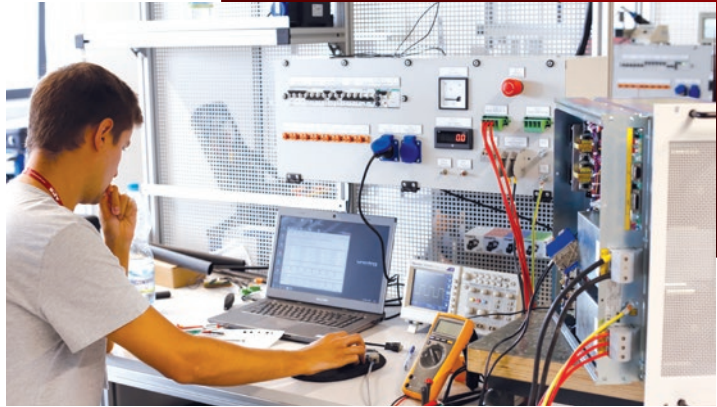


KNOW-HOW

Cooperation with Warsaw University of Technology and other scientific institutions in Poland and abroad provides us unlimited access to cutting-edge solutions in power engineering. We improve our devices on their basis, bringing the highest quality to our customers.

WE SHARE OUR KNOWLEDGE

Engineers and experts of the APS Energia team provide training and consultancy. We organize scientific and technical conferences and present the latest solutions available in our portfolio and in the power engineering industry. We share our knowledge and experience with other representatives from the industry.



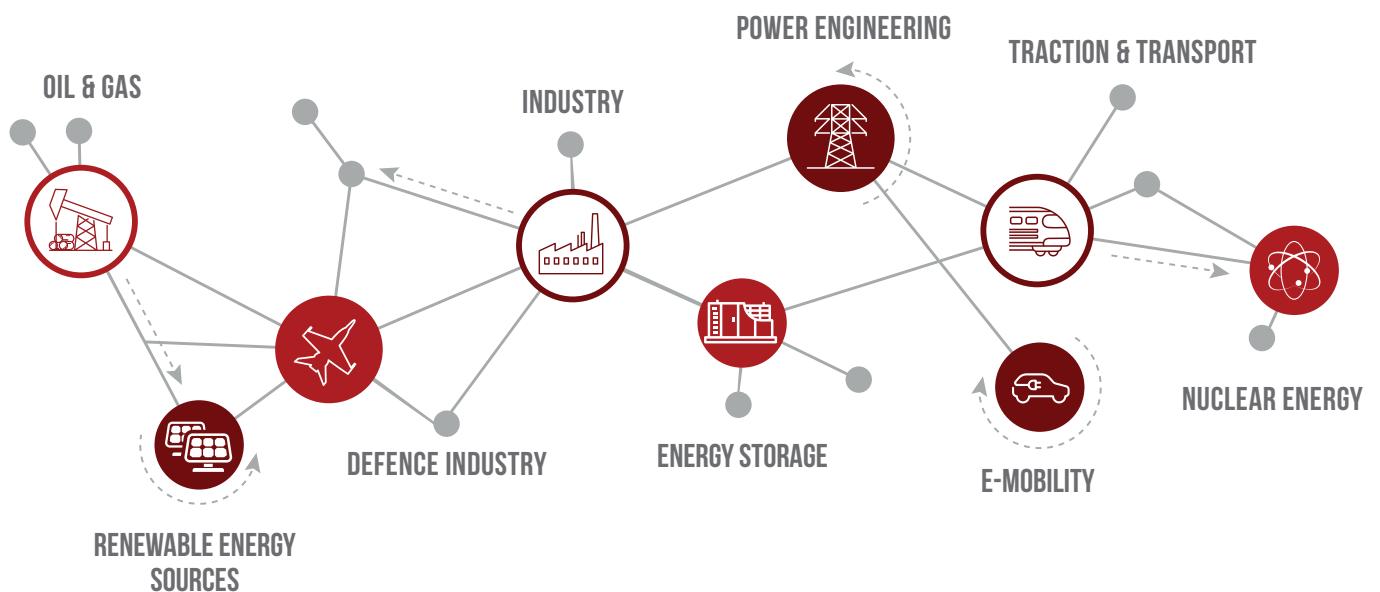
THE HIGH QUALITY OF OUR PRODUCTS AND SERVICES PROOVED BY CERTIFICATES

Quality certificates confirm the high standard of our products and services. APS Energia products comply with European Union directives and Polish legal regulations on product safety and electromagnetic compatibility. We are eligible to use CE marking on all our products.

RELIABILITY

For our customers - power plants, refineries, industrial plants, and rail vehicle manufacturers - stable access to the power supply is of high priority. We manufacture equipment with high technical parameters, guaranteeing resistance to harsh operating conditions. By offering modern solutions and the support of our experts, we help companies eliminate the risk of power outages.

OUR SECTORS



MILESTONES

- 2022** **New strategy for APS Energia Group - 2022-2026**
Obtaining a certificate ISO 14001:2022.
- 2021** **The Economic Award of the President of the Republic of Poland in the "SME Leader" category.**
Medal of Polish Electricians Association President for SAN-RC vehicle parameter recording system.
Obtaining a certificate ISO 45001 – 2021.
- 2020** **25th anniversary of APS Energia.**
Obtaining EAC certification on PBI.
- 2019 Listing as a CAF supplier.
- 2018** **MSWiA concession for the production and trading products for the army and police.**
Certificate of PESA for equipment dedicated to the rail market.
Agreement on cooperation with Warsaw University of Technology.
Obtaining a certificate ISO/TS 22163:201.
- 2017 Obtaining a declaration of conformity from PKP INTERCITY.
Obtaining UL certificate for production of devices for the South American market.
PGE Energia Odnawialna prize for APStorage Energy Storage.
Conducting research and development of 3kV static converter.
Launching APS Energia Turk Elektrik Sanayi Ve Ticaret Limited Şirketi in Ankara.
- 2016** **Launching of the new headquarter of APS Energia J.S.C.**
- 2015 IPO on Warsaw Main Stock Exchange Market.
Business management system certificate in railway transport sector; IRIS rev. 02.1.
- 2014 Obtaining the certification of Russia's, Kazakhstan's and Belarus Customs Union for PBI, BFI, EPI, switchgears, battery containers and SAN 2.
- 2013** IPO on New Connect Stock Exchange.
Certification of ROSATOM for nuclear energy sector products.
- 2012 The establishment of the OOO APS Energia Ukraine company with its registered office in Kiev.
- 2011** **Award for PULSTAR technology in GreenEvo contest organized by the Ministry of the Environment.**
The establishment of the APS Energia Czech s.r.o. company with its registered office in Prague.
- 2008** The acquisition of 100% shares of Enap Ltd.
APS Energia Ltd. expands branches of: OOO APS Energia Rus and APS Energia Caucasus LLC, TOO APS Energia Kazakhstan.
- 2005 Delivery of the BFI convertors with a power of 1.8 MVA for NATO.
- 2004** Business development in Kazakhstan. Establishment of subsidiary of APS Energia company in Almaty.
Obtaining GOST certificates.
Delivery of the inverters to Saudi Arabia for "ARAMCO".
- 2003** The expansion on Czech Republic market.
The prize of the President of the PSE (Polish Electricity Networks) for guaranteed power supply system with inverters operating in parallel.
Medal of the President of SEP for the PULSTAR hydrogen power supply system.
- 2002 The implementation of the ISO 9001:2000 quality system.
- 1997** **The first technical- scientific conference in Kozienice power plant.**
- 1995** **Beginning of the company's business activity. The first devices that were designed by APS were plasma power supplies, which were exported to the Netherlands, Germany, USA, Japan, Taiwan and other countries.**



APS ENERGIA DEVICES FOR TRACTION AND TRANSPORT

Transport and communication are necessary elements of development of a modern country. Therefore, we have observed an increased modernisation of railway rolling stock, railway and tram lines as well as modernisation of roads and motorways for many years now. For over 27 years, APS Energia have been developing converters providing power supply for devices in energetics and industry. AC and DC power supply systems feature very high technical parameters that guarantee power supply for receivers essential for the clients. Appropriate parameters of devices guarantee safety of production, devices and people. We have used this knowledge and experience (in particular knowledge and experience obtained during development and implementation of devices for nuclear energetics) to develop and implement static converters, battery rectifiers and voltage in-

verters used in traction vehicles. Systems offered by APS Energia are designed with the highest precision, using high qualifications of our engineers. Specially selected and reinforced structure of housings, as well as high quality electronic, electric and mechanical components, ensure high quality of devices and resistance to difficult working conditions.

EXAMPLE APPLICATIONS OF DEVICES:

- static converters,
- on-board power supply systems,
- converters providing power supply for traction motors in rail transport and electric buses,
- converters for own needs in vehicles.

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SAN-RC

Pressure and railcar parameter loggers

SAN-RC pressure loggers are designed for continuous monitoring and recording of air pressure values read from sensors located in the pneumatic system of a passenger carriage. In addition, the course, speed, and position of the vehicle are logged from sensors placed on the axles of the wheel sets and the GPS signal. What is more, the devices can act as e.g. an event logger and make information available to the on-board diagnostics system by collecting data from the Ethernet and CANopen networks and the status of digital inputs.

CHARACTERISTICS

Pressure loggers are characterised by the following features:

- Pressure logging – cooperation with analogue sensors,
- Speed and distance measurement – cooperation with pulse sensors,
- Adjustable wheel diameter value,
- Writing measurement data to internal memory,
- Communication over CANopen network,
- Ethernet communication (including web-based user interface),
- Works with an external USB flash memory device,
- Logging of vehicle position and actual time via the built-in GPS receiver or data from the Ethernet network,
- Indication of emergency states by means of digital outputs,
- Modular power backup system (optional).



Fig. 1 Pressure logger SAN-RC2



Fig. 2 Pressure logger SAN-RC1

SAN-RC PRESSURE LOGGERS FAMILY

Parameter	SAN-RC1	SAN-RC2
Supply voltage	24 VDC (EN 50155:2022)	
Analogue inputs – pressure measurement	4 channels 4–20 mA	8 channels 4–20 mA
Analogue inputs – speed measurement	2 channels of 0/1 4–20 mA current signal	1 channel of 0/1 15 V voltage signal 1 channel of 0/1 4–20 mA current signal
Analogue inputs – voltage measurement	none	2 channels
Potential-free inputs	1 input	8 inputs
Potential-free outputs	2 relay outputs	8 transistor outputs 4 relay outputs
GPS antenna input	none	yes (passive/active)
CAN communication	CANopen	
Ethernet communication	1 M12-D socket	
USB port for reading data	1 USB-A 2.0 port	
Internal storage capacity	min. 30 days logging	
Ambient temperature	-25°C to + 70°C	
Housing protection class	IP20	
Dimensions	19" rack module, 2U height	19" rack module, 3U height
Module weight	2 kg	4.5 kg

WAG WAG DIAGNOSTIC on-board diagnostics systems

WAG DIAGNOSTIC on-board diagnostics systems are designed for monitoring the condition of the passenger carriage equipment and controlling its operation. Inside the railcar, the data between the devices is transmitted via CAN (CANopen protocol) and Ethernet. The WTB gateway makes it possible to communicate with the rest of the train.

CHARACTERISTICS

WAG DIAGNOSTIC on-board diagnostics systems are available as integrated function units or as decentralised systems (input/output modules grouped in nodes located in different railcar locations). Communication between the controller modules and the controllers of other subsystems takes place via the CAN bus. Access to diagnostic data via FTP and WWW servers is available via the railcar's Ethernet connection.

On-board diagnostic systems ensure the collection and recording of diagnostic data via CAN, Ethernet, digital and analogue inputs from the railcar equipment such as:

- Static converter,
- Ventilation and air conditioning controller with temperature data logging,
- Door controllers,
- WC controller,
- Fire control panel,
- Pressure logger,
- Brake circuit,
- Outdoor temperature sensor,
- Anti-slip controller,

- Axlebox temperature sensors,
- State of protection of power supply circuits in the railcar compartments,
- SIP and public address system,
- CCTV recorder,
- Systems for measuring the current of tail lights,
- End switches for inter-car bridges,
- Auxiliary switches for overcurrent circuit breakers,
- Battery grounding system.

The extensive diagnostic system software can perform, among other functions, the following:

- Remote access to diagnostic data (e.g. FTP server, WWW available on the railcar),
- Access to minimum 30 days archive data locally in the railcar (SD or SDHC card),
- Option to simulate driving at speeds above 5 km/h and above 50 km/h,
- Communication with other vehicles on the train via WTB gate according to UIC 556,
- Synchronisation of the SIP system between railcars via the WTB gateway,
- Monitoring and diagnostics of CAN and Ethernet connections to other railcar equipment.



Fig. 1 WAG DIAGNOSTIC on-board diagnostics system – WTB gateway and integrated system block



Fig. 2 UIC 557 compliant user interface

STANDARDS

EN 50121-3-2:2016	Railway applications – Electromagnetic compatibility – Part 3-2: Rolling stock – Apparatus
EN 50155:2021	Railway applications – Electronic equipment used in a rolling stock
EN 50153:2014	Railway applications – Rolling stock – Protective measures against electrical hazards
EN 45545-1:2013	Railway applications – Fire protection on railway vehicles – Part 1: General provisions
EN 45545-2:2020	Railway applications – Fire protection on railway vehicles – Part 2: Requirements for fire behaviour of materials and components
EN 61373:2010	Railway applications – Rolling stock equipment – Tests of resistance to mechanical impacts and vibrations
EUROPEAN DIRECTIVES:	
DIRECTIVE 2014/30/UE	The Directive of the European Parliament and of the Council 2014/30/EU dated 26 February 2014 on harmonization of laws of the Member States related to electromagnetic compatibility.

NOTES

Diagnostic Systems

BFI 100T 400/230/24 TRW

Static converter BFI 100T 400/230/24 TRW

The BFI 100T-TRW converter is designed to supply power to the receivers installed in the railcar. With a total output of 100 kW (when supplied by the overhead contact line), the converter is a dedicated device for railcars with higher electricity requirements (e.g. restaurant cars). It is adjusted to cooperate with the SAN-RC logger, which operates as an event buffer for the converter (option).

CHARACTERISTICS

The converter works with the following power sources:

- overhead contact line (all European supply systems according to UIC 550): 3 kV DC, 1.5 kV DC, 1.5 kV AC 50 Hz, 1 kV AC 16.7 Hz, 1 kV AC 50 Hz;
- platform network 3x400 VAC;
- unit 3x400 VAC 10 kW;

Thanks to the IGBT converter topology used, the device is characterized by the following features:

- high stability of voltages and output currents,
- very low current ripple and output voltage,
- small dimensions and mass,
- silent operation,
- high efficiency.

The converter is equipped with microprocessor (DSP) converter operation control system with battery status control function. The device is equipped with the following protection measures:

- against overheating of power systems (limits the output current without interrupting operation),
- against short-circuit of electronic type,
- under- and over-voltage,
- thermal.

The unit consists of three modules enclosed in passive-cooled aluminum boxes for mounting under the railcar.

TRW APS-100 MAG module includes in particular:

- grounding isolator,
- main fuse,
- input gland,
- input rectifier circuit.

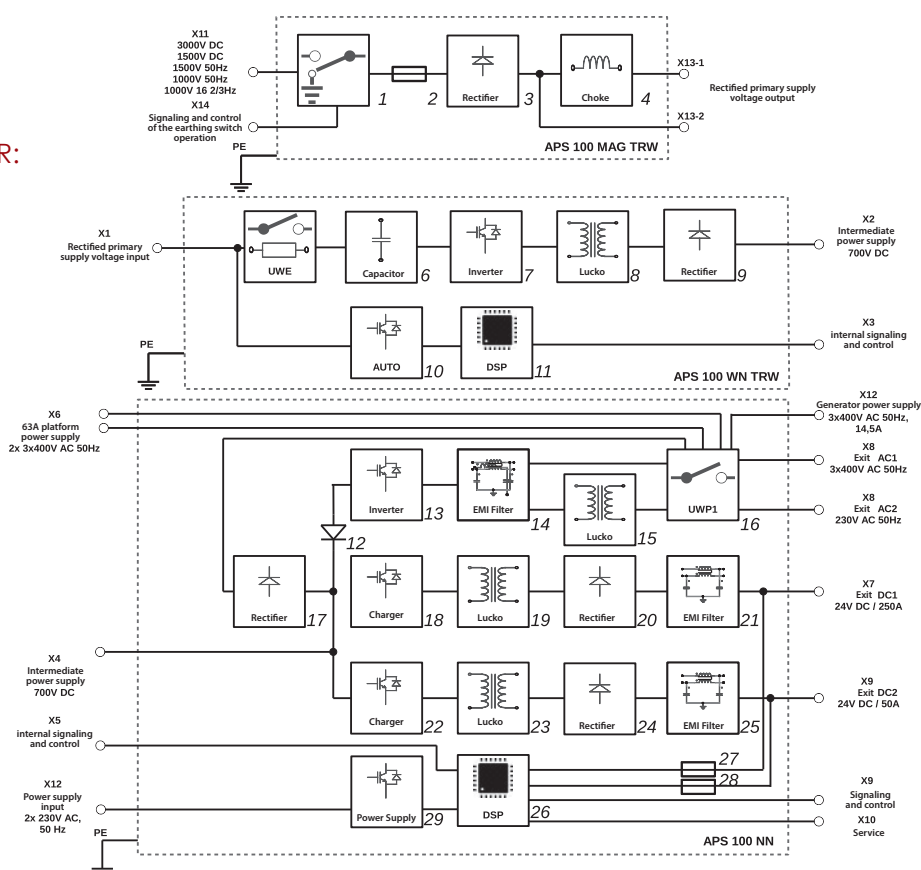
TRW APS-100 WN module is supplied with DC voltage from the MAG module and reduces it to 700 VDC. It includes in particular:

- an autostart system enabling the device to be started when the railcar battery is completely discharged,
- a soft-start system to limit the current surge when the railcar is connected to the high-voltage network (resistor + contactor),
- DC/DC converter for voltage reduction,
- two starting inputs for the 230 VAC platform supply,

The APS-100 LV module converts the 700 VDC voltage from the HV module into output voltages intended for the railcar's receivers. It includes in particular:

- inverter circuit (92 kVA): separated 230 VAC output (10 kVA),
- 24 VDC 250 A battery charger with charging current limitation and automatic adjustment of battery charging voltage in a temperature function,
- 24 VDC 50 A battery charger with charging current limitation and automatic adjustment of battery charging voltage in a temperature function,
- two 3x400 VAC platform supply inputs,
- power input from a 3x400 VAC 10 kW generator,

BLOCK DIAGRAM OF THE BFI 100T-TRW CONVERTER:



TAB. STATIC CONVERTER TYPE BFI 100T-TRW – TECHNICAL CHARACTERISTICS – STANDARD PARAMETERS

Parameter	Value
ELECTRIC	
Power source	1,000 VAC/16.7 Hz; 1,000 VAC/50 Hz; 1,500 VAC/50 Hz; 1,500 VDC; 3,000 VDC according to UIC 550
Power / system topology / outputs	• AC1- 3x400 VAC/50 Hz/45 kVA (air conditioning): Voltage stability ≤5%; frequency stability ≤0.2%; harmonic content ≤5%; electronic short circuit protection. • AC2 - 230 VAC/50 Hz/10 kVA (from isolation transformer fed from inverter AC1) (sockets for laptops, etc.): Voltage stability ≤5%; frequency stability ≤0.2%; harmonic content ≤5%; electronic short circuit protection. • DC1 - 24 VDC/250 A: Voltage stability ≤1%; voltage ripple ≤1%; charge function • DC2 - 24 VDC/50 A battery with temperature compensated voltage: Voltage stability ≤1%; voltage ripple ≤1%; battery charging function with voltage temperature compensation.
Rated power:	100
Efficiency	≥84%
Battery type with which the converter works	24 V alkaline with 460–520 Ah capacity
Input voltage range	According to UIC 550 leaflet
Input voltage level	According to UIC 550 leaflet
Type of input connections	Screw terminals on support insulators
Type of output connections	Harting HPR type connectors
MECHANICAL	
Assembly location	Undercarriage
Cooling type	Natural cooling
Cooling type	External radiators on the device
Ambient temperature	-25°C to + 40°C
Housing protection class	IP56
Method of assembly	Suspended, screws, vibration isolators
Anti-corrosion protection	Powder coating
Housing material	Aluminium
Weight and dimensions	APS-100 MAG TRW: 250x840x650 mm, 700 kg ±5%. APS-100 WN TRW: 2,788x845x500 mm, 700 kg ±10%. APS-100 NN: 1,950x660x500 mm, 370 kg ±5%
COMMUNICATION	
Converter control	Automatic
Operation status indication	YES
Communication bus	CANopen

Fig. APS-100 WN TRW Module

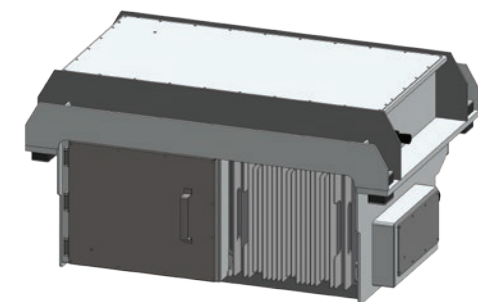
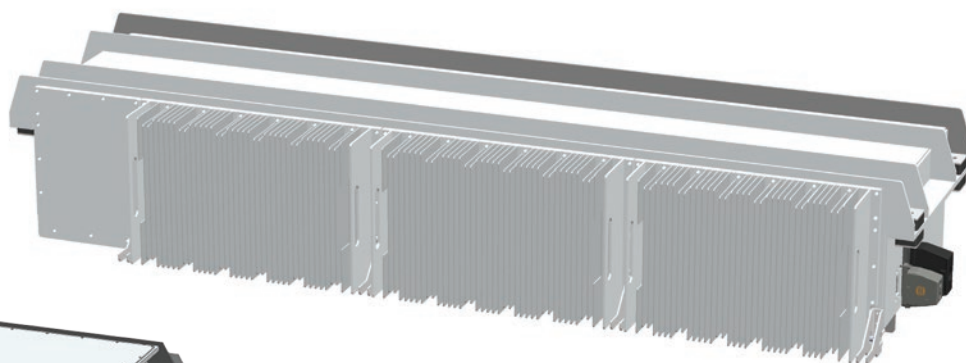


Fig. APS-100 MAG TRW Module

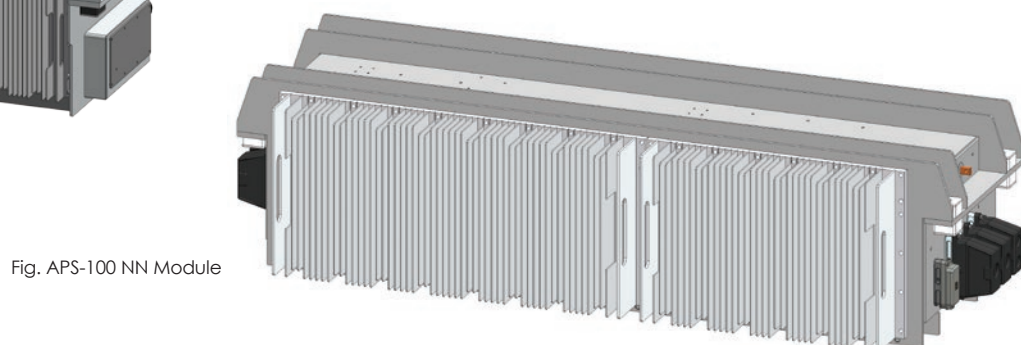
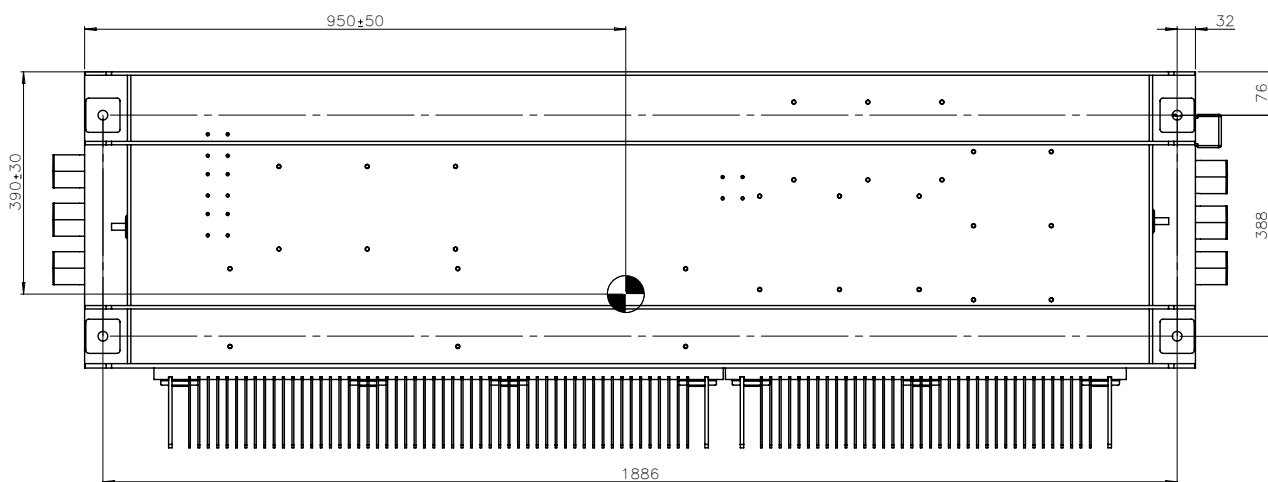
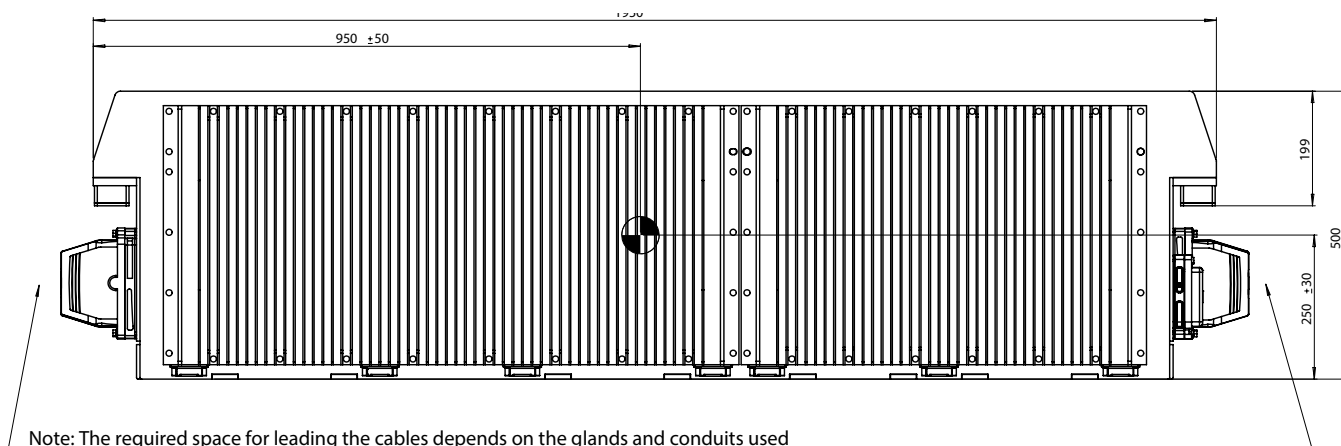
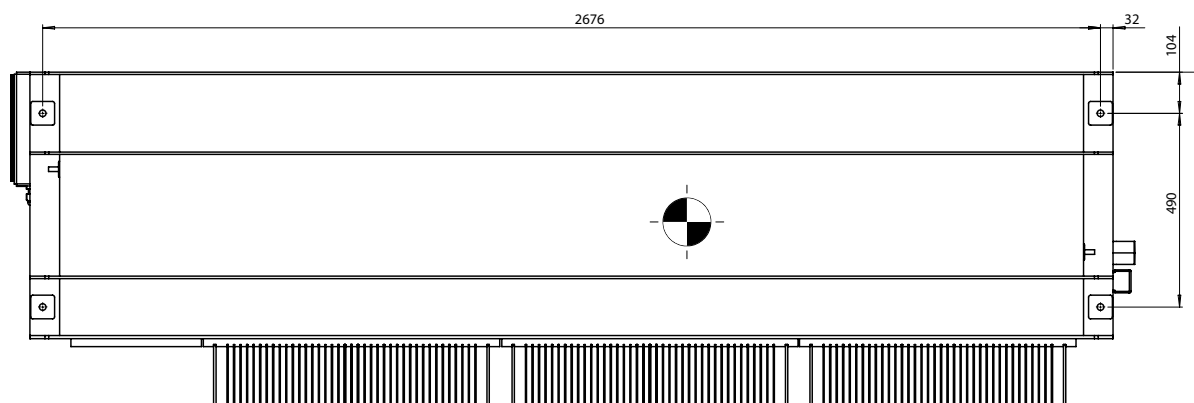
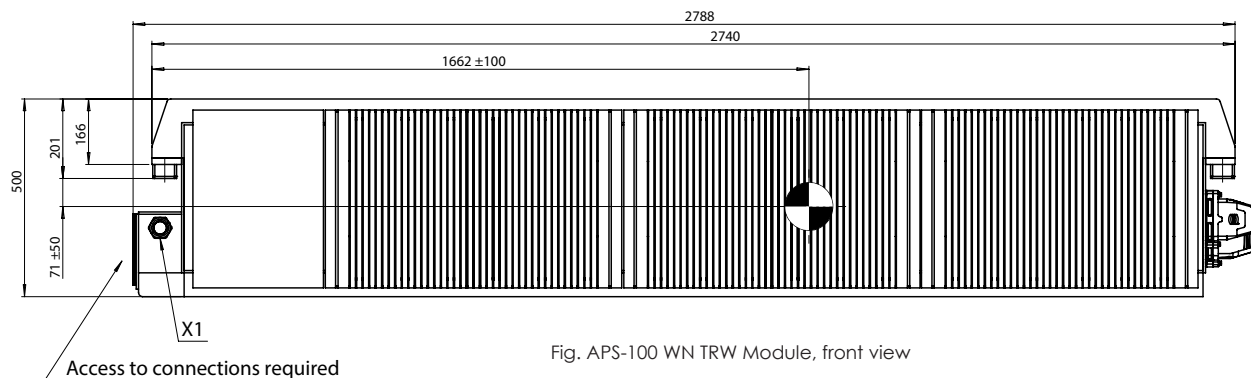


Fig. APS-100 NN Module

MECHANICAL DRAWINGS

(DIMENSIONS OF BOXES DEPENDING ON CONFIGURATION MAY DIFFER FROM THOSE PRESENTED)



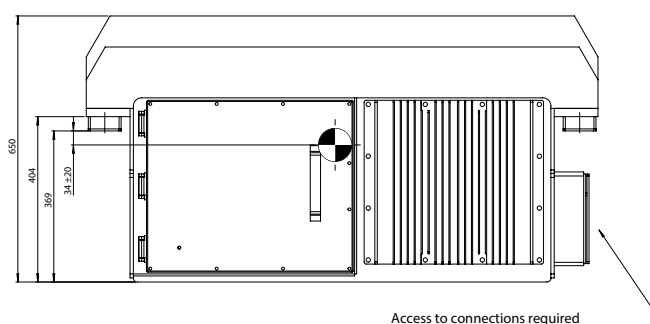


Fig. APS-100 MAG TRW Module, front view

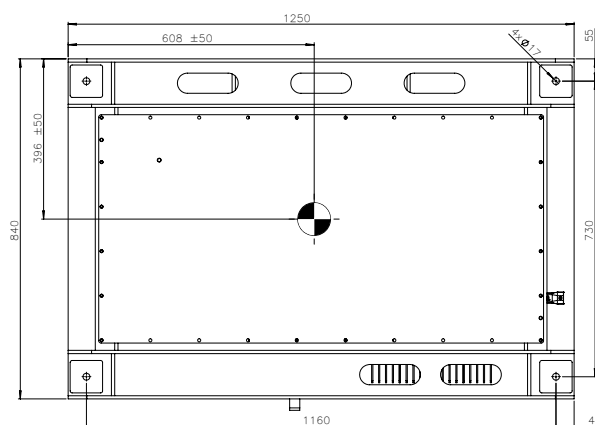


Fig. APS-100 MAG TRW Module, top view

STANDARDS:

EN 50155:2021	Railway applications – Electronic equipment used in a rolling stock.
EN 50160:2010	Parameters of voltage supply in public electricity networks
EN 60529:1991	Protection classes provided by housings (IP code)
EN 50121-3-2:2016	Railway applications – Electromagnetic compatibility – Part 3-2: Rolling stock – Apparatus.
EN 50124-1:2017	Railway applications - Insulation coordination Part 1: Basic requirements - Clearances and creepage distances for all electrical and electronic equipment.
EN 50125-1:2014	Railway applications – Environmental conditions for equipment – Part 1: Rolling stock devices.
EN 50126-1:2017	Railway Applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) - Part 1: Generic RAMS Process
EN 50126-2:2017	Railway Applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) - Part 2: Systems Approach to Safety
EN 50128:2011	Railway applications - Communication, signalling and processing systems - Software for railway control and protection systems.
EN 50153:2014	Railway applications – Rolling stock – Protective measures against electrical hazards.
EN 50238-1:2019	Railway applications – Compatibility between rolling stock and train detection systems.
EN 50413:2019	Basic standard on measurement and calculation procedures for human exposure to electric, magnetic and electromagnetic fields (0 Hz - 300 GHz).
EN 50500:2008	Procedures for measurement levels of magnetic fields generated by electronic and electric devices in a railway environment in relation to exposure of people.
EN 50527-1:2016	Procedure for assessment of exposure of workers with medical implants to electromagnetic fields – Part 1: General information.
EN 61287-1:2014	Railway applications – Electronic converters installed in a rolling stock – Part 1: Characteristics and test methods.
EN 61373:2010	Railway applications – Rolling stock equipment – Tests of resistance to mechanical impacts and vibrations.
EN 45545-1:2013	Fire protection on railway vehicles - Part 1: General provisions
EN 45545-2:2020	Fire protection on railway vehicles - Part 2: Requirements for fire behaviour of materials and components
EUROPEAN DIRECTIVES:	
DIRECTIVE 2014/35/EU	The Directive of the European Parliament and of the Council 2014/35/EU dated 26 February 2014 on harmonization of laws of the Member States related to marketing electric equipment intended to be used in specific voltage limits.
DIRECTIVE 2014/30/EU	The Directive of the European Parliament and of the Council 2014/30/EU dated 26 February 2014 on harmonization of laws of the Member States related to electromagnetic compatibility.

BFI 50T-TRW

BFI 50T-TRW static converter

BFI 50T-TRW converter provides power supply to receipts regardless of a current input voltage. The device may be supplied from 3x400 V platform network. The power supply of the aforementioned network allows for both operation of 24V buffer power supply and receivers supplied with 3x400 voltage installed in a car. Other power sources include the following voltages of the overhead contact line: 1000 V/80 A/16,7 Hz; 1000 V/80 A/50 Hz; 1500 V/53A/50 Hz; 1500 V/53A/DC; 3000 V/53A/DC. The following circuits operate during connection to the overhead contact line: NPC DC/DC converter that reduces input voltage to 700 VDC, auto-start system, contactors system that allows to disconnect the overhead contact line power supply, inverter system and 24V buffer power supply used to charge main batteries and supply on-board devices.

BFI 50T-TRW CONVERTERS FEATURES

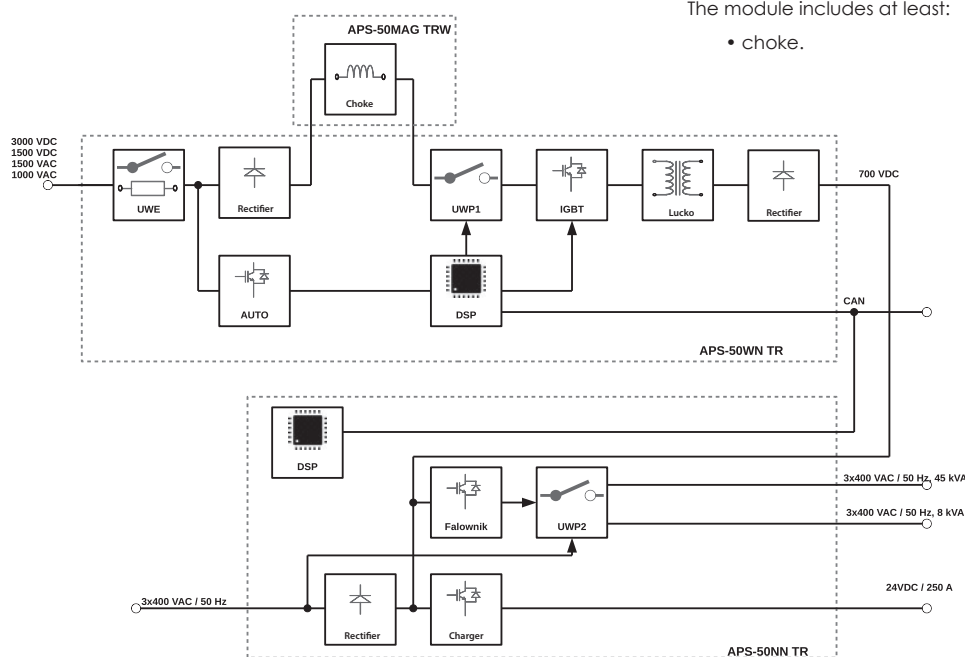
Due to application of IGBT transistors in the power supply converter working with PWM pulse width modulation, the power supply features:

- high stability of output voltages and currents,
- very low output voltage and current ripple,
- small dimensions and mass,
- silent operation,
- high efficiency.

The power supply is equipped with microprocessor (DSP) inverter operation control system with battery status control function. The power supply is equipped with the following protection measures:

- against overheating of power systems (limits the output current without interrupting operation),
- electric protection against short-circuits,
- under- and over-voltage,
- thermal.

BLOCK DIAGRAM OF BFI50T-TRW STATIC CONVERTER



APS-50 WN TRW MODULE

The module includes at least:

- grounding isolator,
- fuse that protects the converters,
- soft start system (resistor + contactor),
- main input contactor,
- auto-start system from the network,
- NPC DC/DC converter that reduces the input voltage.

APS-50NN-TR MODULE

The system includes at least:

- Inverter system (max 75 kVA):
 - 3x400 VAC – 45 kVA;
 - 3x400 VAC – 8 kVA;
 - 230 V/50 Hz - max 10 kVA (option);
- 24 VDC 250 A battery charger with charging current limitation and automatic adjustment of battery charging in a temperature function;
- 24 VDC 50 A battery charger with charging current limitation and automatic adjustment of battery charging in a temperature function (option);
- two inputs of 3x400 VAC platform power supply (for the left and right side of a car) with protection of a possibility to transfer the voltage to an unconnected socket;
- the events buffer, which has a parameters register that collects information about operating parameters of the converter, its possible damage and faults, as well as power supply network parameters, with a possibility to readout parameters from a socket located on a register. The buffer is built-in in the converter. It is equipped with an output (socket) that allows to assembly inside cars, e.g. in an electrical cabinet, with a possibility to readout contents by connecting to a computer.

APS 50-MAG-TRW MODULE

The module includes at least:

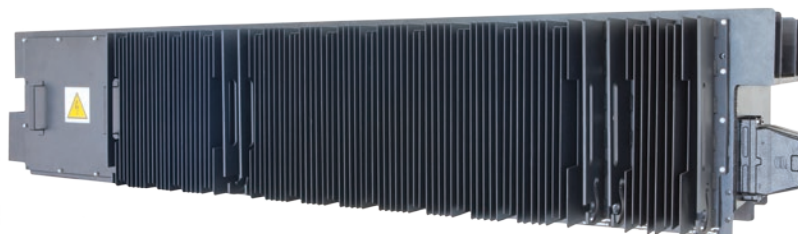
- choke.



Pic. APS-50 NN module



Pic. APS 50-MAG-TRW module



Pic. APS-50 WN TRW module

TAB. STATIC CONVERTER OF BFI 50T-TRW TYPE - TECHNICAL CHARACTERISTICS - STANDARD PARAMETERS

Parameter	Unit	Value
ELECTRICAL		
Power source		1000 VAC/16.7 Hz; 1000 VAC/50 Hz; 1500 VAC/50 Hz; 1500 VDC; 3000 VDC as per UIC 550
Power / system topology / outputs		• 24V output, In=250 A • voltage stability $\leq 1\%$; voltage ripple $\leq 0.5\%$; battery charging function with voltage temperature compensation. • AC1- 3x400 VAC/50 Hz/45 kVA (air conditioning): • voltage stability $\leq 5\%$; frequency stability $\leq 0.2\%$; harmonics content $\leq 5\%$; overload behaviour 200%/5s; electronic protection against short-circuit. • AC2 - 3x400 VAC/50 Hz/8 kVA (laptop sockets, other) • voltage stability $\leq 5\%$; frequency stability $\leq 0.2\%$; harmonics content $\leq 5\%$; overload behaviour 200%/5s; electronic protection against short-circuit. Option: • max 10 kVA/230 V/50 Hz (from separation transformer supplied from an inverter) • 24V output, In=50 A • voltage stability $\leq 1\%$; voltage ripple $\leq 0.5\%$; battery charging function with voltage temperature compensation.
Rated power	kW	52
Required power backup	kW	+15% power depending on the car energy balance
Maximum power	kW	80
Efficiency		89%
Battery type with which the converter works		Alkaline of 24V / 460-520 Ah capacity
Input voltage range		as per UIC 550
Input voltage level		as per UIC 550
Level of interference on the input		EN 50121-3-2:2016 Rolling stock – Apparatus
Conducted interference level – input		EN 50121-1:2017 Railway applications. Electromagnetic compatibility. General
Radio interference level – input		EN 50121-2:2017 Electromagnetic compatibility. Emission of the whole railway system to the outside world
Conducted interruptions level – output		EN 50121-3-1:2017 Railway applications. Electromagnetic compatibility. Rolling stock. Train and complete vehicle
Radio interference level – input		EN 50121-3-2:2016 Rolling stock – Apparatus
Type of input connections		Screw terminals on HV [high voltage] standoff insulators
Type of output connections		Quick-couplers
MECHANICAL		
Assembly location		Undercarriage
Cooling type		Natural cooling
Cooling type		External radiators on the device
Ambient temperature	°C	-25°C to + 40°C
Tightness		IP 56
Method of assembly		Suspended, screws, vibration isolators
Anti-corrosion protection		Paint coating
Housing material		Aluminium
Resistance to vibrations		EN 61373:2010 Railway application – Rolling stock equipment Tests of resistance to mechanical impacts and vibrations
Resistance to mechanical impacts		EN 61373:2010 Railway application – Rolling stock equipment Tests of resistance to mechanical impacts and vibrations
Mass DŁ+WN+NN	kg	570+630+450
COMMUNICATION		
Converter control		Automatic
Operation status indication		YES
Communication bus		CAN OPEN

MECHANICAL DRAWINGS

(DIMENSIONS OF BOXES DEPENDING ON CONFIGURATION MAY DIFFER FROM THOSE PRESENTED)

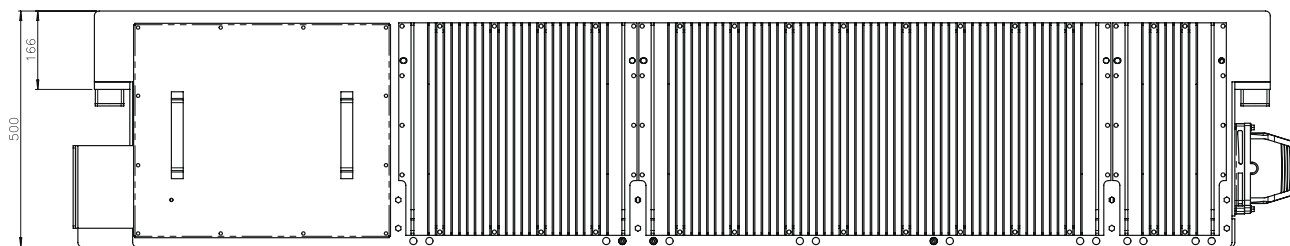


Fig. Front view of APS-50 WN TRW Module

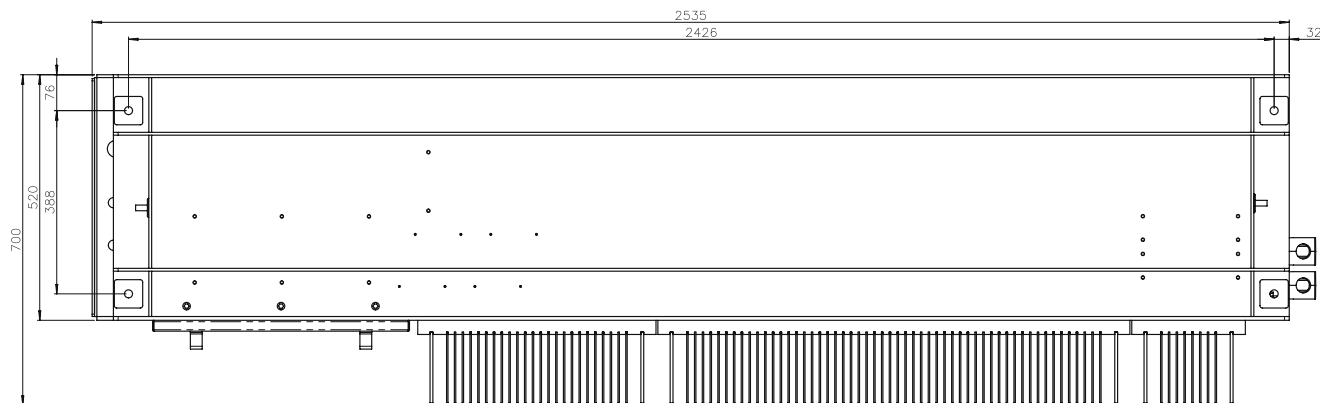


Fig. Top view of APS-50 WN TRW Module

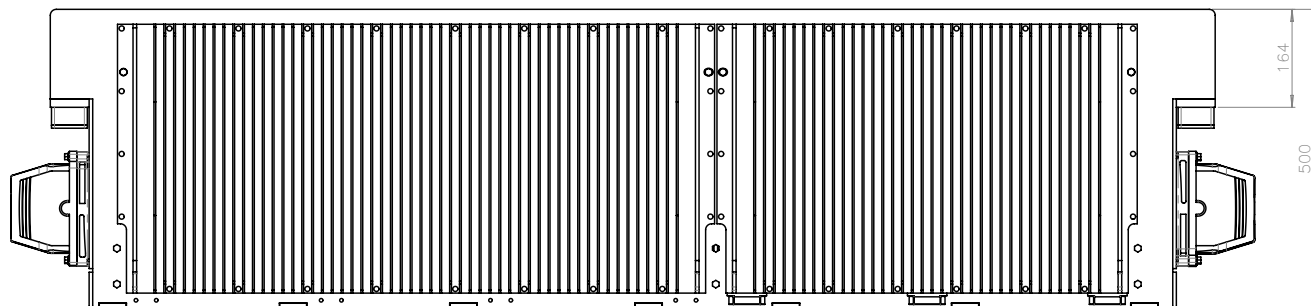


Fig. Front view of APS-50NN-TR Module

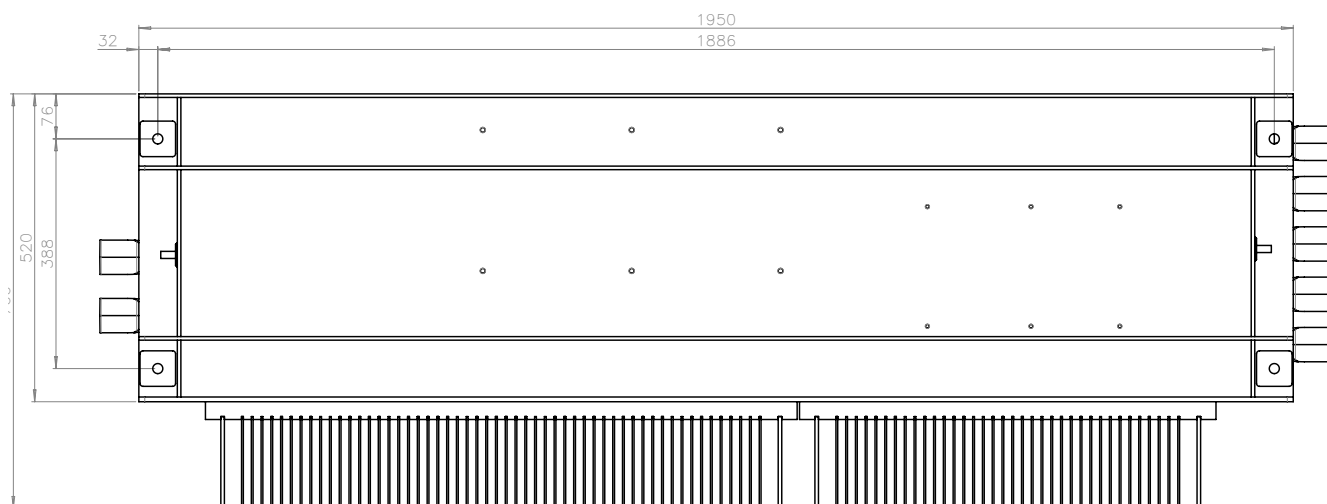


Fig. Top view of APS-50NN-TR Module

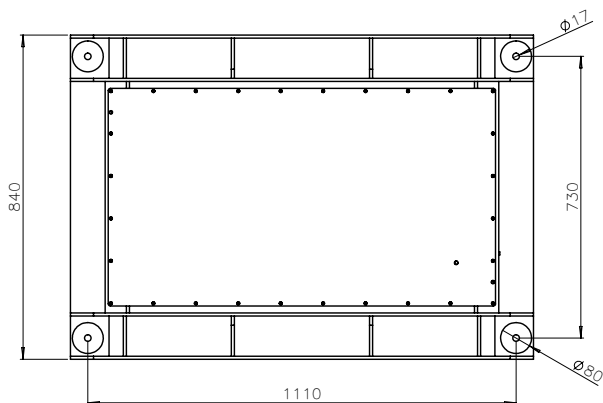


Fig. Top view of APS 50MAG-TR

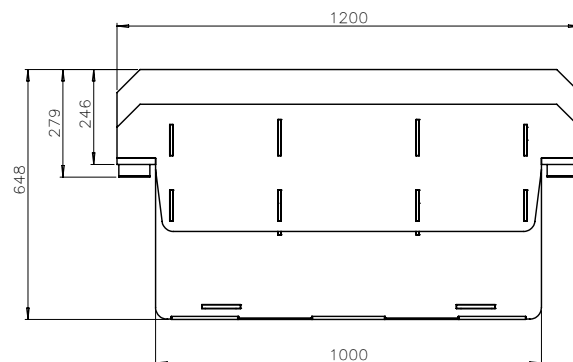


Fig. Front view of APS 50MAG-TR

STANDARDS:

EN 50155:2021	Railway applications – Electronic equipment used in a rolling stock.
EN 50160:2010	Parameters of voltage supply in public electricity networks
EN 60529:1991	Protection classes provided by housings (IP code)
EN 50121-3-2:2016	Railway applications – Electromagnetic compatibility – Part 3-2: Rolling stock – Apparatus.
EN 50124-1:2017	Railway applications - Insulation coordination Part 1: Basic requirements - Clearances and creepage distances for all electrical and electronic equipment.
EN 50125-1:2014	Railway applications – Environmental conditions for equipment – Part 1: Rolling stock devices.
EN 50126-1:2017	Railway Applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) - Part 1: Generic RAMS Process.
EN 50126-2:2017	Railway Applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) - Part 2: Systems Approach to Safety
EN 50128:2011	Railway applications – Communication, signalling and processing systems – Safety related electronic systems for signalling.
EN 50153:2014	Railway applications – Rolling stock – Protective measures against electrical hazards.
EN 50238-1:2019	Railway applications – Compatibility between rolling stock and train detection systems.
EN 50413:2019	Basic standard for methods of measurements and calculation of exposure of people to electric, magnetic and electromagnetic fields (0 Hz-300 GHz).
EN 50500:2008	Procedures for measurement levels of magnetic fields generated by electronic and electric devices in a railway environment in relation to exposure of people.
EN 50527-1:2016	Procedure for the assessment of the exposure to electromagnetic fields of workers bearing active implantable medical devices - Part 1: General
EN 61287-1:2014	Procedure for assessment of exposure of workers with medical implants to electromagnetic fields – Part 1: General information.
EN 61373:2010	Railway applications – Electronic converters installed in a rolling stock – Part 1: Characteristics and test methods.
EN 61375-1:2012	Railway applications – Rolling stock equipment – Tests of resistance to mechanical impacts and vibrations.

EUROPEAN DIRECTIVES:

DIRECTIVE 2014/35/UE	The Directive of the European Parliament and of the Council 2014/35/EU dated 26 February 2014 on harmonization of laws of the Member States related to marketing electric equipment intended to be used in specific voltage limits.
DIRECTIVE 2014/30/UE	The Directive of the European Parliament and of the Council 2014/30/EU dated 26 February 2014 on harmonization of laws of the Member States related to electromagnetic compatibility.

BFI 50T 3000/400/24 TR

BFI 50T 3000/400/24 TR Static converter

BFI 50T-TR converter provides power supply to receipts regardless of a current input voltage. The device may be supplied from 3x400 V platform network. The power supply of the aforementioned network allows for both operation of 24V buffer power supply and receivers supplied with 3x400 voltage installed in a car. The second source of power supply may be 3,000 V from an overhead contact line. The following circuits operate during connection to the overhead contact line: NPC DC/DC converter that reduced input voltage to 700 VDC, auto-start system, contactors system that allows to disconnect the overhead contact line power supply, inverter system and 24V buffer power supply used to charge main batteries and supply on-board devices.

CHARACTERISTICS:

Due to application of IGBT transistors in the power supply converter working with PWM pulse width modulation, the power supply features:

- high stability of voltages and output currents,
- very low current ripple and output voltage,
- small dimensions and mass,
- silent operation,
- high efficiency.

The power supply is equipped with microprocessor (DSP) inverter operation control system with battery status control function.

The power supply is equipped with the following protection measures:

- against overheating of power systems (limits the output current without interrupting operation),
- against short-circuit of electronic type,
- under- and over-voltage,
- thermal.

APS-50 WN TRW MODULE

The module includes at least:

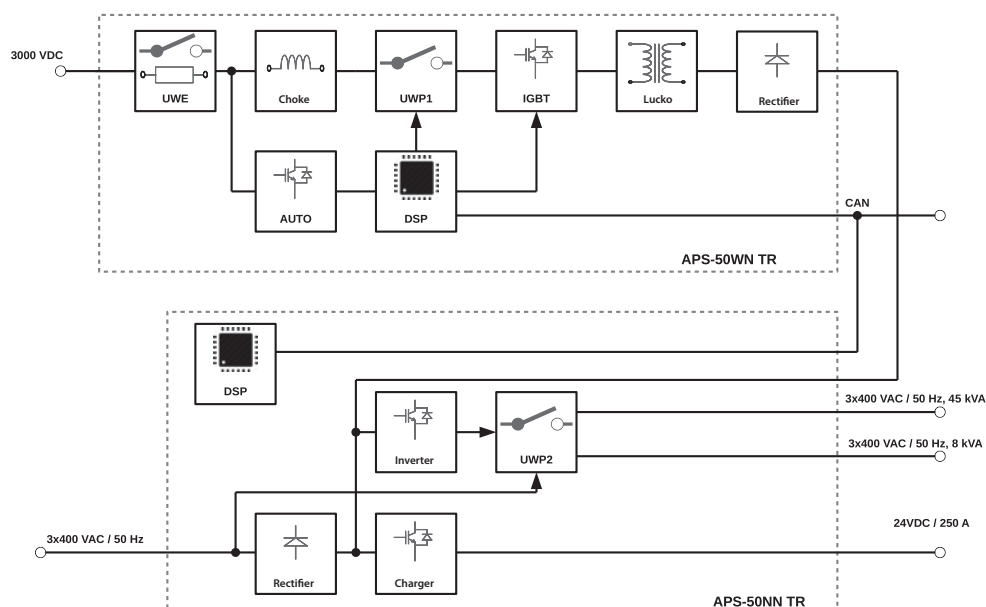
- grounding isolator,
- input gland,
- fuse that protects the converters,
- soft start system (resistor + contactor),
- main input contactor,
- auto-start system from the network,
- NPC DC/DC converter that reduces the input voltage.

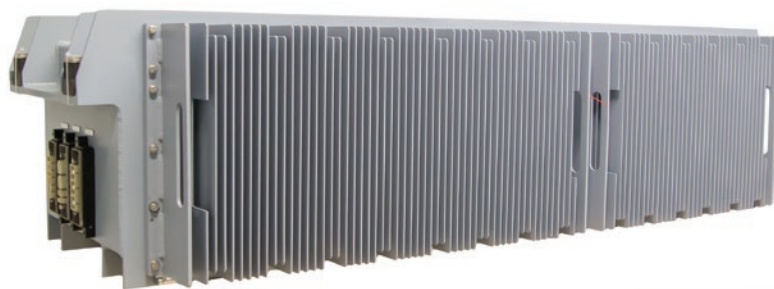
APS-50NN-TR MODULE

The system includes at least:

- Inverter system (max 75 kVA):
 - 3x400 VAC – 45 kVA;
 - 3x400 VAC – 8 kVA;
 - 230 V/50 Hz - max 10 kVA (option);
- 24 VDC 250 A battery charger with charging current limitation and automatic adjustment of battery charging in a temperature function;
- 24 VDC 50 A battery charger with charging current limitation and automatic adjustment of battery charging in a temperature function (option);
- two inputs of 3x400 VAC platform power supply (for the left and right side of a car) with protection of a possibility to transfer the voltage to an unconnected socket;
- the events buffer, which has a parameters register that collects information about operating parameters of the converter, its possible damage and faults, as well as power supply network parameters, providing a possibility to readout parameters from a socket located on a register. The buffer is built-in in the converter. It is equipped with an output (socket) that allows to assembly inside cars, e.g. in an electrical cabinet, with a possibility to read-out contents by connecting to a computer.

CONCEPTUAL DIAGRAM OF BFI50T-TR STATIC CONVERTER:





Pic. APS-50NN-TR module



Pic. APS-50WN-TR module

TAB. STATIC CONVERTER OF BF150T-TR TYPE – TECHNICAL CHARACTERISTICS - STANDARD PARAMETERS

Parameter	Unit	Value
ELECTRICAL		
Power source	V	3,000 VDC, as per UIC550, PK-K-23011:1998
Power / system topology / outputs	kVA, kW	• 24V output, In=250 A • voltage stability $\leq 1\%$; voltage ripple $\leq 0.5\%$; battery charging function with voltage temperature compensation. • AC1 - 3x400 VAC/50 Hz/45 kVA (air conditioning): • voltage stability $\leq 5\%$; frequency stability $\leq 0.2\%$; harmonics content $\leq 5\%$; overload behaviour 200%/5s; electric protection against short-circuit. • AC2 - 3x400 VAC/50 Hz/8 kVA (laptop sockets, other) • voltage stability $\leq 5\%$; frequency stability $\leq 0.2\%$; harmonics content $\leq 5\%$; overload behaviour 200%/5s; electric protection against short-circuit. Option: • max 10 kVA/230 V/50 Hz (from separation transformer supplied from an inverter) • 24V output, In=50 A • voltage stability $\leq 1\%$; voltage ripple $\leq 0.5\%$; battery charging function with voltage temperature compensation.
Rated power	kW	52
Required power backup	kW	+15% power depending on the car energy balance
Maximum power	kW	80
Efficiency		89%
Battery type with which the converter works		Alkaline of 24V / 460-520 Ah capacity
Input voltage range		as per UIC550
Input voltage level		as per UIC550
Level of interference on the input		EN 50121-3-2:2016 Rail vehicles – equipment in the train, including a converter,
Conducted interference level – input		EN 50121-1:2017 General provisions,
Radio interference level – input		EN 50121-2:2017 Applies to emission of interference of the entire railway system,
Conducted interruptions level – output		EN 50121-3-1:2017 Rail vehicles – train and complete vehicle,
Radio interference level – input		EN 50121-3-2:2016 Rail vehicles – equipment in the train, including a converter,
Type of input connections		Screw terminals on HV [high voltage] standoff insulators
Type of output connections		Quick-couplers
MECHANICAL		
Assembly location		Undercarriage
Cooling type		Natural cooling
Cooling type		External radiators on the device
Ambient temperature	°C	-25°C to + 40°C
Tightness		IP 56
Method of assembly		Suspended, screws, vibration isolators
Anti-corrosion protection		Paint coating
Housing material		Aluminium
Resistance to vibrations		EN 61373:2010 Railway application – Rolling stock equipment – Tests of resistance to mechanical impacts and vibrations
Resistance to mechanical impacts		EN 61373:2010 Railway application – Rolling stock equipment – Tests of resistance to mechanical impacts and vibrations
Mass EHV+HV	kg	500+300 +/- 20% depending on configuration
COMMUNICATION		
Converter control		Automatic
Operation status indication		YES
Communication bus		CAN OPEN

MECHANICAL DRAWINGS:
(DIMENSIONS OF BOXES DEPENDING ON CONFIGURATION MAY DIFFER FROM THOSE PRESENTED)

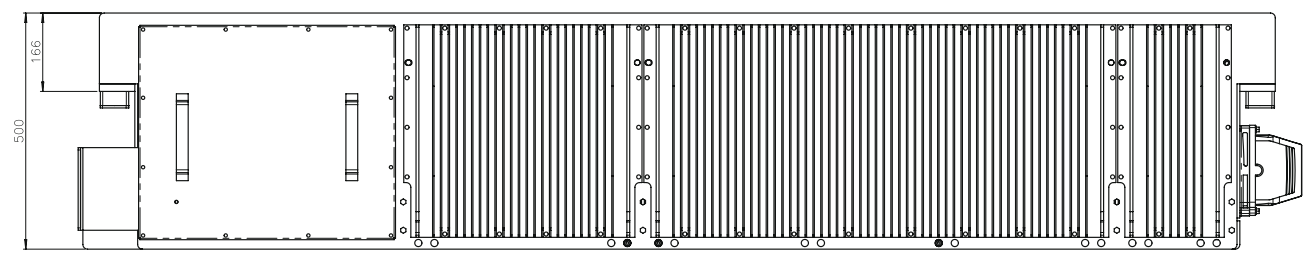


Fig. Front view of APS-50WN-TR Module

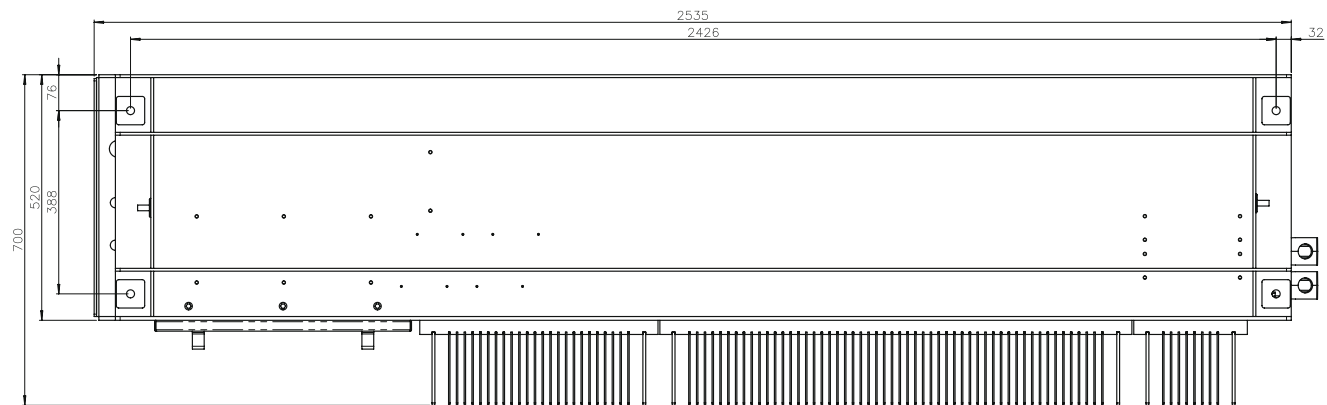


Fig. Top view of APS-50WN-TR Module

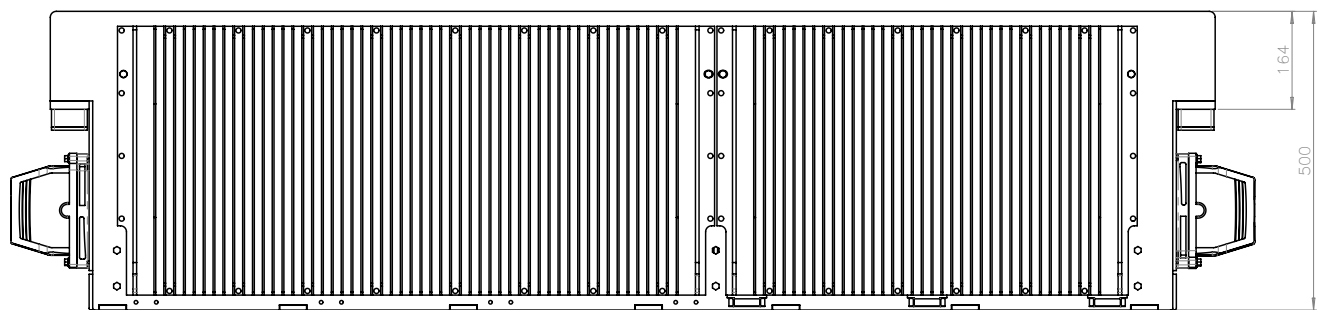


Fig. Front view of APS-50NN-TR Module

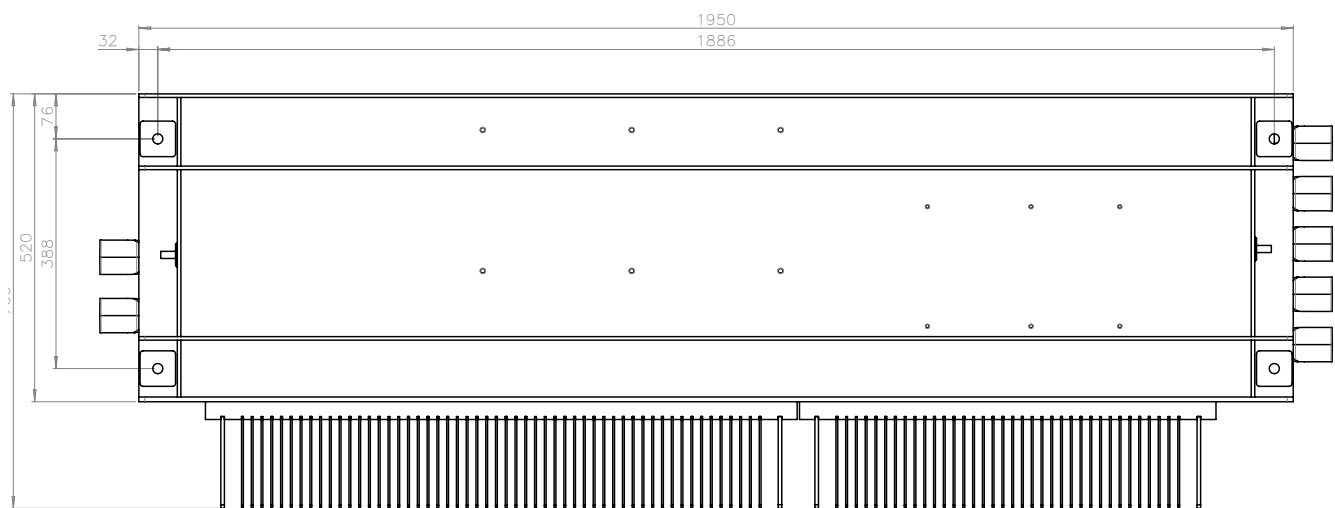


Fig. Top view of APS-50NN-TR Module

STANDARDS:	
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Loggers

Diagnostic Systems

Converters

Regulators

Buffer Power
Supplies

Voltage Inverters

Others

HPI WO HPI 10S 400/230WO converter

HPI 10S 400/230WO inverter module is intended for supplying AC receivers of 230 V AC rated voltage. The converter module is supplied by 3x400 V AC / 50 Hz. The system is equipped with microprocessor control and inverter operation parameters monitoring system.

CHARACTERISTICS:

HPI 10S 400/230WO converter features the following advantages:

- it may operate with receivers in a wide range of power factor,
- high efficiency of the processing system,
- short-circuit protection of the converter,
- power systems temperature protection,
- comfortable access to connections (from the front),
- microprocessor control and inverter operation parameters monitoring system,
- ergonomic housing allowing for comfortable assembly in 19" casing,
- galvanic separation of input and output circuit,
- low level of higher harmonics of the output voltage,
- remote indication of an alarm state – potential-free relay contacts,
- a built-in controller providing a possibility to select RS-485 communication protocol (MODBUS, IEC-103, APS),
- special load control algorithm,
- built-in events buffer.

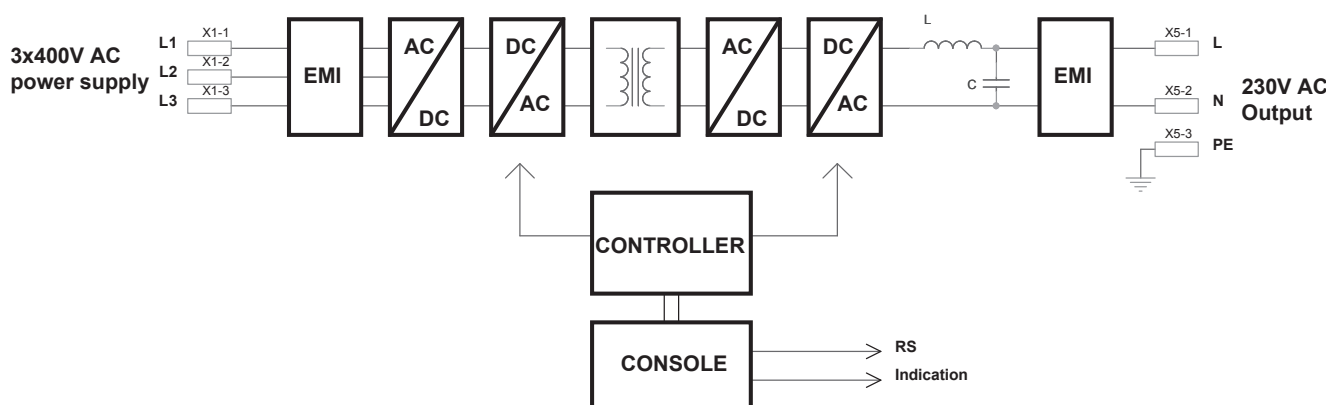


Fig. HPI 10S 400/230WO converter.

INVERTER MODULE MECHANICAL PARAMETERS

Parameter name	unit	value/feature of a parameter
Housing type		M3
Housing protection degree		IP 20
Housing attachment		From the front
Cabling connection		From the front
Housing dimensions (width x depth x height)	mm	482x492x267/19"x6U
Housing colour / Face plate		White zinc plated / RAL 7035

CONCEPTUAL DIAGRAM OF HPI 10S 400/230WO INVERTER:



TAB. HPI 10S 400/230WO CONVERTER – ELECTRIC CHARACTERISTICS – STANDARD PARAMETERS

AC rated input voltage	V	3x400/3x380 +10% /- 15%
Frequency	Hz	50/60 Hz +/- 10%
Rated consumption of current	A	3x16
Rated output AC voltage	V	230±2%
Output voltage frequency	Hz	50±0,1%
Output power	kVA	10
Rated output current	A	44
Overload capacity*		1,1In – long-term 1,1-1,25In – 10 minutes 1,25-1,5In – 3 minutes 1,5-2In – 10 seconds >2In – 1 second
Voltage waveform		sinusoidal
Harmonics content (linear load)		<2%
Scope of cosφ characterising load		0 ind. up to 0 vol.
Total efficiency		>90%
Over-current protection	A	6xIn
Multiplication factor (CF)		3

STANDARDS:

EN 50155:2021	Railway applications – Electronic equipment used in a rolling stock
EN 50153:2014	Railway applications – Rolling stock – Protective measures against electrical hazards
EN 61373:2010	Railway applications – Rolling stock equipment – Tests of resistance to mechanical impacts and vibrations
EN 50121-3-2:2016	Railway applications – Electromagnetic compatibility – Part 3-2: Rolling stock – Apparatus
EN 50124-1:2017	Railway applications - Insulation coordination Part 1: Basic requirements - Clearances and creepage distances for all electrical and electronic equipment.
EN 45545-2:2020	Railway applications - Insulation coordination Part 2: Surges and protection against surges.
EN 60529:1991	Protection classes provided by housings (IP code)
EUROPEAN DIRECTIVES:	
DIRECTIVE 2014/35/UE	The Directive of the European Parliament and of the Council 2014/35/EU dated 26 February 2014 on harmonization of laws of the Member States related to marketing electric equipment intended to be used in specific voltage limits.
DIRECTIVE 2014/30/UE	The Directive of the European Parliament and of the Council 2014/30/EU dated 26 February 2014 on harmonization of laws of the Member States related to electromagnetic compatibility.

MECHANICAL DRAWINGS:

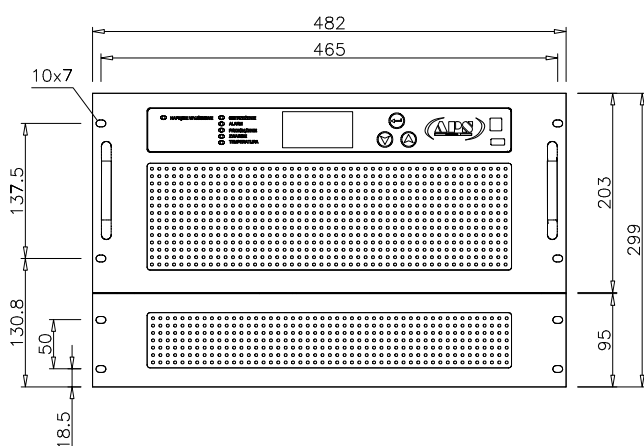


Fig. HPI 10S 400/230WO type converter, front view

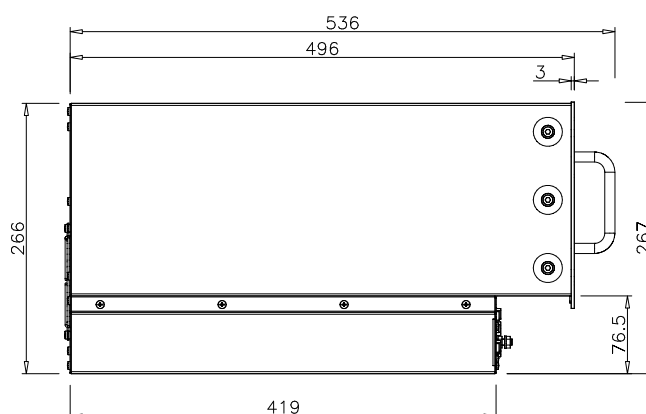


Fig. HPI 10S 400/230WO type converter, side view

SAN-AVR

General excitation voltage controller

SAN-AVR is a system for supervision and regulation of a generator synchronous with an exciter. This system adjusts three-phase generator output voltage through appropriate change of field current of the exciter. Digital adjustment enables correct operation of the generator at non-linear loads, such as LED rectifiers. A wide range of supply voltages allows operation on an external battery.

CHARACTERISTICS:

- measurement and adjustment of three-phase output voltage of the generator,
- wide range of supply voltages that allows for power supply from e.g. 24V battery,
- measurement of electrical values of a generator, such as voltages and output currents, supply voltage, field current,
- measurement of temperature of generator bearings and winding,
- generator overload and short-circuit protection,
- over-current protection,
- temperature protection of generator windings and bearings,
- external communication with CANOPEN protocol, readout of measurements and ability to control the excitation system operation.

SAN-AVR ELECTRIC PARAMETERS

Parameter	Symbol	Value
POWER SUPPLY		
Supply voltage	Un	16V-30 V
Input current	In	17A-10 A
OUTPUT		
Output voltage	Uwy	24V-30 V
Output current	Iwy	10 A
ELECTRIC GENERATOR OPERATION MODES		
S1 – S to 500 kVA (continuous)	Iwy	do 5,1 A
S2 – S to 750 kVA (for 60 min)	Iwy	do 7,5 A
S3 – S to 900 kVA (for 5 min)	Iwy	do 9,5 A
SZ – short-circuit state (for 5 sec)	Iwy	do 10 A
ADJUSTMENT		
Electric generator voltage adjustment	Unp	+5%
Time of response to a load increase	treg	~5 s
Time of response to a load drop	treg	~5 s

SAN-AVR MECHANICAL PARAMETERS

Parameter name	unit	value/feature of a parameter
Housing system type		APS housing
Housing protection class	IP	20
Housing attachment		Fastening using 2 x M6 screws
Cabling connection		Going out from the housing
Dimensions (width x depth x height)	mm	284x350x80
Colour		Galvanised steel

ENVIRONMENTAL CONDITIONS

Ambient temperature	°C	Od -30 do +40
Storage temperature	°C	Od -25 do +65
Location		Possibility to access the housing from the front by unscrewing a cover

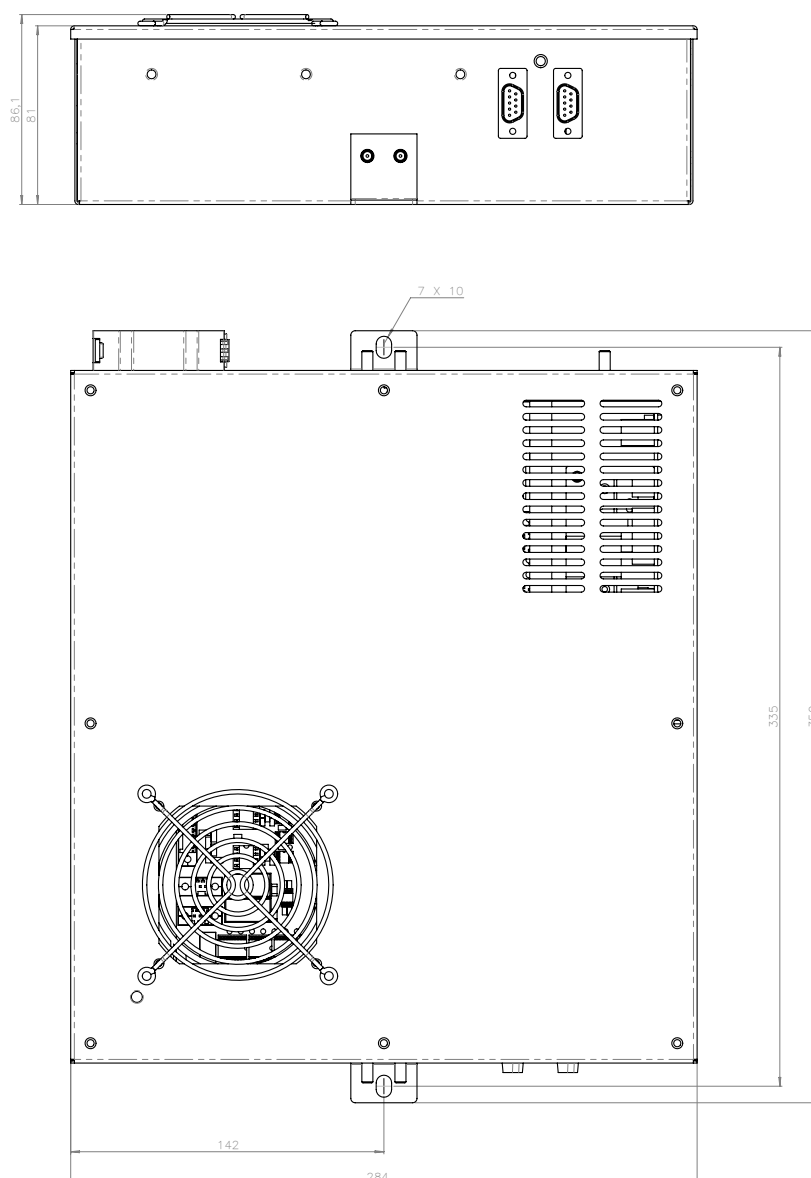


Fig. SAN-AVR type generator excitation voltage controller

STANDARDS:

EN 60529:1991	Protection classes provided by housings (IP code)
EN 50121-3-2:2016	Railway applications – Electromagnetic compatibility – Part 3-2: Rolling stock – Apparatus
EN 50155:2022	Railway applications – Electronic equipment used in a rolling stock
EN 61373:2010	Railway applications – Rolling stock equipment – Tests of resistance to mechanical impacts and vibrations
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MECHANICAL DRAWINGS:



PBI TR

Battery charger with optional diesel aggregator control PBI 24/250 TR

Traction charger of PBI 24/250 TR series is intended for charging batteries present in a vehicle. Rated voltage of the batteries is 24V. PBI 24/250 TR charger is intended for charging batteries from 3x400 VAC platform power network during standstill of a vehicle and controlling the vehicle's diesel generator. Activated and unlocked PBI 24/250 TR charger, after receiving information from CAN bus about activation of 24 VDC vehicle diesel generator or in case of lack of 3x400 VAC power supply, will automatically switch into an operating mode, in which it will control the output voltage of 24 VDC vehicle diesel generator using 4-20 mA current output, thus charging batteries in the vehicle.

Charger control and indication of its operation state is done via dedicated inputs and outputs located on the face plate of the device. Moreover, the battery operation state indication is transferred to the vehicle communication system (TCMS) via CANOPEN V 2.0 A protocol.

CHARACTERISTICS:

Due to application of IGBT transistors in the power supply converter working with PWM pulse width modulation, the power supply features:

- high stability of voltages and output currents,
- very low current ripple and output voltage,
- small dimensions and mass,
- silent operation,
- high efficiency.

The power supply is equipped with microprocessor (DSP) inverter operation control system with battery status control function.

The power supply is equipped with the following protection measures:

- against overheating of power systems (limits the output current without interrupting operation),
- against short-circuit of electronic type,
- under- and over-voltage,
- thermal.

The power supply provides:

- galvanic insulation from mains,
- temperature compensation of the battery voltage,
- limitation of battery charging current,
- minimisation of emitted interference due to application of multi-level anti-interference filters,
- charging characteristics and cooperation with battery according to eurobat characteristics,
- built-in events buffer.



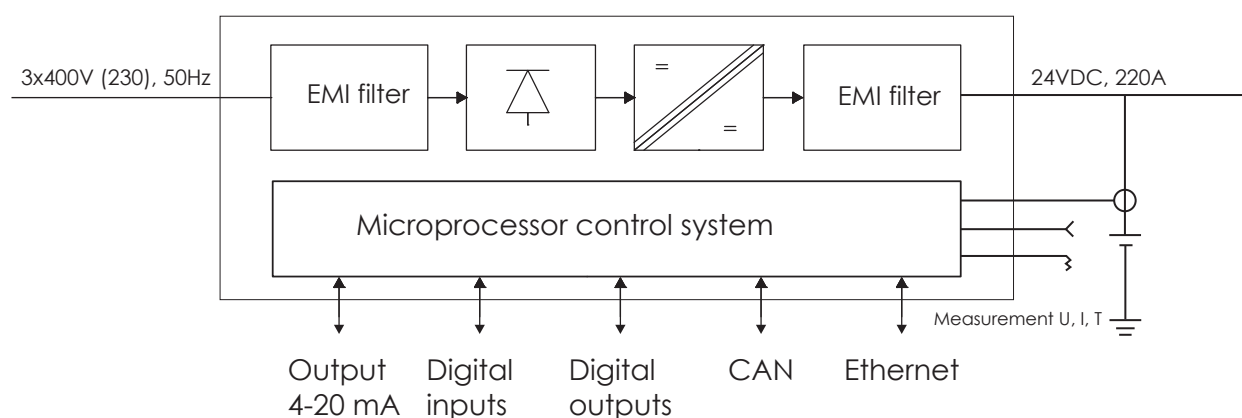
Fig. PBI 24/250 TR battery charger

TAB. PBI 24/250 TR TYPE TRACTION CHARGER – ELECTRIC CHARACTERISTICS – STANDARD PARAMETERS

Parameter name	unit	value/feature of a parameter
Supply voltage	VAC	3x400 +10 %, -10%
Supply voltage frequency	Hz	50/60 +/- 10%
Rated supply current	A	3x10
Rated output voltage (Un)	V	24
Output voltage tolerance		+/- 0.6%
Output voltage ripple (***)		+/- 0.6 %
Temperature compensation of the buffer charging voltage (*)	mV/°C/ogn	0 – 10
Rated output current (In)	A	220
Battery charging current	A	59.4
Battery charging characteristics		IU according to DIN 41773-1
Output current stability (**)		+/- 1 %
Output current ripple (**)		+/- 1 %
Battery charging characteristics		IU according to DIN 41773
Total efficiency		> 91%
Protection level	IP	20
Mass	kg	53,5
Range of thermal charging voltage adjustment	°C	-25- +40

** Battery charging, current controller *** At resistance load

CONCEPTUAL DIAGRAM OF PBI 24/250 TR TRACTION CHARGER



MECHANICAL DRAWINGS:

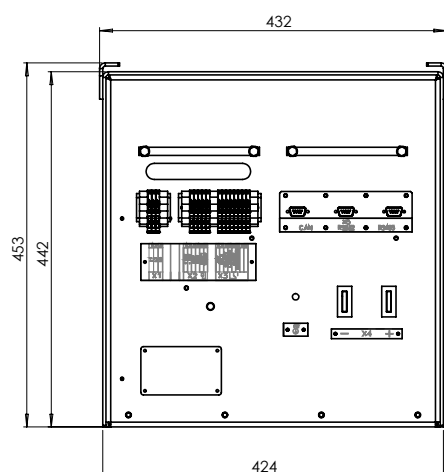


Fig. PBI 24/250 TR type battery charger, front view

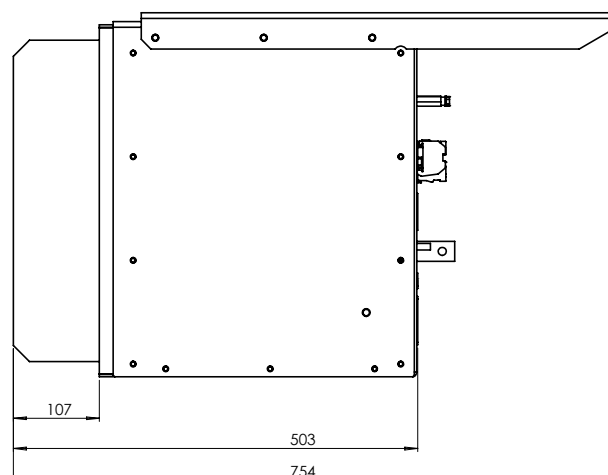


Fig. PBI 24/250 TR type battery charger, side view

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NOTES

Buffer Power Supplies

PBI TR

Two-range battery charger with optional control of PBI 24/220(150) TR diesel aggregator

PBI 24/220(150) TR series traction charger is intended for charging batteries present in the vehicle. Rated voltage of the batteries is 24V. PBI 24/220(150) TR charger is intended for charging batteries from 3x400 VAC platform power network during standstill of a vehicle and controlling the vehicle's diesel generator.

Charger control and indication of its operation state is done via dedicated inputs and outputs located on the face plate of the device. Moreover, the battery operation state indication is transferred to the vehicle communication system (TCMS) via CANOPEN V 2.0 A protocol.

Activated and unlocked PBI 24/220(150) TR charger, after receiving information from CAN bus about activation of 24 VDC vehicle diesel generator or in case of lack of 3x400 VAC and 230 VAC power supply, will automatically switch into an operating mode, in which it will control the output voltage of 24 VDC vehicle diesel generator using 4-20 mA current output, thus charging batteries in the vehicle.

CHARACTERISTICS:

Due to application of IGBT transistors in the power supply converter working with PWM pulse width modulation, the power supply features:

- high stability of voltages and output currents,
- very low current ripple and output voltage,
- small dimensions and mass,
- silent operation,
- high efficiency.

The power supply is equipped with microprocessor (DSP) inverter operation control system with battery status control function.

The power supply is equipped with the following protection measures:

- against overheating of power systems (limits the output current without interrupting operation),
- against short-circuit of electronic type,
- under- and over-voltage,
- thermal.

The power supply provides:

- galvanic insulation from mains,
- temperature compensation of the battery voltage,
- limitation of battery charging current,
- minimisation of emitted interference due to application of multi-level anti-interference filters,
- charging characteristics and cooperation with battery accordant with eurobat characteristics,
- built-in events buffer.



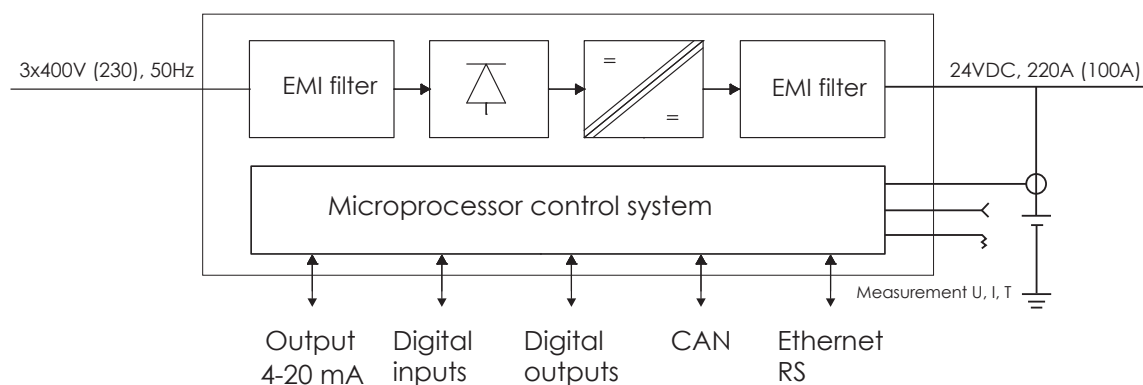
Fig. PBI 24/220(150) TR type battery charger

TAB. PBI 24/220 (150) TR TYPE TRACTION CHARGER – ELECTRIC CHARACTERISTICS – STANDARD PARAMETERS

Supply voltage	VAC	3x400 +10 %, -10% lub 230 +10%, -10%
Rated supply current	A	3x10 lub 15
Supply voltage frequency	Hz	50/60 ±10 %
Rated output voltage (Un)	V	24
Output voltage tolerance		+/- 0.6%
Output voltage ripple (***)		+/- 0.6 %
Range of thermal charging voltage adjustment	°C	-25 – +40
Temperature compensation of the buffer charging voltage (*)	mV/°C/ogn	0 – 10
Rated output current (In) podany dla napięcia zasilania 3x400 VAC	A	220
Maximum output current for 230 VAC supply voltage	A	100
Battery charging current	A	59.4
Output current stability (**)		+/- 1 %
Output current ripple (**)		+/- 1 %
Battery charging characteristics		IU as per DIN 41773
Total efficiency		> 91%
Protection level	IP	20
Mass	kg	53,5

(**) Battery charging, current controller, (***) At resistance load

CONCEPTUAL DIAGRAM OF PBI TR Z TRACTION CHARGER WITH OPTIONAL DIESEL AGGREGATOR CONTROL:



MECHANICAL DRAWINGS:

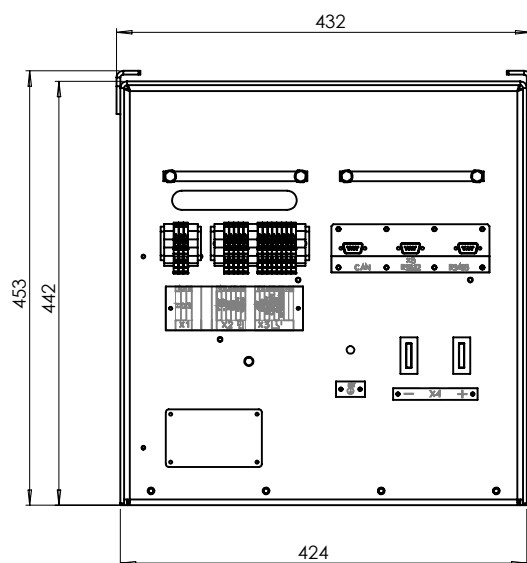


Fig. PBI 24/220 (150) TR type battery charger, front view

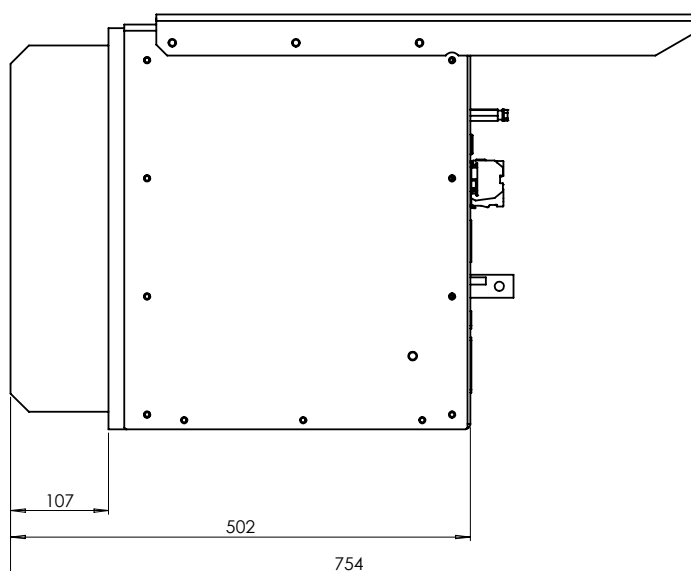


Fig. PBI 24/220 (150) TR type battery charger, side view

STANDARDS:

EN 50155:2021	Railway applications – Electronic equipment used in a rolling stock.
EN 50160:2010	Parameters of voltage supply in public electricity networks
EN 60529:1991	Protection classes provided by housings (IP code)
EN 50121-3-2:2016	Railway applications – Electromagnetic compatibility – Part 3-2: Rolling stock – Apparatus.
EN 50124-1:2017	Railway applications - Insulation coordination Part 1: Basic requirements - Clearances and creepage distances for all electrical and electronic equipment.
EN 50125-1:2014	Railway applications – Environmental conditions for equipment – Part 1: Rolling stock devices.
PN-EN50126:2002	Railway applications – The specification and demonstration of reliability, availability, maintainability and safety.
EN 50128:2011	Railway applications – Communication, signalling and processing systems – Safety related electronic systems for signalling.
EN 50153:2014	Railway applications – Rolling stock – Protective measures against electrical hazards.
EN 50238-1:2019	Railway applications – Compatibility between rolling stock and train detection systems.
EN 50413:2019	Basic standard for methods of measurements and calculation of exposure of people to electric, magnetic and electromagnetic fields (0 Hz-300 GHz).
EN 50500:2008	Procedures for measurement levels of magnetic fields generated by electronic and electric devices in a railway environment in relation to exposure of people.
EN 50527-1:2016	Procedure for assessment of exposure of workers with medical implants to electromagnetic fields – Part 1: General information.
EN 61287-1:2014	Procedure for assessment of exposure of workers with medical implants to electromagnetic fields – Part 1: General information.
EN 61373:2010	Railway applications – Electronic converters installed in a rolling stock – Part 1: Characteristics and test methods.
EN 61375-1:2012	Railway applications – Rolling stock equipment – Tests of resistance to mechanical impacts and vibrations.
EUROPEAN DIRECTIVES:	
DIRECTIVE 2014/35/UE	The Directive of the European Parliament and of the Council 2014/35/EU dated 26 February 2014 on harmonization of laws of the Member States related to marketing electric equipment intended to be used in specific voltage limits.
DIRECTIVE 2014/30/UE	The Directive of the European Parliament and of the Council 2014/30/EU dated 26 February 2014 on harmonization of laws of the Member States related to electromagnetic compatibility.

NOTES

Buffer Power Supplies

Traction chargers of PBI 24/350 TR series are intended for charging batteries present in a vehicle. Rated voltage of the batteries is 24 V. PBI 24/350 TR charger is intended for charging batteries from 3x400 VAC platform power network during both vehicle travel and standstill.

Charger control and indication of its operation state is done via dedicated inputs and outputs located on the face plate of the device. Moreover, the battery operation state indication is transferred to the vehicle communication system (TCMS) via CANOPEN V 2.0 A protocol.

CHARACTERISTICS:

Due to application of IGBT transistors in the power supply converter working with PWM pulse width modulation, the power supply features:

- high stability of voltages and output currents,
- very low current ripple and output voltage,
- small dimensions and mass,
- silent operation,
- high efficiency.

The power supply is equipped with microprocessor (DSP) inverter operation control system with battery status control function.

The power supply is equipped with the following protection measures:

- against overheating of power systems (limits the output current without interrupting operation),
- against short-circuit of electronic type,
- under- and over-voltage,
- thermal.

The power supply provides:

- galvanic insulation from mains,
- temperature compensation of the battery voltage,
- limitation of battery charging current,
- minimisation of emitted interference due to application of multi-level anti-interference filters,
- charging characteristics and cooperation with battery accordant with EUROBAT characteristics,
- built-in events buffer.

TAB. PBI 24/350 TR TYPE TRACTION CHARGER – ELECTRIC CHARACTERISTICS – STANDARD PARAMETERS

Supply voltage	V AC	3x400 +10 %, -10%
Supply voltage frequency	Hz	50/60 +/- 10%
Rated supply current	A	3x16
Rated output voltage (Un)	V	24
Output voltage stability		<1% (rms)
Output voltage ripple (***)		<1% (rms)
Range of thermal charging voltage adjustment	°C	-25 – +45
Rated output current (In)	A	350
Output current ripple (**)		+<2 % (rms)
Battery charging characteristics		IU as per DIN 41773-1
Scope of cosφ characterising load		0 ind. up to 0 vol.
Total efficiency		91%

(**) Battery charging, current controller, (***) At resistance load

CONCEPTUAL DIAGRAM OF PBI 24/350 TR TRACTION CHARGER

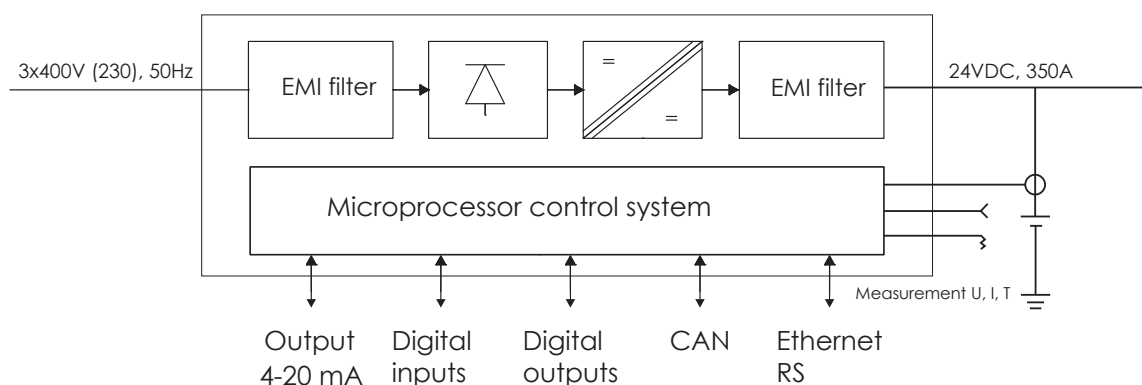




Fig. PBI 24/350 TR type battery charger

STANDARDS:

EN 50155:2021	Railway applications – Electronic equipment used in a rolling stock
EN 50121-3-2:2016	Railway applications – Electromagnetic compatibility – Part 3-2: Rolling stock – Apparatus
EN 50124-1:2017	Railway applications - Insulation coordination Part 1: Basic requirements - Clearances and creepage distances for all electrical and electronic equipment.
EN 50153:2014	Railway applications – Rolling stock – Protective measures against electrical hazards
EN 61287-1:2014	Railway applications – Electronic converters installed in a rolling stock – Part 1: Characteristics and test methods.
EN 61373:2010	Railway applications – Rolling stock equipment – Tests of resistance to mechanical impacts and vibrations
EN 61375-1:2012	Electronic railway equipment – Train connectivity network (TCN) – Part 1: General architecture.

EUROPEAN DIRECTIVES:

DIRECTIVE 2014/35/UE	The Directive of the European Parliament and of the Council 2014/35/EU dated 26 February 2014 on harmonization of laws of the Member States related to marketing electric equipment intended to be used in specific voltage limits.
DIRECTIVE 2014/30/UE	The Directive of the European Parliament and of the Council 2014/30/EU dated 26 February 2014 on harmonization of laws of the Member States related to electromagnetic compatibility.

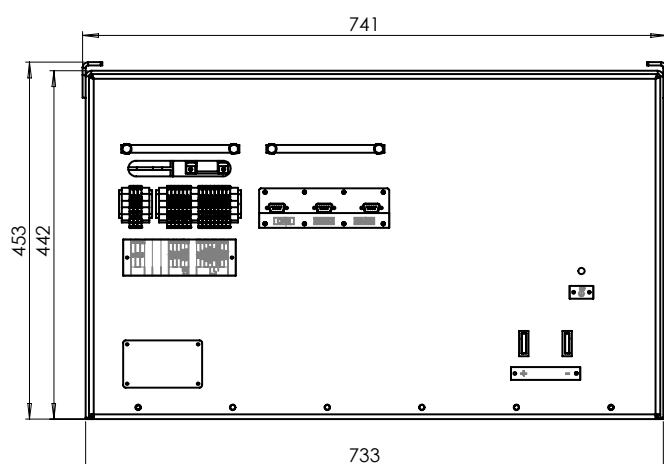
MECHANICAL DRAWINGS:

Fig. PBI 24/350 TR type battery charger, front view

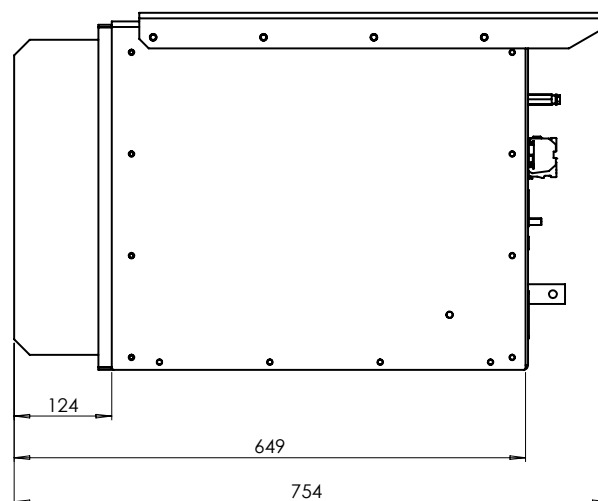


Fig. PBI 24/350 TR type battery charger, side view

PBI MC TR

PBI MC TR type buffer power

Mobile buffer power supplies of PBI MC TR type are intended for operation in uninterrupted constant current power supply systems as power sources for receptions and charging of batteries of rated voltage of 24 VDC.

Constant current receivers power supply may be carried out in cooperation with a buffer battery or directly from a power supply.

CHARACTERISTICS

Due to application of IGBT transistors in the power supply converter working with PWM pulse width modulation and over-acoustic frequencies, the power supply features:

- high stability of voltages and output currents,
- very low current ripple and output voltage,
- small dimensions and mass,
- silent operation,
- high efficiency.

The power supply is equipped with microprocessor (DSP) inverter operation control system and provides a battery status control function.

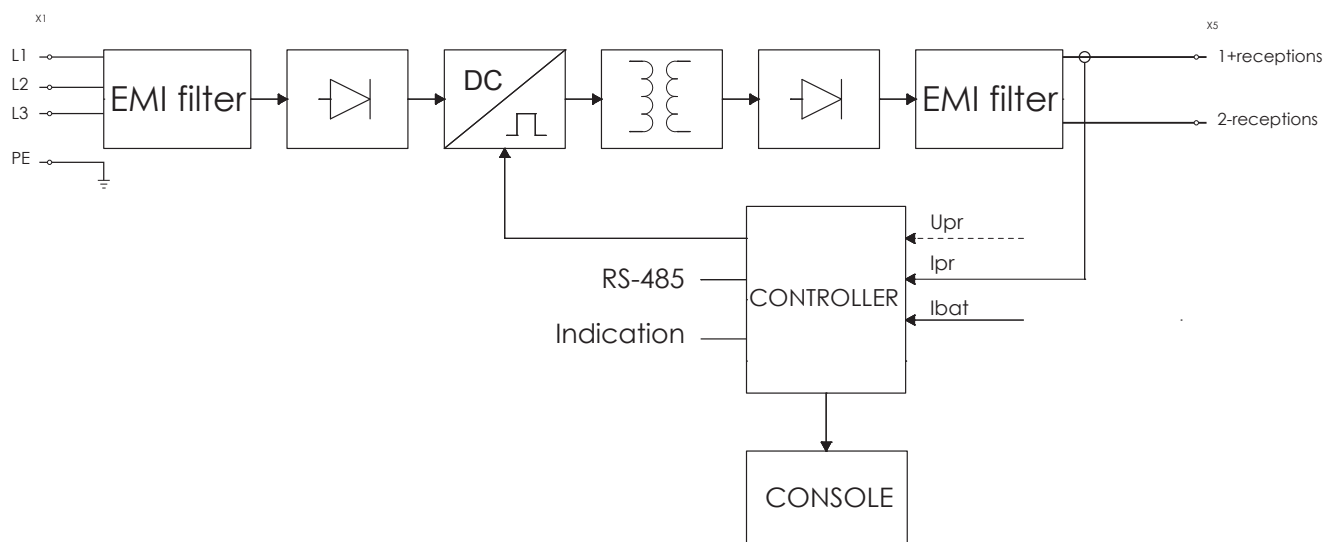
The power supply is equipped with the following protection measures:

- against overheating of power systems (limits the output current without interrupting operation),
- short-circuit protection – electronic type protection and via fuses,
- over-voltage, The power supply provides:
- galvanic insulation from mains,
- temperature compensation of the battery voltage,
- limitation of battery charging current,
- minimisation of interference emitted in frequency due to use of multi-level anti-reference filters,
- charging characteristics and cooperation with battery according with EUROBAT characteristics,
- built-in events buffer.



Fig. PBI MC TR type buffer power supply

CONCEPTUAL DIAGRAM OF PBI MC TR TYPE BUFFER POWER SUPPLY



TAB. PBI MC TR TYPE BUFFER POWER SUPPLY – ELECTRIC CHARACTERISTICS – STANDARD PARAMETERS

Device type		PBI 24/250 MC	PBI 24/300 MC	PBI 24/350 MC
Parameter name	unit	value/feature of a parameter	value/feature of a parameter	value/feature of a parameter
Supply voltage	VAC	3x400 +10 %, -10%	3x400 +10 %, -10%	3x400 +10 %, -10%
Supply voltage frequency	Hz	50/60 +/- 10%	50/60 +/- 10%	50/60 +/- 10%
Rated supply current	A	3x11,5	3x13,9	3x16
Rated output voltage (Un)	V	24	24	24
Output voltage stability		<1% (rms)	<1% (rms)	<1% (rms)
Output voltage ripple (***)		<1% (rms)	<1% (rms)	<1% (rms)
Range of thermal charging voltage adjustment	°C	-25 – +45	-25 – +45	-25 – +45
Rated output current (In)	A	250	300	350
Output current ripple (**)		+<2%(rms)	+<2%(rms)	+<2%(rms)
Battery charging characteristics		IU according to DIN 41773-1	IU according to DIN 41773-1	IU according to DIN 41773-1
Scope of cosφ characterising load		0 ind. up to 0 vol.	0 ind. up to 0 vol.	0 ind. up to 0 vol.
Total efficiency		91%	91%	91%

(**) Battery charging, current controller, (***) At resistance load

STANDARDS:

EN 50155:2021	Railway applications – Electronic equipment used in a rolling stock.
EN 50160:2010	Parameters of voltage supply in public electricity networks
EN 60529:1991	Protection classes provided by housings (IP code)
EN 50121-3-2:2016	Railway applications – Electromagnetic compatibility – Part 3-2: Rolling stock – Apparatus.
EN 50124-1:2017	Railway applications - Insulation coordination Part 1: Basic requirements - Clearances and creepage distances for all electrical and electronic equipment.
EN 50125-1:2014	Railway applications – Environmental conditions for equipment – Part 1: Rolling stock devices.
EN 50126-1:2017	Railway Applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) - Part 1: Generic RAMS Process.
EN 50126-2:2017	Railway Applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) - Part 2: Systems Approach to Safety
EN 50128:2011	Railway applications – Communication, signalling and processing systems – Safety related electronic systems for signalling.
EN 50153:2014	Railway applications – Rolling stock – Protective measures against electrical hazards.
EN 50238-1:2019	Railway applications – Compatibility between rolling stock and train detection systems.
EN 50413:2019	Basic standard for methods of measurements and calculation of exposure of people to electric, magnetic and electromagnetic fields (0 Hz-300 GHz).
EN 50500:2008	Procedures for measurement levels of magnetic fields generated by electronic and electric devices in a railway environment in relation to exposure of people.
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EN 61287-1:2014	Procedure for assessment of exposure of workers with medical implants to electromagnetic fields – Part 1: General information.
EN 61373:2010	Railway applications – Electronic converters installed in a rolling stock – Part 1: Characteristics and test methods.
EN 61375-1:2012	Railway applications – Rolling stock equipment – Tests of resistance to mechanical impacts and vibrations.

EUROPEAN DIRECTIVES:

DIRECTIVE 2014/35/UE	The Directive of the European Parliament and of the Council 2014/35/EU dated 26 February 2014 on harmonization of laws of the Member States related to marketing electric equipment intended to be used in specific voltage limits.
DIRECTIVE 2014/30/UE	The Directive of the European Parliament and of the Council 2014/30/EU dated 26 February 2014 on harmonization of laws of the Member States related to electromagnetic compatibility.

MECHANICAL DRAWINGS:

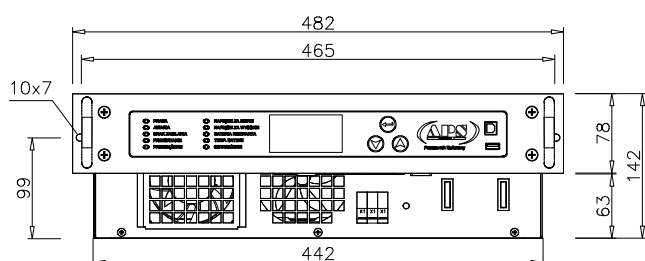


Fig. PBI MC TR type buffer power supplies, front view

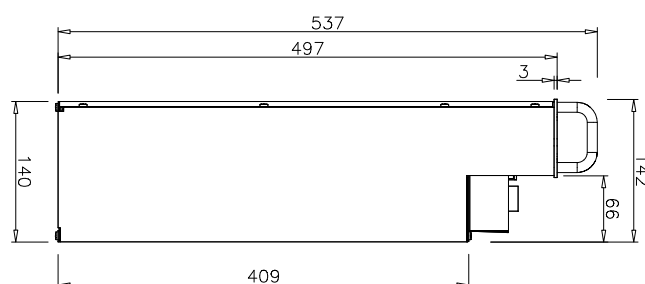


Fig. PBI MC TR type buffer power supplies, side view

POWER SUPPLY MODULE MECHANICAL PARAMETERS

Parameter name	unit	value/feature of a parameter
Housing type		M4
Housing protection degree		IP 20
Housing attachment		From the front
Cabling connection		From the front
Housing dimensions (width x depth x height)	mm	482x494x140/19"x4U
Housing colour / Face plate		White zinc plated / RAL 7035

PBI M/MC TR

Buffer power supplies
of PBI M/MC TR type
(supply from two power sources)

Mobile buffer power supplies of PBI MC type are intended for operation in direct current power supply systems as power sources for receptions and charging of batteries of rated voltage of 24 VDC.

They allow power supply from two voltage sources: 230 VAC and 3x 400 VAC.

Constant current receivers power supply may be carried out in cooperation with a buffer battery or directly from a power supply.

CHARACTERISTICS

Due to application of IGBT transistors in the power supply converter working with PWM pulse width modulation and over-acoustic frequencies, the power supply features:

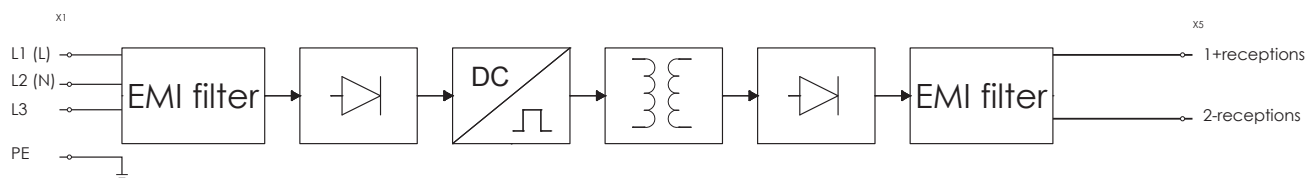
- high stability of voltages and output currents,
- very low current ripple and output voltage,
- small dimensions and mass,
- silent operation,
- high efficiency.

The power supply is equipped with microprocessor (DSP) inverter operation control system and provides a battery status control function.

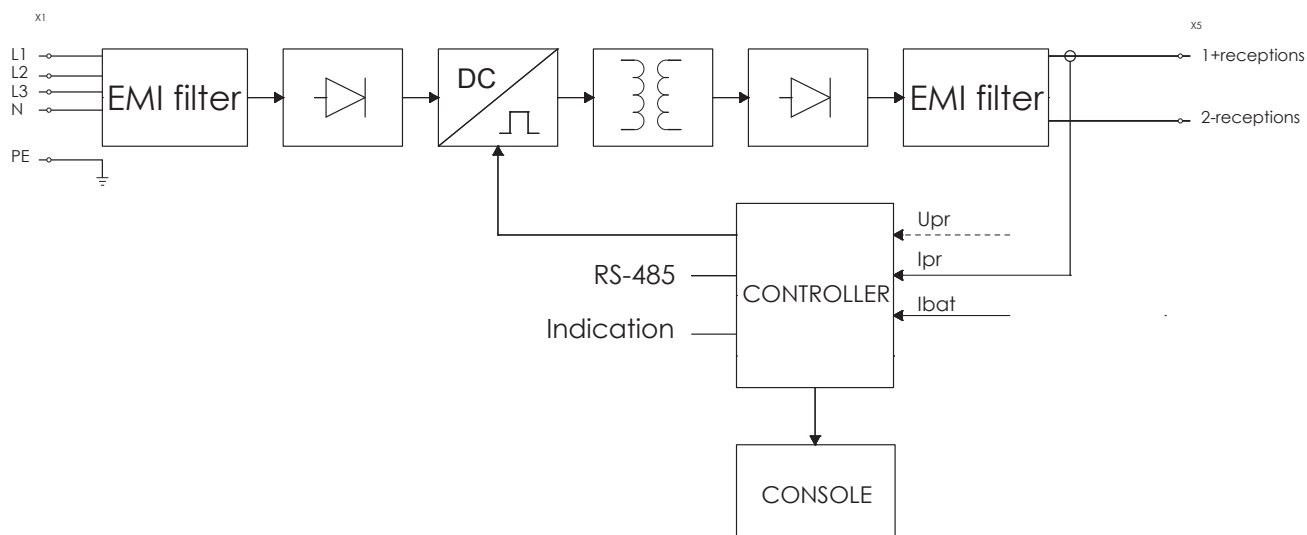
The power supply is equipped with the following protection measures:

- against overheating of power systems (limits the output current without interrupting operation),
- short-circuit protection – electronic type protection and via fuses,
- over-voltage, The power supply provides:
- galvanic insulation from mains,
- temperature compensation of the battery voltage,
- limitation of battery charging current,
- minimisation of interference emitted in frequency due to use of multi-level anti-reference filters,
- charging characteristics and cooperation with battery according with EUROBAT characteristics,

CONCEPTUAL DIAGRAM OF PBI M TR TYPE BUFFER POWER SUPPLY



CONCEPTUAL DIAGRAM OF PBI MC TR TYPE BUFFER POWER SUPPLY



TAB. PBI M/MC TR TYPE BUFFER POWER SUPPLY – ELECTRIC CHARACTERISTICS – STANDARD PARAMETERS

Device type		PBI 24/300(100) MC	PBI 24/50M
Parameter name	unit	value/feature of a parameter	value/feature of a parameter
Supply voltage I	VAC	3x400 +10 %, -10%	3x400 +10 %, -10%
Supply voltage II	VAC	230+10 %, -10%	230+10 %, -10%
Supply voltage frequency	Hz	50/60 +/- 10%	50/60 +/- 10%
Rated supply current I	A	3x13,9	3x2,3
Rated supply current II	A	13,9	6,9
Rated output voltage (Un)	V	24	24
Output voltage stability		<1% (rms)	<1% (rms)
Output voltage ripple (***)		<1% (rms)	<1% (rms)
Range of thermal charging voltage adjustment	°C	-25 – +45	-25 – +45
Output rated current for supply current I (In)	A	250	50
Output rated current for supply current II (In)	A	100	50
Output current ripple (**)		+<2 % (rms)	+<2 % (rms)
Battery charging characteristics		IU as per DIN 41773-1	IU as per DIN 41773-1
Scope of cosφ characterising load		0 ind. up to 0 vol.	0 ind. up to 0 vol.
Total efficiency		91%	91%

(**) Battery charging, current controller, (***) At resistance load



Fig. PBI M TR buffer power supply.



Fig. PBI MC TR type buffer power supply

PBI 24/50M BUFFER POWER SUPPLY
MECHANICAL PARAMETERS TABLE

Parameter name	unit	value/feature of a parameter
Housing type		M4
Housing protection degree		IP 20
Housing attachment		From the front
Cabling connection		From the front
Housing dimensions (width x depth x height)	mm	482x262x136,5/19"
Housing colour / Face plate		White zinc plated / RAL 7035

PBI 24/300(100) MC BUFFER POWER SUPPLY
MECHANICAL PARAMETERS TABLE

Parameter name	unit	value/feature of a parameter
Housing type		M4
Housing protection degree		IP 20
Housing attachment		From the front
Cabling connection		From the front
Housing dimensions (width x depth x height)	mm	482x494x140/19"x4U
Housing colour / Face plate		White zinc plated / RAL 7035

Loggers

Diagnostic Systems

Converters

Regulators

Buffer Power
Supplies

Voltage Inverters

Others

NORMY:

EN 50121-1:2015	Railway applications – Electromagnetic compatibility
EN 50121-3-2:2016	Railway applications – Electromagnetic compatibility – Rolling stock – Apparatus
EN 50163:2006	Railway applications – UIC 550 traction systems power supply voltages
EN 50153:2014	Railway applications – Protection against electric shocks
EN 61373:2010	Railway applications – Rolling stock equipment – Tests of resistance to mechanical impacts and vibrations
EN 50155:2021	Railway applications – technical equipment used in a rolling stock
EN 45545-2:2020	Railway applications – Insulation coordination – Part 1: Basic requirements - Clearances and creepage distances for all electrical and electronic equipment
EN 50124-2:2017	Railway applications – Insulation coordination – Part 2: Surges and protection against surges.
EUROPEAN DIRECTIVES:	
DIRECTIVE 2014/35/UE	The Directive of the European Parliament and of the Council 2014/35/EU dated 26 February 2014 on harmonization of laws of the Member States related to marketing electric equipment intended to be used in specific voltage limits.
DIRECTIVE 2014/30/UE	The Directive of the European Parliament and of the Council 2014/30/EU dated 26 February 2014 on harmonization of laws of the Member States related to electromagnetic compatibility.

MECHANICAL DRAWINGS:

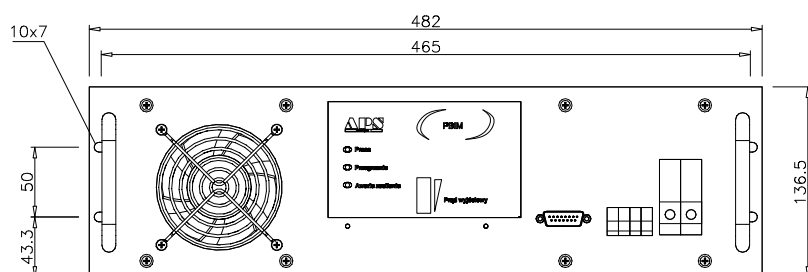


Fig. PBI M TR type buffer power supplies, front view

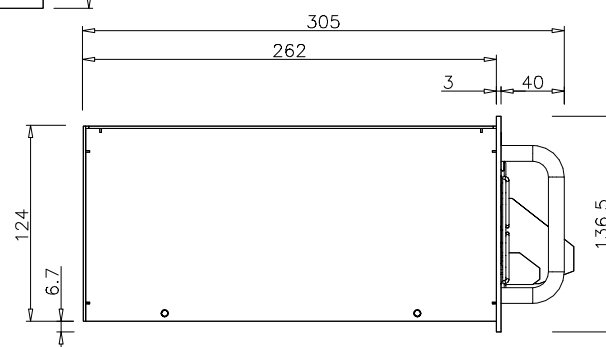


Fig. PBI M TR type buffer power supplies, side view

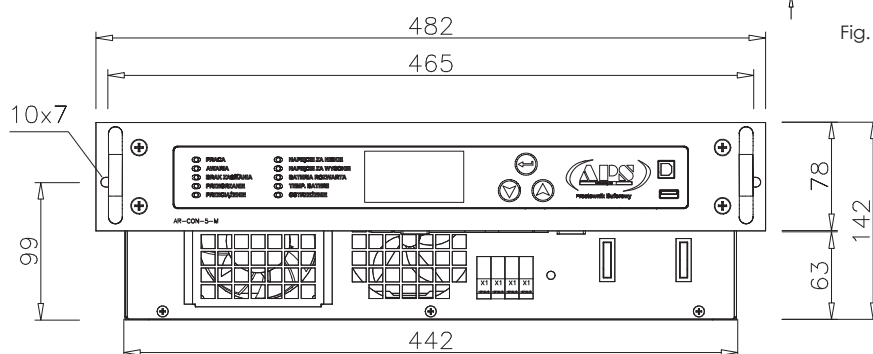


Fig. PBI MC TR type buffer power supplies, front view

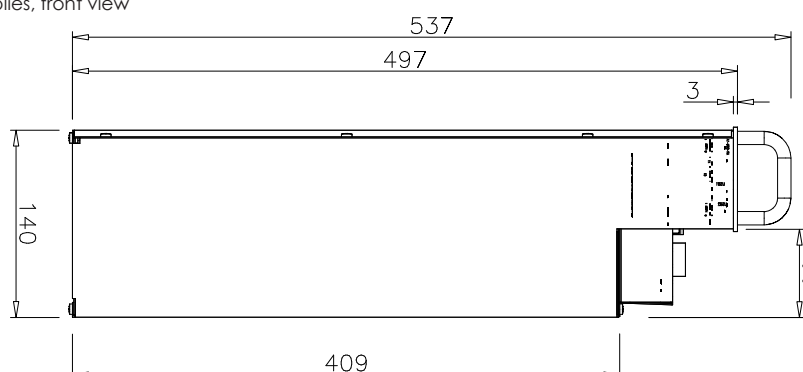


Fig. PBI MC TR type buffer power supplies, side view

NOTES

Buffer Power Supplies

BFI MC

Inverters of BFI MC type

BFI MC inverter module is intended for supplying AC receivers of 230 V AC rated voltage. Inverter module is supplied with 24V DC. The system is equipped with microprocessor control and inverter operation parameters monitoring system.

CHARACTERISTICS:

BFI MC inverter features the following advantages:

- it may operate with receivers in a wide range of power factor,
- high efficiency of the processing system,
- short-circuit protection of the inverter,
- over-current protection against DC power supply,
- power systems temperature protection,
- comfortable access to connections (from the front),
- microprocessor control and inverter operation parameters monitoring system,
- ergonomic housing allowing for comfortable assembly in 19" casing,
- galvanic separation of input and output circuit,
- low level of higher harmonics of the output voltage,
- remote indication of an alarm state – potential-free relay contacts,
- a built-in controller providing a possibility to select RS-485 communication protocol (MODBUS, IEC-103, APS),
- built-in events buffer.



Fig. Inverter of BFI MC type.

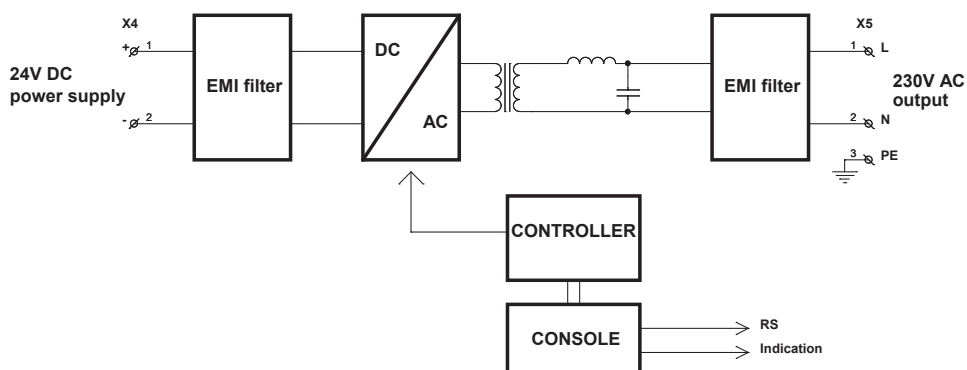
INVERTER MODULE MECHANICAL PARAMETERS

Parameter name	unit	value/feature of a parameter
Housing type		M3
Housing protection degree		IP 20
Housing attachment		From the front
Cabling connection		From the front
Housing dimensions (width x depth x height)	mm	482x492x267/19"x6U
Housing colour / Face plate		White zinc plated / RAL 7035

ENVIRONMENT CONDITIONS OF THE INVERTER MODULE

Parameter name	unit	value/feature of a parameter
Ambient temperature	°C	-30 ÷ +40
Storage temperature	°C	-40 ÷ +55
Humidity		max. 80%
Max operating height metres above the sea level	m	1000

CONCEPTUAL DIAGRAM OF BFI MC INVERTER:



TAB. BFI MC TYPE INVERTER – ELECTRIC CHARACTERISTICS – STANDARD PARAMETERS

Device type		BFI 1,5S 24/230MC	BFI 2S 24/230MC	BFI 3,5S 24/230MC	BFI 5S 24/230MC
Parameter name	unit	value/feature of a parameter	value/feature of a parameter	value/feature of a parameter	value/feature of a parameter
DC rated input voltage	V	24	24	24	24
Input DC voltage changes range	V	18 - 36	18 - 36	16,8 - 36	22 - 31
Rated consumption of DC current	A	68	68	168	220
Rated output AC voltage	V	230±2%	230±2%	230±2%	230±2%
Output voltage frequency	Hz	50±0,1%	50±0,1%	50±0,1%	50±0,1%
Output power	kVA	1,5	2 kVA/1,5 kW	3,5	5 kVA/4 kW
Rated output current	A	6,5	8,7	15,2	21,7
Overload capacity		1,1In – long-term 1,1-1,25In – 10 minutes 1,25-1,5In – 3 minutes 1,5-2In – 10 seconds >2In – 1 second	1,1In – long-term 1,1-1,25In – 10 minutes 1,25-1,5In – 3 minutes >1,5 – 1 second	1,1In – long-term 1,1-1,25In – 10 minutes >1,25 – 1 second	1,1In – long-term 1,1-1,25In – 10 seconds >1,25In – 1 second
Voltage waveform		sinusoidal	sinusoidal	sinusoidal	sinusoidal
Harmonics content (linear load)		<2%	<2%	<2%	<2%
Scope of cosφ characterising load		0 ind. up to 0 vol.	0 ind. up to 0 vol.	0 ind. up to 0 vol.	0 ind. up to 0 vol.
Total efficiency		>90%	>90%	>90%	>90%
Over-current protection	A	3xIn	3xIn	3xIn	3xIn
Multiplication factor (CF)		3	3	3	3

STANDARDS:

EN 50155:2021	Railway applications – Electronic equipment used in a rolling stock.
EN 50160:2010	Parameters of voltage supply in public electricity networks
EN 60529:1991	Protection classes provided by housings (IP code)
EN 50121-3-2:2016	Railway applications – Electromagnetic compatibility – Part 3-2: Rolling stock – Apparatus.
EN 50124-1:2017	Railway applications - Insulation coordination Part 1: Basic requirements - Clearances and creepage distances for all electrical and electronic equipment.
EN 50125-1:2014	Railway applications – Environmental conditions for equipment – Part 1: Rolling stock devices.
EN 50126-1:2017	Railway Applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) - Part 1: Generic RAMS Process.
EN 50126-2:2017	Railway Applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) - Part 2: Systems Approach to Safety
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MECHANICAL DRAWINGS:

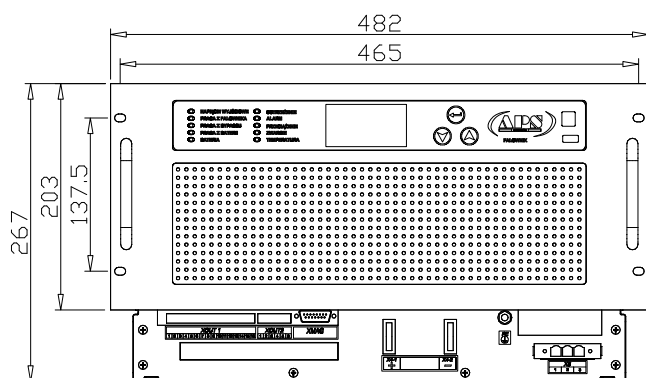


Fig. BFI MC type inverter, front view

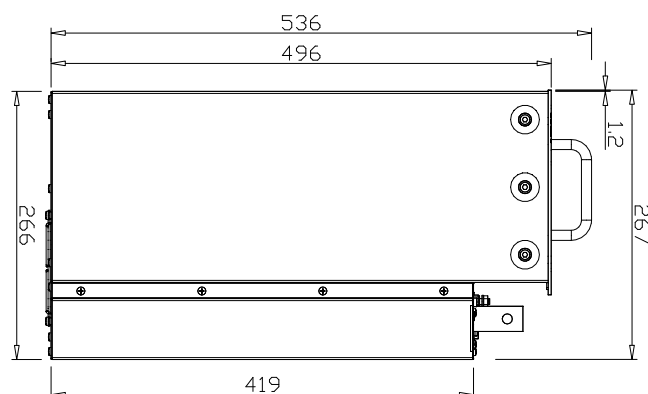


Fig. BFI MC type inverter, side view

PBI M TR

Direct current power supply of PBI 110/20M type

PBI 110/20M type direct current charger processes three-phase supply voltage into voltage and stabilised current, appropriately to the needs of customers. The converter provides galvanic insulation, which isolates direct voltage from a power network. The module is cooled by air circulation forced by fans. The fans have two speeds. The second speed is activated when the temperature of IGBT transistor's radiator increases.

Rectifiers may be broken down into groups according to voltage and rated current. We manufacture power supplies of the following rated voltages: 24V, 48V, 110 V, 220 V.

The aforementioned rated current versions of devices are provided in the following current versions: 50 A, 30 A, 20 A, 10 A.

TAB. PBI M TR TYPE BUFFER POWER SUPPLY – ELECTRIC CHARACTERISTICS – STANDARD PARAMETERS

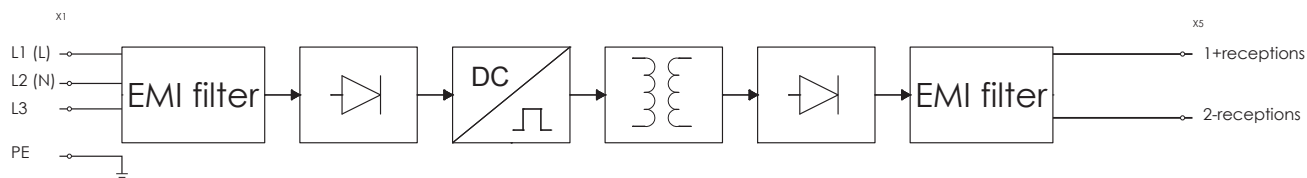
Supply voltage	V	3x400 +10 %, -15% -
Rated supply current	A	3x4A
Supply voltage frequency	Hz	50/60 ±10 %
Rated output voltage (Un)	V	220/110/48/24
Output voltage tolerance (*)		+/- 0.6%
Output voltage ripple (***)		+/- 0.6 %
Rated output current (In)	A	10/20/30/50
Output current stability (**)		+/- 1 %
Output current ripple (**)		+/- 1 %
Total efficiency		> 92%
Protection level	IP	20
Airflow	m³/min	2,5
Mass	kg	11

(*) Buffer operation, voltage controller, (**) Battery charging, current controller
(***) At resistance load



Fig. PBI 110/20M type direct current power supply

CONCEPTUAL DIAGRAM OF PBI M TR TYPE BUFFER POWER SUPPLY



MECHANICAL DRAWINGS:

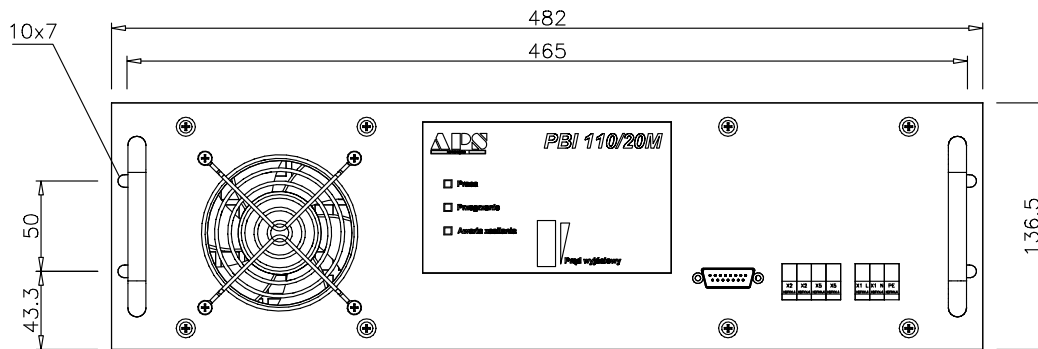


Fig. PBI 110/20M type direct current power supply, front view.

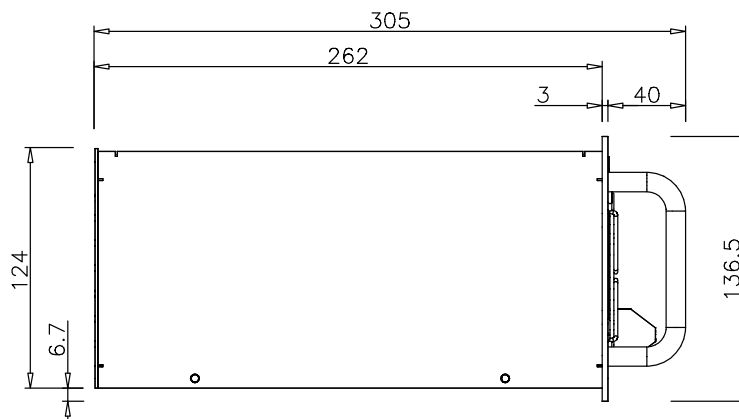


Fig. PBI 110/20M type direct current power supply, side view.

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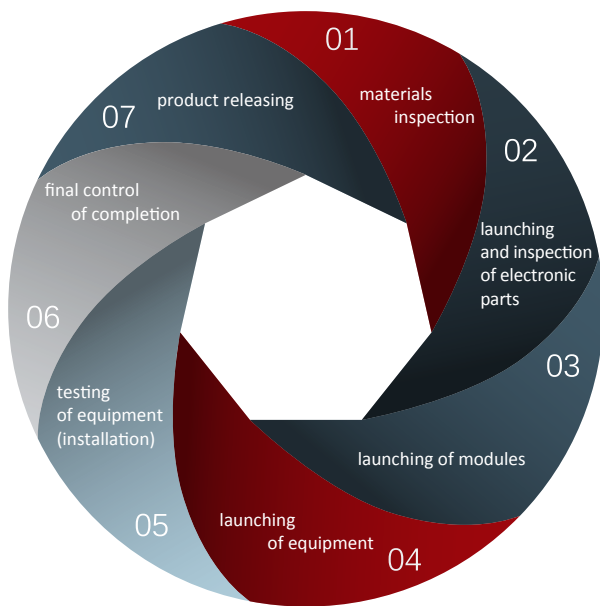
QUALITY MANAGEMENT SYSTEM

WE FOCUS ON QUALITY AND TECHNICAL SAFETY OF DEVICES

HIGH QUALITY OF OUR EQUIPMENT IS ENSURED BY THE IMPLEMENTED CONTROL SYSTEM.
SPECIALIZED TEAM OF INSPECTORS SUPERVISES EVERY STAGE OF PRODUCTION

QUALITY CONTROL PROCESS FLOWCHART

in APS Energia



Each device manufactured by APS Energia passes so called Factory Acceptance Test, including long-term annealing under different load conditions. We also conduct seismic tests, environmental tests and tests of electromagnetic compatibility (EMC).

We are competitive because we care about the technical and economic efficiency of production of our systems. To this end, we have implemented Technical Security Policy. Its main principles include:

- compliance of the developed technical solutions with the EU provisions, national legislation and customer requirements.
- transparency in technical decisions making process
- intensive development of engineering and technological base
- rapid response to potential problems associated with the production or delivery to the Customer,
- cooperation of production departments with the rest of the company, based on the Integrated Management System,
- improvement of technical parameters of devices in line with the latest global technologies,
- execution of orders only from reliable suppliers,
- long-term partnerships with suppliers and contractors based on mutually beneficial cooperation.

WE CARE FOR EMPLOYEES

We achieve our business objectives with the full cooperation and commitment of our employees. In the interests of them, we have implemented Occupational Health and Safety Management System according to the international standard ISO 45001:2018. This is reflected in our modus operandi:

- we make sure that our production processes have no negative impact on people and the environment

- we prevent accidents at work and occupational diseases
- we offer stable employment conditions
- We employ people with appropriate qualifications and systematically raise their competences

STANDARDS



ISO 9001
ISO 14001
ISO 45001
BUREAU VERITAS
Certification



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