UNINTERRUPTIBLE POWER SUPPLY SYSTEMS

ON THE ENERGY MARKET FOR 30 YEARS

RECTIFIER MODULES CATALOGUE

MODULAR DESIGN BUFFER RECTIFIERS

A pulse buffer rectifier is a basic element of guaranteed power supply systems. A rectifier converts alternating current (AC) into direct current (DC). These industrial direct current power supply system meet high requirements in terms of functionality, technical parameters, and reliability.

The catalogue presents the PBI type rectifiers in the form of the 19" module. The are adapted for mounting in industrial cabinets.

Rectifiers are intended for supplying direct current loads and charging accumulator batteries of rated current 24V, 48V, 60 V, 110 V, 220 V, 400 V or other compliant with the device's specification.

Direct current loads power supply may be carried out in cooperation with a buffer battery or directly from a rectifier.

Depending on the output power, the PBI type rectifier may be supplied with single- or three-phase AC mains voltage of 50 or 60 Hz frequency. The modules with a built-in console belong to the MC modules family, while the modules with an external MK console are a part of the MCE modules family.

The M type PBI modules (without own console) are adapted to operate with the external SAN 4-15 or MCE controller. The SAN 4-15 controller may control up to fifteen PBI M type rectifier modules, thus allowing designing rectifier systems of high power.

THE PBI TYPE BUFFER RECTIFIER CHARACTERISTICS:

- IGBT technology with a DSP microprocessor controller;
- three operation modes (buffer, automatic, manual);
- high stability of voltages and output currents;
- charging algorithm (as per DIN 41773), accordant with the recommendations of EUROBAT for various types of batteries;
- very low current ripple and output voltage;
- control and limitation of the battery's charging current;
- battery temperature control;
- battery voltage temperature compensation;
- integrated communication RS485, USB interfaces;
- wide selection of external communication protocols: Modbus RTU, IEC 60870-5-103, APS6000;
- electromagnetic compatibility (EMI filters);
- parallel operation of the rectifiers with automatic equalisation of currents in all modules;
- galvanic isolation from the mains;
- archiving of events and operating states (SD card);
- modular design;
- quiet operation;
- high efficiency;
- monitoring of the earth fault isolation status of both poles;
- internal overload protection of power systems (limits the output current without removing voltage from the output circuits);
- protection against short-circuit;
- over-voltagev protection.

METHOD OF DESIGNATION OF THE PBI TYPE RECTIFIER MODULES

PBI ▭/▭ ▭

Device type: PBI - rectifier
DC rated output voltage, [V] **By standard: 24; 48; 60; 110; 125; 220; 240; 400** **Other solutions depend on the order**
Rated output current, [A] **Solution depends on the order**
Typ obudowy: **M - 19" module without controller** **MC - 19" module with mounted controller** **MCE - 19" module with an external console** **MP - 19" module with natural cooling technology**

Views of the rectifier module

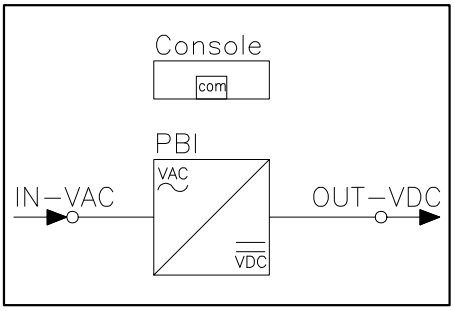


Fig. 1. General block diagram of the rectifier system

KEY OF THE ABBREVIATIONS USED IN THE DIAGRAMS IN THE CHAPTER

BAT – battery	PBI – rectifier
I – current measurement	T – temperature measurement
IN – power supply	VAC – alternating current (AC)
com – communication	VDC – direct current (DC)
OUT – output	

THE PBI TYPE BUFFER RECTIFIERS – TECHNICAL CHARACTERISTICS – STANDARD PARAMETERS

PARAMETER		VALUE
AC INPUT*		
Input voltage:	single-phase	220 / 230 / 240 V
	three-phase	380 / 400 / 415 V
Input voltage tolerance		-15 % to +10 % (±15 % for 380 V)
Frequency of input voltage		50 / 60 Hz
Input voltage frequency tolerance		±10 %
DC OUTPUT		
Output voltage		24 / 48 / 60 / 110 / 220 / 400 V
Output voltage stability**		±0.6 %
Output voltage ripple****		±0.6 %
Range of correction of the buffer charging voltage		between -10 and +50°C
Temperature compensation of the buffer charging voltage**		0 to 10 mV/°C/cell
Rated output current		10 to 1,500 A
Overload capacity		1.1×In for 3 sec
Output current stability***		±1 %
Output current ripple***		±1 %
Battery charging characteristics		IU as per DIN 41773
Total efficiency		>92 %
Available menu language versions		PL | EN | CZ | RU
OPERATING ENVIRONMENT		
Operating temperature (EN 50178 class 3k3)		+5 to +40 °C*
Storage temperature (EN 50178 class 1k4)		-25 to +55 °C*
Humidity (EN 50178 class 3k3)		5 to 85 % (non-condensing)*
Access to the device		operation and maintenance from the front*
Cable entry		from the bottom
Maximum height above the sea level without change of the rated parameters		1,000 m ASL

* – it is possible to design different parameters upon agreement with the manufacturer;
** – buffer operation, voltage regulator;
*** – battery charging, current regulator;
**** – at resistance load.

PBI RECTIFIERS TECHNOLOGY

Three-phase or single-phase power supply voltage is converted in the three-stage converter system.

- mains rectifier,
- high-frequency converter with a converter,
- high-frequency rectifier.

The PBI rectifier is equipped with a microprocessor DSP (Digital Signal Processor) control system which controls the operation of the converter and monitors the state of the battery.

The Pulse Width Modulation (PWM) converter ensures adaptation of the input voltage value to the needs of the loads and the battery. The high-frequency ferrite transformer provides a galvanic insulation for the input and output circuits.

Devices are cooled down with a forced air circulation with regulation depending on the temperature of the heat sinks. Operation of the device is monitored by the controller. The controller also enables communication with the user or master monitoring and control systems.

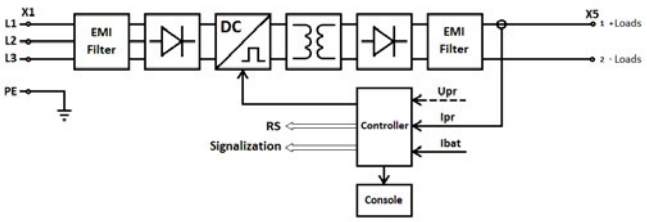


Fig. 2. Conceptual design of the PBI rectifier

View of the PBI rectifier power block

PBI RECTIFIER FUNCTION DESCRIPTION	
Battery circuit continuity test	In the buffer operation state, the rectifier cyclically tests the continuity of the battery's circuit. The process is carried out by way of appropriate regulation of voltage and current measurements. After a positive test result, the rectifier's voltage goes back to the buffer voltage level. The test parameters are set in the rectifier's menu.
Charging interlock	Switching the rectifier into the "charging interlock" mode limits the current flowing to the battery at the 100-hour current level. This function is tripped by applying voltage to the binary input. The charging interlock limits the current during the automatic charging and supervised charging. This function is most often used with another system, e.g., a battery room's ventilation system. Failure of the ventilation generates a signal to the "charging interlock" to limit the charging current, and thus protect the battery against potential overheating, increased aeration of the electrolyte, etc.
Rectifier operation interlock	In this mode, the rectifier does not transfer energy from the mains to the loads and the battery, and only remains in the standby mode. The rectifier will start automatically after the "rectifier interlock" signal has been removed. This function is tripped by applying voltage to the binary input. This function is necessary if the rectifier must be controlled remotely.
Over-voltage protection of the load	When a voltage dangerous to loads is present for a time longer than 500ms at the power supply's output, an over-current protection is activated to turn the rectifier off. This voltage is preset appropriately to the rated voltage of the power supply. After the excessively high voltage at the input ceases, the rectifier restarts.
Charger alarm levels	All of the set alarm levels have hysteresis of the system on the level of alarm stimulation.
Battery voltage thermal compensation	The battery's buffer voltage changes with the temperature fluctuations. In accordance with the recommendations of the battery manufacturers, the battery's charging voltage thermal compensation is applied. The rectifier may carry out a procedure of automatic temperature compensation to adapt the battery's voltage to the environmental conditions.
Limitation of the battery charging current	The rectifier limits the battery's charging current to the value set by the user and expressed by the time in which we want to charge the battery. During the supervised charging, the current is limited to the value set by the personnel when configuring the supervised charging parameters.
Battery earth fault isolation resistance	The rectifier is equipped with a microprocessor earth fault control system. The earth fault control system is intended for measuring the value of the insulation resistance in the direct current installation circuits (the battery's poles ground faults control). The device measures and signals a drop of the symmetrical and asymmetrical resistance. A drop of the value of resistance below the warning or alarm threshold is signalled in the status of the device and trips relevant alarm relays.
Auto-restart	The PBI rectifiers are equipped with an auto-restart function when the power supply voltage appears, if a power supply voltage break caused the rectifier to turn off.
Fans operation control	The fans installed in the modules are equipped with damage sensors. Stoppage of the fans is signalled by illumination of the "warning" diode on the rectifier's console. Information about the damage is stored in the event buffer. There is a possibility to signal such a state using relay outputs.
Data archiving	The events buffer is an area in the permanent memory of the rectifier, in which all alarm events, including date and time, are saved. The archive buffer is an area of the permanent memory of the rectifier, in which measurement series are stored with an interval set by the user. USB 2.0 ports enable communication between the power supply and the computer system or transferring alarm logs to a FLASH portable memory (USB flash drive).
Communication with the user	Communication between the user and the device may take place both locally and remotely. Locally, using the console (keyboard, LCD, indicating diodes), located on the front side of the device. Electrical parameters are displayed constantly, regardless of the selected operation mode of the panel. Alarm states are indicated using glowing diodes and the display. Additionally, a sound signal is generated, which informs about an alarm state (the sound signaller is located behind the panel's board). Remotely, using the binary inputs and outputs, as well as communication ports. You may assign different functions to the binary inputs to change the operation of the rectifier. The functions are assigned in the rectifier's menu. The transmission communication ports (RS485, USB) allow connecting multiple transmitters and loads. The following transmission protocols are available at the rectifier's connections: Selected from the controller's menu: APS6000, Modbus RTU, IEC 60870-5-103. They allow to read the full set of data from the rectifier.
Parallel operation of rectifiers	During operation on the common load bus, all PBI type rectifiers automatically and evenly distribute the load between each other by equalising the output currents.
Self-test	Thanks to the "self-test" function, the user obtains information about correctness of internal and intermediate parameters responsible for proper operation of the device.
Soft Start	Thanks to the "Soft Start" function, when the rectifier starts-up, there is no sudden load of the power supply lines. The soft start of the rectifier is carried out in two stages: in the first one, the condensers are loaded and the rectifier's controls are started-up, and then the rectifier gradually increases the voltage at the output until reaching the operating point. The soft start cycle lasts several to a dozen or so seconds depending on the load.

PBI RECTIFIER OPERATION MODES

Buffer operation

In this state, the device supplies the battery and/or loads with direct current of high degree of stability and required value (usually 2.23V/cell). The buffering voltage is compensated thermally by a thermal probe (which must be positioned in the vicinity of the supplied battery) present in the standard equipment. Thanks to this, the output voltage of the power supply is always adapted to the needs of the battery, and maintenance of its fully charged state and readiness for operation in the case of a power supply failure is ensured. During buffer operation, the continuity of the battery's circuit is cyclically checked.

Automatic charging

This function is used in the case of partial or complete discharge of the battery (e.g., as a result of power supply failure), when the battery must be charged as quickly as possible to prepare it for a possible failure. In this case, the power supply will automatically charge the battery to Umax voltage.

Supervised charging

This mode is used in the case of cooperation with open acid batteries, when there is a need to carry out additional equalising charging to 2.7V/cell. This charging process must be carried out strictly according to the guidelines of the manufacturer of the battery and always in the presence of the operating personnel.

Operation modes parameters

Operation mode	Factory settings		Possible regulation range
	Lead-acid batteries	Ni-Cd batteries	
Buffer mode (Float mode)	2.23 V/cell	1.41 V/cell	0.8 – 2.4 V/cell
Automatic charging (Boost mode)	2.40 V/cell	1.50 V/cell	0.8 – 2.7 V/cell
Supervised charging (Equalising mode)	2.70 V/cell	1.80 V/cell	0.8 – 2.7 V/cell

Three-stage I_1 U_1 U_2 battery charging technique

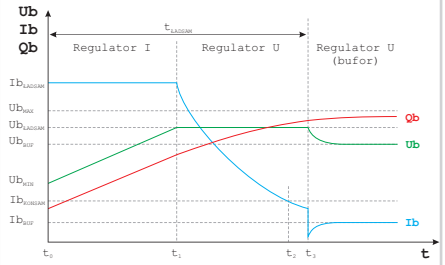
In the case of discharge of the battery, the PBI rectifier will automatically activate the quick charging mode (optionally, this mode may be activated manually). The charging parameters are configured in the memory of the rectifier in accordance with the requirements of the producer of the battery of a given type. The charging has three stages:

1st phase – direct current charging I_1 (the first limit parameter): this charging includes limitation of the battery charging current. The rectifier gradually increases the battery voltage to not exceed the recommended charging current (most often, limitation at the level of current I_1 = 5 to 10-hour charging (I_{C10}));

2nd phase – direct current charging U_1 (the second limit parameter): the battery is partially charged after the first phase of charging, there is no risk that the increase of the charging voltage will exceed the set battery current I_1, the second limit parameter works, the allowed (maximum voltage at the DC bus due to loads or due to the battery) voltage U_1. Completion of the 2nd phase of charging depends on the adopted algorithm. APS Energia SA uses the DBC method.

3rd phase – direct current charging U_2; the system has completed quick charging, and the rectifier switches to voltage U_2 = Ubuf buffer voltage.

Charging characteristics DBC (Dynamic Charge Characteristic) model



Configurable parameters:

- charging current – Ib_{C10}
- maximum voltage – Ub_{MAX},
- recharge current – Ib_{DOL},
- time of automatic charging – T_2,In accordance with the recommendations of EUROBAT.As per DIN 41773.

DBC charging method

The DBC is a charging method developed by APS Energia SA based on the experience in production of buffer rectifiers and in strict cooperation with the manufacturers and users of batteries. The Dynamic Battery Charging (DBC) is a method which controls all charging parameters, and thus ensures quick replenishment of the battery's electric charge according to all recommendations of the producer of a given type of cell. The method consists in charging the battery with voltage U_1 in the second phase until the two following criteria are met at the same time:

- criterion no. 1 – achievement of the set value (e.g., 0.2×I_{C10}) by the dropping charging current – a configurable parameter;
- criterion no. 2 – charging of the battery after the criterion no. 1 has been met for 30 minutes – a configurable parameter;

As an option of the DBC method, an additional criterion of completion of the quick completion phase is assumed, i.e., the length and the depth of the battery's discharge.

The rectifier modules are provided with an external battery current measurement (ZPP), which means that it is necessary to connect an external current measurement transducer to the XI connector of the rectifier. The rectifier has a single output (X5), common for the battery and the loads. The battery's circuits and the loads must be separated in an external distribution board.

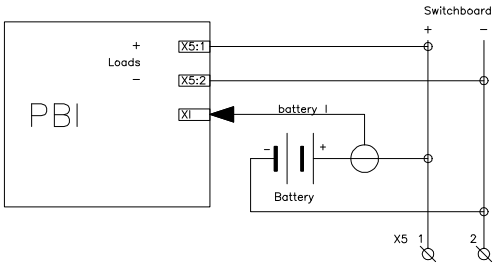


Fig. 3. A rectifier with an external battery current measurement

AUTONOMOUS OPERATION MODE

Autonomous operation is an operating mode of the device in which only one rectifier is used to charge the battery and/or supply the section of loads.

The rectifiers indented for autonomous operation are presented in Fig. 4.

Communication of the device is described in chapter "COMMUNICATION WITH THE USER".

If the rectifier is to be used as a DC charger (to supply DC loads without a battery), it will be appropriately configured – the battery-related functions will be disabled.

Every M, MC or MCE module is cooled using fans. RPM of fans is adjusted seamlessly in the external temperature function of the device, which significantly increases their lifetime.

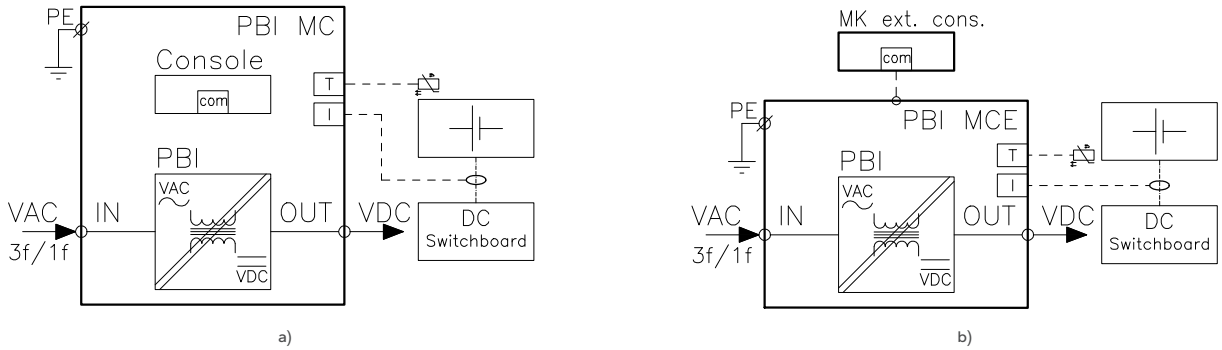


Fig. 4. Block diagram of the PBI type rectifier module for autonomous operation:
a) with a built-in console; b) with external MK console.

PARALLEL OPERATION MODE

The parallel operation mode of the rectifier modules constitutes an extension of the rectifiers' autonomous operation mode (see chapter "AUTONOMOUS OPERATION MODE"). This mode is created by the n×PBI configuration.

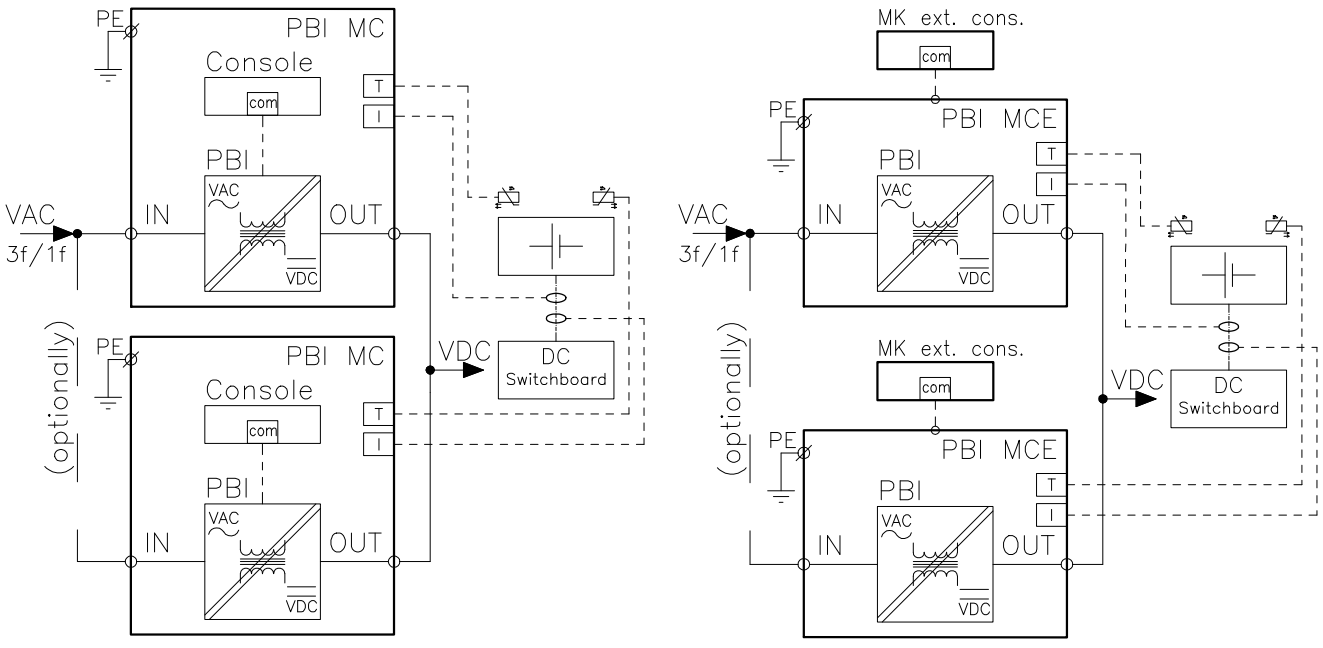
During parallel operation, each "n" rectifier operates for a common battery and/or section of loads. These systems are presented in Fig. 5.

The PBI MC and PBI MCE modules for parallel operation do not require an external controller, but the maximum number of modules operating in parallel is limited to 4 units. The PBI M modules are adapted to parallel operation via use of the SAN 4-15 or MCE external controller in systems consisting of a larger number of modules (>4). For more details, see chapter "CONTROLLER MODULE".

Communication of the device is described in chapter "COMMUNICATION WITH THE USER".

If the rectifier is to be used as a DC charger (to supply DC loads without a battery), it will be appropriately configured – the battery-related functions will be disabled.

Every M, MC or MCE module is cooled using fans. RPM of fans is adjusted seamlessly in the external temperature function of the device, which significantly increases their lifetime.



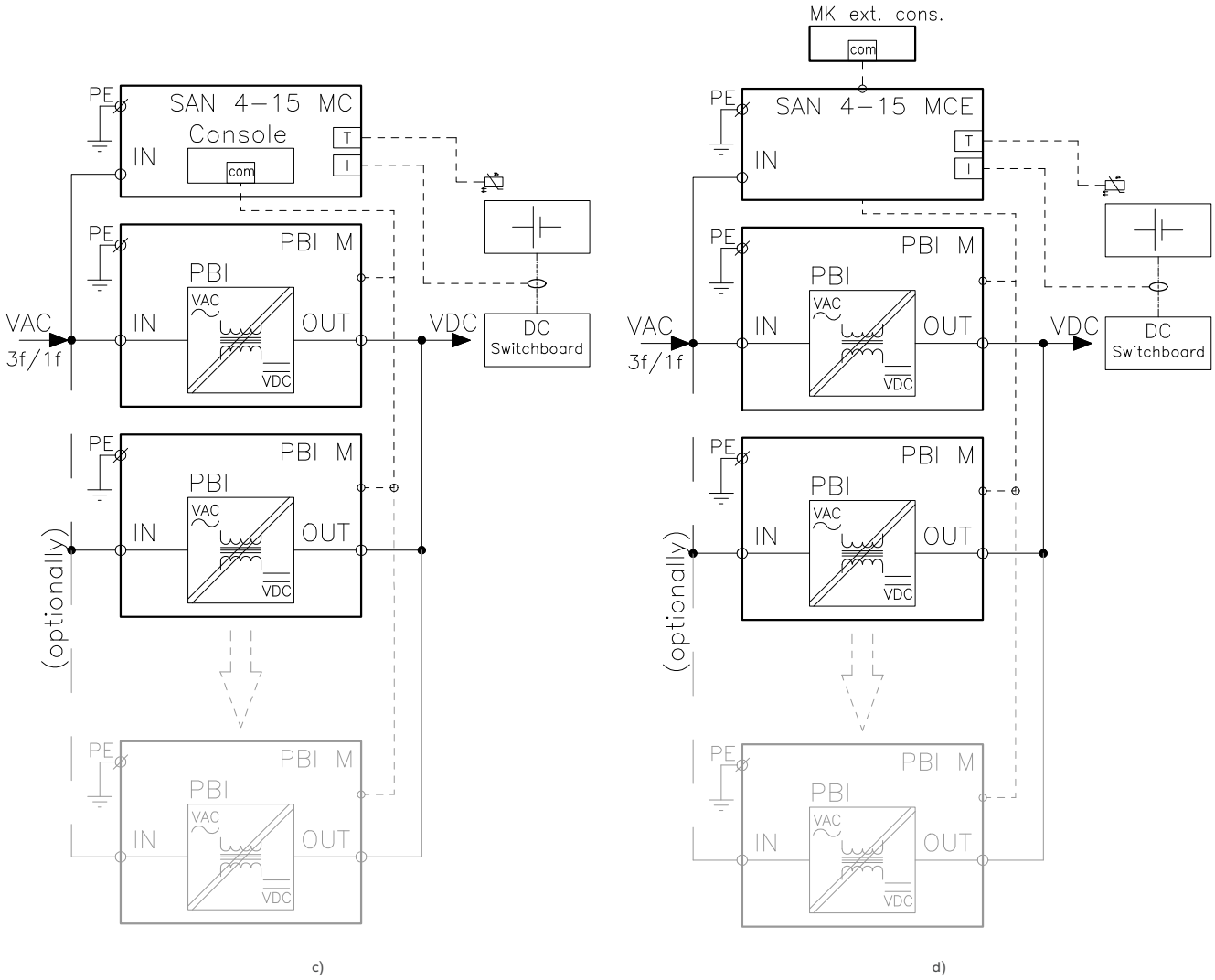


Fig. 5. Block diagram of the modules of the PBI type rectifier for parallel operation:

a) the PBI MC type modules system; b) the PBI MCE type modules system; c) the PBI M modules and the SAN 4-15 MC type controller system; d) the PBI M and the SAN 4-15 MCE type controller system with an external MK console.

CONTROLLER MODULE

The SAN 4-15 external controller is used to control, monitor, and visualise operating or emergency states of the system made of the M series rectifiers operating in parallel. It is also responsible for appropriate charging of the battery using measurements of voltage, current, and the battery' temperature. This controller is a 19" module of standardised 4U height, adapted to be mounted in an industrial cabinet. The SAN 4-15 modules with a built-in console belong to the MC family (Fig. 5 b), while modules with an external console are a part of the MCE modules family (Fig. 5 c). Overall dimensions of the SAN 4-15 module are presented in Fig. 8 a, c).

View of the controller module

A compact design system (Fig. 5 c, d) intended for installation in an industrial cabinet is made of:

The PBI M type rectifier modules	The modules are described in chapter "PARALLEL OPERATION MODE"
The SAN 4-15 type controller module	The external microprocessor controller controls the PBI M modules, acts as a monitoring system, decides about selection of the operation mode, and carries out other necessary tasks to ensure correct operation of buffer rectifiers. The controller is equipped with a console (built-in or external), which informs about the state of operation of the rectifier, as well as enables configuration of DC systems. The device features integrated RS485 and USB interfaces, which enables configuration and sending data to the master system.
Battery temperature measurement sensor	It is an external temperature probe located in the battery compartment, close to the accumulators, to ensure correct operation of the compensation algorithm.
Battery current measurement transducer	The controller module uses an external battery current measurement (ZPP) to optimally control the battery charging process. The battery's current measurement requires application of appropriate measurement transducers (Fig. 7) in the battery circuit (Fig. 6). The signal from the external current measuring transducer is fed to the XIBAT connector of the controller's module. This transducer may be located in the DC distribution board or directly on any pole of the battery, taking into account the direction of the current.

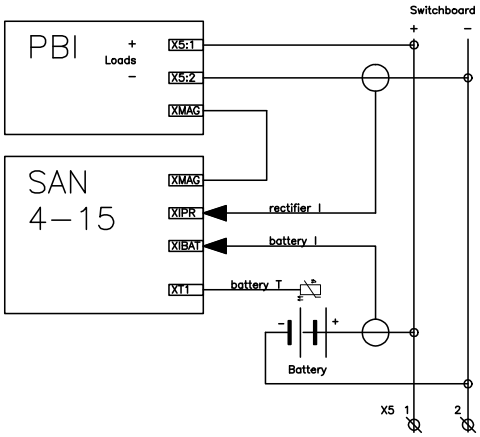
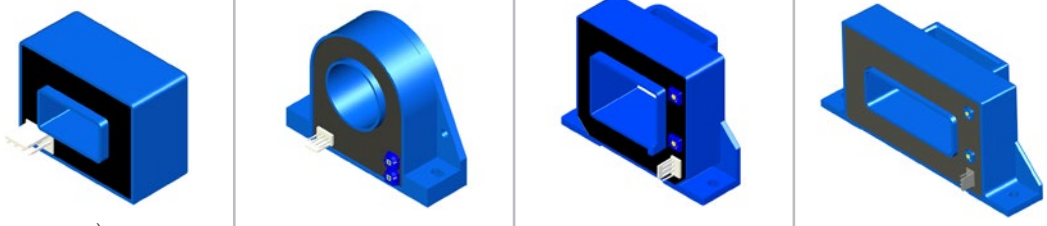


Fig. 6. The rectifier and the controller with the temperature, battery current, and rectifier current measurement functions

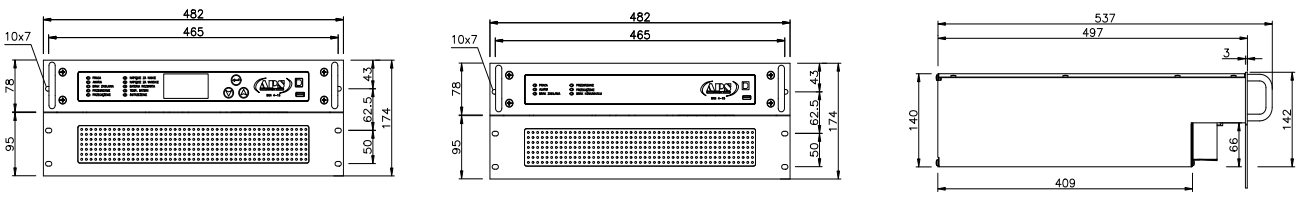
When selecting a transducer, consider the cross-section of the line (or the bus) on which it will be installed, as well as the current that may flow to and out of the battery.

There are following measuring transducers:



a) b) c) d)

Fig. 7. Visualisation of the measuring transducer:
a) the HAS type; b) the HTA type; c) the HAT type; d) the HAX type.



a) b) c)

Fig. 8. Views with dimensions of the SAN 4-15 MC / MCE external controller modules in the M4 enclosure:
a) front view – a module with a built-in console; b) front view – a module without a console; c) left-side view.

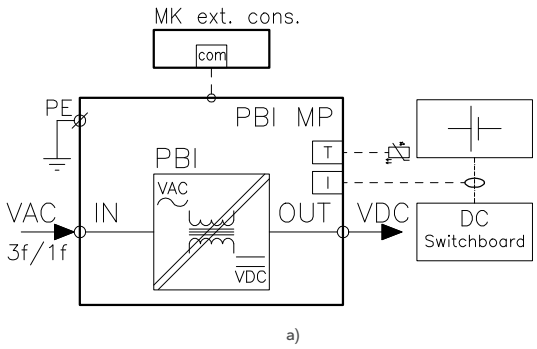
MODULES WITH PASSIVE COOLING

The MP family modules (Fig. 9) are cooled by the natural air circulation (passive cooling).

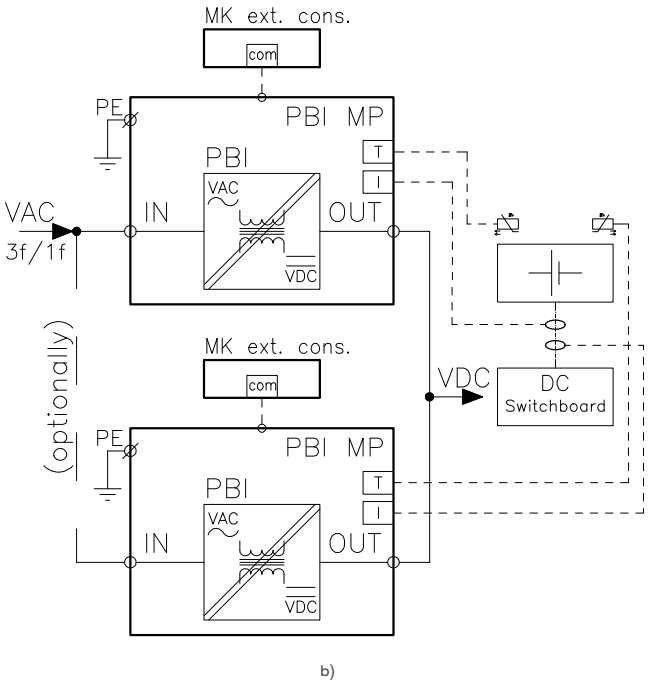
The PBI MP type modules are adapted to autonomous and parallel operation. The PBI MC modules for parallel operation do not require an external controller, but the maximum number of modules operating in parallel is limited to 4 units.

Communication between the user and the PBI MP type rectifier module is carried out via the MK PBI K3 external console that allows reading and configuring the settings of the rectifier.

By standard, the PBI MP type modules are installed in rooms with aggressive environments. Therefore, installation of the K1 and K2 type external consoles is not recommended. It is recommended to use the module with passive cooling with the MK PBI K3 type mobile console connected to the PBI MP module only for the time of reading or changing the rectifier's parameters.



a)



b)

Fig. 9. Block diagram of the PBI MP type rectifier modules (with natural cooling):

a) for autonomous operation;

b) for parallel operation.

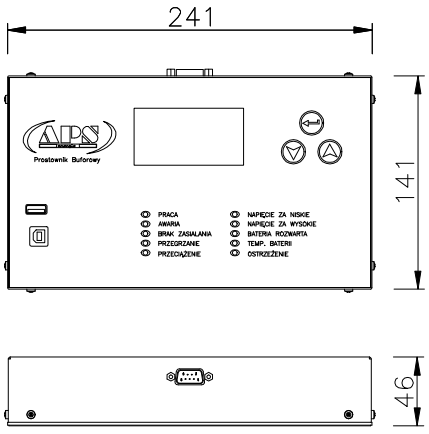


Fig. 10. Views with dimensions of the K3 type external console

View of the module with passive cooling

OPTIONAL ACCESSORIES FOR THE PBI TYPE RECTIFIER MODULES

Optional	Description
Special designs	Upon request, it is possible to adapt the devices to special requirements of a given project in relation to: • greater DC rated currents; • standard of voltages and frequencies of AC power supply: (110/190 V, 115/200 V, 120/208V, 127/220 V, 50/60 Hz); • level of the DC output voltages; • extension of the range of input voltages; • environmental requirements related to ambient temperature (-20 ºC to +55 ºC), presence of aggressive factors, etc.
Measurement of the charge accumulated in the battery	The charge is calculated during charging and discharging of the battery considering the battery charging efficiency coefficient. The user may set the current parameters of the battery (e.g., after a controlled discharge); these parameters will be the starting point for calculation of the charge.

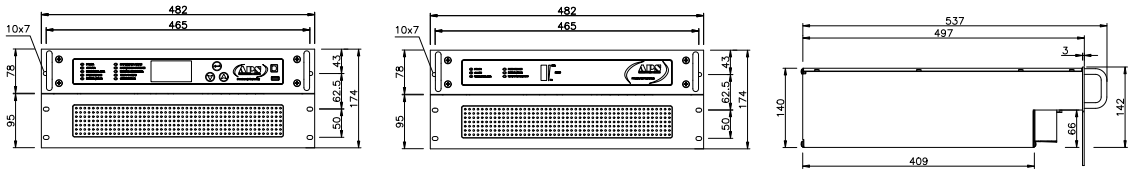
RECTIFIER MODULES SERIES OF TYPES

SERIES TYPE: RECTIFIER MODULE 10 ÷ 350 A FOR AUTONOMOUS AND PARALLEL OPERATION

Rated output current, [A]	DC rated input voltage, [V]	AC rated input voltage, [V]	Example type	Enclosure dimensions**
25 / 30 / 50 / 75 / 100 / 150 / 200	24	3×400 or 230	PBI 24/25 MC*	M4
250 / 300 / 350		3×400	PBI 24/250 MC*	
60		3×400 or 230	PBI 24/60 MP	M3-MP
25 / 30 / 50 / 75 / 100	48		PBI 48/25 MC*	M4
150 / 200		3×400	PBI 48/150 MC*	
250 / 300 / 350			PBI 48/250 MC*	M3
30		3×400 or 230	PBI 48/30 MP	M3-MP
25 / 30 / 50 / 60	60		PBI 60/25 MC*	M4
75 / 100 / 150		3×400	PBI 60/75 MC*	
200 / 250 / 300			PBI 60/200 MC*	M3
10 / 20 / 25 / 30 / 50	110	3×400 or 230	PBI 110/10 MC*	M4
60 / 75 / 80 / 100		3×400	PBI 110/60 MC*	
150 / 200			PBI 110/150 MC*	M3
20			PBI 110/20 MP	M3-MP
10 / 20 / 25 / 30 / 40 / 50	125	3×400 or 230	PBI 125/10 MC*	M4
75		3×400	PBI 125/75 MC*	
100 / 150			PBI 125/100 MC*	M3
10 / 20 / 25	220	3×400 or 230	PBI 220/10 MC*	M4
30 / 50		3×400	PBI 220/30 MC*	
60 / 75 / 80 / 100			PBI 220/60 MC*	M3
10			PBI 220/10 MP	M3-MP
10 / 20	240	3×400 or 230	PBI 240/10 MC*	M4
25 / 30 / 40		3×400	PBI 240/25 MC*	
50 / 75 / 80			PBI 240/50 MC*	M3
10 / 20 / 25	400		PBI 400/10 MC*	M4
30 / 50 / 60			PBI 400/30 MC*	M3

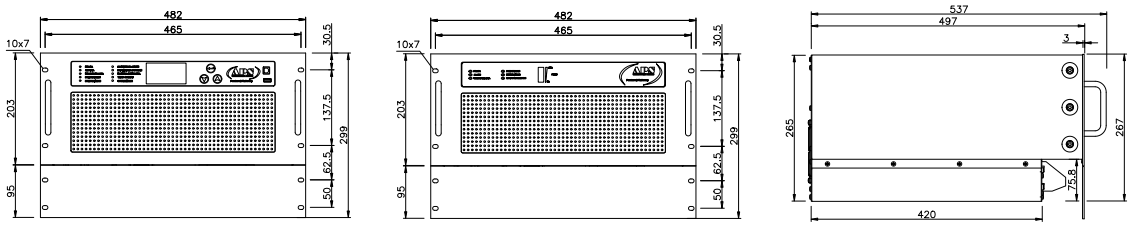
* – Possible options: M / MC / MCE;

** – M4 (4U): 482×142×496; M3 (6U): 482×267×496. (W×H×D).



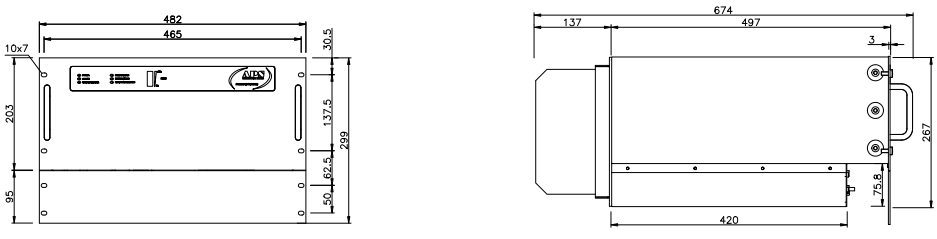
a) b) c)

Fig. 11. Views with dimensions of the M/MC/MCE PBI rectifier module in the M4 enclosure:
a) front view – a module with a built-in console; b) front view – a module without a console; c) left-side view.



a) b) c)

Fig. 12. Views with dimensions of the M/MC/MCE PBI rectifier module in the M3 enclosure:
a) front view – a module with a built-in console; b) front view – a module without a console; c) left-side view.



a) b)

Fig. 13. Views with dimensions of the PBI MP type rectifier module in the M3-MP enclosure: a) front view; b) left-side view.

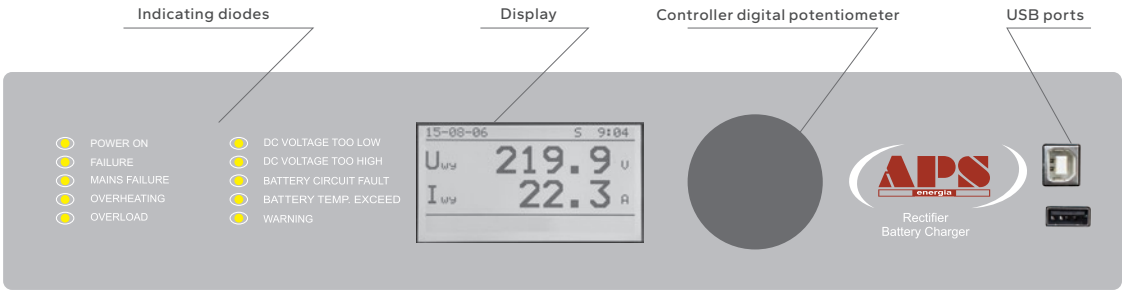
EXTERNAL COMMUNICATION – DIRECT CURRENT SYSTEMS

The rectifiers and DC converters are equipped with an extensive communication system with the user and master systems – HMI (Human Machine Interface).

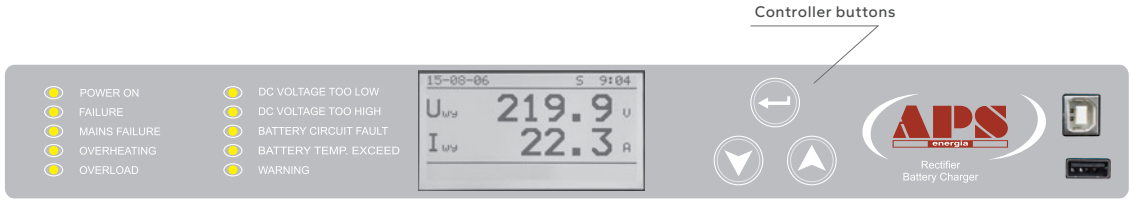
The communication system consists of:

1. A local user panel with an indicator diode system, an LCD screen for displaying messages and reading parameters, and a digital potentiometer or cursors for navigating the console menu.
2. A set of potential-free relay contacts for binary signals.
3. External communication links. Data transmission via RS485, Ethernet and USB ports (reading the archive buffer) is possible.

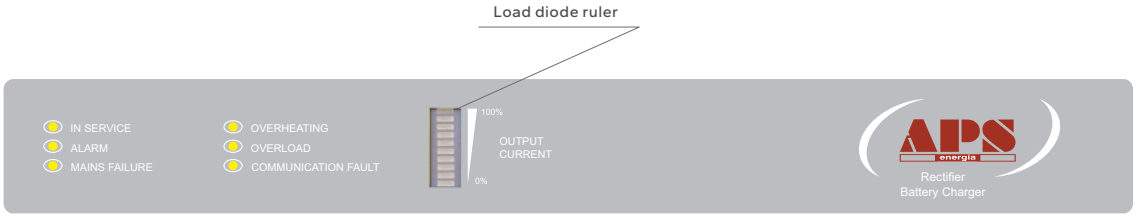
LOCAL USER PANEL



View of the console with a digital potentiometer



View of a console with navigation cursors



View of the console without a display, for modules in multi-module systems and with a separate controller.

SIGNALLED ALARMS ON THE LCD OF THE PBI RECTIFIER

output voltage is too low;	earth fault + warning;
output voltage is too high;	earth fault – warning;
voltage of loads is too low;	earth fault meter error;
voltage of loads is too high;	battery temperature is too high;
deep discharge of the main battery;	battery temperature is too low;
deep discharge of the booster battery;	rectifier temperature is too high;
deep battery discharge;	module failure;
module power supply failure;	failure;
power supply failure;	module overheating;
no power supply to the module;	overheat;
no power supply;	overload;
battery circuit discontinuity;	no communication;
damage of the battery temperature sensor;	fan fault;
earth fault + alarm;	no parallel communication;
earth fault – alarm;	XIN fuse tripping.

THE PBI RECTIFIER'S MEASURED PARAMETERS

output voltage;
battery current;
rectifier current;
battery temperature.

PARAMETERS MEASURED FOR THE "SELF-TEST" FUNCTION OF THE PBI RECTIFIER

By carrying out the self-test, the user obtains information about the internal and intermediate parameters responsible for proper operation of the device, such as:
current measurement transducers internal supply voltage;
processors supply voltages;
compliance of the measurements with the measurement range.

INTEGRATED RS485, USB, ETHERNET COMMUNICATION INTERFACES

RS485 LINK

RS485 is wired interface used in industrial networks. The basic advantage of data transmission via the RS485 bus bar is resistance to external distortions (e.g., of induction equipment, such as engines). The RS485 standard allows to connect many transmitters and loads (up to 32). The range of this standard is approx. 1,200 m.

The RS485 link of the rectifier features APS6000, Modbus RTU, IEC 60870-5-103 transmission protocols. They allow reading a complete set of data from the device.

By use of an external converter, it is possible to transmit data in the Profibus DP protocol and other protocols.

USB LINK

In the APS Energia devices, the USB link is used to copy archive logs saved during operation.

The USB port (A) is used to connect mass memory (USB flash drive).

The USB port (B) operates in the bulk memory mode (Mass Storage Device). After connecting it to a PC, it is shown as an additional drive.

ETHERNET LINK

Ethernet (IEEE 802.3) is the most commonly used technology in local networks (LAN). This interface allows connecting the device to a local computer network in the facility, and thus easily reading data even from several stations at the same time.

The Ethernet interface may be implemented by application of an additional converter, ensuring transmission using one of the following protocols:

- IEC 61850 (APS SAN KP1 converter)
- SNMP (AGENT-APS2)
- Modbus TCP.

Storage of events and states of the operation of the device on an SD card.

A 2GB internal memory card stores data stored in the events buffer and the archive buffer. Lack of a card makes saving logs impossible and is indicated on the display by "SD" symbol.

Copying data to a FLASH memory stick:

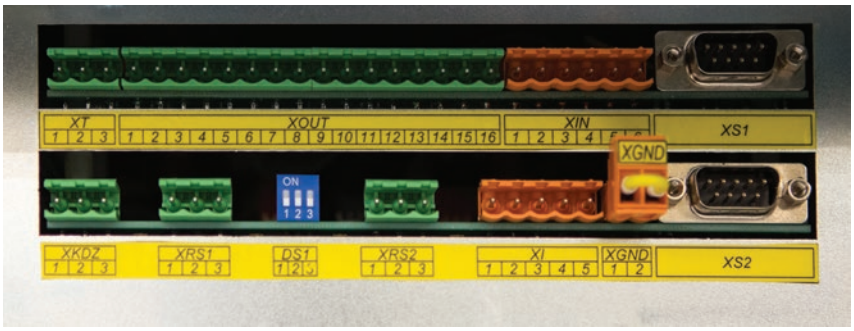
USB 2.0 ports enable communication between the power supply and the computer system or transferring alarm logs to a FLASH portable memory (USB flash drive).

The USB type port (B) sends archive data directly to a PC

The USB type port (A)

THE PBI RECTIFIER BINARY SIGNALS

INPUT BINARY SIGNALS:	OUTPUT BINARY SIGNALS:
charging interlock	general alarm 1
rectifier operation interlock	general alarm 2 (configurable)
fuse tripping	no power supply
DC +24V auxiliary supply	output voltage is too high
	output voltage is too low
	battery circuit fault
	proper operation
	alarm 8 (configurable)
	earth fault (option)



Connection panel of the PBI MC type rectifier

THE MK PBI TYPE EXTERNAL CONSOLE

One of the equipment options for modules is the console (display).

Depending on the location of the console or lack of the console, the modules are broken down into:

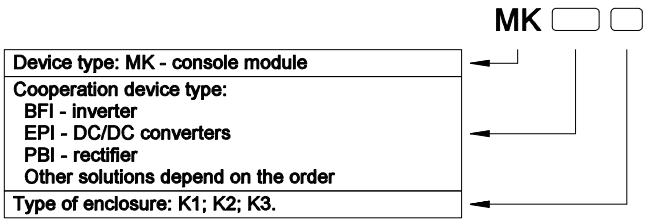
- Devices with a built-in console (display) – designated as the MC type modules;
- Devices with an external console (display) – designated as the MCE type modules;
- Devices without a console (display) – designated as the M type modules.

An external console is used mainly in cabinet systems containing modular devices. In the case of such systems, where it is necessary to quickly (easily) access information about the state of the device, you may use the MK PBI type external console. If it is possible to open the door to access the console or the door is glazed, you may use the MC type modules with a built-in console.

There are two types of external consoles: MK PBI K1 and MK PBI K2. These versions feature different overall dimensions (Fig. 14).

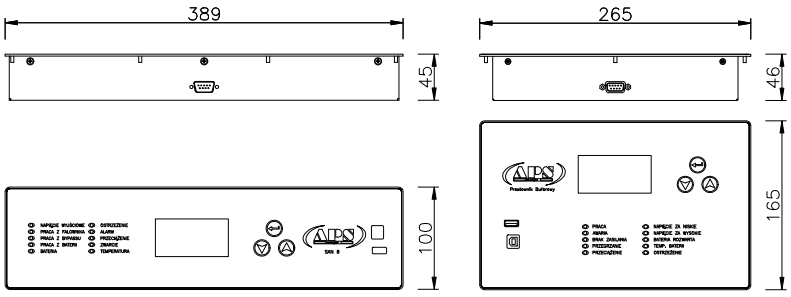
The MK PBI consoles may be designed in a version which, after appropriate installation on the cabinet's door, allows obtaining a higher IP rating, up to IP 54. The required IP rating must be provided when placing an order.

METHOD OF DESIGNATION OF THE MK EXTERNAL CONSOLES



View of the external console

VIEWS WITH DIMENSIONS OF THE MK TYPE EXTERNAL CONSOLES



a) b)

Fig. 14. Views with dimensions of external consoles: a) K1 console; b) K2 console.

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