Chapter 4 • Power Panel 21

1. Photo

Figure 40: Power Panel 21 photo

2. Order data

Model number	Short description
4P0420.00-490	Power Panel 21, LC-display 4 x 20 characters, background lighting, 34 function keys, system compatible 2003 CPU, 700 KB SRAM, 1.4 MB FlashPROM, 1 PCMCIA slot, 1 RS232 interface, 1 CAN interface (electrically isolated, network capable), 6 slots for screw-in modules, 10 digital inputs 24 VDC, 8 digital outputs 24 VDC, 0.4 A, IP65 protection (from front), 155 x 190 mm (B x H), 24 VDC. Order TB712 terminal blocks separately!
Note	
All parts required to install the Power Panel, including key legend sheets, are included in its delivery. The backup battery and the 4 pin terminal block for the supply are also included. Two 12-pin terminal blocks must be ordered separately.	
Required accessories	
7TB712.9	Accessory terminal block, 12-pin, screw clamp, 1.5 mm²
7TB712.91	Accessory terminal block, 12-pin, cage clamp, 1.5 mm²

Table 27: Power Panel 21 order data

Model number	Short description
Optional accessories	
0AC201.9[1)]	Lithium batteries, 5 pcs., 3 V / 950 mAh, button cell
4A0006.00-000[1)]	Lithium battery, 3 V / 950 mAh, button cell
0MC111.9	PCMCIA memory card, 2 MB FlashPROM
0MC211.9	PCMCIA memory card, 2 MB SRAM
4A0035.00-000	A4 legend strip template, for PP21 (4P0420.00-490); 2 sheets, 10 devices, with CorelDraw template.
7AC911.9	Bus connector, CAN

Table 27: Power Panel 21 order data (Forts.)

1) Replacement part

3. Technical data

Description	Power Panel 21
General information	
Certification	CE, C-UL-US, GOST-R
Standards Temperature Shock / tests carried out Vibration / tests carried out Emission / tests carried out Immunity / tests carried out	 IEC61131-2 / IEC60068-2-x IEC61131-2 / IEC60068-2-27 IEC61131-2 / IEC60068-2-6 EN61000-6-4 / EN55022 IEC 61131-2 / IEC 61000-4-x
Display	
Type	LCD b/w
Resolution	4 x 20 characters
Character set	English / Katakana
Reading angle	Approx. 60 °
Character height	4.75 mm
Keys	
Design	Mylar keypad with metallic snap-action disks
Front	Multi-layered cover with insertion slots for key legends
Total keys	34 membrane keys
Function keys	17, with LEDs, labeled with legend sheets
System keys	17 (number block, control keys)

Table 28: Power Panel 21 technical data

Description	Power Panel 21
Processor	
Additional I/O processor	Handles I/O data points
Typical instruction cycle time	0.5 µs (average value with 70% bit and 30% analog processing)
Standard memory User RAM SystemPROM User PROM	 700 kB SRAM 600 kB FlashPROM 1.4 MB FlashPROM
Data buffering with backup battery	Lithium battery 3 V / 950 mAh
Data buffering / buffer current (typ./max.)	10 µA / 200 µA
Hardware Watchdog	Yes
Voltage monitoring	Internal supply monitored for overvoltage and undervoltage
Fans	No
Peripherals	
Real-time clock	1 s resolution, nonvolatile memory
Status display	LEDs
System bus for expansions	No
Slots for B&R 2003 screw-in modules Suitable for IF modules (without CAN) TPU functionality support Suitable for CAN communication	6 Slots 1 - 3 Slots 4 - 6 Slot 1 with interface module 4IF370.7
PCMCIA slot (see "PCMCIA slot", on Page 87) Memory size SRAM FlashPROM Standard Card height Card type	1 Max. 4 MB Max. 4 MB JEIDA V 4.0 or PCMCIA standard release 2.0 Max. 3 mm Memory cards
Standard communication interfaces	
Application interface IF1 Type Design Electrical isolation Max. transfer rate Max. distance	 RS232 9-pin DSUB plug No 115.2 kbit/s 15 m / 19,200 bit/s
Application interface IF2 Type Design Electrical isolation Max. transfer rate Max. distance	 CAN bus 9-pin DSUB plug Yes 500 kbit/s 1,000 m

Table 28: Power Panel 21 technical data (Forts.)

Description	Power Panel 21
Digital inputs	
Number of channels	10
Additional functionalities for inputs	4 x TPU
Input frequency (TPU)	50 kHz (incremental encoder operation)
Input circuit	Sink
Input voltage (min./nom./max.)	18 VDC / 24 VDC / 30 VDC
Input current at nominal voltage	Approx. 4 mA
Input filter	<1 ms (not TPU)
Electrical isolation Channel - bus Channel - channel Group isolation	 Yes No Input group - output group
Digital outputs	
Amount	8 + 1 floating relay contact
Type	Highside driver IC (transistor)
Switching voltage (min. /nom. /max.)	18 VDC / 24 VDC / 30 VDC
Output voltage	0.4 A
Total current	3.2 A
Output circuit	Source
Switching delay Log. 0 - log. 1 Log. 1 - log. 0	 Max. 450 µs Max. 450 µs
Output protection	Overload protection
Internal protective circuit	Yes
Load for potential-free relay contact	Max. 0.5 A
Leakage current when switched off	12 µA
Switching on after overload cutoff	Automatically within seconds (depends on the panel temperature)
Permanent short circuit current	Typ. 4 A
Braking voltage when switching off inductive loads	47 V
Electrical isolation Channel - bus Channel - channel Group isolation	 Yes No Input group - output group
Power supply	
Input voltage (min./nom./max.)	18 VDC / 24 VDC / 30 VDC
Power consumption	Max. 20 W
Output power for screw-in modules and PCMCIA interface	10 W

Table 28: Power Panel 21 technical data (Forts.)

Description	Power Panel 21
Environmental conditions	
Temperature Operation Storage	 0°C to 50°C -20°C to 60°C
Humidity Operation Storage	 10 to 90% (non-condensing) 5 to 95% (non-condensing)
Operational conditions	
Mounting orientation	Vertical, ±45°
Altitude	Max. 3,000 m
Mechanics	
Protection	IP65 (from front)
Outer dimensions (B x H x T [mm])	155 x 190 x 84.4
Weight	1.25 kg

Table 28: Power Panel 21 technical data (Forts.)

4. Images

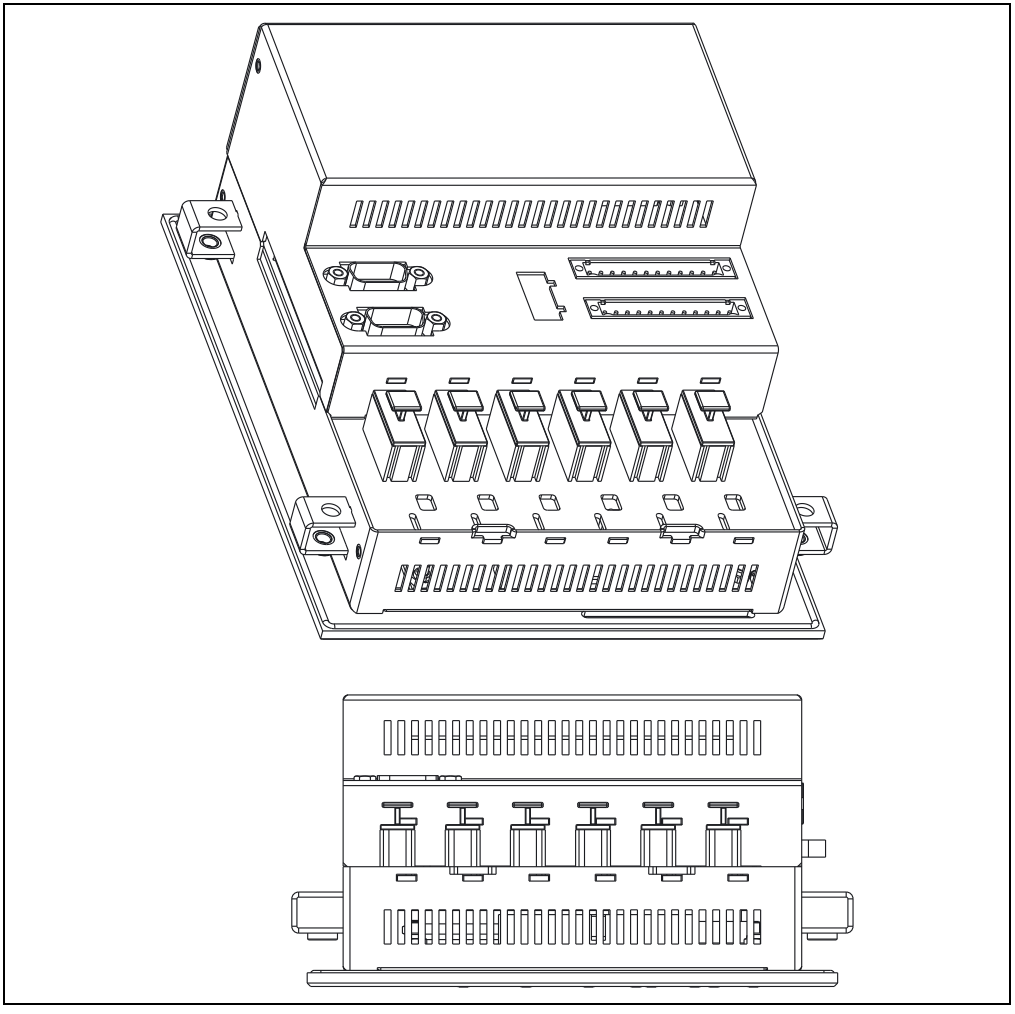


Figure 41: Power Panel 21 images

5. Dimensions

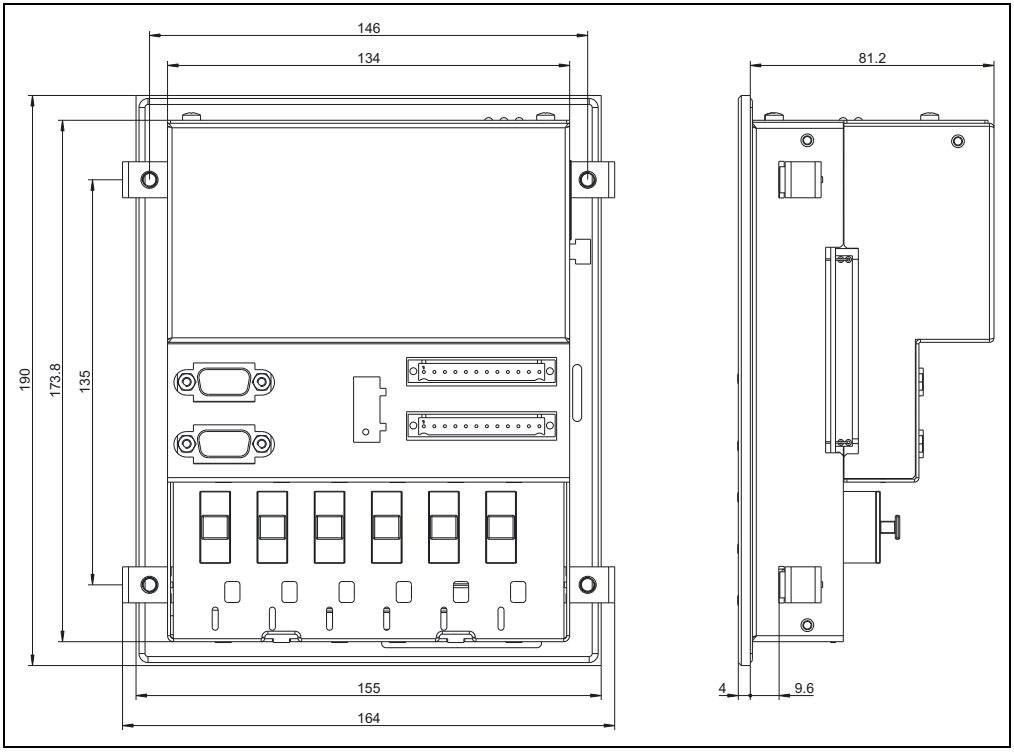


Figure 42: Power Panel 21 dimensions

Installation dimensions: 138 mm x 179 mm

6. Component descriptions

6.1 Status LEDs

LED	Color	Meaning
CAN	Yellow	Data transfer to or from CAN controller
RS232	Yellow	Indicates if data is being transmitted or received
ERR	Red	Lit when in Service mode
RUN	Green	Lit in RUN and in Service mode
MODE	Yellow	Lit when programming FlashPROM
READY	Yellow	Lit when in Service mode

Table 29: Power Panel 21 status LEDs

6.2 Power supply

The Power Panel 21 is equipped with a 24 VDC power supply. The pin assignment is printed on the housing.

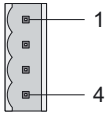
Pin assignment - power supply[1)]		
Pin	Description	
1	+	
2	+	
3	-	
4	-	

Table 30: Power Panel 21 pin assignment - power supply

1) Both "+" and "-" pins are connected to each other internally

6.3 Interfaces

The Power Panel has two interfaces:

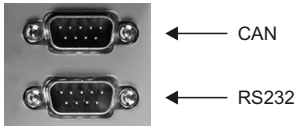


Figure 43: Power Panel 21 interfaces

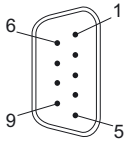
6.3.1 CAN interface

The electrically isolated standard fieldbus interface is used for the following tasks:

- Communication with other control systems
- Decentralization and remote I/O expansion using B&R 2003 components and a CAN bus controller

We recommend using the AC911 T-connector for connecting to a CAN network. A terminal resistance is integrated into the T-connector for the bus termination, which can be switched on or off. For more information on wiring CAN fieldbus systems, see chapter 2, "Installation", section "CAN fieldbus" of the B&R SYSTEM 2003 User's Manual.

Pin assignment for CAN interface	
Electrically isolated Assignment according to CiA DS 102-1	
Pin	**Assignment**
1	n. c.
2	CAN_L
3	CAN_GND
4	n. c.
5	n. c.
6	Reserved
7	CAN_H
8	n. c.
9	n. c.



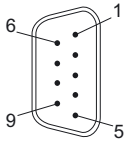
9-pin DSUB plug

Table 31: Power Panel 21 pin assignment - CAN interface

6.3.2 RS232 interface

This non-electrically isolated interface is primarily intended for programming the CPU. The RS232 can also be used as a general interface (e.g. printer, bar code reader, etc.).

Pin assignment - RS232 interface	
RS232 interface Not electrically isolated up to 115 kbit/s	
Pin	**Assignment**
1	CTS
2	RXD
3	TXD
4	5 VDC / max. 500 mA
5	GND
6	n. c.
7	RTS
8	CTS
9	GND



9-pin DSUB plug

Table 32: Power Panel 21 pin assignment - RS232 interface

6.4 Operating mode switch

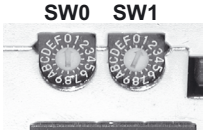


Figure 44: Power Panel 21 operating mode switch

The Power Panel 21 is equipped with 2 hex switches, which are used as an operating mode switch. Switch positions 01 - FC are available for any purpose in an application. The switch's position can be evaluated from an application program. The operating system only interprets the switch position when switched on.

All other switch positions are reserved for special functions.

Switch position	Description
00	In this switch position, the operating system can be programmed via the online interface. User FlashPROM is only deleted after the update begins.
01 - FC	Freely available for use in an application (e.g. CAN node number)
FD	This setting should not to be used. **Update Mode** - In this switch position, the Power Panel checks if an update memory card is inserted. If no card is inserted, the Power Panel goes into Service mode. Otherwise (depending on the Update configuration) the operating system and/or the user-ROM for the Power Panel is cleared and reinstalled from the memory card. If an error occurs during installation the red ERRor LED blinks. If installation has been successfully completed, the green RUN LED and the yellow READY LED blink.
FE	Reserved for B&R expansions – these setting is not allowed to be used!
FF	**Diagnostics mode:** The CPU boots in Diagnostics mode. Program sections in User RAM and User FlashPROM are not initialized. After diagnostics mode, the CPU always boots with a cold restart.

Table 33: Power Panel 21 switch settings for the MODE switch

6.5 Programming System Flash

The Power Panel is delivered without an operating system installed. An operating system can be downloaded or updated using the programming software. Installation of the operating system is possible with both programming systems. When downloading the operating system for the first time using B&R Automation Studio™, complete the following steps:

1) Turn off power to the PLC.
2) Set the MODE switch to 00.
3) Switch on the power supply again.
4) Make on-line connection to PC (physically).
5) Start B&R Automation Studio™ ("OFFLINE" is displayed in the status bar)
6) Select menu item "PROJECT" - "SERVICES" - "TRANSFER OPERATING SYSTEM"
7) A window named "Operating System Transfer" opens
8) The COM port can be changed in this window, if required. Only in this case (using the "Try to connect Bootstraploader" button) must the connection be reestablished. If several PLC SW versions are available, these can also be selected.
9) By clicking on "Next" in the new window CAN bus specific settings can be made.

6.6 PCMCIA slot

The Power Panels are equipped with one PCMCIA interface for B&R memory cards. PCMCIA memory cards conforming to JEIDA V4.0 Type I or PCMCIA Standard Release 2.0 (max. 3 mm high) are supported.

The memory on the PCMCIA card can be used with all types of B&R modules. Executable programs (Task) should not be stored on the PCMCIA card, because accessing the card takes considerably longer than accessing the Power Panel's onboard memory.

The Power Panel 21 supports memory cards with up to 4 MB SRAM or with up to 4 MB FlashPROM. The following memory cards can be ordered from B&R:

Model number	Short description	Power consumption
0MC111.9	PCMCIA memory card, 2 MB FlashPROM	Max. 0.8 W
0MC211.9	PCMCIA memory card, 2 MB SRAM	Max. 0.8 W

Table 34: Power Panel 21 order data - PCMCIA memory cards

The memory cards are used by the Power Panel as ROM type "MEMCARD".

6.6.1 Limitations when using memory cards

Access to memory cards is very slow.

- Internal variables cannot be stored on the memory card
- Memory cannot be allocated to the memory cards

The SRAM and FlashPROM memory cards can only be written to by the Power Panel. Therefore, it is not possible to program the system software or the application on a memory card directly on a PC with a PCMCIA interface.

6.7 Power Panel interface

The Power Panel 21 is equipped with six slots for B&R SYSTEM 2003 screw-in modules. The required screw-in modules are inserted into the Power Panel interface and screwed firmly into place. The screw-in interface modules can be operated in slots 1 - 3. Screw-in modules can be used in slots 4 - 6, which possess TPU functionality. The first slot has a second CAN port and allows a second CAN interface by using an IF370 module.

6.8 Screw-in module overview

A description of the B&R SYSTEM 2003 screw-in module can be found in the "B&R SYSTEM 2003 User's Manual " (model. no.: MASYS22003-E).

Module	Type	Description
4IF370.7	Interface	Power Panel interface module, 1 CAN interface, electrically isolated, network capable, screw-in module **Note: This module can only be operated in slot 1.**
7AI261.7	Analog IN	2003 analog input module, 1 input for evaluation of full-bridge strain gauge, 24-bit, screw-in module
7AI294.7	Analog IN	2003 analog input module, 4 inputs, potentiometer evaluation, 13-bit, screw-in module
7AI351.70	Analog IN	2003 analog input module, 1 input, ±10 V or 0 to 20 mA, 12-bit + sign, screw-in module, 1 x TB712 terminal block sold separately.
7AI354.70	Analog IN	2003 analog input module, 4 inputs, ±10 V, 12-bit + sign., screw-in module. Order 1 x TB712 terminal block separately.
7AI774.70	Analog IN	2003 analog input module, 4 inputs, 0 to 20 mA, 12-bit, screw-in module. Order 1 x TB712 terminal block separately.
7AM351.70	Analog IN Analog OUT	2003 analog mix module, 1 input, ±10 V, 16-bit, 1 output, ±10 V, 16-bit, screw-in module, terminal block 1 x TB712 sold separately.
7AO352.70	Analog OUT	2003 analog input module, 2 inputs, ±10 V or 0-20 mA, 12-bit, screw-in module. Order 1 x TB712 terminal block separately.
7AT324.70	Analog in	2003 analog input module, 4 temperature inputs (2-line connection), KTY10 -50 to 150°C, KTY84 -40 to 300°C, PT100 -200 to 850°C, PT1000 -200 to 850°C, screw-in module, order terminal block 1 x TB712 separately.
7AT352.70	Analog IN	2003 analog input module, 2 inputs, PT100 (3-line connection), -200 to 850°C, screw-in module. Order 1 x TB712 terminal block separately.
7AT664.70	Analog IN	2003 analog input module, 4 inputs, thermal elements, -270 to 1768°C, screw-in module. Order 1 x TB712 terminal block separately.
7DI135.70	Digital IN	2003 digital input module, 4 inputs 24 VDC, sink, incremental encoder operation: 50 kHz, event counter operation: 100 kHz, 1 comparator output 24 VDC, screw-in module, order 1 x TB712 terminal block separately.
7DI138.70	Digital IN	2003 digital input module, 10 inputs 24 VDC, sink, 2 inputs for event counter operation, input frequency 20 kHz, screw-in module. Order 1 x TB712 terminal block separately.
7DI140.70	Digital IN	2003 digital input module, 10 inputs 24 VDC, sink, 2 inputs for event counter operation or for direction dependent position determination, input frequency 50 kHz, 4 inputs can be used as high speed inputs (e.g. gate, frequency measurement), screw-in module. Order 1 x TB712 terminal block separately.
7DO135.70	Digital OUT	2003 digital output module, 4 FET outputs 12 to 24 VDC, 0.1 A, screw-in module. Order 1 x TB712 terminal block separately.
7DO138.70	Digital OUT	2003 digital output module, 8 outputs 24 VDC, 0.5 A, short circuit protection, thermal overload protection, screw-in module. Order 1 x TB712 terminal block separately. **Note: This module can only be operated in the slots 4 - 6.**
7IF311.7	Interface	2003 interface module, 1 RS232 interface, screw-in module
7IF321.7	Interface	2003 interface module, 1 RS485/RS422 interface, electrically isolated, network capable, screw-in module
7IF361.70-1	Interface	2003 interface module, 1 RS485 interface, electrically isolated and network capable, transfer protocol: PROFIBUS-DP, screw-in module
7NC161.7	Encoder module	2003 encoder module, input frequency 100 kHz, incremental or absolute, 32-bit, encoder supply 5 VDC or 24 VDC, screw-in module

Table 35: Power Panel 21 screw-in module overview

6.9 Data/real-time buffering

The battery voltage is checked cyclically. The load test of the battery does not considerably shorten the battery life, instead it gives an early warning of weakened buffer capacity. The status information, "Battery OK" can be accessed using the B&R-TRAP function, "SYS_battery".

6.10 Digital inputs

6.10.1 Terminal block connections

Inputs 1 - 4 are equipped with additional functions (event counter, ABR evaluation, etc.). The supply voltage for the digital inputs can be monitored with the application program.

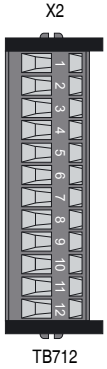
12-pin terminal block	Terminal	Assignment
	1	Input 1
	2	Input 2
	3	Input 3
	4	Input 4
	5	Input 5
	6	Input 6
	7	Input 7
	8	Input 8
	9	Input 9
	10	Input 10
	11	24 VDC
	12	GND

Table 36: Power Panel 21 terminal assignments - digital inputs

6.10.2 Connection example

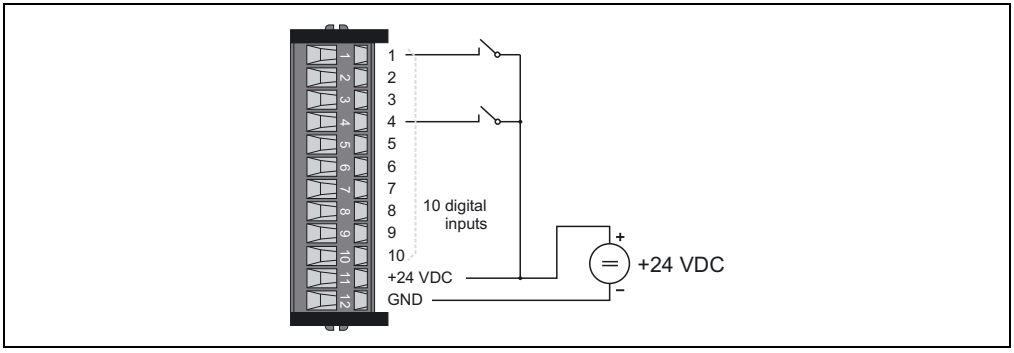


Figure 45: Power Panel 21 connection example - digital inputs

6.10.3 Input circuit diagram

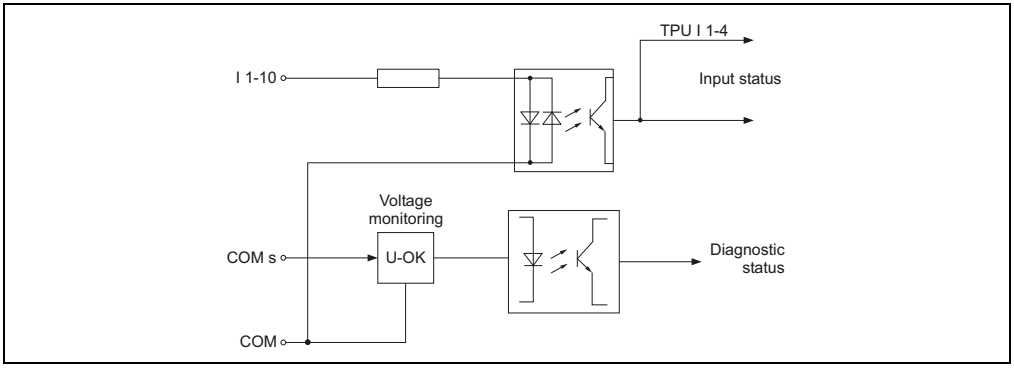


Figure 46: Power Panel 21 input circuit diagram - digital inputs

6.11 Digital outputs

6.11.1 Terminal block connections

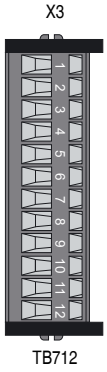
12-pin terminal block	Terminal	Assignment
	1	Output 1
	2	Output 2
	3	Output 3
	4	Output 4
	5	Output 5
	6	Output 6
	7	Output 7
	8	Output 8
	9	Potential-free relay contact
	10	Potential-free relay contact
	11	24 VDC, outputs 1 - 8
	12	GND, outputs 1 - 8

Table 37: Power Panel 21 terminal assignments - digital outputs

6.11.2 Connection examples

Outputs 1 - 8

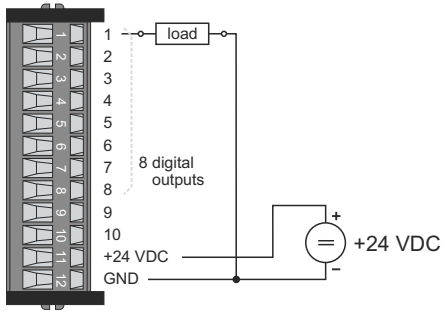


Figure 47: Power Panel 21 connection example - outputs 1 - 8

Potential-free relay contact

E-STOP circuit

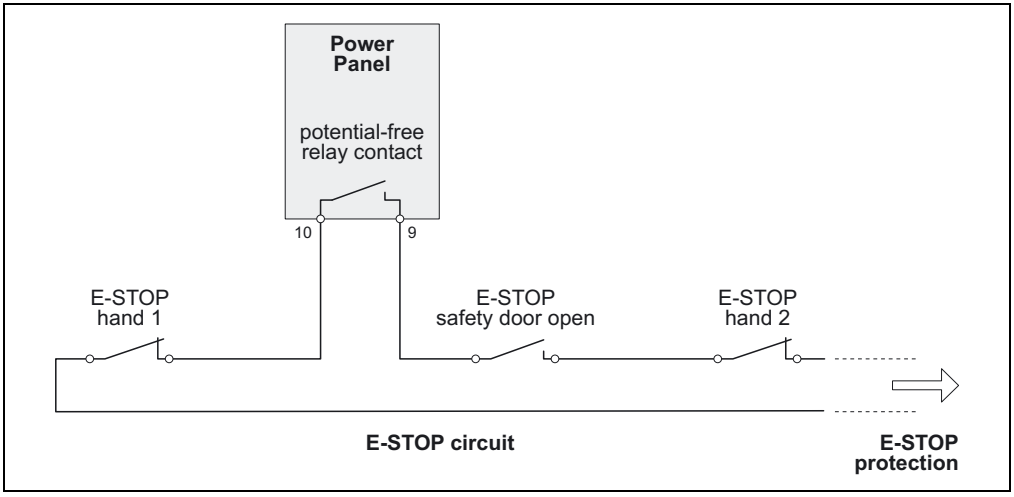


Figure 48: Power Panel 21 E-STOP circuit

Switching a load

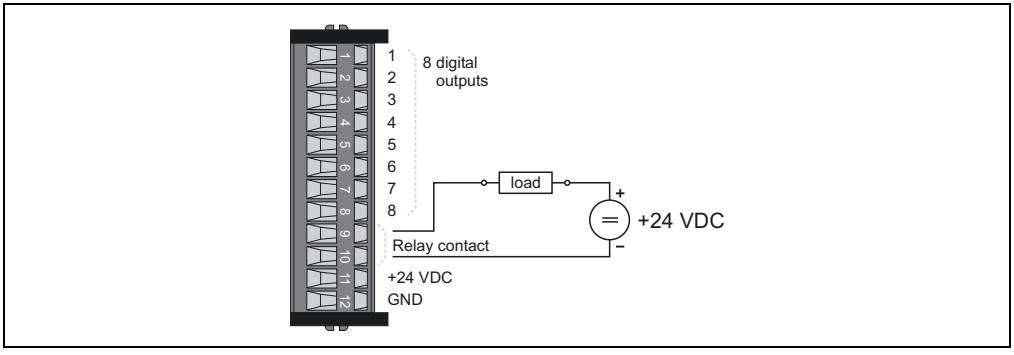


Figure 49: Power Panel 21 switching a load

6.11.3 Output circuit diagram

Digital outputs

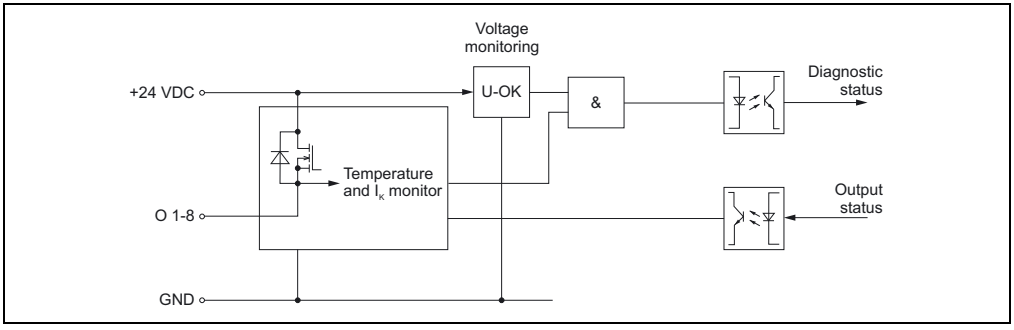


Figure 50: Power Panel 21 output circuit diagram - digital outputs

Potential-free relay contact

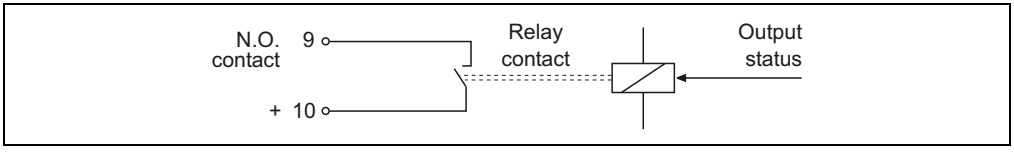


Figure 51: Power Panel 21 connection example - relay contact

7. Changing the battery

7.1 Battery data

Lithium battery	3 V / 950 mAh
Model number	0AC201.9 (lithium batteries, 5 pcs.) 4A0006.00-000 (lithium battery, 1 pc.)
Storage time	Max. 3 years at 30° C
Humidity	0 to 95% (non-condensing)

Table 38: Power Panel 21 battery data

7.2 Buffer duration

Buffer current	Panel CPU
Typical	10 µA
Maximum	200 µA

Table 39: Power Panel 21 buffer duration

Information:

B&R recommends changing the batteries after five years of operation.

7.3 Steps for changing the battery

The product design allows the battery to be changed with the Power Panel switched on or off. In some countries, safety regulations do not allow batteries to be changed while the module is switched on.

Information:

The data in RAM is buffered up to 10 min thanks to gold foil capacitors. During this time period, a battery change without data loss is guaranteed.

The battery is changed as follows:

- Touch the mounting rail or ground connection (not the power supply!) in order to discharge any electrostatic charge from your body.
- Remove the cover from the lithium battery holder using a screwdriver.

- Remove the battery from the holder by pulling the removal strip (don't use uninsulated tools -> risk of short circuiting).

Figure 52: Power Panel 21 changing the battery

- The battery should not be held by its edges. **Insulated** tweezers may also be used for removing the battery.

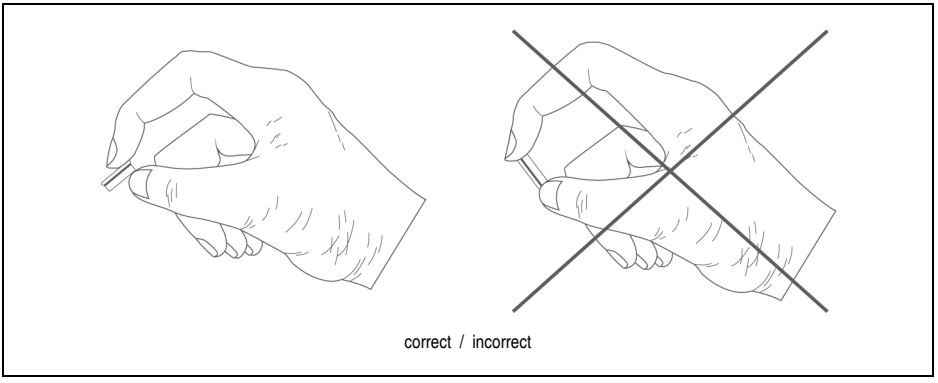


Figure 53: Power Panel 21 handling the battery

- Insert the new battery with correct polarity. The removal strip should be protruding from the battery holder and the "+" side of the battery should be facing downward. In order to be able to remove the battery again in future, the removal strip **must** protrude from the upper side of the battery.
- Now wrap the end of the removal strip over the top of the battery and insert it underneath the battery so that it does not protrude from the battery holder.

Information:

Lithium batteries are considered hazardous waste. Used batteries should be disposed of accordingly.

8. Note regarding operation

Caution!

Pressing several function or system keys at the same time may trigger unintended actions.

9. Mounting instructions

The following mounting instructions should be noted:

1) The Power Panel 21 should be mounted with the four retaining clips (two left and two right), which are supplied in the delivery.

2) In order to guarantee proper air circulation, allow a distance of at least 100 mm (above and below) between the ventilation slots and all other objects.

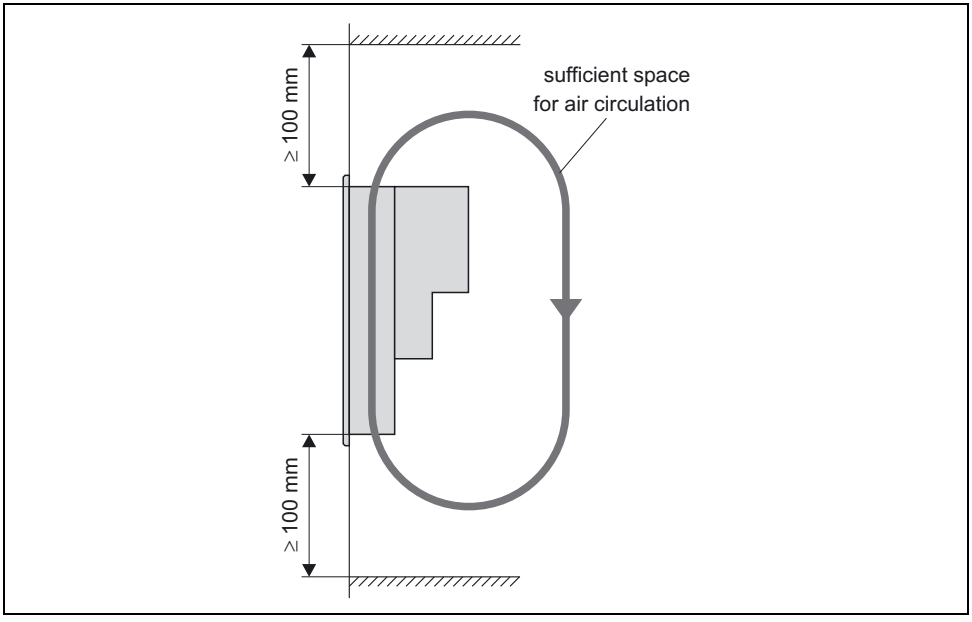


Figure 54: Power Panel 21 distance for air circulation